This book is a collection papers consist of three parts. Part-1, Spatial-Island Economy, discussing on: Model Input-Output untuk Analisis Ekonomi Spasial, GIRIOT: A New Hybrid Procedure for Spatial-Island Economy, Struktur Ruang Perekonomian Indonesia: Analisis Input-Output Antar Daerah; Keberartian Sektor Industri di Pulau Jawa dalam Perekonomian Indonesia; Spatial Dimension of Multipliers in Sumatera Island Economy;Spatial Dimension of Multipliers in Java Island Economy; Spatial Dimension of Multipliers in Kalimantan Island Economy; Pengganda Spatial dalam Perekonomian Kepulauan Nusa Tenggara; Dimension of Multipliers in Eastern Indonesia's Economy, and Spatial Linkages in Indonesian-Island Economy. Part-2, Technology and Economic Development, presents 12 Chapters, discussing on: Technical Efficiency in Indonesian Economy during the New Order and Reformation Governments; Sectoral Variation in Technical Efficiency in Indonesian Economy; Spatial Variation in Technical Efficiency in Indonesian Economy; Technical Efficiency in Indonesian Economy at National, Sectoral and Spatial; Technological Progress and Economic Growth in Indonesia; Technological Progress and Poverty Reduction in Indonesia; The Contribution of Technology on Indonesia Economy, Technology Contribution to Indonesian Regional Economy; The Impact of Technological Prgress on Human Development; The Impact of Technological Progress on Indonesia's Global Competitiveness; Does the Philip Curve Exist in the Short-Run? Evidence from all over the World; The Existence of the Philip-Curve in the Long-Run: Evidences from Australia, South-Korea and Indonesia. Part-3, Islamicity, Development and Happiness, consists of 6 Chapters: Islamicity, Human Development and Global Competitiveness; Economic Growth, Human Development and Happiness; Economic Growth, Human Development and Global Competitiveness; Human Development, Global Competitiveness and Happiness; Economic Growth, Human Development, Global Competitiveness and Happiness; Islamicity, Human Development, Global Competitiveness and Happiness.

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Technology, Development & Happiness

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TECHNOLOGY, DEVELOPMENT AND HAPPINESS IN A SPATIAL-ISLAND ECONOMY

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PREFACE

When the title of this book, Technology, Development, and Happiness in a Spatial Island Economy, is exposed, the writer would like to analyze the correlation among the three key words in dealing with the development of islands countries, or it can be said in archipelago countries. It is understandable that in archipelago contries, there are some barriers in developing economy in every island. One of the visible barriers is demographic factors. Among islands must have straits, sea depths, natural disasters, people habbits and characters, weathers, and many more. Indonesia, for example, has about 17,000 islands from the west to the east, and from the north to the south. It is one of the islands countries in the world that has demographic factor which influence its economic growth. These demographic factors may make different development among them, one island may have better economy condition than the others. These different conditions may absolutely reflect to the condition of the islands country, in particular in its economy development of the country. Why economy? This has been agreed that a good economy condition of a country may reflect a good condition of a country. To look into the topic, this book describes about the importance of technology, development, and happiness of the economy condition in a spatial island economy. The writer organized the discussion into three parts, Spatial Island Economy, Technology and Economic Development, and Islamicity, Development and Happiness.

Spatial Island Economy in Part I, discusses about Input-Output (IO) model for spatial economy analysis, a new hybrid procedure for spatial island economy, the essence of industrial sectors in Java Island in Indonesian economy, spatial dimension of economic multipliers in Sumatera, Java, Kalimantan, Nusa Tenggara islands, and eastern part of indonesia. Input-Output (IO) model for special economy analysis is said to be a model that does not only describe kinds, the agents, and the venues of economic activities, but it can also give analysis about direct impact, indirect impact, and induced impact. The IO is also can be used for analizing the sectoral interdependency and spatial interdependency that are common in spatial economy or islands countries.

The writer tried to expose the GIRIOT (Generation of Inter-Regional Input Output Tables) as a hybrid procedure of Island Economy. GIRIOT is dirived from GRIT III, a method developed by University of Queensland (West et.al 1989) and a technique developed by Boomsma & Oostenhaven 1992 called DEBRIOT (Double Entry Bi-Regional Input-Output Tables). Although the DEBRIOT is good only for economic deals with a two regions model, the writer tried to find out the possibility for the use in Indonesia with thousands islands. The other important breakdowns in this Part I are on the concentration of Industries in Java island and a look on the spatial dimension of economic multilpliers in many island areas in Indonesia.

In Part II, the book talked on the relation of technology and economic development in spatial island economy that includes technology efficiency and return to scale. It also ranges from spatial, sectoral, and national perspectives, economic growth, poverty reduction, the role of technology, the existance of Philip Curve. Despite of the use of technology in economic development, the issues on the human development and the global human competitiveness are also important. The writer quoted a view from Streeten (1994) that development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives. All of the factors the writer mentioned are very important to pursue economic welfare for people particularly people's economy in spatial island country like Indonesia.

Part III is giving us about the Islamicity that may create development and happiness for people in a spatial island economy. It is interesting that religion like Islam may also have a power to influence the economic development and happiness. The Islamic live is regarded to have a strong influence to the economic growth, human development and human happiness, and economic global competitiveness in spatial island country like Indonesia. The writer mentioned interesting issue that he tried to analyze the direct and indirect impact of Islam in global economic competitiveness. He quoted the world index of human being from 123 countries that the result showed the Islamicity has direct and positive impact to the economic global comepetitiveness.

Overall, this book describes and conveys some issues on the technology, development and happiness in a spatial island economy. There are many spatial island countries in the world including Indonesia, Japan, the Phillipines, Srilangka, Singapore, and many more. In particular, this book focuses on the economic condition in Indonesia. There must be differences in economy development in spatial island countries and the ones in land countries like China, India, USA, Australia, and some more.

This book is very important and it is worth to learn by academicians in Indonesia and in other countries as well.

Jakarta, 17 August 2018

Tim Editor

CONTENTS

Chapter-1

Technology, Development and Happiness in a Spatial Island Economy: An Introduction

1. Introduction

This book consists of collection of papers that were published in scientific journals both national and international. In national journals, three chapters were written in Bahasa, but the rests were written in English. All chapters published in Accredited National Journals were written in English. Internationally, some chapters were published by indexed international journals. Two chapters were published in Scopus indexed International Journal (*International Jurnal of Economic Perspectives*), others were published in Thompson Reuter Indexed International Journal as well as Copernicus International indexed International Journal, among others:in*International Journal of Science and Research, International Journal of Advanced Research, International Journal of Social Science and Economic Research, International Journal of Economic and Research*, and others.

This 30 chapter book divided into 3 parts. Part one discusseson the spatial island economy of Indonesia with 10 chapters on it. Chapter 2 discusses on input-output model for analyzing spatial aspects for an economy. Chapter 3 proposes a new hybrid model for constructing inter-regional input-output tables. Chapter 4 presents and discusses the spatial structure of Island economy of Indonesian. Chapter 5 presents and discussed economic significance of manufacturing Industry, the Island of Java and manufacturing Industry in Island of Java on Indonesian economy. In the next 5 chapters discusses on spatial multipliers in Indonesian Island economy. Chapter 6 discusses spatial dimension of multipliers in Sumatera Island economy. Chapter 7 presents spatial dimension of multipliers in Java Island economy. Chapter 8 discusses spatial dimension of multipliers in Kalimantan Island economy. Chapter9 provides spatial multipliers in Nusa

Tenggara Island economy. Chapter10 discusses spatial dimension of multipliers in Eastern Indonesia's economy. Finally in Chapter 11 spatial multipliers and linkages in Indonesian economy is presented and discussed.

Part two consists of 12 chapters, mainly discusses on technology and economic development. The first 4 chapters namely Chapter 12, 13, 14 and 15 discusses on technical efficiency in Indonesian economy. Chapter 12 discusses technical efficiency in Indonesian economy during the New Order and Reformation governments. Chapter 13 presents sectoral variation in Indonesian economy, meanwhile Chapter 14 presents spatial variation in Indonesian economy. Chapter 15 summaries the technical efficiency in Indonesian economy. Chapter 16 discusses the relationship between technological progress and economic growth using regression analysis. Chapter 17 discusses the relationship and impact of technological progress on poverty reduction during Yudhoyono administration, using path analysis. Chapter 18 and Chapter 19 discusses technology contribution on Indonesian economy both at national and regional levels. Chapter 20 and Chapter 21 discusses on the impact of technological progress on two important development indicators: human development index and the index of global competitiveness. Chapter 22 and Chapter 23 discuss on the Philip Curve, trade-off between inflation and unemployment both in the short-run and in the long-run; negative correlation between the rate of inflation and unemployment rate.

Part three consists of 6 chapters discussing on happiness related to development and Islamicity. Chapter 24discusses on Islamicity, Human Development and Global Competitiveness. Chapter 25 discusses on the relationship and impact ofIslamicity, Economic Growth and Human Development on Happiness. Chapter-26 discusses on Human Development, Global Competitiveness and Happiness, and Chaper-27 discusses on Economic Growth, Human Development and Global Competitiveness. Chapter-28 discusses on Economic Growth, Human Development, Global Competitiveness and Happiness. Finally, Chapter 29 discusses on Islamicity, Economic Growth, Human Development and Happiness.

This introductory chapter will explore the concepts discussed in this book, such as happiness, global competitiveness, human development, economic growth, technological progress and Islamicity. The methods of analysis will also be introduced.

2. Concepts

Happiness.Happiness is a mental or emotional state of well-being defined by positive or pleasant emotions ranging from contentment to intense joy (Hornby, A.S., 1985). The Merriam Webster online dictionary defines happiness as a state of well-being or contentment, a pleasurable or satisfying experience. Happy mental states may also reflect judgments by a person about their overall well-being (Anand, P., 2016). Happiness is a fuzzy concept and can mean many different things to many people. Related concepts are well-being, quality of life and flourishing. At least one author defines happiness as contentment (Graham, M. C., 2014). Some commentators focus on the difference between the hedonistic tradition of seeking pleasant and avoiding unpleasant experiences, and the eudaimonic tradition of living life in a full and deeply satisfying way (Deci, E.L. & Ryan, R. M., 2006). Algoe, S., & Haidt, J., (2009) stated that happiness may be the label for a family of related emotional states, such as joy, amusement, satisfaction, gratification, euphoria, and triumph.

It has been argued that happiness measures could be used not as a replacement for more traditional measures, but as a supplement (Weiner, E. J., 2007). Several scales have been used to measure happiness, such as: the SHS (Subjective Happiness Scale) is a four-item scale, measuring global subjective happiness (Lyubomirsky, S. & Lepper, H. S., 1999). The PANAS (Positive and Negative Affect Schedule) is used to detect the relation between personality traits and positive or negative affects at this moment, today, the past few days, the past week, the past few weeks, the past year, and generally (on average). The SWLS (Satisfaction with Life Scale) is a global cognitive assessment of life satisfaction developed by Diener, E., et al., (1985).

There have also been some studies that happiness related religion (among others: Baetz, M & Toews, J, 2009; Ellison, C. G. & George, L.K., 1994). There are a number of mechanisms through which religion may make a person happier, including social contact and support that result from religious pursuits, the mental activity that comes with optimism and volunteering, learned coping strategies that enhance one's ability to deal with stress, and psychological factors such as reason for being. It may also be that religious people engage in behaviours related to good health, such as less substance abuse, since the use of psychotropic substances is sometimes considered abuse (Baetz & Toews, 2009; Ellison & George, 1994; Strawbridge, W. J., et al., 2001; Burris, C.T., 1999).The Handbook of Religion and Health describes a survey that examined happiness in Americans who have given up religion, in which it was found that there was little relationship between religious disaffiliation and unhappiness (Koenig, H. G. et al., 2001). A survey also cited in this handbook, indicates that people with no religious affiliation appear to be at greater risk for depressive symptoms than those affiliated with a religion. A review of studies by 147 independent investigators found, "the correlation between religiousness and depressive symptoms was -0.096, indicating that greater religiousness is mildly associated with fewer symptoms" (Smith, T. B., et al., 2003).

Some religion teaching on the happiness, such as from Buddhist view that happiness forms a central theme of Buddhist teachings (O'Brien, B., 2016). Happiness in Judaism is considered an important element in the service of God (Yanklowitz, S, 2012). The primary meaning of happiness in various European languages involves good fortune, chance or happening. In Catholicism, the ultimate end of human existence consists in felicity blessed happiness (Thomas, A., 2010).

In April 2012, the first World Happiness Report was published in support of the High Level Meeting at the United Nations on happiness and well-being, chaired by the Prime Minister of Bhutan. The report outlined the state of world happiness, causes of happiness and misery, and policy implications highlighted by case studies. In September 2013 the second World Happiness Report offered the first annual follow-up and reports are now issued every year (Helliwell, J, et al., 2016). On March 2016 on UN Happiness Day, United Nations Development Programme updated the World Happiness Report 2016 which is a landmark survey of the state of global happiness (United Nations Development Programme, 2016).

Global Competitiveness. According to Porter (2009), fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services. However, competitiveness has been defined and understood diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to IMD (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (WEF, 1996).

But According to Feurer, R. and Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes.

National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R. & Lodge, G. C., 1985). Competitiveness includes both efficiency; reaching goals at the lowest possible cost and effectiveness; having the right goals. It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et al, 1998).

The concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report 2009-2010 of the World Economic Forum (2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum (2003), in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook.

The Global Competitiveness Report is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index (World Economic Forum, 2015), developed by Xavier, S, M., and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index. Up to 2009, the GCI provides a holistic overview of factors that are critical to driving productivity and competitiveness, and groups them into nine pillars: Institutions, Infrastructure, Macro-economy, Health and primary education, Higher education and training, Market efficiency, Technological readiness, Business sophistication, and Innovation The selection of these pillars and the factors underlying them is based on the latest theoretical and empirical research. It is important to note that none of these factors alone can ensure competitiveness (World Economic Forum, 2009). From 2010, the pillars adjusted into 12 and grouped into 3 keys, namely key for factor driven consist of pillars: Institutions, Infrastructure, Macroeconomic environment, and Health and primary education; key for efficiency driven consist of pillars: Higher education and training, Goods market efficiency, Labor market efficiency, Financial market development, Technological readiness, and Market size; key for innovation driven, consist of pillars: Business sophistication, and Innovation (World Economic Forum, 2010).

Human Development. The human development approach, developed by the economist Mahbub Ul-Haq (2003), is anchored in Nobel Laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition, with its core being the capability approach. It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress. The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms people enjoy; to lead a kind of life they have reason to value (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015a). The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nation Development Program, 2015b).

Economic Growth. Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. This growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Theories and models of economic growth include: Classical Growth Theory of Ricardian, which was originally Thomas Maltus' theory about agriculture (Bjork, G.J., 1999); Solow-Swan Model, developed by Sollow, R., (1956) and Swan, T., (1956); Endogenous Growth Theory, which focus on what increases human capital or technological change (Helpman, E., 2004); Unified Growth Theory, developed by Galor, O., (2005); The Big Push Theory, which was popular in the 1940s; Schumpeterian Growth Theory, which is where entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002); Institutions and Growth Theory (Acemoglu, at.al., 2001); Human Capital and Growth Theory (Barro & Lee, 2001).

Technological Progress. Technological progress, technological development, technological achievement, or technological progress is the overall process of invention, innovation and diffusion of technology or processes. In essence technological progress is the invention of technologies and their commercialization via research and development, the continual improvement of technologies, and the diffusion of technologies throughout industry or society. In short, technological progress is based on both better and more technology (Jaffe et al., 2002). In economics, change in a production function that alters the relationship between inputs and outputs. Normally it is understood to be an improvement in technology, or technological progress. Technological progress is a change in the set of feasible production possibilities (Hicks, J.R., 1963).

Technological progress and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Anonymous, 2017).

It has been observed that major part of increased productivity is due to technological progress. Technological progress is one of the most important determinants of the shape and evolution of the economy. Technological progress has improved working conditions, permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded as primary source in economic development and the various technological progresses contribute significantly in the development of underdeveloped countries (Anonymous, 2017).

The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased. On the one hand, consumption of the household rises, while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases (Anonymous, 2017).

Technological progress may produce short-run employment-adjustment problems overstate those problems. They also often fail to mention that the short-run unemployment that occurs is primarily the result of artificial imperfections in certain labor and product markets. The amount of short-run unemployment created by advancing technology is directly related to the degree of artificiality in the particular labor markets affected. It will be argued that the workers harmed by technological advancement are those who have been receiving wages in excess of the amount they would receive in a fully competitive labor market (Mabry, R.H. & Sharplin, A.D, 1986). Even though technological progress may adversely affect the demand for labor in some labor markets, the overall effect of technological progress on total employment may be positive. Technological progress tends to increase the rate of economic growth. Higher rates of economic growth are generally associated with lower unemployment rates. Baumol, W.J., & Wolff, E.N., (1998) addressed the issue of structural unemployment that results from a more rapid pace of technological progress. They note that a higher rate of technological progress generally results in higher rates of structural unemployment. Technological progress tends to create more jobs than are lost (OECD, 2016).

Islamicity. Islam is the religion that is a complete way of life. Nothing is too small or too big to be covered by the teachings of Islam. Rejoice and be happy, remain positive and be at peace. This is what Islam teaching about happiness (Al Qarni, 2003). Every single one of God's commandments aims to bring happiness to the individual. This applies in all aspects of life, worship, economics, and society (Stacey, A, 2011). Rehman, S.S., & Askari, H., (2010a; 2010b) develop an index to measure the "Islamicity" of 208 countries adherence to Islamic principles using four sub-indices related to economics, legal and governance, human and political rights, and international relations. Further, Askari et al., (2016) continue to measure Islamicity index and published Islamicity ranking for 2015. In order to measure the Islamicity of the countries in their study, Aksari et al., (2016) divided Islamic teachings into the following four dimensions: economic Islamicity, legal and governance, human and political right and international relation with overall Islamicity representing the fifth. So far, no study has been conducted to test the correlation between competitiveness and Islamicity; *vice versa*.

3. Methods of Analysis

This Section provides description on methods of analysis employed in the chapters. In part one, input-output analysis was used in all chapters, Chapter 2 through Chapter 11. In part two, regression analysis andgrowth accounting technics were used to calculate total factor productivity to measure technological progress and the contribution of technology in Indonesian economy. In Part three, path analysis for correlation and impact analysis were intensively employed.

Input-Output analysis. An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1,2,...,n) \text{ and } (r, s = 1,2,...,m) \qquad (1)$$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions. In matrix term, the model can be expressed as:

$$x = Ax + y \text{ or } x = (I - A)^{-1}y \qquad (2)$$

where: x is a vector of output, A is a matrix of input-output coefficients with elements of a_{ij}-s and y is a vector of final demand; $(I - A)^{-1}$ is Leontief inverse matrix with elements of b_{ij}-s. Basically, A matrix in equation (2) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model (Muchdie, 2011). Equation (2) can then be rewritten as:

$$x = \mathrm{T}\,(\mathrm{A}\,x + y) \quad \text{or} \quad x = (\mathrm{I} - \mathrm{T}\,\mathrm{A})^{-1}y \tag{3}$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated by Indonesian data 2015 (Muchdie, 2017).

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West and Jensen in Muchdie (2011) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

Table 1.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, in Muchdie (2011) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table1.

DiPasquale & Polenske in Muchdie (2011) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment.

Table 1.2

Inter-regional Sector-Specific and Region-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_i$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ i = 1,..n

Note : *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region.

Regression analysis and growth accounting method. The method for calculating TFP, as measure of technology contribution as well as to measure technological progress, in this research was growth accounting method. This method has been used in many countries to calculate TFP. So the results can easily be compared with other countries. Using the production function of Cobb-Douglas, as:

$$Q_t = A_t\, F\,(K_t\, L_t) \qquad (1)$$

where Q_t is output in year-t, $K_t$is Capital and L_t is Labor. Hananto Sigit (2004) calculated TFP with formulating trans-log production function as:

$$\ln Q_t = \ln\alpha_0 + \alpha_t T + \alpha_k \ln K_t + \alpha_l \ln L_t + ½\, \beta_{kk}(\ln K_t)^2 + \beta_{kl}\ln K_t \ln L_t + ½\, \beta_{ll}(\ln L_t)^2 + \beta_{kT} T\ln K_t + \beta_{Tl} T\ln L_t + ½\, \beta_{TT}T^2 \qquad (2)$$

If equation (2), differentiated toward time, then :

$$Q_t^* = \alpha_t + \alpha_k K_t^* + \alpha_l L_t^* + \beta_{kk} (\ln K_t)\, K_t^* + \beta_{lk} (K_t^* \ln L_t + L_t^* \ln K_t) + \beta_{ll} (\ln L_t)\, L_t^* + \beta_{kT} (TK_t^* + \ln K_t) + \beta_{lT} (TL_t^* + \ln L_t) + \beta_{TT} T \qquad (3)$$

Equation (3)is a growth equation. Start notasion, *, indicate a continum growth. Equation (3) can be rewritten as

$$Q_t^* = TFP_t^* + S_k\, K_t^* + S_l\, L_t^* \qquad (4)$$

Based on equation (4), the value of TFP can be calculated. As the equation (4) is a continum equation, but the values needed are discrit TFP then the equation of TFP growth reformulated as:

$$TFPG_t = ½\,(TFP_t^* + TFP_{t-1}^*) = (\ln Q_t - \ln Q_{t-1}) - ½\,(S_{kt} + S_{kt-1})(\ln K_t - \ln K_{t-1}) - ½\,(S_{lt} + S_{lt-1})(\ln L_t - \ln L_{t-1}) \qquad (5)$$

With the equation (5), the TFP growth at year can easily be calculated.

Data needed for this study were: 1. Gross Domestic Product and/or Gross Regional Domestic Product, 2. Capital Stock, 3. Labour, 4. Wage/Salary, and 5. Depreciation. Data adjusted by excluding indirect tax, so data of GDP and or GRDP are data at factors cost. For national analysis data are available for the year of 1967-2011, for sectoral analysis data are available for the year of 1977-2007 and for spatial analysis data are available for year 202-2010.

After data adjustment process, steps in calculation TFP growth using *growth accounting method* are as follows:

1. Calculate labor income share year-t (LIS_t) with formula :

$$LIS_t = \frac{Wage/Salary\ at\ year\text{-}\ t}{GDP\ year\text{-}\ t} \qquad (6)$$

2. Calculate average labor income share at year-t *($LISA_t$)*:

   $$LISA_t = ½ (LIS_t + LIS_{t-1}) \qquad (7)$$

   where:

   LIS_t = Labor income share at year-t

   LIS_{t-1} = Laborincome share at year t-1
3. Calculate capital income share at year-t (KIS_t) with formula:

   $$KIS_t = 1 – LIS_t \qquad (8)$$
4. Calculate average capital income shareat year- t ($KISA_t$):

   $$KISA_t = ½ (KIS_t + KIS_{t-1}) \qquad (9)$$

   where:

   KIS_t = Capital income share year-t

   KIS_{t-1} = Capital income shareyear t-1
5. Calculate the rate of economic growth at year-t (EG_t):

   $$EG_t = (ln\ GDP_t – ln\ GD_{t-1}) \times 100 \qquad (10a)$$

   where:

   GDP_t = GDP at constant price at year-t

   GDP_{t-1} = GDP at constant price at year t-1

   For sectoral calculation:

   $$SGi_t = (ln\ VAi_t – ln\ VAi_{t-1}) \times 100 \qquad (10b)$$

   where:

   VAi_t = Value-Added sector i at constant price at year-t

   VAi_{t-1} = Value-Added sector i at constant price at year t-1
6. Calculate the rate of capital stock growth at year -t (KG_t):

   $$KG_t = (ln\ K_t – ln\ K_{t-1}) \times 100 \qquad (11)$$

where:

K_t = Capitak stock at year-t

K_{t-1} = Capital stock at yeat- t-1

7. Calculate weigthed average the growth rate of capital stock at year-t (KGA_t):

$$KGA_t = ½ (KIS_t + KIS_{t-1}) x (ln K_t – ln K_{t-1}) x 100 \quad (12)$$

8. Calculate the growth rate of labor at year-t (LG_t):

$$LG_t = (ln L_t – ln L_{t-1}) x 100 \quad (13)$$

where:

L_t = Labor at year-t

L_{t-1} = Labor at year- t-1

9. Calculate weigthed average of the labor growth at year-t (LGA_t) :

$$LGA_t = ½ (LIS_t + LIS_{t-1}) x (ln L_t – ln L_{t-1}) x 100 \quad (14)$$

10. The growth rate of TFP at year-t ($TFPG_t$) can be calculated as follow:

$$TFPG_t = EG_t – KGA_t – LGA_t \quad (15)$$

Further more, contribution of factors such as labor, capital and TFP on economic growth are calculated as:

11. Contribution of capital $= \frac{\text{Equation (12)}}{\text{Equation (10)}} \text{ X } 100$ (16)

12. Contribution of labor $= \frac{\text{Equation (14)}}{\text{Equation (10)}} \text{ X } 100$ (17)

13. Contribution of TFP $= \frac{\text{Equation (15)}}{\text{Equation (10)}} \text{ X } 100$ (18)

Path analysis. Path analysis represents an attempt to deal with causal types of relationships. In statistics, path analysis is used to describe the directed dependencies among a set of variables. It was developed by Sewall Wright (1921; 1934). This includes models equivalent to any form of multiple regression analysis, factor analysis, canonical correlation analysis, discriminant analysis, as well as more general families of models in the multivariate analysis of variance and covariance analyses (MANOVA, ANOVA, ANCOVA).In addition to being thought of as a form of multiple regressions focusing on causality, path analysis can be viewed as a special case of structural equation modeling (SEM).

That is, path analysis is SEM with a structural model, but no measurement model. Other terms used to refer to path analysis include causal modeling, analysis of covariance structures, and latent variable models.

Basically, the path model can be used to analysis two types of impacts: direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin, D.F., & Hauser, R.M., 1975).It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y., 2003). In the model below, the two exogenous variables (Ex_1 and Ex_2) are modeled as being correlated and as having both direct and indirect (through En_1) effects on En_2 (the two dependent or 'endogenous' variables). In most real models, the endogenous variables are also affected by factors outside the model (including measurement error). The effects of such extraneous variables are depicted by the "e" or error terms in the model. Using the same variables, alternative models are conceivable. For example, it may be hypothesized that Ex_1 has only an indirect effect on En_2, deleting the arrow from Ex_1 to En_2; and the likelihood or 'fit' of these two models can be compared statistically.

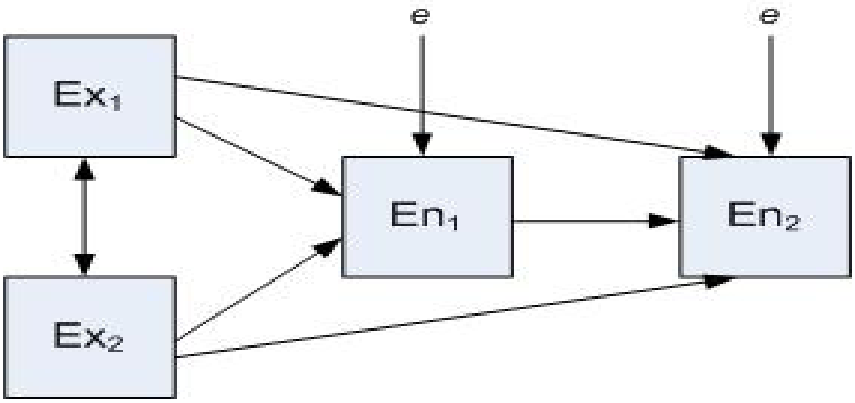

Figure 1.1
Path Model used toDirect and Indirect Impact Analysis

Path coefficients could be calculated by solving these path equations; given that the coefficients of correlation have been calculated. If P_{ij}> 0.5 then the impact will be statistically significant.

Table 1.3

Path Equations

1). $r_{12} = p_{21}$ Direct efect (DE)	4). $r_{14} = p_{41} + p_{42}r_{12} + p_{43}\, r_{13}$ Direct effect + Indirect effect (IE)
2). $r_{13} = p_{31} + p_{32}\, r_{12}$ Direct effect (DE) + Indirect efect (IE)	5). $r_{24} = p_{41}\, r_{12} + p_{42} + p_{43}r_{23}$ Direct effect (DE) + Indirect effect (IE) + Spurious (S)
3). $r_{23} = p_{31}\, r_{12} + p_{32}$ Spuriuos effect (S) + Direct effect (DE)	6). $r_{34} = p_{41}\, r_{13} + p_{42}r_{23} + p_{43}$ Direct effect (DE) + Spurious (S)

Source: http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001), "The Colonial Origins of Economic Development: an Empirical Investigation", **American Economic Review**, 91(5): 1369–1401.

Aghion, P., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality", **Econometrica**, 70 (3): 855–882.

Al Qarni, A idh Ibn Abdullah, (2003). *Don't be Sad*. Saudi Arabia: International Islamic Publishing House.

Algoe, S. B., and Haidt, J., (2009), "Witnessing Excellence in Action: The 'Other-praising' Emotions of Elevation, Gratitude, and Admiration", **The Journal of Positive Psychology**, 4 (2): 105–127. Doi:10.1080/17439760802650519.

Alkire, S., (1998), **Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities,**University of Oxford, Oxford,OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975), "The Decomposition of Effects in Path Analysis", **American Sociological Review**, 40(1): 37-47.

Anand, P., (2016), **Happiness Explained**, Oxford University Press, Oxford.

Anonymous, (2017), http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

Askari, H., Mohammadkhan, H., and Mydin, L., (2016), **Islamicity Indices 2015**, available on line at http://islamicity-index.org/wp/islamicity-indices/

Baetz, M., and Toews, J., (2009), "Clinical Implications of Research on Religion, Spirituality, and Mental Health", **Canadian Journal of Psychiatry**, 54 (5): 292–301.

Barro, R. J., and Lee J.W., (2001), "International Data on Educational Attainment: Updates and Implications", **Oxford Economic Papers,** 53 (3): 541–563.

Baumol, W. J., and Wolff, E. N., (1998), "Side Effects of Progress", **Public Policy Brief**, Available at http://www.levy.org/docs/hili/41a.html.

Bjork, G.J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport, CT, London: 251, ISBN 0-275-96532-5.

Buckley, P.J., Le Pass, C., and Prescott, K., (1988), "Measures of International Competitiveness: A Critical Survey", **Journal of Marketing Management**, 4(2): 175-200.

Burris, C.T., (1999),"Religious Orientation Scale", In Hill, P.C., and Hood, R.W., (Eds), **Measures of Religiosity**, Religious Education Press, Birmingham: 144–53,ISBN 978-0-89135-106-1.

Deci, E. L., and Ryan, R. M., (2006), "Hedonia, Eudaimonia, and Well-being: An introduction", **Journal of Happiness Studies**, 9 (1): 1–11. Doi:10.1007/ s10902-006-9018-1.

Diener, E., Emmons, R. A., Larsen, R. J., and Griffin, S., (1985),"The Satisfaction with Life Scale",**Journal of Personality Assessment**,49(1): 71–5, DOI: 10.1207/ s15327752jpa4901_13.

Dodge, Y., (2003), **The Oxford Dictionary of Statistical Terms**, OUP, ISBN 0-19-920613-9.

Ellison, C.G., and George, L.K., (1994), "Religious Involvement, Social Ties, and Social Support in a Southeastern Community", **Journal for the Scientific Study of Religion**, 33 (1): 46–61. DOI: 10.2307/1386636, JSTOR 1386636.

Feurer, R., and Chaharbaghi, K., (1995), "Strategy Development: Past, Present and Future", **Management Decision**, 33(6): 11 – 21.

Galor, O., (2005), "From Stagnation to Growth: Unified Growth Theory", **Handbook of Economic Growth**, Elsevier.

Graham, M. C., (2014), **Facts of Life: Ten Issues of Contentment**, Outskirts Press: 6–10, ISBN 978-1-4787-2259-5.

Helliwell, J., Layard, R., and Sachs, J., (2016), "World Happiness Report", **United Nations Development Programme**.

Helpman, E., (2004),**The Mystery of Economic Growth,** Harvard University

Press, Harvard.

Hicks, J.R., (1963), **The Theory of Wages**, Ch. VI, Appendix, and Section III. Macmillan.

Hornby, A.S., (1985), **Oxford Advanced Learner's Dictionary of Current English**, Twenty Second Impression, Oxford University Press, Oxford.

Hulu, E (1990), **Model Input-Output: Teori dan Applikasinya (Input-Output Model: Theory and Its Applications),** Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Jakarta: Universitas Indonesia (*the University of Indonesia*).

IMD, (2003), **World Competitiveness Yearbook 2003** available at www. imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking; https:// worldcompetitiveness. imd.org/

IMF, (2012), **Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Jaffe, A.B., Newell, R.G. & Stavins, R.N., (2002), "Environmental Policy and Technological Change", **Environment Resource Economics**, 22: 41. DOI: 10.1023/A: 1015519401088.

Koenig, H. G., Larson, D. B., and Mcculloug, M. E., (2001), **Handbook of Religion and Health**,: 122, Oxford University Press, Oxford, ISBN: 0-8133-6719-0.

Lyubomirsky, S., and Lepper, H. S., (1999), "A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation", **Social Indicators Research**,46 (2): 137–55,DOI:10.1023/A:1006824100041

Mabry, R. H, and Sharplin, A.D., (1986) "Does More Technology Create Unemployment?" **Cato Institute Policy Analysis No. 68**.

Muchdie, (1998), **Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study**, Unpublished PhD Thesis, Department of Economics, the University of Queensland, Australia. http://espace.library. uq.edu.au/view/UQ:218710

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables**, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6.

Muchdie, (2017), "GIRIOT Revisited, Up-dated and Evaluated", **International Journal of Social Science and Economic Research,** 2(02): 2377-2396.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006), **A New Deal for Effective European Research Policy**, Springer, ISBN: 978-1-4020-5550-8.

Nussbaum, M., (2000), **Women and Human Development: The Capabilities Approach**, Cambridge University Press, Cambridge New York, ISBN 9780521003858.

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, MA: 33-34, ISBN 0674072359.

OECD, (2016), "The OECD Jobs Study: Facts, Analysis, and Strategies", Retrieved on 16 August 2016. http://www1.oecd.org/sge/min/job94/part2c.htm

Porter, M., (2009), "Clusters and Economic Policy", **ISC White Paper**, Available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf.

Rehman, S. S., and Askari, H., (2010a), "How Islamic are Islamic Countries?", **Global Economy Journal**, 10(2): 1-37, http://www.bepress.com/gej /vol10/iss2/2 DOI: 10.2202/1524-5861.1614.

Rehman, S. S., and Askari, H., (2010b), "An Economic Islamicity Index (EI2)", **Global Economy Journal**, 10(3): 1-37, http://www.bepress.com/gej/ vol10/iss3/1 DOI: 10.2202/1524-5861.1680

Scott, B. R., and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston MA.

Sen, A., (2005), "Human Rights and Capabilities", **Journal of Human Development**, 6 (2): 151–166, DOI: 10.1080/14649880500120491.

Sigit, Hananto, (2004), "Total Factor Productivity Growth: Survey Report", **Part II National Report: Indonesia,** Asian Productivity Organization, Tokyo.

Smith, T. B., McCullough, M. E., and Poll, J., (2003),"Religiousness and Depression: Evidence for a Main Effect and the Moderating Influence of Stressful Life Events", **Psychological Bulletin,** 129 (4): 614–36, DOI:10.1037/0033-2909.129.4.614.

Solow, R. M., (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics**, 70 (1): 65-94.

Srinivasan, T.N., (1994). "Human Development: A New Paradigm or Reinvention of the Wheel?" **Human Development**, 84 (2): 238–243.

Stacey, A., (2011), **Happiness in Islam: Happiness is found in Sincere Worship**, http://www.islamreligion.com/articles/435/viewall/happiness-in-islam.

Stajano, A., (2010), **Research, Quality, Competitiveness**, EU Technology Policy for the Knowledge-based Society, Springer ISBN: 978-0-387-79264-4.

Strawbridge, W. J., Shema, S. J., Cohen, R. D., and Kaplan, G. A., (2001), "Religious Attendance Increases Survival by Improving and Maintaining Good Behaviors, Mental Health, and Social Relationships", **Annals of Behavioral Medicine**, 23 (1): 68–74,DOI:10.1207/S15324796ABM2301_10. PMID 11302358.

Streeten, P., (1994), "Human Development: Means and Ends", **Human Development**, 84(2): 232–237.

Swan, T.W., (1956), "Economic Growth and Capital Accumulation", **Economic Record**, 32: 334–361, DOI: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003), "The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S., (Eds), **Readings in Human Development**: 17-34. Oxford, Oxford University Press, UK.

United Nations Development Programme, (1997), "Human Development Report", pp: 15. ISBN 978-0-19-511996-1.

United Nations Development Programme, (2015a), "Human Development Reports", at http: http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2015b), "Human Development Reports", at http://hdr.undp.org/eandevn/hum.

Weiner, E. J., (2007), "Four Months of Boom, Bust, and Fleeing Foreign Credit", **Los Angeles Times,** Archived from the original on December 22, 2007.

World Economic Forum, (1996), **Global Competitiveness Report 1996**, Geneva: World Economic Forum, pp: 19.

World Economic Forum, (2010), **The Global Competitiveness Report 2009–2010**, pp: 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Health Organization, (2016), "Preventing Disease Through Healthy Environments: A Global Assessment of the Burden of Disease from Environmental Risks", Available at http://www.eho.org/ Retrieved 4 August 2016

Wright, S., (1921), "Correlation and Causation", **Journal Agricultural Research**, 20, 557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical Statistics**, 5(3), 161-215.

Xavier, S.M., and Artadi, E.A., (2004), "The Global Competitiveness Index", **Global Competitiveness Report**, Global Economic Forum.

Part-1

SPATIAL-ISLAND ECONOMY

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Chapter 11
Spatial Multipliers and Linkages in Indonesian Economy

Chapter-2

Model Input-Output untuk Analisis Ekonomi Spasial[1]

Ringkasan

Bab ini membahas model input-output, khususnya model-model yang berdimensi spasial, sebagai metoda analisis dan perencanaan ekonomi spasial. Pertama-tama, kerangka dasar model dijelaskan dan dilengkapi dengan beberapa contoh tabel transaksi. Model-model berdimensi spasial kemudian dibahas dan dilanjutkan dengan membahas berbagai kegunaan model, baik kegunaan deskriptif maupun kegunaan analitik, khususnya untuk keperluan perencanaan ekonomi spasial; ekonomi wilayah. Akhirnya, beberapa kelemahan model juga dikemukakan dan solusi ditawarkan.

Summary

This chapter attempts to describe input-output model, especially those with spatial dimension, as a method of spatial analysis and planning. Basic framework of the model will firstly be described in which examples of several types of transaction tabel are provided. Spatial dimensions of the model are then introduced. Some important usefulness of the model both for descriptive and analytical purposes are stressed, especially those for spatial planning purposes. Finally, some notes regarding the drawbacks of the model are also provided.

[1] This chapter has been published in **Jurnal Ilmiah Teknologi dan Desain**, Universitas Trisakti, No. 6/Tahun 3/VII/1999, pp: 75-101.

1. Pendahuluan

Salah satu hasil nyata kegiatan pembangunan adalah telah makin meningkatnya "aspirasi" dan kebutuhan masyarakat. Pada keadaan seperti ini, model ekonomi agregat akan tidak terlalu banyak manfaatnya bagi perencanaan dan evaluasi kegiatan pembangunan. Mereka yang terlibat dalam proses pengambilan keputusan, termasuk ekonom, perencana dan pengawas pembangunan, bahkan politisi, membutuhkan sebuah model yang bukan hanya dapat menggambarkan jenis, lokasi dan pelaku kegiatan ekonomi, tetapi juga mampu memberikan analisis tentang dampak langsung, dampak tidak langsung dan dampak terimbas (*induced impact*) dari kegiatan-kegiatan pembangunan yang direncanakan.Model Input-Output (IO) mempunyai kapasitas tersebut. Seperti pernah dipaparkan oleh Jensen, Mandeville & Karunaratne (1979), model IO merupakan "*an excellent descriptive device and a powerful analytical technique*". Model ini bukan hanya merupakan suatu potret matematik suatu perekonomian karena dapat memberikan gambaran tentang ketergantungan struktural, tetapi juga mampu memprediksi dampak dari kegiatan-kegiatan ekonomi yang direncanakan. Bahkan, model Input-Output Antar-Daerah (IOAD), sebuah model yang berdimensi spasial, selain mampu memberikan gambaran tentang struktur ketergantungan sektoral (*sectoral-interdependency*), juga mampu menunjukkan ketergantungan spasial (*spatial-interdependency*); antar satu kegiatan ekonomi di satu daerah dengan kegiatan ekonomi di daerah lain (West, Morison & Jensen, 1982; West et al, 1989; Hulu, 1990).

Di Indonesia, kesadaran akan penggunaan model ini terutama untuk kepentingan perencanaan di daerah; pada tingkat provinsi, Kabupaten dan Kota. Ini ditunjukkan dengan telah semakin banyak daerah yang menyusun model input-output daerah. Hampir semua daerah provinsi telah mempublikasikan tabel input-output provinsi. Tahun 1997 saja, Muchdie mencatat tidak kurang dari 21 provinsi yang telah memiliki tabel input-output daerah tunggal. Sementara itu, beberapa daerah Kabupaten/Kota juga telah mempublikasikan tabel input-output.

Mengawali bagian dari buku ini, Bab-2 membahas model input-output sebagai model analisis perencanaan spasial, dengan pertama-tama menyajikan kerangka dasar model, termasuk beberapa jenis tabel transaksi. Kemudian, pembahasan difokuskan pada model-model IO yang berdimensi spasial. Kegunaan model IO, baik untuk keperluan deskriptif maupun untuk keperluan analitik, khususnya untuk kepentingan perencanaan spasial, dikemukakan sebelum dibahas beberapa catatan mengenai kelemahan-kelemahan model IO.

2. Model IO

a. Kerangka Dasar Model IO

Hubungan antara susunan input dan distribusi output kegiatan suatu perekonomian merupakan teori dasar yang melandasi model IO (Miller & Blair, 1985).Secara sederhana, model IO menyajikan informasi tentang transaksi barang dan jasa serta saling keterkaitan antar-satuan kegiatan ekonomi pada suatu wilayah untuk suatu waktu tertentu, yang disajikan dalam bentuk tabel. Isian sepanjang baris menunjukkan alokasi output dan isian Menurut kolom menunjukkan pemakaian input dalam proses produksi (BPS, 1985).

Kerangka dasar model IO terdiri atas empat kuadran seperti disajikan pada Gambar 1. Kuadran pertama menunjukkan arus barang dan jasa yang dihasilkan dan digunakan oleh sektor-sektor dalam suatu perekonomian. Kuadran ini menunjukkan distribusi penggunaan barang dan jasa untuk suatu proses produksi, sehingga disebut juga sebagai transaksi-antara (*intermediate transaction*). Kuadran kedua menunjukkan permintaan akhir (*final demand*), yaitu penggunaan barang dan jasa bukan untuk proses produksi, yang biasanya terdiri atas: konsumsi rumah tangga, pengeluaran pemerintah, persediaan (*stock*), investasi, dan ekspor. Kuadran Ketiga memperlihatkan input primer sektor-sektor produksi, yaitu semua balas jasa faktor produksi yang biasanya meliputi: upah dan gaji, surlus usaha, penyusutan, dan pajak tidak langsung. Kuadran Keempat memperlihatkan input primer yang langsung didistribusikan ke sektor-sektor permintaan akhir.

Gambar 2.1

Kerangka Dasar Model Input-Output

Kuadran I: Transaksi antar kegiatan (n x n)	Kuadran II: Permintaan akhir (n x m)
Kuadran III: Input primer sektor produksi (p x n)	Kuadran IV: Input primer permintaan akhir (p x m)

Tiap kuadran dinyatakan dalam bentuk matriks, masing-masing dengan dimensi seperti tertera pada Gambar 1. Bentuk seluruh matriks ini menunjukkan kerangka dasar model IO yang berisi uraian statistik mengenai transaksi barang dan jasa antar berbagai kegiatan ekonomi wilayah pada suatu periode waktu tertentu. Kumpulan sektor produksi pada kuadran pertama, yang berisi kelompok produsen, memanfaatkan berbagai sumberdaya dalam menghasilkan barang dan jasa secara makro, disebut sebagai sistem produksi. Sektor di dalam sistem produksi ini dinamakan sektor endogen. Sedangkan sektor di luar sistem produksi disebut sektor eksogen. Dengan demikian, dapat dilihat secara jelas bahwa model IO membedakan dengan tegas sektor endogen dan sektor eksogen. Output yang digunakan dalam sistem produksi ada yang berasal dari dalam sistem berupa input-antara dan juga ada yang berasal dari luar sistem, yang disebut input primer.

Sebagai ilustrasi, misalnya hanya ada tiga sektor ekonomi dalam suatu wilayah, yaitu sektor-1: primer (pertanian dan pertambangan), sektor-2: sekunder (industri manufaktur) dan sektor-3: tersier (jasa). Atas dasar klasifikasi ini, tabel transaksi disajikan pada Gambar 2.2.

Gambar 2.2

Ilustrasi Model Input-Output Tiga Sektor

Alokasi Output Susunan Input	Permintaan Antara Sektor Produksi	Permintaan Akhir	Penyediaan	
			Impor	Jumlah Output
Input Antara	Kuadran I	Kuadran II		
Sektor-1	X_{11} X_{12} X_{13}	Y_1	M_1	X_1
Sektor-2	X_{21} X_{22} X_{23}	Y_2	M_2	X_2
Sektor-3	X_{31} X_{32} X_{33}	Y_3	M_3	X_3
Input Primer	Kuadran III V_1 V_2 V_3			
Jumlah Input	X_1 X_2 X_3			

Penyediaan sektor-1 terdiri atas output domestik sektor-1 sebesar X_1 dan impor sebesar M_1. Dari jumlah tersebut sebesar X_{11} digunakan sendiri sebagai input, sebesar X_{12} digunakan oleh sektor-2 dan sebesar X_{13} digunakan oleh sektor-3. Sisanya, sebesar Y_1 digunakan untuk memenuhi permintaan akhir sektor-1 (lihat Kuadran II), berupa konsumsi rumah tangga, pengeluaran pemerintah, investasi dan ekspor.

Untuk menghasilkan output sebesar X_1, sektor-1 membutuhkan input dari sektor-1, sektor-2 dan sektor-3, masing-masing sebesar X_{11}, X_{21} dab X_{31} dan input primer sebesar V_1. Di sini dapat dilihat bahwa angka pada setiap sel bersifat ganda. Di lihat secara horisontal, angka-angka tersebut merupakan distribusi output, baik output hasil produksi domestik maupun impor. Secara vertical, angka-angka tersebut merupakan susunan input suatu sektor, yang diperoleh dari sektor-sektor lainnya. Gambaran di atas menunjukkan bahwa susunan angka-angka dalam bentuk matriks tersebut memperlihatkan suatu jalinan yang kait mengkait diantara sektor-sektor yang terdapat dalam suatu perekonomian.

Karena model IO merupakan "potret" matematika ekonomi dari suatu perekonomian, maka dapat digambarkan hubungan matematika sebagai berikut:

Dibaca menurut baris:

$$\begin{aligned} X_{11} + X_{12} + X_{13} + Y_1 &= X_1 + M_1 \\ X_{21} + X_{22} + X_{23} + Y_2 &= X_2 + M_2 \\ X_{11} + X_{12} + X_{13} + Y_1 &= X_1 + M_1 \end{aligned} \qquad (1)$$

yang secara umum dapat ditulis :

$$\sum_{j=1} X_{ij} + Y_i = X_i + M_i, \text{ untuk } i = 1, 2, 3 \qquad (2)$$

artinya, permintaan antara ditambah permintaan akhir sama dengan penyediaan, yaitu produksi domestik ditambah impor.

Persamaan (2 dapat ditulis sebagai:

$$X_i = \sum_{=1} X_{ij} + Y_i - M_i \qquad (3)$$

dimana:

X_{ij}: banyaknya output sektor-I yang digunakan sebagai input sektor-j

Y_i : permintaan akhir terhadap sektor-i

X_i : total output sektor-i

M_i: impor sektor-i

X_j : total output sektor-j

Jika koefisien input-output, yaitu jumlah input sektor-I yang digunakan per satuan output sektor-j, dirumuskan sebagai:

$a_{ij} = X_{ij}/X_j$, di mana i,j = 1, 2,…n (4)

Substitusikan persamaan (4) ke dalam persamaan (3), menghasilkan:

$X_i = (\sum_{j=1} a_{ij} X_j) + Y_i - M_i$ I = 1, 2,…n (5)

yang dalam bentuk matriks dituliskan sebagai:

$x = Ax - M + y$ (6)

di mana x adalah vektor total output, A adalah matriks koefisien input output, M adalah vektor impor dan y vektor permintaan akhir. Kemudian, melalui teknik manipulasi matematik, sejumlah persamaan linier tersebut dapat diselesaikan menjadi:

$x = (I - A + M)^{-1} y$ (7)

di mana I adalah matriks identitas, yaitu suatu matriks dengan unsur diagonalnya bernilai 1 dan unsur lainnya bernilai nol, $(I - A + M)^{-1}$ merupakan matriks kebalikan *Leontief* dari suatu tabel transaksi domestik, yang mempunyai kegunaan sangat penting dalam analisis pengganda (*multipliers*) model IO.

b. Jenis-Jenis Tabel Transaksi

Tabel transaksi adalah tabel yang menggambakan besarnya nilai transaksi barang dan jasa antara sektor-sektor kegiatan ekonomi suatu wilayah. Berdasarkan harga, terdapat dua jenis tabel transaksi, yaitu: tabel transaksi atas dasar harga pembeli dan tabel transaksi atas dasar harga produsen. Sedangkan berdasarkan perlakuan impor, dibedakan menjadi: tabel transaksi total, di mana impor diberlakukan secara bersaing dan tabel transaksi domestik, di mana impor diberlakukan secara tidak bersaing.

Tabel transaksi atas dasar harga pembeli adalah tabel transaksi yang menggambarkan nilai transaksi barang dan jasa antar kegiatan ekonomi yang dinyatakan atas dasar harga pembeli. Dalam tabel transaksi ini unsur marjin perdagangan dan biaya angkutan masih tergabung dalam nilai input bagi sektor yang membeli. Dalam penyusunan tabel IO, tabel transaksi inilah yang pertama kali disusun. Tabel transaksi atas dasar harga pembeli untuk 3 sektor ekonomi dicontohkan pada Tabel 2.1.

Tabel 2.1

Tabel Transaksi Total atas dasar Harga Pembeli (Milliar Rupiah)

	1	2	3	Permintaan Antara	Permintaan Akhir	Permintaan Total	Impor	Perdagangan & Angkutan	Output Total	Penyediaan Total
1	2.040	43.770	3.319	48.129	42.243	90.373	3.394	8.588	78.391	90.373
2	6.436	63.136	19.525	89.097	154.947	244.044	42.645	31.521	169.879	244.044
3	2.546	6.924	13.822	23.292	63.721	87.014	7.072	-40.109	120.050	87.014
Biaya Antara	11.023	113.829	35.666	160.912	260.912	421.430	53.111	0	368.320	421.430
Nilai Tambah	67.368	56.049	84.384	207.801						
Input Total	78.391	169.879	120.050	368.320						

Sumber: Diolah dari BPS, 1994

Sektor-1, meliputi sektor Pertanian dan pertambangan

Sektor-2, meliputi sektor Industri, Listrik, Gas & Air Minum, Bangunan

Sektor-3, meliputi sektor lainnya

Tabel transaksi atas dasar harga produsen adalah tabel transaksi yang menggambarkan nilai transaksi barang dan jasa antarsektor ekonomi dalam suatu wilayah yang dinyatakan atas dasar harga produsen. Artinya, dalam tabel transaksi ini unsur marjin perdagangan dan biaya angkutan telah dipisahkan sebagai input yang dibeli dari sektor perdagangan dan angkutan; dinyatakan dalam sektor tersendiri. Dengan mengeluarkan unsur marjin perdagangan dan biaya angkutan dari tabel transaksi atas dasar harga pembeli akan diperoleh tabel transaksi total atas dasar harga produsen, seperti diilustrasikan pada Tabel 2.2.

Tabel 2.2

Tabel Transaksi Total atas dasar Harga Produsen (Milliar Rupiah)

	1	2	3	Permintaan Antara	Permintaan Akhir	Permintaan Total	Impor	Perdagangan & Angkutan	Output Total	Penyediaan Total
1	1.811	41.130	1.906	44.848	36.938	81.785	3.394	0	78.391	81.785
2	5.582	54.121	16.462	76.164	136.359	212.523	42.645	0	169.879	212.523
3	3.629	18.579	17.299	39.507	87.615	127.122	7.072	0	120.050	127.122
Biaya Antara	11.023	113.829	35.666	160.912	260.912	421.430	53.111	0	368.320	421.430
Nilai Tambah	67.368	56.049	84.384	207.801						
Input Total	78.391	169.879	120.050	368.320						

Sumber: Diolah dari BPS, 1994

Tabel transaksi total adalah tabel transaksi yang menggambarkan besarnya nilai transaksi barang dan jasa, baik yang berasal dari produksi domestik maupun impor. Artinya, pada tabel transaksi ini nilai transaksi input-antara (Kuadran

I) antar sektor ekonomi mencakup transaksi barang dan jasa produksi dalam domestik dan impor. Pada tabel transaksi ini tergambar informasi mengenai nilai impor menurut sektor ekonomi yang ditujukan pada vector kolom di Kuadran II (Permintaan Akhir). Penyajian tabel seperti ini juga disebut sebagai model IO dengan perlakuan impor secara bersaing (*competitive import model*). Penyajian tabel transaksi total pada dasarnya sama dengan penyajian tabel transaksi, baik atas dasar harga pembeli maupun atas dasar harga produsen. Tabel 2.1 dan Tabel 2.2 merupakan contoh tabel transaksi total.

Tabel 2.3

Tabel Transaksi Domestik atas dasar Harga Produsen (Million Rupiah)

	1	2	3	Permintaan Antara	Permintaan Akhir	Permintaan Total	Impor	Perdagangan & Angkutan	Output Total	Penyediaan Total
1	1.789	38.070	1.894	41.752	36.639	78.391	0	0	78.391	78.391
2	4.909	35.757	13.974	51.639	115.239	169.879	0	0	169.879	169.879
3	3.423	17.795	15.569	30.788	83.262	120.050	0	0	120.050	120.050
Biaya Antara	10.120	91.622	31.437	133.180	235.140	368.320	0	0	368.320	368.320
Impor	902	22.207	4.230	27.339	25.772	53.111	0	0		53.111
Nilai Tambah	67.368	56.049	84.384	207.801						
Input Total	78.391	169.879	120.050	368.320						

Sumber: Diolah dari BPS, 1994

Tabel transaksi domestik adalah tabel transaksi yang menggambarkan besarnya nilai transaksi barang dan jasa antar sektor ekonomi yang hanya berasal dari produksi domestik; produksi lokal suatu wilayah. Tabel transaksi ini diperoleh dengan memisahkan nilai transaksi barang dan jasa yang berasal dari impor, baik transaksi antara maupun permintaan akhir, dari transaksi total. Jumlah impor masing-masing kolom disajikan dalam vektor baris tersendiri. Data pada sektor baris ini sekaligus menunjukkan rincian barang dan jasa menurut sektor yang menggunakan barang dan jasa tersebut. Penyajian model IO dengan memunculkan impor sebagai vektor baris disebut juga sebagai model IO dengan perlakuan impor tidak bersaing (*non-competitive import model*), seperti disajikan pada Tabel 2.3, di atas.

c. Matriks Koefisien Langsung dan Matriks Kebalikan

Tabel transaksi seperti disajikan pada Tabel 2.1, Tabel 2.2 dan Tabel 2.3 hanyalah merupakan suatu laporan neraca mengenai keadaan perekonomian pada suatu waktu tertentu. Tabel seperti ini mempunyai kemampuan analisis yang terbatas. Untuk keperluan analisis yang lebih menyeluruh, berikut ini akan dibahas matriks-matriks dalam bentuk koefisien, yaitu matriks koefisien langsung (*direct-coefficient matrix*), matriks kebaikan terbuka (*open-inverse matrix*), yang menggambarkan koefisien langsung dan tidak langsung dan matriks kebalikan tertutup (*closed-inverse matrix*) yang menggambarkan koefisien langsung, tidak langsung dan terimbas (*induced*). Matriks-matriks tersebut merupakan matriks yang sangat penting dalam analisis model IO.

Untuk contoh pada bahasan berikut akan digunakan tabel transaksi domestik atas dasar harga produsen (Tabel 2.4) yang diyakini sebagai model IO yang lebih mencerminkan keadaan yang sesungguhnya dari suatu perekonomian. Tabel transaksi ini terdiri atas empat sektor transaksi-antara ditambah sektor rumah tangga, baik pada kolom permintaan akhir maupun pada baris input primer. Sektor rumah tangga pada kolom permintaan akhir berupa kolom konsumsi rumah tangga, sedangkan sektor rumah tangga pada baris input primer berupa upah dan gaji yang diterima rumah tangga. Selain itu, untuk memudahkan analisis, juga disajikan kolom ekspor dan permintaan akhir lainnya pada sektor permintaan akhir serta baris impor dan input primer lainnya pada sektor input primer. Tenaga kerja yang diserap oleh setiap sektor juga disajikan menurut baris tenaga kerja.

Tabel 2.4
Tabel Transaksi Domestik atas dasar Harga Produsen (Milliar Rupiah)

	1	2	3	4	Permintaan Antara	Konsumsi Rumah Tangga	Permintaan Akhir lainnya	Ekspor	Output Total
1	4.057	4	22.706	3.439	30.206	20.280	320	1.379	53.186
2	7	142	9.384	3.026	12.559	0	2.796	13.265	28.620
3	3.771	718	19.866	23.848	48.202	42.271	3.965	28.621	123.059
4	2.239	1.799	11.745	26.439	42.223	52.690	58.529	10.023	163.465
Input Antara	10.073	2.664	63.701	56.751	133.190	116.242	65.610	53.289	368.330
Gaji-Upah	7.951	2.155	10.615	36.256	56.978	0	0	0	56.978
Input Primer Lainnya	34.581	23.479	31.352	61.412	150.824	0	0	0	150.824
Impor	581	322	17.390	9.046	27.339	7.942	17.829	0	53.111
Input Total	53.186	28.620	123.059	163.465	368.330	124.184	83.439	53.289	629.242
Tenaga kerja	39.005	698	8.027	26.548	74.278	0	0	0	74.278

Sumber: Diolah dari BPS, 1994

Sektor-1 meliputi sektor pertanian

Sektor-2 meliputi sektor pertambangan dan galian

Sektor-3 meliputi sektor industri

Sektor-4 meliputi sektor jasa

Matriks koefisien langsung. Matriks koefisien langsung, seperti disajikan pada Tabel 2.5, dihitung dengan cara membagi setiap sel (menurut kolom) dengan input total. Misalnya, untuk kolom sektor-1 Tabel 2.5, semua sel dibagi dengan 53.186 (input total pada Tabel 2.4). Matriks koefisien ini sering digunakan secara membingungkan karena kadang-kadang ada yang menyebutnya sebagai matriks koefisien teknik, matriks koefisien teknologi, matriks koefisien input-output ataupun matriks koefisien langsung. Kadang kadang, istilah ini juga digunakan untuk seluruh matriks dan kadang kadang hanya mencakup kuadran-antara saja. Lebih sering, matriks ini disebut dengan matriks A, yang unsur-unsurnya a_{ij}. Menggunakan program komputer IO-7 matriks ini dengan mudah dapat dihitung.

Tabel 2.5
Matriks Koefisien Langsung

	1	2	3	4	Permintaan Antara	Konsumsi Rumah Tangga	Permintaan Akhir lainnya	Ekspor	Output Total
1	0.0763	0.0002	0.1845	0.0210	0.2820	0.1714	0.0038	0.0259	0.4831
2	0.0001	0.0050	0.0763	0.0185	0.0999	0.0000	0.0335	0.2489	0.3823
3	0.0709	0.0251	0.1614	0.1459	0.4033	0.3404	0.0475	0.5371	1.3283
4	0.0421	0.0629	0.0954	0.1617	0.3621	0.4243	0.7015	0.1881	1.6760
Input Antara	0.1894	0.0931	0.5176	0.3472	1.1473	0.9360	0.7863	1.0000	3.8697
Gaji dan Upah	0.1495	0.0753	0.0863	0.2218	0.5329	0.0000	0.0000	0.0000	0.5329
Input Primer Lainnya	0.6502	0.8204	0.2548	0.3757	2.1010	0.0000	0.0000	0.0000	2.1010
Impor	0.0109	0.0113	0.1413	0.0553	0.2188	0.0640	0.2137	0.0000	0.4965
Input Total	1.000	1.000	1.000	1.000	4.000	1.0000	1.0000	1.0000	7.0000
Tenaga kerja	0.7334	0.0244	0.0652	0.1624	0.9854	0.0000	0.0000	0.0000	0.9854

Sumber: Diolah dari BPS, 1994

Koefisien setiap kolom pada Tabel 2.5 menunjukkan jumlah input yang dibutuhkan secara langsung oleh setiap sektor dengan nomor di atasnya dari setiap sektor yang ada di sebelah kirinya. Misalnya, untuk setiap Rp. 10.000 output sektor-1 membutuhkan:

Rp. 763 dari sektor-1 (sektor pertanian)

Rp. 1 dari sektor-2 (sektor pertambangan dan galian)

Rp. 709 dari sektor-3 (sektor industri manufaktur)

Rp. 421 dari sektor-4 (sektor jasa), atau

Rp.1.894 secara total dari seluruh sektor produksi domestik

Selain itu, sebanyak:

Rp. 1.495 dalam bentuk gaji dan upah

Rp. 6.502 dalam bentuk input primer lainnya

Rp. 109 dalam bentuk input yang diimpor

Ini merupakan koefisien input langsung, yang juga disebut sebagai koefisien pembelian input pada putaran pertama (*first-round purchases of inputs*) dan tidak mencerminkan pengaruh tidak langsung (*indirect-effect*) terhadap perekonomian lokal. Matriks A menunjukkan ketergantungan antar-sektor dalam suatu perekonomian; setiap koefisien a_{ij} menunjukkan jumlah input yang dibutuhkan dari sektor-i untuk setiap unit output sektor-j.

Matriks kebalikan terbuka. Selain pengaruh langsung, terdapat juga serangkaian pengaruh tidak langsung sebagai suatu gelombang pembelian pada putaran kedua, ketiga dan selanjutnya dalam suatu perekonomian. Misalnya, peningkatan permintaan terhadap output sektor-1 akan membutuhkan input dari semua sektor pada putaran pertama; sektor-sektor ini kemudian perlu meningkatkan outputnya agar dapat menyediakan permintaan sektor-1 yang meningkat tadi dan karenanya perlu membeli input sebagai pengaruh putaran kedua terhadap suatu perekonomian.

Satu hal penting dalam analisis model IO adalah penyusunan suatu tabel yang dapat menunjukkan pengaruh langsung dan pengaruh tidak langsung sebagai akibat berubahnya output suatu sektor. Berbagai metode, yang secara konsepsi serupa, dapat digunakan untuk menghitung pengaruh-pengaruh ini. Salah satu teknik yang paling dikenal adalah teknik matriks kebalikan (*matrix inversion*), yang biasanya disebut dengan matriks kebalikan Leontief terbuka (*open Leontief inverse matrix*), matriks penyelesaian umum terbuka (*open general solution matrix*) atau secara sederhana disebut sebagai matriks kebalikan terbuka (open inverse matrix). Kata "terbuka" digunakan untuk menunjukkan bahwa model yang digunakan hanya mencakup sektor-sektor produksi atau sektor-antara dan tidak ada satupun sektor permintaan akhir yang dicakup oleh matriks A.

Matriks kebalikan terbuka untuk contoh kasus disajikan pada Tabel 6, yang dengan menggunakan software IO-7, matriks ini akan sangat mudah dihitung.

Tabel 2.6 menunjukkan pengaruh langsung dan tidak langsung dari meningkatnya permintaan akhir sektor yang ada di atasnya terhadap sektor yang ada di sebelah kiri. Misalnya, peningkatan permintaan output sektor-1 sebesar Rp.10.000, setelah memperhitungkan pengaruh langsung dan tidak langsung, akan meningkatkan output sektor-1 Rp. 11.052 (termasuk Rp. 10.000 injeksi awal), sekor-2 hanya sebesar Rp. 95, sektor-3 sebesar Rp. 1.056 dan sektor-4 sebesar Rp. 682 sehingga secara total meningkatkan output perekonomian secara keseluruhan sebesar Rp. 12.886. Setiap sel pada Tabel 2.6 sebenarnya merupakan angka-angka dampak berganda yang mengindikasikan besarnya respon yang diharapkan dari meningkatnya permintaan akhir sebesar Rp. 10.000.

Tabel 2.6

Matriks Kebalikan Terbuka

Sektor	1	2	3	4	Total
1	1.1052	0.0111	0.2524	0.0719	1.4406
2	0.0095	1.0100	0.0985	0.0397	1.1576
3	0.1056	0.0453	1.2449	0.2203	1.6162
4	0.0682	0.0815	0.1618	1.2246	1.5361
Total	1.2886	1.1478	1.7576	1.5565	5.7505

Matriks kebalikan terbuka mempunyai sejumlah kegunaan dalam analisis ekonomi. Yang jelas, matriks ini mempunyai beberapa karakteristik yang dapat diduga. Pertama, unsur-unsur dalam diagonal utama akan bernilai 1 atau lebih besar. Kedua, unsur-unsur pada tabel adalah positif dan mencerminkan tingkat saling ketergantungan ekonom secara terbuka.

Matriks kebalikan tertutup. Model terbuka yang dibahas di muka hanya menggambarkan suatu situasi ketika sektor-sektor produksi dalam perekonomian diasumsikan endogen terhadap sistem, yaitu ketika semua sektor permintaan akhir diasumsikan ditentukan oleh faktor-faktor di luar sistem produksi. Jika asumsi ini tidak memuaskan, model IO dapat secara sebagian atau seluruhnya "ditutup" (*closed*). Kebanyakan pakar IO setuju dengan asumsi bahwa sektor rumah tangga merupakan komponen endogen dalam suatu perekonomian, dalam arti bahwa tingkat produksi adalah penting dalam menentukan tingkat pendapatan rumah tangga, yang kemudian sebagian besar dibelanjakan secara lokal dan selanjutnya mempengaruhi tingkat konsumsi, yang lebih lanjut akan mempengaruhi tingkat output setiap sektor. Pada kasus ini, model telah memasukkan sektor rumah tangga ke dalam kuadran-antara (*intermediate-quadrant*); dengan cara menggabungkan kolom dan baris rumah tangga ke dalam kuadran-antara.

Matriks baru disebut sebagai matriks yang ditambahkan (*augmented matrix*) dan dinyatakan dengan A*. Secara konseptual matriks ini sama dengan matriks A, kecuali bahwa setiap putaran dalam reaksi ekonomi telah menggabungkan pendapatan rumah tangga dan peningkatan output sektor-sektor untuk memenuhi kebutuhan yang ditimbulkan oleh meningkatnya pengeluaran rumah tangga karena meningkatnya pendapatan. Dengan demikian, matriks kebalikan dari model tertutup mencakup dampak berganda pendapatan dan pengaruh konsumsi. Untuk kasus pada bahasan ini, matriks kebalikan tertutup disajikan pada Tabel 2.7.

Sel-sel pada matriks kebalikan tertutup merupakan angka dampak berganda output. Nilainya lebih besar dibandingkan dengan nilai-nilai unsur pada matriks kebalikan terbuka karena nilai-nilai tersebut juga mencakup tingkat output yang dibutuhkan untuk memenuhi pengaruh imbasan konsumsi rumah tangga. Misalnya, setiap peningkatan permintaan output sektor-1 sebesar Rp. 10.000 akan menyebabkan peningkatan secara langsung, tidak langsung dan imbasan output sektor-1 sebesar Rp. 11.804 (termasuk injeksi awal), sektor-2 sebesar Rp. 223, sektor-3 sebesar Rp. 2.371 dan sektor-4 sebesar Rp. 2.123, menghasilkan peningkatan output sektor produksi secara total sebesar Rp. 16.521.

Tabel 2.7

Matriks Kebalikan Tertutup

Sektor	1	2	3	4	Total	Rumah Tangga	Total
1	1.1804	0.0505	0.3268	0.1921	1.7498	0.3950	2.1448
2	0.0223	1.0167	0.1111	0.0601	1.2102	0.0671	1.2773
3	0.2371	0.1143	1.3752	0.4308	2.1574	0.6915	2.8490
4	0.2123	0.1570	0.3045	1.4552	2.1290	0.7575	2.8864
Total	1.6521	1.3384	2.1177	2.1382	7.2463	1.9112	9.1575
Rumah Tangga	0.2457	0.1288	0.2434	0.3932	1.0110	1.2918	2.3028
Total	1.8977	1.4672	2.3611	2.5314	8.2573	3.2029	11.4603

Sumber: Diolah dari BPS, 1994

1. Dimensi Spasial pada Model IO

Sejauh ini terdapat empat tipe model IO yang berdimensi ruang, yaitu: (1) model daerah tunggal (single-region model), (2) model intra-nasional (*intra-national model*), (3) model antar-daerah (*inter-regional model*), dan model banyak-daerah (*multi-region model*). Namun demikian, hanya dua model yang terakhir yang dapat menggambarkan struktur ruang suatu perekonomian.Dua model yang pertama, sama sekali belum mengintegrasikan aspek spasial (Polenske, 1995). Untuk itu, berdasarkan bentuk tabel transaksi domestik, berikut akan dibahas model-model IO yang berdimensi ruang, dengan fokus pada model IO antar-daerah dan model IO banyak-daerah.

d. Model Daerah-Tunggal dan Model Intra-Nasional

Pada model daerah-tunggal, setiap sel pada tabel transaksi menunjukkan jumlah yang dibeli oleh suatu sektor pada daerah tersebut dari sektor itu sendiri dan dari sektor lain pada daerah yang sama. Perdagangan antar-daerah hanya ditunjukkan dalam jumlah totalnya. Asal dan tujuan barang dan jasa tidak diketahui. Dengan model ini, dampak nasional terhadap daerah tersebut tidak dapat dianalisis karena daerah tersebut terisolasi. Walaupun daerah-tunggal sangat mirip dengan model nasional, ada dua hal yang membedakannya, yaitu pola kegiatan produksi dan pola perdagangan. Akan tetapi, biasanya, dalam menyusun tabel daerah-tunggal dengan metode non-survei, koefisien teknologi pada tingkat daerah dianggap sama dengan koefisien teknologi pada tingkat nasional.

Pada model intra-nasional, yang diperkenalkan Leontief (1953) dan digunakan Leontief et al (1965) dalam analisis dampak regional dari pemotongan anggaran persenjataan, setiap sel pada tabel transaksi menunjukkan jumlah barang dan jasa yang dibeli oleh suatu sektor dari suatu daerah, baik dari sektor itu sendiri maupun dari sektor lain tanpa memandang daerah asal barang dan jasa tersebut. Perdagangan antar-daerah hanya dilihat dari nilai bersihnya saja. Model ini tidak dapat menganalisis dampak umpan-balik daerah (*regional feed-back effects*) dari suatu kegiatan ekonomi. Meski model ini sangat berguna dalam memprediksi dampak regional dari Kebijakan nasional, sifatnya yang "top-down" membuatnya kurang bermanfaat dalam mengkaji dampak nasional dari suatu Kebijakan pembangunan daerah.

e. Model Input-Output Antar-Daerah

Model input-output antar-daerah, yang juga dikenal dengan model idealnya Isard, dianggap sebagai model yang paling komprehensif dan sistematis karena model ini merupakan pengembangan konsep input-output yang mengintegrasikan unsur spasial secara "simple" dan "elegant" (West et al, 1989), Selanjutnya disebut model IOAD. Model ini membagi ekonomi nasional berdasarkan sektor dan daerah kegiatan (Hulu, 1990; West et al, 1989; Oosterhaven, 1981).

Struktur model IOAD terdiri atas dua jenis matriks yang menggambarkan dua jenis ketergantungan ekonomi. Pertama adalah matriks transaksi intra-daerah (*intra-regional transaction*) yang berada pada diagonal utama yang menunjukkan transaksi antar-sektor dalam suatu daerah. Kedua adalah matriks perdagangan antar-daerah (*inter-regional trade transaction*) yang menunjukkan arus perdagangan antar-sektor dari satu daerah ke daerah lainnya. Matriks ini secara khusus menunjukkan keterkaitan antar-industri dan antar-daerah sehingga setiap kegiatan dapat diketahui jenis dan lokasinya.

Secara umum, model IOAD dapat dinyatakan melalui persamaan berikut:

$^{A}X_i = \sum_j \sum_B {}^{AB}X_{ij} + \sum_B {}^{AB}Y_i$; di mana i,j = 1,2,…n dan A,B= 1,2, …, m (8)

Terdapat (m x n) persamaan yang menunjukkan bahwa output setiap sektor di suatu daerah ($^{A}X_i$) sama dengan penjualan kepada semua sektor di semua daerah ($\sum_j \sum_B {}^{AB}X_{ij}$) ditambah dengan penjualan kepada semua kepada penggunaan akhir di semua daerah ($+ \sum_B {}^{AB}Y_i$).

Input koefisien Spasial (*coefficient of spatial input*) dinyatakan sebagai:

$^{AB}a_{ij} = {}^{AB}X_{ij} / {}^{B}X_j$ (9)

Substitusi persamaan (9) ke persamaan (8) menghasilkan:

$^{A}X_i = \sum_j \sum_B {}^{B}a_{ij} {}^{B}X_i + \sum_B {}^{AB}Y_i$; di mana i,j = 1,2,…n dan A,B= 1,2, …, m (10)

Mengingat persamaan (8) sampai persamaan (10) mengacu kepada kasus umum, maka akan lebih mudah jika merujuk secara khusus kepada matriks intra-daerah dan antar-daerah, sehingga:

$^{A}X_i = \sum_j {}^{AA}X_{ij} + \sum_j {}^{AB}X_{ij} + {}^{A}Y_i$; dimana i,j = 1,2, …,n (11)

dan

$^{B}X_i = \sum_j {}^{BA}X_{ij} + \sum_j {}^{BB}X_{ij} + {}^{B}Y_i$; dimana i,j = 1,2, …,n (12)

Dari persamaan (11) dan (12) dapat ditentukan koefisien input yang merujuk daerah berdasarkan matriks perdagangan intra dan antar-daerah:

$^{AA}a_{ij} = {}^{AA}X_{ij} / {}^{A}X_j$ (13)

$^{AB}a_{ij} = {}^{AB}X_{ij} / {}^{B}X_j$ (14)

$^{BA}a_{ij} = {}^{BA}X_{ij} / {}^{A}X_j$ (15)

$^{BB}a_{ij} = {}^{BB}X_{ij} / {}^{B}X_j$ (16)

Persamaan (13) dan (16) menunjukkan koefisien langsung intra-daerah, Sedangkan persamaan (14) dan (15) menunjukkan koefisien perdagangan antar-daerah. Jika persamaan (13) – (16) disubstitusikan ke persamaan (11) dan (12), maka akan dihasilkan:

$^{A}X_i = \sum_j {}^{AA}a_{ij}\,{}^{A}X_j + \sum_j {}^{AB}a_{ij}\,{}^{B}X_j + {}^{A}Y_i$; di mana i,j = 1,2, …,n (17)

dan

$^{B}X_i = \sum_j {}^{BA}a_{ij}\,{}^{A}X_j + \sum_j {}^{BB}a_{ij}\,{}^{B}X_j + {}^{B}Y_i$; dimana i,j = 1,2, …,n (18)

Oleh karena koefisien input langsung daerah pada persamaan (13)-(16) mengandung unsur-unsur teknologi dan perdagangan, maka kedua koefisien tersebut ($^{AB}a_{ij}$) dapat dipisahkan menjadi koefisien perdagangan ($^{AB}t_{ij}$) dan koefisien teknologi ($^{B}a_{ij}$). Pemisahan ini menghasilkan persamaan yang pada dasarnya sama dengan persamaan pada model input-output daerah tunggal, yang dituliskan sebagai:

$X = \mathrm{T}\,(\mathrm{A}x + y)$ atau $x = (\mathrm{I} - \mathrm{TA})^{-1}y$ (19)

Walaupun model IOAD adalah model yang paling ideal, ada dua masalah yang serius dalam penggunaannya. Pertama berkaitan dengan ketatnya asumsi yang menyatakan suatu komoditi yang diproduksi di suatu daerah, secara teknis berbeda dengan komoditas yang sama yang dihasilkan oleh daerah lain. Misal, bata yang diproduksi di Jawa berbeda dengan bata yang diproduksi di Kalimantan, sehingga tidak ada substitusi di antara keduanya. Asumsi ini terlalu kaku dan tidak realistis sebab, bagi konsumen, bata tetap saja bata di manapun dia diproduksi. Kedua, berkaitan dengan penerapan praktis dari modelIOAD. Untuk memperoleh estimasi nilai $^{AB}t_{ij}$ diperlukan data arus perdagangan menurut daerah asal dan daerah tujuan dan menurut sektor produksi dan sektor konsumsi. Data seperti ini biasanya tidak tersedia, bahkan di negara yang statistiknya sudah maju sekalipun. Untuk dapat memperolehnya dilakukan survei yang akan membutuhkan biaya, tenaga dan waktu yang banyak. Hal ini menyebabkan sangat sedikit negara yang sudah memiliki tabel IOAD.

f. Model Input-Output Banyak-Daerah

Untuk mengatasi masalah-masalah yang terdapat pada model IOAD, berbagai model IO banyak-daerah (IOBD) sudah dikembangkan. Pada model ini diasumsikan bahwa barang yang sama tidak lagi dibedakan dari daerah asalnya. Dalam penerapannya, ada yang menggunakan perkiraan titik (Chenery, 1956; Moses, 1955; Leontief, 1966), yang menggunakan teori gravitasi (Leontief & Strout, 1963; Polenski, 1970) dan ada yang menggunakan formulasi pemograman linier (Moses, 1960).

Untuk memahami model ini, misalkan ekonomi nasional terdiri atas m daerah dan n sektor ekonomi yang identik. Persamaan keseimbangan pada suatu sistem banyak-daerah sama dengan persamaan (8), yang ditulis kembali sebagai:

$$^{A}X_{i} = \sum_{j}\sum_{B} {}^{AB}X_{ij} + \sum_{B} {}^{AB}Y_{i}; \text{ di mana } i,j = 1,2,\ldots n \text{ dan } A,B= 1,2,\ \ldots,\ m \quad (20)$$

Dua gugus koefisien yang menyusun koefisien input langsung ($^{AB}a_{ij}$) pada model IOBD adalah, pertama koefisien teknologi ($^{B}a_{ij}$), yang menggambarkan jumlah komoditas i yang dibutuhkan oleh sektor j dari semua daerah untuk setiap unit sektor i di daerah B. Kedua adalah koefisien perdagangan antar-daerah ($^{AB}c_{i}$) yang menunjukkan pola perdagangan setiap komiditas antar-daerah yang berpasangan. Koefisien ini menunjukkan proporsi komoditi i di daerah B yang dibeli dari daerah A. Proporsi ini diasumsikan sama bagi setiap sektor pembeli, sehingga:

$$^{AB}c_{i1} = {}^{AB}c_{i2} = \ldots = {}^{AB}c_{ij} = {}^{AB}c_{i} \quad (21)$$

Jika komoditas i di daerah B mengimpor 1 persen kebutuhannya dari daerah A, maka setiap industri j di daerah B juga mengimpor 1 persen kebutuhannya dari daerah A. Dengan menggunakan kedua gugus koefisien ini, keseimbangan persamaan (8) dapat ditulis sebagai:

$$^{A}X_{i} = \sum_{j}\sum_{B}({}^{AB}c_{i})({}^{B}a_{ij}) + \sum_{B}({}^{AB}c_{i})({}^{AB}Y_{i}); \text{ di mana } i,j = 1,2,\ldots n$$
$$\text{dan } A,B= 1,2,\ \ldots,\ m \quad (22)$$

Dengan koefisien teknologi ($^{B}a_{ij}$) untuk setiap daerah dan koefisien perdagangan ($^{AB}c_{i}$) untuk setiap komoditas, maka persamaan (22) dapat diselesaikan untuk setiap tingkat produksi ($^{A}X_{j}$) di setiap daerah. Dalam bentuk matriks, persamaan (22) dapat ditulis sebagai:

$$x = CA\ x + C\ y \text{ atau } x = (I - CA)^{-1}\ y \quad (23)$$

Persamaan (23) di atas secara matematis sama dengan persamaan (19), dengan catatan bahwa matriks koefisien perdagangan (matriks T) pada persamaan (19) diperkirakan oleh matriks perdagangan C pada persamaan (23). Model ini lebih mudah diterapkan karena data asal-tujuan barang secara total biasanya tersedia. Lebih-lebih di negara kepulauan seperti Indonesia. Arus barang lebih mudah dideteksi di setiap pelabuhan. Selain itu, pemisahan koefisien input menjadi koefisien teknologi dan koefisien perdagangan sangat bermanfaat untuk simulasi model jangka panjang, di mana koefisien tersebut dapat diperbarui secara berkala (Toyomane, 1988).

2. Kegunaan Model IO

Tabel input-output yang sangat kaya akan informasi yang berkaitan dengan ekonomi. Tabel tersebut menyajikan suatu ringkasan dari semua transaksi ekonomi yang sangat berguna, baik secara deskriptif maupun untuk keperluan analisis. Kegunaan deskriptif, antara lain meliputi struktur input dan distribusi output. Sedangkan kegunaan analitisnya, antara lain meliputi analisis keterkaitan (*linkages*) dan analisis dampak berganda (*multipliers*).

a. Kegunaan Deskriptif

Struktur input. Salah satu kegunaan deskriptif dari tabel input-output adalah bahwa tabel tersebut dapat menyajikan struktur produksi kegiatan ekonomi suatu wilayah. Dari Tabel 5 dapat dilihat bahwa susunan input suatu kegiatan ekonomi wilayah terdiri atas: input-antara, yaitu input yang berasal dari sektor-sektor produksi dan input primer yang umumnya terdiri atas: gaji dan upah, penyusutan, pajak tidak langsung, subsidi, dan impor. Misalnya, untuk satu satuan input dari sektor-1 terdiri atas: 0.1894 input-antara yang berasal dari sektor-1 (0.0763), sektor-2 (0.0001), sektor-3 (0.0709), dan sektor-4 (0.0421), 0.8106 input primer, yang terdiri atas gaji dan upah (0.1495), input primer lainnya (0.6502) dan impor (0.0109). Susunan input ini merupakan kebutuhan langsung input untuk keperluan produksi pada sektor-1. Secara lebih analitis, berdasarkan susunan input ini dapat diturunkan indeks keterkaitan ke depan (keterkaitan terhadap kebutuhan input) suatu sektor.

Distribusi output. Kegunaan deskriptif yang kedua dari suatu tabel IO adalah kemampuannya dalam menyajikan distribusi output, baik ke sektor-sektor ekonomi lainnya sebagai input produksi yang disebut juga sebagai permintaan-antara, maupun didistribusikan ke permintaan-akhir, seperti: konsumsi rumah tangga, pengeluaran pemerintah, pembentukan modal, perubahan (*stock*) dan ekspor. Software pada model IO biasanya bekerja menurut kolom, Sedangkan distribusi output dihitung menurut baris. Oleh karenanya, program komputer IO-7 yang dikembangkan West (1993) menyediakan fasilitas untuk memutar tabel IO, yaitu merubah baris menjadi kolom sehingga distribusi output dengan mudah dapat dihitung. Seperti halnya pada susunan input, dari distribusi output juga dapat diturunkan indeks keterkaitan antar sektor produksi yang dikenal dengan keterkaitan ke belakang langsung, yaitu keterkaitan langsung dengan sektor-sektor yang menggunakan output sektor tersebut sebagai input antara.

Neraca regional. Tabel IO merupakan bagian integral dari sistem neraca sosial. Pada tingkat nasional, tabel tersebut biasanya sudah merupakan bagian dari proses neraca nasional. Akan tetapi, pada tingkat regional neraca-neraca daerah jarang tersedia sehingga tabel IO yang disusun untuk keperluan lain dapat menjadi sumber informasi yang sangat berharga dalam menyusun neraca-neraca regional. Sayangnya, kebanyakan tabel IO regional tidak menyediakan data yang rinci agar memungkinkan penyusunan neraca-neraca tersebut karena ada kecenderungan untuk mengkonsentrasikan pada transaksi antar industri. Salah satu neraca regional yang dapat diturunkan dari tabel IO adalah PDB (produksi domestik bruto atau *gross domestic product*) yang merupakan penjumlahan pembayaran terhadap faktor produksi (tenaga kerja berupa upah dan gaji, pemerintah berupa penerimaan pajak tidak langsung, pemilik modal berupa surplus usaha, dan sebagainya).

Indikator ekonomi makro regional. Para ekonom cenderung menggunakan indikator-indikator ekonomi makro secara agregat. Sementara itu, tabel IO menyajikan secara detail indikator-indikator tersebut. Jika tabel IO disusun berdasarkan kerangka neraca sosial konvensional, definisi istilah-istilah pada tabel tersebut juga akan konsisten dengan sistem neraca regional. Dengan demikian, dari tabel IO dapat diturunkan kontribusi sektoral berupa output, pendapatan, nilai tambah, ekspor, impor, dan sebagainya.

b. Kegunaan Analitik

Keterkaitan sektoral. Model IO telah secara luas digunakan untuk meneliti keterkaitan antar sektor produksi dalam suatu perekonomian. Tahun 1981, Sritua Arief telah menggunakan model IO untuk meneliti sektor-sektor kunci (*key sectors*) dalam ekonomi Indonesia (Sritua Arief, 1993). Alauddin (1986) telah mengidentifikasi sektor-sektor kunci dalam perekonomian Bangladesh dengan pendekatan keterkaitan antar sektor. Muchdie dan M.H. Imansyah (1995) selain menerapkan analisis keterkaitan juga menggunakan beberapa pendekatan seperti pengaruh berganda (*multipliers*) dan elastisitas input-output, dalam analisis sektor-sektor unggulan dalam perekonomian Indonesia.

Analisis indeks keterkaitan mulanya dikembangkan oleh Rasmussen (1956) dan Hirschman (1958) untuk melihat keterkaitan antar sektor, terutama untuk menentukan strategi kebijakan pembangunan. Dikenal dua jenis keterkaitan, yaitu (1) keterkaitan ke belakang (*backward-linkages)* yang merupakan keterkaitan dengan bahan input dan dihitung menurut kolom, dan (2) keterkaitan ke depan (*forward linkages*) yang merupakan keterkaitan dengan output dan dihitung menurut baris.

Analisis keterkaitan ke belakang dapat dibedakan menjadi tiga, yaitu (1) keterkaitan ke belakang langsung (*direct backward linkages*), (2) keterkaitan ke belakang langsung dan tidak langsung (*direct and indirect backward linkages*), (3) keterkaitan ke belakang langsung, tidak langsung dan terimbas (*direct, indirect and induced backward linkages*), yang masing-masing dapat dibedakan menurut output, pendapatan, dan tenaga kerja.

Seperti halnya analisis keterkaitan ke belakang, analisis keterkaitan ke depan juga dapat dibedakan menjadi tiga, yaitu (1) keterkaitan ke depan langsung (*direct forward linkages*), (2) keterkaitan ke depan langsung dan tidak langsung (*direct and indirect forward linkages*), dan (3) keterkaitan ke depan langsung, tidak langsung dan terimbas (*direct, indirect and induced forward linkages*), yang masing-masing dapat dibedakan menurut output, pendapatan dan kesempatan kerja. Bedanya, jika keterkaitan ke belakang dihitung menurut kolom, analisis keterkaitan ke depan dihitung menurut baris. Software IO-7 mempunyai fasilitas untuk memutar baris menjadi kolom sehingga perhitungan-perhitungan keterkaitan ke depan dapat dilakukan seperti halnya perhitungan keterkaitan ke belakang.

Analisis dampak. Penganda (*multipliers*) pada model IO adalah respon meningkatnya permintaan akhir suatu sektor terhadap output, pendapatan dan kesempatan kerja pada sektor-sektor lain. Konsep pengganda sering digunakan secara rancu sehingga menghasilkan interpretasi yang juga keliru. Mendapatkan adanya sejumlah ketidakkonsistenan (*inconsistencies*) dalam definisi komponen-komponen pengganda, West & Jensen (1980) dan West et al (1989) membedakan kategori pengganda menjadi: dampak awal (*initial impact*), dampak imbasan kegiatan produksi (*production-induce impact*), terdiri atas pengaruh langsung (*direct effect*) yang sering juga disebut sebagai pengaruh pembelian putaran pertama (*first-round effects*) dan pengaruh tidak langsung (*indirect-effect*) yang merupakan pengaruh pembelian putaran kedua dan seterusnya, yang juga dikenal sebagai pengaruh dukungan industri (*industrial-support effect*) dan dampak imbasan konsumsi (*consumption-induced effect*). Selain itu, juga ada kategori lain, yang disebut dampak luberan (*flow-on effect*). Tabel 8 memberikan rumusan definisi pengganda untuk setiap jenis dampak berdasarkan output, pendapatan dan kesempatan kerja, yang pada prinsipnya dapat diperluas untuk impor, pajak, keuntungan usaha, subsidi dan sebagainya.

Berkaitan dengan kajian dampak, Jensen & West (1986) telah membuat klasifikasi sebagai berikut:

1. Kajian signifikansi ekonomi (*economic significance*), yang mengukur signifikansi ekonomi atau kontribusi sebuah perusahaan, industri atau sektor dan juga wilayah terhadap suatu perekonomian pada kondisi output dan permintaan saat ini.
2. Kajian dampak perubahan pada permintaan-akhir untuk keperluan "forecasting" ataupun proyeksi, seperti dampak perubahan pada salah satu unsur permintaan akhir, dampak perubahan banyak unsur pada permintaan-akhir.
3. Kajian dampak perubahan yang terjadi pada tabel transaksi seperti muncul atau hilangnya suatu perusahaan atau industri, perubahan teknologi ataupun adanya teknologi baru, substitusi impor, ataupun perubahan lainnya pada tabel termasuk: ekspor, keseimbangan neraca perdagangan, nilai tambah, pajak tidak langsung, pengeluaran pemerintah, perubahan stok, konsumsi rumah tangga, dan sebagainya.
4. Kajian dampak peubah-peubah bukan tabel (*non-table variables*), termasuk: angkutan kerja, kebutuhan ener i, tingkat polusi, kebutuhan lahan dan sebagainya.

Tabel 2.8

Rumusan Angka Pengganda Berdasarkan Tipe Dampak

Dampak	Output	Pendapatan	Tenaga kerja
Awal	1	h_j	e_j
Putaran pertama	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Dukungan industri	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Imbasan konsumsi	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Luberan	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$
Type IA	$(1 + \sum a_{ij})/1$	$(h_j + \sum a_{ij} h_i)/ h_j$	$(e_j + \sum a_{ij} e_i)/ e_j$
Type IB	$(\sum b_{ij})/1$	$(\sum b_{ij} h_i)/ h_j$	$(\sum b_{ij} e_i)/ e_j$
Type IIA	$(\sum b^*_{ij})/1$	$(\sum b^*_{ij} h_i)/ h_j$	$(\sum b^*_{ij} e_i)/ e_j$
Type IIB	$(\sum b^*_{ij} - 1)/1$	$(\sum b^*_{ij} h_i - h_j)/ h_j$	$(\sum b^*_{ij} e_i - e_j)/ e_j$

Sumber: West et al, 1989

Catatan: p_i= koefisien pendapatan rumah tangga; e_i = koefisien tenaga kerja; aij = koefisien input langsung; b_{ij} = koefisien matriks kebalikan terbuka; b^*_{ij} = koefisien matriks kebalikan tertutup.

2. Catatan Penutup

Sebagai catatan penutup, ada beberapa hal yang perlu diperhatikan berkaitan dengan penggunaan model IO, baik untuk kegunaan deskriptif maupun untuk kegunaan analisis. Catatan ini inginmengingatkan berbagai kelemahan yang terdapat pada model IO, baik secara konseptual maupun secara operasional. Dari sisi konseptual, keterbatasan ini dapat dilihat dari asumsi-asumsi yang digunakan. Sedangkan secara operasional, terdapat sejumlah kesulitan dalam penyusunan model, terutama karena terbatasnya data.

Secara konseptual, ada tiga asumsi dasar yang melandasi penyusunan model IO, yaitu: (1) asumsi homogenitas, yang mensyaratkan bahwa tiap sektor produksi suatu output tunggal dengan struktur input tunggal dan bahwa tidak ada substitusi otomatis antara berbagai sektor; (2) asumsi proporsionalitas, yang mensyaratkan bahwa dalam proses produksi hubungan antara input dengan output merupakan fungsi linier, yaitu tiap jenis input yang diserap oleh sektor tertentu naik atau turun sebanding dengan kenaikan atau penurunan output sektor tersebut; dan (3) asumsi additivitas, yaitu suatu asumsi yang menyebutkan bahwa efek total pelaksanaan produksi di berbagai sektor dihasilkan oleh masing-masing sektor secara terpisah. Ini berarti bahwa di luar sistem input-output semua pengaruh luar diabaikan.

Dengan asumsi-asumsi tersebut, model IO mempunyai keterbatasan-keterbatasan, antara lain: karena rasio input-output konstan sepanjang periode analisis, produsen tidak dapat menyesuaikan perubahan-perubahan inputnya atau merubah proses produksi. Selain itu, hubungan yang tetap ini berarti bahwa apabila input suatu sektor diduakalikan maka outputnya akan duakali juga. Asumsi semacam ini menolak adanya pengaruh perubahan teknologi ataupun produktivitas yang berarti perubahan kuantitas dan harga input sebanding dengan perubahan kuantitas dan harga output.

Walaupun model IO bersifat statis dan "demand-driven", model ini merupakan alat analisis ekonomi yang sangat lengkap dan komprehensif, lebih-lebih dengan telah dikembangannya model-model yang dinamis dan memperhitungkan kendala keterbatasan sumberdaya, seperti pada model keseimbangan umum yang dapat dihitung (*computable-general equilibrium model*).

Untuk mengatasi kesulitan dalam penyusunan model, terutama pada tingkat daerah, sejauh ini dikenal ada tiga metode dalam penyusunan model IO, yaitu metode survei langsung, metode non-survei dan teknik-teknik "*ready-made*", serta metoda hibrida. Metode survei langsung, walaupun diakui akan menghasilkan model yang paling teliti, dianggap bukan lagi cara yang tepat karena dalam prosesnya membutuhkan sumberdaya (tenaga dan dana) yang besar serta waktu yang lama. Metode non-survei memang menghemat waktu, tenaga dan biaya, tetapi pakar telah sepakat bahwa metode non-survei dan teknik-teknik "ready-made" hanya akan menghasilkan tabel IO yang diragukan ketelitiannya. Tabel yang disusun melalui metoda survai langsung terlalu mahal dan metode non-survei sama sekali tidak teliti. Hal ini mendorong upaya pengembangan metode hibrida (*hybrid method*), yang menggabungkan keunggulan keduanya melalui optimalisasi ketelitian dengan kendala dana, waktu dan tenaga. Dengan pengembangan teknik hibrida tersebut maka akan semakin terbuka kemungkinan penggunaan model IO baik untuk kegunaan deskriptif sebagai potret perekonomian spasial, maupun untuk analisis dampak sebagai alat bantu dalam perencanaan pembangunan. Mengingat tingkat kompleksitas dan kebutuhan sumberdaya (waktu, tenaga dan dana), Daerah Tingkat II (Kabupaten dan Kota) merupakan satuan wilayah terkecil yang dapat disarankan dalam penyusunan model IO.

Daftar Pustaka

Alauddin, M (1986), "Identification of Key Sectors in the Bangladesh Economy: A Linkage Analysis Approach", **Applied Economics**, 18:421-442.

BPS, (1995), **Kerangka Teori dan Analisis Tabel Input-Output,**Biro Pusat Statistik, Jakarta.

BPS, (1994), **Tabel Input-Output Indonesia 1990**, Jilid 1-2, Biro Pusat Statistik, Jakarta.

Chenery, H.B, (1956), "Inter-regional and Inter-national Input-Output Analysis" in T. Barna (Ed.), **The Structural Interdependence of the Economy**, John Wiley and Sons Inc., New York, pp: 341-356.

Dewhurst, J. H. LI, (1991), "Using the RAS Technique as a Test of Hybrid Methods of Regional Input-Output Table Updating", **Regional Studies**, 26: 81-91.

Hartwick, (1971), "Notes on the Isard and Chenery-Moses Inter-regional Input-Output Models", **Journal of Regional Science**, 11(1):73-86.

Hill, H(1991), **Unity and Diversity: Regional Economic Development in Indonesia since1970**, Oxford University Press, Singapore.

Hulu, E., (1990), **Model Input-Output: Teori dan Applikasinya**, Pusat Antar

Universitas-Studi Ekonomi, Universitas Indonesia, Jakarta.

Isard, W., (1951), "Inter-regional and Regional Input-Output Analysis: A Model of a Space-Economy", **Review of Economics and Statistics**, 33, 4: 318-328.

Jensen R.C, and West, G.R., (1986), **Input-Output for Practitioners: Theory and Application**, Office of Local Government, Department of Local Government and Administrative Sciences, Canberra.

Jensen, R.C., Mandeville, T.D and Karunaratne, N.D, (1979), **Regional Economic Planning: Generation of Regional Input-Output Analysis**, Groom Helm, London.

Leontief, W.W, (1953), "Inter-regional Theory", in Leontief et al., **Studies in the Structure of the American Economy**, Oxford University Press, New York.

Leontief, W.W, (1966), **Input-Output Economics**, Oxford University Press, New York.

Leontief, W.W, and Strout, A, (1963), "Multi-regional Input-Output Analysis", **in** T. Barna, (Ed), **Structural Interdependence and Economic Development**, Macmillan, London.

Leontief, W.W, Morgan, A., Polenske, K.R., Simpson, D and Tower, E., 1965, "The Economic Impact-Industrial and Regional-of an Arm Cut", **The Review of Economics and Statistics**, 47(3): 217-241.

Miller, R.E and Blair, P.D., (1985), **Input-Output Analysis: Foundation and Extensions**, Englewood Cliffs, Prentice-Hall, New Jersey.

Moses, L.N., (1955), "The Stability of Inter-regional Trading Pattern and Input-Output Analysis", **American Economic Review**, 45(5): 803-832.

Moses, L.N, (1960), "A General Equilibrium Model of Production, Inter-regional Trade and Location of Industry", **Review of Economics and Statistics**,42(4):373-397.

Muchdie, (1998), "Teknik Hibrida dalam Penyusunan Tabel Input-Output AntarDaerah: Sebuah Prosedur untuk Ekonomi Kepulauan", **Ekonomi dan Keuangan Indonesia**, 46(1): 117-145.

Muchdie dan MH Imansyah, (1995), "Sektor-Sektor Unggulan dalam Perekonomian Indonesia pada Pembangunan Jangka Panjang Kedua: Penerapan Analisis Input-Output" dalam: Marjaldi Loeis, Refyul Fatri, Yos Adiguna Ginting dan Zainurlis Zainudin (Eds), **Proceeding of Indonesian**

Students' First Scientific Paper Competition and Second National Seminar, Perhimpunan Pelajar Indonesia Australia, Melbourne.

Oosterhaven, J., 1981, **Interregional Input-Output Analysis and Dutch Regional Policy Problems,** Gower Publishing Company, England.

Polenske, K.R,(1970),"Empirical Implementation of a Multi-regional Input-Output Gravity Trade Model" in A. P. Carter and A. Brody (Ed), **Contributions to Input-Output Analysis**, North Holland Publishing, Amsterdam, pp: 143-163.

Polenske, KR,(1995), "Leontief's Spatial Economic Analysis", **Structural Change and Economic Dynamics**, 6: 309-318.

Rasmussen, R (1956), **Studies in Intersectoral Relations**, North Holland Publishing Company, Amsterdam.

Richardson, HW, (1985), "Input-Output and Economic Base Multipliers: Looking Backward and Forward", **Journal of Regional Science,** 25(4): 607-661.

Sritua Arief, (1993), **Metodologi Penelitian Ekonomi**, Penerbit Universitas Indonesia, Jakarta.

Toyomane, N., (1985), **A Study on the Multi-regional Input-Output Model: Foundations for An Inter-regional Simulation of Indonesia**, University Microfilms International, Ann Arbor, Michigan.

Toyomane, N, (1988), **Multi-regional Input-Output Models in Long Term Simulation**, Kluwer Academic Publishers, Dordrecht/Boston/Lancaster.

West, GR (1993), Input-Output for Practitioners: User's Guide, Department of Economics, the University of Queensland, St. Lucia.

West, GR, and Jensen, RC, (1980), "Some Reflections on Input-Output Multipliers", **Annals of Regional Science**, 14(2):77-89.

West, GR, and Jensen, RC, (1988), "Regional Input-Output Modelling: GRIT and GRIMP" **in** Newton, P., Taylor, M., and Sharp, R., (Ed), **Desktop Planning**, Hargen Publishing, Melbourne, p.185-194.

West G.R, Morison, J.B. and Jensen, R.C., 1982, **An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

Chapter-3

GIRIOT: A New Hybrid Procedure for Island Economy[1]

Ringkasan

Bab ini menggagas, mengembangkan dan menerapkan prosedur hibrida baru dalam penyusunan model input-output antar-daerah pada suatu perekonomian kepulauan, dengan mengacu kepada kasus khusus Indonesia. Prosedur ini, disebut GIRIOT (*Generation of Inter-Regional Input-Output Tables*), merupakan kombinasi dan modifikasi dari prosedur GRIT II dan GRIT III; prosedur hibrida yang dirancang untuk perekonomian maju di negara benua, Australia. Dua prosedur hibrida dalam penyusunan model input-output antar-daerah akan juga ditelaah. Kemudian, empatpertimbangan dasar dari prosedur hibrida baru akandikemukakan, sebelum prosedur yang diusulkandibahas tahap demi tahap. Menggunakan data Indonesia tahun 1990, dua model input-output antar-daerah kemudian dihasilkan.Pengujianvaliditas model menunjukkan bahwa prosedur yang digagas menghasilkan model input-output antar-daerah yang dalam batas tertentu mencerminkan karakteristik perekonomian kepulauan Indonesia.

Summary

This chapter proposes, develops and applies new hybrid procedure in constructing inter-regional input-output in island economy with special reference

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to Indonesia. This procedure, called GIRIOT (Generation of Inter-Regional Input-Output Tables), is a combination and modification of GRIT II and GRIT III procedures; hybrid procedures designed for Mainland economy in developed country, Australia. Two hybrid procedures will be reviewed. Further, four basic considerations will be discussed before the proposed procedure discussed step by step; phase by phase. Using Indonesian data of 1990, two modes of inter-regional input-output have been resulted. Validity tests show that the proposed procedure resulting inter-regional input-output tables those representing island economic characteristics.

1. Introduction

The inability of national or single-region input-output to model the spatial aspects of the economy is major limitation, especially in an island economy like Indonesia. Richardson (1972) strongly recommended the development of inter-regional input-output models. He contended that these models would validate the use of regional input-output studies as general equilibrium models.

Regional policy in developing countries is determined and often executed at the national level. Input-output analysis should be inter-regional in design if it is to be relevant for measuring the spatial distribution of these policies (Oosterhaven, 1981). The development of the inter-regional input-output model has enabled the regional analyst to incorporate spatial interdependence into empirical analysis. This is an important contribution to analytical methods. While the general spatial implications of an event, action or policy might not seem important, many economic impact and forecasting studies would improve significantly if spatial implications were provided in detail (West, Morison & Jensen, 1982; West et al., 1989).

Many analysts including Richardson (1972), Polenske (1969; 1980; 1995), Miller and Blair (1985), Freeman et al (1985), Ngo et al (1986), West et al (1982;1989), Hulu et. al. (1992) and Dewhurst (1994) argued that inter-regional models have significant advantages and uses over single-region model. Firstly, an operational inter-regional model provides consistency checks on its data. For instance, total inter-regional imports must equal total inter-regional exports. Secondly, aided by acceptable recently developed methods, the data requirements of inter-regional models are not disproportionately heavy, particularly if a government collects some of the necessary information as part of its normal statistical service. Thirdly, inter-regional models have wider application than the single region model because they can be used to compare and contrast the various regions which comprise the table. They can also represent the differential effects of an action or policy on each region. West et al., (1982; 1989) provided a good example of how the regional economic effects of migration of population and industry can be represented in more meaningful detail if the compensating effects on the migration on all regions can be studied.

Polenske (1969) lists the following potential uses for an inter-regional input-output model: studies of shifts in the location of industrial activity and employment; estimation of regional and industrial differences in production techniques; establishment of regional accounts; regional impact studies; regional economic development programs; transportation planning; and civil defense planning. Richardson (1972) points out more specific applications of inter-regional input-output models that includes calculation of the effects on different regions of changes in central government, evaluating the effects of inter-regional shifts in industrial location, measurement and forecasts of export markets for a region, estimation of the effects of freight rate changes on regional production and trade, calculation of spill-over effects of expanded development in rich regions on poorer regions and of inter-regional feedbacks.

A further advantage of inter-regional models is that they can compare the effect on the whole economy of increases in demand for the output of one region with the effect of increases in demand for the output of a different region. As a government, for instance, can affect the spatial allocation of final demand it would be able to use this as a means to improve the growth of the economy as a whole (Dewhurst, 1994). If employment data are available, one could estimate the employment effects of such stimuli to the economy. Suppose then the government increased its demand for a product. The inter-regional model could not only measure the number of job created and where they are located, but also provide a measure of the relative costs of creating jobs using different sectoral and spatial patterns of increased demand.

For developing country like Indonesia, the need for spatial analysis would appear to be increasing (Hulu and Hewings, 1993) because national development process is very often accompanied by a sharp increase in the disparities in welfare across regions (Williamson, 1965). The identification of optimum development strategies must include consideration of location. Attempts to reduce welfare disparities are often hampered by substantial inter-regional leakages as regional economies in developing countries are very open. Without a reliable accounting system, it is difficult to make informed judgments about appropriate project selection. It is difficult to monitor projects and provide ex post evaluation.

One very important aspects of the model development process for Indonesia has been the provision of a strong link between national and regional systems through an inter-regional input-output model (Hulu & Hewings, 1993).

Empirically, the major problem in the development of inter-regional input-output models for Indonesia is the fact that not all Provincial Statistical Offices have constructed and published single-region input-output table, due to data limitations. Even if the single-region input-output tables were available for all provinces, another problem is that data on inter-regional flows among provinces are not readily available.

The objective of the research reported in this chapter is to develop a new hybrid procedure for the construction of inter-regional input-output tables of an economy with special reference to Indonesia. In Section 2, two hybrid procedures for the construction of inter-regional tables will critically be reviewed. In Section 3, four basic considerations of the new hybrid procedure will be stressed before the procedure is fully described. Using Indonesian data of 1990, two inter-regional input-output tables were empirically constructed and be discussed in Section 4. This includes discussion on regional definitions and sectoral classifications, data and their sources and model validation. Finally in Section 5, some notes regarding the problems and prospects of these new hybrid procedures are provided.

2. Previous Inter-Regional Hybrid Procedures

The principle of using hybrid techniques to construct regional input-output tables is widely accepted, therefore, there is no reason for this technique to be less appropriate for constructing inter-regional input-output tables (West, 1990). At least two hybrid procedures have been do far developed for constructing inter-regional input-output tables. One method developed at the University of Queensland (West et al, 1982; 1983 and West et al 1989) is called GRIT III. The other technique developed by Boomsma & Oosterhaven (1992, is called DEBRIOT an acronym for Double Entry Bi-Regional Input-Output Tables.

a. The GRIT III Procedure

The central focus of GRIT III is the derivation of the trade matrices which are initially estimated from the exports vectors of the single-region tables, and later balanced with the estimates of inter-regional imports. The procedure of GRIT III consists of four phases and 12 steps as (see Table 1).

Phase I provides for the selection of regional tables appropriate for inclusion in the inter-regional table. It also insures the accounting conformity of these tables. Phase II identifies the significant inter-regional trade flow. Special attention is paid to ensuring the accuracy of those cells of the table which are expected to contribute significantly to the inter-regional multipliers. Superior data, if available, are directly inserted in this phase.

Phase III estimates those cells for which superior data are not available. These cells are generally the less significant cells of the table. Zero cells are identified where the single-region tables showed that no trade occurs or is presumed to occur. Non-zero cells are estimated by employing various allocation methods, such as gravity model allocation processes.

Table 3.1

The GRIT III Methodological Sequences

Phase I.	**Selection and Adjustment of Regional Tables**
Step 1.	Determination of the inter-regional set
Step 2.	Adjustments for accounting uniformity
Phase II.	**Identification of Significant Trade Flows**
Step 3.	Identification of significant regional trade components
Step 4.	Identification of significant inter-regional trade components
Step 5.	Insertion superior data
Phase III.	**Estimation of Remaining Trade Flows**
Step 6.	Identification of zero cells
Step 7.	Allocation methods
Step 8.	Preparation of preliminary inter-regional table
Phase IV.	**Derivation of Final Tables and Multipliers**
Step 9.	Ensuring the regional trade balance
Step 10.	Consistency checks
Step 11.	Analysis of sensitivity and coefficient significance
Step 12.	Derivation of inverses and multipliers for final transaction tables

Source: West et al. (1982; 1983; 1989)

Phase IV provides the preparation final version of the inter-regional table. This phase requires close observation of the regional trade balance and professional overview of the table consistency. This phase also makes provision for the calculation of the inverses and multipliers for the inter-regional tables. For the system of the regions where single-region tables have been constructed for each region, the GRIT III procedure seem promising because it is designed for the derivation of an inter-regional table, given the existence of appropriate single-region tables. When the single region tables have not been constructed a procedure that combines GRIT II and GRIT III procedures must be developed. For Indonesian, a new procedure is required since the single-region tables are not available for all regions. A further complication is that the single-region tables that are available are not uniform in sectoral classification. As well, they are constructed on different base-year.

b. The DEBRIOT Procedure

Table 3.2. The DEBRIOT Construction Method

Phase I.	**Adaptation of Given Data**
Step 1.	Confrontation of the national input-output table with regional(sectoral) totals
Step 2.	Estimation of lacking regional (household consumption) totals
Phase II.	**Limited Regional Trade Survey**
Step 3.	Identification of relatively and absolutely large regional sectors
Step 4.	Selection of firms per sectors and determination of question to be asked
Step 5.	Survey of firms and sector specialists and weighting of the regional trade data
Phase III.	**Construction of the Regional Domestic Use Table**
Step 6.	Application of national technology coefficients to regional total use
Step 7.	Confrontation with available regional technology data
Step 8.	Estimation of missing “technology” data (household consumption, etc)
Step 9.	Application of national foreign import coefficients per cell
Step 10.	Confrontation with regional foreign import data from the trade survey
Phase IV.	**Construction of the Regional Domestic Sales Table**
Step 11.	Confrontation of official regional foreign export data with foreign export coefficient from survey
Step 12.	Determination of the regional domestic sales coefficients
Step 13.	Application of regional domestic sales coefficients to regional total domestic sales
Phase V.	**Construction of the Intra-Regional Transaction Table**
Step 14.	Determination per cell of maxima for intra-regional transactions and minima for regional domestic imports and regional domestic exports and confrontation these minima with data from the survey
Step 15.	Application of cell-specific domestic export coefficients to the domestic sales table and reduction of remaining cells from the maximum intra-regional transaction table to reach the trade survey’s overall regional domestic export coefficients per sectors
Step 16.	Plausibility verification of the preliminary regional domestic import coefficients andconfrontationwith the import coefficients available from the trade survey
Step 17.	Determination of the final intra-regional transaction table through selective collection of additional data and revision of earlier estimate

Phase VI.	Construction of the Bi-Regional Input-Output Table
Step 18.	Calculation of the regional domestic exports table
Step 19.	Calculation of the regional domestic imports table
Step 20.	Calculation of the intra-regional transaction table for the rest of the country

Source: Boomsma and Oosterhaven, 1992

The DEBRIOT model developed for the Netherlands can also be employed for constructing single-region tables. The procedure consists of 20 steps in six phases. All phases and steps in the DEBRIOT procedure are summarized in Table 2.

This method is different from the usual hybrid approach in two major aspects. First, it avoids the use of mechanical calculation methods to estimate the regional trade coefficients. Second, it tackles the construction problem from the output or sales side. It then proposes a new non-survey method to estimate a regional domestic sales table which is believed to have no systematic bias. Rather than concentrating on the construction of regional purchase coefficients the method focuses on estimating regional sales coefficients. The main reason is that firms in the Netherlands have more and better data on the spatial destination of their outputs than they have on the spatial origin of their imports.

The main weakness of this technique, unfortunately, is that it can only dealt with a two region models. Neither GRIT III nor DEBRIOT are appropriate for constructing inter-regional input-output tables for Indonesia because Indonesia has more than two regions and has insufficient and inconsistently composed single-region tables. This is because the GRIT III was designed for the derivation of inter-regional tables given the existence of the appropriate single-region tables. DEBRIOT can deal only with two regions since it was designed for constructing two-region input-output tables. To construct a hybrid many-region input-output table where no single-region tables are available, GRIT II and GRIT III procedures should be combined and some modifications on the procedure are, of course, required.

3. The GIRIOT Procedure

a. Basic Considerations

The GIRIOT procedure developed in this chapter was designed to conform to four important considerations. The first consideration was that the procedure be applicable to the construction of either the single-region input-output tables or the inter-regional input-output tables. A combination of GRIT II and GRIT III procedures was judged appropriate since the combination of the procedures will provide a facility in which either the single-region or the many-region input-output tables can be constructed. To generate an inter-regional table, the complete procedure should be followed but only certain procedure need to be followed forthe generationof single-region tables. Some modifications are required to satisfy the first and the following considerations. The second consideration was that the non-survey techniques employed in the procedure be able to provide the most accurate initial estimates so that the cells or sectors that do not receive superior data are as accurate possible. For this purpose, the procedure had to ensure three important factors: (1) that the difference in regional technology could be taken into account, (2) that more accurate techniques could be employed to estimate the intra-regional input coefficients, (3) that more appropriate techniques could be provided to estimate the inter-regional input coefficients for a developing country's island economy.The third consideration was that superior data could be inserted at any stage of table construction. This characteristic is important since it is anticipated that superior data could be available at any level of disaggregation, from highly disaggregated to highly aggregated and at any form; in coefficients or in flows.

The fourth consideration was that the procedure be open to professional judgment. Confirming with this final consideration is very important for ensuring that, first, the procedure produces a model which represents the structure of the economy being studied and, second, the results in the form of multipliers represent reality within acceptable professional norms.

b. The Procedure

The proposed procedure is a modification as well as a combination of GRIT II and GRIT III procedures (West et al., 1980; West et al. 1982, 1984, 1989; West, 1990). The GIRIOT procedure consists of three stages, seven phases and twenty four steps (Table 3.3).

Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional

Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables.

Estimation of Regional Technology Coefficients

This first stage provides an estimation of regional technical coefficients. This stage consists of two phases, namely Phase 1, Derivation of National Technical Coefficients; and Phase 2, Adjustment for Regional Technology.

Phase 1: Derivation of National Technical Coefficients. The national technical coefficients are derived from the national input-output table in which imports are directly allocated and at produces prices (Step 1). In case the national tables are only available with direct allocation of imports, the table must be adjusted by "adding-back" the national imports to derive the national technical coefficients from national input coefficients, as had been employed in GRIT (see Jensen, et. al., 1979).

Step 2 converts the national transaction flows are then converted into coefficients by dividing the flows by total input (${}^{n}X_{ij}/{}^{n}X_{j}$), so that:

$${}^{n}a_{ij} = ({}^{n}X_{ij}/{}^{n}X_{j}) \quad \text{for } i, j = 1,2,\ldots\ldots n \tag{1}$$

where ${}^{n}a_{ij}$ is the national technical coefficient, ${}^{n}X_{ij}$ is the amount of industry *i* that is used by industry *j* at national level, and ${}^{n}X_{j}$ is national total input of industry *j*.

Step 3 provides an option is provided for updating the national regional technical coefficients due to prices and technological changes.

Phase 2: Adjustment for Regional Technology. Regional technology might be similar or different from it at national counterpart, therefore, Phase 2, Adjustment for Regional Technology, provides an adjustment for regional technology differences. Step 4 provides a procedure for adjusting regional technical differences. However, data are only available on regional gross output (${}^{r}X_{i}$, which are the same as total regional input (${}^{r}X_{j}$) and regional value-added (${}^{r}V_{j}$).

Table 3.3

Proposed Hybrid Procedures for GenerationInter-regional Input-Output Tables (GIRIOT) for Indonesia

Stage I.	**Estimation of Regional Technical Coefficients**
Phase 1.	Derivation of National Technical Coefficients
Step 1.	Preparation of national input-output tables
Step 2.	Calculation of national technical coefficients
Step 3.	Updating for price and technological change
Phase 2.	**Adjustment for Regional Technology**
Step 4.	Adjustment for regional technology differences
Step 5.	Separation of non-competitive imports coefficients
Step 6.	Insertion of superior data
Stage II.	**Estimation of Regional Input Coefficients**
Phase 3.	**Estimation of Intra-regional Input Coefficients**
Step 7.	Estimation of domestic trade flows
Step 8.	Calculation of total competitive import
Step 9.	Calculation of total competitive import ratio
Step 10.	Estimation of regional competitive import coefficients
Step 11.	Derivation of intra-regional input coefficients
Phase 4.	Estimation of Inter-regional Input Coefficients
Step 12.	Calculation of total domestic import
Step 13.	Estimation of inter-regional flows
Step 14.	Calculation of inter-regional import ratio
Step 15.	Derivation of inter-regional input coefficients
Step 16.	Insertion of superior data
Stage III.	**Derivation of Transaction Tables**
Phase 5.	**Derivation of Initial Transaction Tables**
Step 17.	Preparation of a complete coefficient table
Step 18.	Derivation of initial transaction table
Step 19.	Insertion of superior data and adjustments
Step 20.	Calculation of inverses and multipliers for the initial table
Phase 6.	**Sectoral Aggregation**
Step 21.	Aggregation sectors
Step 22.	Insertion of aggregated superior data and balancing
Phase 7.	**Derivation of Final Transaction Tables**
Step 23.	Final superior data insertions and other adjustments
Step 24.	Consistency check and sensitivity analysis

Source: Muchdie, 2011.

To calculate the total of regional intermediate input ratio, the column adjustment technique of Round (1978a, 1983) is more applicable for the initial estimation of regional technical coefficients. The initial regional technical coefficients, $({}^{r*}a_{ij})$ are estimated by adjusting the national technical coefficients $({}^{n}a_{ij})$ so that:

$^{r*}a_{ij} = [(\Sigma^r a_j)/ (\Sigma^n a_{ij})] (^n a_{ij})$ for $i, j = 1,2,\ldots\ldots\ldots n$ (2)

where:

$^{r*}a_{ij}$= initial regional technical coefficient

$(\Sigma^r a_j)$= total regional intermediate input coefficient sector j, calculated as:

$(\Sigma^r a_j) = (^r X_j - {}^r V_j)/(^r X_j)$

$(\Sigma^n a_{ij})$= total national intermediate input sector j

$^n a_{ij}$= national technical coefficients

$^r X_j$= total regional input sector j

$^r V_j$= regional value-added sector j

The above initial regional technical coefficients still contain import components; both competitive and non-competitive imports.

Step 5 separates the non-competitive imports are separated from the initial regional technical coefficients, resulting in $^{r**}a_{ij}$; the regional technical coefficients in which the non-competitive imports have been separated out. The regional non-competitive imports are identified by checking whether the sectors or industries exist in the region:

$$^r X_i \begin{cases} > 0 & \text{then } ^{r**}a_{ij} = {}^{r*}a_{ij} \text{ for } i,j = 1,2, \ldots n \\ = 0 & \text{then } ^{r**}a_{ij} = 0 \text{ for } i,j = 1,2, \ldots n \end{cases} \quad (3)$$

If a sector exists in the region, $^r X_i > 0$ then set $r^{**}a_{ij}$ equal $^{r*}a_{ij}$ for all j. If it does not, $^r X_i = 0$, set$^{r**}a_{ij} = 0$, for all j. This means that the value of regional technical coefficients for the ith row is zero.

Total regional non-competitive import coefficients for sector j $(\Sigma^r nm_j)$ are calculated as:

$$\Sigma^r nm_j = \Sigma^{r*}a_{ij} - \Sigma^{r**}a_{ij} \qquad \text{for } i,j = 1,2, \ldots n \quad (4)$$

This procedure should also employ to separate non-competitive imports of final demand, especially those of household consumption and other final demand.

Step 6 provides for the insertion of more reliable, superior data on commodity or sectoral cost structure of production if they are available for the region. Attempts to insert more reliable data of regional technical coefficients should be focused on the sectors that are generally resource-based, namely those in which their technology vary considerably by region. Lahr (1993) identifies the three sectors whose technology varies considerably by location, namely: agriculture, extractive industry and miscellaneous industries. For every province in Indonesia, the costs structure data for some agricultural commodities, mining and quarrying, and for almost all manufacturing sectors are usually available.

Up to this phase, whichcompareswith Phase 1 of GRIT II, this GIRIOT procedure provides a more accurate initial estimation since the different between national and regional technology is adjusted. GRIT assumes that regional technology is the same as that at the national level, so that national technical coefficients can be used as substitutes for regional technical coefficients. This assumption might be more appropriate for mainland economy in more developed country like Australia where spatial variations in technical structure are not significant. For Indonesia, it is evident that regional variations in technical structure do exist.

Estimation of Regional Input Coefficients

After the national technical coefficients are regionally adjusted in order to derive more accurate regional technical coefficients, Stage 2 provides a procedure for the estimation of regional input coefficients. Phase 3 estimates the intra-regional input coefficients, namely those regional input that are supplied locally. Phase 4estimates the inter-regional input coefficients, that is, those inputs that come from other regions within the country.

Phase 3: Estimation of Intra-regional Input Coefficients. The intra-regional input coefficients are the coefficients of regional inputs in which the regional import components have been separated from regional technical coefficients. In other words, the intra-regional input coefficients are the coefficients of regional inputs that are supplied locally.

The objective of Phase 3 is to derive the intra-regional input coefficients (${}^{rr}a_{ij}$) by separating the regional competitive imports (${}^{r}cm_{ij}$) from regional technical coefficients (${}^{r}a_{ij}$). Since the regional technical coefficients have been estimated previously, the main task in this phase is to estimate the regional competitive import coefficients (${}^{r}cm_{ij}$):

$$ {}^{r}cm_{ij} = ({}^{r}CM_{ij})/({}^{r}X_{j}) \qquad \text{for } i,j = 1,2, \ldots n \qquad (5) $$

Unfortunately, data on ${}^{r}CM_{ij}$ are usually not available, so that an estimation of the regional competitive import coefficients is required by employing data on total regional competitive import (${}^{r}CM_{i}$).

Two approaches have commonly been employed for estimating import matrices. The most popular is the row-only approach employing such techniques as location quotients (LQ), supply-demand pool (SDP) and regional purchase coefficients (RPC) as well as regional supply percentage (RSP). The analogy to the row-only approach is the approach that is applied to columns-only where a matrix of imports (${}^{r}cm_{ij}$) could be created by multiplying the diagonal import proportion (${}^{r}cm_{j}$) by corresponding columns of the regional technology matrix (${}^{r}a_{ij}$). This column approach input coefficient matrix is referred to as regional input proportion (RIP) technique.

Since the first approach is row average and the second one is column average, neither approach is likely to generate a partitively accurate matrix of regional imports. Two different regional input matrices will then be obtained. This GIRIOT procedure proposes reconciling the results of the two approaches using RAS procedure.

The two sources of total regional competitive imports (${}^{r}CM_{i}$) are international (foreign) imports (${}^{fr}CM_{i}$) in which data are available at regional (provincial level) and inter-regional (domestic) imports (${}^{dr}CM_{i}$); which provide data from other regions within the country. Since the international import data are available, the main task of this phase is to estimate the domestic competitive imports, by firstly estimating domestic trade flows.

Based upon the structure of the input-output table in which imports are indirectly allocated, the estimation of domestic competitive imports are as follow:

$$\sum {}^{r}a_{ij}{}^{r}X_{j} + {}^{r}F_{i} - {}^{r}M_{i} = {}^{r}X_{i} \qquad (6)$$

$${}^{r}F_{i} = {}^{r}H_{i} + {}^{r}O_{i} + {}^{r}E_{i} \qquad (7)$$

$${}^{r}E_{i} = {}^{fr}E_{i} + {}^{dr}E_{i} \qquad (8)$$

$${}^{r}M_{i} = {}^{rf}M_{i} + {}^{rd}M_{i} \qquad (9)$$

where:

${}^{r}a_{ij}$=regional technical coefficients

${}^{r}X_{j}$=regional input

${}^{r}X_{i}$=regional output

^{RFi}=final demand that consists of:

${}^{r}H_{i}$=household consumption, and

${}^{r}O_{i}$=other final demand

${}^{r}E_i$=regional exports, that consists of:

${}^{fr}E_i$=regional export that go to foreign country and

${}^{dr}E_i$=regional export that go to other regions within the country

${}^{r}M_i$=regional competitive imports, that consists of :

${}^{rf}M_i$=regional competitive import that come from foreign country

${}^{rd}M_i$=regional competitive import that come from other regions in the country

Substituting (7), (8) and (9) into (6) resulting:

$$\sum {}^{r}a_{ij}{}^{r}X_j + {}^{r}H_i + {}^{r}O_i + {}^{fr}E_i + {}^{dr}E_i - ({}^{rf}M_i + {}^{rd}M_i) = {}^{r}X_i \qquad (10)$$

Rearranging the above equation, the regional net domestic flows are calculated as:

$$({}^{dr}E_i - {}^{rd}M_i) = [{}^{r}X_i - (\sum {}^{r}a_{ij}{}^{r}X_j + {}^{r}H_i + {}^{r}O_i + {}^{fr}E_i) + {}^{rf}M_i] \qquad (11)$$

If $({}^{dr}E_i - {}^{rd}M_i)$ is positive, it means that domestic competitive export is larger than the regional competitive import. In net term, the region is assumed to export goods and services to other regions within the country. Otherwise, if $({}^{dr}E_i - {}^{rd}M_i)$ is negative, the region is assumed to import goods and services from other regions within the country.

Domestic competitive imports are then formulated as:

$$ {}^{dr}CM_i = \begin{cases} 0 \text{ for } ({}^{dr}E_i - {}^{rd}M_i) > 0 \\ ({}^{dr}E_i - {}^{rd}M_i) \text{ for } ({}^{dr}E_i - {}^{rd}M_i) < 0 \end{cases} \qquad (12)$$

Step 8 calculates total competitive imports (${}^{r}CM_i$) as a sum of foreign competitive import (${}^{fr}CM_i$) and domestic competitive import (${}^{dr}CM_i$) so that:

$${}^{r}CM_i = {}^{fr}CM_i + {}^{dr}CM_i \qquad (13)$$

Step 9 calculates the ratio of total competitive imports.This step employs the generalized RSP technique introduced by Lahr (1992) for row-only estimation and generalised RIP technique for column-only estimation. Assuming that exports comprise local and imported goods and services in certain proportions, these techniques can easily handle a situation where regional exports and/or imports are larger than regional output, a situation that is not unlikely in port cities. The simplest variant of this technique which is employed in this procedure assumes that local and imported exports are in the same proportion and calculated as:

$^{r}cm_{i} = (^{r}CM_{i}) / (^{r}X_{i} + ^{r}CM_{i})$ (14)

where:

$^{r}CM_{i}$ = Total competitive imports of region *r* for sector *i*.

$^{r}X_{i}$ = Total input region *r* for sector *i*.

This formulation is the analog for the column-only approach by replacing *i* (row) with *j* (column).

This step also derives a diagonal matrix of RSP and RIP that can be employed in deriving the intra-regional input coefficients in Step 11. The elements of diagonal RSP matrix can be calculated as:

$^{r}s_{i} = (^{r}X_{i}) / (^{r}X_{i} + ^{r}CM_{i})$ (15)

whichequals to (1 - $^{r}cm_{i}$). The elements of the diagonal RIP matrix are calculated as: $^{r}i_{j} = (^{r}X_{i}) / (^{r}X_{i} + ^{r}CM_{i})$ (16)

Step 10 estimates the regional competitive import coefficient matrix (with elements of $^{r}cm_{ij}$) will be estimated by multiplying the diagonal matrix of total import ratio (with diagonal elements of $^{r}cm_{i}$) calculated in Step 9, by the regional technical coefficient matrix ($^{r}a_{ij}$) of Step 6, both by row and column only.

for row-only allocation: $^{r}cm_{ij} = \sum (^{r}cm_{i}) (^{r}a_{ij})$; for i , j = 1,2,…n. (17) for column only allocation: $^{r}cm_{ij} = \sum (^{r}a_{ij}) (^{r}cm_{j})$; for i, j = 1,2,…n. (18)

Using RAS procedure (where the coefficients matrix is firstly transformed into transactions by multiplying it with the vector of total regional input), the above import matrices could be reconciled.

Step 11 calculates the intra-regional input coefficients ($^{rr}a_{ij}$) in one of the following ways. The first method separates the competitive import coefficients ($^{r}cm_{ij}$) from regional technical coefficients ($^{r}a_{ij}$) so that:

$^{rr}a_{ij} = ^{r}a_{ij} - ^{r}cm_{ij}$ for i, j = 1,2,…n. (19)

An alternative method can also be used to cross-check the results of the first method. This method involves multiplication of the diagonal matrix of RPC by the matrix of regional technology for row only estimation or by multiplying the regional technology matrix with the diagonal matrix of RIP for column only estimation.

In row-only estimation, the intra-regional input coefficients are calculated as:

$^{rr}a_{ij} = \sum (^{r}s_{i}) (^{r}a_{ij})$ for i, j = 1,2,…n. (20)

In column-only estimation, the intra-regional input coefficients are calculated as:

$$^{rr}a_{ij} = \sum (^{r}a_{ij}) (^{r}i_{j}) \text{ for } i, j = 1,2,\ldots n. \quad (21)$$

Using RAS these two matrices of regional input coefficients are reconciled. Total intra-regional input coefficients, $(\sum {}^{rr}a_{ij})$ should be equal to the difference between total regional technical coefficients $(\sum {}^{r}a_{ij})$ and total competitive import coefficients: $(\sum {}^{rr}a_{ij}) = (\sum {}^{r}a_{ij}) - (\sum {}^{r}cm_{ij})$ for $i, j = 1,2,\ldots n.$ (22) where, $(\sum {}^{r}cm_{ij}) = {}^{r}cm_{j}$. The total regional competitive imports are then inserted in the import competitive row in the table.The results of this phase are the coefficients of intra-regional inputs $(^{rr}a_{ij})$ where the competitive import components were separated from regional technical coefficients. This step also derivesthe intra-regional household consumption and other final demand is also derived by separating their component of competitive imports. This results in intra-regional household consumption and intra-regional other final demand.

Generating a single-region table requires continuing Stage III, starting from Step 17 to derive the initial transaction tables. To construct an inter-regional table, repeat Step 1 to Step 11 to estimate the intra-regional input coefficients of each region in the nation or system of regions, and then continue to Phase 4.

Phase 4: Estimation of Inter-regional Input Coefficients. This phase estimates the inter-regional input coefficients. Ideally, if trade flow data are available in the form of region and sector of origin to region and sector of destinations as in the pure, ideal approach of Isard (1951), they can be used directly for the estimation of inter-regional input coefficients. However, for many countries these data are not available. The main task in this phase, therefore, is to decompose total inter-regional import $(^{dr}M_{j})$ into sector and region of origin and destination.

Step 12 calculates the total of inter-regional imports $(^{dr}M_{j})$. Since data on foreign imports are more reliable because they are well documented, the non-competitive imports calculated in Step 5 are assumed to come from domestic sources only, not from foreign sources. The total inter-regional imports will then consist of the non-competitive imports $(^{r}NM_{j})$ and the domestic competitive imports $(^{dr}CM_{j})$ so that:

$$^{dr}M_{j} = {}^{r}NM_{j} + {}^{dr}CM_{j} \text{ for } j = 1,2,\ldots n. \quad (23)$$

where:

$^{dr}M_{j}$ = total inter-regional imports

${}^{r}NM_j$= regional non-competitive imports

${}^{dr}CM_j$= domestic competitive imports

Step 13 estimates the inter-regional import flows that is import by region of origins and destinations for every sector (${}^{sr}X_j$). This occurs by disaggregating the total of inter-regional imports calculated in Step 12, so that:

$$\sum {}^{sr}X_j = {}^{dr}M_j \text{ for } j = 1,2,\ldots n. \tag{24}$$

The transport pattern will firstly be used to estimate the inter-regional imports of region *r* that come from region *s* for commodity/sector-*j*(${}^{sr}X_j$). Furthermore, for those where the transport pattern data are not available, the estimation process is then focused on the non-zero total inter-regional imports. Many modeling techniques are available depending on the types of regional trade data available. In Indonesia, those sectors are expected to be service sectors in which population distribution play an important role in determining the flows of the services. The total inter-regional imports are then intuitively allocated into the region of origin and destination. The allocation is based on the pattern of population distribution since this approach seems more appropriate for an island economy.

Step 14 provides a calculation of inter-regional import ratios (${}^{sr}a_j$). The rations are defined as a proportion of inter-regional import (${}^{sr}X_j$) estimated in Step 13 to total regional inputs (${}^{r}X_j$) so that:

$$ {}^{sr}a_j = ({}^{sr}X_j)/\,({}^{r}X_j) \tag{25}$$

where:

${}^{sr}a_j$ = inter-regional import ratio of sector *j*

${}^{sr}X_j$ = inter-regional import of sector *j* that come from region *s*

${}^{r}X_j$ = total regional input of sector *j*

Step 15 derives the inter-regional input coefficients (${}^{sr}a_{ij}$)by allocating the inter-regional import ratio (${}^{sr}a_j$) into the inter-regional inter-industry cells following the pattern of regional import. As in Step 10, two approaches of allocation could be performed, namely by row and by column only estimation. In row-only estimation, the inter-regional input coefficients are estimated as:

$$ {}^{sr}a_{ij} = \sum({}^{sr}a_j)({}^{rr}a_{ij}) \text{ for } i, j = 1,2, \ldots,\text{n and } r, s = 1,2,\ldots \text{m} \tag{26}$$

and in column only estimation, the inter-regional input coefficients are calculated as:

$$ {}^{sr}a_{ij} = \sum({}^{rr}a_{ij})({}^{sr}a_j) \text{ for } i, j = 1,2, \ldots,\text{n and } r, s = 1,2,..\text{m}. \tag{27}$$

Since zero domestic trade balance is only required at the national level, it is not necessary that total domestic imports are equal to total domestic exports at the regional level. Row and column reconciliation is therefore required at this step.

This technique of estimation is different to that used by Riefler-Tiebout (1970). The Riefler-Tiebout procedure follows the import pattern of the region, but ignores the existence of regional non-competitive imports. This proposed technique is believed to provide more accurate estimation because it takes into account the existence of regional non-competitive imports.

Furthermore, Step 16 provides the opportunity to insert more reliable data, especially when Isard's type data are available.

Derivation of Transaction Tables

The third stage of the procedure consists of three phases, namely derivation of initial transaction tables (Phase 5), sectoral aggregation (Phase 6) and derivation of final transaction tables (Phase 7). Either single-region tables or inter-regional tables could be generated.

Phase 5: Derivation of Initial Transaction Tables. Phase 5 provides the derivation of initial transaction tables. Step 17 prepares a complete coefficient tableby putting together all the coefficients in one table. To generate a single-region table, only the coefficients of the region concerned are to be arranged. To generate an inter-regional table, however, all single-region coefficients that consist of the intra-regional input coefficients as well as the inter-regional input coefficients are to be arranged.

In Step 18 derives an initial transaction table. Coefficients in each column are multiplied by total regional input (${}^{r}X_{j}$) to obtain first estimates of transactions. In this step, the values of final demand quadrants are also put together into the table to complete the prototype table.Conventionally, the components of final demand are household consumption, government expenditure, capital formulation, stock change and exports. Only two components of final demand are frequently used in regional analysis, namely household consumption and exports. Therefore, only they are shown separately and the others are aggregated as other final demand.

Many studies show that the household sector has a very important role in regional economy (Stevens& Trainers, 1976; Park et al, 1981; Jensen & West, 1983; Cochrane, 1990; Lahr, 1993). This sector one of the sources of error in regional multipliers. The household column, therefore, should be based on the most reliable data available. In Indonesia every province publishes data on household expenditure surveys. The estimation of regional exports also relies on the use of superior data, where the Central Bureau of Statistics publishes national statistics of imports and exports annually that is broken-down by commodity and by province.

In Step 19, more reliable data are inserted should they be available, and other final demand and other value-added are adjusted so that total output equals to the total input. The RAS technique is employed for balancing the table and to reconcile the table.

Step 20 calculates multipliers of the initial table. The inter-regional multipliers are compared to the single-region multipliers. Sectoral multipliers of a region are also compared to those of other regions. Inter-regional feed-back effects are also calculated.

Phase 6: Sectoral Aggregation. In Phase 6, sectors are aggregated in Step 21. Since all the sectors are in transaction form no aggregation problem involved in this step. Ideally, if a table is constructed for general purpose, the level of aggregation is better kept as disaggregate as possible. However, increasing the accuracy of the table by inserting more reliable data it will be depended on the level of aggregation of the superior data available. If superior data are available at the same level of disaggregation, no aggregation is required. If superior data are only available at more aggregate level, however, the table should be aggregated so that they are in the same level of aggregation. Insertion of aggregated superior data and balancing is provided in Step 22.

Phase 7: Derivation of Final Transaction Tables. Finally, final transaction tables are derived in Phase 7. However, in Step 23 there are still some opportunities to insert superior data to improve the accuracy of the table. In Step 24, the last step, final transaction tables are generated by ensuring that the regional trade is balanced, the consistency is checked and sensitivity analysis is fully conducted. Inverses and multipliers are calculated.

4. Empirical Application to the Indonesian Data

a. Regional Definitions

At least three definitions of regions have been adopted in the literature: homogenous regions; nodal regions; and planning or administrative regions (Blair, 1991; Richardson, 1969).

The concept of a homogenous region is based on the view that spatial units might be linked together as a single region when they have uniform characteristics. These characteristics might be economic (e.g. similarities in production structure or consumption patterns); geographical (e.g. similarities in topography or climate); social or political (e.g. similarities in regional identity or traditional party allegiances). The task of defining regional boundaries is more difficult when regions are uniform in some respects but dissimilar in others.

It is evident that differences in economic phenomena exist between regions. Most regions comprise urban and rural areas. Moreover, large areas are likely to exhibit an uneven distribution of population with greater numbers in urban centres and fewer people in some rural areas. Acceptance of the lack of uniformity in the space economy leads to the second concept of regions: nodal regions. These regions are composed of closely and functionally interrelated heterogeneous units both internal and external. Internally, the functional linkages occur through trade and service connections within the region. Externally, production links, trade links, transportation networks, communication networks, migration networks and the flow of raw materials and manufactured goods connect a particular region to other regions as well as the rest of the world.

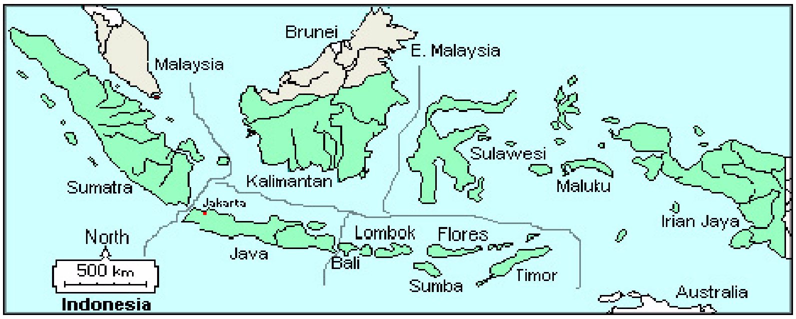
The third classification for regions requires dividing a nation into planning or administrative regions. These divisions are important questions arise concerning regional policy and planning. Since implementing regional policy presupposes power to act then these regions need to be defined as administrative areas with political jurisdiction of various sizes and levels.

In research, the choice of an ideal region depends mainly on the purpose of the study of the regions, the overall structure of the regions, and the degree of integration of the regional system as a whole. It is easier to divide a nation into regions if a number of areas have clearly defined economic structures. However, the choice of regional boundaries becomes more difficult and arbitrary where clearly marked geographic areas of economic specialisation are not evident.

Ideally, the regions defined for an input-output analysis should demonstrate reasonably stable intra-regional as well as inter-regional trade coefficients. They should also conform to production areas that exhibit local economic structure (West, Morison & Jensen, 1982; West et al., 1989).

Figure 3.1

Map of main islands of Indonesia and country's regional boundaryfor this study



In a developing country in general, and in Indonesia in particular, governments tend to intervene directly or indirectly in economic activity through policy formulation and planning. Direct intervention is usually implemented through the government's administrative hierarchy, from the highest level (e.g. central and provincial governments) to the lowest level (e.g. rural and sub-district governments). For the construction of inter-regional input-output tables for Indonesia, the nation was divided into regions based on the country's administrative units because statistical data are available on every stage of administrative level.

Administratively, Indonesia comprises 24 provinces and 3 special territories. For the purpose of modeling the spatial structure of the island economy of Indonesia, the division of the nation into regions was based on the five main island groups. Based on data so far available, the national economy was disaggregated into five regions: (1) Sumatra (SUM), consisting of all provinces in Sumatra as well the special territory of Aceh; (2) Java (JAV), including all three provinces of the island plus its two special territories, (3) Kalimantan (KAL),comprising of four provinces; (4) Nusa Tenggara (NUS), which includes Bali, West Nusa Tenggara, East Nusa Tenggara and East Timor; and (5) Other eastern islands (OTH), which consists of all provinces in Sulawesi, Maluku and Irian Jaya.

Table 3.4

Regional definitions for generating of inter-regional input-output tables (GIRIOT) for Indonesia

No.	Region/island	Province
1.	Sumatra (SUM)	1. Special Territory of Aceh 2. North Sumatra 3. West Sumatra 4. Riau 5. Jambi 6. South Sumatra 7. Bengkulu 8. Lampung
2.	Java (JAV)	Special Territory of Greater Jakarta 8. West Java 9. Central Java Special Territory of Yogyakarta East Java
3.	Kalimantan (KAL)	West Kalimantan Central Kalimantan South Kalimantan East Kalimantan
4.	Nusa Tenggara (NUS)	Bali West Nusa Tenggara East Nusa Tenggara
5.	Other islands (OTH)	North Sulawesi Central Sulawesi South Sulawesi South-East Sulawesi Maluku& Irian Jaya

Source: Muchdie, 2011

Figure 3.1 shows the main islands of Indonesia and the country's regional boundaries for the purpose of this study. Table 3.4 provides a list of the names of the regions, including the provinces comprising the regions.

b. Sectoral Classification

In an input-output model, the number of intermediate sectors and the formal classification of those sectors are determined mainly by the aim of the model's construction. The number of sectors varies from highly-disaggregated tables to highly-aggregated tables.

Table 3.5

Sectoral classification for generating inter-regional input-output tables (GIRIOT) for Indonesia

No.	9-Sector Classification	No.	28-Sector Classification
1.	Agriculture, livestock, forestryand fishery	01.	Food crops
		02.	Estate crops
		03.	Livestock
		04.	Forestry
		05.06.	Fishery
2.	Mining and quarrying	07.	Oil and gas mining
		08.	Non-oil and gas mining
		09.	Food, beverages and cigarettes
		10.	Textiles
3.	Manufacturing	11.	Wood processing
		12.	Paper and printing
		13.	Chemical and rubber products
		14.	Machines and electrical machines
		15.	Transport equipment
		16.	Non-metallic mineral products
		17.	Iron and steel
		18.	Non-ferrous basic metal products
		19.	Fabricated metal products
		20.	Other manufactured products
4.	Electricity, water and gas	21.	Electricity, water and gas
5.	Construction	22.	Construction
6.	Trade, hotels and restaurants	23.	Trade
		24.	Hotels and restaurants
7.	Transportationandcommunication		Transportation and communication
	Banking and other finance	25.	Banking and other finance
8.	Other services	26.	Public administration and defense
9.		27.	Other services
		28.	Unspecified

Source: Muchdie, 2011

A high level of disaggregation (i.e. tables with a large number of sectors) has the advantage of providing more detailed specification of an economy. They also identify give significant features of the table with more accuracy. The disadvantage of a high level of disaggregation, however, is a concomitant high cost for constructing the table. For an inter-regional table, a high level of disaggregation can magnify the size of the table, so that the table becomes difficult to visualize. More aggregated tables (i.e. tables with few sectors) have the advantage of visual simplicity. However, they have two important disadvantages. First, as the aggregation proceeds from establishment into groups of establishments or into broad sectors, it will include more groups of establishments which are less homogenous in term of products as well as in terms of input structure. An aggregate table would be sufficient for a simple exercise. For analytical research, however, a table of this type could not only blur important relationships, but also be quite misleading. The second weakness of the highly-aggregated table is that it makes it impossible for the analyst to identify any economic activity other than that of major economic aggregates. The fewer the sectors in a table, the more restricted its use for specific the purposes of studying economic interdependence.

The decision regarding the number of sectors in input-output tables will also be constrained by data availability and the resources available for data collection. Even though the national input-output table of Indonesia provides a 66-sector classification, sectoral disaggregation at provincial level is still very limited to about a half of the national level. So far, the most common sectoral classifications use 9, 11, 15, 19 or 22 sectors. The National Development Planning Agency (NDPA), disaggregated the regional economy into 25 sectors using the Statistics of Regional Income. Recently, the Indonesian Central Bureau of Statistics (CBS) provided an estimation of regional gross-output, value added, and employment, as well as foreign exports and imports data, for a 28-sector classification.

After an intensive consultation of key persons at CBS and NDPA, this spatial structure study uses the 28-sector classification of CBS since this is the only classification available at the most consistent disaggregation level. For general purposes it is advisable to keep the table as disaggregate as possible. However, since some superior data are only available at higher aggregate levels, this study used a 9-sector classification which is presented in Table 3.5.

c. Data and Their Sources

The availability of data largely determines the estimation procedure and its accuracy in regard to the construction of inter-regional input-output tables. This section describes the data used in applying the GIRIOT procedure and theirs sources. The following publications from CBS were the main data sources of the GIRIOT:

1. Biro Pusat Statistik, Badan Perencanaan Pembangunan Nasional and Japan International Cooperation Agency, 1995, **Tabel Input Output Intra-Regional Indonesia Menurut 5 Pulau/Kepulauan 1990** *(Indonesia's Intra-Regional*

Input Output Tables by Islands 1990), Kerjasama Biro Pusat Statistik, Badan Perencanaan Pembangunan Nasional dan Japan International Cooperation Agency *(Joint Project : Central Bureau of Statistics, National Development Planning Agency and the Japan International Cooperation Agency*), Jakarta.

2. Biro Pusat Statistik, 1994a, **Tabel Input-Output Indonesia 1990** (*Indonesian Input-Output Table 1990*), Jilid 1 dan Jilid 2 (*Volume 1* and *Volume 2*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.
3. Biro Pusat Statistik, 1994b, **Produk Domestik Regional Bruto Propinsi Propinsi di Indonesia Menurut Lapangan Usaha 1987-1991** (*Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin 1987-1991*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.
4. Biro Pusat Statistik, 1994c, **Produk Domestik Regional Bruto Propinsi Propinsi di Indonesia Menurut Penggunaan 1987-1991** (*Gross Regional Domestic Product of Provinces in Indonesia by Expenditure 1987-1991*), Biro Pusat *Statistik (Central Bureau of Statistics*), Jakarta.
5. Biro Pusat Statistik, 1991a, **Statistik Perdagangan Luar Negeri Indonesia, Import 1990** (*Indonesia Foreign Statistics, Imports 1990*), Jilid 1 (*Volume 1*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.
6. Biro Pusat Statistik, 1991b, **Statistik Perdagangan Luar Negeri Indonesia, Ekspor 1990** (*Indonesia Foreign Statistics, Exports 1990*), Jilid 2 (*Volume 2*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.
7. Departemen Perhubungan and Biro Pusat Statistik, 1992, **Statistik Angkutan Laut 1990** (*Sea Transport Statistics 1990*), Departemen Perhubungan dan Biro Pusat Statistik (*Department of Transport and Central Bureau of Statistics*), Jakarta
8. Biro Pusat Statistik, 1992a, **Statistik Bongkar Muat Barang di Pelabuhan Indonesia 1990** (*Cargo Loading and Unloading at Ports of Indonesia 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta
9. Biro Pusat Statistik, 1992b, **Survey Sosial Ekonomi Nasional, Buku 3: Pengeluaran Untuk Konsumsi Penduduk Indonesia per Propinsi 1990** (*National Survey for Socio-Economy, Book 3: Expenditure for Consumption of Indonesia by Province 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

The two most important data sources were the National Input-Output Table (NIOT) for 1990 from CBS, for 1990 which is available for 66 economic sectors (Biro Pusat Statistik, 1994a) and the Intra-Regional Input-Output Tables for the five main islands, which provide information for 28 economic sectors (Biro Pusat Statistik, Badan Perencanaan Pembangunan Nasional & Japan International Cooperation Agency, 1995). The NIOT is aggregated into 28 sectors. This aggregation forms the basic framework of the GIRIOT procedure.

Those publications above provided estimates of the 28-sector classification in the following areas: (1) gross-output by region; (2) value-added by region; (3) wages and salaries by region; (4) employment by region; (5) household consumption by region; (6) other final demand by region including government expenditure, capital formation and stock estimation; (7) foreign exports by region; and (8) foreign imports by region. These data became available when CBS, together with NDPA and JICA, prepared five island intra-regional input-output tables for 1990. The methods of estimation were also discussed in these publications.

Other important data for GIRIOT are international and domestic cargo loading and unloading data and domestic transportation data by port of origins and destinations. Converting the data into 28-sector classification allows the pattern of inter-regional trade for primary and secondary sectors to emerge. These data are used to estimate the inter-regional flow of non-zero inter-regional imports from the primary and secondary sectors. Since transport pattern data are not available for service sectors, the estimation of inter-regional flows for these sectors is based on other estimation techniques.

Data on the cost structure for several sectors are also available. For almost all agricultural commodities the cost structure data are published yearly (Biro Pusat Statistik, 1993b). For all manufacturing sectors, the cost structure data are also available since every province publishes the industrial statistics yearly and, more generally, every province publishes yearly provincial general statistics. At the national level, the following CBS publications are useful:

1. Biro Pusat Statistik, 1991c, **Survey Tahunan Perusahaan Industri Besar dan Sedang 1990** (*Industrial Statistics, Survey of Manufacturing Industries, Large and Medium Scale 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.
2. Biro Pusat Statistik, 1991d, **Statistik Industri Kecil 1990** (*Small Scale Manufacturing Industry Statistics 1990*), Biro Pusat Statistik (*Central Bureau*

of Statistics), Jakarta.

3. Biro Pusat Statistik, 1991e, **Statistik Industri Kerajian/Rumah Tangga 1990** (*Household/Cottage Industry Statistics 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

For other sectors such as oil and gas mining as well as electricity, water and gas data on the cost structure are also available (Biro Pusat Statistik, 1992c). These data are treated as superior data and inserted when applicable.

d. Model Validation

It is difficult to validate the inter-regional input-output model produced by GIRIOT procedure as no reliable inter-regional input-output table has been produced for Indonesia. However, in the evaluation of any method of economic model compilation, Jensen (1987) provided important guidance by identifying two fundamental questions that should be answered: Does the method produce a model which is representative of reality within professionally acceptable limits? Do the results of the model have a professionally acceptable level of integrity in the real world?

To evaluate the procedure designed to generate an inter-regional input-output table for studying the spatial structure of the Indonesian economy; these questions can be rephrased thus: (1) Does the procedure produce inter-regional input-output tables that reflect the spatial characteristics of the Indonesian economy? (2) Do the results, in the form of multipliers, represent reality within acceptable professional norms?

Table 3.6

Direct coefficients: 5-region-1-sector model (Column estimation)

SECTOR	SUM	JAV	KAL	NUS	OTH	TOT	H-SUM	H-JAV	H-KAL	H-NUS	H-OTH	OFD	EXPRT	TOT
SUM	0.3358	0.0216	0.0205	0.0131	0.0152	0.4061	0.8308	0.0340	0.0142	0.0840	0.0683	0.1461	0.3533	1.9367
JAV	0.0047	0.3731	0.0206	0.0323	0.0099	0.4406	0.1089	0.8319	0.2053	0.0872	0.1358	0.7218	0.4164	2.9473
KAL	0.0015	0.0150	0.2539	0.0273	0.0419	0.3396	0.0095	0.0155	0.6394	0.0434	0.0560	0.0211	0.1614	1.2860
NUS	0.0007	0.0013	0.0034	0.2240	0.0027	0.2320	0.0038	0.0134	0.0198	0.7793	0.0635	0.0443	0.0041	1.1610
OTH	0.0022	0.0097	0.0194	0.0343	0.2812	0.3468	0.0043	0.0194	0.0846	0.0032	0.6046	0.0418	0.0648	1.1694
TOTAL	0.3449	0.4207	0.3177	0.3309	0.3509	1.7651	0.9572	0.9141	0.9633	0.9972	0.9283	0.9751	1.0000	8.5004
HH-SUM	0.1515	0.0000	0.0000	0.0000	0.0000	0.1515	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1515
HH-JAV	0.0000	0.1789	0.0000	0.0000	0.0000	0.1789	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1789
HH-KAL	0.0000	0.0000	0.1977	0.0000	0.0000	0.1977	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1977
HH-NUS	0.0000	0.0000	0.0000	0.2184	0.0000	0.2184	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2184
HH-OTH	0.0000	0.0000	0.0000	0.0000	0.2264	0.2264	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2264
OVA	0.4336	0.2344	0.4215	0.4335	0.3881	1.9111	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9111
IMPORT	0.0700	0.1659	0.0623	0.0134	0.0334	0.3450	0.0428	0.0859	0.0367	0.0028	0.0717	0.0249	0.0000	0.6098
TOTAL	1.0000	1.0000	1.0000	1.0000	1.0000	5.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	12.0000
EMPLOY	0.1752	0.1967	0.1444	0.5220	0.2544	1.2927	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.2927

Source: Muchdie, 2011

The first question might be answered by inspecting the structure of inter-regional input-output tables in the most aggregate form. More specifically, it will be answered by inspecting the proportion of regional imports and the pattern of inter-regional trade flows.

Two versions of very similar tables resulted when the procedure was applied to Indonesia. One version originated from a column-only estimation and the other resulted from a row-only estimation. These two tables were aggregated into a 5-region-1-sector model. The question arises at to which table is more likely to represent the spatial structure of the island economy of Indonesia.

The two tables are different in the value of the cells in the intermediate sector, even though the total intermediate input and total intermediate demand were made equal. Inspection therefore, should focus on the intermediate quadrant of the two tables.

Table 3.7

Direct coefficients: 5-region-1-sector model (Row estimation)

SECTOR	SUM	JAV	KAL	NUS	OTH	TOT	H-SUM	H-JAV	H-KAL	H-NUS	H-OTH	OFD	EXPRT	TOT
SUM	0.3098	0.0330	0.0130	0.0106	0.0029	0.3693	0.8308	0.0340	0.0142	0.0840	0.0683	0.1461	0.3533	1.8999
JAV	0.0223	0.3578	0.0404	0.0710	0.0599	0.5513	0.1089	0.8319	0.2053	0.0872	0.1358	0.7218	0.4164	3.0579
KAL	0.0044	0.0170	0.2389	0.0141	0.0367	0.3111	0.0095	0.0155	0.6394	0.0434	0.0560	0.0211	0.1614	1.2574
NUS	0.0015	0.0017	0.0032	0.2145	0.0004	0.2213	0.0038	0.0134	0.0198	0.7793	0.0635	0.0443	0.0041	1.1504
OTH	0.0069	0.0113	0.0222	0.0207	0.2510	0.3121	0.0043	0.0194	0.0846	0.0032	0.6046	0.0418	0.0648	1.1347
TOTAL	0.3449	0.4207	0.3177	0.3309	0.3509	1.7651	0.9572	0.9141	0.9633	0.9972	0.9283	0.9751	1.0000	8.5004
HH-SUM	0.1515	0.0000	0.0000	0.0000	0.0000	0.1515	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1515
HH-JAV	0.0000	0.1789	0.0000	0.0000	0.0000	0.1789	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1789
HH-KAL	0.0000	0.0000	0.1977	0.0000	0.0000	0.1977	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1977
HH-NUS	0.0000	0.0000	0.0000	0.2184	0.0000	0.2184	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2184
HH-OTH	0.0000	0.0000	0.0000	0.0000	0.2264	0.2264	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2264
OVA	0.4336	0.2344	0.4215	0.4335	0.3881	1.9111	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.9111
IMPORT	0.0700	0.1659	0.0623	0.0134	0.0334	0.3450	0.0428	0.0859	0.0367	0.0028	0.0717	0.0249	0.0000	0.6098
TOTAL	1.0000	1.0000	1.0000	1.0000	1.0000	5.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	12.0000
EMPLY	0.1752	0.1967	0.1444	0.5220	0.2544	1.2927	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.2927

Source: Muchdie, 2011

Tables 6 and 7 show that the intra-regional coefficients of the table that originated from the column-only estimation are larger than those of the table derived from row-only estimation. Consequently, given that each table received the same amount of total intermediate input, the inter-regional import proportions of the first table are smaller (Table 3.8). In comparison, the intra-regional coefficients for Sumatra (0.3358), Java (0.3731), Kalimantan (0.2539), Nusa Tenggara (0.2277) and Other Islands (0.2812) of Table 3.3 are all higher than those of Table 3.4, the proportion of imports in the column-only table for Sumatra (total : 7.9 %, inter-regional: 0.9%), Java (total: 21.3%, inter-regional:4.7%), Kalimantan (total 12.7%, inter-regional: 6.5%), Nusa Tenggara (total: 12.0%, inter-regional: 10.7%) and Other Islands (total: 10.4%, inter-regional : 7.1%) are all smaller than those of the row-only table.

For an island economy where every island tends to be self-sufficient because of difficulties associated with inter-regional trade, it seems reasonable to expect that the intra-regional input coefficients (the coefficients of input that are supplied locally) would be higher. The same reason could explain why the proportions of inter-regional imports are smaller. As the size of the region and the stage of economic development determines the size of regional imports, Table 3.8 shows that Nusa Tenggara, the less-developed region in the country, with an area just 4.6 per cent of the nation total areas, has the largest import proportion. Other islands, at about the same stage of economic progress as Nusa Tenggara but with a larger area (35.7 % of the national total), is the second-highest region in regard to inter-regional imports. The proportion of domestic imports for Java is higher than Sumatra, mainly because the area of Java is only one-fifth that of Sumatra. The inter-regional input-output table whose initial estimations were based on the column average could reflect the spatial structure of an island economy more properly.

Table 3.8

Regional import proportion by island (% of total input)

Column Estimation	SUM	JAV	KAL	NUS	OTH
Total Import	7.9	21.3	12.7	12.0	10.4
Inter-regional	0.9	4.7	6.5	10.7	7.1
Foreign	7.0	16.6	6.2	1.3	3.3
Row Estimation	SUM	JAV	KAL	NUS	OTH
Total Import	10.5	22.8	14.2	13.3	13.4
Inter-regional	3.5	6.3	8.0	12.0	10.1
Foreign	7.0	16.6	6.2	1.3	3.3

Source: Muchdie, 2011

To evaluate whether the constructed inter-regional input-output tables reflect the spatial structure of an island economy, the pattern of inter-regional trade flows could be analyzed by applying the feed-back loop approach (Sonis & Hewings, 1991; Sonis, Oosterhaven & Hewings, 1993; Sonis, Hewings & Gazel, 1995). Intermediate transaction flows of two 5-region-1-sector models are presented in the two tables following: Table 3.9 was initially constructed by applying column-only allocations; and Table 3.10 was initially constructed by applying row-only estimations.

Table 3.9

Intermediate transaction flows (column-only estimation), in billion rupiahs

REGION	SUM	JAV	KAL	NUS	OTH	TOT
SUM	27,011	4,903	558	148	334	32,954
JAV	377	84,839	562	365	217	86,359
KAL	123	3,417	6,919	308	921	11,688
NUS	53	302	92	2,530	58	3,036
OTH	177	2,200	528	387	6,176	9,469
TOTAL	27,741	95,661	8,660	3,739	7,706	143,507

Source: Muchdie, 2011

Table 3.9 shows that the total intermediate transactions in 1990 equaled Rp.143, 507 billions. This was only about 39 per cent of the total national gross-output. As expected, intra-regional transactions dominated the flow patterns where total intra-regional transactions equaled Rp. 127,475 billions and accounted for 89 per cent of the Rp. 143,507 billion total intermediate transactions. The remaining percentage of the total intermediate transaction, 11 per cent, was the inter-regional flows.

Table 3.10 shows that intra-regional transactions in 1990 equalled Rp. 120,713 billions or 84 per cent of the total intermediate transactions. The remaining 16 per cent were the inter-regional flows. In the USA, an example of a developed economy of a mainland country, Hewings and Gazel (1993) reported that inter-regional transactions accounted for 13 per cent of the total intermediate transactions. It seems more appropriate, therefore, to accept the inter-regional table initially estimated by the column-only approach to represent the spatial structure of the island economy of Indonesia. It shows that 11 per cent of the total intermediate transactions are inter-regional flows whereas the other table's inter-regional flow proportion is higher (16 % of intermediate transaction) than the developed economy of a mainland country (i.e. the USA: 13% of intermediate transaction).

Table 3.10

Intermediate transaction flows (row-only estimation), in billion Rupiahs

REGION	SUM	JAV	KAL	NUS	OTH	TOTAL
SUM	24,919	7,496	355	120	64	32,954
JAV	1,795	81,348	1,100	803	1,315	86,359
KAL	351	3,860	6,511	159	807	11,688
NUS	118	398	88	2,423	8	3,036
OTH	558	2,560	605	234	5,512	9,469
TOTAL	27,741	95,661	8,660	3,739	7,706	143,507

Source: Muchdie, 2011

To inspect the structure of inter-regional trade flows more closely, Table 3.11 and Table 3.12 provide bi-region and inter-regional trade flows among the islands. As expected, Java, Sumatra and Kalimantan dominate the inter-regional transactions in Indonesia's economy. The trade flow between Java and the rest of Indonesia accounts for 77 per cent of the nation's inter-regional trade flows. The highest percentage trade flow occurred between Java and Sumatra (33 %), followed by Java and Kalimantan (25 %), Java and Other Islands (15 %), and Java and Nusa Tenggara (4 %).

Table 3.11

Bi-region transaction flows, Indonesia 1990

Two-region flows	Rp. billion	Percent	Two-region flows	Rp. billion	Percent
S-J, J-S	5,280	32.83	J-S,S-J	5,280	32.83
J-K,K-J	3,979	24.74	K-J,J-K	3,979	24.74
J-O,O-J	2,417	15.02	O-J,J-O	2,417	15.02
K-O,O-K	1,450	9.01	O-K,K-O	1,450	9.01
S-K,K-S	681	4.23	K-S,S-K	681	4.23
J-N,N-J	674	4.19	N-J,J-N	674	4.19
S-O,O-S	511	3.18	O-S,S-O	511	3.18
N-O,O-N	470	2.92	O-N,N-O	470	2.92
K-N.N-K	421	2.62	N-K,K-N	421	2.62
S-N,N-S	201	1.25	N-S,S-N	201	1.25
Total	16,085	100.00	Total	16,085	100.00

Source: Calculated from Table 3.9.

The trade flow between Sumatra and the rest of Indonesia accounted for more than 42 per cent of the total inter-regional trade whereas the trade flow between Sumatra and Java accounted for 33 per cent, and trade flows between Sumatra and Kalimantan, Nusa Tenggara and Other Islands was less than 10 per cent of total inter-regional transactions.

The trade flow between Kalimantan and the rest of Indonesia accounted for 40 per cent, with the general trade flow dominated by Java (25%). The rest of Kalimantan's trade was with Sumatra (4%), Nusa Tenggara (3%) and Other Islands (9%). The trade flow between the Other Islands and the rest of Indonesia accounted for 30 per cent of the total inter-regional trade while the trade flows with Java accounted for 15 per cent of the total, with Nusa Tenggara 3 per cent; Kalimantan 9 per cent; and Sumatra 3 per cent. Finally, the trade flow between Nusa Tenggara and the rest of Indonesia amounted 11 per cent of the total inter-regional trade: 4 per cent of the trade flow between Nusa Tenggara and Java; 3 per cent trade between Nusa Tenggara and Other Islands; 3 per cent trade between Nusa Tenggara and Kalimantan; and 1 per cent trade between Nusa Tenggara and Sumatra.

Table 3.12

Inter-region transactions between island and the rest of Indonesia

Inter-regional flows	Rp. billion	Percent	Dominant two-region trade flows
J-the rest of Indonesia	12,351	76.78	(J-S,S-J; J-K,K-J;J-O,O-J:J-N,N-J)
S-the rest of Indonesia	6,673	41.49	(S-J,J-S; S-K,K-S;S-O,O-S;S-N,N-S)
K-the rest of Indonesia	6,531	40.60	(K-J,J-K;K-O,O-K;K-S,S-K;K-N,N-K)
O-the rest of Indonesia	4,848	30.14	(O-J,J-O; O-K,K-O: O-N,N-O,;O-S,S-O)
N-the rest of Indonesia	1,767	10.99	(N-J,J-N :N-O,O-N;N-K,K-N :N-S,S-N;)

Source: Calculated from Table 3.9.

To answer the second question (Do the results, in the form of multipliers, represent reality within acceptable professional norm?), the stability of the multipliers could be examined by inspecting the indicative parameters of the total multipliers as well as by conducting sensitivity analysis to determine the cells and sectors that are critical to the accuracy of the model.

Table 3.13 provides the indicative parameters of total output, income and employment multipliers at a 95 per cent confidence interval. The highest standard error for the total output multipliers is for Java (0.221) while the lowest is for Kalimantan (0.123). For total income multipliers, the highest standard error is Java (0.040) and the lowest is for Sumatra (0.022). For the total employment multipliers, Nusa Tenggara has the highest standard error (0.056) while Kalimantan has the lowest (0.021). All observed values total multipliers for output, income and employment lie between the lower and upper bound of the 95 per cent confidence interval, indicating that the total multipliers of the model are stable.

Finally, to identify which coefficients are critical to the accuracy of the model, sensitivity analysis was performed. Using GRIMP Input-Output software, a shock of 10 per cent changes was applied to all direct coefficients. The changes of the total multipliers are ranked. For the inter-regional model with 5 regions and 9 sectors, the closed inverse of the Leontief matrix consisted of 2500 cells. The sensitivity analysis ranked 361 cells in total output, 362 cells in total income, and 334 cells in total employment. Those were the cells that experienced changes of more than 0.01 per cent in multipliers due to 10 per cent changes in direct coefficients. When this value was used as the criterion for critical cells generating multipliers, only 14.4, 14.4 and 13.4 per cent of the cells of direct coefficients are important for creating total output, income, and employment multipliers respectively. The rest of the cells are not important and can be ignored.

Table 3.13

Indicative parameters of total multipliers

Total output multipliers

Region	Observed Value	Expected Value	Standard Error	95% Confidence Interval	
				Lower	Upper
SUM	1.979	1.99	0.145	1.734	2.31
JAV	2.363	2.384	0.221	2.006	2.887
KAL	2.082	2.091	0.123	1.873	2.362
NUS	2.224	2.235	0.138	1.991	2.542
OTH	2.253	2.265	0.152	1.997	2.602

Total income multipliers

	Observed	Expected	Standard	95% Confidence Interval	
Region	Value	Value	Error	Lower	Upper
SUM	0.304	0.306	0.022	0.266	0.355
JAV	0.424	0.428	0.040	0.360	0.518
KAL	0.407	0.409	0.024	0.366	0.461
NUS	0.468	0.470	0.028	0.420	0.533
OTH	0.488	0.490	0.032	0.433	0.561

Total employment multipliers

	Observed	Expected	Standard	95% Confidence Interval	
Region	Value	Value	Error	Lower	Upper
SUM	0.351	0.353	0.026	0.307	0.410
JAV	0.467	0.471	0.044	0.396	0.571
KAL	0.337	0.339	0.021	0.301	0.386
NUS	0.978	0.981	0.056	0.880	1.104
OTH	0.551	0.553	0.037	0.488	0.634

The results of the tests were summarized in a matrix, called Boolean or Adjacency matrix. This is a matrix that contains unity and zero cells (Cochrane, 1990). A zero cell denotes an element of direct coefficients considered not critical in the sense that 10 per cent change in direct coefficients generates less than 0.01 per cent changes in multipliers. A cell with a value of 1 denotes a critical cell.

Rather than specifying coefficients as critical, it would be equally useful to determine which sectors are critical for accuracy of the table. This information is very important for designing surveys for updating table where data for all inputs are gathered, not just a few types of inputs.

The sums of rows plus the sums of columns of the Boolean matrix are calculated to indicate which sectors contain the greatest number of critical cells. If a sector comprises 15 or more critical cells it is considered a critical sector. Table 3.14 presents the most critical sectors for creating output, income and employment multipliers.

Table 3.14 highlights three significant results. First, the number of sectors that are crucial in generating multipliers varies: 20 sectors for output multipliers; 22 sectors for income multipliers; and 18 sectors for employment multipliers. Second, except in Other Islands, the household sectors are consistently critical. This confirms the suggestion that household sectors might be the most important feature of at region's economy. Third, the manufacturing sectors in all regions are the next significant critical sectors for generating output, income and employment multipliers. Transport and communication sectors are crucial for Sumatra, Java and Kalimantan. Trade sectors in Sumatra, Java, Nusa Tenggara and Other Islands are also critical for generating output, income and employment multipliers. Financial sectors are critical only in Sumatra and Java. Except in Kalimantan, no agricultural sectors are identified as critical sectors.

Table 3.14

The most critical sectors in generating multipliers

Rank	Output	Income	Employment
1	HH-SUM	HH-SUM	HH-SUM
2	JAV-3	JAV-3	JAV-3
3	HH-NUS	HH-NUS	HH-NUS
4	KAL-3	SUM-3	HH-KAL
5	SUM-3	JAV-7	KAL-3
6	JAV-7	NUS-3	NUS-3
7	HH-KAL	HH-JAV	SUM-3
8	NUS-3	KAL-3	OTH-3
9	HH-JAV	HH-KAL	HH-JAV
10	OTH-3	SUM-6	JAV-1
11	SUM-6	OTH-3	NUS-6

Rank	Output	Income	Employment
12	KAL-7	JAV-6	SUM-6
13	JAV-6	KAL-7	JAV-6
14	NUS-6	OTH-6	JAV-7
15	SUM-7	SUM-7	KAL-1
16	SUM-8	SUM-8	KAL-7
17	OTH-6	JAV-8	NUS-7
18	KAL-1	KAL-1	OTH-6
19	JAV-8	NUS-6	
20	OTH-8	OTH-8	
21		SUM-9	
22		OTH-7	

Source: Muchdie, 2011.

To summarizes,while it is not easy to test the validity of inter-regional input-output model produced by GIRIOT, an attempt has been performed to evaluate the validity of the model by answering the two fundamental question suggested by Jensen (1987). These questions were answered by examining the proportion on inter-regional imports, the pattern of inter-regional flows and the stability of multipliers.

Inspecting the structure of contructed inter-regional input-output tables in the most aggregate form (5 region-1 sector), it can be expected for an island economy that the proportion of inter-regional import would be small because of difficulties associated with inter-regional trade. Applying the feed-back loop analysis introduced by Sonis and Hewings (1991), Sonis, Oosterhaven and Hewings (1993), Sonis, Hewing and Gazel (1995) it was showed that inter-regional flows in the Indonesian economy was only 11 per cent. This was smaller that that of mainland economy of the USA reported by Hewing and Gazel (1993) but higher than that of small island economies in the South Pacific reported by Fairbairn (1985). Inspecting bi-regional transaction flows, the contructed model, as expected, showed that Java dominated the inter-island transactions in the Indonesia's economy in which the trade flow between Java and the rest of Indonesia accounted for 77 per cent of the nation's inter-regional trade flows.

The stability of the multipliers resulted by the model was tested by inspecting the indicative parameters of the total multipliers. It was showed that all observed values of the total multipliers lie between the lower and upper bound of the 95 per cent confidence interval, indicating that the total multipliers of the model are stable. To identify which sectors are critical to the accuracy of the model, sensitivity analysis was also performed.

In conclusion, although it is difficult to validate constructed inter-regional input-output model for Indonesia, it can be justified that the GIRIOT procedure would produce inter-regional input-output tables that reflect the spatial characteristics of the Indonesian economy and the result, in the form of multipliers, represent reeality within acceptable profesional norms.

5. Closing Remark

Although hybrid procedures have been widely accepted in the practice of constructing regional and inter-regional input output tables, there are still some general considerations that should be kept in mind when formulating these tables. As in many modeling techniques, one of the most important considerations when applying the GIRIOT procedure is the question of table accuracy. The problem of accuracy is related to several interrelated factors, such as the purpose of the table construction, the primary use of the model, level of disaggregation of available data, and the availability of necessary and desirable quantities and types of primary data.

The purpose of the table construction and the primary use of the model can be crucial to the construction process and methodology (West, 1990). For instance, if the purpose of the model construction is for an impact study of a certain industry, the process can be directed into the sector of economy under study, with less emphasis on other sectors.

Drake (1976) and Conway (1977) show that the critical cells of a particular industry are located in industries with strong inter-sectoral linkages to it. Therefore, the sector under study should be isolated and detailed as much as possible. Ready-made models might be better for this kind of impact study. However, if the model is constructed for general purposes decisions regarding the level of disaggregation and data sources become more critical. In this case it might be necessary to move closer the full survey so that partitively accurate tables can be constructed. Alternatively, if the model is designed for general purpose impact studies, more scope for compromise is available. In the latter case, the activity under study can be isolated from the remainder of the table and additional detailed survey data for that activity can be collected and inserted as part of the impact analysis. This latter procedure produces a table with holistic accuracy.

The early GRIT hybrid studies (Jensen, Mandeville & Karunaratne, 1979) aimed to produce regional input-output tables that were accurate in all substantial respects, but not for cells by cells accuracy. This was described as whole table accuracy in terms of "freedom from significant error". Further, Jensen (1980b) defined holistic accuracy as "a mathematical portrait" of an economy with which the table represents the main features of the economy in a descriptive sense. At the same time, the table preserves the importance of these features in an analytical sense. Jensen's holistic approach is based on two facts. First, the critical cells in the table, with respect to analytical accuracy, are the larger and more interconnected cells. These cells must exhibit a high degree of accuracy. Second, the smaller and less interrelated cells have little analytical significance; therefore, it is relatively unproductive in an empirical sense to devote time to the less significant elements. The concept of holistic accuracy in an operational sense was explicitly incorporated in the later GRIT studies (West, Wilkinson & Jensen, 1979; Jensen, 1980b) by the identification of those cells in the table that were more significant in multipliers formation and by ensuring the accuracy of these cells.

The inter-regional input-output table constructed for studying the spatial structure of the Indonesian economy was a massive empirical exercise. Cell entries were required for five 28-sectors regional tables (3,920 cells), 20 trade matrices (15,680 cells), the sum of 19,600 intermediate cells and 1,960 cells for primary input and final demand sectors. This made a total of 21,560 cells that required attention.

With severe limitations on data and with resources constraints, it was not possible to ensure the achievement of partitive accuracy. Inspection of the finished table shows a large number of zero entries, so that cells by cells exactness are not necessary for the achievement of a holistic accuracy table.

As well, the GIRIOT procedure employed for constructing the inter-regional input-output table for the island economy of Indonesia could not guarantee that the resulting table was partitively accurate. However, the table as a whole is believed to be an acceptable representation of the regional and inter-regional structure of the island economy of Indonesia. Its accuracy can be improved whenever more superior data are available.

Although the standard of accuracy reached was very satisfactory, detailed attention should be given to data collection and processing since data collection and data processing have very important roles in determining the accuracy of the table. The data problem is one of the most restrictive constraints on the quality of economic models. For the inter-regional input-output model, the problem of quality and quantity data is the main reason for a noticeable dearth of the models.

The approach to solving the problem will be determined by the general approach to table compilation. In a hybrid approach, where non-survey data are combined with more-reliable data, the data problem becomes less serious because a great deal of crucial data required for the completion of acceptable quality input-output tables is available more readily and cheaply than suggested in the literature on input-output compilation. At a minimum level, data are required to provide a series of controls since the framework for the inter-regional table is provided by the control totals, representing the total gross outputs of the row and column. Once these data are available, the task of allocating these totals across sectors in the intra and inter-regional matrices can be undertaken easily.

These data should include regional and sectoral estimates of employment, gross output, net output (net of primary inputs), wages and salaries and other items of value added, household consumption, other final demand, and inter-regional trade patterns. For Indonesia, data on regional foreign exports and imports are also available in more disaggregate forms. Almost all of these data can be obtained from the Indonesian Central Bureau of Statistics (CBS), the National Development Planning Agency (NDPA), other government reports, and indirect estimation methods. Some of the data are readily available in publications; some are in unpublished forms for restricted readers.

Although a great deal of data directly relevant to the GIRIOT procedure exist in various sources and are readily available, the magnitude of the task of preparing a set of data for the construction of the inter-regional input-output table for Indonesia cannot be underestimated. Several technical problems relating to data processing could still be encountered. Different types of data and sources have different classifications. For instance, data on regional foreign exports and imports as well as data on inter-regional trade patterns are classified differently to those with input-output classification. Fortunately, these data are classified in highly disaggregated so that, although it takes times, they can be transformed into input-output classification easily.

Problems of attempting to estimate unrecorded data occurred as anticipated. When it was not possible to obtain estimates from official sources, judgments were made based on previous studies of related or similar situation. For example, when data on inter-regional transport pattern of service sectors as estimates of inter-regional trade pattern was not available then data on population distribution was employed to estimate the inter-regional trade flows for these sectors.

In the process of constructing the model, survey and non-survey estimates were integrated into the table. This integration created problems for reconciling the table. In many stages of the table construction, the more reliable or superior data were inserted. The reconciliation procedures applied for a full survey model were employed and the balancing procedures were monitored carefully to avoid introducing distortions.

Data problems could still be encountered when applying the empirical GIRIOT procedure, but the prospects of this procedure are promising. This procedure cannot only produce an inter-regional table of many regions but it will also generate accompanying single-region tables. As the usefulness of an inter-regional model for an island economy like Indonesia is more recognized, the importance of the inter-regional input-output model the basis of a more powerful hungry-data inter-regional model such as the inter-regional SAM (Social Accounting Matrix) and inter-regional CGE (Computable General Equilibrium) models must also be realized. More inter-regional data are now being collected. More computing facilities are now available at more affordable prices. Since government institutions have now more political will to produce acceptably accurate inter-regional models, more resources could be expected to be made available.

The NDPA employed very mechanistic procedures with little or no region-specific data to construct a multi-region input-output table. The resulting table would not be acceptable to most professional input-output analysts. The CBS, in its function as data provider, is now planning to conduct a full survey for constructing an inter-island input-output table. Their plans will involve the expenditure of significant national resources. This GIRIOT procedure provides more scope for compromise.

References

Biro Pusat Statistik, 1991a, **Statistik Perdagangan Luar Negeri Indonesia, Import 1990** (*Indonesia Foreign Statistics, Import 1990*), Jilid 1 (*Volume 1*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1991b, **Statistik Perdagangan Luar Negeri Indonesia, Ekspor 1990** (*Indonesia Foreign Statistics, Export 1990*), Jilid 2 (*Volume 2*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1991c, **Survey Tahunan Perusahaan Industri Besar dan Sedang 1990** (*Industrial Statistics, Survey of Manufacturing Industries, Large and Medium Scale 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1991d, **Statistik Industri Kecil 1990** (*Small Scale Manufacturing Industry Statistics 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1991e, **Statistik Industri Kerajian/Rumah Tangga 1990** (*Household/ Cottage Industry Statistics 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1992a, **Statistik Bongkar Muat Barang di Pelabuhan Indonesia 1990** (*Cargo Loading and Unloading at Ports of Indonesia 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1992b, **Survey Sosial Ekonomi Nasional, Buku 3: Pengeluaran Untuk Konsumsi Penduduk Indonesia per Propinsi 1990** (*National Survey for Socio-Economy, Book 3: Expenditure for Consumption of Indonesia by Province 1990*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1992c, **Statistik Air Minum** (*Water Supply Statistics*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1993, **Struktur Ongkos Usaha Tani Padi and Palawija 1990** (*Cost Structure of Farms Paddy and Palawija* 1990), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1994a, **Tabel Input-Output Indonesia 1990** (*Indonesian Input-Output Table 1990*), Jilid 1 dan Jilid 2 (*Volume 1* and *Volume 2*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1994b, **Produk Domestik Regional Bruto Propinsi Propinsi**

di Indonesia Menurut Lapangan Usaha 1987-1991 (*Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin 1987-1991*), Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, 1994c, **Produk Domestik Regional Bruto Propinsi Propinsi di Indonesia Menurut Penggunaan 1987-1991 (*Gross Regional Domestic Product of Provinces in Indonesia by Expenditure 1987-1991*)**, Biro Pusat Statistik (*Central Bureau of Statistics*), Jakarta.

Biro Pusat Statistik, Badan Perencanaan Pembangunan Nasional and Japan International Cooperation Agency, 1995, **Tabel Input Output Intra-Regional Indonesia Menurut 5 Pulau/Kepulauan *1990*** (*Indonesia's Intra Regional Input Output Table by Islands 1990*), Kerjasama Biro Pusat Statistik, Badan Perencanaan Pembangunan Nasional dan Japan International Cooperation Agency (*Joint Project : Central Bureau of Statistics, National Development Planning Agency and the Japan International Cooperation Agency*), Jakarta.

Blair, J.,P., 1991, **Urban and Regional Economics**, Irwin Publisher, Homewood, Illinios.

Boomsma, P., and Oosterhaven, J., 1992, "A Double Entry Method for the Construction of Bi-regional Input-Output Tables", **Journal of Regional Science**, 32 (3) : 269-284.

Cochrane, S.G., 1990, "Input-Output Linkages in a Frontier Region of Indonesia", **International Regional Science Review**, 13(1-2):183-203.

Conway, R.S., 1977, "The Stability of Regional Input-Output Multipliers", **Environment and Planning A**, 9:197-214.

Departemen Perhubungan and Biro Pusat Statistik**, 1992**, **Statistik Angkutan Laut 1990** (*Sea Transport Statistics 1990*), Departemen Perhubungan dan Biro Pusat Statistik (*Department of Transport and Central Bureau of Statistics*), Jakarta.

Dewhurst, J. H. LI, 1994, "Regional Policy Implications from Interregional Input-Output Tables: A Comparison of Two UK Interregional Tables", **International Review of Applied Economics,** 8(1): 1-18.

Drake, R.L., 1976, "A Short-Cut to Estimates of Regional Input-Output Multipliers: Methodology and Evaluation", **International Regional Science Review**, 1 (2): 18-29.

Fairbairn, T.I.J., 1985, **Island Economies: Studies from the South Pacific**, Institute of Pacific Studies of the University of the South Pacific in association with Asia Pacific Research Unit, Wellington, New Zealand.

Hewings, G.J.D, and Gazel, R., 1993, **Regional and Inter-regional Impacts of the US-Canada Free Trade Agreement**, Discussion Paper 93-P1, Regional Economics Applications Laboratory, University of Illinois, Urbana.

Hulu, E, and Hewings, G.J.D., 1993, "The Development and Use of Inter-regional Input-Output Model for Indonesia under Condition of Limited Information", **Review of Urban and Regional Development Studies**, 5:135-153.

Hulu, E.,Hewing, G.J.D. and Azis, I, J., 1992, "Spatial Implications of the Export Promotion Strategy in Indonesia" in T.J. Kim, G. Knaap, and I.J. Azis, (Ed.), **Spatial Development in Indonesia: Review and Prospects**, pp: 45-69, Avebury-Aldershot, England.

Isard, W., 1951, Inter-regional and Regional Input-Output Analysis: A Model of a Space-Economy, **Review of Economics and Statistics**, 33, 4: 318-328.

Jensen, R.C., 1987, "On the Concept of Ready-Made Regional Input-Output Model", Review **of Regional Studies**, 17(2): 20-24.

Jensen, R.C., Mandeville, T.D., and Karunaratne, N.D., 1979, **Regional Economic Planning: Generation of Regional Input-Output Analysis**, Croom Helm, London.

Lahr, M.L, 1992, **An Investigation into Methods for Producing Hybrid Regional Input-Output Tables,** University Microfilms International, Ann Arbor, Michigan.

Lahr, M.L, 1993, "A Review of the Literature Supporting the Hybrid Approach to Constructing Regional Input-Output Models", **Economic Systems Research,** 5(3): 277-293.

Miller, R.E, and Blair, P.D., 1985, **Input-Output Analysis: Foundation and Extensions**, Englewood Cliffs, Prentice-Hall, New Jersey.

Ngo, T.W., Jazayeri, A., and Richardson, H.W., 1986, Regional Policy Simulations with an Interregional Input-Output Model of the Philippines, **Regional Studies**, 21: 121 - 130.

Oosterhaven, J., 1981, **Interregional Input-Output Analysis and Dutch Regional Policy Problems,** Gower Publishing Company, England.

Park, S.H., Mohtadi, M., and Kurubusi, A., 1981, "Errors in Regional Non-

Survey Input-Output Models: Analytical and Simulation Results", **Journal of Regional Science,** 21: 321-339

Polenske, K.R, 1969, **A Multi-Regional Input-Output Model - Concept and Results**, Harvard Research Economic Project, Harvard.

Polenske, K.R, 1995, "Leontief's Spatial Economic Analysis", **Structural Change and Economic Dynamics**, 6: 309-318.

Richardson, H.W, 1972, **Input-Output and Regional Economics**, John Wiley & Sons, New York.

Richardson, H.W., 1969, **Elements of Regional Economics**, Penguin, Harmondsworth.

Riefler, R.F., and Tiebout, C.M., 1970, "Interregional Input-Output: An Empirical California-Washington Model" **Journal of Regional Science**, 10:135-152.

Round, J.I., 1978, "An Interregional Input-Output Approach to the Evaluation of Non-Survey Methods", **Journal of Regional Science,** 18: 179-194.

Round, J.I, 1983, "Non-Survey Techniques: A Critical Review of the Theory and the Evidence", **International Regional Science Review**, 8(3): 189-212.

Sonis, M., and Hewings, G.J.D., 1991, "The Matrioshka Principle in the Hierarchical Decomposition of Multi-regional Social Accounting System" **in** L. Anselin and M.Madden (Editors), **New Directions in Regional Analysis: Multi-regional Approaches**, Pinter, London.

Sonis, M.,, Oosterhaven, J., and Hewings, G.J.D., 1993, "Spatial Economics Structure and Structural Changes in the EC: Feedback Loop Input-Output Analysis", **Economic System Research**, 5 (2): 173-184.

Sonis, M.,Hewings and Gazel, R., 1995, "The Structure of Multi-regional Trade Flows: Hierarchy, Feedbacks and Spatial Linkages", **The Annals of Regional Science**, 29:409-430.

Stevens, B.H., and Trainer, G.A., 1980, "Error Generation in Regional Input-Output Analysis and Its Implications for Non-Survey Models", in S. Pleeter (Editors), **Economic Impact Analysis: Methodology and Applications**, Studies in Applied Regional Science No.19, Martinus Nijhof Publishing, Boston.

West, G.R., 1990, "Regional Trade Estimation: A Hybrid Approach", **International Regional Science Review**, 13 (1&2): 103-118.

West, G.R., 1993, "GRIMP: Input-output analysis for practitioners: User's guides", Department of Economics, University of Queensland, St. Lucia.

West, G.R., Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., 1989, **Regional and Inter-regional Input-Output Tables for Queensland 1985/86**, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia.

West, G.R, Morison, J.B. and Jensen, R.C., 1982, **An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

West, G.R., Morison, J.B. and Jensen, R.C., 1983, "A Method for the Estimation of Hybrid Inter-regional Input-Output Tables, **Regional Studies,** 18(5):413-422

West, G.R., Wilkinson, J.T., and Jensen, R.C., 1979, **Generation of Regional Input-Output Tables for the State and Regions of South Australia**, Report to the Treasury Department, the Department of Urban and Regional Affairs, and the Department of Trade and Industry, South Australia, Department of Economics, University of Queensland, St. Lucia.

Williamson, J.G., 1965,"Regional Inequality and the Process of National Development: A Description of the Patterns", **Economic Development and Cultural Change**, 13: 3- 84.

Chapter-4

Struktur Spasial Perekonomian Indonesia[1]

Ringkasan

Bab ini membahas struktur spasial dalam perekonomian Indonesia menggunakan model input-output antar-pulau. Model tersebut dibangun menerapkan prosedur hibrida yang dirancang khusus untuk perekonomian kepulauan. Struktur spasial dianalisis dengan menyajikan pengganda spasial dan dampak luberan serta indeks tumpahan dan efek balik spasial. Menarik disimak dari hasil analisis bahwa peningkatan kegiatan ekonomi di pulau Jawa mempunyai efek balik spasial ke pulau Jawa yang lebih besar dibanding efek tumpahannya ke luar pulau Jawa. Sementara itu, peningkatan kegiatan ekonomi diluar pulau Jawa mempunyai efek tumpahan yang lebih besar ke pulau Jawa dibanding efek baliknya ke luar pulau Jawa.

Summary

This chapter discusses the spatial structure of the Indonesian economy using an inter-island input-output model. The model is constructed applying a new hybrid procedure designed specifically for an island economy. The spatial structure is analyzed by presenting spatial multipliers and flow-on effects as well as the index of spill-over and feed-back effects. It is interesting to learn that increasing economic activities in the island of Jawa has higher feed-back effect to Island of Java compare to the index of spill-over to other island out-side the island of Java. On the other hand, increasing economic activities out-side island of Java has higher index of spill-over to Java island compare to the effect of feed-back to out-side of the island of Java.

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1. Pendahuluan

Kesadaran rnasyarakat akan makna pembangunan membutuhkan model-model ekonomi yang lebih rinci dan detil; suatu model yang bukan hanya dapat menggambarkan jenis, lokasi dan pelaku kegiatan ekonomi tetapi juga mampu memberikan analisis tentang dampak langsung, tidak langsung, dan yang terimbas (*induced effects*) dari kegiatan-kegiatan pembangunan yang direncanakan. Model-model ekonomi agregat tidak lagi memadai karena tidak dapat menggambarkan aspek ruang suatu perekonomian, baik dalam pelaksanaan kegiatan maupun dalam pemanfaatan hasil pembangunan.

Bagi Indonesia, suatu negara yang sangat "bhineka", yang terdiri atas ribuan pulau baik besar maupun kecil dengan beragam suku bangsa dan adat istiadat serta tingkat teknologi dan perkembangan ekonomi yang berbeda antardaerah-antarpulau, adalah sangat riskan untuk mengabaikan aspek ruang; aspek daerah dan wilayah. Perkembangan sosial politik akhir-akhir ini membuktikan bahwa ancaman disintegrasi bangsa akan semakin kuat manakala aspek pemerataan antardaerah kurang mendapat perhatian. Bagi Indonesia, ketidakmerataan antardaerah mempunyai implikasi yang sangat penting, yang dipandang dari sudut kepentingan nasional, hal ini sangat sensitif sehingga dengan cara apapun harus dihindari (Toyomane, 1988).

Dengan memanfaatkan model input-output antardaerah yang disusun dengan. prosedur hibrida (Muchdie, 1998a; 1998b), Bab ini bertujuan untuk membahas aspek ruang dalam perekonomian Indonesia. Pembahasan difokuskan pada pengganda spasial, dampak bersih spasial serta dampak tumpahan dan dampak balik antardaerah. Untuk itu, pertama-tama akan dijelaskan konsep model input-output antar daerah dan prosedur penyusunannya.

2. Metodologi

a. Model Input-Output Antar Daerah

Secara sederhana model IO menyajikan informasi tentang transaksi barang dan jasa serta saling keterkaitan antar-satuan kegiatan ekonomi untuk suatu waktu tertentu yang disajikan dalam bentuk tabel. Isian sepanjang baris menunjukkan alokasi output dan isian menurut kolom menunjukkan pemakaian input dalam proses produksi (Biro Pusat Statistik, 1995). Sebagai model kuantitatif,table IO mampu memberi gambaran menyeluruh tentang: (I) struktur perekonomian yang mencakup struktur output dan nilai tambah masing-masing kegiatanekonomi di suatu daerah, (2) struktur input-antara (intermediate-input), yaitu penggunaan barang dan jasa oleh kegiatan produksi di suatu daerah, (3) struktur penyediaan barang dan jasa baik yang berupa produksi dalam negeri maupun barang-barang yang berasaI dari impor, dan (4)struktur permintaan barang dan jasa, baik permintaan oleh kegiatan produksi maupun permintaan akhir untuk konsumsi, investasi dan ekspor.

Sejauh ini terdapat empat tipe model IO yang berdimensi ruang, yaitu: (I) model input-output daerah-tunggal (*single-region model*), (2) model input output intra-nasional (*intra-nationalmodel*), (3) model input-output antardaerah (*inter-regional model*) dan (4) model input-output banyak daerah (*multi-region model*).

Namun demikian, hanya dua model yang terakhir yang dapat menggambarkan aspek ruang suatu perekonomian (Polenske, 1995).

Model input-output antar daerah (IOAD), yang juga dikenal dengan model ”ideal-murni”nya Isard, dianggap sebagai model yang paling komprehensif dan sistematis karena model ini merupakan pengembangan konsep input-output yang mengintegrasikan unsur ruang secara”simple” dan “elegant” (West et.al.,1(89).Modell OAD membagi ekonomi nasional berdasarkan sektor dan daerah kegiatan (Hulu, 1990), sedang struktur dasar model lOAD secara rinci telah dibahas dalam Muchdie (l998a, 1999).

Walaupun model lOAD adalah model yang paling ideal, model ini mempunyai dua masalah yang serius (Toyomane, 1988). Pertama, berkaitan dengan ketatnya asumsi yang menyatakan bahwa suatu komoditi yang diproduksi suatu daerah, secara teknis berbeda dengan komoditi sama yang dihasilkan oleh daerah lainnya. Misalnya, batako yang diproduksi di Jawa berbeda dengan batako yang diproduksi di Sulawesi, sehingga tidak ada substitusi di antara keduanya. Asumsi ini terlalu kaku dan tidak realistik sebab bagi konsumen, batako tetap saja batako dimanapun barang itu diproduksi, Kedua, berkaitan dengan penerapan model lOAD. Untuk memperoleh estimasi nilai koefisien teknis ${}^{AB}t_{ij}$ diperlukan data arus perdagangan menurut daerah asal dan daerah tujuan serta menurut sektor produksi dan sektor konsumsi. Data seperti ini biasanya tidak tersedia, bahkan di negara yang statistiknya sudah maju sekalipun. dan untuk dapat memperolehnya diperlukan survai yang akan membutuhkan biaya, tenaga dan waktu yang banyak. Hal-hal inilah yang menyebabkan sangat sedikit negara yang sudah menyusun tabel lOAD.

Untuk mengatasi masalah-masalah yang terdapat pada model lOAD, berbagai model input-output banyak daerah (IOBD) sudah dikembangkan. Pada model ini diasumsikan bahwa barang yang sama tidak lagi perlu dibedakan dari darerah asalnya. Dalam penerapannya, ada yang menggunakan perkiraan titik (Chenery, 1956; Moses, 1955), ada pula yang menggunakan teori gravitasi (Leontief & Strout, 1963) dan ada yang menggunakan perumusan pemograman linear (Moses, 1960).

b. Prosedur Penyusunan Model

Sejauh inidikenal tiga metode dalam penyusunan model IO, yaitu metode survai. metode non-survei dan teknik-teknik “siap-saji” serta metode hibrida. Metode survei, walaupun diakui akan menghasilkan model yang paling teliti, dianggap bukan lagi cara yang tepat karena dalam prosesnya mernbutuhkan sumberdaya (tenaga, dana) yang besar dan waktu yang lama (Richardson, 1985; West & Jensen, 1988). Menurut Richardson (1985), sebuah tabel yang disusun melalui metode survei membutuhkan dana 10 kali lebih besar dan membutuhkan waktu antara 8 sampai 10 kali lebih lama dibanding metode non-survei, hal ini membuat tabel itu menjadi kadaluarsa ketika dipublikasikan (West & Jensen,1988). Metoda non-survei memang dapat menghemat waktu, tenaga dan biaya (Bruckers, Hasting & Latham,1987; 1990), namun para pakar telah sepakat bahwa metode non-survei dan teknik-teknik “siap-saji” hanya akan menghasilkan table lO yang diragukan ketelitiannya (Jensen, 1980; 1990). Dewhurst (1991) menyatakan bahwa tabel yang disusun melalui survai jelasterlalu mahal dan metode non-survei sarna sekali tidak teliti. Ini mendorong upaya pengembangan metode hibrida (*hybrid method*)yang menggabungkan keunggulan dari keduanya; rnengoptimalkan ketelitian dengan kendala dana, waktu dan tenaga.

Tabel input-output antardaerah yang digunakan dalam studi ini disusun dengan menggunakan prosedur hibrida yang secara khusus dikembangkan untuk ekonomi kepulauan (Muchdie,1998a; 1999), yang disebut Sebagai prosedur GIRIOT(Generation of lnter-Regional Input-OutputTables). Prosedur ini terdiri atas 3 tingkat, yang dirinci menjadi 7 tahap dan 23 langkah, Tingkat I (Perkiraan koefisien teknologi daerah) terdiri atas dua tahap, yaitu tahap 1 (Penurunan koefisien Teknologi nasional) dan tahap 2(Penurunan koefisien Teknologi daerah). Tingkat II (Perkiraan koefisien input daerah) terdiri dari 2 tahap, yaitu tahap 3 (Perkiraan koefisien input intra-daerah) dan tahap 4 (Perkiraan input antar-daerah). Tingkat yang terakhir terdiri atas 3 tahap, yaitutahap 5 (Penyusunan tabel transaksi awal), tahap 6 (Agregasi sektor atau daerah) dan tahap 7 (Penyusunan tabel transaksi akhir).

c. Pengukuran Struktur Ruang

Dengan model input-output antar daerah yang telah di susun, analisis struktur ruang, struktur daerah dalam perekonomian Indonesia akan dibahas. Dalam pembahasan tersebut, akan menggunakan analisis: (1) dampak pengganda total (*total multiplier effects*), baik sektoraI maupun spasial, (2) dampak bersih sektoral dan spasial, dan (3) dampak tumpahan (spill-overeffects), dan (4) dampak balik (*feed-back effects*).

Pada dasarnya, angka pengganda merupakan ukuran kepekaan suatu perekonomian terhadap rangsangan perubahan yang dinyatakan dalam hubungan sebab-akibat. Pengganda pada model I0 biasanya diasumsikan sebagai respon terhadap meningkatnya permintaan akhir suatu sektor tertentu. Konsep pengganda sering digunakan secara rancu sehingga menghasilkan interpretasi yang keliru. Adanya sejumlah ketidakkonsistenan (*inconsistencies*) dalam pendefinisian komponen-komponen pengganda input-output konvensional, West dan Jensen (1988) dan West et al (1989) membedakan kategori pengganda menjadi: dampak awal (*initial impact*), dampak imbasan kegiatan produksi (*production-induced impact*), 2) dan dampak imbasan konsumsi (*consumption-induced effect*). Selain itu,juga ada kategori lain yang disebut dampak luberan (*flow-on impact*), yang merupakan dampak bersih.

Tabel 4.1 menyajikan ringkasan rumusan perhitungan angka pengganda yang dirinci berdasarkan tipe dampak: awal, langsung, tidak langsung dan imbasan konsumsi. Selain itu, angka pengganda juga dapat dihitung untuk parameter-parameter ekonomi lainnya seperti output, pendapatan dan kesempatan kerja, nilai tambah, pajak tidak langsung, surplus usaha, impordan sebagainya.

Tabel 4.1

Rumusan Perhitungan Angka Pengganda berdasarkan Tipe Dampak

Dampak	Output	Pendapatan	Tenaga kerja
Awal	1	h_j	e_j
Pengaruh langsung	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Pengaruh tidak langsung	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Imbasan konsumsi	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Bersih	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Di Pasquale dan Polenske (1980) merinci lebih jauh menjadi empat tipe pengganda, dua diantaranya relevan dengan kajian model antardaerah, yaitu penganda khusus sektoral (*sector-specific multipliers*) dan pengganda khusus spasial (*spatial-specific multipliers*). Pengganda khusus sektoral menyatakan jumlah input yang dibutuhkan dari perekonomian secara keseluruhan (tanpa memandang ruang) untuk memenuhi bertambahnya satu unit permintaan akhir sektor yang dimaksud. Pengganda khusus spasial menyatakan jumlah input yang dibutuhkan dari semua sektor pada suatu daerah karena meningkatnya satu unit permintaan akhir daerah yang bersangkutan. Tabel 4.2 menyajikan rumusan perhitungan kedua jenis pengganda tersebut untuk output, pendapatan dan kesempatan kerja.

Tabel 4.2

Rumusan Perhitungan Pengganda Sektoral dan Pengganda Spasial

	Output	Income	Employment
Pengganda sektoral	$\sum^{rs} b^*_{ij}$; $r = 1,..m$	$\sum^{rs} b^*_{ij}\, {}^{s}h_{i}$; $r = 1,..m$	$\sum^{rs} b^*_{ij}\, {}^{s}e_{i;}$ $r = 1,..m$
Pengganda spasial	$\sum^{rs} b^*_{ij;}$ $i = 1,..n$	$\sum^{rs} b^*_{ij}\, {}^{s}h_{i;}$ $i = 1,..n$	$\sum^{rs} b^*_{ij}\, {}^{s}e_{i;}$ $i = 1,..n$

Pengukuran dampak balik antardaerah dan dampak tumpahan telah dikembangkan oleh Miller (1966; 1969; 1986), Guccione et al, (1988), Millerdan Blair(1985),Blair dan Miller (1990) dan Cochrane (1989). Millerdan Blair(1985) telah mendefinisikan IDBAD (indeks dampak balik antardaerah atau *interregional feed-back index*) dan lDBTAD (indeks dampak balik dan tumpahan antardaerah atau *inter-regional feed back* and *spill-over index*) untuk mengukur saling ketergantungan antardaerah. Berdasarkan kedua indeks tersebut dapat dianalisis pentingnya keterkaitan antardaerah di antara kepulauan Indonesia.

Dampak balik pengganda total dapat dengan mudah diperlihatkan sebagai selisih antara pengganda total pada model daerah-tunggal dan pengganda total pada model antardaerah, yaitu pengganda total yang terjadi di daerah yang bersangkutan pada model antardaerah. Dampak tumpahan adalah pengganda total yang terjadi di daerah lain karena terjadinya peningkatan permintaan akhir pada daerah yang sedang dipelajari. lni diukur dari perbedaan antara pengganda total dan pengganda yang terjadi hanya pada daerah yang dipelajari. Persentase kesalahan secara keseluruhan karena mengabaikan keterkaitan antardaerah diukur menggunakan kedua indeks tersebut, yang rumusannya untuk output, pendapatan dan kesempatan kerja disajikan pada Tabel 4.3. Tabel 4.4 menyajikan rumusan perhitungan IDBADdan IDBTADyangterjadipada dampak bersih.

Tabel 4.3

Rumusan Perhitungan IDBAD dan IDBTAD pada Pengganda Total

	Output	Income	Employment
Tabel AntarDaerah o Pengganda total o Pengganda intra-daerah o Pengganda antar-daerah	$TOM = \sum^{rr} b^*_{ij} + \sum^{sr} b^*_{ij}$ $AOM = \sum^{rr} b^*_{ij}$; $i = 1,2,..n$ $EOM = \sum_{s=1} {}^{sr}b^*_{ij}$; $i = 1,2,..n$	$TNM = \sum^{rr} b^*_{ij} {}^{r}h_i + \sum^{sr} b^*_{ij} {}^{r}h_i$ $ANM = \sum^{rr} b^*_{ij} {}^{r}h_i$; $i = 1,2,..n$ $ENM = \sum_{s=1} {}^{sr}b^*_{ij} {}^{r}h_i$; $i = 1,2,..n$	$TEM = \sum^{rr} b^*_{ij} {}^{r}e_i + \sum^{sr} b^*_{ij} {}^{r}e_i$ $AEM = \sum^{rr} b^*_{ij} {}^{r}e_i$; $i = 1,2,..n$ $EEM = \sum_{s=1} {}^{sr}b^*_{ij} {}^{r}e_i$; $i = 1,2,..n$
Table DaerahTunggal o Pengganda total	$SOM = \sum^{rr} b^*_{ij}$	$SNM = \sum^{rr} b^*_{ij} {}^{r}h_i$	$SEM = \sum^{rr} b^*_{ij} {}^{r}e_i$
Dampak balik	FBOM = AOM – SOM	FBNM = ANM – SNM	FBEM = AEM – SEM
Dampak tumpahan	SOOM = TOM - AOM	SONM = TNM – ANM	SOME = TEM – AEM
Dampak umpan balik	FSOM = TOM - SOM	FSNM = TNM - SNM	FSEM = TEM - SEM
IDBAD	(FBOM/AOM)100	(FBNM/ANM)100	(FBEM/AEM)100
IDBTAD	(FSOM/TOM)100	(FSNM/TNM)100	(FSEM/TEM)100

Tabel 4.4

Rumusan Perhitungan IDBAD dan IDBTAD pada Dampak Bersih

	Output	Income	Employment
Tabel AntarDaerah o Dampak Bersih Total o Dampak Bersih Intra-Daerah o Dampak Bersih Antar-Daerah	$TOF = (\sum^{rr} b^*_{ij} + \sum^{sr} b^*_{ij}) - 1$ $AOF = (\sum^{rr} b^*_{ij}) - 1$ $EOF = \sum_{s=1} {}^{sr}b^*_{ij}$; for $i = 1,2,..n$	$TNF = (\sum^{rr} b^*_{ij} {}^{r}h_i + \sum^{sr} b^*_{ij} {}^{r}h_i) - {}^{r}h_i$ $ANF = (\sum^{rr} b^*_{ij} {}^{r}h_i) - {}^{r}h_i$ $ENF = \sum_{s=1} {}^{sr}b^*_{ij} {}^{r}h_i$;for $i = 1,2,..n$	$TEF = (\sum^{rr} b^*_{ij} {}^{r}e_i + \sum^{sr} b^*_{ij} {}^{r}e_i) - {}^{r}e_i$ $AEF = (\sum^{rr} b^*_{ij} {}^{r}e_i) - {}^{r}e_i$ $EEF = \sum_{s=1} {}^{sr}b^*_{ij} {}^{r}e_i$;for $i = 1,2,..n$
Tabel Daerah-Tunggal o Dampak Bersih Total	$SOF = (\sum^{rr} b^*_{ij}) - 1$	$SNF = (\sum^{rr} b^*_{ij} {}^{r}h_i) - {}^{r}h_i$	$SEF = (\sum^{rr} b^*_{ij} {}^{r}e_i) - {}^{r}e_i$
Dampak balik	FBOF = AOF - SOF	FBNF = ANF – SNF	FBEF = AEF – SEF
Dampak tumpahan	SOOF = TOF - AOF	SONF = TNF – ANF	SOEF = TEF – AEF
Dampak balik + tumpahan	FSOF = TOF - SOF	FSNF = TNF - SNF	FSEF = TEF - SEF
IDBAD	(FBOF/AOF)100	(FBNF/ANF)100	(FBEF/AEF)100
IDBTAD	(FSOF/TOF)100	(FSNF/TNF)100	(FSEF/TEF)100

3. Hasil dan Pembahasan

a. Pengganda Total

Tabel 4.5 menyajikan sepuluh sektor yang mempunyai angka pengganda total terbesar. Untuk pengganda output, urutannya adalah JAV-5: Konstruksi di Jawa (2.866), NUS-3: Industri di Nusa Tenggara (2.837). KAL-4: Jasa listrik, air dan gas di Kalimantan (2.829), NUS-4: Jasa listrik, air, dan gas di Nusa Tenggara (2.837), dan KAL-9: Jasa-jasa lain di Kalimantan (2.808), SUM-

4:Jasa listrik, air, dan gas di Sumatra (2.761), OTH-4: Jasa listrik, air, dan gas di Sulawesi dan Papua (2.647, JAV-4: Jasa listrik, air, dan gas di Jawa (2.568), JAV-9: Jasa-jasa lain di Jawa (2.564), dan KAL-5: Konstruksi di Kalimantan (2.561).

Tabel 4.5

Urutan Sepuluh Besar Sektor Menurut Pengganda Total

Pengganda	Output		Pendapatan		Tenaga kerja	
Urutan	Sektor	Nilai	Sektor	Nilai	Sektor	Nilai
1	JAV-5	2.886	KAL-9	0.928	NUS-2	2.316
2	NUS-3	2.837	OTH-9	0.883	NUS-1	1.241
3	KAL-4	2.829	SUM-9	0.815	NUS-3	1.170
4	NUS-4	2.819	NUS-9	0.799	NUS-4	0.916
5	KAL-9	2.808	JAV-9	0.772	NUS-7	0.906
6	SUM-4	2.761	NUS-2	0.583	NUS-9	0.903
7	OTH-4	2.647	KAL-8	0.489	NUS-5	0.887
8	JAV-4	2.568	NUS-7	0.474	OTH-5	0.773
9	JAV-9	2.564	JAV-5	0.462	JAV-1	0.740
10	KAL-5	2.561	OTH-5	0.457	NUS-8	0.738

Untuk pengganda pendapatan, semua sektor jasa-jasa lain (Sektor-9) masuk ke dalam urutan sepuluh besar, yaitu sektor jasa-jasa lain di Kalimantan (KAL-9), Sulawesi dan Papua (OTH-9) Sumatra (SUM-9), Nusa Tenggara (NUS-9) dan Jawa (JAV-9). Pertambangan dan penggalian di Nusa Tenggara (NUS-2), Perbankan dan lembaga keuangan di Kalimantan (KAL8), Transportasi dan komunikasi di Nusa Tenggara(NUS-7), Konstruksi di Jawa (JA V-5) dan Konstruksi di Sulawesi dan Papua(OTH-5) juga termasuk ke dalam urutan sepuluh sektor yang mempunyai pengganda pendapatan total terbesar.

Satu contoh untuk menjelaskan rincian dampak pengganda pendapatan, menggunakan angka-angka pengganda yang terinci (*disaggregated income multipliers*), adalah sebagai berikut: Peningkatan permintaan akhir sektor Jasalistrik, air, dan gas di Kalimantan (KAL-9) sebesar Rp. 1.OOO akan meningkatkan pendapatan total dari sektor tersebut sebesar Rp. 928. Peningkatan disebabkan karena adanya empat hal, air yaitu: dampak awal sebesar Rp. 593, dan dampak langsung sebesar Rp. 43, dampak tidak langsung sebesar Rp. 28, dan dampak imbasan konsumsi sebesar Rp.264.

Tabel 4.5 juga menunjukkan urutan sepuluh sektor yang mempunyai pengganda kesempatan kerja total terbesar. Kebanyakan sektor yang mempunyai angka kesempatan kerja terbesar terdapat di Nusa Tenggara, hanya ada satu sektor yang terdapatdi Jawa. Kesepuluh sektor tersebut adalah NUS-2: Pertambangan dan penggalian di Nusa Tenggara (2.316), NUS-1: Pertanian, peternakan, kehutanan dan perikanan di Nusa Tenggara (1.241). NUS-3: Industri di Nusa Tenggara (1.170), NUS-4: Listrik, air, dan gas di Nusa Tenggara (0.916), NUS-7: Transportasi dan komunikasi di Nusa Tenggara (0.906). NUS-9: Jasa-jasa lain di Nusa Tenggara (0.903), NUS-5: Konstruksi di Nusa Tenggara (0.887), OTH-5: Konstruksi di Sulawesi dan Papua (0.773), JAV-I: Pertanian, peternakan, kehutanan, dan perikanan di Jawa (0.740), dan NUS-8: Bank dan lembaga keuangan lainnya di Nusa Tenggara (0.738).

Nusa Tenggara memiliki angka pengganda kesempatan kerja yang relatif tinggi. Satu alasan tingginya pengganda kesempatan kerja di Nusa Tenggara adalah rendahnya tingkat upah sehingga menyebabkan tingginya rasio tenaga kerja-output yang kemudian memberikan kontribusi terhadap tingginya dampak awal. Misalnya, kegiatan pada NUS-2: pertambangan dan penggalian melibatkan banyak tenaga kerja. Peningkatan permintaan akhir sektor ini sebesar 1 juta rupiah akan meningkatkan kesempatan kerja sebanyak 2,316 orang. Dari jumlah ini, 1,923 orang merupakan dampak awal karena koefisien langsung tenaga kerja sektor ini sebesar 1,923 orang per 1juta rupiah output. Dampak lain adalah dampak langsung (43 orang), dampak tidak langsung (22 orang) dan dampak imbasan konsumsi (328 orang).

Pengganda Sektoral. Tabel 4.6 menyajikan pengganda sektoral yang lebih rinci untuk output, pendapatan dan kesempatan kerja. Dari Tabel 4.6 dapat dilihat bahwa, terutama untuk output dan pendapatan, umumnya dampak yang terjadi pada sektor sendiri lebih besar dibandingkan dengan dampak yang terjadi pada sektor lain. Di beberapa sektor, pengganda pada sektor sendiri mencapai lebih dari 60 persen dari pengganda total karena besarnya dampak awal. Misalnya, untuk pengganda output adalah sektor-1: Pertanian, peternakan, kehutanan dan perikanan, sektor-2: Pertambangan dan penggalian, dan sektor-3: Industri. Pada pengganda pendapatan adalah sektor-1: Pertanian, petemakan, kehutanan dan perikanan, sektor-8: Bank dan lembaga keuangan lain, dan sektor-9: Jasa-jasa lain, sedangkan pada pengganda kesempatan kerja adalah sektor-1: Pertanian, peternakan, kehutanan dan perikanan. Akan tetapi, ada beberapa sektor dimana dampak pengganda yang terjadi pada sektor lain lebih besar dibanding dengan yang terjadipada sektor sendiri. Ini terutama karena kuatnya keterkaitan antarsektor antardaerah melalui pembelian input. Misalnya, untuk pengganda output, sektor-sektor yang dampaknya lebih besar terjadi pada sektor lain adalah sektor-5: Konstruksi, dan sektor-9: Jasa-jasa lain.

Sedangkan untuk pengganda pendapatan, sektor-sektor yang dampaknya lebih besar terjadi pada sektor lain adalah sektor-3: Industri, sektor-4: Listrik, air, dan gas dan sektor-5: Konstruksi.

Tabel 4.6

Pengganda Sektoral dalam Perekonomian Indonesia

Output				Pendapatan				Kesempatan Kerja			
Sektor	Sendiri	Lain	Total	Sektor	Sendiri	Lain	Total	Sektor	Sendiri	Lain	Total
Sek-1	1.168	0.537	1.705	Sek-1	0.226	0.091	0.317	Sek-1	0.643	0.077	0.720
Sek-2	1.020	0.375	1.395	Sek-2	0.096	0.072	0.168	Sek-2	0.116	0.080	0.196
Sek-3	1.425	0.818	2.243	Sek-3	0.153	0.157	0.310	Sek-3	0.184	0.263	0.447
Sek-4	1.237	1.392	2.629	Sek-4	0.112	0.219	0.331	Sek-4	0.179	0.270	0.449
Sek-5	1.015	1.754	2.769	Sek-5	0.168	0.276	0.444	Sek-5	0.159	0.359	0.518
Sek-6	1.113	0.796	1.909	Sek-6	0.191	0.141	0.332	Sek-6	0.181	0.185	0.366
Sek-7	1.175	1.069	2.244	Sek-7	0.215	0.213	0.428	Sek-7	0.134	0.232	0.366
Sek-8	1.157	0.812	1.969	Sek-8	0.283	0.144	0.427	Sek-8	0.171	0.177	0.348
Sek-9	1.108	1.456	2.564	Sek-9	0.575	0.222	0.797	Sek-9	0.267	0.315	0.582

Pengganda kesempatan kerja memberikan hasil yang berlawanan. Dampak berganda yang terjadi pada sektor lain umumnya lebih besar dibandingkan dengan yang terjadi pada sektor sendiri. Fenomena ini mengindikasikan bahwa keterkaitan sektoral yang kuat terjadi dalam penciptaan kesempatan kerja. Kecuali sektor-1: Pertanian, peternakan, kehutanan dan perikanan dan sektor-2: Pertambangan dan penggalian, dampak yang terjadi justru lebih besar pada sektor-sektor lain.

Pengganda Spasial. Tabel 4.7 menyajikan pengganda spasial yang secara rinci dibedakan menjadi dampak yang terjadi pada pulau sendiri dan pulau lain. Pada Tabel 4.7 tersebut terlihat bahwa pengganda output yang terjadi pada pulau sendiri umumnya lebih besar dibandingkan dengan yang mengimbas ke pulau lain. Ada dua hal yang kiranya dapat menjelaskan hal ini, yaitu dampak awal yang terjadi pada pulau itu sendiri dan lemahnya keterkaitan antarpulau. Di Sumatra dan Jawa, dua pulau yang dianggap paling maju di Indonesia, persentase pengganda yang terjadi di pulau sendiri secara konsisten tinggi. Di Sumatra, 94.2% pengganda output terjadi di pulau sendiri sementara hanya 5.8% yang terjadi di pulau lainnya. Untuk pendapatan, pengganda yang terjadi di pulau sendiri mencapai 92.8% dan untuk kesempatan kerja persentase pengganda yang terjadi di pulau sendiri sebesar 92.9%. Di Jawa, pengganda yang terjadi di pulau sendiri sekitar 89% baik untuk pengganda output, pendapatan dan kesempatan kerja. Tingginya persentase dampak pengganda yang terjadi di pulau sendiri menunjukkan bahwa pulau tersebut, sangat mandiri, tetapi ini juga berarti bahwa keterkaitan spasial dengan pulau-pulau lainnya sangat lemah.

Tabel 4.7

Pengganda Spasial dalam Perekonomian Indonesia

Pengganda Output				Pengganda Pendapatan				Pengganda Kesempatan Kerja			
Pulau	Sendiri	Lain	Total	Pulau	Sendiri	Lain	Total	Pulau	Sendiri	Lain	Total
SUM	1.863	0.116	1.979	SUM	0.282	0.022	0.304	SUM	0.326	0.025	0.351
JAV	2.112	0.251	2.363	JAV	0.378	0.045	0.423	JAV	0.415	0.052	0.467
KAL	1.631	0.447	2.078	KAL	0.323	0.084	0.407	KAL	0.236	0.101	0.337
NUS	1.657	0.554	2.211	NUS	0.362	0.103	0.465	NUS	0.865	0.107	0.972
OTH	1.736	0.511	2.247	OTH	0.393	0.093	0.486	OTH	0.442	0.106	0.548

Untuk tiga kelompok pulau lainnya, yaitu Kalimantan, Nusa Tenggara serta Sulawesi dan Papua, persentase dampak pengganda yang terjadi di pulau lain hanya sekitar 10-15%. Di Kalimantan, misalnya, persentase dampak pengganda yang terjadi di pulau sendiri adalah sebesar 78.5%. 79.4% dan 70.2% masing-masing untuk output, pendapatan dan kesempatan kerja. Di Nusa Tenggara, persentase tersebut masing-masing 75.0%, 77.8% dan 89.0% untuk output, pendapatan, dan kesempatan kerja. Di Sulawesi dan Papua, Jaya, persentase tersebut masing-masing sebesar 77.3%, 80.8% dan 80,6% untuk output, pendapatan dan kesempatan kerja.

b. Dampak Bersih

Nilai pengganda total saja dapat menyesatkan jika analisis ditujukan untuk memilih sektor-sektor yang menjadi kegiatan unggulan. Dampak bersih (yang juga sering disebut sebagai *flow-on effects*) agaknya lebih tepat karena menunjukkan dampak bersih akibat berubahnya permintaan akhir. Dampak bersih mengukur dampak yang terjadi pada semua sektor spasial sebagai hasil dari dampak awal. Dampak bersih diukur dari dampak langsung, dampak tidak langsung dan dampak imbasan. Dampak awal yang merupakan sebab telah dikeluarkan dalam perhitungan sehingga diperoleh dampak bersih. Dalam konteks antarpulau, dampak bersih ini tersebar pada berbagai sektor dan juga pada berbagai pulau.

Tabel 4.8

Urutan Sepuluh Besar Sektor Menurut Dampak Bersih

Dampak Bersih	Output		Pendapatan		Kesempatan Kerja	
Urutan	Sektor-Spasial	Nilai	Sektor-Spasial	Nilai	Sektor-Spasial	Nilai
1	JAV-5	1.866	KAL-9	0.335	NUS-3	0.784
2	NUS-3	1.837	NUS-3	0.328	NUS-9	0.596
3	KAL-4	1.829	NUS-9	0.314	OTH-3	0.515
4	NUS-4	1.819	OTH-3	0.308	NUS-4	0.494
5	KAL-9	1.808	NUS-4	0.305	NUS-7	0.484
6	SUM-4	1.761	OTH-9	0.303	NUS-5	0465
7	OTH-4	1.647	JAV-5	0.297	NUS-6	0.441
8	JAV-4	1.568	KAL-4	0.296	KAL-9	0.402
9	JAV-9	1.564	OTH-5	0.292	NUS-2	0.393
10	KAL-5	1.561	NUS-7	0.292	OTH-9	0.390

Tabel 4.8 menyajikan urutan sepuluh besar sektor berdasarkan dampak bersih yang diciptakannya, untuk pengganda output, pendapatan dan kesempatan kerja. Kesepuluh sektor pada pengganda output pada Tabel 4.8 ini menunjukkan urutan yang sama dengan pengganda output total (Tabel 4.5). Hal ini bisa terjadi oleh karena, untuk pengganda output, dampak awal untuk semua sektor sama dengan satu, sedangkan untuk pendapatan dan kesempatan kerja, dampak awal ini berbeda antar satu sektor dengan sektor lainnya. Dengan demikian, untuk pendapatan dan kesempatan kerja, akan muncul sektoryang berbeda pada urutan sepuluh besar menurut dampak bersih.

Berdasarkan dampak bersih, sepuluh sektor dengan pengganda pendapatan terbesar adalah KAL-9: Jasa-jasa lain di Kalimantan (0.335), NUS-3: Industri di Nusa Tenggara (0.328), NUS-9: Jasa-jasa lain di Nusa Tenggara (0.314). OTH-3: Industri di Sulawesi dan Papua (0.308), NUS-4: Listrik, air dan gas di Nusa Tenggara (0.305), OTH-9: Jasa-jasa laindi Sulawesi dan Papua (0.303), JAV-5: Konstruksi di Jawa (0.297), KAL-4: Listrik, airdan gas di Kalimantan (0.296). OTH-5: Konstruksi di Sulawesi dan Irian Jaya (0.292), dan NUS-7: Transportasi dan komunikasi di Nusa Tenggara (0.292).

Sepuluh sektor dengan dampak bersih kesempatan kerja terbesar adalah: NUS-3: Industri di Nusa Tenggara (0. 784); NUS-9: Jasa-jasa lain di Nusa Tenggara (0.596), OTH-3: Industri di Sulawesi dan Papua (0.515), NUS-4: Listrik, air dan gas di Nusa Tenggara (0.494), NUS-7: Transportasi dan komunikasi di Nusa Tenggara (0.484), NUS-5: Konstruksi di Nusa Tenggara (0.465), NUS-6: Perdagangan, hotel dan restoran di Nusa Tenggara (0.441), KAL-9: Jasa-jasa lain di Kalimantan (0.402), NUS-2: Pertambangan dan penggalian di Nusa

Tenggara(0.393), dan OTH-9: Jasa-jasa lain di Sulawesi dan Papua (0.390). Sektor sama yang juga muncul dalam urutan sepuluh besar berdasarkan pengganda total adalah: NUS-3: Industri di Nusa Tenggara, NUS-9: Jasa-jasa lain di Nusa Tenggara, NUS-4: Listrik, air dan gas di Nusa Tenggara, NUS-7: Transportasi dan komunikasi di Nusa Tenggara, NUS-5: Konstruksi di Nusa Tenggara, dan NUS-2: Pertambangan dan penggalian di Nusa Tenggara.

Dampak Bersih Sektoral. Tabel 4.9, 4.10 dan 4.11 berturut-turut menyajikan distribusi sektoral dampak bersih untuk output, pendapatan dan kesempatan kerja. Secara umum, Tabel 4.9 menunjukkan bahwa dampak bersih output yang diciptakan karena perubahan permintaan akhir dinikmati oleh tiga sektor dominan dalam perekonomian Indonesia, yaitu: Sektor-3: Industri (26.1%), Sektor-1: Pertanian, peternakan, kehutanan dan perikanan (23.2%), dan Sektor-6: Perdagangan, hotel dan restoran (12.2%).

Perubahan permintaan akhir pada setiap sektor dan distribusinya secara sektoral dapat diperiksa pada Tabel 4.9. Misalnya, jika terjadi perubahan permintaan akhir pada sektor-1: Pertanian, peternakan, kehutanan dan perikanan, dampak bersih output akan dinikmati oleh sektor-1: Pertanian, petemakan, kehutanan dan perikanan, (30.2%), sektor-3: Industri (28.8%), dan sektor-6: Perdagangan, hotel dan restoran (12.2%). Untuk dampak bersih pendapatan, sektor-1: Pertanian, peternakan, kehutanan dan perikanan, sektor-3: Industri dan sektor-9: Jasa-jasa lain merupakan tiga sektor utama yang menikmati perubahan permintaan akhir (Tabel 4.10). Jika perubahan permintaan akhir terjadi secara rata-rata nasional, 25.2% dampak bersih pendapatan akan didistribusikan ke sektor-1: Pertanian, peternakan, kehutanan dan perikanan, 16.6% ke sektor-9: Jasa-jasa lain, dan 15.8% ke sektor-3: Industri.

Tabel 4.9

Distribusi Sektoral Dampak Bersih Output (%)

Sektor	Sek-1	Sek-2	Sek-3	Sek-4	Sek-5	Sek-6	Sek-7	Sek-8	Sek-9	Total
Sek-1	30.2	4.3	28.8	1.3	1.4	12.2	8.5	7.8	5.4	100.0
Sek-2	19.5	5.7	24.6	1.4	3.1	13.4	11.6	14.0	6.7	100.0
Sek-3	39.2	11.8	24.6	1.2	0.8	8.0	5.9	5.1	3.2	100.0
Sek-4	12.3	20.7	24.0	15.6	1.8	10.8	7.0	4.6	3.3	100.0
Sek-5	22.2	12.0	30.9	1.0	1.0	14.0	9.2	6.3	3.4	100.0
Sek-6	27.3	3.9	25.3	3.2	1.9	12.0	11.2	9.9	5.3	100.0
Sek-7	16.9	4.0	24.6	1.8	2.2	11.9	17.3	10.4	11.0	100.0
Sek-8	18.3	3.5	23.3	2.2	6.0	12.6	10.1	17.2	6.9	100.0
Sek-9	23.3	3.8	28.5	2.5	1.4	14.8	10.0	8.7	7.0	100.0
Rerata	23.2	7.7	26.1	3.4	2.2	12.2	10.1	9.3	5.8	100.0

Untuk dampak bersih pendapatan, sektor-1: Pertanian, peternakan, kehutanan dan perikanan, sektor-3: Industri dan sektor-9: Jasa-jasa lain merupakan tiga sektor utama yang menikmati perubahan permintaan akhir (Tabel 4.10).

Jika perubahan permintaan akhir terjadi secara rata-rata nasional, 25.2% dampak bersih pendapatan akan didistribusikan ke sektor-1: Pertanian, peternakan, kehutanan dan perikanan, 16.6% ke sektor-9: Jasa-jasa lain, dan 15.8% ke sektor-3: Industri.

Tabel 4.10

Distribusi Sektoral Dampak Bersih Pendapatan (%)

Sektor	Sek-1	Sek-2	Sek-3	Sek-4	Sek-5	Sek-6	Sek-7	Sek-8	Sek-9	Total
Sek-1	32.8	1.9	17.6	0.5	1.1	11.9	8.5	10.5	15.3	100.0
Sek-2	20.4	2.3	13.6	0.2	2.7	12.4	11.0	18.8	18.6	100.0
Sek-3	44.5	6.3	15.8	0.6	0.7	8.0	6.4	7.5	10.2	100.0
Sek-4	16.2	15.9	17.0	9.1	1.7	12.6	8.3	7.6	11.6	100.0
Sek-5	25.3	9.9	19.7	0.4	0.9	14.6	9.7	9.0	10.6	100.0
Sek-6	29.2	1.6	15.0	1.3	1.6	11.7	10.9	13.3	15.3	100.0
Sek-7	16.3	1.8	13.1	0.6	1.6	9.9	15.4	12.7	28.5	100.0
Sek-8	17.4	1.1	13.4	0.9	5.5	10.7	9.6	21.4	20.0	100.0
Sek-9	24.7	1.7	16.8	1.1	1.1	13.9	9.7	11.5	19.5	100.0
Rerata	25.2	4.7	15.8	1.6	1.9	11.7	9.9	12.5	16.6	100.0

Pada Tabel 4.11 terlihat bahwa dampak bersih sektoral kesempatan kerja terutama terjadi pada sektor-1: Pertanian, peternakan, kehutanan dan perikanan, sektor-1: lndustri dan dalam batas-batas tertentu pada sektor-6: Perdagangan, hotel dan restoran. Secara umum, pada tingkat nasional, dampak bersih kesempatan kerja sebagai akibat adanya perubahan pada permintaan akhir akan terdistribusi pada sektor-1: Pertanian, peternakan, kehutanan dan perikanan (49.8%), sektor-3: Industri (16.9%) dan sektor-6: Perdagangan, hotel dan restoran (7.5%). Jika permintaan akhir sektor-1 berubah, maka 59.3% dampak bersih kesempatan kerja akan terjadi pada sektor-1: Pertanian, peternakan, kehutanan dan perikanan, kemudian 17.2% pada sektor-3: lndustri, dan 6.7% pada sektor-6: Perdagangan, hotel dan restoran.

Tabel 4.11

Distribusi Sektoral Dampak Bersih Kesempatan Kerja (%)

Sektor	Sek-1	Sek-2	Sek-3	Sek-4	Sek-5	Sek-6	Sek-7	Sek-8	Sek-9	Total
Sek-1	59.3	1.9	17.2	0.7	0.7	6.7	3.8	4.8	4.9	100.0
Sek-2	46.3	3.2	16.9	0.9	1.7	8.4	5.8	9.7	7.0	100.0
Sek-3	68.6	5.3	13.1	0.5	0.3	4.3	2.5	2.7	2.7	100.0
Sek-4	34.0	17.0	17.3	11.0	1.3	7.7	4.2	3.5	4.0	100.0
Sek-5	48.4	7.7	20.4	0.5	0.6	9.2	5.2	4.5	3.6	100.0
Sek-6	56.6	1.8	15.6	1.8	1.0	6.7	5.5	6.1	4.7	100.0
Sek-7	40.9	2.4	16.9	1.1	1.9	7.4	10.5	7.7	11.2	100.0
Sek-8	43.6	1.7	16.3	1.3	4.8	8.1	5.3	11.9	7.0	100.0
Sek-9	50.3	1.9	18.5	1.6	1.0	8.9	5.3	5.9	6.5	100.0
Rerata	49.8	4.8	16.9	2.2	1.5	7.5	5.3	6.3	5.7	100.0

Dampak Bersih Spasial. Tabel 4.12 menyajikan distribusi spasial dampak bersih untuk output, pendapatan dan kesempatan kerja.

Pola penyebaran dampak bersih untuk output, pendapatan dan kesempatan kerja sangat mirip. Jika ada perubahan permintaan akhir di Sumatra dan Jawa, sekitar 80% dampak bersih terjadi pada pulau sendiri. Untuk output, persentase dampak bersih terjadi pada pulau sendiri adalah 88.8%, jika perubahan permintaan akhir terjadi di Sumatra; dan 79.5% jika perubahan permintaan akhir terjadi diJawa. Untuk pendapatan, persentase dampak bersih yang terjadi di pulau sendiri adalah 89.7% jika perubahan permintaan akhir terjadi di Sumatra dan 81.9%, jika perubahan permintaan akhir terjadi di Jawa. Untuk kesempatan kerja, persentase dampak bersih yang terjadi pada pulau sendiri adalah 84.5% jika perubahan permintaan akhir terjadi di Sumatra; dan 80.3% jika perubahan permintaan akhir terjadi di Jawa. Besarnya angka dampak bersih di Sumatera dan Jawa terjadi karena lemahnya keterkaitan antardaerah dalam perekonomian pulau.

Tabel 4.12

Distribusi Spasial Dampak Bersih: Output, Pendapatan dan Kesempatan Kerja (%)

Output

Pulau	SUM	JAV	KAL	NUS	OTH	Total
SUM	88.8	7.9	1.4	0.5	1.3	100.0
JAV	11.5	79.5	4.1	1.2	3.7	100.0
KAL	8.5	21.5	57.4	2.5	10.1	100.0
NUS	15.0	16.7	8.4	52.9	7.0	100.0
OTH	14.4	11.9	13.4	4.6	55.6	100.0

Pendapatan

Pulau	SUM	JAV	KAL	NUS	OTH	Total
SUM	89.7	7.9	1.1	0.2	1.2	100.0
JAV	9.9	81.9	4.0	0.9	3.4	100.0
KAL	6.5	20.7	61.2	1.9	9.7	100.0
NUS	12.8	14.8	8.6	53.9	9.9	100.0
OTH	18.5	10.3	13.0	2.9	55.3	100.0

Kesempatan Kerja

Pulau	SUM	JAV	KAL	NUS	OTH	Total
SUM	84.5	12.5	0.8	0.9	1.3	100.0
JAV	9.6	80.3	2.7	2.8	4.5	100.0
KAL	7.3	23.8	49.6	5.7	13.5	100.0
NUS	7.5	9.4	3.9	74.3	5.0	100.0
OTH	10.4	16.3	8.6	9.4	55.2	100.0

Di Kalimantan, persentase dampak bersih yang terjadi di pulau sendiri hampir mencapai 60% dan lebih dari 20% dampak bersih mengalir ke Jawa. Adapun persentasenya adalah 21.5%, 20.7%, dan23.8% masing-masing untuk pengganda output, pendapatan dan kesempatan kerja. Dampak bersih yang terjadi di pulau sendiri jika terjadi perubahan permintaan akhir di Nusa Tenggara hanya sekitar 50% untuk output dan pendapatan (tepatnya: 52.9% untuk output dan 53.9% untuk pendapatan) dan 74.3% untuk kesempatan kerja. Akhirnya, jika perubahan permintaan akhir terjadi di Sulawesi dan Papua, dampak bersih yang terjadi di pulau sendiri juga sekitar 50%, yaitu 55.6% untuk output, 55.3% untuk pendapatan dan 55.2% untuk kesempatan kerja.

Seberapa besar persentase dampak bersih akan terjadi di pulau sendiri sangat ditentukan oleh besarnya keterkaitan antarpulau melalui dampak tumpahan (*spill-over effects*) dan dampak balik (*feed-back effecls*). Semakin besar dampak tumpahan. akan semakin besar dampak bersih yang terjadi di pulau lain dan semakin kecil dampak bersih yang terjadi di pulau sendiri. Semakin besar dampak balik, akan semakin besar persentase dampak bersih yang terjadi di pulau sendiri. Pada bagian berikut kedua hal tersebut akan dibahas secara lebih rinci.

c. Dampak Tumpahan dan Dampak Balik

Tabel 4.13 menyajikan ukuran agregat, berupa persentase kesalahan total angka pengganda (*overall percentage error*) karena mengabaikan keterkaitan spasial dengan menggunakan ukuran dan definisi IDBAD dan IDBTAD. Perhitungan ini didasarkan atas matriks kebalikan Leontief tertutup yang secara total sudah mempertimbangkan dampak imbasan konsumsi. Dari Tabel 4.13 terbukti bahwa pada tingkat nasional, nilai IDBAD adalah kecil untuk semua angka pengganda total, baik output, pendapatan maupun kesempatan kerja. Akan tetapi, nilai IDBTAD cukup berarti mengingat besarnya dampak tumpahan. Mengabaikan dampak balik dan dampak tumpahan antardaerah akan menyebabkan angka pengganda total lebih rendah, yakni sebesar 24.2% untuk output, 22.0% untuk pendapatan dan 23.0% untuk kesempatan kerja. Dengan menggunakan ukuran IDBAD saja dapat menyebabkan angka pengganda total tetap lebih rendah karena dampak tumpahannya belum diperhitungkan. Kesalahan angka pengganda karena tidak menggunakan model antardaerah relatif kecil, yaitu masing-masing 6.5% untuk pengganda output, 7.2% untuk pengganda pendapatan dan 8. 1% untuk pengganda kesempatan kerja. Namun demikian, nilai lDBTAD akan lebih relevan dalam analisis keterkaitan antardaerah karena indeks tersebut mencakup analisis yang lebih menyeluruh dimana diperhitungkan dampak tumpahan dan dampak balik secara bersama-sama. Dalam bentuk yang lebih rinci berdasarkan pulau, nilai lOBTAD untuk pengganda output, pendapatan dan kesempatan kerja dapat disajikan pada Tabel 4.14. Nilai IDBTAD untuk Sumatra dan Jawa relatif kecil dibandingkan dengan nilai lDBTAD pulau-pulau lain. Untuk Sumatra, nilai lDBTAD masing-masing 11.3%, 11.2% dan 16.3% untuk pengganda output, pendapatan dan kesempatan kerja. Untuk Jawa, nilai IDBTAD masing-masing 12.2%, 10.5% dan 11.3% untuk pengganda output, pendapatan dan kesempatan kerja. Penjelasan untuk hal ini adalah bahwa kedua pulau ini merupakan wilayah ekonomi yang paling mandiri dalam perekonomian nasional. Jika dihitung berdasarkan rasio antara pengganda intra-daerah dengan pengganda total seperti pemah dilakukan oleh Cochrane (1989), indeks kemandirian spasial adalah 0,942 untuk Sumatra dan 0,894 untuk Jawa. Tiga kelompok pulau yang lain, yaitu: Kalimantan, Nusa Tenggara serta Sulawesi dan Papua tampak lebih tergantung pada pulau-pulau lainnya. Indeks kemandirian spasial masing-masing sebesar 0.785,0,750 dan 0,773 untuk Kalimantan, Nusa Tenggara serta Sulawesi dan Papua. Ketiga gugus pulau ini sangat bergantung kepada Jawa dan dalam beberapa hal kepada Sumatra. Misalnya, Kalimantan sangat tergantung kepada Jawa dalam hal penyediaan input untuk rnenghasilkan barang dan jasa: dimana sekitar 50% inputnya didatangkan dari Jawa.

Tabel 4.13

Indeks Dampak Balik AntarDaerah (IDBAD) dan Indeks Dampak Balik dan Tumpahan AntarDaerah (IDBTAD): Output, Pendapatan dan Kesempatan Kerja.

	Output	Pendapatan	Kesempatan Kerja
IDBAD	6.5	7.2	8.1
IDBTAD	24.2	22.5	23.0

Tabel 4.14

Indeks Dampak Balik dan Tumpahan AntarDaerah menurut Pulau: Output, Pendapatan dan Kesempatan Kerja

IDBTAD	Output	Pendapatan	Kesempatan Kerja
Sumatra (SUM)	11.3	11.2	16.3
Java (JAVA)	12.2	10.5	11.3
Kalimantan (KAL)	30.0	26.8	40.6
Nusa Tenggara (NUS)	36.9	34.6	21.6
Sulawesi dan Papua (OTH)	29.1	25.1	27.1
Rata-rata Nasional	24.2	22.5	23.0

Perubahan permintaan akhir di Kalimantan akan menciptakan dampak tumpahan yang cukup besar ke Jawa. Nilai IDBTAD untuk Kalimantan masing-masing sebesar 30.0, 26.8 dan 40.6 untuk pengganda output, pendapatan dan kesempatan kerja. Untuk Nusa Tenggara, nilai IDBTAD masing-masing 36.9, 34.6 dan 21.6 untuk pengganda output, pendapatan dan kesempatan kerja. Untuk Sulawesi dan Papua nilai IDBTAD masing-masing 29.1, 25.1, dan 27.1 untuk pengganda output pendapatan dan kesempatan kerja.

Nilai IDBTAD di atas menunjukkan pentingnya keterkaitan antarpulau dalam ekonomi kepulauan, seperti di Indonesia. Pengabaian keterkaitan spasial akan menyebabkan nilai perkiraan dampak ekonomi wilayah lebih kecil dari yang sesungguhnya terjadi. Mengingat model daerah tunggal mengabaikan dampak tumpahan dan dampak balik, adalah kemudian menjadi penting untuk menggunakan model antardaerah.

Pengukuran IDBTAD yang dirinci menurut sektor-spasial, akan lebih menjelaskan sifat-sifat keterkaitan antar sektor. Sepuluh sektor-spasial yang memiliki nilai IDBTAD tertinggi masing-masing untuk pengganda output, pendapatan dan kesempatan kerja disajikan pada Tabel 4.15.

Tabel 4.15

Urutan Sepuluh Sektor-Spasial dengan IDBTAD Tertinggi:
Output, Pendapatan dan Kesempatan Kerja

Output	Pendapatan	Kesempatan Kerja
NUS-4 (50.8)	NUS-4 (59.0)	KAL-8 (54.3)
OTH-4 (50.6)	OTH-4 (57.8)	KAL-5 (53.1)
KAL-9 (44.9)	NUS-5 (48.1)	KAL-9 (50.5)
NUS-5 (44.7)	NUS-3 (46.9)	OTH-4 (47.3)
OTH-5 (42.5)	OTH-5 (44.0)	KAL-4 (42.6)
NUS-3 (41.0)	KAL-5 (34.4)	KAL-2 (39.9)
NUS-2 (40.6)	KAL-8 (32.2)	KAL-7 (37.7)
KAL-8 (37.6)	KAL-4 (31.0)	KAL-6 (36.4)
NUS-9 (36.7)	NUS-2 (30.9)	NUS-9 (35.2)
KAL-5 (33.0)	NUS-6 (29.5)	OTH-9 (34.2)

Di antara sepuluh sektor-spasial dengan nilai IDBTAD tertinggi untuk pengganda output adalah lima sektor dalamperekonomian Nusa Tenggara, yaituNUS-4: Listrik, airdangas. NUS-5: Konstruksi, NUS-3: Industri, NUS-2: Pertambangan dan penggalian dan NUS-9: Jasa-jasa lain.

Untuk pengganda pendapatan, lima sektor di Nusa Tenggara yang termasuk urutan dan sepuIuh sektor-spasiaI dengan IDBTAD tertinggi, yaitu: NUS- 4: Listrik,air dan gas, NUS-5: Konstruksi, NUS-3: Industri, NUS-2: Pertambangan dan penggalian, dan NUS-6: Perdagangan, hotel dan restoran.

Untuk pengganda kesempatan kerja, tujuh sektor-spasial di Kalimantan termasuk dalam urutan sepuluh besar yang memiliki IDBTAD tertinggi, yaitu: KAL-8: Bank dan lembaga keuangan lain, KAL-5: Konstruksi, KAL-9: Jasa lain, KAL-4: Listrik, air, dan gas, KAL-2: Pertambangan dan penggalian, KAL-7: Transportasi dan komunikasi dan KAL6: Perdagangan, hotel dan restoran. Menurut sektor, tiga sektor sektor-9: Jasa lainnya, termasuk ke dalam urutan sepuluh sektor dengan nilai IDBT AD tertinggi, yaitu:KAL-9: Jasa lain di Kalimantan, NUS-9: Jasa lain di Nusa Tenggara dan OTH-9: Jasa lain di Sulawesi dan Papua. Mengingat pengukuran IDBT AD didasarkan atas elernen-elemen pada matriks kebalikan Leontief, nilai IDBTAD menunjukkan bahwa keterkaitan yang kuat terjadi antara Nusa Tenggara dengan pulau-pulau lain di Indonesia melalui pembelian input untuk sektor-4: Listrik, air dan gas, sektor-5: Konstruksi, sektor-3: Industri dan sektor-9: Jasa-jasa lain. Untuk sektor-1: Pertanian, peternakan, kehutanan dan perikanan di Nusa Tenggara lebih mengandalkan sumberdaya lokal. Dalam penciptaan kesempatan kerja, hampir semua sektor ekonomi di Kalimantan mempunyai keterkaitan yang kuat dengan pulau-pulau lain di seluruh Indonesia, khususnya Jawa. Tenaga kerja lokallebih merupakan input bagi sektor Pertanian, peternakan, kehutanan dan perikanan.

Dampak Bersih. Sebagaimana teIah dikemukakan, penggunaan pengganda total dalam analisis struktur ruang suatu perekonomian bisa menyesatkan karena masih rnemasukan nilai dampak awal dalam perhitungannya. Untuk itu, analisis akan menggunakan konsep dampak bersih dimana dampak awal dikeluarkan dalarn perhitungan. Bagian ini akan mernbahas indeks dampak balik dan dampak tumpahan untuk dampak bersih. Tabel 4.16 menyajikan nilai IDBT AD untuk dampak bersih output, pendapatan dan kesempatan kerja yang dirinci menurut pulau.

Tabel 4.16

Indeks Dampak Balik dan Tumpahan AntarDaerah (IDBTAD) Dampak Bersih dirinci menurut Pulau: output, pendapatan dan kesempatan kerja.

IDBTAD	Output	Pendapatan	Kesempatan Kerja
Sumatra (SUM)	21.1	23.3	27.7
Jawa (JAV)	22.9	21.0	20.7
Kalimantan (KAL)	53.5	51.7	63.0
Nusa Tenggara (NUS)	65.5	66.7	49.9
Sulawesi dan Papua ((OTH)	54.8	59.2	50.4
Rata-rata Nasional (NAS)	44.3	47.3	44.2

Membandingkan Tabel 4.16 dengan Tabel 4.14 tampak bahwa pola keterkaitan spasial dampak bersih mirip dengan pola keterkaitan spasial pengganda total. Akan tetapi ukuran keterkaitan spasial dampak bersih lebih besar dibandingkan dengan pengganda total karena dikeluarkannya dampak awal dalam perhitungan. Pengabaian keterkaitan spasial dalarn rnemperkirakan dampak bersih yang terjadi karena perubahan permintaan akhir di Sumatra dan Jawa akan menghasilkan kesalahan sekitar 20%. Nilai IDBTAD untuk dampak bersih output, pendapatan dan kesempatan kerja di Sumatra masing-rnasing sebesar 21.1, 23.3 dan 27.7. Untuk Jawa, nilai IDBTAD adalah 22.9, 21.0 dan20.7 untuk dampak bersih output, pendapatan dan kesempatan kerja.

Kesalahan yang disebabkan pengabaian keterkaitan spasial bahkan lebih tinggi jika perubahan permintaan akhir terjadi pada tiga kelompok pulau lainnya. Nilai IDBTAD untuk dampak bersih output, pendapatan dan kesempatan kerja masing-masing sebesar 53.5, 51.7, dan 63.0, jika perubahan permintaan akhir terjadi di Kalimantan. Jika perubahan permintaan akhir terjadi di Nusa

Tenggara, nilai lDBTAD adalah masing-masing sebesar 65.5, 66.7 dan 49.9 untuk dampak bersih output, pendapatan dan kesempatan kerja. Di Sulawesi dan Papua, nilai lDBTAD masing-rnasing sebesar 54.8, 59.2 dan 50.4 untuk dampak bersih output, pendapatan dan kesempatan kerja. Sekali lagi, hasil-hasil ini mengkonfirmasikan bahwa ketiga kelompok pulau, Kalimantan, Nusa Tenggara serta Sulawesi dan Papua, mempunyai keterkaitan spasial yang kuat dengan pulau-pulau lain di Indonesia terutarna melalui pembelian input. Secara lebih rinci, Tabel 4.17 mengurutkan sepuluh sektor-spasial yang mempunyai, nilai IDBTAD tertinggi untuk dampak bersih output, pendapatan dan kesempatan kerja. Serupa dengan analisis nilai IDBTAD untuk pengganda total, diantara sepuluh sektor dengan nilai IDBTAD tertinggi untuk dampak bersih terdapat lima sektor perekonomian di Nusa Tenggara, yaitu NUS-4: Listrik, air dan gas, NUS-2: Pertambangan dan penggalian, NUS-5: Konstruksi, NUS8: Bank dan lembaga keuangan lain, dan NUS-1: Pertanian, peternakan, kehutanan dan perikanan. Untuk dampak bersih pendapatan, lima sektor-spasial di Nusa Tenggara rnuncul sebagai sepuluh sektor dengan nilai IDBTAD tertinggi,yaitu: NUS-4: Listrik, air, dan gas, NUS-2: Pertambangan dan penggalian, NUS-5: Konstruksi, NUS-1: Pertanian, peternakan, kehutanan, dan perikanan, dan NUS-8: Bank dan lembaga keuangan lain. Untuk dampak bersih kesempatan kerja, dibandingkan dengan tujuh sektor yang muncul berdasarkan pengganda total, hanya lima sektor di Kalimantan yang termasuk ke dalam urutan sepuluh besar sektor-spasial dengan IDBTAD dampak bersih tertinggi. Sektor-sektor tersebutadalah KAL-9: Jasa lain, KAL-8: Bank dan lembaga keuangan lain, KAL-5: Konstruksi, KAL·2: Pertambangan dan penggalian dan KAL-6: Perdagangan, hotel dan restoran.

Tabel 4.17

Urutan Sepuluh Sektor-Spasial dengan IDBTAD Tertinggi untuk Dampak Bersih: Output, Pendapatan dan Kesempatan Kerja

Output	Pendapatan	Kesempatan Kerja
OTH-4 (43.6)	NUS-4 (83.8)	KAL-9 (76.1)
NUS-4 (37.0)	OTH-8 (82.3)	KAL-8 (75.3)
NUS-2 (31.9)	OTH-4 (78.7)	OTH-4 (74.4)
NUS-5 (28.4)	NUS-2 (76.9)	KAL-5 (67.7)
OTH-5 (23.2)	NUS-5 (75.5)	OTH-5 (65.5)
KAL-9 (23.1)	NUS-1 (69.1)	KAL-2 (65.5)
NUS-8 (21.1)	OTH-5 (68.8)	NUS-2 (64.5)
KAL-8 (20.9)	NUS-8 (68.1)	KAL-6 (63.3)
NUS1 (20.8)	KAL-9 (68.0)	OTH-2(61.1)
NUS-3 (17.2)	KAL-8 (64.7)	NUS-5 (60.1)

Khusus berkaitan dengan dampak balik dan dampak tumpahan, baik untuk pengganda total maupun dampak bersih, hasil-hasil analisis yang didiskusikan dalam Bab ini menjustifikasikan pemikiran bahwa kegiatan pembangunan seharusnya difokuskan di Kawasan Timur Indonesia yang mencakup Kalimantan, Nusa Tenggara (tidak termasuk Bali), dan Sulawesi serta Irian Jaya. Ini mendukung gagasan pemerintah yang diluncurkan dalam pidato kenegaraan 1990 dimana Kawasan Timur Indonesia akan mendapat prioritas utama dalam kegiatan pembangunan. Kebijakan ini bukan hanya akan menguntungkan Kawasan Timur Indonesia, tetapi bagian lain dari negara ini juga akan tetap menikmati hasil-hasil pembangunan karena adanya keterkaitan spasial dan dampak tumpahan.

4. Penutup

Dengan mengaplikasikan model input-output antardaerah, Bab ini telah membahas struktur spasial perekonomian Indonesia yang dirinci rnenurut 5 kelompok pulau besar, yaitu: Sumatra, Jawa, Kalimantan, Nusa Tenggara dan Sulawesi dan Papua. Pembahasan struktur spasial difokuskan kepada pengganda total baik sektoral maupun spasial, dampak bersih baik sektoral maupun spasial dan dampak luberan serta dampak balik spasial.

Analisis pengganda menurut sektor menunjukkan bahwa secara umum pengganda yang terjadi pada sektor sendiri mencapai lebih dari 60% terhadap total karena besarnya dampak awal. Analisis pengganda spasial juga menunjukkan bahwa secara umum pengganda yang terjadi di pulau sendiri lebih besar dibandingkan dengan yang terjadi dipulau lain. Analisis distribusi sektoral dan spasial padadampak bersih juga menunjukkan hal yang serupa.

Selanjutnya, analisis dampak luberan dan dampak balik dapat menjelaskan kedua hasil analisis di atas. Sumatra dan Jawa memiliki dampak luberan yang relatif kecil yang berarti bahwa dampak yang terjadi di pulau sendiri jauh lebih besar dibandingkan dengan dampak luberan yang terjadi di pulau lain. Ini menunjukkan bahwa Sumatra dan Jawa relatif lebih mandiri. Nilai dampak balik yang cukup besar untuk Jawa dan Sumatra menggambarkan bahwa hasil pembangunan yang mengalir dari Jawa, setelah beberapa saat,akan kembali lagi ke Jawa.

Hasil analisis ini mempunyai implikasi bahwa untuk merelokasikan kegiatan pembangunan diperlukan intervensi pemerintah mengingat bahwa tumpahan antarsektor dan tumpahan antarpulau tidak akan memadai. Berkaitan dengan dampak balik dan dampak tumpahan, hasil-hasil analisis menjustifikasikan pemikiran bahwa kegiatan pembangunan seyogyanya difokuskan di Kawasan Timur Indonesia. Kebijakan relokasi ini bukan hanya akan menguntungkan Kawasan Timur Indonesia, tetapi bagian lain dari negara ini juga akan tetap menikmati hasil-hasil pembangunan karena adanya keterkaitan spasial dan dampak tumpahan.

Adanya konsentrasi kegiatan pembangunan di Jawadan Sumatra akan memperburuk masalah pemerataan dalam perekonomian Indonesia. Jawa dan Sumatra secara tradisional telah mendominasi perekonomian Indonesia. Rendahnya darnpak tumpahan dari kedua pulau tersebut berarti bahwa dampak bersih di Jawa dan Sumatra tidak mengalir secara memadai ke wilayah lain di Indonesia. Sebaliknya, dampakumpan balikdari pembangunan di Kawasan Timur Indonesia akan mengalir ke Jawa dan Sumatra.

Daftar Pustaka

Bayne, B.A. dan West, G.R, (1989**), GRIT: Generation of Regional Input-Output Tables: User's Reference Manual**, Canberra: Australian Government Publishing Service

Biro Pusat Statistik,(1995), **Kerangka Teori dan Analisis Tabel Input-Output,** Jakarta: Biro Pusat Statistik.

Blair, P.O. dan Miller, R.E, (1990),"Spatial Linkages in the US economy", In M.Chatterji & R.E. Kuenne (eds**.), Dynamics and Conflict in Regional Structural Change: Essays in Honour of Walter Isard**, Volume2, New York: New York University Press

Bruckers, S.M. Hasting, S. E. dan Latham Ill, W.R, (1990),"The Variation of Estimated Impacts from Five Regional Input-Output Models", **International Regional Science Review**, 13(1&2): 119-139.

Bruckers, S.M. Hasting, S. E. dan Latham III, W.R, (1987),"Regional Input-Output Analysis: A Comparison of Five Ready-Made Model Systems**", Review of Regional Studies,** 17(2): 1-16.

Chenery, H.B, (1956),"Inter-regional and Internationallnput-Output Analysis" In T. Barna (eds),**The Structural lnterdependence of the Economy,** pp: 341-356. New York: John Wiley and Sons Inc.

Cochrane, S.G, (1989), **lnput-Output Analysis of a Frontier Region: Linkages and Policy in Indonesia**, Ann Arbor: University Microfilms International.

Dewhurst, J. H. LI, (199I),"Using the RAS Technique as a Test of Hybrid

Methods of Regional Input-Output Table Updating", **Regional Studies**, 26: 81-91.

Di Pasquale, D, dan Polenske, K.R (1980), "Output, Income and Employment Input-Output Multipliers", In S. Pleeter (eds.), **Economic Impact Analysis: Methodology and Application, Studies in Applied Regional Science**, 19: 85-113. Boston: Martinus Nijh off Publishing.

Guccione, A, Gillenm G.J, Blair. P.O, dan Miller R.C, (1988),"Inter-regional Feedbacks in Input-Output Models: The Least Upper Bounds", **Journal of Regional Science**, 28:397-104.

Hewings. G.J.D dan Jensen. R.C, (1986),"Regional, Interregional and Multiregional lnput-Output Analisis", In Nijkamp, P, (ed.), **Handbook of Regional and Urban Economics**, Volume 1, Amsterdam: Elsevier Publishers North Holland.

Hulu, E, (1990), **Model Input-Output: Teori dan Applikasinya**, Jakarta: Pusat Antar Universitas-Studi Ekonomi Universitas Indonesia.

Jensen, R.C, (1980),"An Introspective Evaluation of The Regional Input-Output Technique", **Paper to the First World Regional Science Congress,** Cambridge- Massachusetts.

Jensen, R.C, (1990),"Construction and Use of Regional Input-Output Models: Progress and Prospects", **lnternational Regional Science Review**, 13 (1&2): 9-25.

Leontief, W.W dan Strout, A. (1963), "Multi-regional Input-Output Analysis", In T. Barna, (ed.),**Structural Interdependence and Economic Development,** London: Macmillan.

Miller, R.E, (1966),"Inter-regional Feedback Effects in Input-Output Models: Some Preliminary Results", **Papers of the Regional Science Association**, 17:105- 125.

Miller, R.E, (1969),"Inter-regional Feedback Effects in Input-Output Models: Some Experimental Results**", Western Economic Journal,** 7(1):57-70.

Miller, R.E, dan Blair, P.D, (1985), **Input-Output Analysis: Foundation and Extensions**, New Jersey: Englewood Cliffs, Prentice-Hall.

Miller, R.E. (1986), "Upper Bounds on the Sizes of lnter-regional Feedback in Multiregional Input-Output Models**", Journal of Regional Science**, 26(2):285-306.

Moses, L.N, (1955),"The Stability of Inter-regional Trading Pattern and Input-Output Analysis", **American Economic Review**, 45(5): 803-832.

Moses, L.N, (1960),"A General Equilibrium Model of Production, Inter-regional Trade and Location of Industry", **Review of Economics and Statistics**, 42 (4): 373-397.

Muchdie, (1998a),"Teknik Hibrida Dalam Penyusunan Tabel Input-Output Antardaerah: Sebuah Prosedur untuk Ekonomi Kepulauan", **Ekonomi dan Keuangan Indonesia**,XLVI(I): 117-145.

Muchdie, (l998b),"Pemodelan Struktur Ruang Ekonomi Indonesia: Penerapan Prosedur GIRIOT untuk Menyusun Tabel Input-Output Antardaerah", **Ekonomi dan Keuangan Indonesia**, XLVI (3): 279-305.

Muchdie, (1998c),"Pengganda Input-Output Sektor-Sektor Pariwisata", **Majalah Ilmiah Ilmu dan Wisata,** (17): 1- 18.

Muchdie, (1999),**Model Input-Output Antar-Daerah: Prosedur Hibrida untuk Ekonomi Kepulauan**, Jakarta: Direktorat Kebijaksanaan Teknologi untuk Pengembangan Wilayah, Jakarta.

Polenske, K.R,(1995),"Leontief's Spatial Economic Analysis", **Structural Change and Economic Dynamics**, 6:309-318.

Richardson, H.W, (1985),"Input-Output and Economic Base Multipliers: Looking Backward and Forward", **Journal of Regional Science**, 25(4): 607-661.

Toyomane, N, (1988), **Multi-regional Input-Output Models in Long Term Simulation**. Dordrecht/Boston/Lancaster: Kluwer Academic Publishers.

West, G.R, (1986), **Alternative Construction Procedures for A State Input-Output Table**, Report to Center for Economic Analysis and Statistics, West Virginia University.

West, G.R, dan Jensen, R.C, (1988), Regional Input-Output Modeling: GRIT and GRIMP", In Newton, P. Taylor, M. dan Sharp, R. (eds.),**Desktop Planning**, pp: 185-194. Melbourne: Hargen Publishing.

West, G.R. Jensen, R.C. Cheeseman, W.E. Bayne, B.A. Robinson.LJ. Jancic, H dan Garhart, R.E, (1989**), Regional and Inter-regional Input-Output Tables for Queensland 1985/86,** Report to the Queensland Treasury Departmen, St. Lucia: Department of Economics, University of Queensland.

West, G.R, (1990),"Regional Trade Estimation: A Hybrid Approach**", International Regional Science Review**, 13(1&2): 103-11

Chapter 5

Keberartian Sektor Industri di Pulau Jawa dalam Perekonomian Indonesia[1]

Ringkasan

Pulau Jawa sangat penting dalam perekonomian Indonesia karena secara nasional perekonomian Indonesia terkonsentrasi di pulau Jawa. Secara historis, pulau Jawa mendominasi perekonomian Indonesia sejak jaman kolonial Belanda. Lebih dari 60 persen output perekonomian Indonesia dihasilkan oleh pulau Jawa. Begitu juga sektor industri mulai penting bagi perekonomian Indonesia, meski Indonesia termasuk negara agraris. Menggunakan model input-output antar-pulau (MIOAP), Bab ini memperlihatkan keberartian sektor industri, keberartian pulau Jawa dan keberartian sektor industri di pulau Jawa dalam perekonomian Indonesia.

Summary

The island of Java is significantly important for the Indonesian economy as the national economy is highly concentrated in this island. Historically, the island of Java has dominated the Indonesian economy since the colonial era. More than 60 per cent output of the Indonesian economy resulted by the Island of Java. It is the case of manufacturing industry sector, even though Indonesia is categorized as agricultural country. Using an inter-island input-output model (IIIOM), this chapter shows the economic significant of manufacturing industry, the Island of Java and Java's manufacturing industry in the Indonesian economy.

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1. Pendahuluan

Secara historis, pulau Jawa telah sejak jaman kolonial mendominasi perekonomian Indonesia. Peran dan fungsi pulau Jawa sebagai pusat perdagangan, pemerintahan, kebudayaan dan pendidikan menyebabkan konsentrasi berbagai kegiatan di pulau Jawa. Pembangunan ekonomi semasa Orde Baru melalui proses industrialisasi telah menempatkan Jawa sebagai pusat-pusat lokasi industri. Hal ini lebih lanjut menempatkan sektor industri di Jawa sebagai kegiatan ekonomi yang "memimpin" perekonomian nasional.

Dikotomi Jawa-Luar Jawa, meski telah beralih menjadi KBI (Kawasan Barat Indonesia)-KTI (Kawasan Timur Indonesia), telah sejak lama diteliti dan diperbincangkan. Namun, hal ini tetap relevan jika dikaitkan dengan teori pusat-pinggiran (*centre-periphery*) dalam konteks wilayah nodal/fungsional (Richardson 1969; Ngo, Jazayeri & Richardson, 1987; Blair, 1991).

Model input-output antar-daerah (IOAD), selain mampu memberikan gambaran tentang struktur ketergantungan sektoral (*sectoral interdependency*), juga mampu menunjukkan ketergantungan regional/spasial (*regional/spatial interdependency*); antar satu kegiatan ekonomi di suatu daerah dengan kegiatan ekonomi lainnya di daerah lain (West, Morison & Jensen, 1982; West et al, 1989; Hulu, 1990). Dengan model ini, bukan hanya dampak langsung antar-daerah, antar-pulau, dapat diperlihatkan, tetapi juga dampak tidak langsung dan dampak imbasan (*induced-effects*) konsumsi dapat ditelusuri; sesuatu yang dengan model-model agregat tidak dapat ditunjukkan. Kontribusi sektoral dan spasial yang biasanya ditunjukkan secara langsung, dengan model IOAD kontribusi tidak langsung baik sektoral maupun spasial dengan mudah dapat ditunjukkan.

Masalahnya, untuk menyusun model ini masih dihadapi sejumlah kendala, baik kendala operational maupun kendala konseptual. Lebih-lebih untuk negara besar yang terdiri atas pulau-pulau, seperti Indonesia. Untuk itu telah dikembangkan suatu prosedur hibrida, yang merupakan gabungan antara metoda-metoda non-survai dengan data-data yang lebih dipercaya (*superior data*), khusus untuk negara kepulauan (lihat Muchdie, 1998a; 1998b).

Memanfaatkan model IOAD yang disusun dengan prosedur hibrida, Bab ini bertujuan untuk membahas keberartian sektor industri di pulau Jawa dalam perekonomian Indonesia. Pembahasan difokuskan pada keberartian ekonomi (*economic significant*)sektor industri, pulau Jawa dan sektor industri di pulau Jawa dalam perekonomian Indonesia dengan melihat kontribusi langsung dan kontribusi total sektor industri, pulau Jawa dan sektor industri di pulau Jawa dalam perekonomian Indonesia. Untuk itu, pertama-tama akan dijelaskan konsep model IOAD dan prosedur penyusunannya menggunakan teknik hibrida baru, yang disusun khusus untuk negara kepulauan.

2. Metode Analisis

a. Model Input-Output Antar-Daerah

Secara sederhana, model IO menyajikan informasi tentang transaksi barang dan jasa serta saling keterkaitan antar-satuan kegiatan ekonomi untuk suatu waktu tertentu yang disajikan dalam bentuk tabel. Isian sepanjang baris menunjukkan alokasi output dan isian menurut kolom menunjukkan pemakaian input dalam proses produksi (Biro Pusat Statistik, 1995). Sebagai model kuantitatif, tabel IO mampu memberi gambaran menyeluruh tentang: (1) struktur perekonomian yang mencakup struktur output dan nilai tambah masing-masing kegiatan ekonomi di suatu daerah, (2) struktur input-antara (*intermediate input*), yaitu penggunaan barang dan jasa oleh kegiatan produksi di suatu daerah, (3) struktur penyediaan barang dan jasa, baik yang berupa produksi dalam Negeri maupun barang dan jasa yang berasal dari impor, dan (4) struktur permintaan barang dan jasa, baik permintaan oleh kegiatan produksi maupun permintaan akhir untuk investasi, konsumsi dan ekspor.

Sejauh ini terdapat empat tipe model IO yang berdimensi spasial, yaitu: (1) model input-output daerah-tunggal (*single-region model*), (2) model input-output intra-nasional (*intra-national model*), (3) model input-output antar-daerah (*inter-regional model*), dan (4) model input-output banyak-daerah (*multi-region model*). Akan tetapi, hanya dua model terakhir yang dapat menggambarkan aspek spasial suatu perekonomian (Polenske, 1995).

Model IOAD yang juga dikenal dengan model "ideal-murni"nya Isard (1951) dianggap sebagai model yang paling komprehensif dan sistematis karena model ini merupakan pengembangan konsep input-output yang mengintegrasikan unsur ruang secara "simple" dan "elegant" (West, et al, 1989). Model IOAD membagi ekonomi nasional berdasarkan sektor dan daerah kegiatan (Hulu, 1990; West et al, 1989; Oosterhaven, 1981).

Struktur dasar model IOAD terdiri atas dua jenis matriks, yang menggambarkan dua jenis ketergantungan ekonomi. Pertama, matriks transaksi intra-daerah (*intra-regional transaction*), yang menunjukkan transaksi antarsektor dalam suatu daerah. Kedua, matriks perdagangan antar-daerah (*inter-regional trade transaction*), yang menunjukkan arus perdagangan antar sektor dari satu daerah ke daerah lainnya. Matriks ini secara khusus menunjukkan keterkaitan antar industri dan antar daerah sehingga setiap kegiatan dapat diketahui jenis dan lokasinya.

Model antar-pulau dapat dinyatakan serupa dengan persamaan untuk model nasional ataupun untuk model daerah tunggal. Dalam bentuk umum:

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1, 2,..., n) \text{ and } (r, s = 1, 2,..., m) \qquad (1)$$

Terdapat (*m x n*) persamaan tipe ini untuk setiap sektor di setiap wilayah yang menunjukkan bahwa output setiap sektor sama dengan penjualan ke semua sektor antara di semua sektor di semua wilayah ditambah penjualan kepada permintaan akhir di semua wilayah. Koefisien input wilayah diperoleh dengan cara yang sama sebagaimana koefisien input langsung pada model nasional ataupun model daerah tunggal. Untuk wilayah *s*, koefisien input wilayah dinyatakan sebagai:

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \qquad (2)$$

Mensubstitusikan (2) ke dalam (1):

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}a_{ij} \, {}^{s}X_{j} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1, 2,..., n) \text{ and } (r, s = 1, 2,..., m) \qquad (3)$$

Karena persamaan (1) sampai (3) merujuk pada kasus umum, dirasa lebih nyaman untuk merujuk secara khusus kepada matriks intra-wilayah (*intra-regional matrices*) dan matriks antar-wilayah (*inter-regional matrices*):

$$^{r}X_{i} = \sum_{j} {}^{rr}X_{ij} + \sum_{j} {}^{rs}X_{ij} + {}^{r}Y_{i}; \; (i, j = 1, 2,... n) \qquad (4)$$

dan

$$^{s}X_{i} = \sum_{j} {}^{sr}X_{ij} + \sum_{j} {}^{ss}X_{ij} + {}^{s}Y_{i}; \; (i, j = 1, 2,... n) \qquad (5)$$

Dari persamaan (4) dan (5), dapat didefinisikan koefisien-koefisien input wilayah, berdasarkan matriks perdagangan intra dan antar-wilayah:

$$^{rr}a_{ij} = {}^{rr}X_{ij}/{}^{r}X_{j} \qquad (6)$$

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \qquad (7)$$

$$^{sr}a_{ij} = {}^{sr}X_{ij}/{}^{r}X_{j} \qquad (8)$$

$$^{ss}a_{ij} = {}^{ss}X_{ij}/{}^{s}X_{j} \qquad (9)$$

Persamaan (6) dan (9) merupakan koefisien input langsung intra-wilayah, sementara persamaan (7) dan (8) merupakan koefisien-koefisien perdagangan antar-wilayah. Selanjutnya, persamaan (6) sampai (9) dapat disubstitusikan ke dalam persamaan (4) dan (5), menghasilkan persamaan input-output tradisional:

$$^{r}X_{i} = \sum_{j} {}^{rr}a_{ij}{}^{r}X_{j} + \sum_{j} {}^{rs}a_{ij}{}^{s}X_{j} + {}^{r}Y_{i} \; ; \; (i, j = 1,2,...n) \qquad (10)$$

dan

$$^{s}X_{i} = \sum_{j} {}^{sr}a_{ij}{}^{r}X_{j} + \sum_{j} {}^{ss}a_{ij}{}^{s}X_{j} + {}^{s}Y_{i} \; ; \; (i, j = 1,2,...n) \qquad (11)$$

Persamaan-persamaan di atas dapat diperluas sejalan dengan sistem input-output daerah tunggal atau nasional. Dalam bentuk matriks, dinyatakan sebagai:

$$^{r}x = {}^{rr}A \, {}^{r}x + {}^{r}y \text{ or } {}^{r}x = (I - {}^{rr}A)^{-1}\, {}^{r}y \qquad (12)$$

dan

$$^{s}x = {}^{ss}A \, {}^{s}x + {}^{s}y \text{ or } {}^{s}x = (I - {}^{ss}A)^{-1}\, {}^{s}y \qquad (13)$$

dimana $(I - {}^{rr}A)^{-1}$ dan $(I - {}^{ss}A)^{-1}$ adalah kebalikan dari model input-output terbuka. Dalam kasus umum, persamaan (12) dan (13) dapat ditulis kembali sebagai:

$$x = A\,x + y \text{ or } x = (I - A)^{-1}y \qquad (14)$$

Karena koefisien input wilayah pada persamaan (6) sampai (9) atau matriks A pada persamaan (13) yang terdiri atas karakteristik teknik dan perdagangan, Hartwick (1971) memisahkan koefisien input ini (${}^{rs}a_{ij}$) menjadi koefisien-koefisien perdagangan (${}^{rs}t_{ij}$) dan koefisien-koefisien teknis (${}^{s}a_{ij}$). Pemisahan ini pada dasarnya sama dengan yang dilakukan pada model daerah tunggal. Persamaan (13) kemudian dapat ditulis ulang sebagai:

$$x = T\,(A\,x + y) \text{ or } x = (I - T\,A)^{-1}y \qquad (15)$$

Walaupun model IOAD adalah model yang paling ideal, dia mempunyai dua masalah yang serius (Toyomane, 1988). Pertama berkaitan dengan ketatnya asumsi yang menyatakan bahwa suatu komoditas yang diproduksi di suatu daerah, secara teknis berbeda dengan komoditi yang sama yang dihasilkan daerah lainnya. Misalnya genteng yang diproduksi di Jawa berbeda dengan genteng yang diproduksi di Sulawesi, sehingga tidak ada substitusi bagi keduanya. Asumsi ini terlalu kaku dan tidak realistic sebab bagi konsumen, genteng tetap saja genteng di manapun diproduksi.

Kedua berkaitan dengan penerapan praktis dari model IOAD. Untuk memperoleh estimasi nilai ${}^{rs}t_{ij}$ diperlukan data arus perdagangan. Menurut daerah asal dan daerah tujuan serta menurut sektor produksi dan sektor konsumsi. Data seperti ini biasanya tidak tersedia, bahkan di negara yang statistiknya sudah maju sekalipun. Untuk memperolehnya dilakukan survai yang akan membutuhkan biaya, tenaga dan waktu yang banyak. Hal ini menyebabkan sangat sedikit negara yang sudah memiliki tabel IOAD.

Untuk mengatasi masalah-masalah yang terdapat pada model IOAD, berbagai model input-output banyak-daerah sudah dikembangkan. Pada model ini diasumsikan bahwa barang yang sama tidak perlu dibedakan dari daerah asalnya. Dalam penerapannya, ada yang menggunakan perkiraan titik (Chenery, 1956; Moses, 1955), ada yang menggunakan teori gravitasi (Leontief & Strout, 1963; Polenske, 1970) dan ada yang menggunakan perumusan pemograman linier (Moses, 1960).

b. Prosedur Penyusunan Model

Sejauh ini dikenal tiga metoda dalam penyusunan model IO, yaitu metoda survei langsung (Misalnya: Richardson, 1972; Bulmer-Thomas, 1982; Miller & Blair, 1985), metode non-survei dan teknik-teknik "siap-saji" (Round, 1978, 1983; Miller & Blair, 1985; Richardson, 1985; Schaffer & Chu, 1969; Smith & Morrison, 1974; McMenamin & Haring, 1974; Stevens et al, 1983; Hewings & Jensen, 1986; West, 1986; Lahr, 1992; dan Flagg et al, 1994; 1995) serta metoda hibrida (Schaffer, Laurent & Sutter, 1972; Jensen, Mandeville & Karutnaratne, 1979; Phibbs & Holsman, 1982; Hewings & Jensen, 1986; West, 1986; West & Jensen, 1988; Bayne & West, 1986; West, Morrison & Jensen, 1982; West et al, 1989; Boomsma & Oosterhaven, 1992).

Metode survei langsung walaupun diakui akan menghasilkan model yang paling teliti, dianggap bukan lagi cara yang tepat karena dalam prosesnya membutuhkan sumberdaya (waktu, tenaga dan dana) yang besar (Richardson, 1972; 1985; West & Jensen, 1988). Menurut Richardson (1985), sebuah tabel yang disusun melalui metoda survei membutuhkan dana 10 kali lebih besar dan waktu antara 8 sampai 10 kali lebih lama dibandingkan metoda non-survai, membuat tabel tersebut kadaluarsa ketika dipublikasikan (West & Jensen, 1988). Metode non-survei memang dapat menghemat waktu, tenaga dan biaya (lihat Misalnya: Brucker, Hasting & Latham, 1987;1990). Sayangnya para pakar telah sepakat bahwa metode non-survei dan teknik-teknik "siap-saji" hanya akan menghasilkan tabel IO yang diragukan ketelitiannya (Jensen, 1990). Dewhurst (1991) menyatakan bahwa tabel yang disusun melalui survei jelas terlalu mahal dan metode non-survei sama sekali tidak teliti. Ini mendorog upaya pengembangan metode hibrida (*hybrid method*), yang menggabungkan keunggulan dari keduanya; optimalisasi ketelitian dengan kendala dana, waktu dan tenaga (Hewings & Jensen, 1986; West, 1986; West & Jensen, 1988; Bayne & West, 1989; West,1990).

Tabel IOAD yang digunakan dalam studi ini disusun dengan menggunakan prosedur hibrida yang secara khusus dikembangkan untuk ekonomi kepulauan (lihat Muchdie, 1998a), yang disebut dengan prosedur GIRIOT (*Generation of Inter-Regional Input-Output Tabel*). Prosedur ini terdiri atas 3 Tingkat, 7 tahap dan 24 langkah. Tingkat I: Estimasi Koefisien Teknis Wilayah, terdiri atas 2 tahap, yaitu Tahap 1: Penurunan Koefisien Teknis Nasional dan Tahap 2: Penyesuaian Teknologi Wilayah. Tingkat II: Estimasi Koefisien Input Wilayah, terdiri atas dua tahap, yaitu Tahap 3: Estimasi of Koefisien Input Intra-Wilayah dan Tahap 4: Estimasi Koefisien Input Antar-Wilayah, dan Tingkat III: Penyusunan Tabel Transaksi, terdiri atas 3 tahap, yaitu Tahap 5: Penyusunan Tabel Transaksi Awal, Tahap 6: Agregasi Sektoral, dan Tahap 7: Penyusunan Tabel Transaksi Akhir.

Pada model ini Indonesia dipecah menjadi 5 wilayah berdasarkan 5 pulau-pulau besar, yaitu SUM: pulau Sumatera, JAV: pulau Jawa, KAL: pulau Kalimantan, NUS: pulau Nusa Tenggara dan OTH: pulau-pulau lain, mencakup pulau Sulawesi, Maluku dan Papua. Sementara itu, kegiatan ekonomi dipecah ke dalam 9 sektor, yaitu: 1 (Pertanian, peternakan dan perikanan), 2 (Pertambangan dan galian), 3 (Industri manufaktur), 4 (Listrik, air dan gas), 5 (Konstruksi), 6 (Perdagangan, hotel dan restoran), 7 (Transportasi dan komunikasi), 8 (Perbankan dan jasa keuangan lainnya) dan 9 (Jasa lainnya).

Menggunakan data Indonesia tahun 1990 yang dirinci menurut 5 pulau besar/gugus pulau dan 9 sektor ekonomi, prosedur tersebut telah diterapkan dan diuji validitasnya secara empiris (Muchdie, 1998b). Atas dasar model ini, analisis Keberartian secara ekonomi baik sektor maupun spasial akan dibahas pada bagian-bagian berikut.

3. Keberartian Sektor Industri

a. Keberatian Langsung

Keberartian ekonomi secara langsung bagi suatu industri mengacu kepada keberartian yang dicerminkan hanya pada kaitan pertama. Di sini diperlihatkan kontribusi secara langsung suatu industri dalam menciptakan output, nilai tambah, pendapatan rumah tangga, kesempatan kerja ekspor dan impor.

Tabel 5.1

Kontribusi Langsung sektor industri dalam Perekonomian Indonesia

Kategori	Persen dari Total (%)	Urutan
Output	34.3	1
Nilai tambah	11.4	4
Pendapatan Rumah Tangga	20.6	2
Konsumsi Rumah Tangga	34.0	1
Impor	80.0	1
Ekspor	63.7	1
Penjualan antara	37.8	1
Pembelian antara	48.3	1
Input primer	25.4	1
Permintaan akhir	32.1	1
Tenaga kerja	22.0	2

Sumber: Muchdie, 1998

Tabel 5.1 menyajikan kontribusi ekonomi secara langsung sektor industri manufaktur dalam perekonomian Indonesia. Pada tabel tersebut jelas terllihat bahwa sektor industri mempunyai kontribusi langsung yang sangat penting di hampir semua kategori. Akan tetapi, dalam menciptakan nilai tambah, kontribusi langsung sektor industri kurang penting (11.4%); hanya menempati urutan keempat dalam perekonomian Indonesia. Sebagai sektor yang paling dinamis sejak "meledaknya" harga minyak di tahun 1973, sektor industri tumbuh sangat cepat; sebesar 12.5 persen dalam periode 1965-1991 (Hill, 1994). Sebagian penjelasan dari pertumbuhan ekonomi yang pesat ini, pada perekonomian agraris, adalah rendahnya output pada saat awal. Sebelum 1950, proses industrialisasi sangat sulit diwujudkan dan di tahun 1960-an, Indonesia merupakan negara Asia yang paling tertinggal (McCawley, 1981; Soehoed, 1967).

Lebih lanjut, adalah bermanfaat untuk menelusuri fase-fase di mana sektor industri telah tumbuh secara sangat pesat. Hill (1994) menandai 4 fase perubahan struktural dan pertumbuhan sektor industri yang sangat tinggi. Tahap awal pertumbuhan pesat (1967-1973) lebih disebabkan karena adanya proses liberalisasi ekonomi dan pulihnya perekonomian nasional. Tahap kedua terjadi ketika adanya kenaikan harga minyak di mana proses industrialisasi dicirikan oleh pertumbuhan yang sangat cepat, meskipun tidak efisien. Meningkatnya proteksi dan investasi pemerintah menyebabkan peningkatan pendapatan selama tahap ini digunakan secara langsung untuk memenuhi permintaan industri domestik.

Turunnya harga minyak setelah 1981 menandai fase Ketiga. Antara 1982 dan 1985 kebijakan industri nasional terbatas pada penanganan ekonomi makro dan devaluasi Rupiah di tahun 1983. Investasi pemerintah sangat besar di sektor migas, dan untuk itu pemerintah melindunginya dengan rintangan-rintangan bukan tariff (*non-tariff barriers*). Setelah 1985, tahap keempat dimulai. Pada tahap ini peran swasta sangat didorong dan prioritas diberikan kepada ekspor non-migas. Sebagaimana ditunjukkan pada Tabel 5.1, sektor industri memberikan lebih dari 60 persen terhadap total ekspor nasional.

b. Keberartian Total

Meskipun analisis keberartian langsung sangat berguna, ukuran Keberartian total lebih disukai karena tidak hanya mencakup keterkaitan langsung pada putaran pertama, tetapi juga pada keterkaitan tidak langsung dan terimbas. Tabel 5.3 menggambarkan kontribusi total sektor industri dalam perekonomian Indonesia.

Panel A pada Tabel 5.2 menyajikan komponen pengganda pada sektor industri, sementara Panel B menyajikan dampak luberan (*flow-on effects*) yang terjadi pada setiap sektor. Kolom pengganda output menunjukkan bahwa setiap Rp. 1.000 output sektor industri mempunyai dampak langsung (putaran pertama) sebesar Rp. 548, dampak tidak langsung (putaran kedua, imbasan produksi) sebesar Rp. 248, dan dampak imbasan konsumsi sebesar Rp. 446, sehingga secara total menghasilkan output sebesar Rp. 2.243 dan dampak luberan sebesar Rp. 1.243. Kolom persen menunjukkan persentase setiap komponen pengganda. Misalnya, dampak luberan sektor industri sebesar 55.4 persen.

Panel B pada Tabel 5.2 menyediakan informasi yang sangat penting berkaitan dengan pola sektoral dari dampak bersih. Dampak bersih sektor industri disebarkan ke berbagai sektor dalam perekonomian Indonesia, sehingga 39.2 persen ke sektor-1: Pertanian, peternakan, kehutanan dan perikanan; 24.6 persen ke sektor-3:industri; 11.8 persen ke sektor-2: pertambangan dan penggalian, dan 8 persen ke sektor-6: perdagangan, hotel dan restoran.

Tabel 5.2

Kontribusi total sektor industri dalam perekonomian Indonesia

Dampak	Output		Pendapatan		Tenagakerja	
	Pengganda	Persen	Pengganda	Persen	Pengganda	Persen
A. Komponen pengganda						
- Awal	1.000	44.6	0.107	34.6	0.129	28.9
- Langsung	0.548	24.4	0.082	26.4	0.153	34.3
- Tidak langsung	0.248	11.1	0.040	12.9	0.062	13.9
- Imbasan konsumsi	0.446	19.9	0.081	26.1	0.102	22.9
Total	2.243	100.0	0.310	100.0	0.447	100.0
Luberan	1.243	55.4	0.203	65.4	0.318	71.1
Rasio Luberan	-	-	1.897	-	2.457	-
B. Dampak bersih sektoral						
- Sektor-1	0.488	39.2	0.090	44.5	0.218	68.6
- Sektor-2	0.147	11.8	0.013	6.3	0.017	5.3
- Sektor-3	0.306	24.6	0.032	15.8	0.042	13.1
- Sektor-4	0.015	1.2	0.001	0.6	0.002	0.5
- Sekotr-5	0.010	0.8	0.001	0.7	0.001	0.3
- Sektor-6	0.100	8.0	0.016	8.0	0.014	4.3
- Sektor-7	0.073	5.9	0.013	6.4	0.008	2.5
- Sektor-8	0.064	5.1	0.015	7.5	0.009	2.7
- Sektor-9	0.040	3.2	0.021	10.2	0.009	2.7
Total	1.243	100.0	100.0	100.0	0.318	100.0

Sumber: Muchdie, 1998

Kolom pendapatan pada Tabel 5.2 berkaitan dengan pengganda pendapatan yang dapat dinikmati rumah tangga yang bekerja pada sektor industri. Dampak bersih pendapatan rumah tangga sektor industri tersebar ke berbagai sektor dalam perekonomian Indonesia. Misalnya, 44.5 persen terjadi pada sektor-1: pertanian, peternakan, kehutanan dan perikanan; 15.8 persen terjadi pada sektor-3: industri; 10.2 persen terjadi pada sektor-9: jasa-jasa.

Kolom tenaga kerja pada Tabel 5.2 menunjukkan pengganda kesempatan kerja dari sektor industri. Dampak bersih tenaga kerja tersebar di sektor-1: Pertanian, peternakan, kehutanan dan perikanan (68.6%), sektor-3: industri (13.1%) dan sektor-sektor lain dalam persentase yang sangat kecil.Rasio luberan pada Tabel 5.2 menunjukkan bahwa setiap Rp. 1.000 pendapatan rumah tangga yang bekerja di sektor industri berkaitan dengan (tetapi tidak mempunyai hubungan sebab-akibat) Rp. 1.897 pada berbagai sektor dalam perekonomian Indonesia. Hal serupa terjadi pada tenaga kerja, dimana setiap pekerja berkaitan dengan 2,457 tenaga kerja pada dampak bersih.

Berkaitan dengan analisis Keberartian ekonomi sektor industri dalam perekonomian Indonesia, ada delapan hal penting yang perlu digarisbawahi (Hill, 1994; 1996). Pertama, Terdapat suatu peningkatan yang sangat dramatik dalam hal mutu dan kisaran produk. Beberapa industri di tahun 1960-an mempunyai mutu yang sedemikian rupa rendahnya, sehingga dapat dipandang sebagai produk yang tidak dapat dijual. Sangat sedikit modal dan barang setengah jadi yang diproduksi pada pertengahan tahun 1960-an. Kedua, membanjirnya teknologi baru yang diimpor sejak 1965. Untuk dua kali sepuluh tahun yang pertama sebelum Orde Baru (1940-1950 dan 1956-1966) tidak ada investasi di sektor industri. Selama pertengahan pertama 1960-an, Indonesia memutuskan hubungan perdagangan internasional. Akibatnya, Indonesia hanya memiliki cadangan yang "*out of date*" sampai akhir 1960-an. Modernisasi teknologi secara cepat telah menggeser industri-industri yang padat karya. Investasi padat modal yang besar merupakan gambaran umum investasi pada perusahaan-perusahaan negara di tahun 1970-an dan 1980-an. Ini berkisar dari industri pesawat terbang dan kapal sampai industri amunisi dan elektronik.

Ketiga, sektor industri telah mengalami pertumbuhan yang pesat dalam skala, kedalaman dan kecanggihan. Rata-rata ukuran perusahaan menengah dan besar meningkat dari 92 menjadi 141 orang pada periode 1974-1988. Produktivitas tenaga kerja sektor industri telah meningkat secara tajam; perusahaan menengah dan besar tumbuh sekitar 9 persen per tahun antara 1975 dan 1986. Indikator lain berkaitan dengan perubahan structural, khususnya pergeseran dari barang konsumsi yang sederhana dan industri pengolahan bahan baku menjadi industri berat yang lebih padat modal. Secara lebih umum, kontribusi barang-barang konsumsi telah menurun secara berarti mencerminkan perubahan structural secara cepat dan mendorong ke arah industri berat. Keempat, sektor industri telah menjadi sangat beragam. Di satu ekstrim adalah industri "*multi-million dollar*" yang menggunakan teknologi canggih dengan komponen input asing yang besar dalam perekonomian internasional. Bersamaan dengan itu, terdapat industri kecil, berskala rumah tangga dan bersifat musiman yang hanya menggunakan tenaga kerja keluarga dan produknya dijual ke tetangga.

Kelima, pertumbuhan tenaga kerja sektor industri telah tumbuh secara sangat berarti; sekitar 5.6 persen dari 1975 sampai 1986. Keenam, ekspor sektor industri telah tumbuh secara spektakuler, pada periode 1985-1995. Ekspor sektor industri tumbuh empat kali lipat antara 1980-1985; hampir dua kali lipat pada 1985-1987 dan 1987-1989 dan Selanjutnya meningkat sebesar 50 persen pada 1989-1991. Selama periode 1975 sampai 1991, ekspor tumbuh sebesar 30 persen per tahun. Sebagian besar terjadi pada industri kayu lapis, setelah ekspor kayu gelondongan dilarang pada awal 1980-an. Di akhir 1980-an, basis industri telah meluas mencakup garmen, tekstil, alas kaki, furniture, pupuk, kertas dan banyak produk lainnya.

Gambaran ketujuh pada sektor industri di Indonesia adalah soal pola pemilikan. Investasi asing terutama dominan pada sektor di mana mereka dapat mengambil keuntungan karena keunggulan teknologi (petro-kimia, serat sintesis, sepeda motor, kaca lembaran, dan elektronik), merek terkenal (rokok putih,minuman), dan pengetahuan mengenai pasar internasional (alas kaki). Perusahaan negara unggul pada industri pengilangan minyak, gas, alam cair, pabrik gula, semen, pupuk, pesawat terbang, teh, dan barang-barang mesin. Perusahaan domestik pada umumnya lebih kecil dari perusahaan negara atau perusahaan asing. Mereka juga lebih padat karya dan memproduksi barang-barang konsumsi.

Terakhir, tiga aspek dari pola spasial sektor industri perlu mendapat perhatian. Pertama, kontribusi pulau Jawa dalam hal output dan tenaga kerja telah menurun secara berangsur-angsur. Penurunan ini terjadi pada industri non-migas karena kebanyakan industri migas terdapat di Sumatera dan Kalimantan Timur. Sebagian Sumatera dan Kalimantan telah mengambil alih penurunan di Jawa. Kedua, hampir semua kegiatan industri yang "*foot-loose*" umumnya berlokasi di Jawa. Ketiga, di Jawa sendiri terdapat pola barat-timur, di mana kompleks industri besar terdapat di Cilegon, Jakarta, dan Surabaya dan daerah sekitarnya.

4. Keberartian Pulau Jawa

a. Keberartian Langsung

Pulau Jawa telah mendominasi perekonomian Indonesia sejak jaman kolonial. Tabel 5.3 menyajikan kontribusi langsung pulau Jawa dalam perekonomian Indonesia. Dari semua kategori yang ada pada tabel tersebut, kontribusi pulau Jawa menduduki urutan teratas. Pulau Jawa memberikan kontribusi sekitar 60 persen dari output nasional. Persentase yang sama juga diberikan untuk pendapatan rumah tangga dan kesempatan kerja. Sementara itu, kontribusi pulau Sumatera sekitar 20 persen, kira-kira sama dengan jumlah kontribusi pulau-pulau yang ada di Kawasan Timur Indonesia (Sulawesi, Nusa Tenggara, Maluku, dan Papua).

Tabel 5.3

Kontribusi Langsung Pulau Jawa dalam Perekonomian Indonesia

Kategori	Kontribusi (%)	Urutan
Output	61.7	1
Nilai tambah	52.5	1
Pendapatan rumah tangga	61.9	1
Konsumsi rumah tangga	56.6	1
Impor	82.1	1
Ekspor	41.6	1
Penjualan antara	60.2	1
Pembelian antara	66.7	1
Input primer	58.6	1
Permintaan akhir	62.7	1
Tenaga kerja	60.2	1

Sumber: Muchdie, 1998.

Untuk melengkapi gambaran di atas, di pulau Jawa terdapat beberapa sektor yang mempunyai kontribusi berarti dalam perekonomian nasional, yaitu sektor-3: industri, sektor-1: Pertanian, peternakan, kehutanan dan perikanan, sektor-6: perdagangan, hotel dan restoran, sektor-9: jasa-jasa lain, da sektor-5: kontruksi. Misalnya, dalam penciptaan output sektor-sektor yang mempunyai kontribusi berarti adalah sektor-3: industri (40.0%), sektor-5: Konstruksi (13%), dan sektor-6: perdagangan, hotel dan restoran (13%). Dalam penciptaan nilai tambah, sektor-sektor yang memberikan kontribusi berarti adalah sektor-3: industri (22.3%), sektor-1: Pertanian, peternakan, kehutanan, dan perikanan (21.7%) dan sektor-9: jasa-jasa lain (12.7%). Selanjutnya, dalam penciptaan pendapatan rumah tangga beberapa sektor yang mempunyai kontribusi berarti adalah sektor-3: industri (24.9%), sektor-9: jasa-jasa lain (24.6%) dan sektor-6: perdagangan, hotel, dan restoran. Sektor-3: industri mempunyai kontribusi lebih dari 70 persen dalam penciptaan ekspor dan menyerap impor.

b. Keberartian Tidak Langsung

Lebih bermanfaat untuk membahas kontribusi total ekonomi pulau Jawa dalam perekonomian Indonesia karena hal ini bukan hanya mencakup keberartian ekonomi secara langsung, tetapi juga mencakup keberartian tidak langsung dan terimbas oleh kegiatan ekonomi pulau Jawa.

Total kontribusi pulau Jawa dalam hal output, pendapatan dan tenaga kerja, disajikan pada Tabel 5.4. Bagian A dari tabel menyajikan komponen pengganda untuk pulau Jawa, sementara Bagian B menyajikan komponen dampak bersih yang terjadi, baik di pulau Jawa maupun di pulau-pulau lain.

Panel A pada Tabel 5.4 menyajikan komponen pengganda pada pulau Jawa, sementara Panel B menyajikan dampak luberan (*flow-on effects*) yang terjadi pada pulau-pulau lain. Kolom pengganda output menunjukkan bahwa setiap Rp. 1.000 output sektor industri mempunyai dampak langsung (putaran pertama) sebesar Rp. 421, dampak tidak langsung (putaran kedua, imbasan produksi) sebesar Rp. 289, dan dampak imbasan konsumsi sebesar Rp. 643, sehingga secara total menghasilkan output sebesar Rp. 2.363 dan dampak luberan sebesar Rp. 1.363. Kolom persen menunjukkan persentase setiap komponen pengganda. Misalnya, dampak luberan sektor industri sebesar 57.7 persen.

Tabel 5.4

Kontribusi Total Pulau Jawa dalam Perekonomian Indonesia

Dampak	Output		Pendapatan		Tenagakerja	
	Pengganda	Persen	Pengganda	Persen	Pengganda	Persen
Komponen Dampak						
- Awal	1.000	42.3	0.179	42.2	0.197	42.2
- Langsung	0.421	17.8	0.075	17.7	0.082	17.6
- Tidak langsung	0.289	12.2	0.052	12.3	0.057	12.2
- Imbasan konsumsi	0.653	27.6	0.118	27.8	0.131	28.1
- Total	2.363	100.0	0.424	100.00	0.467	100.0
- Luberan	1.363	57.7	0.245	57.8	0.270	57.8
- Rasio Luberan			1.369		1.371	
Dampak bersih spasial						
- Sumatera	0.157	11.5	0.024	9.9	0.026	9.6
- Jawa	1.084	79.5	0.201	81.9	0.217	80.3
- Kalimantan	0.056	4.1	0.010	4.0	0.007	2.7
- Nusa Tenggara	0.016	1.2	0.002	0.9	0.008	2.8
- Sulawesi dan Papua	0.050	3.7	0.008	3.4	0.012	4.5
Total	1.363	100.0	0.245	100.0	0.270	100.0

Bagian B pada Tabel 5.4 menunjukkan bahwa dampak bersih output, 79.5 persen terdistribusi di pulau Jawa, 11.5 persen di pulau Sumatera, 4.1 persen di pulau Kalimantan, 3.7 persen di kepulauan Sulawesi dan Papua serta hanya 1.2 persen di kepulauan Nusa Tenggara. Dampak bersih yang mengalir ke Kawasan Indonesia Timur kecil sekali, kurang dari 10 persen, suatu jumlah yang sangat kecil dibandingkan dengan luas wilayahnya.

Kolom pendapatan pada Tabel 5.4 menunjukkan pengganda pendapatan rumah tangga dan dampak seluruh kegiatan ekonomi yang disebabkan oleh kegiatan ekonomi pulau Jawa. Distribusi dampak menurut tipe, 42.2 persen merupakan dampak awal, dampak langsung sebesar 17.7 persen, dampak tidak langsung sebesar 12.3 persen dan imbasan konsumsi sebesar 27.8 persen, menghasilkan dampak bersih sebesar 57.8 persen. Secara spasial dampak bersih pendapatan terdistribusi ke pulau Sumatera 9.9 persen, pulau Jawa 81.9 persen, pulau Kalimantan 4.0 persen, Sulawesi dan Papua 3.4 persen, dan kurang dari 1 persen pendapatan terdistribusi ke kepulauan Nusa Tenggara.

Kolom tenaga kerja pada Tabel 5.4 menunjukkan pengganda kesempatan kerja dari ekonomi pulau Jawa. Pulau Jawa awalnya akan menciptakan 44,723 ribu kesempatan kerja, 18, 616 ribu orang akan memperoleh kesempatan kerja sebagai akibat putaran pertama, 12, 940 ribu pekerjaan akan muncul sebagai dampak tidak langsung dan 29, 740 ribu kesempatan kerja akan tersedia sebagai imbasan konsumsi. Dampak total tenaga kerja yang tercipta sebesar 106 ,018 kesempatan kerja, dengan dampak bersih sebesar 61,295 ribu kesempatan kerja.

Secara spasial dampak bersih kesempatan kerja akan terdistribusi ke pulau Sumatera 9.6 persen, pulau Jawa 49.6 persen, pulau Kalimantan 2.7 persen, kepulauan Nusa Tenggara 2.8 persen dan pulau Sulawesi dan Papua 4.5 persen. Dampak bersih kesempatan kerja yang tercipta di Kawasan Timur Indonesia hanya kurang dari 10 persen.

5. Keberartian Sektor Industri di Pulau Jawa

a. Keberartian Langsung

Tabel 5.5 menyajikan kontribusi langsung sektor industri di pulau Jawa (JAV-3) dalam perekonomian Indonesia. Kecuali kontribusinya dalam penyerapan tenaga kerja, semua kategori kontribusi langsung sektor industri di pulau Jawa menempati urutan pertama. Ini menunjukkan bahwa secara langsung, sektor industri di pulau Jawa mempunyai peranan sangat penting dalam perekonomian Indonesia. Bahkan, dua per tiga impor nasional digunakan oleh sektor industri di pulau Jawa.

Seperti telah dikemukakan, penelaahan kontribusi langsung masih kurang memadai dalam analisis keberartian ekonomi. Kontribusi total akan lebih bermanfaat, dan akan dibahas pada bagian berikut.

Tabel 5.5

Kontribusi Langsung Sektor Industri di Pulau Jawa dalam Perekonomian Indonesia

Kategori	Kontribusi (%)	Urutan
Output	24.7	1
Nilai tambah	11.7	1
Pendapatan rumah tangga	15.4	1
Konsumsi rumah tangga	22.4	1
Impor	68.0	1
Ekspor	31.0	1
Penjualan antara	27.5	1
Pembelian antara	33.6	1
Input primer	19.0	1
Permintaan akhir	22.8	1
Tenaga kerja	15.8	2

Sumber: Muchdie, 1998

Tabel 5.6

Kontribusi Total Sektor Industri di Pulau Jawa dalam Perekonomian Indonesia

Dampak	Output					
	Pengganda	Persen	Pengganda	Persen	Pengganda	Persen
Komponen Dampak						
- Awal	1.000	44.5	0.112	36.0	0.129	29.7
- Langsung	0.531	23.6	0.077	24.8	0.143	32.9
- Tidak langsung	0.267	11.9	0.042	13.4	0.064	14.7
- Imbasan konsumsi	0.450	20.0	0.080	25.8	0.099	22.7
- Total	2.248	100.0	0.310	100.0	0.436	100.0
- Luberan	1.248	55.5	0.198	64.0	0.307	70.3
- Rasio Luberan	-		1.775		2.372	

Dampak bersih sektoral

- Sektor-1	0.305	24.5	0.058	29.1	0.179	58.4
- Sektor-2	0.092	7.4	0.006	3.1	0.008	2.6
- Sektor-3	0.501	40.2	0.056	28.1	0.066	21.5
- Sektor-4	0.024	1.9	0.002	1.0	0.003	1.0
- Sektor-5	0.010	0.8	0.001	0.5	0.001	0.2
- Sektor-6	0.127	10.2	0.021	10.7	0.022	7.3
- Sektor-7	0.065	5.2	0.012	6.1	0.006	2.0
- Sektor-8	0.075	6.0	0.018	9.2	0.010	3.3
- Sektor-9	0.049	3.9	0.024	12.2	0.011	3.6
Total	1.248	100.0	0.198	100.0	0.307	100.0

Dampak bersih spasial

- Sumatera	0.126	10.1	0.015	7.7	0.022	7.3
- Jawa	1.047	83.9	0.170	85.7	0.269	87.8
- Kalimantan	0.044	3.5	0.009	4.6	0.005	1.7
- Nusa Tenggara	0.009	0.7	0.001	0.5	0.004	1.3
- Sulawesi dan Papua	0.022	1.8	0.003	1.5	0.006	2.0
Total	1.248	100.0	0.198	100.0	0.307	100.0

Sumber: Muchdie, 1998

b. Keberartian Total

Tabel 5.6 menyajikan kontribusi total sektor industri di pulau Jawa dalam perekonomian Indonesia. Sama dengan pada Tabel 5.2 dan Tabel 5.4, Bagian A Tabel 5.6 menyajikan komponen-komponen pengganda untuk sektor industri di pulau Jawa. Kolom pada Bagian B menyajikan komponen-komponen dampak bersih menurut sektor dan spasial.

Pada awalnya, dampak output sektor industri di pulau Jawa sebesar 1.000, yang menyebabkan dampak putaran pertama (dampak langsung) output sebesar 0.531 dan dampak tidak langsung sebesar 0.267 dan dampak imbasan konsumsi sebesar 0.450, menghasilkan dampak total sebesar 2.248, sehingga dampak bersihnya sebesar 1.248.

Secara sektoral (Bagian B Tabel 5.6), dampak bersih output ini terdistribusi ke sektor-3 sebesar 40.2 persen; sektor-1: pertanian, peternakan, kehutanan dan perikanan sebesar 24.5 persen; sektor-6: perdagangan, hotel dan restoran sebesar 10.2 persen; sektor-2: pertambangan dan galian sebesar 7.4 persen; sektor-8: bank dan lembaga keuangan lainnya sebesar 6.0 persen; sektor-7: transportasi dan komunikasi sebesar 5.2 persen; sektor-9: jasa-jasa lain sebesar 3.9 persen; sektor-4: listrik, air, dan gas sebesar1.9 persen dan sektor-5: konstruksi sebesar 0.8 persen.

Secara spasial (Bagian C Tabel 5.6), dampak bersih output sektor industri di pulau Jawa terdistribusi ke berbagai pulau di Indonesia, di mana 83.9 persen terjadi di pulau sendiri, pulau Jawa; 10.1 persen di pulau Sumatera; 3.5 persen di pulau Kalimantan; 1.8 persen di kepulauan Sulawesi dan Papua dan 0.7 persen di kepulauan Nusa Tenggara. Dampak bersih output sektor industri di pulau Jawa yang mengalir ke Kawasan Timur Indonesia hanya sekitar 6 persen, suatu proporsi yang sangat tidak berarti dibandingkan dengan luas wilayahnya.

Kolom pendapatan pada Tabel 5.6 menunjukkan pengganda dan dampak pendapatan yang diharapkan dari sektor industri di pulau Jawa. Peningkatan output sektor industri di pulau Jawa sebesar Rp. 1.000, mula-mula akan menciptakan pendapatan rumah tangga sebesar Rp. 112 (36%), dampak langsung sebesar Rp. 77 (24.8%), dampak tidak langsung sebesar Rp. 42 (13.4%),menghasilkan dampak total Rp. 310 (100%), sehingga dampak bersih yang tercipta sebesarRp. 198 (64.0%).

Secara sektoral, dampak bersih pendapatan sektor industri di pulau Jawa terdistribusi secara struktural ke berbagai sektor dalam perekonomian nasional:

29.1 persen ke sektor-1: pertanian, peternakan, kehutanan dan perikanan; 28.1 persen ke sektor-3: industri manufaktur; 12.2 persen ke sektor-9: jasa-jasa lainnya; 10.7 persen ke sektor-6: perdagangan, hotel dan restoran; 9.2 persen ke sektor-8: bank dan lembaga keuangan lainnya;6.1 persen ke sektor-7: transportasi dan komunikasi; 3.1 persen ke sektor-2: pertambangan dan galian; 1.0 persen ke sektor-4: listrik, air dan gas dan 0.5 persen ke sektor-5: konstruksi.

Secara spasial, dampak bersih pendapatan sektor industri di pulau Jawa terdistribusi ke berbagai pulau di Indonesia, di mana 85.7 persen terdistribusi di pulau Jawa; 7.7 persen terjadi di pulau Sumatera;4.6 persen di pulau Kalimantan; 1.5 persen ke pulau Sulawesi dan Papua dan 0.5 persen ke kepulauan Nusa Tenggara.

Kolom tenaga kerja pada Tabel 5.6 menunjukkan pengganda tenaga kerja sektor industri di pulau Jawa. Sektor tersebut mula-mula menciptakan 11,712 ribu kesempatan kerja; secara langsung tercipta 12,990 ribu kesempatan kerja dan secara tidak langsung tercipta 5,820 ribu kesempatan kerja, menghasilkan kesempatan kerja secara total 39, 496 ribu orang sehingga dampak bersihnya sebesar 27,784 ribu tenaga kerja. Secara sektoral, dampak bersih penciptaan lapangan kerja sektor industri di pulau Jawa terdistribusi ke berbagai sektor perekonomian Indonesia, di mana 58.4 persen pada sektor-1: pertanian, peternakan, kehutanan dan perikanan; 21.5 persen pada sektor-3: industri manufaktur; 7.3 persen ke sektor-6: perdagangan, hotel dan restoran; 3.6 persen ke sektor-9: jasa-jasa lainnya; 3.3 persen pada sektor-8: bank dan lembaga keuangan lainnya; 2.6 persen pada sektor-2: pertambangan dan galian; 2.0 persen ke sektor-7: transportasi dan komunikasi; 1.0 persen ke sektor-4: listrik, air dan gas; dan 0.3 persen ke sektor-5: konstruksi. Secara spatial, dampak bersih penciptaan lapangan kerja sektor industri di pulau Jawa tersebar ke berbagai wilayah, di mana 87.8 persen ke pulau Jawa; 7.3 persen ke pulau Sumatera; 2.0 persen ke kepulauan Sulawesi dan Papua; 1.7 persen ke pulau Kalimantan dan 1.3 persen ke kepulauan Nusa Tenggara.

6. Penutup

Menggunakan model IOAD, Bab ini telah membahas keberartian ekonomi (*economic significant*) sektor industri, pulau Jawa dan sektor industri di pulau Jawa dalam perekonomian Indonesia.

Secara langsung, sektor industri nasional mempunyai kontribusi yang sangat berarti dalam perekonomian Indonesia. Kinerja sektor industri nasional berada pada urutan pertama dalam hal output, konsumsi rumah tangga, impor, ekspor, penjualan antara, pembelian antara, dan permintaan akhir. Secara spasial, pulau Jawa mempunyai kontribusi langsung yang juga sangat penting dalam perekonomian nasional. Dalam semua kategori, pulau Jawa menempati urutan pertama.

Secara sektor-spasial, sektor industri di pulau Jawa mempunyai kontribusi langsung yang sangat berarti dalam perekonomian nasional. Sektor industri di pulau Jawa menempati urutan pertama di semua kategori: output, nilai tambah, pendapatan rumah tangga, konsumsi rumah tangga, impor, ekspor, penjualan-antara, pembelian-antara, input primer, permintaan akhir, dan penciptaan lapangan kerja.

Kontribusi total sektor industri, pulau Jawa dan sektor industri di pulau Jawa telah dibahas secara mendalam pada bab ini. Kontribusi dilihat dalam bentuk output, pendapatan dan kesempatan kerja. Kontribusi total sektor industri, pulau Jawa dan sektor industri di pulau Jawa dalam perekonomian nasional ditunjukkan dengan dampak awal, dampak langsung, dampak tidak langsung dan dampak terimbas. Kemudian, dampak bersih yang dihasilkan ditunjukkan distribusinya baik secara sektoral maupun secara spasial.

Dari pembahasan dapat disimpulkan bahwa sektor industri nasional, pulau Jawa dan sektor industri di pulau Jawa mempunyai tingkat keberartian yang tinggi dalam perekonomian Indonesia. Implikasi penting dari hasil analisis adalah: jika yang dikejar pertumbuhan ekonomi nasional, maka secara sektoral, sektor industri yang perlu mendapat prioritas pengembangan. Secara spasial, pembangunan pulau Jawa akan memberi kontribusi yang sangat berarti dalam pembangunan nasional. Lebih khusus, optimalisasi pengembangan sektor industri nasional harus dilakukan di pulau Jawa. Namun perlu ditekankan bahwa Kebijakan ini hanya dapat dilakukan jika pertumbuhan ekonomi dan efisiensi yang menjadi sasaran utama pembangunan. Bukan yang lain.

Daftar Pustaka

Biro Pusat Statistik, (1995), **Kerangka Teori dan Analisis Tabel Input-Output**, Biro Pusat Statistik, Jakarta.

Bayne, B.A and West G.R, (1989), **GRIT- Generation of Regional Input-Output Tables: User's Reference Manual**, Australian Government Publishing

Service, Canberra.

Blair, J.P (1991), **Urban and Regional Economics**, Irwin Publisher, Homewood, Illinois.

Boomsma, P and Oosterhaven, J, (1992), "A Double Entry Method for Construction of Bi-Regional Input-Output Tables", **Journal of Regional Science**, 32(3): 269-284.

Brucker, S.M, Hasting, S.E, and Latham III, W.R, (1987), "Regional Input-Output Analysis: Comparison of Five Ready-Made Model System", **Review of Regional Studies**, 17(2): 1-16.

Brucker, S.M, Hasting, S.E, and Latham III, W.R, (1990), "The Variation of Estimated Impacts from Five Regional Input-Output Models", **International Regional Science Review,** 13(1-2): 119-139.

Bulmer-Thomas, V, (1982), **Input-Output Analysis in Developing Countries**, John Willey & Sons, Chichester.

Chenery, H.B, (1956), "Inter-Regional and International Input-Output Analysis" **dalam** T. Barna (Eds), **The Structural Interdependence of the Economy**, John Willey & Sons Inc., New York, pp: 341-356.

Dewhurst, J.H.Li, (1991), "Using the RAS Technique as a Test of Hybrid Methods of Regional Input-Output Table Updating", **Regional Studies**, 26: 81-91.

Flagg, A.T, Webber, C.D, and Elliot, M.V, (1994), "A New Approach to the Use of the Location Quotients in Building a Regional Input-Output Model Using National Data" Paper Presented at **the 25th Annual Conference of the Regional Science Association International (British and Irish Section)**, Trinity College, Dublin.

Flagg, A.T, Webber, C.D, and Elliot, M.V, (199), "On the Appropriate Use of the Location Quotients in Generating Regional Input-Output Tables", **Regional Studies**, 29: 547-561.

Hartwick, (1971), "Notes on the Isard and Chenery Moses Inter-Regional Input-Output Models", **Journal of Regional Science**, 11(1): 73-86.

Hewings, G.J.D, and Jensen, R.C, (1986), "Regional, Inter-Regional and Multi-Regional Input-Output Analysis", **in** Nijkamp, P (Eds**), Handbook of Regional and Urban Economics**, Vol.1, Elsevier Publishers, North Holland, Amsterdam.

Hill, H, (1994), **Indonesia's New Order: The Dynamics of Socio-Economic Transformation**, Allen & Unwin, St. Leonards, NSW, Australia.

Hill, H, (1996), **The Indonesian Economy since 1986: South-East Asia's Emerging Giant**, Cambridge University Press, Melbourne, Australia.

Hulu, E, (1990), **Model Input-Output: Teori dan Aplikasi**, Pusat Antar Universitas (PAU) Studi Ekonomi, Universitas Indonesia, Jakarta.

Isard, W, (1951), "Inter-Regional and Regional Input-Output Analysis: A Model of a Space-Economy, Review of Economics", **Review of Economics and Statistics**, 33(4): 318-326.

Jensen, R.C, Mandeville, T.D and Karunaratne, N.D, (1979), **Regional Economic Planning: Generation of Regional Input-Output Analysis**, Croom Helm, London.

Jensen, R.C, (1980), "The Concepts of Accuracy in Regional Input-Output Models", **International Regional Science Review**, 5(2): 139-154.

Jensen, R.C, (1990), "Construction and Use of Regional Input-Output Models", **International Regional Science Review**, 13(1-2): 9-25.

Lahr, M.L, (1992), **An Investigation into Methods for Producing Hybrid Regional Input-Output Tables**, University Microfilms International, Ann Arbor, Michigan.

Leontief, W.W, and Strout, A, (1963), "Multi-regional Input-Output Analysis", **in** T. Barna, (Ed), **Structural Interdependence and Economic Development**, Macmillan, London.

McCawley, P, (1981), "The Growth of the Industrial Sector" in Booth, A and McCawley, P (Eds), **The Indonesian Economy during the Suharto Era**, Oxford University Press, Kuala Lumpur, pp: 62-101.

McMenamin, D.G and Haring, J.E, (1974), "An Appraisal of Non-Survey Techniques for Estimating Regional Input-Output Models", **Journal of Regional Science**, 14(2): 191-205.

Miller, R.E and Blair, P.D, (1985), **Input-Output Analysis: Foundation and Extensions**, Englewood Clifts, Prentice-Hall, New Jersey.

Moses, L.N, (1955), "The Stability of Inter-Regional Trading Pattern and Input-Output Analysis", **American Economic Review**, 45(5); 803-832.

Moses, L.N, (1960), "A General Equilibrium Model of Production, Inter-Regional Trade and Location on Industry", **Review of Economics and Statistics**, 42(4): 373-397.

Muchdie, (1998), **Spatial Structure of the Island Economy of Indonesia: An Inter-Regional Input-Output Study**, unpublished PhD Thesis submitted to the Department of Economics, the University of Queensland, St. Lucia, Brisbane, Australia.

Muchdie, (1998a), “Teknik Hibrida dalam Penyusunan Tabel Input-Output AntarDaerah: Sebuah Prosedur untuk Ekonomi Kepulauan”, **Ekonomi dan Keuangan Indonesia**, 46(1): 117-145.

Muchdie, (1998b), “Pemodelan Struktur Ruang Ekonomi Indonesia: Penerapan Prosedur GIRIOT untuk Menyusun Tabel Input-Output AntarDaerah”, **Ekonomi dan Keuangan Indonesia**, 46(3): 279-305.

Ngo, Jazayeri and Richardson, (1987), “Regional Policy Simulation with an Inter-Regional Input-Output Model of the Philippines”, **Regional Studies**, 21(2): 121-129.

Oosterhaven, J., 1981, **Interregional Input-Output Analysis and Dutch Regional Policy Problems,** Gower Publishing Company, England.

Pibbs, P.J and Holsman, A.J, (1982), “Estimating Input-Output Multipliers: A New Hybrid Approach”, **Environment and Planning A**, 14: 335-342.

Polenske, K.R,(1970),”Empirical Implementation of a Multi-regional Input-Output Gravity Trade Model” in A. P. Carter and A. Brody (Ed), **Contributions to Input-Output Analysis**, North Holland Publishing, Amsterdam, pp: 143-163.

Polenske, KR,(1995), “Leontief’s Spatial Economic Analysis”, **Structural Change and Economic Dynamics**, 6: 309-318.

Richardson, H.W, (1969), **Element of Regional Economics**, Penguin, Harmondsworth.

Richardson, H.W, (1972), **Input-Output and Regional Economics**, John Willey & Sons, New York.

Richardson, HW, (1985), “Input-Output and Economic Base Multipliers: Looking Backward and Forward”, **Journal of Regional Science,** 25(4): 607-661.

Round, J.I, (1978), “An Inter-Regional Input-Output Approach to the Evaluation of Non-Survey Methods”, **Journal of Regional Science**, 18: 179-194.

Round, J.I, (1983), “Non-Survey Techniques: A Critical Review of the Theory and the Evidence”, **International Regional Science Review**, 8(3): 189-212.

Schaffer, W.A and Chu, K, (1969), “Non-Survey Techniques for Constructing

Regional Inter-Industri Models" **Papers of Regional Science Association**, 23: 83-101.

Schaffer, W.A, Laurent, E.A and Sutter, E.M, (1972), **Introducing the Georgia Economic Model**, Georgia Department of Industry and Trade.

Smith, P and Morrison, W.J, (1974), **Simulating the Urban Economy**, Pion Press, London.

Stevens, B.H, Treyz, G.I, Ehrlich, D.J, and Bower, J.R (1983), "A New Technique for Construction of Non-Survey Regional Input-Output Models", International Regional Science Review, 8(3): 271-286.

Soehoed, A.R, (1967), "Manufacturing in Indonesia", **Bulletin of Indonesian Economic Studies**, 8: 65-84.

Toyomane, N, (1988), **Multi-Regional Input-Output Models in Long Term Simulation**, Kluwer Academic Publishers, Dordrech/Boston/Lancaster.

West, G.R, (1986), **Alternative Construction Procedures for A State Input-Output Table**, Report to Centre for Economic Analysis and Statistics, West Virginia University.

West, G.R, (1990), "Regional Trade Estimation: A Hybrid Approach", **International Regional Science Review**, 13(1-2): 103-118.

West G.R, Morison, J.B. and Jensen, R.C., 1982,**An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

West, G.R, and Jensen, R.C, (1988), "Regional Input-Output Modelling: GRIT and GRIMP" in Newton, P, Taylor, M and Sharp, R (Eds), **Desktop Planning**, Hargen Publishing, Melbourne, pp: 185-194.

West, G.R, Jensen, R,C, Cheeseman, W.E, Bayne, B.A, Robinson J.J, Jancic,H and Garhart, R.E, (1989), **Regional and Inter-Regional of Input-Output Tables for Queensland 1985/1986**, Report to the Queensland Treasury Department, Department of Economics, the University of Queensland, St. Lucia.

Chapter-6

Spatial Dimension of Multiplier in Sumatera Island Economy[1]

Ringkasan

Bab ini menyajikan hasil analisis angka pengganda dan efek mengalir: total, sektor-spesifik dan spatial-spesifik dalam perekonomian di pulau Sumatera. Model yang digunakan adalah Model Input-Output Antar-Pulau (MIOAP) yang dikembangkan menggunakan metode hibrida yang dikembangkan secara khusus untuk perekonomian kepulauan. Awalnya, model ini diaplikasikan untuk data Indonesia tahun 1995 dan diperbarui menggunakan data tahun 2015. Hasilnya menunjukkan bahwa pertama, sektor-sektor penting dalam perekonomian pulau Sumatera dapat ditentukan berdasarkan angka pengganda dan efek mengalir, baik output, pendapatan maupun kesempatan kerja. Kedua, sektor-sektor penting dalam perekonomian pulau Sumatera dapat ditentukan berdasarkan pengganda sektor-spesifik; pengganda yang terjadi di sektor sendiri dan di sektor lain. Ketiga, sektor-sektor penting dalam perekonomian pulau Sumatera dapat ditentukan berdasarkan pengganda spatial-spesifik; pengganda yang terjadi pada pulau Sumatera dan pulau lain. Keempat, sektor-sektor penting dalam perekonomian pulau Sumatera dapat ditentukan berdasarkan distribusi spatial efek mengalir; efek mengalir yang terjadi di pulau Sumatera dan pulau lain.

Summary

This chapter provides the results of analysis of total, sectoral-specific, and spatial-specific multipliers and flow-on effects in Sumatera Island economy. The model

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employed was Inter-Island Input-Output Model (IRIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Sumatra Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.

1. Introduction

Sumatra (Indonesian: Sumatera) is one of large island in Indonesia and the sixth-largest island in the world at 473,481 km2, including adjacent islands such as the Riau Islands and Bangka Belitung Islands. Sumatra is an elongated landmass spanning a diagonal northwest-southeast axis. The Indian Ocean borders the west, northwest, and southwest sides of Sumatra with the island chain of Simeulue, Nias and Mentawai bordering the southwestern coast. On the northeast side the narrow Strait of Malacca separates the island from the Malay Peninsula, an extension of the Eurasian continent. On the southeast the narrow Sunda Strait separates Sumatra from Java. The northern tip of Sumatra borders the Andaman Islands, while on the lower eastern side are the islands of Bangka and Belitung, Karimata Strait and the Java Sea (Wikipedia, 2016, https://en.wikipedia.org/wiki/Sumatra)

The ten administrative Provinces of Sumatra – including the smaller islands nearby – are: Nangroe Aceh Darussalam, a special province with Capital City Banda Aceh, North Sumatra with Capital City Medan, West Sumatra with Capital City Padang, Riau with Capital City Pekanbaru, Jambi with Capital City Jambi, South Sumatra with Capital City Palembang, Bengkulu with Capital City Bengkulu, Lampung with Capital City Bandar Lampung, Bangka-Belitung with Capital City Pangkal Pinang, and Riau Islands with Capital City Tanjung Pinang. Note some 4 million of these residents of Sumatra do not live on the island itself—but on nearby islands administered collectively as “Sumatra”. The final two of the provinces below do not have territory on the actual island (Anonymous, 2015).

According to Prihawantoro, S., et al (2013), the main economic activities in Sumatra Island were Sector-1 Agriculture, livestock and fishery (Nangroe Aceh Darussalam, North Sumatra, West Sumatra, Jambi, Bengkulu, Lampung), Sector-2 Mining and quarrying (Riau Mainland, Riau Island, South Sumatra), Sector-3 Manufacturing (North Sumatra, Riau Mainland, South Sumatra, Bangka-Belitung), and Sector-6 Trade, hotel and restaurant (North Sumatra, Riau Island). Based on the statistical data by the year of 2013 which is released by Badan Pusat Statistik, Sumatra Island itself contributes at about 20% of Indonesia's Gross Domestic Product (Anonymous, 2015).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (see among others: Dornbusch, R., & Stanley, F., 1994; McConnell, C., et. al, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (see among others: Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes (such as lump-sum taxes or proportional taxes).

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's (1931) description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioral assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief (1951), who developed a set of national-level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard (1951) then applied input-output analysis to a regional economy. According to Richardson (1985), the first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson (1955) for the state of Utah. In a parallel development, Tiebout (1956) specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending.

In a survey of input-output and economic base multipliers, Richardson (1985) notes the difficulty inherent in specifying the local share of spending. He notes the growth of survey-based regional input-output models in the 1960s and 1970s that allowed for more accurate estimation of local spending, though at a large cost in terms of resources. To bridge the gap between resource intensive survey-based multipliers and "off-the-shelf" multipliers, Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Three other papers on the general topic of the use and misuse of regional multipliers are briefly noted. Grady & Muller (1988) argued that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) noted the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discussed the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Additional papers focus on the uses and misuse of regional multipliers for particular types of studies. Harris (1997) discussed the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, et al, (2006) discussed the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused. Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific, so they can further be used for planning and evaluating regional economic development in Sumatera Island.

2. Method of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990 and West et.al, 1982; 1989). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$^{r}X_{i} = \sum_{j}\sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \ (i, j = 1, 2,\ldots,n) \text{ and } (r, s = 1,2,\ldots,m) \quad (1)$$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions.

The spatial input coefficients are derived in the same way as the direct input coefficients in the national or the single-region model. For region s, the spatial input coefficients are expressed as:

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \quad (2)$$

Substituting (2) into (1):

$$^{r}X_{i}= \sum_{j}\sum_{s} {}^{rs}a_{ij}\,{}^{s}X_{j} + \sum_{s} {}^{rs}Y_{i}; \ (i, j = 1,2,\ldots,n) \text{ and } (r ,s = 1,2,\ldots, m) \quad (3)$$

Since equations (1) to (3) refer to general case, it is more convenient to refer specifically to each of the intra-regional and the inter-regional matrices:

$$^{r}X_{i} = \sum_{j} {}^{rr}X_{ij} + \sum_{j} {}^{rs}X_{ij} + {}^{r}Y_{i}; \ (i, j = 1, 2,\ldots, n) \quad (4)$$

and

$$^{s}X_{i} = \sum_{j} {}^{sr}X_{ij} + \sum_{j} {}^{ss}X_{ij} + {}^{s}Y_{i}; \ (i, j = 1, 2,\ldots, n) \quad (5)$$

From (4) and (5), it is possible to determine regionally defined input coefficients, according to the relevant intra-regional and inter-regional trade matrices:

$$^{rr}a_{ij} = {}^{rr}X_{ij}/{}^{r}X_{j} \quad (6)$$

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \quad (7)$$

$$^{sr}a_{ij} = {}^{sr}X_{ij}/{}^{r}X_{j} \quad (8)$$

$$^{ss}a_{ij} = {}^{ss}X_{ij}/{}^{s}X_{j} \quad (9)$$

Equations (6) and (9) present the familiar intra-regional direct input coefficients, while equations (7 and (8 represent inter-regional trade coefficients.

Equations (6) to (9) can be substituted into equation (4) and (5) resulting the traditional input-output equations:

$$ {}^{r}X_i = \sum_j {}^{rr}a_{ij}{}^{r}X_j + \sum_j {}^{rs}a_{ij}{}^{s}X_j + {}^{r}Y_i \; ; (i, j = 1,2,\ldots, n) \tag{10} $$

and

$$ {}^{s}X_i = \sum_j {}^{sr}a_{ij}{}^{r}X_j + \sum_j {}^{ss}a_{ij}{}^{s}X_j + {}^{s}Y_i \; ; (i, j = 1,2,\ldots,n) \tag{11} $$

The equations outlined above can be extended in parallel to the national or single region input-output system. In matrix terms they can be expressed as:

$$ {}^{r}x = {}^{rr}A\, {}^{r}x + {}^{r}y \text{ or } {}^{r}x = (I - {}^{rr}A)^{-1}\,{}^{r}y \tag{12} $$

and

$$ {}^{s}x = {}^{ss}A\,{}^{s}x + {}^{s}y \text{ or } {}^{s}x = (I - {}^{ss}A)^{-1}\,{}^{s}y \tag{13} $$

where $(I - {}^{rr}A)^{-1}$ and $(I - {}^{ss}A)^{-1}$ are the inverse of the open inter-regional model. In general term, equation (12) and (13) can be written as:

$$ x = Ax + y \text{ or } x = (I - A)^{-1}y \tag{14} $$

Since the regional input coefficients of equations (6) to (9) or the A matrix in equation (13) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model. Equation (13) can then be rewritten as:

$$ x = T\,(A\,x + y) \text{ or } x = (I - T\,A)^{-1}y \tag{15} $$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportation and communication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West et.al, (1982; 1989) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 6.1.

DiPasquale & Polenske (1980) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region.

Table 6.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Source: West, *et.al* (1982; 1989).

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

Table 6.2

Inter-regional Sector-Specific and Region-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij} {}^{s}h_i$; r = 1,..m	$\sum {}^{rs}b^*_{ij} {}^{s}e_i$; r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij}$; i = 1,..n	$\sum {}^{rs}b^*_{ij} {}^{s}h_i$; i = 1,..n	$\sum {}^{rs}b^*_{ij} {}^{s}e_i$; i = 1,..n

Source: DiPasquale & Polenske (1980).

Note : *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

Formula provided in Table 6.1 and Table 6.2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

3. Results and Discussion

a. Total Multipliers and Flow-on Effects

Table 6.3 present total output, income and employment multipliers and flow-on effects in Sumatra Island. In term of output, the highest output multipliers was SUM-4 (Electricity, water and gas), 2.761. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.761 including the initial increase of 1.000. It was followed by SUM-9 (Other services), 2.542 meaning that an increase of final demand of that sector by 1.000 would increase total output by 2.542 including the initial increase of 1.000. The lowest total multipliers was in SUM-2 (Mining and quarrying), 1.241. An increase of final demand of that sector by 1.000 units would increase total output by 1.241 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (SUM-4) the flow-on effect was 1.761, meaning the impact of increase of final demand of SUM-4 (Electricity, water and gas) to total output was 1.761 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Sumatra Island economy showed that the rank of total multipliers were the same as flow-on effects where SUM-4 (Electricity, water and gas) had the highest output flow-on effects, followed by SUM-9 (Other services) and the lowest value of output flow-on effects was SUM-2 (Mining and quarrying).

Table 6.3

Multipliers and Flow-on Effects: Output, Income and Employment

SECTOR	Initial	Output Flow-on	Total	Initial	Income Flow-on	Total	Initial	Employment Flow-on	Total
SUM-1	1.000	0.804	1.804	0.203	0.174	0.331	0.496	0.174	0.670
SUM-2	1.000	0.241	1.241	0.039	0.044	0.082	0.116	0.044	0.160
SUM-3	1.000	1.088	2.088	0.087	0.256	0.237	0.113	0.256	0.369
SUM-4	1.000	1.761	2.761	0.091	0.290	0.310	0.116	0.290	0.406
SUM-5	1.000	1.515	2.515	0.165	0.293	0.383	0.063	0.293	0.356
SUM-6	1.000	0.939	1.939	0.176	0.204	0.335	0.106	0.204	0.310
SUM-7	1.000	1.395	2.395	0.182	0.260	0.433	0.092	0.260	0.352
SUM-8	1.000	1.108	2.108	0.243	0.211	0.445	0.116	0.211	0.327
SUM-9	1.000	1.542	2.542	0.553	0.336	0.815	0.217	0.336	0.553

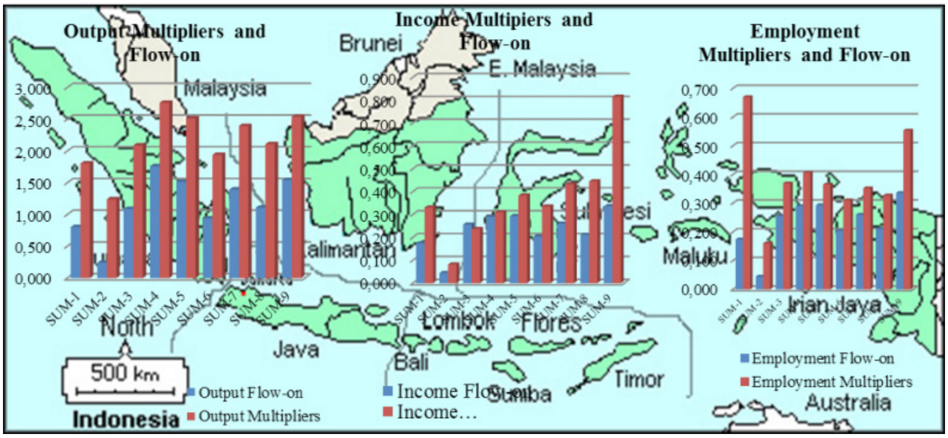

Figure 6.1

Multipliers and Flow-on Effects: Output, Income and Employment

In term of household income, the highest total income multiplier was in SUM-9 (Other services), 0.815. It means that an increase of final demand of SUM-9 (Other services) by 1.000 units would increase initial household income by 0.553 and then would increase total income by 0.815. It was followed by SUM-8 (Banking and other finance) with total income multipliers of 0.445. The lowest total income multiplier was, again, in SUM-2 (Mining and quarrying) with total income multipliers of 0.082. Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in SUM-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.553, resulting total income of 0.815. The income flow-on effect of SUM-9 (Other services) was 0.336. The highest income flow-on effect was in SUM-9 (Other services), followed by SUM-5 (Construction). The lowest income flow-on effect was in, again, SUM-2 (Mining and quarrying).

In term of employment, the highest total employment multiplier was in SUM-1 (Agriculture, livestock and fishery), 0.670. It means that an increase of final demand of SUM-1 (Agriculture, livestock and fishery) by 1.000 units would increase initial employment of SUM-1 (Agriculture, livestock and fishery) by 0.496 and then would increase total employment by 0.670. It was followed by SUM-9 (Other services) with total employment multipliers of 0.553. The lowest total employment multiplier was, again, in SUM-2 (Mining and quarrying) with total employment multipliers of 0.160. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in SUM-9 (Other services), followed by SUM-5 (Construction). The lowest income flow-on effect was in, again, SUM-2 (Mining and quarrying).

b. Sector-Specific Multipliers

Table 6.4 and also Figure 6.2 provide sector-specific multipliers for output, income and employment in Sumatra Island economy. In term of output, there were 4 sectors in which multipliers occurred in own sector were less than 50 per cent, namely SUM-4 (Electricity, water and gas), SUM-5 (Construction), SUM-7 (Transportation and communication) and SUM-9 (Other services).

Meanwhile, other 5 sectors in which multipliers occurred in own region were more than 50 per cent. These were: SUM-1 (Agriculture, livestock, forestry and fishery), SUM-2 (Mining and quarrying), SUM-3 (Manufacturing), SUM-6 (Trade, hotel and restaurant), and SUM-8 (Banking and other finance).

Table 6.4

Sector-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total
SUM-1	1.202	0.602	1.804	0.243	0.088	0.331	0.599	0.071	0.670
SUM-2	1.018	0.223	1.241	0.039	0.043	0.082	0.118	0.042	0.160
SUM-3	1.237	0.851	2.088	0.107	0.130	0.237	0.140	0.229	0.369
SUM-4	1.228	1.533	2.761	0.111	0.199	0.310	0.142	0.264	0.406
SUM-5	1.012	1.503	2.515	0.167	0.216	0.383	0.064	0.292	0.356
SUM-6	1.108	0.831	1.939	0.194	0.141	0.335	0.064	0.246	0.310
SUM-7	1.192	1.203	2.395	0.217	0.216	0.433	0.110	0.242	0.352
SUM-8	1.169	0.939	2.108	0.284	0.161	0.445	0.136	0.191	0.327
SUM-9	1.088	1.454	2.542	0.601	0.214	0.815	0.236	0.317	0.553

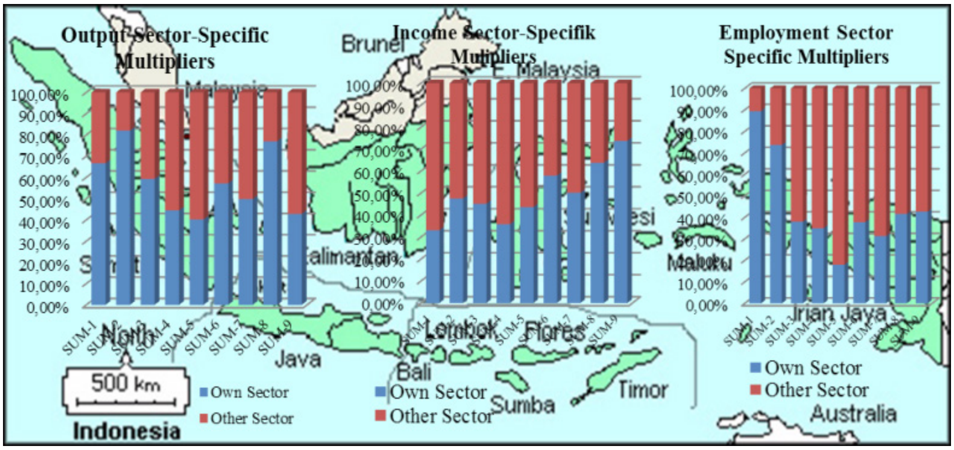

Figure 6.2

Sector-Specific Multipliers: Output, Income and Employment

In term of income, there were 6 sectors in which multipliers occurred in own region were less than 50 per cent, namely SUM-1 (Agriculture, livestock and fishery), SUM-2 (Mining and Quarrying), SUM-3 (Manufacturing), SUM-4 (Electricity, water and gas), SUM-5 (Construction) and SUM-7 (Transportation and communication). Meanwhile, other 3 sectors in which multipliers occurred in own region were more than 50 per cent. These sectors were: SUM-6 (Trade, hotel and restaurant), SUM-8 (Banking and other finance) and SUM-9 (Other services).

In term of employment, there were 7 sectors in which multipliers occurred in own sector were less than 50 per cent, namely SUM-3 (Manufacturing), SUM-4 (Electricity, water and gas), SUM-5 (Construction), SUM-6, SUM-7 (Transportation and communication), SUM-8 and SUM-9 (Other services). Meanwhile, only 2 sectors in which multipliers occurred in own sectors were more 50 per cent multipliers. These sectors were: SUM-1 (Agriculture, livestock, forestry and fishery), and SUM-2 (Mining and quarrying).

c. Spatial-Specific Multipliers

Table 6.5

Spatial-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
SUM-1	1.723	0.081	1.804	0.317	0.014	0.331	0.644	0.026	0.670
SUM-2	1.217	0.024	1.241	0.078	0.004	0.082	0.154	0.006	0.160
SUM-3	2.021	0.067	2.088	0.226	0.011	0.237	0.347	0.022	0.369
SUM-4	2.613	0.148	2.761	0.282	0.028	0.310	0.366	0.040	0.406
SUM-5	2.333	0.182	2.515	0.351	0.032	0.383	0.305	0.051	0.356
SUM-6	1.832	0.107	1.939	0.316	0.019	0.335	0.277	0.033	0.310
SUM-7	2.279	0.116	2.395	0.412	0.021	0.433	0.315	0.037	0.352
SUM-8	1.914	0.194	2.108	0.409	0.036	0.445	0.275	0.052	0.327
SUM-9	2.284	0.258	2.542	0.769	0.046	0.815	0.473	0.80	0.553

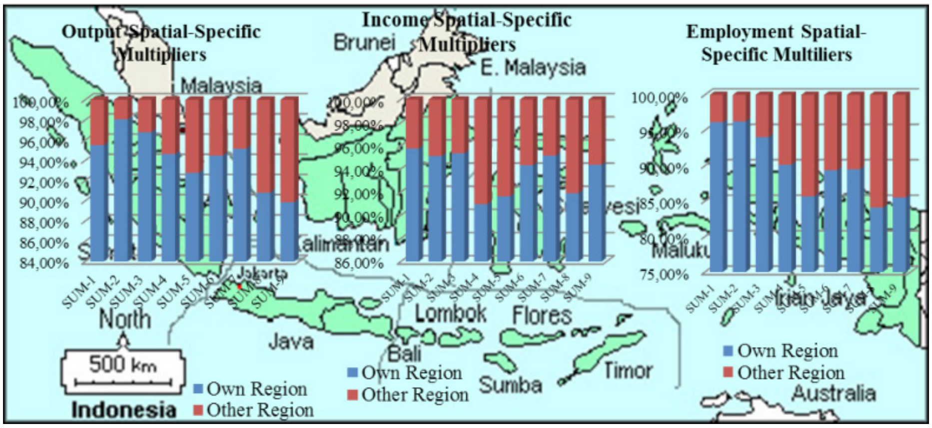

Figure 6.3

Spatial-Specific Multipliers: Output, Income and Employment

Table 6.5 and Figure 6.3 provide spatial-specific multipliers of output, income and employment multipliers in Sumatra. In term of output, all sectors had more than 50 per cent of multipliers that occurred in own region; in Sumatra Island. All sectors had less than 50 per cent of multipliers that occurred in other regions; other Islands. It applied for income. All sectors had more than 50 per cent of multipliers that occurred in own region; Sumatra Island. All sectors had less than 50 per cent of multipliers occurred in other regions; the rest of Indonesia. In term of employment, all sectors had more than 50 per cent of multipliers that occurred in own region; Sumatra Island. Again, all sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia. ‘

d. Spatial Distribution of Flow-on

Flow-on effects are the difference between total effects (total multipliers) and initial effect. It consists of direct effects, indirect effect and induced effects of a change in final demand. As Table 6.3 and Figure 6.1 provided the total flow-on effects for every spatial sector in Sumatra Island, Table 6.6 and Figure 6.4 presents spatial distribution of flow-on effects in Sumatra Island economy. In term of output, all sectors had more than 50 per cent of flow-on occurred in own region. It means that, in all sectors, flow-on effects that occurred in other regions were less than 50 per cent. The highest output flow-on effect that occurred in other regions was in SUM-8 (Banking and other finance), followed by SUM-9 (Other services) and SUM-5 (Construction). The lowest output flow-on effect that occurred in other regions was in SUM-3 (Manufacturing).

Table 6.6

Spatial Distribution of Flow-on: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
SUM-1	90,00%	10,00%	0.804	90,50%	9,50%	0.128	85,50%	14,50%	0.174
SUM-2	90,00%	10,00%	0.241	97,50%	2,50%	0.043	88,40%	11,60%	0.044
SUM-3	93,80%	6,20%	1.088	93,30%	6,70%	0.150	92,50%	7,50%	0.256
SUM-4	91,60%	8,40%	1.761	88,80%	11,20%	0.219	87,40%	12,60%	0.290
SUM-5	88,00%	12,00%	1.515	85,70%	14,30%	0.218	82,90%	17,10%	0.293
SUM-6	88,60%	11,40%	0.939	90,90%	9,10%	0.159	84,20%	15,80%	0.204
SUM-7	91,70%	8,30%	1.395	93,50%	6,50%	0.251	86,40%	13,60%	0.260
SUM-8	82,50%	17,50%	1.108	83,80%	16,20%	0.202	76,10%	23,90%	0.211
SUM-9	83,30%	16,70%	1.542	83,10%	16,90%	0.262	76,90%	23,10%	0.336

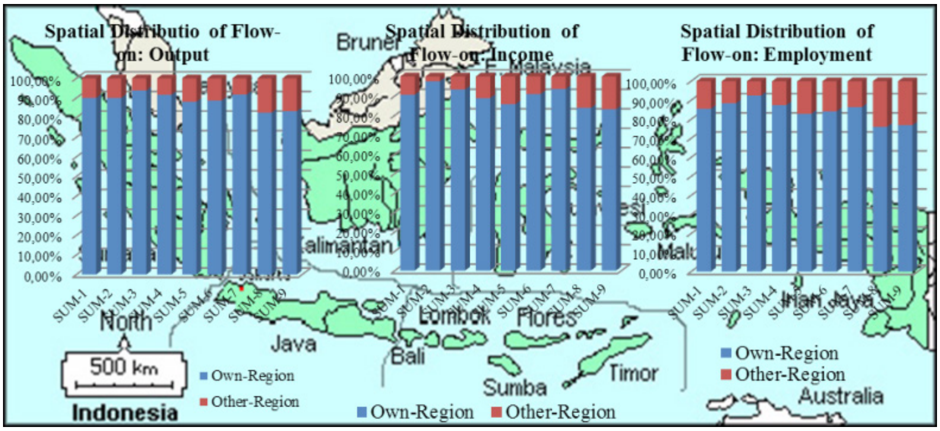

Figure 6.4

Spatial Distribution of Flow-on: Output, Income and Employment

The same case also applies in income flow-on effects. All sectors had flow-on effects that more than 50 per cent of the flow-on occurred in own region. The flow-on effects that occurred in other regions were less than 50 per cent. The highest income flow-on effect that occurred in other regions was in SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-5 (Construction). The lowest income flow-on that occurred in other regions was in SUM-2 (Mining and quarrying).

In term of employment, again, all sector had employment flow-on that occurred in own region more than 50 per cent. All sectors had the flow-on effects that occurred in other regions were less than 50 per cent. The highest employment flow-on effect that occurred in other regions were in SUM-9 (Other services), SUM-8 (Banking and other finance) SUM-5 (Construction) and the lowest employment flow-on that occurred in other regions was in SUM-3 (Manufacturing).

4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Sumatra Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services) and SUM-5 (Construction). Based on total income multipliers, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Sumatra Island economy were SUM-1 (Agriculture, livestock, forestry and fishery), SUM-9 (Other services) and SUM-4 (Electricity, water and gas). Based on output flow-on effects, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services), and SUM-5 (Construction). Based on income flow-on effects, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Electricity, water and gas). Based on employment flow-on effects, three important sectors were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Manufacturing).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were SUM-2 (Mining and quarrying), SUM-1(Agriculture, livestock, and fishery) and SUM-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were SUM-9 (Other services), SUM-1 (Agriculture, livestock and fishery) and SUM-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were SUM-1 (Agriculture, livestock and fishery), SUM-2 (Mining and quarrying) and SUM-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Sumatra Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were SUM-2 (Mining and quarrying), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were SUM-1 (Agriculture, livestock and fishery), SUM-6 (Trade, hotel and restaurant) and SUM-8 (Banking and other finance).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Sumatra Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other services) and SUM-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other service) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were SUM-3 (Manufacturing), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant).

References

Anonymous, 2015, **Statistik Indonesia 2014**, Badan Pusat Statistik, Jakarta.

Ahiakpor, J.C.W. (2000),"Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance?", **History of Political Economy**, 32 (4): 889-908.

https://muse.jhu.edu/article/13245/pdf

Beemiller, R.M. (1990), "Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque", **International Regional Science Review**, 13 (1-2):99-101.

http://journals.sagepub.com/doi /abs/10.1177/016001769001300107

Coughlin, C. and Mandelbaum, T.B. (1991),"A Consumer's Guide to Regional Economic Multipliers", **Federal Reserve Bank of St. Louis Review**, January/ February 1991, p: 19-32.

https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-to-regional-economic-multipliers/

DiPasquale, D. and Polenske, K.R. (1980), "Output, Income and Employment Input-Output Multipliers", in **S. Pleeter. (Ed). Economic Impact Analysis: Methodology and Applications: Studies in Applied Regional Science**. Boston: Martinus Nijhoff Publishing: 85-113.

Dornbusch, R. and Stanley, F. (1994), **Macroeconomics,** Sixth Edition, International Edition, McGraw-Hill.

Grady, P. and Muller, R., A. (1988),"On the use and misuse of input-output based impact analysis in evaluation", **The Canadian Journal of Program Evaluation**, 2 (3): 49-61.

https://www.researchgate.net/publication/43126426_On_The_Use_and_Misuse_of_Input-Output_Based_Impact_Analysis_in_Evaluation

Hall, R. E. (2009). "By How Much Does GDP Rise if the Government Buys More Output?", **NBER Working Paper 15496**, National Bureau of Economic Research.

www.nber.org/papers/w15496.pdf?new_window=1

Harris, P. (1997),"Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry", **The Journal of Tourism Studies**, 8(2): 1-12.

http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impact-multipliers-by-practitioners.html

Hughes, D. W. (2003), **Policy uses of economic multipliers and impact analysis**, Choices Publication of the American Agricultural Economics Association, Second Quarter.

http://www.choicesmagazine.org/2003-2/2003-2-06.htm

Hulu, E. (1990), **Model Input-Output: Teori dan Applikasinya (*Input-Output Model: Theory and Its Applications*)**, Pusat Antar Universitas-Studi Ekonomi (Inter-University Centre-Economics) Jakarta: Universitas Indonesia (the University of Indonesia).

Isard, W. (1951),"Inter-regional and Regional Input-Output Analysis: A Model of a Space-Economy", **Review of Economics and Statistics**, 33(4): 318-328.

http://www.jstor.org/stable/1926459

Kahn, R. (1931),"The Relation of Home Investment to Unemployment", Economic **Journal**, 41(162):173-198. http://dx.doi.org/10.2307/2223697

Krugman, P., and Wells, R. (2009), **Economics**, Worth Publisher, p: 1200, Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier, p: 393–396.

http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECPS3e_Macro_CH14.pdf

Leontief, W.W. (1951). **The Structure of American Economy 1919-1939**. Second Edition, Cambridge: Harvard University Press.

http://www.wleontief.ru/eng/40.html

Mankiw, N.G. (2008), **Macroeconomics**, Eight Edition, South-Western Publishing, Part VI: Money and Prices in the Long Run: The Money Multiplier, p:347–349.

https://www.academia.edu/15354353/Mankiw_macroeconomics_8th_ edition

McConnell, C, Brue, S, and Flynn, S. (2011), **Macroeconomics**, McGraw-Hill Series Economics, 19th Edition. ISBN-13: 978-0077337728, ISBN-10: 0077337727.

https://www.amazon.com/Macroeconomics-McGraw-Hill-Economics-Campbell-McConnell/dp/0077337727

Mills, E. C. (1993),"The Misuse of Regional Economic Models", **Cato Journal**, 13(1): 29-39.

https://ideas.repec.org/a/cto/journl/v13y1993i1p29-39.html

Moore, F.T, and Petersen, J. (1955),"Regional Analysis: An Inter-industry Model of Utah", **Review of Economics and Statistics**, 37: 368-383.

http://www.jstor.org/stable/1925851?seq=1#page_scan_tab_contents

Muchdie, (1998), **Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study**, unpublished PhD Thesis, Department of Economics, the University of Queensland, Australia.

http://espace.library.uq.edu.au/view/UQ:218710

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables**, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6.

Pindyck, R. and Rubinfeld, D. (2012), **Macroeconomics**, The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X

https://www.amazon.com/Microeconomics-Student-Value-Pearson-Economics/dp/0132870436

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana, (2013),**Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach)**, Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Richardson, H.W. (1985), "Input-Output and Economic Base Multipliers: Looking Backward and Forward", **Journal of Regional Science**, 25 (4): 607-661.

http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1985.tb00325.x/abstract

Siegfried, J, Allen R., Sanderson, A.R., and McHenry, P. (2006), "The Economic Impact of Colleges and Universities", **Working Paper No. 06-W12**,

http://www.accessecon.com/pubs/VUECON/vu06-w12.pdf

Tiebout, C.M. (1956), "A Pure Theory of Local Expenditures", **The Journal of Political Economy**, 64(5): 416-424. http://www.jstor.org/stable/1826343

West, G.R, and Jensen, R.C. (1980), "Some Reflections on Input-Output Multipliers", **Annals of Regional Science**, 14 (2): 77-89.

https://www.researchgate.net/publication/226244596_Some_Reflections_on_Input-Output_Multipliers

West, G.R., and Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., 1989, **Regional and Inter-regional Input-Output Tables for Queensland 1985/86**, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia.

https://www.library.ohiou.edu/indopubs/2001/08/25/0033.html

West, G.R., Morison, J.B. and Jensen, R.C., 1982, **An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

Wikipedia, (2016), Sumatra. https://en.wikipedia.org/wiki/Sumatra

Chapter-7

Spatial Dimension of Multipliers in Java Island Economy[1]

Ringkasan

Bab ini menyajikan hasil analisis tentang pengganda total dan efek mengalir, pengganda sektor yang spesifik, penganda spatial yang spesifik dan sebaran spasial efek mengalir baik output, pendapatan dan kesempatan kerja. Model yang digunakan adalah Model Input-Ouput AntarDaerah (MIOAD) yang dikembangkan menggunakan prosedur hibrida untuk ekonomi kepulauan. Data yang digunakan untuk model ini adalah data untuk tahun 2015. Hasilnya menunjukkan bahwa, pertama sektor penting yang menjadi prioritas dapat didasarkan pada angka pengganda dan efek mengalir yang tertinggi. Kedua, prioritas sektor penting yang menjadi priorotas dapat ditentukan berdasar pengganda sektor yang spesifik; pengganda yang terjadi pada sektor tersebut. Ketiga, sektor penting yang menjadi prioritas dapat ditentukan berdasarkan pengganda spasial yang spesifik; pengganda yang terjadi pada pulau sendiri; pulau Jawa. Terakhir, sektor penting yang menjadi prioritas dapat juga ditentukan berdasarkan efek mengalir yang terjadi pada pulau sendiri; pulau Jawa.

Summary

This chapter provides the results of analysis on total, sectoral-specific, and spatial-specific multipliers and flow-on effects in Java Island economy. The model employed was Inter-Regional Input-Output Model (IRIOM) developed using new hybrid procedures with special attention on Island economy. Data used for

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model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Java Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.

1. Introduction

Java (Indonesian; *Jawa*; Javanese) is an island of Indonesia with a population of over 141 million (the island itself) or 145 million (the administrative region) as of 2015 Census released in December 2015 (Anonymous, 2015). Java is home to 56.7 percent of the Indonesian population and is the most populous island on Earth. The Indonesian capital city, Jakarta, is located on western Java. Java was also the center of the Indonesian struggle for independence during the 1930s and 1940s. Java dominates Indonesia politically, economically and culturally.

The origins of the name "Java" are not clear. One possibility is that the island was named after the *jáwa-wut* plant, which was said to be common in the island during the time, that the island had different names. There are other possible sources: the word *jaú* and its variations mean "beyond" or "distant". In Sanskrit*yava* means barley, a plant for which the island was famous. "Yawadvipa" is mentioned in India's earliest epic, the Ramayana. Sugriva, the chief of Rama's army dispatched his men to Yawadvipa, the island of Java, in search of Sita (Kapur, 2010). Another source states that the "Java" word is derived from a Proto-Austronesian root word, *Iawa* that meaning "home"(Hartley, *et.at*, 1984).

Administratively, Java Island consists of 6 provinces: Banten (Capital: Serang), West Java (Capital: Serang), Special Region of Capital City of Grater Jakarta, Central Java (Capital: Semarang), Special Region of Yogyakarta and East Java (Capital: Surabaya).

Though Java is increasingly becoming more modern and urban, only 75% of the island has electricity. Villages and their rice paddies are still a common sight. Unlike the rest of Java, the population growth in Central Java remains low. Central Java however has a younger population than the national average. The slow population growth can in part be attributed to the choice by many people to leave the more rural Central Java for better opportunities and higher incomes in the bigger cities (Agus Maryono, 2009). With a combined population of 145 million in the 2015 census (including Madura's 3.7 million), which is estimated for 2014 at 143.1 million (including 3.7 million for Madura), Java is the most populous island in the world and is home to 57% of Indonesia's population (Anonymous, 2010). At over 1,100 people per km² in 2014, it is also one of the most densely populated parts of the world.

Initially the economy of Java relied heavily on rice agriculture. Java was famous for rice surpluses and rice export since ancient times, and rice agriculture contributed to the population growth of the island (Cribb, 2016). During these colonial times, the Dutch introduced the cultivation of commercial plants in Java, such as sugarcane, rubber, coffee, tea, and quinine.

According to Prihawantoro (2013), the main economic activities in Java Island were Sector-3 manufacturing (Banten, West Java, Central Java, and East Java), Sec-8 Banking and other finance services (Jakarta), Sector-6 Trade, hotel and restaurant (Yogyakarta and East Java) and Sector-9 Other Services (Jakarta, Yogyakarta). Based on the statistical data by the year of 2013 which is released by Badan Pusat Statistik, Java Island itself contributes at least 58.15% of Indonesia's Gross Domestic Product (BPS, 2015).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (see among others:Dornbusch, R., & Stanley, F., 1994; McConnell, C., et., al, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (see among others: Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes, such as lump-sum taxes or proportional taxes.

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioral assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief, who developed a set of national-level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard in 1951 then applied input-output analysis to a regional economy. The first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson in 1955 for the state of Utah. In a parallel development, Tiebout in 1956 specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending (Muchdie, 2011).

Surveys of input-output and economic base multipliers have been conducted by Richardson in 1985 note the difficulty inherent in specifying the local share of spending. The growth of survey-based regional input-output models in the 1960s and 1970s allowed for more accurate estimation of local spending, though at a large cost in terms of resources (Muchdie, 2011). To bridge the gap between resource intensive survey-based multipliers and "off-the-shelf" multipliers, Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Three other papers on the general topic of the use and misuse of regional multipliers are briefly noted. Grady & Muller (1988) argue that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) notes the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discusses the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Additional papers focus on the uses and misuse of regional multipliers for particular types of studies. Harris (1997) discusses the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, Sanderson, and McHenry (2006) discuss the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused. Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy.

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific, so they can further be used for planning and evaluating regional economic development in Java Island. The significant contribution of this chapter is the calculation of sector-specific multipliers as well as spatial-specific multipliers.

2. The Methods

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$ {}^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1,2,\ldots,n) \text{ and } (r, s = 1,2,\ldots,m) \quad (1) $$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions. In matrix term, the model can be expressed as:

$$ x = Ax + y \;\text{ or }\; x = (I - A)^{-1}y \quad (2) $$

where: x is a vector of output, A is a matrix of input-output coefficients with elements of a_{ij}-s and y is a vector of final demand; $(I - A)^{-1}$ is Leontief inverse matrix with elements of b_{ij}-s. Basically, A matrix in equation (2) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model (Muchdie, 2011). Equation (2) can then be rewritten as:

$$ x = T\,(A\,x + y) \;\text{ or }\; x = (I - T\,A)^{-1}y \quad (3) $$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, cited by Muchdie (2011) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 1.

DiPasquale & Polenske in Muchdie (2011) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and spatial-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region. Formula provided in Table 7.1 and Table 7.2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

Table 7.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

Table 7.2

Inter-Regional Sector-Specific and Spatial-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_i$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ r = 1,..m
Spatial-Specific	$\sum {}^{rs}b^*_{ij;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ i = 1,..n

Note: *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

Table 7.2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment. The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region. Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

3. Result and Discussion

a. Total Multipliers and Flow-on Effects

Table 7.3 present total output, income and employment multipliers and flow-on effects in Java Island. In term of output, the highest output multipliers was JAV-5 (Construction Sector in Java Island), 2.886. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.886 including the initial increase of 1.000. It was followed by JAV-4 (Electricity, water and gas in Java Island), 1.568 meaning that an increase of final demand of that sector by 1.000 would increase total output by 1.568 including the initial increase of 1.000. The lowest total multipliers was in JAV-2 (Mining and quarrying in Java Island), 1.329. An increase of final demand of that sector by 1.000 units would increase total output by 1.329 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (JAV-5) the flow-on effect was 1.866, meaning the impact of increase of final demand of JAV-5 (Construction) to total output was 1.866 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Java Island economy showed that JAV-8 (Banking and other finance) had the highest output flow-on effects, followed by JAV-6 (Trade, hotel and restaurant) and the lowest value of output flow-on effects was JAV-7 (Transportation and Communication).

Table 7.3

Total Multipliers and Flow-on Effects: Output, Income and Employment

SECTOR	Initial	Output Flow-on	Total	Initial	Income Flow-on	Total	Initial	Employ-ment Flow-on	Total
JAV-1	1.000	0.629	1.629	0.186	0.108	0.294	0.595	0.145	0.740
JAV-2	1.000	0.329	1.329	0.052	0.062	0.114	0.078	0.063	0.141
JAV-3	1.000	1.248	2.248	0.112	0.198	0.310	0.129	0.307	0.436
JAV-4	1.000	1.568	2.568	0.091	0.234	0.325	0.145	0.287	0.432
JAV-5	1.000	1.866	2.866	0.165	0.297	0.462	0.145	0.374	0.519
JAV-6	1.000	0.908	1.908	0.169	0.157	0.326	0.184	0.191	0.375
JAV-7	1.000	1.217	2.217	0.182	0.242	0.424	0.099	0.243	0.342
JAV-8	1.000	0.924	1.924	0.243	0.173	0.416	0.145	0.186	0.331
JAV-9	1.000	1.564	2.564	0.501	0.271	0.772	0.246	0.328	0.574

Source: Data Processed using IO7 software.

In term of household income, the highest total income multiplier was in JAV-9 (Other services), 0.772. It means that an increase of final demand of JAV-9 (Other services) by 1.000 units would increase initial household income by 0.501 and then would increase total income by 0.772. It was followed by JAV-5 (Construction) with total income multipliers of 0.462. The lowest total income multiplier was, again, in JAV-2 (Mining and quarrying in Java Island) with total income multipliers of 0.294. Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in JAV-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.501, resulting total income of 0.772. The income flow-on effect of JAV-9 (Other services) was 0.271. The highest income flow-on effect was in JAV-8 (Banking and other finance), followed by JAV-6 (Trade, hotel and restaurant). The lowest income flow-on effect was in, again, JAV-2 (Mining and quarrying).

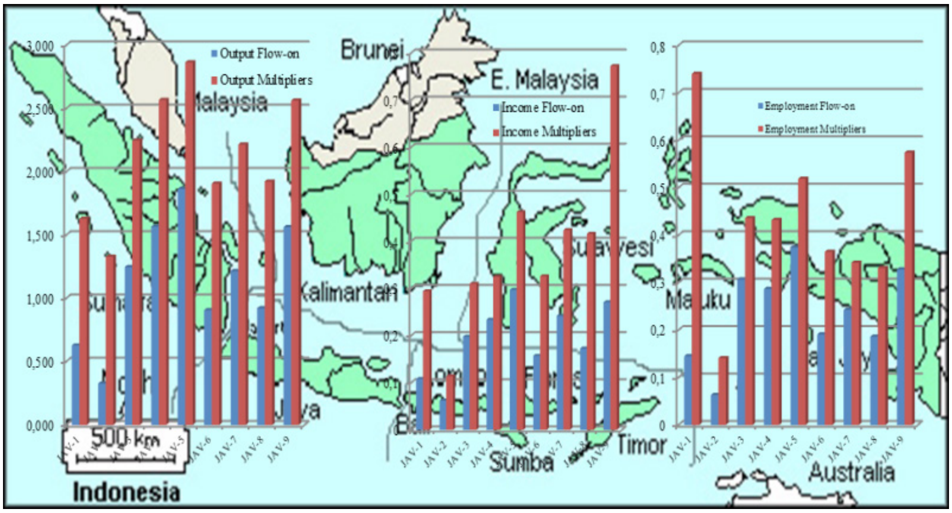

Figure 7.1

Total Multipliers and Flow-on Effects: Output, Income and Employment

In term of employment, the highest total employment multiplier was in JAV-1 (Agriculture, livestock, forestry and fishery), 0.740. It means that an increase of final demand of JAV-1 (Agriculture, livestock and fishery) by 1.000 units would increase initial employment of JAV-1 (Agriculture, livestock and fishery) by 0.595 and then would increase total employment by 0.740. It was followed by JAV-9 (Other services) with total income multipliers of 0.574. The lowest total employment multiplier was, again, in JAV-2 (Mining and quarrying) with total employment multipliers of 0.141. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in JAV-5 (Construction), followed by JAV-9 (Other services). The lowest income flow-on effect was in, again, JAV-2 (Mining and quarrying).

b. Sector-Specific Multipliers

Table 7.4 and also Figure 7.2 provide sector-specific multipliers for output, income and employment in Java Island economy. In term of output, there were 3 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of Multipliers occurred in other sector, namely JAV-4 (Electricity, water and gas), JAV-5 (Construction) and JAV-9 (Other). Meanwhile, other 6 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 6 sectors with less than 50 per cent multipliers occurred in other sector. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-2 (Mining and quarrying), JAV-3 (Manufacturing), JAV-6 (Trade, hotel and restaurant), JAV-7 (Transportation and communication) and JAV-8 (Banking and other finance).

In term of income, there were 4 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of multipliers occurred in other sectors, namely JAV-2 (Mining and Quarrying), JAV-4 (Electricity, water and gas) JAV-5 (Construction) and JAV-7 (Transportation and communication). Meanwhile, other 5 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 5 sectors with less than 50 per cent of multipliers occurred in other sectors. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-3 (Manufacturing), JAV-6 (Trade, hotel and restaurant), JAV-8 (Banking and other finance) and JAV-9 (Other services).

Table 7.4

Sector-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total
JAV-1	69.55%	30.45%	1.629	71.77%	28.23%	0.294	90.27%	9.73%	0.740
JAV-2	76.22%	23.78%	1.329	45.61%	54.39%	0.114	56.03%	43.97%	0.141
JAV-3	66.77%	33.23%	2.248	53.87%	46.13%	0.310	44.50%	55.50%	0.436
JAV-4	47.90%	52.10%	2.568	34.15%	65.85%	0.325	40.74%	59.26%	0.432
JAV-5	35.42%	64.58%	2.866	36.15%	63.85%	0.462	28.13%	71.87%	0.519
JAV-6	58.49%	41.51%	1.908	57.98%	42.02%	0.326	54.40%	45.60%	0.375
JAV-7	52.10%	47.90%	2.217	49.53%	50.47%	0.424	33.63%	66.37%	0.342
JAV-8	59.56%	40.44%	1.924	66.83%	33.17%	0.416	50.15%	49.85%	0.331
JAV-9	43.49%	56.51%	2.564	72.28%	27.72%	0.772	47.56%	52.44%	0.574

Source: Data Processed using IO7 software.

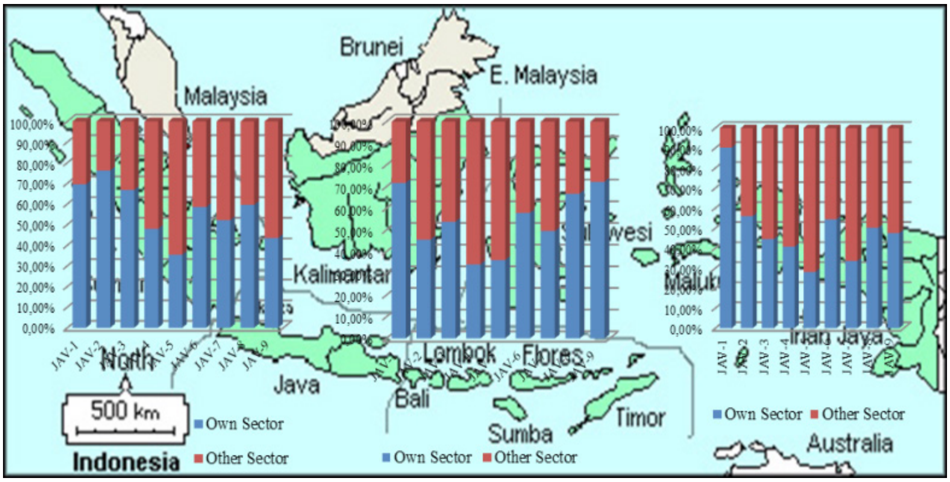

Figure 7.2

Sector-Specific Multipliers: Output, Income and Employment

In term of employment, there were 5 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of multipliers occurred in other sectors, namely JAV-3 (Manufacturing), JAV-4 (Electricity, water and gas), JAV-5 (Construction), JAV-7 (Transportation and communication) and JAV-9 (Other services). Meanwhile, other 4 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 4 sectors with less than 50 per cent of multipliers occurred in other sectors. These sectors were: JAV-1 (Agriculture, livestock, forestry and fishery), JAV-2 (Mining and quarrying), JAV-6 (Trade, hotel and restaurant), and JAV-8 (Banking and other finance).

c. Spatial-Specific Multipliers

Table 7.5

Spatial-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
JAV-1	90.24%	9.76%	1.629	91.50%	8.50%	0.294	94.59%	5.41%	0.740
JAV-2	93.60%	6.40%	1.329	86.84%	13.16%	0.114	89.36%	10.64%	0.141
JAV-3	91.01%	8.99%	2.248	90.32%	9.68%	0.310	90.60%	9.40%	0.436
JAV-4	80.14%	19.86%	2.568	76.92%	23.08%	0.325	79.17%	20.83%	0.432
JAV-5	85.31%	14.69%	2.866	85.06%	14.94%	0.462	82.85%	17.15%	0.519
JAV-6	92.61%	7.39%	1.908	92.94%	7.06%	0.326	92.53%	7.47%	0.375
JAV-7	89.45%	10.55%	2.217	90.09%	9.91%	0.424	85.38%	14.62%	0.342
JAV-8	93.50%	6.50%	1.924	95.19%	4.81%	0.416	92.15%	7.85%	0.331
JAV-9	91.38%	8.62%	2.564	95.60%	4.40%	0.772	91.29%	8.71%	0.574

Source: Data Processed using IO7 software.

Table 7.5 and Figure 7.3 provide spatial-specific multipliers of output, income and employment multipliers. In term of output, all sectors had more than 50 per cent of multipliers occurred in own region, in Java Island. All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands. It applied for income. All sectors had more than 50 per cent of multipliers occurred in own region; own Island. All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands. In term of employment, all sectors had more than 50 per cent of multipliers occurred in own region; own Island. Again, all sectors had less than 50 per cent of multipliers occurred in other regions; other Islands.

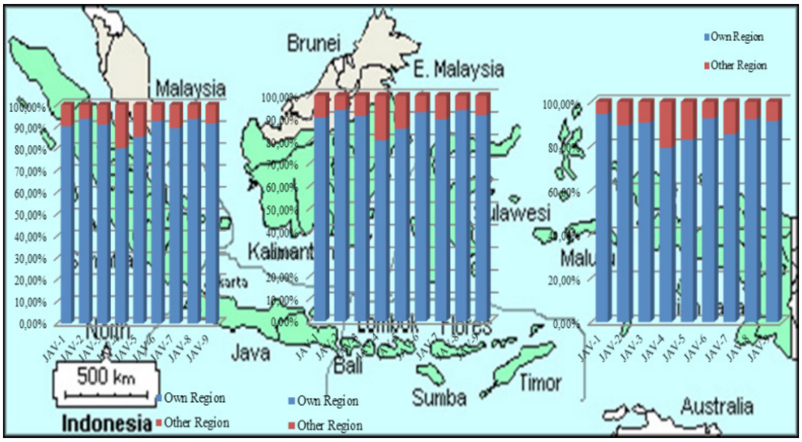

Figure 7.3

Spatial-Specific Multipliers: Output, Income and Employment in Java Island

d. Spatial Distribution of Flow-on

Flow-on effects are the difference between total effects (total multipliers) and initial effect. It consists of direct effects, indirect effect and induced effects of a change in final demand. As Table 7.3 and Figure 7.1 provided the total flow-on effects for every spatial sector in Java Island, Table 7.6 and Figure 7.4 presents spatial distribution of flow-on effects in Java Island economy.

Table 7.6

Spatial Distribution of Flow-on: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
JAV-1	74.8	25.2	0.629	77.6	22.4	0.108	73.9	26.1	0.145
JAV-2	74.2	25.8	0.329	79.7	20.3	0.062	76.2	23.8	0.063
JAV-3	83.9	16.1	1.248	85.7	14.3	0.198	87.8	12.2	0.307
JAV-4	67.5	32.5	1.568	68.8	31.2	0.234	69.4	30.6	0.287
JAV-5	77.5	22.5	1.866	77.6	22.4	0.297	76.4	23.6	0.374
JAV-6	84.4	15.6	0.908	87.0	13.0	0.157	85.8	14.2	0.191
JAV-7	80.8	19.2	1.217	83.0	17.0	0.242	80.4	19.6	0.243
JAV-8	86.5	13.5	0.924	90.0	10.0	0.173	87.0	13.0	0.186
JAV-9	85.9	14.1	1.564	87.8	12.2	0.271	85.5	14.5	0.328

Source: Data Processed using IO7 software.

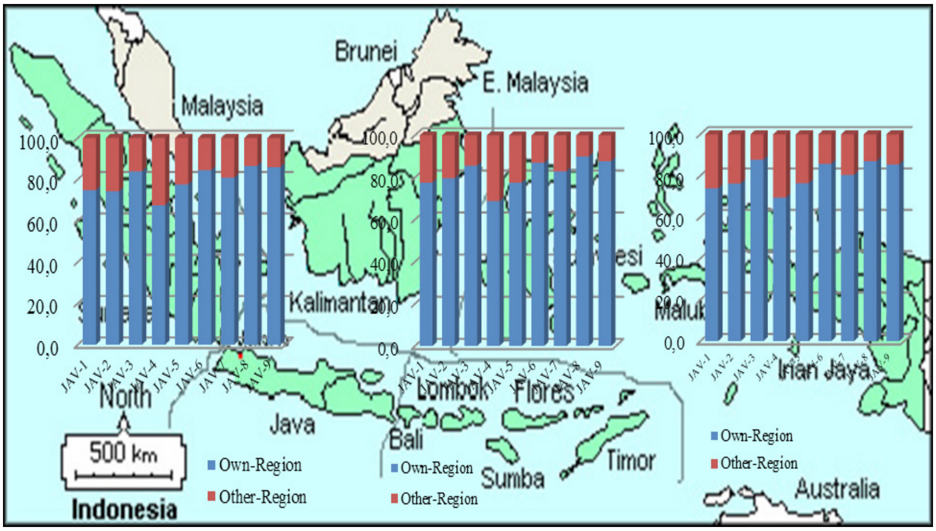

Figure 7.4

Spatial Distribution of Flow-on: Output, Income and Employment

In term of output, all sectors had flow-on effects that more than 50 per cent of flow-on occurred in own region. It means that, in all sectors, flow-on effects that occurred in other regions were less than 50 per cent. The highest output flow-on effect that occurred in other regions was in JAV-4 (Electricity, water and gas) and the lowest output flow-on effect that occurred in other regions was in JAV-8 (Banking and other finance). The same case also applies in income flow-on effects. All sectors had flow-on effects that more than 50 per cent of the flow-on occurred in own region. The flow-on effects that occurred in other regions were less than 50 per cent. The highest income flow-on effect that occurred in other regions was in JAV-4 (Electricity, water and gas) and the lowest income flow-on that occurred in other regions was in JAV-8 (Banking and other finance).

In term of employment, again, all sector had employment flow-on that occurred in own region more than 50 per cent. All sectors had the flow-on effects that occurred in other regions were less than 50 per cent. The highest employment flow-on effect that occurred in other regions was in JAV-4 Electricity, water and gas) and the lowest employment flow-on that occurred in other regions was in JAV-8 (Banking and other finance).

4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Java Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9 (Other services). Based on total income multipliers, three important sectors in Java Island economy were JAV-9 (Other services), JAV-5 (Construction) and JAV-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Java Island economy were JAV-1 (Agriculture, livestock, forestry and fishery), JAV-9 (Other services) and JAV-5 (Construction). Based on output flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9 (Other services). Based on income flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-9 (Other services) and JAV-7 (Transportation and communication). Based on employment flow-on effects, three important sectors were JAV-5 (Construction), JAV-9 (Other services) and JAV-3 (Manufacturing).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were JAV-2 (Mining and quarrying), JAV-1(Agriculture, livestock, and fishery) and JAV-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were JAV-9 (Other services), JAV-1 (Agriculture, livestock and fishery) and JAV-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-2 (Mining and quarrying) and JAV-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Java Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were JAV-2 (Mining and quarrying), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were JAV-9 (Other services), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-6 (Trade, hotel and restaurant and JAV-8 (Banking and other finance).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Java Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other services) and JAV-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other service) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were JAV-3 (Manufacturing), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant).

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References

Maryono, A. (2009), “Central Java strives to alleviate poverty”,**The Jakarta Post**, Archived from the original on 8 September 2015, Retrieved 16 August 2015.

Ahiakpor, J.C.W. (2000), “Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance?” History of Political Economy, 32 (4) 889-908. https://muse.jhu.edu/article/13245/pdf

Anonymous, (2010), “Population growth good for Papua”, **The Jakarta Post**, 23 August 2010, Archived from the original on 24 August 2010, Retrieved 30 August 2010.

Anonymous, (2015), https://citypopulation.De/ Indonesia-MU.html.

Badan Pusat Statistik, (2015), **Perkembangan Produk Domestik Bruto dan Produk Domestik Bruto per Kapita Atas Dasar Harga Konstan 2010, 2010-2014**, http://www.bps.go.id/Subjek/view/id/11#subjekViewTab3|accordion-daftar-subjek2.

Beemiller, R.M, (1990), “Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque”, **International Regional Science Review**, 13 (1-2), 99-101.

http://journals.sagepub.com/doi /abs/10.1177/016001769001300107

Coughlin, C. and Mandelbaum, T.B, (1991),“A Consumer’s Guide to Regional

Economic Multipliers", **Federal Reserve Bank of St. Louis Review**. January/ February 1991.19-32.

https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-to-regional-economic-multipliers/

Cribb, R, (2016),"Digital Atlas of Indonesian History", Retrieved on December 2016.

http://www.indonesianhistory.info/pages/about-author.html)

Dornbusch, R. and Stanley, F, (1994),**Macroeconomics**, Sixth Edition, International Edition, McGraw-Hill.

Grady, P and Muller, R, A, (1988), "On the use and misuse of input-output based impact analysis in evaluation",**The Canadian Journal of Program Evaluation**, 2 (3) 49-61.

https://www.researchgate.net/publication/43126426_On_The_Use_and_Misuse_of_Input-Output_Based_Impact_Analysis_in_Evaluation

Hall, R. E, (2009),"By How Much Does GDP Rise if the Government Buys More Output?",**NBER Working Paper 15496**, National Bureau of Economic Research.

www.nber.org/papers/w15496.pdf?new_window=1

Hamilton, J. (1994), **Time Series Analysis** Chapter 1, p: 2, Princeton University Press.

Harris, P. (1997),"Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry", The Journal of Tourism Studies, 8(2): 1-12.

http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impact-multipliers-by-practitioners.html

Hatley, R., Schiller, J., Lucas, A., Martin-Schiller, B, (1984)."Mapping cultural regions of Java", in: Other Javas away from the Kraton. pp. 1–3.

Hughes, D. W. (2003),"Policy uses of economic multipliers and impact analysis",**Choices Publication of the American Agricultural Economics Association**, Second Quarter.

http://www.choicesmagazine.org/2003-2/2003-2-06.htm

Hulu, E. (1990). Model Input-Output: Teori dan Applikasinya (*Input-Output Model: Theory and Its Applications*). Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Jakarta: Universitas Indonesia (*the University of Indonesia*).

Kapur, K. (2010),**History of Ancient India (Portraits of a Nation) New**

Delhi, Sterling Publisher Private Limited.

https://books.google.co.id/books?id=9ic4BjWFmNIC&pg=PA465&rediresc=y#v=onepage&q&f= false).

Krugman & Wells, (2009),**Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier**, pp: 393–396.

http://dictionary.sensagent.com/money%20multiplier/en-en/

Mankiw, N.G. (2008),"Part VI: Money and Prices in the Long Run: The Money Multiplier", **Macroeconomics**, Eighth Edition,pp:347–349.

https://www.academia.edu/15354353/Mankiw_macroeconomics_8th_edition

McConnell, C, Brue, S, and Flynn, S, (2011),**Macroeconomics**, McGraw-Hill Series Economics, 19th Edition. ISBN-13: 978-0077337728, ISBN-10: 0077337727.

https://www.amazon.com/Macroeconomics-McGraw-Hill-Economics-Campbell-McConnell/dp/0077337727

Mills, E. C,(1993),"The Misuse of Regional Economic Models", **Cato Journal**, 13(1) 29-39.

https://ideas.repec.org/a/cto/journl/v13y1993i1p29-39.html

Pindyck, R. and Rubinfeld, D, (2012), **Macroeconomics**,The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X

https://www.amazon.com/Microeconomics-Student-Value-Pearson-Economics/dp/0132870436

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana, (2013).**Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach),** Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Siegfried, J, Allen R., Sanderson, A.R., and McHenry, P, (2006),"The Economic Impact of Colleges and Universities",**Working Paper No. 06-W12**.

http://www.accessecon.com/pubs/VUECON/vu06-w12.p

Chapter-8

Spatial Distribution of Multipliers in Kalimantan Island Economy[1]

Ringkasan

Bab ini menyajikan hasil analisis tentang angka pengganda total dan efek mengalir, pengganda sektor spesifik, dan pengganda spatial spesifik dalam perekonomian pulau Kalimantan, utamanya untuk keperluan evaluasi, perencanaan, dan pengendalian pembangunan ekonomi. Model yang digunakan adalah Model Input-Output Antar-Pulau (MIOAP) yang dikembangkan menggunakan prosedur hibrida baru dengan perhatian khusus pada ekonomi kepulauan. Data untuk model ini adalah data Indonesia tahun 2015. Hasilnya menunjukkan bahwa, pertama sektor-sektor penting dapat didasarkan pada angka pengganda, baik total maupun efek mengalir dari output, pendapatan dan kesempatan kerja. Kedua, sektor penting juga dapat ditentukan berdasarkan pengganda spesifik sektor dengan melihat besaran angka pengganda yang terjadi pada sektor sendiri atau juga pada sektor lain. Ketiga, sektor penting juga dapat ditentukan berdasarkan pengganda spatial spesifik; yaitu pengganda yang terjadi di wilayah sendiri. Terakhir, sektor penting dan prioritas dapat ditentukan berdasarkan distribusi ruang efek mengalir; di wilayah sendiri atau di wilayah lain. Kontribusi penting paper ini adalah pada perhitungan pengganda spesifik-sektor dan pengganda spesifik-ruang; pengganda yang terjadi di pulau sendiri dan di pulau lain.

Summary

This chapter provides the results of analysis on total multipliers and flow-on, sectoral-specific, and spatial-specific multipliers as important indicators for evaluating, planning and controlling regional development in Kalimantan

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Island economy. The model employed was Inter-Island Input-Output Model (IIIOM) developed using new hybrid procedures with special attention on Island economy. Data used for the model were updated on Indonesian data for the year of 2015. The results show that firstly, the important sectors of Kalimantan Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Finally, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions. The novel contribution of this paper is on calculation of sector-specific multipliers as well as spatial-specific multipliers; multipliers that occur in own Island and in Other Islands.

1. **Introduction**

Borneo (/ b rnio /; Indonesian: *Kalimantan*, Malay: *Borneo*) is the third-largest island in the world and the largest island in Asia. At the geographic centre of Maritime Southeast Asia, in relation to major Indonesian islands, it is located north of Java, west of Sulawesi, and east of Sumatra. Kalimantan is the Indonesian portion of the island of Borneo (Britannica, 2016) which is comprises 73% of the island's area. The non-Indonesian parts of Borneo are Brunei and East Malaysia. With an area of 743,330 square kilometres, it is the third-largest island in the world, and is the largest island of Asia (the largest continent). Its highest point is Mount Kinabalu in Sabah, Malaysia, with an elevation of 4,095 m. The largest river system is the Kapuas in West Kalimantan, with a length of 1,143 km (710 mi). Other major rivers include the Mahakam in East Kalimantan (980 km long), the Barito in South Kalimantan (880 km long).

There are four provinces in Indonesian Kalimantan, namely: West Kalimantan with capital city Pontianak, Central Kalimantan with capital city Palangka Raya, South Kalimantan with Banjarmasin as capital city and East Kalimantan with Samarinda as capital city (Anonymous, 2015). According to Prihawantoro, S, *et. al* (2013), the main economic activities in Kalimantan Island were Sector-1 Agriculture, livestock and fishery (West Kalimantan, Central Kalimantan, and South Kalimantan), Sector-2 Mining and quarrying (South Kalimantan and

East Kalimantan), and Sector-3 Manufacturing (East Kalimantan). Based on the statistical data by the year of 2013 which is released by Badan Pusat Statistik, Kalimantan Island itself contributes at about 8.7 per cent of Indonesia's Gross Domestic Product. Meanwhile, Java contributes about 60 per cent and Sumatra does about 23.9 per cent (Anonymous, 2016).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (Dornbusch, R., & Stanley, F., 1994; McConnell, C., *et. al*, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes.

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioral assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief's work in 1951, which developed a set of national level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard then applied input-output analysis to a regional economy (Muchdie, 2011). The first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson in 1955 for the state of Utah. In a parallel development, Tiebout in 1956 specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending (Muchdie, 2011).

In a survey of input-output and economic base multipliers, Richardson notes the difficulty inherent in specifying the local share of spending. He notes the growth of survey-based regional input-output models in the 1960s and 1970s that allowed for more accurate estimation of local spending, though at a large cost in terms of resources (Muchdie, 2011). Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Grady & Muller (1988) argued that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) noted the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discussed the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Harris (1997) discussed the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, *et al* (2006) discussed the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused.

Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy (Muchdie, 2011).

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen in Muchdie (2011) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific multipliers that can be used for evaluation and planning economic development in Kalimantan Island.

The most significant contribution of this paper is the calculation of sector-spesific multipliers that could trace multipliers that occurs in own sector and other sectors as well as the calculation of spatial-specific multipliers; multipliers that occur in own island and other islands.

2. Methods of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$ {}^{r}X_i = \sum_j \sum_s {}^{rs}X_{ij} + \sum_s {}^{rs}Y_i; \ (i, j = 1,2,...,n) \text{ and } (r, s = 1,2,...,m) \qquad (1)$$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions. In matrix term, the model can be expressed as:

$$x = Ax + y \text{ or } x = (I - A)^{-1}y \quad (2)$$

where: x is a vector of output, A is a matrix of input-output coefficients with elements of a_{ij}-s and y is a vector of final demand; $(I - A)^{-1}$ is Leontief inverse matrix with elements of b_{ij}-s. Basically, A matrix in equation (2) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model (Muchdie, 2011). Equation (2) can then be rewritten as:

$$x = T\,(A\,x + y) \text{ or } x = (I - T\,A)^{-1}y \quad (3)$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated by Indonesian data 2015 (Muchdie, 2017).

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West and Jensen in Muchdie (2011) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

Table 8.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, in Muchdie (2011) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 8.1.

DiPasquale & Polenske in Muchdie (2011) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 8.2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment.

Table 8.2

Inter-regional Sector-Specific and Region-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_i$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ i = 1,..n

Note : *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region.

Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

2. Result and Discussion

a. Total Multipliers and Flow-on

Table 8.3 presents total output, income and employment multipliers and flow-on effects in Kalimantan Island. In term of output, the highest output multipliers was KAL-4 (Electricity, water and gas), 2.829. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.829 including the initial increase of 1.000. It was followed by KAL-9 (Other services), 2.808 meaning that an increase of final demand of that sector by 1.000 would increase total output by 2.808 including the initial increase of 1.000. The lowest total multipliers was in KAL-2 (Mining and quarrying), 1.722. An increase of final demand of that sector by 1.000 units would increase total output by 1.722 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (KAL-4) the flow-on effect was 1.829, meaning the impact of increase of final demand of KAL-4 (Electricity, water and gas) to total output was 1.829 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Kalimantan Island economy showed that the rank of total multipliers were the same as flow-on effects where KAL-4 (Electricity, water and gas) had the highest output flow-on effects, followed by KAL-9 (Other services) and the lowest value of output flow-on effects was KAL-2 (Mining and quarrying).

In term of household income, the highest total income multiplier was in KAL-9 (Other services), 0.829. It means that an increase of final demand of KAL-9 (Other services) by 1.000 units would increase initial household income by 0.593 and then would increase total income by 0.829. It was followed by KAL-8 (Banking and other finance) with total income multipliers of 0.489.

The lowest total income multiplier was in KAL-6 (Trade, hotel and restaurant) with total income multipliers of 0.338.

Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in KAL-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.593, resulting total income of 0.829. The income flow-on effect of KAL-9 (Other services) was 0.335. The highest income flow-on effect was in KAL-9 (Other services), followed by KAL-4 (Electricity, water and gas). The lowest income flow-on effect was in, again, KAL-2 (Mining and quarrying).

Table 8.3

Total Multipliers and Flow-on Effects: Output, Income and Employment

SECTOR	Initial	**Output Flow-on**	Total	Initial	Income Flow-on	Total	Initial	Employment Flow-on	Total
KAL-1	1.000	1.047	2.047	0.197	0.192	0.389	0.363	0.217	0.580
KAL-2	1.000	0.722	1.722	0.204	0.136	0.340	0.091	0.144	0.235
KAL-3	1.000	1.221	2.221	0.119	0.224	0.343	0.097	0.271	0.368
KAL-4	1.000	1.829	2.829	0.091	0.296	0.387	0.091	0.289	0.380
KAL-5	1.000	1.561	2.561	0.165	0.291	0.456	0.092	0.335	0.427
KAL-6	1.000	0.876	1.876	0.175	0.163	0.338	0.147	0.201	0.348
KAL-7	1.000	1.223	2.223	0.182	0.242	0.424	0.092	0.228	0.320
KAL-8	1.000	1.253	2.253	0.243	0.246	0.489	0.091	0.240	0.331
KAL-9	1.000	1.808	2.808	0.593	0.335	0.928	0.206	0.402	0.608

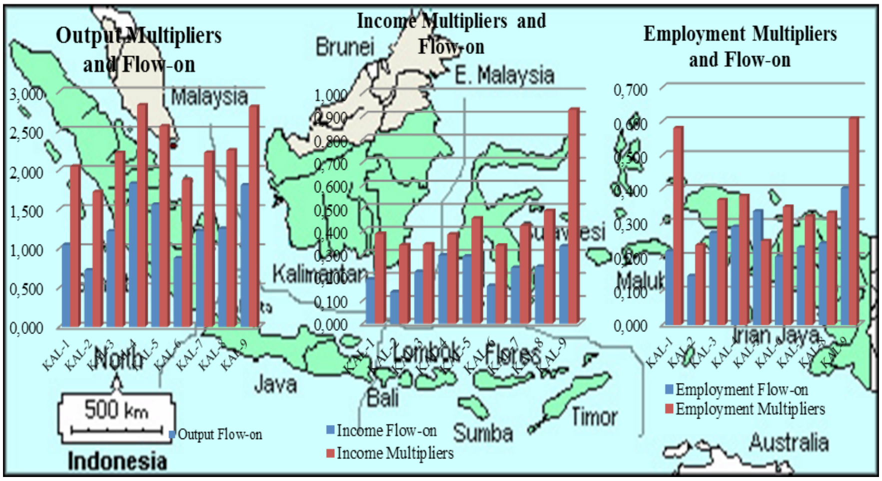

Figure 8.1

Total Multipliers and Flow-on Effects: Output, Income and Employment

In term of employment, the highest total employment multiplier was in KAL-9 (Other services), 0.608. It means that an increase of final demand of in KAL-9 (Other services) by 1.000 units would increase initial employment of in KAL-9 (Other services) by 0.206 and then would increase total employment by 0.608. It was followed by KAL-1 (Agriculture, livestock and fishery) with total employment multipliers of 0.580. The lowest total employment multiplier was in KAL-2 (Mining and quarrying) with total employment multipliers of 0.160.

Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in KAL-9 (Other services), followed by KAL-5 (Construction). The lowest income flow-on effect was in, again, KAL-2 (Mining and quarrying).

b. Sector-Specific Multipliers

Table 8.4

Sector-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total
KAL-1	1.289	0.758	2.047	0.254	0.135	0.389	0.486	0.094	0.580
KAL-2	1.047	0.675	1.722	0.210	0.130	0.340	0.095	0.140	0.235
KAL-3	1.257	0.964	2.221	0.149	0.194	0.343	0.130	0.138	0.368
KAL-4	1.258	1.571	2.829	0.114	0.273	0.387	0.115	0.265	0.380
KAL-5	1.017	1.544	2.561	0.168	0.288	0.456	0.095	0.332	0.427
KAL-6	1.067	0.809	1.876	0.188	0.150	0.338	0.157	0.191	0.348
KAL-7	1.188	1.035	2.223	0.216	0.208	0.424	0.110	0.210	0.320
KAL-8	1.225	1.028	2.253	0.298	0.191	0.489	0.116	0.215	0.331
KAL-9	1.104	1.704	2.808	0.650	0.278	0.928	0.231	0.377	0.608

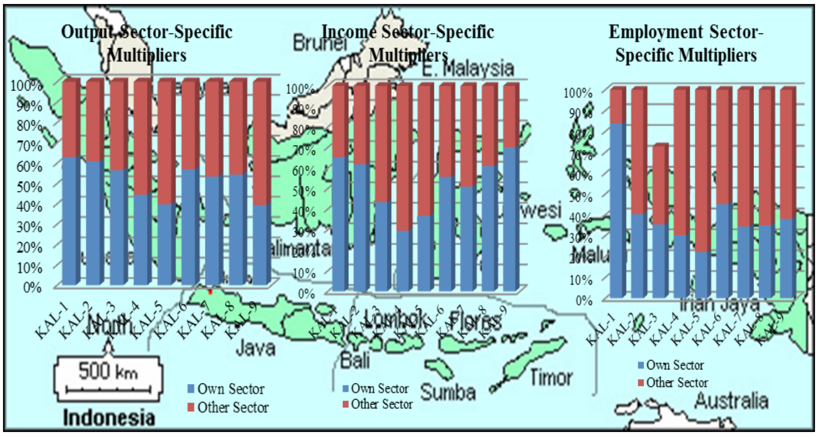

Figure 2

Sector-Specific Multipliers: Output, Income and Employment

Table 8.4 and also Figure 8.2 provide sector-specific multipliers for output, income and employment in Kalimantan Island economy. In term of output, there were 3 sectors in which multipliers occurred in own sector were less than 50 per cent, namely KAL-4 (Electricity, water and gas), KAL-5 (Construction), and KAL-9 (Other services). Meanwhile, other 6 sectors in which multipliers occurred in own region were more than 50 per cent. These were: KAL-1 (Agriculture, livestock, and fishery), KAL-2 (Mining and quarrying), KAL-3 (Manufacturing), KAL-6 (Trade, hotel and restaurant), KAL-7 (Transportation and Communication) and KAL-8 (Banking and other finance).

In term of income, there were 4 sectors in which multipliers occurred in own region were less than 50 per cent, KAL-3 (Manufacturing), KAL-4 (Electricity, water and gas), KAL-5 (Construction) and KAL-7 (Transportation and communication). Meanwhile, other 5 sectors in which multipliers occurred in own region were more than 50 per cent. These sectors were: KAL-1 (Agriculture, livestock and fishery), KAL-2 (Mining and quarrying), KAL-6 (Trade, hotel and restaurant), KAL-8 (Banking and other finance) and KAL-9 (Other services).

In term of employment, there were 8 sectors in which multipliers occurred in own sector were less than 50 per cent, namely KAL-2 (Mining and quarrying), KAL-3 (Manufacturing), KAL-4 (Electricity, water and gas), KAL-5 (Construction), KAL-6 (Trade, hotel and restaurant), KAL-7 (Transportation and communication), KAL-8 (Banking and other finance) and KAL-9 (Other services). Meanwhile, only 1 sectors in which multipliers occurred in own sectors were more 50 per cent multipliers, namely KAL-1 (Agriculture, livestock, and fishery).

c. Spatial-Specific Multipliers

Table 8.5 and Figure 8.3 provide spatial-specific multipliers of output, income and employment multipliers in Kalimantan Island. In term of output, all sectors had more than 50 per cent of multipliers that occurred in own region; in Kalimantan Island. All sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia. It applied for income. All sectors had more than 50 per cent of multipliers that occurred in own region; Kalimantan Island. All sectors had less than 50 per cent of multipliers occurred in other regions; the rest of Indonesia. In term of employment, all sectors had more than 50 per cent of multipliers that occurred in own region; Kalimantan Island. Again, all sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia.

Table 8.5

Spatial-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
KAL-1	1.668	0.379	2.047	0.325	0.064	0.389	0.483	0.097	0.580
KAL-2	1.423	0.299	1.722	0.288	0.052	0.340	0.164	0.071	0.235
KAL-3	1.808	0.413	2.221	0.279	0.064	0.343	0.265	0.103	0.368
KAL-4	2.169	0.660	2.829	0.293	0.094	0.387	0.242	0.138	0.380
KAL-5	1.845	0.716	2.561	0.327	0.129	0.456	0.230	0.197	0.427
KAL-6	1.453	0.423	1.876	0.264	0.074	0.338	0.241	0.107	0.348
KAL-7	1.845	0.378	2.223	0.361	0.063	0.424	0.226	0.094	0.320
KAL-8	1.545	0.708	2.253	0.357	0.132	0.489	0.178	0.153	0.331
KAL-9	1.827	0.981	2.808	0.760	0.168	0.928	0.365	0.243	0.608

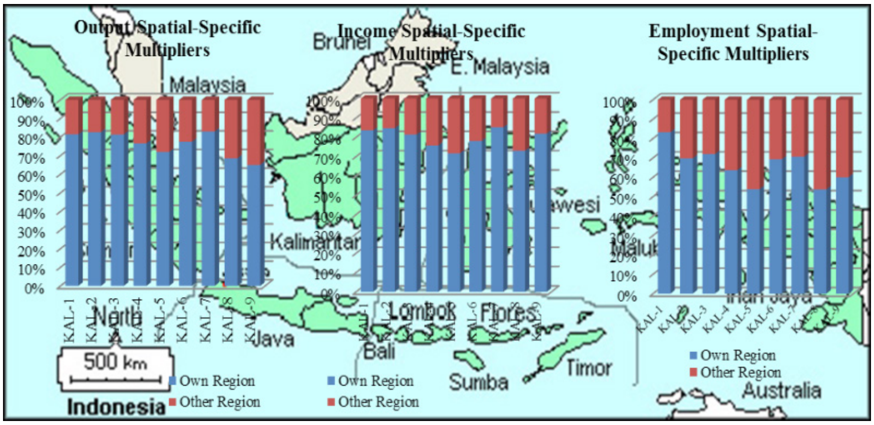

Figure 8.3

Spatial-Specific Multipliers: Output, Income and Employment

d. Spatial Distribution of Flow-on

Flow-on effects are the difference between total effects (total multipliers) and initial effect. It consists of direct effects, indirect effect and induced effects of a change in final demand. As Table 8.3 and Figure 8.1 provided the total flow-on effects for every spatial sector in Kalimantan Island, Table 8.6 and Figure 8.4 presents spatial distribution of flow-on effects in Kalimantan Island economy. In term of output, 7 sectors had more than 50 per cent of flow-on occurred in own region. It means that, in 7 sectors, flow-on effects that occurred in other regions were less than 50 per cent. The highest output flow-on effect that occurred in other regions was in KAL-8 (Banking and other finance), followed by KAL-9 (Other services) and KAL-6 (Trade, hotel and restaurant).

The lowest output flow-on effect that occurred in other regions was in KAL-7 (Transportation and communication).

Table 8.6

Spatial Distribution of Flow-on: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
KAL-1	64%	36%	1.047	67%	33%	0.192	56%	44%	0.217
KAL-2	59%	42%	0.722	62%	38%	0.136	51%	49%	0.144
KAL-3	66%	34%	1.221	71%	29%	0.224	63%	38%	0.271
KAL-4	64%	36%	1.829	68%	32%	0.296	53%	47%	0.289
KAL-5	54%	46%	1.561	56%	44%	0.291	41%	59%	0.335
KAL-6	52%	48%	0.876	56%	44%	0.163	47%	53%	0.201
KAL-7	69%	31%	1.223	73%	27%	0.242	60%	40%	0.228
KAL-8	44%	57%	1.253	47%	53%	0.246	37%	63%	0.240
KAL-9	46%	54%	1.808	51%	50%	0.335	39%	61%	0.402

In term of income flow-on effects, 8 sectors had flow-on effects that more than 50 per cent of the flow-on occurred in own region. In that sector, the flow-on effects that occurred in other regions were less than 50 per cent. The highest income flow-on effect that occurred in other regions was in KAL-9 (Other services), KAL-8 (Banking and other finance), KAL-5 (Construction) and KAL-6 (Trade, hotel and restaurant). The lowest income flow-on that occurred in other regions was in KAL-7 (Transportation and communication).

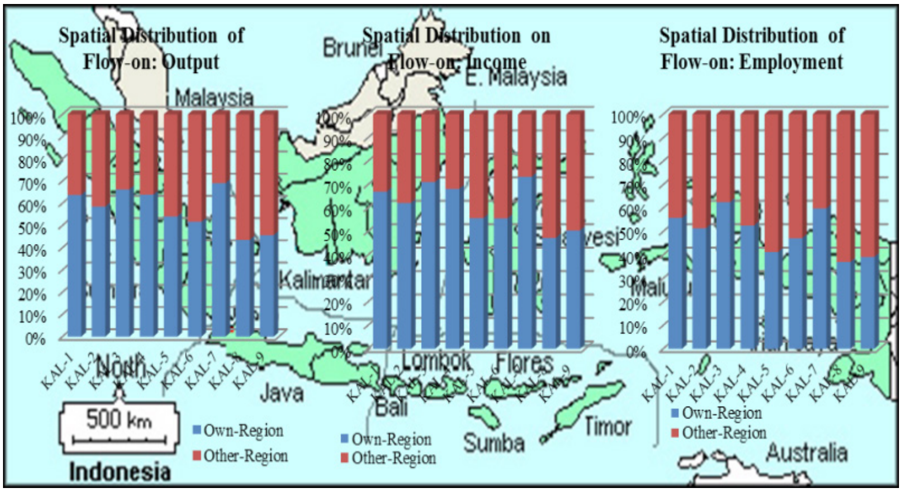

Figure 8.4

Spatial Distribution of Flow-on: Output, Income and Employment

In term of employment, 4 sector had employment flow-on that occurred in own region more than 50 per cent. It means that in that 4 sectors with employment flow-on in other region were less than 50 per cent. The highest employment flow-on effect that occurred in other regions were in KAL-8 (Banking and other finance), KAL-9 (Other services) and KAL-5 (Construction) and the lowest employment flow-on that occurred in other regions was in KAL-3 (Manufacturing).

4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Kalimantan Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Kalimantan Island economy were KAL-4 (Electricity, water and gas), KAL-9 (Other services) and KAL-5 (Construction). Based on total income multipliers, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-8 (Banking and other finance) and KAL-5 (Construction). Based on total employment multipliers, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-4 (Electricity, water and gas). Based on output flow-on effects, three important sectors in Kalimantan Island economy were KAL-4 (Electricity, water and gas), KAL-9 (Other services), and KAL-5 (Construction). Based on income flow-on effects, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-4 (Electricity, water and gas), and KAL-5 (Construction). Based on employment flow-on effects, three important sectors were KAL-9 (Other services), KAL-5 (Construction), and KAL-4 (Electricity, water and gas).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were KAl-1(Agriculture, livestock, and fishery), KAL-2 (Mining and quarrying), KAL-3 (Manufacturing) and KAL-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-2 (Mining and quarrying. Based on employment sector-specific multipliers that occurred in own sector, three important sectors were KAL-1 (Agriculture, livestock and fishery), KAL-6

(Trade, hotel and restaurant), and KAL-2 (Mining and quarrying).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Kalimantan. Based on output spatial-specific multipliers that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-2 (Mining and quarrying), KAL-1 (Agriculture, livestock and fishery), and KAL-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own region, three important sectors were KAL-2 (Mining and quarrying), KAL-7 (Transportation and communication) and KAL-1 (Agriculture, livestock and fishery). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were KAL-1 (Agriculture, livestock and fishery), KAL-3 (Manufacturing) and KAL-7 (Transportation and communication).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Kalimantan Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-3 (Manufacturing) and KAL-1 (Agriculture, livestock and fishery). Based on income spatial distribution of low-on that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-3 (Manufacturing) and KAL-1 (Agriculture, livestock and fishery). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were KAL-3 (Manufacturing), KAL-7 (Transportation and communication) and KAL-1 (Agriculture, livestock and fishery).

References

Anonymous, (2016), “Indonesia’s Most Populous Island Java Continues to Dominate the Economy”, **Indonesia-Investments**.

http://www.indonesia-investments.com/news/todays-headlines/indonesias-most-populous-island-of-java-continues-to-dominate-the-economy/item972

Anonymous, (2015), **Statistik Indonesia 2014**, Jakarta: Badan Pusat Statistik.

http://www.bps.go.id/index.php/publikasi/326

Encyclopedia Britannica, (2016), **Kalimantan**, Region, Indonesia,

https://www.britannica.com/place/Kalimantan

Ahiakpor, J.C.W. (2000),"Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance?",**History of Political Economy**. 32 (4): 889-908.

https://muse.jhu.edu/article/13245/pdf

Beemiller, R.M. (1990),"Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque",**International Regional Science Review**, 13 (1-2): 99-101.

http://journals.sagepub.com/doi /abs/10.1177/016001769001300107

Coughlin, C, and Mandelbaum, T.B, (1991),"A Consumer's Guide to Regional Economic Multipliers", **Federal Reserve Bank of St. Louis Review**. January/February 1991.19-32.

https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-to-regional-economic-multipliers/

Dornbusch, R, and Stanley, F, (1994),**Macroeconomics**, Sixth Edition. International Edition, McGraw-Hill.

Grady, P and Muller, R. A, (1988), "On the use and misuse of input-output based impact analysis in evaluation",**The Canadian Journal of Program Evaluation,** 2 (3): 49-61.

https://www.researchgate.net/publication/43126426_On_The_Use_and_Misuse_of_Input-Output_Based_Impact_Analysis_in_Evaluation

Hall, R. E, (2009),"By How Much Does GDP Rise if the Government Buys More Output?",**NBER Working Paper 15496**, National Bureau of Economic Research.

www.nber.org/papers/w15496.pdf?new_window=1

Harris, P. (1997),"Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry", **The Journal of Tourism Studies**, 8(2): 1-12.

http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impact-multipliers-by-practitioners.html

Hughes, D. W, (2003),"Policy uses of economic multipliers and impact analysis",**Choices Publication of the American Agricultural Economics Association**, Second Quarter.

http://www.choicesmagazine.org/2003-2/2003-2-06.htm

Hulu, E (1990),**Model Input-Output: Teori dan Applikasinya (*Input-Output Model: Theory and Its Applications*),** Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Jakarta: Universitas Indonesia (*the University of Indonesia*).

Krugman, P and Wells, R, (2009),**Economics**, Worth Publisher, p: 1200, Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier: 393–396.

http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECPS3e_Macro_CH14.pdf

Mankiw, N. G (2008), **Macroeconomics**, Eight Edition, South-Western Publishing, Part VI: Money and Prices in the Long Run: The Money Multiplier: 347–349.

https://www.academia.edu/15354353/Mankiw_macroeconomics_8th_edition

McConnell, C, Brue, S, and Flynn, S, (2011),**Macroeconomics**. McGraw-Hill Series Economics, 19th Edition, ISBN-13: 978-0077337728, ISBN-10: 0077337727.

https://www.amazon.com/Macroeconomics-McGraw-Hill-Economics-Campbell-McConnell/dp/0077337727

Mills, E. C, (1993), "The Misuse of Regional Economic Models", **Cato Journal**, 13(1): 29-39.

https://ideas.repec.org/a/cto/journl/v13y1993i1p29-39.html

Muchdie, (1998), **Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study**, Unpublished PhD Thesis, Department of Economics, the University of Queensland, Australia. http://espace.library.uq.edu.au/view/UQ:218710

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables**, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6.

http://repository.uhamka.ac.id/139/

Muchdie, (2017), "GIRIOT revisited, up-dated and evaluated", **International Journal of Social Science and Economic Research,** 2(02): 2377-2396.

http://www.ijsser.org/more2017.php?id=148

Pindyck, R & Rubinfeld, D (2012),**Macroeconomics,**The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X

https://www.amazon.com/Microeconomics-Student-Value-Pearson-Economics/dp/0132870436

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana, (2013), **Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach),** Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Siegfried, J, Allen R, Sanderson, A.R., and McHenry, P, (2006), "The Economic Impact of Colleges and Universities", **Working Paper No. 06-W12**.

http://www.accessecon.com/pubs/VUECON/vu06-w12.pdf.

Chapter 9

Sectorand Spatial-Specific Multipliers in Nusa Tenggara Island Economy[1]

Ringkasan

Bab ini menyajikan hasil analisis tentang angka pengganda total dan efek mengalir, pengganda sektor spesifik, dan pengganda spesifik ruang dan distribusi ruang efek mengalir dalam perekonomian kepulauan Nusa Tenggara, utamanya untuk keperluan evaluasi dan perencanaan. Model yang digunakan adalah Model Input-Output Antar-Pulau (MIOAP), yang dikembangkan menggunakan prosedur hibrida baru dengan perhatian khusus pada ekonomi kepulauan. Data untuk model ini adalah data Indonesia tahun 2015. Hasilnya menunjukkan bahwa, pertama sektor-sektor penting dapat didasarkan pada angka pengganda, baik total maupun efek mengalir dari output, pendapatan dan kesempatan kerja. Kedua, sektor penting juga dapat ditentukan berdasarkan pengganda spesifik sektor dengan melihat besaran angka pengganda yang terjadi pada sektor sendiri atau juga pada sektor lain. Ketiga, sektor penting juga ditentukan berdasarkan pengganda spasial spesifik; yaitu pengganda yang terjadi di wilayah sendiri. Terakhir, sektor penting dan prioritas dapat ditentukan berdasarkan distribusi ruang efek mengalir; di wilayah sendiri atau di wilayah lain.

Summary

This chapter aimed to provide the results of analysis on total and flow-on multipliers, sectoral-specific, and spatial-specific multipliers in Nusa Tenggara Islands economy, mainly for planning and evaluation purposes. The model employed was Inter-Island Input-Output Model (IIIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Nusa Tenggara Island economy could be based on total

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multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers effects; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions. Fourthly, important economic sectors could be based on spatial distribution of flow-on; flow-on effects that occurred in own region as well as in other regions.

1. Introduction

Nusa Tenggara Islands or The Lesser Sunda Islands or Kepulauan Sunda Kecil ("Southeastern Islands") is a group of islands in Maritime Southeast Asia, north of Australia. Together with the Greater Sunda Islands to the west they make up the Sunda Islands. The islands are part of a volcanic arc, the Sunda Arc, formed by sub-duction along the Sunda Trench in the Java Sea. The main Lesser Sunda Islands are, from west to east: Bali, Lombok, Sumbawa, Flores, Sumba, Timor, Alor archipelago, Barat Daya Islands, and Tanimbar Islands (Wikipedia, 2016).

Nusa Tenggara Islands comprise many islands, most of which are part of Indonesia and are administered as the provinces of Bali with Denpasar as capital city, West Nusa Tenggara with Mataram as capital city, and East Nusa Tenggara with Kupang as capital city (Anonymous, 2015). The province of Bali includes the island of Bali and a few smaller neighbouring islands, notably Nusa Penida, Nusa Lembongan, and Nusa Ceningan. It is located at the westernmost end of the Lesser Sunda Islands, between Java to the west and Lombok to the east. Its capital, Denpasar, is located in the southern part of the island. The island is home to most of Indonesia's Hindu minority. According to the2010 Census, 83.5 per cent of Bali's population adhered to Balinese Hinduism, followed by 13.4 per cent Muslim, Christianity at 2.5 per cent, and Buddhism 0.5 per cent (Anonymous, 2015).

West Nusa Tenggara (Indonesian: Nusa Tenggara Barat – NTB) is a province of Indonesia. It comprises the western portion of the Lesser Sunda Islands, with the exception of Bali which is its own province. Mataram, on Lombok, is the capital and largest city of the province. The province's area is 19,708.79 km2. The two largest islands in the province are Lombok in the west and the larger Sumbawa in the east (Anonymous, 2015). East Nusa Tenggara (Indonesian:

Nusa Tenggara Timur – NTT) is the southernmost province of Indonesia. It is located in the eastern part of the Lesser Sunda Islands and includes West Timor. It has a total area of 48,718.1 km2 (Wikipedia, 2016). The provincial capital is Kupang on West Timor. The province consists of more than 500 islands, the three largest being Flores, Sumba, and the western half of Timor (West Timor)

According to Prihawantoro, et al (2013), the main economic activities in Nusa Tenggara Island were Sector-1; Agriculture, livestock and fishery in all provinces, Sector-6: Trade, hotel and restaurant (only in Bali). Bali-Nusa Tenggara contribution to national economy less than 3 per cent (Harian Aktual, December 2015), but Bali position as international tourist destination is very important. According to Tribunenews (2016), Bali's economic growth (10.3%) was far above national economic growth (5.02%).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (Dornbusch, R., & Stanley, F., 1994; McConnell, C., et. al, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes.

Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioural assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief's work in 1951, which developed a set of national level multipliers that could be used to estimate the economy-wide effect that an initial change in final demand has on an economy. Isard then applied input-output analysis to a regional economy (Muchdie, 2011). The first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson in 1955 for the state of Utah. In a parallel development, Tiebout in 1956 specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending (Muchdie, 2011).

In a survey of input-output and economic base multipliers, Richardson notes the difficulty inherent in specifying the local share of spending. He notes the growth of survey-based regional input-output models in the 1960s and 1970s that allowed for more accurate estimation of local spending, though at a large cost in terms of resources (Muchdie, 2011). Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional I-O multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects.

Grady & Muller (1988) argued that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) noted the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discussed the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Harris (1997) discussed the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, et al (2006) discussed theapplication of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused.

Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions.

Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy (Muchdie, 2011).

The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects (West & Jensen, 1980; West et al, 1982; 1989).

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen in Muchdie (2011) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific multipliers that can be used for evaluation and planning economic development in Nusa Tenggara Island. The most significant contribution of this paper is the calculation of sector-spesific multipliers that could trace multipliers that occurs in own sector and other sectors as well as the calculation of spatial-specific multipliers; multipliers that occur in own island and other islands.

2. Method of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990 and West et.al, 1982; 1989). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matricesrepresenting the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing interindustry trade flows between each pair of regions. These matrices show the specific interindustry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i};\ (i, j = 1,2,\dots,n) \text{ and } (r, s = 1,2,\dots,m) \qquad (1)$$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions.

The spatial input coefficients are derived in the same way as the direct input coefficients in the national or the single-region model. For region *s*, the spatial input coefficients are expressed as:

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \qquad (2)$$

Substituting (2) into (1):

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}a_{ij}\, {}^{s}X_{j} + \sum_{s} {}^{rs}Y_{i};\ (i, j = 1,2,\dots,n) \text{ and } (r ,s = 1,2,\dots,m) \qquad (3)$$

Since equations (1) to (3) refer to general case, it is more convenient to refer specifically to each of the intra-regional and the inter-regional matrices:

$$^{r}X_{i} = \sum_{j} {}^{rr}X_{ij} + \sum_{j} {}^{rs}X_{ij} + {}^{r}Y_{i};\ (i, j = 1, 2,\dots n) \qquad (4)$$

and

$$^{s}X_{i} = \sum_{j} {}^{sr}X_{ij} + \sum_{j} {}^{ss}X_{ij} + {}^{s}Y_{i};\ (i, j = 1, 2,\dots n) \qquad (5)$$

From (4) and (5), it is possible to determine regionally defined input coefficients, according to the relevant intra-regional and inter-regional trade matrices:

$$^{rr}a_{ij} = {}^{rr}X_{ij}/{}^{r}X_{j} \qquad (6)$$

$$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_{j} \qquad (7)$$

$$^{sr}a_{ij} = {}^{sr}X_{ij}/{}^{r}X_{j} \qquad (8)$$

$$^{ss}a_{ij} = {}^{ss}X_{ij}/{}^{s}X_{j} \qquad (9)$$

Equations (6) and (9) present the familiar intra-regional direct input coefficients, while equations (7 and (8 represent inter-regional trade coefficients. Equations (6) to (9) can be substituted into equation (4) and (5) resulting the traditional input-output equations:

$${}^{r}X_{i} = \sum_{j} {}^{rr}a_{ij} {}^{r}X_{j} + \sum_{j} {}^{rs}a_{ij} {}^{s}X_{j} + {}^{r}Y_{i} \; ; \; (i, j = 1,2,...n) \quad (10)$$

and

$${}^{s}X_{i} = \sum_{j} {}^{sr}a_{ij} {}^{r}X_{j} + \sum_{j} {}^{ss}a_{ij} {}^{s}X_{j} + {}^{s}Y_{i} \; ; \; (i, j = 1,2,...n) \quad (11)$$

The equations outlined above can be extended in parallel to the national or single region input-output system. In matrix terms they can be expressed as:

$${}^{r}x = {}^{rr}A \, {}^{r}x + {}^{r}y \quad \text{or} \quad {}^{r}x = (I - {}^{rr}A)^{-1} \, {}^{r}y \quad (12)$$

and

$${}^{s}x = {}^{ss}A \, {}^{s}x + {}^{s}y \quad \text{or} \quad {}^{s}x = (I - {}^{ss}A)^{-1} \, {}^{s}y \quad (13)$$

where $(I - {}^{rr}A)^{-1}$ and $(I - {}^{ss}A)^{-1}$ are the inverse of the open inter-regional model. In general term, equation (12) and (13) can be written as:

$$x = Ax + y \quad \text{or} \quad x = (I - A)^{-1}y \quad (14)$$

Since the regional input coefficients of equations (6) to (9) or the A matrix in equation (13) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model. Equation (13) can then be rewritten as:

$$x = T\,(A\,x + y) \quad \text{or} \quad x = (I - T\,A)^{-1}y \quad (15)$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I:

Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated by Indonesian data 2015.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West and Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

Table 9.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Source: West, *et al* (1982; 1989).

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, (1982; 1989) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table 9.1.

Table 9.22

Inter-regional Sector-Specific and Region-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i}$; r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij}$; i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i}$; i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i}$; i = 1,..n

Source: DiPasquale & Polenske (1980).

Note: *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

DiPasquale & Polenske (1980) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment.

The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region. Formula provided in Table 1 and Table 2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

3. Results and Discussions

a. Total and Flow-on Effects

Table 9.3 and Figure 9.1 present total output, income and employment multipliers and flow-on effects in Nusa Tenggara Island. In term of output, the highest total multiplier was NUS-3 (Manufacturing in Nusa Tenggara Island), 2.837. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.837 including the initial increase of 1.000.It was followed by NUS-4 (Electricity, water and gas in Nusa Tenggara Island), 2.819 meaning that an increase of final demand of that sector by 1.000 would increase total output by 2.819 including the initial increase of 1.000. The flow-on effect was 1.819. The lowest total multipliers was in NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Island), 1.620. An increase of final demand of that sector by 1.000 units would increase total output by 1.620 including the initial increase of 1.000.

Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in NUS-3 (Manufacturing in Nusa Tenggara Island), the increase of final demand by 1.000 would have initial income effects by 0.114, resulting total income of 0.442. The income flow-on effect of NUS-3 (Manufacturing in Nusa Tenggara Island) was 0.328. The highest income flow-on effect was in NUS-3 (Manufacturing in Nusa Tenggara Island) 0.328, followed by NUS-9 (Other services in Nusa Tenggara Island). The lowest income flow-on effect was in, NUS-1 (Agriculture, livestock and fishery), 0124. In this case ranking based on total income multipliers were different than those based on flow-on effect as there were differences in initial effects.

Table 9.3

Total and Flow-on Effects: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Initial	Flow-on	Total	Initial	Flow-on	Total	Initial	Flow-on	Total
NUS-1	1.000	0.620	1.620	0.187	0.124	0.311	0.981	0.260	1.241
NUS-2	1.000	1.145	2.145	0.349	0.234	0.583	1.923	0.393	2.316
NUS-3	1.000	1.837	2.837	0.114	0.328	0.442	0.386	0.784	1.170
NUS-4	1.000	1.819	2.819	0.091	0.305	0.396	0.422	0.494	0.916
NUS-5	1.000	1.531	2.531	0.165	0.290	0.455	0.422	0.465	0.887
NUS-6	1.000	1.011	2.011	0.158	0.198	0.356	0.232	0.441	0.673
NUS-7	1.000	1.262	2.262	0.182	0.292	0.474	0.422	0.484	0.906
NUS-8	1.000	0.885	1.885	0.243	0.185	0.428	0.422	0.316	0.738
NUS-9	1.000	1.520	2.520	0.485	0.314	0.799	0.307	0.596	0.903

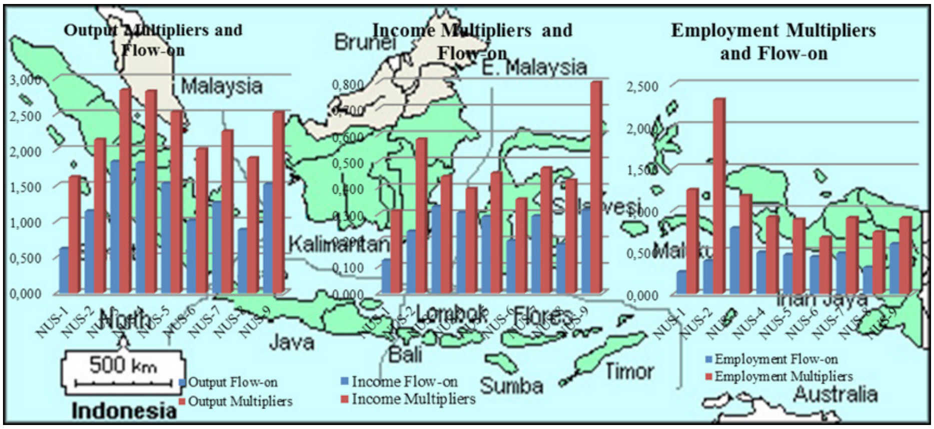

Figure 9.1

Total Multipliers and Flow-on Effects: Output, Income and Employment

In term of employment, the highest total employment multiplier was in NUS-2 (Mining and quarrying in Nusa Tenggara Island), 2.316. It was then followed by NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Island) with total income multipliers of 1.241. The lowest total employment multiplier was in NUS-6 (Trade, hotel and restaurant) with total employment multipliers of 0.673. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in NUS-3 (Manufacturing in Nusa Tenggara Island), 0.596 and followed by NUS-9 (Other services in Nusa Tenggara Island), 0.260. The lowest income flow-on effect was in, again, NUS-1 (Agriculture, livestock and fishery).

b. Sector-Specific Multipliers

Figure 9.2 provides sector-specific multipliers for output, income and employment in Nusa Tenggara Island economy. In term of output, there were 5 sectors that less than 50 per cent of multipliers occurred in own sectors; it means that more than 50 per cent of multipliers occurred in other sector, namely NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara), NUS-3 (Manufacturing in Nusa Tenggara Island) NUS-6 (Trade, hotel and restaurant in Nusa Tenggara Island), NUS-7 (Transportation and communication in Nusa Tenggara Island) and NUS-8 (Banking and other finance in Nusa Tenggara Island). Meanwhile, other 4 sectors with more than 50 per cent multipliers occurred in own sector; in other words that there were 5 sectors with less than 50 per cent multipliers occurred in other sector. These sectors were: NUS-2 (Mining and quarrying in Nusa Tenggara Island), NUS-4 (Electricity, Water and Gas), NUS-5(Construction in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands).

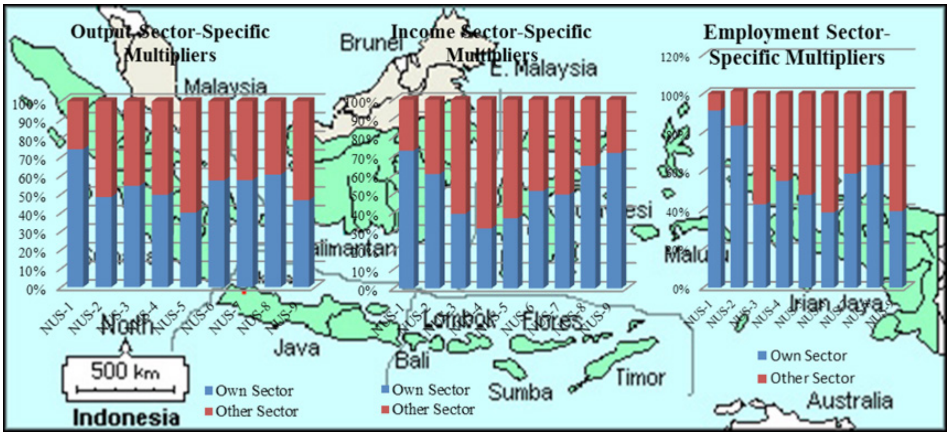

Figure 9.2

Sector-Specific Multipliers: Output, Income and Employment

In term of income, there were 4 sectors that more than 50 per cent of multipliers occurred in own sectors; it means that less than 50 per cent of multipliers occurred in other sectors, namely NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-2 (Mining and Quarrying in Nusa Tenggara Islands), NUS-8 (Bank and other finance in Nusa Tenggara Islands) and NUS-9 (Other services in Nusa Tenggara Islands). Meanwhile, other 5 sectors with less than 50 per cent multipliers occurred in own sector; in other words that there were 5 sectors with more than 50 per cent of multipliers occurred in other sectors. These sectors were: NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, Water and Gas in Nusa Tenggara Islands), NUS-5 (Construction in Nusa Tenggara Islands), NUS-6 (Trade, hotel and restaurant) and NUS-7 (Transportation and communication in Nusa Tenggara Islands).

In term of employment, there were 5 sectors that more than 50 per cent of multipliers occurred in own sectors; it means that less than 50 per cent of multipliers occurred in other sectors, namely NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-2 (Mining and Quarrying in Nusa Tenggara Islands), NUS-4 (Electricity, Water and Gas in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands) and NUS-8 (Banking and other finance in Nusa Tenggara Islands). Meanwhile, other 4 sectors with less than 50 per cent multipliers occurred in own sector; in other words that there were 4 sectors with more than 50 per cent of multipliers occurred in other sectors. These sectors were: NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-5 (Construction in Nusa Tenggara Islands), NUS-6

(Trade, hotel and restaurant), and NUS-9 (Other services in Nusa Tenggara Islands).

c. Spatial-Specific Multipliers

Figure 3 provides spatial-specific multipliers of output, income and employment multipliers in Nusa Tenggara Islands' economy. In term of output, all sectors had more than 50 per cent of multipliers occurred in own region, in Nusa Tenggara Islands. All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands. For income, all sectors had more than 50 per cent of multipliers occurred in own region; in Nusa Tenggara Islands, except NUS-4 (Electricity, Water and Gas in Nusa Tenggara Islands). All sectors had less than 50 per cent of multipliers occurred in other regions; other Islands, except for NUS-4. In term of employment, all sectors had more than 50 per cent of multipliers occurred in own region; Nusa Tenggara Islands. Again, all sectors had less than 50 per cent of multipliers occurred in other regions; other Islands.

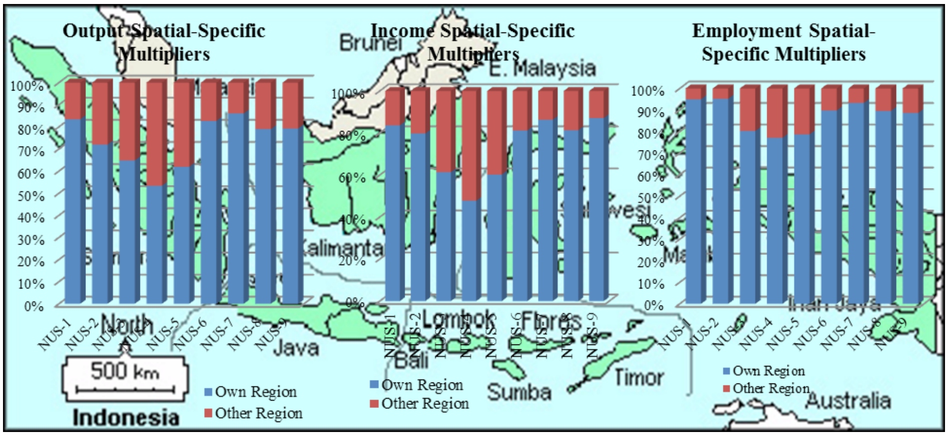

Figure 9.3

Spatial-Specific Multipliers: Output, Income and Employment

d. Spatial Distribution of Flow-on Effects

Figure 9.4 presents spatial distribution of flow-on effects in Nusa Tenggara Islands' economy. In term of output, 5 sectors had flow-on effects that more than 50 per cent of flow-on occurred in own region, namely: NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-6 (Trade, hotel and restaurant in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands), NUS-8 (Banking and other finance in Nusa Tenggara Islands) and NUS-9 (Other services in Nusa Tenggara Islands). Meanwhile, 4 other sectors had flow-on effect that less than 50 per cent occurred in own region, meaning that more than 50 per cents of flow-on effect occurred in other region, namely: NUS-2 (Mining and quarrying in Nusa Tenggara Islands), NUS-3(Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands) and NUS-5 (Construction in Nusa Tenggara Islands).

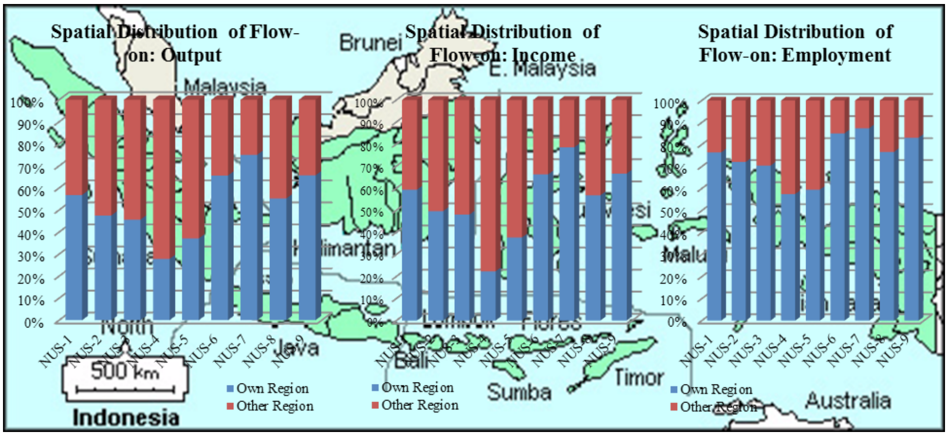

Figure 9.4

Spatial Distribution of Flow-on Effects: Output, Income and Employment

In term of income, 6 sectors had flow-on effects that more than 50 per cent of flow-on occurred in own region, namely: NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-2 (Mining and quarrying in Nusa Tenggara Islands), NUS-6 (Trade, hotel and restaurant in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands), NUS-8 (Banking and other finance in Nusa Tenggara Islands) and NUS-9 (Other services in Nusa Tenggara Islands). Meanwhile, 3 other sectors had flow-on effect that less than 50 per cent occurred in own region, meaning that more than 50 per cents of flow-on effect occurred in other region, namely: NUS-3(Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands) and NUS-5 (Construction in Nusa Tenggara Islands).

In term of employment, all sector had employment flow-on that occurred in own region more than 50 per cent. All sectors had the flow-on effects that occurred in other regions were less than 50 per cent.

4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Nusa Tenggara Islands' economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Java Islands economy were NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands), and NUS-5 (Construction in Nusa Tenggara Islands). Based on total income multipliers, three important sectors in Java Islands economy were NUS-2 (Mining and quarrying in Nusa Tenggara Islands), NUS-3 (Manufacturing in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on total employment multipliers, three important sectors in Nusa Tenggara Islands economy were NUS-1 (Agriculture, livestock, forestry and fishery), NUS-2 (Mining and quarrying in Nusa Tenggara Islands), and NUS-3 (Manufacturing in Nusa Tenggara Islands). Based on output flow-on effects, three important sectors in Nusa Tenggara Islands economy were NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands), and NUS-5 (Construction in Nusa Tenggara Islands). Based on income flow-on effects, three important sectors in Nusa Tenggara Islands economy were NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on employment flow-on effects, three important sectors were NUS-3 (Manufacturing in Nusa Tenggara Islands), NUS-4 (Electricity, water and gas in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were: NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-8 (Banking and other finance in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-8 (Banking and other finance in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were NUS-1 (Agriculture, livestock and fishery in Nusa

Tenggara Islands), NUS--2 (Mining and quarrying in Nusa Tenggara Islands), and NUS-8 (Banking and other fiancé in Nusa Tenggara Islands).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Java Islands. Based on output spatial-specific multipliers that occurred in own region, three important sectors were: NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-6 (Trade, hotel and restaurant in Nusa Tenggara Islands), and NUS-7 (Transportation and communication in Nusa Tenggara Islands). Based on income sector-specific multipliers that occurred in own region, three important sectors were: NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were NUS-1 (Agriculture, livestock and fishery in Nusa Tenggara Islands), NUS-2 (Mining and quarrying in Nusa Tenggara Islands), and NUS-7 (Transportation and communication in Nusa Tenggara Islands).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Nusa Tenggara Islands. Based on output spatial distribution of flow-on that occurred in own region, three important sectors were: NUS-6 (Trade, hotel and restaurant in Nusa Tenggara Islands), NUS-7 (Transportation and communication in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on income spatial distribution of low-on that occurred in own region, three important sectors were: NUS-7 (Transportation and communication in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were NUS-7 (Transportation and communication in Nusa Tenggara Islands), and NUS-9 (Other services in Nusa Tenggara Islands).

References

Ahiakpor, J.C.W., (2000),"Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance?",**History of Political Economy**, 32 (4): 889-908. https://muse.jhu.edu/article/13245/pdf

Anonymous, (2015), **Statistik Indonesia 2014**, Jakarta: Badan Pusat Statistik.

http://www.bps.go.id/index.php/publikasi/326

Beemiller, R.M., (1990),"Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque",**International Regional Science Review**, 13 (1-2): 99-101.

http://journals.sagepub.com/doi/abs/10.1177/ 016001769001300107

Coughlin, C., and Mandelbaum, T.B., (1991)," A Consumer's Guide to Regional Economic Multipliers",**Federal Reserve Bank of St. Louis Review**, January/February 1991:19-32. https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-to-regional-economic-multipliers/

DiPasquale, D., and Polenske, K.R., (1980),"Output, Income and Employment Input-Output Multipliers", in S. Pleeter (Ed),**Economic Impact Analysis: Methodology and Applications**, Studies in Applied Regional Science, Boston: Martinus Nijhoff Publishing: 85-113. http://www.springer.com/gp/book/9789401174077

Dornbusch, R., and Stanley, F.,(1994), **Macroeconomics**, Sixth Edition, International Edition, McGraw-Hill.

Grady, P., and Muller, R., A., (1988),"On the use and misuse of input-output based impact analysis in evaluation",**The Canadian Journal of Program Evaluation**, 2 (3): 49-61,https://www.researchgate.net/publication/43126426_n_The_Use_and_ Misuse_of_ Input-Output_Based_Impact_Analysis_in_Evaluation

Hall, R. E., (2009),"By How Much Does GDP Rise if the Government Buys More Output?", NBER Working Paper 15496,**National Bureau of Economic Research**,www.nber.org/papers/w15496.pdf?new_window=1

Harian Aktual, (2015)," Bali-Nusa Tenggara Berkontribusi Terhadap Perekonomian Nasional", **Harian Aktual,** 5 Desember 2015. http://www.aktual.com/bali-nusa-tenggara-berkontribusi-terhadap-perekonomian-nasional/

Harris, P., (1997), "Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry", **The Journal of Tourism Studies**, 8(2): 1-12,http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impact-multipliers-by-practitioners.html

Hartwick, J.,(1971), "Notes on the Isard and Chenery-Moses Inter-regional Input-Output Models", **Journal of Regional Science**, 11(1):73-86. http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1971.tb00241.x/full

Hughes, D. W., (2003),"Policy uses of economic multipliers and impact analysis",**Choices Publication of the American Agricultural Economics Association**, Second Quarter,http://www.choicesmagazine.org/2003-2/2003-2-06.htm

Hulu, E., (1990), Model Input-Output: Teori dan Applikasinya (*Input-Output Model: Theory and Its Applications*), Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Jakarta: Universitas Indonesia (*the University of Indonesia*).

Isard, W., (1951),"Inter-regional and Regional Input-Output Analysis: A Model of a Space-Economy". **Review of Economics and Statistics**, 33(4): 318-328. http://www.jstor.org/stable/1926459

Kahn, R., (1931),"The Relation of Home Investment to Unemployment",**Economic Journa**l, 41(162):173-198,http://dx.doi.org/10.2307/2223697

Krugman, P., and Wells, R., (2009),**Economics**, Worth Publisher, p: 1200, Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier: 393–396. http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECPS3e_Macro_CH14.pdf

Leontief, W.W., (1951),**The Structure of American Economy 1919-1939**, Second Edition, Cambridge: Harvard University Press. http://www.wleontief.ru/eng/40.html

Mankiw, N.G., (2008),**Macroeconomics**, Eight Edition, South-Western Publishing, Part VI: Money and Prices in the Long Run: The Money Multiplier: 347–349.

McConnell, C., Brue, S., and Flynn, S., (2011),**Macroeconomics**, McGraw-Hill Series Economics, 19th Edition. ISBN-13: 978-0077337728, ISBN-10: 0077337727. https://www.amazon.com/Macroeconomics-McGraw-Hill-Economics-Campbell-McConnell/dp/0077337727

Mills, E. C., (1993),"The Misuse of Regional Economic Models", **Cato Journal**, 13(1): 29-39. https://ideas.repec.org/a/cto/journl/v13y1993i1p29-39.html

Moore, F.T., and Petersen, J., (1955),"Regional Analysis: An Inter-industry Model of Utah",**Review of Economics and Statistics**, 37: 368-383. http://www.jstor.org/stable/1925851?seq= 1#page_scan_ tab_contents

Muchdie, (1998), "Spatial Structure of Island Economy of Indonesia: An Inter-

Regional Input-Output Study", **unpublished PhD Thesis**, Department of Economics, the University of Queensland, Australia. http://espace.library.uq.edu.au/view/UQ:218710

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables**, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6. http://repository.uhamka.ac.id/139/

Pindyck, R., and Rubinfeld, D., (2012), **Macroeconomics,**The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X. https://www.amazon.com/Microeconomics-Student-Value-Pearson-Economics/dp/0132870436

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana. (2013),**Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity**, Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Richardson, H.W., (1985),"Input-Output and Economic Base Multipliers: Looking Backward and Forward",**Journal of Regional Science**, 25 (4): 607-661. http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1985.tb00325.x/abstract

Siegfried, J, Allen R., Sanderson, A.R., and McHenry, P., (2006),**The Economic Impact of Colleges and Universities,** Working Paper No. 06-W12. http://www.accessecon.com/pubs/VUECON/vu06-w12.pdf.

Tiebout, C.M., (1956),"A Pure Theory of Local Expenditures",**The Journal of Political Economy**, 64(5): 416-424, http://www.jstor.org/stable/1826343

Tribunenews, 2016," Pertumbuhan Ekonomi Bali dan Nusa Tenggara dalam Kategori Luar Biasa", 9 Februari 2016. http://www.tribunnews.com/bisnis/2016/02/29/pertumbuhan-ekonomi-bali-dan-nusa-tenggara-kategori-luar-biasa

West, G.R, and Jensen, R. C., (1980),"Some Reflections on Input-Output Multipliers", **Annals of Regional Science**, 14 (2): 77-89. https://www.researchgate.net/publication/226244596_Some_ Reflections_on_Input-Output_Multipliers

West, G.R., and Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., (1989),**Regional and Inter-regional Input-Output Tables for Queensland 1985/86**, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia. https://www.library.ohiou.edu/indopubs/2001/08/25/0033.html

West, G.R., Morison, J.B. and Jensen, R.C., (1982,An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

Wikipedia (2016), https://id.wikipedia.org/wiki/Kepulauan_Nusa_Tenggara

Chapter-10

Spatial Dimension of Multipliers in Eastern Indonesia's Economy[1]

Ringkasan

Bab ini menyajikan hasil analisis tentang angka pengganda total dan efek mengalir, pengganda sektor spesifik, dan pengganda spesifik ruang dan distribusi ruang efek mengalir dalam perekonomian di kepulauan Indonesia Timur, utamanya untuk keperluan evaluasi dan perencanaan. Kepulauan ini terdiri atas 3 gugus kepulauan: Sulawesi (6 provinsi), Maluku (2 provinsi) dan Papua (2 provinsi). Model yang digunakan adalah Model Input-Output Antar-Pulau (MIOAP), yang dikembangkan menggunakan prosedur hibrida baru dengan perhatian khusus pada ekonomi kepulauan. Data untuk model ini adalah data Indonesia tahun 2015. Hasilnya menunjukkan bahwa, pertama sektor-sektor penting dapat didasarkan pada angka pengganda, baik total maupun efek mengalir dari output, pendapatan dan kesempatan kerja. Kedua, sektor penting juga dapat ditentukan berdasarkan pengganda spesifik sektor dengan melihat besaran angka pengganda yang terjadi pada sektor sendiri atau juga pada sektor lain. Ketiga, sektor penting juga ditentukan berdasarkan pengganda spatial spesifik; yaitu pengganda yang terjadi di wilayah sendiri. Terakhir, sektor penting dan prioritas dapat ditentukan berdasarkan distribusi ruang efek mengalir; di wilayah sendiri atau di wilayah lain.

Summary

This chapter aimed to provide the results of analysis on total and flow-on multipliers, sectoral-specific, and spatial-specific multipliers in Eastern Indonesia's

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Islands economy, mainly for planning and evaluation purposes. These Islands consist of three big Islands such as: Sulawesi (6 provinces), Maluku (2 provinces) and Papua (2 provinces). The model employed was Inter-Island Input-Output Model (IIIOM) developed using new hybrid procedures with special attention on Island economy. Data used for model were updated Indonesian data for the year of 2015. The results show that firstly, the important sectors of Eastern Indonesia's Island economy could be based on total multipliers and flow-on effects of output, income and employment. Secondly, important economic sectors could be based on sector-specific multipliers; multipliers that occurred in own sector and other sectors. Thirdly, important economic sectors could be based on spatial-specific multipliers; multipliers that occurred both in own region and other regions.

1. Introduction

Eastern Indonesia's island in this study consists of three big groups of Islands: Sulawesi, Maluku and Papua. Sulawesi is one of the country's main islands, which stands as the 11th largest island in the world. The Maluku Islands, also known as the Spice Islands, comprise 632 islands alone. Famous for their nutmeg, cloves, and mace, these mountainous forest-covered areas are largely unexplored and offer a wealth of complex, indigenous charm. Papua is widely considered one of the most remote places on earth and home to some of the most abundant biodiversity in the world. Off Papua's coast are the 610 islands that make up the Raja Ampat islands. Spread over 50,000 kilometers, the Raja Ampat islands offer spectacular scenery with majestic limestone structures covered in orchids, craggy spires, and the greatest and healthiest coral reef biodiversity for its size in the world (Anonymous, 2016).

Administratively, Eastern Indonesia consists of ten provinces. In Sulawesi Island there are six provinces, namely:North Sulawesi, Gorontalo, Central Sulawesi, South-East Sulawesi, West Sulawesi and South Sulawesi. In Maluku Islands, there are two provinces: North Maluku and Maluku, and in Papua island there are two provinces: West Papua and Papua.

According to Prihawantoro (2013), the main economic activities in Sulawesi Island were Sector-1; Agriculture, livestock and fishery in North Sulawesi, Gorontalo, Central Sulawesi, South-East Sulawesi, West Sulawesi and South Sulawesi; Sector-5: Construction in North Sulawesi; Sector-6 : Trade, hotel and restaurant in North Sulawesi and South Sulawesi; and Sector-9: Other services in North Sulawesi and South Sulawesi.

Based on 2013 data, Eastern Indonesia's contribution to Indonesia GDP was only about 7 per cent. Meanwhile Sumatra Island contributed about 23 per cent; Java's contribution was 58 per cent; Kalimantan contribution was about 9 per cent; Nusa Tenggara contribution was 3 per cent (Anonymous, 2015).

In macroeconomics, a multiplier is a factor of proportionality that measures how much an endogenous variable changes in response to a change in some exogenous variable (Dornbusch, R., & Stanley, F., 1994; McConnell, C., et. al, 2011; Pindyck, R & Rubinfeld, D., 2012). In monetary microeconomics and banking, the money multiplier measures how much the money supply increases in response to a change in the monetary base (Krugman & Wells 2009; Mankiw, 2008). Multipliers can be calculated to analyze the effects of fiscal policy, or other exogenous changes in spending, on aggregate output. Other types of fiscal multipliers can also be calculated, like multipliers that describe the effects of changing taxes. Literature on the calculation of Keynesian multipliers traces back to Richard Kahn's (1931) description of an employment multiplier for government expenditure during a period of high unemployment. At this early stage, Kahn's calculations recognize the importance of supply constraints and possible increases in the general price level resulting from additional spending in the national economy (Ahiakpor, J.C.W., 2000). Hall (2009) discusses the way that behavioural assumptions about employment and spending affect econometrically estimated Keynesian multipliers.

The literature on the calculation of I-O multipliers traces back to Leontief (1951), who developed a set of national level multipliers that could be used to estimate the economy wide effect that an initial change in final demand has on an economy. Isard (1951) then applied input-output analysis to a regional economy. According to Richardson (1985), the first attempt to create regional multipliers by adjusting national data with regional data was Moore & Peterson (1955) for the state of Utah. In a parallel development, Tiebout (1956) specified a model of regional economic growth that focuses on regional exports. His economic base multipliers are based on a model that separates production sold to consumers from outside the region to production sold to consumers in the region. The magnitude of his multiplier is based on the regional supply chain and local consumer spending. In a survey of input-output and economic base multipliers, Richardson (1985) notes the difficulty inherent in specifying the local share of spending. He notes the growth of survey-based regional input-output models in the 1960s and 1970s that allowed for more accurate estimation of local spending, though at a large cost in terms of resources. Beemiller (1990) of the BEA describes the use of primary data to improve the accuracy of regional multipliers. The literature on the use and misuse of regional multipliers and models is extensive. Coughlin & Mandelbaum (1991) provide an accessible introduction to regional IO multipliers. They note that key limitations of regional I-O multipliers include the accuracy of leakage measures, the emphasis on short-term effects, the absence of supply constraints, and the inability to fully capture interregional feedback effects. Grady & Muller (1988) argued that regional I-O models that include household spending should not be used and argue that cost-benefit analysis is the most appropriate tool for analyzing the benefits of particular programs. Mills (1993) noted the lack of budget constraints for governments and no role for government debt in regional IO models. As a result, in less than careful hands, regional I-O models can be interpreted to over-estimate the economic benefit of government spending projects. Hughes (2003) discussed the limitations of the application of multipliers and provides a checklist to consider when conducting regional impact studies. Harris (1997) discussed the application of regional multipliers in the context of tourism impact studies, one area where the multipliers are commonly misused. Siegfried, et al (2006) discussed the application of regional multipliers in the context of college and university impact studies, another area where the multipliers are commonly misused. Input-output analysis, also known as the inter-industry analysis, is the name given to an analytical work conducted by Leontief in the late 1930's. The fundamental purpose of the input-output framework is to analyze the interdependence of industries in an economy through market based transactions. Input-output analysis can provide important and timely information on the interrelationships in a regional economy and the impacts of changes on that economy. The notion of multipliers rests upon the difference between the initial effect of an exogenous change (final demand) and the total effects of a change. Direct effects measure the response for a given industry given a change in final demand for that same industry. Indirect effects represent the response by all local industries from a change in final demand for a specific industry. Induced effects represent the response by all local industries caused by increased (decreased) expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a specific industry. Total effects are the sum of direct, indirect, and induced effects. One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West & Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

The objective of this paper is to report the research in developing and applying a model that provides information on multipliers: total, flow-on, sectoral-specific and spatial-specific, so they can be further used for planning and evaluating regional economic development in Eastern part of Indonesia.

2. Method of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990 and West et.al, 1982; 1989). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location. The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$ {}^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1,2,\ldots,n) \text{ and } (r, s = 1,2,\ldots,m) \tag{1} $$

There are (m x n) equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions.The spatial input coefficients are derived in the same way as the direct input coefficients in the national or the single-region model. For region s, the spatial input coefficients are expressed as:

$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_j$ (2)

Substituting (2) into (1):

$^{r}X_i = \sum_j \sum_s {}^{rs}a_{ij}\,{}^{s}X_j + \sum_s {}^{rs}Y_i$; $(i, j = 1,2,...,n)$ and $(r, s = 1,2,...,m)$ (3)

Since equations (1) to (3) refer to general case, it is more convenient to refer specifically to each of the intra-regional and the inter-regional matrices:

$^{r}X_i = \sum_j {}^{rr}X_{ij} + \sum_j {}^{rs}X_{ij} + {}^{r}Y_i$; $(i, j = 1, 2,...n)$ (4)

and

$^{s}X_i = \sum_j {}^{sr}X_{ij} + \sum_j {}^{ss}X_{ij} + {}^{s}Y_i$; $(i, j = 1, 2,...n)$ (5)

From (4) and (5), it is possible to determine regionally defined input coefficients, according to the relevant intra-regional and inter-regional trade matrices:

$^{rr}a_{ij} = {}^{rr}X_{ij}/{}^{r}X_j$ (6)

$^{rs}a_{ij} = {}^{rs}X_{ij}/{}^{s}X_j$ (7)

$^{sr}a_{ij} = {}^{sr}X_{ij}/{}^{r}X_j$ (8)

$^{ss}a_{ij} = {}^{ss}X_{ij}/{}^{s}X_j$ (9)

Equations (6) and (9) present the familiar intra-regional direct input coefficients, while equations (7 and (8 represent inter-regional trade coefficients.

Equations (6) to (9) can be substituted into equation (4) and (5) resulting the traditional input-output equations:

$^{r}X_i = \sum_j {}^{rr}a_{ij}\,{}^{r}X_j + \sum_j {}^{rs}a_{ij}\,{}^{s}X_j + {}^{r}Y_i$; $(i, j = 1,2,...n)$ (10)

and

$^{s}X_i = \sum_j {}^{sr}a_{ij}\,{}^{r}X_j + \sum_j {}^{ss}a_{ij}\,{}^{s}X_j + {}^{s}Y_i$; $(i, j = 1,2,...n)$ (11)

The equations outlined above can be extended in parallel to the national or single region input-output system. In matrix terms they can be expressed as:

${}^{r}x = {}^{rr}A\,{}^{r}x + {}^{r}y$ or ${}^{r}x = (I - {}^{rr}A)^{-1}\,{}^{r}y$ (12)

and

${}^{s}x = {}^{ss}A\,{}^{s}x + {}^{s}y$ or ${}^{s}x = (I - {}^{ss}A)^{-1}\,{}^{s}y$ (13)

where $(I - {}^{rr}A)^{-1}$ and $(I - {}^{ss}A)^{-1}$ are the inverse of the open inter-regional model. In general term, equation (12) and (13) can be written as:

$x = A\,x + y$ or $x = (I - A)^{-1}y$ (14)

Since the regional input coefficients of equations (6) to (9) or the A matrix in equation (13) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model. Equation (13) can then be rewritten as:

$$x = \mathrm{T}\,(\mathrm{A}\,x + y) \quad \text{or} \quad x = (\mathrm{I} - \mathrm{T\,A})^{-1}y \tag{15}$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: *Estimation of Regional Technical Coefficients*, consists of two phases, namely Phase 1: *Derivation of National Technical Coefficients* and Phase 2: *Adjustment for Regional Technology*. Stage II: *Estimation of Regional Input Coefficients*, consists of two phases, namely Phase 3: *Estimation of Intra-regional Input Coefficients*, and Phase 4: *Estimation of Inter-regional Input Coefficients*, and Stage III: *Derivation Transaction Tables*, consists of three phases, namely Phase 5: *Derivation of Initial Transaction Tables*, Phase 6: *Sectoral Aggregation*, and Phase 7: *Derivation of Final Transaction Tables*. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015.

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West and Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West *et.al*, (1982; 1989) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formulas of such effects are provided in Table10.1.

Table 10.1

Component Effects of Output, Income and Employment Multipliers

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Source: West, *e, al* (1982; 1989).

Note: h_j is household income coefficient, e_j is employment output ratio, a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix.

DiPasquale & Polenske (1980) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment.

The inter-regional sector-specific multiplier expresses the inputs required from the whole economy to satisfy a unit expansion of a named sector's exogenously determined final demand. The inter-regional region-specific multiplier quantifies the inputs required from all sectors in a specified region to satisfy the unit demand expansion in a given region.

Formula provided in Table 10.1 and Table 10.2 were used to calculate total and flow-on multipliers, sector-specific multipliers and spatial-specific multipliers.

Table 10.2

Inter-regional Sector-Specific and Region-Specific Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i}$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i;}$ i = 1,..n

Source:DiPasquale & Polenske (1980).

Note: *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

3. Results and Discussions

a. Total Multipliers and Flow-on

Table 10.3 and Figure 10.1 present total output, income and employment multipliers and flow-on effects of output, income and employment in Eastern Indonesia's Island. In term of output, the highest output multipliers was EIR-4 (Electricity, water and gas), 2.647. It means that an increase of final demand of the sector by 1.000 would increase total output by 2.647 including the initial increase of 1.000. It was followed by EIR-5 (Construction), 2.551 meaning that an increase of final demand of that sector by 1.000 would increase total output by 2.551 including the initial increase of 1.000. The lowest total multipliers was in EIR-1 (Agriculture, livestock and fishery), 1.585. An increase of final demand of that sector by 1.000 units would increase total output by 1.585 including the initial increase of 1.000. The flow-on effects of output were the difference between total increase and initial increase. Flow-on effect is summation of direct, indirect and induced effects of an economic activity. In case of highest total multipliers (EIR-4) the flow-on effect was 1.647, meaning the impact of increase of final demand of EIR-4 (Electricity, water and gas) to total output was 1.647 as the initial effect was not included. The rank of total output multipliers might be different than that of output flow-on effects. The evidence from Eastern Indonesia's Island economy showed that the rank of total multipliers were the same as flow-on effects where EIR-4 (Electricity, water and gas) had the highest output flow-on effects, followed by EIR-5 (Construction) and EIR-9 (Other services) and the lowest value of output flow-on effects was EIR-1 (Agriculture, livestock and fishery).

In term of household income, the highest total income multiplier was in EIR-9 (Other services), 0.883. It means that an increase of final demand of EIR-9 (Other services) by 1.000 units would increase initial household income by 0.580 and then would increase total income by 0.883. It was followed by EIR-5 (Construction) with total income multipliers of 0.457. The lowest total income multiplier was in EIR-1 (Agriculture, livestock and fishery) with total income multipliers of 0.322. Income flow-on effects were the difference between total income multipliers and initial income effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects of an economic activity. For instance, in EIR-9 (Other services), the increase of final demand by 1.000 would have initial income effects by 0.580, resulting total income of 0.883. The income flow-on effect of EIR-9 (Other services) was 0.292. The highest income flow-on effect was in EIR-3 (Manufacturing), followed by EIR-9 (Other services). The lowest income flow-on effect was in, again, EIR-1 (Agriculture, livestock and fishery).

In term of employment, the highest total employment multiplier was in EIR-5 (Construction), 0.773. It means that an increase of final demand of in EIR-5 (Construction) by 1.000 units would increase initial employment of in EIR-5 (Construction) by 0.422 and then would increase total employment by 0.773. It was followed by EIR-3 (Manufacturing) with total employment multipliers of 0.720. The lowest total employment multiplier was in EIR-7 (Transportation and communication) with total employment multipliers of 0.305. Employment flow-on effects were the difference between total employment multipliers and initial employment effects from the increase of final demand in that sector. It is the summation of direct, indirect and induced effects on employment from an economic activity. The highest employment flow-on was in EIR-3 (Manufacturing), followed by EIR-9 (Other services). The lowest income flow-on effect was in EIR-2 (Mining and quarrying).

Table 10.3

Total Multiplies and Flow-on Effects: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Initial	Flow-on	Total	Initial	Flow-on	Total	Initial	Flow-on	Total
EIR-1	1.000	0.585	1.585	0.207	0.115	0.322	0.396	0.166	0.562
EIR-2	1.000	0.608	1.608	0.207	0.120	0.327	0.385	0.143	0.528
EIR-3	1.000	1.542	2.542	0.117	0.308	0.425	0.205	0.515	0.720
EIR-4	1.000	1.647	2.647	0.091	0.252	0.343	0.161	0.282	0.443
EIR-5	1.000	1.551	2.551	0.165	0.292	0.457	0.422	0.351	0.773
EIR-6	1.000	0.818	1.818	0.189	0.159	0.348	0.104	0.208	0.312
EIR-7	1.000	1.036	2.036	0.196	0.224	0.420	0.081	0.224	0.305
EIR-8	1.000	0.888	1.888	0.263	0.179	0.442	0.161	0.216	0.377
EIR-9	1.000	1.547	2.547	0.580	0.303	0.883	0.223	0.390	0.613

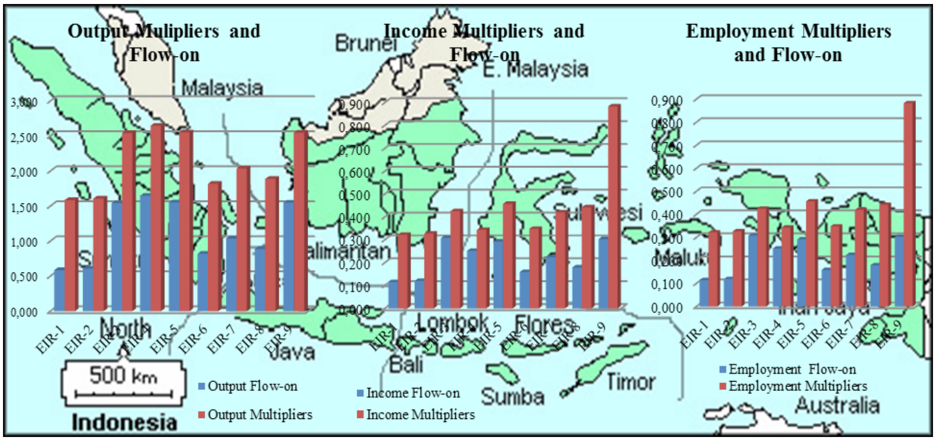

Figure 10.1

Total Multipliers and Flow-on Effects: Output, Income and Employment

b. Sector-Specific Multipliers

Table 10.4 and also Figure 10.2 provide sector-specific multipliers for output, income and employment in Eastern Indonesia's Island economy. In term of output, there were 4 sectors in which multipliers occurred in own sector were less than 50 per cent, namely EIR-3 (Manufacturing), EIR-4 (Electricity, water and gas), EIR-5 (Construction), and EIR-9 (Other services). Meanwhile, other 5 sectors in which multipliers occurred in own region were more than 50 per cent. These were: EIR-1 (Agriculture, livestock, forestry and fishery), EIR-2 (Mining and quarrying), EIR-6 (Trade, hotel and restaurant), EIR-7 (Transportation and Communication) and EIR-8 (Banking and other finance).

In term of income, there were 3 sectors in which multipliers occurred in own region were less than 50 per cent, EIR-3 (Manufacturing), EIR-4 (Electricity, water and gas), and EIR-5 (Construction).Meanwhile, other 6 sectors in which multipliers occurred in own region were more than 50 per cent. These sectors were: EIR-1 (Agriculture, livestock and fishery), EIR-2 (Mining and quarrying), EIR-6 (Trade, hotel and restaurant), EIR-7 (Transportation and communication), EIR-8 (Banking and other finance) and EIR-9 (Other services).

Table 10.4

Sector-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total	Own Sector	Other Sector	Total
EIR-1	1.260	0.325	1.585	0.260	0.062	0.322	0.510	0.052	0.562
EIR-2	1.042	0.566	1.608	0.213	0.114	0.327	0.390	0.138	0.528
EIR-3	1.161	1.381	2.542	0.134	0.291	0.425	0.236	0.484	0.720
EIR-4	1.232	1.415	2.647	0.112	0.231	0.343	0.189	0.254	0.443
EIR-5	1.017	1.534	2.551	0.167	0.290	0.457	0.425	0.348	0.773
EIR-6	1.105	0.713	1.818	0.209	0.139	0.348	0.116	0.196	0.312
EIR-7	1.211	0.825	2.036	0.237	0.183	0.420	0.099	0.206	0.305
EIR-8	1.187	0.701	1.888	0.312	0.130	0.442	0.190	0.187	0.377
EIR-9	1.070	1.477	2.547	0.619	0.264	0.883	0.239	0.374	0.613

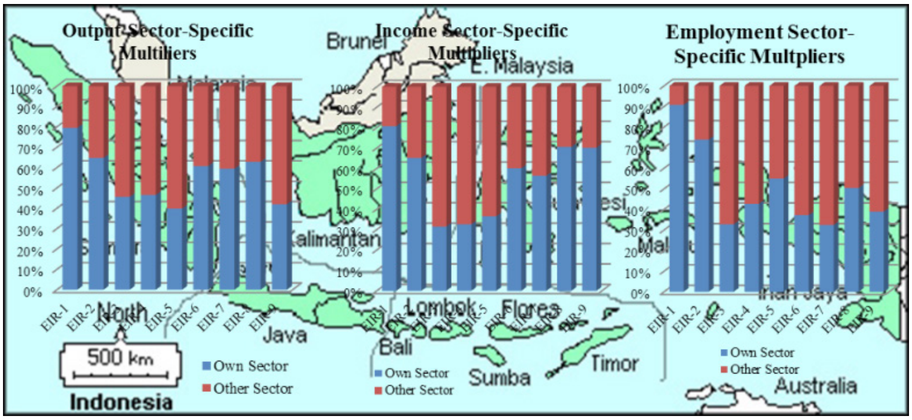

Figure 10.2

Sector-Specific Multipliers: Output, Income and Employment

In term of employment, there were 5 sectors in which multipliers occurred in own sector were less than 50 per cent, namely EIR-3 (Manufacturing), EIR-4 (Electricity, water and gas), EIR-6 (Trade, hotel and restaurant), EIR-7

(Transportation and communication), and EIR-9 (Other services). Meanwhile, 4 sectors in which multipliers occurred in own sectors were more 50 per cent multipliers, namely EIR-1 (Agriculture, livestock, forestry and fishery), EIR-2 (Mining and quarrying), EIR-5 (Construction), and EIR-8 (Banking and other finance).

c. Spatial-Specific Multipliers

Table 10.5 and Figure 10.3 provide spatial-specific multipliers of output, income and employment multipliers in Eastern Indonesia's Island. In term of output, all sectors had more than 50 per cent of multipliers that occurred in own region; in Eastern Indonesia's Kalimantan Island. All sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia. It applied for income. Almost all sectors, except EIR-4 (Electricity, water and gas) had more than 50 per cent of multipliers that occurred in own region; Eastern Indonesia's Island. Almost all sectors, except EIR-4 (Electricity, water and gas) had less than 50 per cent of multipliers occurred in other regions; the rest of Indonesia. In term of employment, all sectors had more than 50 per cent of multipliers that occurred in own region; Eastern Indonesia's Island. Again, all sectors had less than 50 per cent of multipliers that occurred in other regions; the rest of Indonesia.

Table 10.5

Spatial-Specific Multipliers: Output, Income and Employment

SECTOR	Output			Income			Employment		
	Own Region	Other Region	Total	Own Region	Other Region	Total	Own Region	Other Region	Total
EIR-1	1.373	0.212	1.585	0.286	0.036	0.322	0.499	0.063	0.562
EIR-2	1.310	0.298	1.608	0.273	0.054	0.327	0.455	0.073	0.528
EIR-3	2.145	0.397	2.542	0.356	0.069	0.425	0.598	0.122	0.720
EIR-4	1.372	1.275	2.647	0.160	0.183	0.343	0.246	0.197	0.443
EIR-5	1.566	0.985	2.551	0.279	0.178	0.457	0.566	0.207	0.773
EIR-6	1.464	0.354	1.818	0.286	0.062	0.348	0.228	0.084	0.312
EIR-7	1.736	0.300	2.036	0.368	0.052	0.420	0.221	0.084	0.305
EIR-8	1.568	0.320	1.888	0.387	0.055	0.442	0.288	0.089	0.377
EIR-9	1.937	0.610	2.547	0.778	0.105	0.883	0.438	0.175	0.613

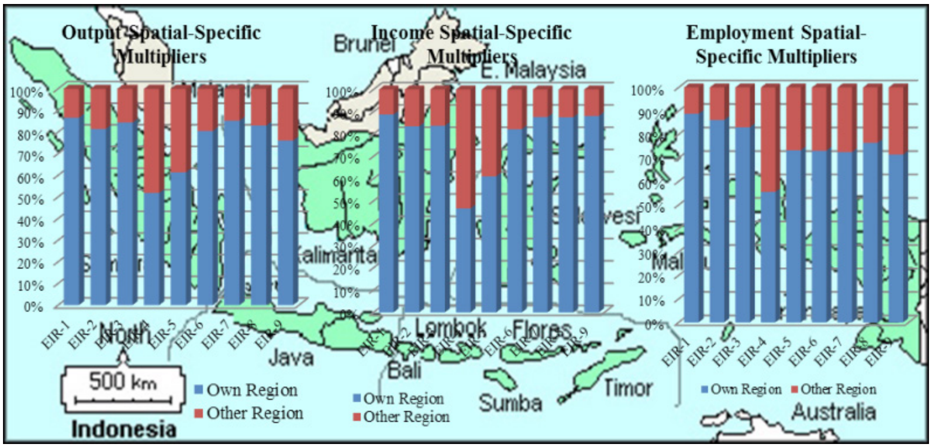

Figure 10.3
Spatial-Specific Multipliers: Output, Income and Employment

4. Conclusion

The conclusions could be drawn were: firstly, the important sectors of Eastern Indonesia's Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors were EIR-4 (Electricity, water and gas), EIR-5 (Construction) and EIR-9 (Other services). Based on total income multipliers, three important sectors in Kalimantan Island economy were EIR-9 (Other services), EIR-5 (Construction) and EIR-8 (Banking and other finance). Based on total employment multipliers, three important sectors in Kalimantan Island economy were EIR-5 (Construction), EIR-3 (Manufacturing) and EIR-9 (Other services). Based on output flow-on effects, three important sectors were EIR-4 (Electricity, water and gas), EIR-5 (Construction) and EIR-9 (Other services). Based on income flow-on effects, three important sectors were EIR-3 (Manufacturing), EIR-9 (Other services), and EIR-5 (Construction). Based on employment flow-on effects, three important sectors were EIR-3 (Manufacturing), EIR-9 (Other services), and EIR-5 (Construction).

Secondly, important economic sectors could be based on sector-specific multipliers. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were EIR-1 (Agriculture, livestock, and fishery), EIR-2 (Mining and quarrying), and EIR-8 (Banking and other finance). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-2 (Mining and quarrying. Based on employment sector-specific multipliers that occurred in own sector, three important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-8 (Banking and other finance), and EIR-9 (Other services).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Eastern Indonesia. Based on output spatial-specific multipliers that occurred in own region, three important sectors were), EIR-1 (Agriculture, livestock and fishery), EIR-7 (Transportation and communication and EIR-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own region, four important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-7 (Transportation and communication), EIR-8 (Banking and other finance) and EIR-9 (Other services). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-2 (Mining and quarrying), andEIR-3 (Manufacturing).

References

Anonymous (2016), "Eastern Indonesia", kerdowney.com.

http://kerdowney.com/destinations/indonesia/eastern-indonesia/

Anonymous, (2016), "Indonesia's Most Populous Island Java Continues to Dominate the Economy", Indonesia-Investments.

http://www.indonesia-investments.com/news/todays-headlines/indonesias-most-populousisland-of-java-continues-to-dominate-the-economy/item972

Anonymous, (2015), **Statistik Indonesia 2014**, Jakarta: Badan Pusat Statistik.

http://www.bps.go.id/index.php/publikasi/326

Encyclopedia Britannica, (2016), Kalimantan, Region, Indonesia.

https://www.britannica.com/place/Kalimantan

Ahiakpor, J.C.W. (2000),"Hawtrey on the Keynesian Multiplier: A Question of Cognitive Dissonance?", **History of Political Economy**, 32 (4): 889-908.

https://muse.jhu.edu/article/13245/pdf

Beemiller, R.M. (1990),"Improving Accuracy by Combining Primary Data with RIMS: Comment on Bourque", International Regional Science Review, 13 (1-2): 99-101.

http://journals.sagepub.com/doi /abs/10.1177/016001769001300107

Coughlin, C and Mandelbaum, T.B, (1991),"A Consumer's Guide to Regional Economic Multipliers", Federal Reserve Bank of St. Louis Review, January/ February 1991.19-32.

https://research.stlouisfed.org/publications/review/1991/01/01/a-consumers-guide-toregional-economic-multipliers/

DiPasquale, D. and Polenske, K.R (1980),"Output, Income and Employment Input-Output Multipliers" in S. Pleeter. (Ed), **Economic Impact Analysis: Methodology and Applications**,**Studies in Applied Regional Science**, Boston: Martinus Nijhoff Publishing: 85-113.

http://www.springer.com/gp/book/9789401174077

Dornbusch, R and Stanley, F, (1994), **Macroeconomics**, Sixth Edition, International Edition, McGraw-Hill.

Grady, P and Muller, R, A (1988),"On the use and misuse of input-output based impact analysis in evaluation", The Canadian Journal of Program Evaluation, 2 (3): 49-61.

https://www.researchgate.net/publication/43126426_On_The_Use_and_Misuse_of_InputOutput_Based_Impact_Analysis_in_Evaluation

Hall, R. E (2009),"By How Much Does GDP Rise if the Government Buys More Output?", **NBER Working Paper 15496**, National Bureau of Economic Research.

www.nbr.org/papers/w15496.pdf?new_window=1

Harris, P (1997),"Limitations on the use of regional economic impact multipliers by practitioners: An application to the tourism industry", **The Journal of Tourism Studies**, 8(2): 1-12.

http://docplayer.net/14498955-Limitations-on-the-use-of-regional-economic-impactmultipliers-by-practitioners.html

Hartwick, 1971, "Notes on the Isard and Chenery-Moses Inter-regional Input-Output Models", **Journal of Regional Science,** 11(1):73-86.

http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1971.tb00241.x/full

Hughes, D. W, (2003),"Policy Uses of Economic Multipliers and Impact Analysis", **Choices Publication of the American Agricultural Economics Association**, Second Quarter. http://www.choicesmagazine.org/2003-2/2003-2-06.htm

Hulu, E, (1990), **Model Input-Output: Teori dan Applikasinya (Input-**

Output Model: Theory and Its Applications), Pusat Antar Universitas-Studi Ekonomi (Inter-University Centre-Economics), Jakarta: Universitas Indonesia (the University of Indonesia).

Isard, W, (1951),"Inter-regional and Regional Input-Output Analysis: A Model of a Space Economy", **Review of Economics and Statistics**, 33(4): 318-328.

http://www.jstor.org/stable/1926459

Kahn, R. (1931),"The Relation of Home Investment to Unemployment", Economic Journal, 41(162):173-198. http://dx.doi.org/10.2307/2223697

Krugman, P and Wells, R (2009), **Economics,** Worth Publisher, p: 1200, Chapter 14: Money, Banking, and the Federal Reserve System: Reserves, Bank Deposits, and the Money Multiplier: 393–396.

http://bcs.worthpublishers.com/webpub/economics/krugmanwellsmacro3/Solutions%20Manual/KrugWellsECPS3e_Macro_CH14.pdf

Leontief, W.W. (1951), **The Structure of American Economy 1919-1939**, Second Edition, Cambridge: Harvard University Press.

http://www.wleontief.ru/eng/40.html

Mankiw, N. G (2008), **Macroeconomics**, Eight Edition, South-Western Publishing, Part VI: Money and Prices in the Long Run: The Money Multiplier: 347–349.

https://www.academia.edu/15354353/Mankiw_macroeconomics_8th_edition

McConnell, C, Brue, S, and Flynn, S (2011), **Macroeconomics**, McGraw-Hill Series Economics, 19th Edition. ISBN-13: 978-0077337728, ISBN-10: 0077337727.

Mills, E. C, (1993),"The Misuse of Regional Economic Models", **Cato Journal**, 13(1): 29-39.https://ideas.repec.org/a/cto/journl/v13y1993i1p29-39.html

Moore, F.T, and Petersen, J (1955),"Regional Analysis: An Inter-industry Model of Utah", **Review of Economics and Statistics**, 37: 368-383.

http://www.jstor.org/stable/1925851?seq=1#page_scan_tab_contents

Muchdie, (1998), **Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study**, unpublished PhD Thesis, Department of Economics, the University of Queensland, Australia. http://espace.library.uq.edu.au/view/UQ:218710

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid for Generation Inter-regional Input-Output Tables**, Lambert Academic Publishing, Germany, ISBN 978-3-8454-1847-6. http://repository.

uhamka.ac.id/139/

Pindyck, R. and Rubinfeld, D, (2012), **Macroeconomics**,The Pearson Series in Economics, 8th Edition, ISBN-13:978-0132857123, ISBN-10: 013285712X

https://www.amazon.com/Microeconomics-Student-Value-PearsonEconomics/dp/0132870436

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana, (2013), **Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach**), Jakarta: Badan Pengkajian dan Penerapan Teknologi.

Richardson, H.W, (1985), "Input-Output and Economic Base Multipliers: Looking Backward and Forward",**Journal of Regional Science**, 25 (4): 607-661.

http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9787.1985.tb00325.x/abstract

Siegfried, J, Allen R, Sanderson, A.R, and McHenry, P, (2006),"The Economic Impact of Colleges and Universities",**Working Paper No. 06-W12**.

http://www.accessecon.com/pubs/VUECON/vu06-w12.pdf

Tiebout, C.M, (1956),"A Pure Theory of Local Expenditures", The Journal of Political Economy, 64(5): 416-424. http://www.jstor.org/stable/1826343

West, G R, and Jensen, R C, (1980),"Some Reflections on Input-Output Multipliers", Annals of Regional Science, 14 (2): 77-89.

https://www.researchgate.net/publication/226244596_Some_Reflections_on_InputOutput_Multipliers

West, G.R., and Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., (1989), **Regional and Inter-regional Input-Output Tables for Queensland 1985/86**, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia.

https://www.library.ohiou.edu/indopubs/2001/08/25/0033.html

West, G.R., Morison, J.B. and Jensen, R.C., 1982, **An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

Chapter-11

Spatial Multipliers and Linkages in Indonesian Economy[1]

Ringkasan

Bab ini menyajikan hasil perhitungan angka pengganda spasial dan keterkaitan spasial dalam perekonomian Indonesia. Angka-angka ini berguna bagi proses perencanaan, evaluasi dan pengendalian pembangunan ekonomi baik pada tingkat wilayah maupun pada tingkat nasional. Model yang digunakan adalah model input-output antar-pulau yang dibangun menggunakan metode hibrida. Hasilnya menunjukkan bahwa pertama, semua pengganda spasial (output, pendapatan dan kesempatan kerja), penganda yang terjadi di pulau sendiri secara signifikan dalam kategori tinggi. Di Sumatera dan Jawa, lebih dari 90 persen pengganda terjadi di pulau sendiri. Hanya sebagian kecil saja yang mengalir ke pulau lain. Di Kalimantan, Bali-Nusa Tenggara dan di pulau lainnya, pengganda yang terjadi di pulau sendiri antara 70-80 persen. Kedua, efek mengalir, yang merupakan dampak bersih perubahan permintaan akhir, menyediakan ukuran yang lebih akurat dibanding pengganda total. Semua sektor spasial yang masuk dalam urutan 10 besar pengganda total juga terdapat pada distribusi efek mengalir. Terakhir, analisis keterkaitan spasial mengkonfirmasi bahwa pulau Sumatra dan pulau Jawa mempunyai keterkaitan yang rendah; lebih mandiri dibanding tiga gugus kepulauan lainnya. Bagian terbesar pengganda maupun efek mengalir terjadi di pulau sendiri. Memfokuskan pembangunan ekonomi di kedua pulau ini mungkin akan meningkatkan pertumbuhan ekonomi secara keseluruhan, tetapi pada saat yang sama akan memperburuk ketimpangan.

Summary

This chapter calculated spatial multipliers, flow-on effects and linkages in Indonesian economy that can be used for planning, evaluation and control

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purposes of both at national and regional development. Using hybrid procedure, inter-island input-output model for Indonesia has been constructed. Spatial multipliers, flow-on effects and spatial linkages then calculated. The results show that, firstly, all measures of spatial-specific multipliers (output, income and output) showed that, for an island economy, the percentage of multipliers that occurred in the own-region is significantly high. For the island of Sumatra and Java, the two most developed islands in the country, the percentage of output, income and employment multipliers that occurred in the own region were about 90 per cent indicating that the two islands were relatively spatially independent. Only a small proportion of inputs from the rest of the country were required in producing goods and services. For other three groups of islands, the Kalimantan Island, the islands of Nusa Tenggara and Other islands, the percentage of multiplier effects in own-region ranged from 70 to 80 per cent of total multiplier effects. Secondly, the flow-on effects, by which the net-impact of change in final demand is measured, provides more accurate measures than that of total. On the lists of the ten largest ranking spatial sectors, the same sectors as those in output multipliers also emerged in output flow-on rank order. Finally, the spatial linkage analysis consistently confirms that the island of Sumatra and the island of Java were more independent with weak spatial linkages. A large proportion of multipliers or flow-on effects would occur in the own-region if the changes of final demand occurred in those islands. Focusing economic activities on these islands would increase the economic growth of the country, but at the same time would make the economic distribution among regions worse.

1. Introduction

Indonesia is one of the largest economies in Southeast Asia and is one of the emerging market economies of the world. The country is also a member of G-20 major economies and classified as a newly industrialized country. It is the sixteenth largest economy in the world by nominal GDP and is the eighth largest in terms of GDP (PPP). Indonesia still depends on domestic market, and government budget spending and its ownership of state-owned enterprises and the administration of prices of a range of basic goods including, rice, and electricity plays a significant role in Indonesia market economy, but since the 1990s, 80 percent of the economy has been controlled by private Indonesians and foreign companies. In the aftermath of the financial and economic crisis that began in mid1997 the government took custody of a significant portion of private sector assets through acquisition of nonperforming bank loans and corporate assets through the debt restructuring process and the companies in custody has been sold out by privatization several years later. Since 1999 the economy has recovered and growth has accelerated to over 4–6% in recent years; Indonesian economy grows on average at 5.06 per cent per year at period between 1967- 2011 (Prihawantoro, et al, 2013).

Modelling inter-island economy, Indonesia divided into 5 big group of island: Sumatra, Java, Kalimantan, Bali-Nusa Tenggara Island and Other island (Muchdie, 1998). The island of Java is significantly important for the Indonesian economy as the national economy is highly concentrated in this island. Historically, the island of Java has dominated the Indonesian economy since the colonial era. More than 60 per cent output of the Indonesian economy resulted by the Island of Java (Muchdie, 2011).

Spatial multipliers measure multipliers occur in own region; own island and other region/other island, Meanwhile, spatial flow-on measure the flow-on effects occur in own-region and other region. DiPasquale & Polenske (1980) specify four types of multipliers, in which one of them is relevant in the context of the inter-island input-output model; spatial or region-specific multipliers.

Backward linkages are usually measured using output multipliers as based on the input matrix. Similarly, value-added and import multipliers are derived by additionally using the corresponding primary input coefficients. For measuring forward linkages, input multipliers have been frequently used. Within a 'supply-driven' input-output model, these multipliers are obtained from the output matrix (Dietzenbacher, E., 2002). Spatial feed-back effects of multipliers can easily be shown by the difference between the single-region multipliers and the intra-regional multipliers, those multipliers that occur in own-region, of the inter-regional model. Spatial spill-over are the multiplier effects that occur in other regions due to the change of final demand of own region. The spatial spill-over effects are calculated as the difference between the total multiplier and the multiplier effects that occurred in own-region.

Measures of inter-regional feed-back and spill-over linkages have been developed by Miller (1966; 1969; 1986), Guccione, et al., (1988), Miller & Blair (1985) and Cohrance (1990). Blair & Miller (1988) defined an inter-regional feed-back index (IFI) and a feed-back and spill-over index (FSI) to measure the importance of inter-regional connection for a region by calculating output forthcoming from sectors in a region in response to a change in that region's final demands. Similarly, the spatial feed-back of flow-on effects can easily be shown by the difference between the flow-on to the single-region model and the intra-regional flow-on of the inter-regional model. The spatial spill-over of flow-on is the flow-on that occurs in other regions due to the change of final demand of a certain region. The total feed-back and spill-over effects of flow-on are calculated as the difference between total flow-on of the inter-regional model and those of the single-regional model.

The objective of this paper is to analyze spatial multipliers, flow-on effect and spatial linkages through spill-over effects and feed-back effect in Indonesian economy.

2. Methods of Analysis

An inter-regional input-output model divides a national economy not only into sectors but also regions (Hulu, 1990). An industry in the Leontief model is split into as many regional sub-industries as there are regions. The table consists of two types of matrices representing the two types of economic interdependence. The first are the intra-regional matrices, which are on the main diagonal showing the inter-sectoral transactions which occur within each region. The second are the trade matrices, termed inter-regional matrices, representing inter-industry trade flows between each pair of regions. These matrices show the specific inter-industry linkages between regions, allowing each economic activity to be identified by industry as well as by location.

The inter-regional model can be expressed similar to the equations for the national as well as the single region model. In the general case:

$$^{r}X_{i} = \sum_{j} \sum_{s} {}^{rs}X_{ij} + \sum_{s} {}^{rs}Y_{i}; \; (i, j = 1,2,\ldots,n) \text{ and } (r, s = 1,2,\ldots,m) \qquad (1)$$

There are $(m \; x \; n)$ equations of this type for each sector in each region showing that the output of each sector is equal to the sales to all intermediate sectors in all regions plus sales to final demand in all regions. In matrix term, the model can be expressed as:

$$x = Ax + y \;\text{ or }\; x = (I - A)^{-1}y \qquad (2)$$

where: x is a vector of output, A is a matrix of input-output coefficients with elements of a_{ij}-s and y is a vector of final demand; $(I - A)^{-1}$ is Leontief inverse matrix with elements of b_{ij}-s. Basically, A matrix in equation (2) contains both technical and trade characteristics, Hartwick (1971) separated these input coefficients (${}^{rs}a_{ij}$) into trade coefficients (${}^{rs}t_{ij}$) and technical coefficients (${}^{s}a_{ij}$). This separation is essentially the same as one that has been done for the single region model (Muchdie, 2011). Equation (2) can then be rewritten as:

$$x = \mathrm{T}\,(\mathrm{A}\,x + y) \quad \text{or} \quad x = (\mathrm{I} - \mathrm{T}\,\mathrm{A})^{-1} y \tag{3}$$

Method employed for constructing Indonesian Inter-regional Input-Output model was hybrid method that specified for studying Island economy of Indonesia. In this model, the regions were disaggregated into 5 regions, namely 5 big-group of Island, namely SUM for Sumatera Island, JAV for Java Island, KAL for Kalimantan Island, NUS for Nusa Tenggara Island and OTH for Other Island which includes Sulawesi, Maluku and Papua Islands. Meanwhile, economic activities were disaggregated into 9 economic sectors, namely: Sec-1 for Agriculture, livestock, forestry and fishery, Sec-2 for Mining and quarrying, Sec-3 for Manufacturing, Sec-4 for Electricity, water and gas, Sec-5 for Construction, Sec-6 for Trade, hotels and restaurants, Sec-7 for Transportationandcommunication, Sec-8 for Banking and other finance, and Sec-9: Other services.

The GIRIOT (Generation Inter-Regional Input-Output Tables) procedures proposed and developed by Muchdie (1998) and have been applied using Indonesian data for the year 1990 (Muchdie, 1998; 2011). The GIRIOT procedure consists of three stages, seven phases and twenty four steps. Stage I: Estimation of Regional Technical Coefficients, consists of two phases, namely Phase 1: Derivation of National Technical Coefficients and Phase 2: Adjustment for Regional Technology. Stage II: Estimation of Regional Input Coefficients, consists of two phases, namely Phase 3: Estimation of Intra-regional Input Coefficients, and Phase 4: Estimation of Inter-regional Input Coefficients, and Stage III: Derivation Transaction Tables, consists of three phases, namely Phase 5: Derivation of Initial Transaction Tables, Phase 6: Sectoral Aggregation, and Phase 7: Derivation of Final Transaction Tables. These procedures have been revisited, evaluated and up-dated using Indonesian data for the year 2015 (Muchdie, 2017).

Multipliers: Total and Flow-on Effects

One of the major uses of input-output information is to assess the effect on an economy of changes in elements that are exogenous to the model of that economy. The capabilities and usefulness of the Leontief inverse matrix which is the source of analytical power of the model are well known. However, the meaning and interpretations are sometimes confusing. West and Jensen (1980) clarified the meaning of some of the components of the multipliers and suggested a multiplier format which is consistent and simpler to interpret but retains the essence of the conventional multipliers.

Table 11.1

Formula for Calculation of Multipliers and Flow-on Effects

Effects	Output	Income	Employment
Initial	1	h_j	e_j
First-round	$\sum a_{ij}$	$\sum a_{ij} h_i$	$\sum a_{ij} e_i$
Industrial-support	$\sum b_{ij} - 1 - \sum a_{ij}$	$\sum b_{ij} h_i - h_i - \sum a_{ij} h_i$	$\sum b_{ij} e_i - e_i - \sum a_{ij} e_i$
Consumption-induced	$\sum (b^*_{ij} - b_{ij})$	$\sum (b^*_{ij} h_i - b_{ij} h_i)$	$\sum (b^*_{ij} e_i - b_{ij} e_i)$
Total	$\sum b^*_{ij}$	$\sum b^*_{ij} h_i$	$\sum b^*_{ij} e_i$
Flow-on	$\sum b^*_{ij} - 1$	$\sum b^*_{ij} h_i - h_j$	$\sum b^*_{ij} e_i - e_j$

Source: West, et al, 1982; 1989

Note: a_{ij} is direct input coefficients, b_{ij} is the element of open inverse of Leontief matrix, and b^*_{ij} is the element of closed inverse Leontief matrix, h_j is household income coefficient, e_j is employment output ratio.

As a measurement of response to an economic stimulus, a multiplier expresses a cause and effect line of causality. In input-output analysis the stimulus is a change (increase or decrease) in sales to final demand. Similar to those in the single-region model, in the inter-regional model West et al., (1982; 1989) defined the major categories of response as: initial, first-round, industrial-support, consumption-induced, total and flow-on effects. Formula of such effects is provided in Table 11.1.

DiPasquale & Polenske (1980) specify four types of multipliers, in which two of them are relevant in the context of the inter-regional input-output model; sector-specific and region-specific multipliers. Table 2 provides formula for the calculation of both sector-specific and region-specific multipliers for output, income and employment.

Tabel 11.2

Formula for Calculation of Sector and Spatial Specific-Multipliers

	Output	Income	Employment
Sector-Specific	$\sum {}^{rs}b^*_{ij;}$ r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_i$; r = 1,..m	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i\,;}$ r = 1,..m
Region-Specific	$\sum {}^{rs}b^*_{ij;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}h_{i\,;}$ i = 1,..n	$\sum {}^{rs}b^*_{ij}\, {}^{s}e_{i\,;}$ I = 1,..n

Source: DiPasquale & Polenske, 1980

Note: *r* and *s* are the *m* origin and destination regions, *i* and *j* are the n producing and purchasing sectors, ${}^{rs}b^*_{ij}$ is the element of closed inverse of Leontief matrix, m is the number of regions and n is the number of sectors.

Spatial Feed-back and Spill-over Effects: Multipliers and Flow-on Effects

Measures of inter-regional feed-back and spill-over linkages have been developed by Miller (1966; 1969; 1986), Guccione, et al., (1988), Miller & Blair (1985) and Cohrance (1990). Blair & Miller (1988) defined an inter-regional feed-back index (IFI) and a feed-back and spill-over index (FSI) to measure the importance of inter-regional connection for a region by calculating output forthcoming from sectors in a region in response to a change in that region's final demands under two alternative assumptions: (1) that the region is a fully-connected part of an inter-regional input-output system, and (2) that the region is totally isolated from the remaining regions.

Using these two indices, the importance of inter-regional linkages among the islands of Indonesia will be analysed in this section. In this study, however, there are two principal differences with those of Miller. Firstly, the indices are measured by calculating the inter-regional feed-back index (IFI) and feed-back and spill-over index (FSI) of output, income and employment multipliers; rather than calculating output as in Miller studies. Secondly, to eliminate the initial effects of multipliers, the two indices of flow-on effects are also calculated and presented.

Table 11.3

Formula for Calculation of IFI and FSI of Multipliers

	Output	Income	Employment
Inter-Regional Table - Total Multipliers - Intra-Reg Multipliers - Inter-Reg Multipliers	TOM= $\sum^{rr}b^*_{ij} + \sum^{sr}b^*_{ij}$ AOM= $\sum^{rr}b^*_{ij\ ;\ i=1,2,..n}$ EOM= $\sum_{s=1}{}^{sr}b^*_{ij\ ;i=1,2,..n}$	TNM=$\sum^{rr}b^*_{ij}\,{}^{r}h_i+\sum^{sr}b^*_{ij}\,{}^{r}h_i$ ANM= $\sum^{rr}b^*_{ij}\,{}^{r}h_{i\ ;i=1,2,..n}$ ENM= $\sum_{s=1}{}^{sr}b^*_{ij}\,{}^{r}h_{i\ ;i=1,2,..n}$	TEM=$\sum^{rr}b^*_{ij}\,{}^{r}e_i+\sum^{sr}b^*_{ij}\,{}^{r}e_i$ AEM= $\sum^{rr}b^*_{ij}\,{}^{r}e_{i\ ;i=1,2,..n}$ EEM= $\sum_{s=1}{}^{sr}b^*_{ij}\,{}^{r}e_{i\ ;\ i=1,2,..n}$
Single-Region Table o Total Multipliers	SOM= $\sum^{rr}b^*_{ij}$	SNM= $\sum^{rr}b^*_{ij}\,{}^{r}h_i$	SEM= $\sum^{rr}b^*_{ij}\,{}^{r}e_i$
Feed-back Effects	FBOM = AOM – SOM	FBNM = ANM – SNM	FBEM = AEM – SEM
Spill-over Effects	SOOM = TOM – AOM	SONM = TNM – ANM	SOME = TEM – AEM
Feed-back + Spill-over	FSOM = TOM - SOM	FSNM = TNM - SNM	FSEM = TEM - SEM
IFI	(FBOM/AOM)100	(FBNM/ANM)100	(FBEM/AEM)100
FSI	(FSOM/TOM)100	(FSNM/TNM)100	(FSEM/TEM)100

Source: Blair and Miller (1988); Cochrane (1990).

Spatial feed-back effects of multipliers can easily be shown by the difference between the single-region multipliers and the intra-regional multipliers, those multipliers that occur in own-region, of the inter-regional model. Spatial spill-over are the multiplier effects that occur in other regions due to the change of final demand of own region. The spatial spill-over effects are calculated as the difference between the total multiplier and the multiplier effects that occurred in own-region. The overall percentage error of ignoring the inter-regional linkages is measured using IFI and FSI. Formulation of IFI and FSI calculation for output, income and employment multipliers and flow-on effects is provided in Table 3.

Similar to those of multipliers, the spatial feed-back of flow-on effects can easily be shown by the difference between the flow-on to the single-region model and the intra-regional flow-on of the inter-regional model. The spatial spill-over of flow-on is the flow-on that occurs in other regions due to the change of final demand of a certain region. The total feed-back and spill-over effects of flow-on are calculated as the difference between total flow-on of the inter-regional model and those of the single-regional model. The advantage of using this measure in analysing the spatial feed-back and spill-over effects is that the initial effects of multipliers have been excluded, so that "the net-impacts" of changes in final demand can be provided. Table 11.4 provides the formula of IFI and FSI calculation for output, income and employment flow-on effects.

Table 11.4

Formula for Calculation of IFI and FSI of Flow-on Effects

	Output	Income	Employment
Inter-regional Table o Total Flow-on o Intra-Reg Flow-on o Inter-Reg Flow-on	$TOF= (\sum^{rr} b^*_{ij} + \sum^{sr} b^*_{ij}) - 1$ $AOF= (\sum^{rr} b^*_{ij}) - 1$ $EOF= \sum_{s=1}{}^{sr} b^*_{ij}$; for i= 1,2,..n	$TNF=(\sum^{rr} b^*_{ij}\, {}^r h_i + \sum^{sr} b^*_{ij}\, {}^r h_i) - {}^r h_i$ $ANF= (\sum^{rr} b^*_{ij}\, {}^r h_i) - {}^r h_i$ $ENF= \sum_{s=1}{}^{sr} b^*_{ij}\, {}^r h_i$; for i= 1,2,..n	$TEF=(\sum^{rr} b^*_{ij}\, {}^r e_i + \sum^{sr} b^*_{ij}\, {}^r e_i) - {}^r e_i$ $AEF= (\sum^{rr} b^*_{ij}\, {}^r e_i) - {}^r e_i$ $EEF= \sum_{s=1}{}^{sr} b^*_{ij}\, {}^r e_i$;for i= 1,2,..n
Single-region Table o Total Flow-on	$SOF= (\sum^{rr} b^*_{ij}) – 1$	$SNF= (\sum^{rr} b^*_{ij}\, {}^r h_i) - {}^r h_i$	$SEF= (\sum^{rr} b^*_{ij}\, {}^r e_i) - {}^r e_i$
Feed-back Effects	FBOF = AOF – SOF	FBNF = ANF – SNF	FBEF = AEF – SEF
Spill-over Effects	SOOF = TOF – AOF	SONF = TNF – ANF	SOEF = TEF – AEF
Feed-back + Spill-over	FSOF = TOF - SOF	FSNF = TNF - SNF	FSEF = TEF - SEF
IFI	(FBOF/AOF)100	(FBNF/ANF)100	(FBEF/AEF)100
FSI	(FSOF/TOF)100	(FSNF/TNF)100	(FSEF/TEF)100

Source: Blair and Miller (1988); Cochrane (1990).

3. Result and Discussion

a. Total Multipliers

Table 11.5 provides the ten sectors with the largest total multipliers.The top ten sectors with total output multipliers were JAV-5: Construction industry in the island of Java (2.866), NUS-3: Manufacturing industry in the islands of Nusa Tenggara (2.837), KAL-4: Electricity, water and gas services in the Kalimantan island (2.829), NUS-4: Electricity, water and gas services in the islands of Nusa Tenggara (2.819) and KAL-9: Other services in the Kalimantan island (2.808), SUM-4: Electricity, water and gas services in the island of Sumatra (2.761), OTH-4: Electricity, water and gas services in Other islands (2.647), JAV-4: Electricity, water and gas services in the island of Java (2.568), JAV-9: Other services in the island of Java (2.564) and KAL-5: Construction industry in the Kalimantan island (2.561).

Table 11.5 also presents total income multipliers where the ten top sectors in generating total income are ranked. Most of them were Sector-9: Other services. They were KAL-9: Other services in the Kalimantan island (0.928), OTH-9: Other services in Other islands (0.883), SUM-9: Other services in the island of Sumatra (0.815), NUS-9: Other services in the islands of Nusa Tenggara (0.799) and JAV-9: Other services in the island of Java (0.772), NUS-2: Mining and quarrying industry in the islands of Nusa Tenggara (0.583), KAL-8: Bank and other finance services in the Kalimantan island (0.489), NUS-7: Transportation and communication in the islands of Nusa Tenggara (0.474), JAV-5: Construction industry in the island of Java (0.462) and OTH-5: Construction industry in Other island (0.457).

Tabel 11.5

Rank of Ten Largest Total Multipliers in Indonesian Economy: Output, Income and Employment

Multipliers	Total Output		Total Income		Total Employment	
Rank	SECTOR	Value	SECTOR	Value	SECTOR	Value
1	JAV-5	2.866	KAL-9	0.928	NUS-2	2.316
2	NUS-3	2.837	OTH-9	0.883	NUS-1	1.241
3	KAL-4	2.829	SUM-9	0.815	NUS-3	1.170
4	NUS-4	2.819	NUS-9	0.799	NUS-4	0.916
5	KAL-9	2.808	JAV-9	0.772	NUS-7	0.906
6	SUM-4	2.761	NUS-2	0.583	NUS-9	0.903
7	OTH-4	2.647	KAL-8	0.489	NUS-5	0.887
8	JAV-4	2.568	NUS-7	0.474	OTH-5	0.773
9	JAV-9	2.564	JAV-5	0.462	JAV-1	0.740
10	KAL-5	2.561	OTH-5	0.457	NUS-8	0.738

Source: Data Processed using IO7 software.

Total employment multipliers are also ranked in Table 11.5. Most of the ten sectors with the highest total employment multipliers were in the islands of Nusa Tenggara; only one was in the island of Java and the other was in Other islands. They were NUS-2: Mining and quarrying industry in the islands of Nusa Tenggara (2.316), NUS-1: Agriculture, livestock, forestry and fishery in the islands of Nusa Tenggara (1.241), NUS-3: Manufacturing industry in the island of Nusa Tenggara (1.170), NUS-4: Electricity, water and gas services in the island of Nusa Tenggara (0.916) and NUS-7: Transportation and communication in the island of Nusa Tenggara (0.906), NUS-9: Other services in the islands of Nusa Tenggara (0.903), NUS-5: Construction industry in the islands of Nusa Tenggara (0.887), OTH-5: Construction industry in Other islands (0.773), JAV-1: Agriculture, livestock, forestry and fishery in the island of Java (0.740) and NUS-8: Bank and other finance services in the island of Nusa Tenggara (0.738).

One reason for high total employment multipliers in the islands of Nusa Tenggara, the less developed region in the country, is the existence of low wage-rates. This makes the employment-output ratio high and further contributes the high of initial employment effects. For NUS-2: Mining and quarrying industry and NUS-1: Agriculture, livestock, forestry and fishery can be explained as follow: NUS-2: Mining and quarrying industry where small amount of output were produced; all were from quarrying sector, many people were involved. An increase in Rp. 1 million of final demand of this sector would increase total employment by 2,316 persons. Out of this, 1,923 persons were the result of initial employment effects since the direct coefficient of employment of this sector is 1, 923 persons per Rp. 1 million of output. Other effects were first round effects (43 persons), industrial-support effects (22 persons) and consumption-induced effects (328 persons). A similar explanation could be applied to NUS-1: Agriculture, livestock, forestry and fishery where the employment direct coefficient is 981 persons per Rp 1 million of output.

b. Spatial-Specific Multipliers

Table 11.6 presents a form of spatial-specific multipliers, it only specifies own-region and other regions.From Table 11.6, one can see that output multiplier effects occurring in own-region are generally much larger than those which occurred in other regions. This is simply because the intial effects occurred in own-region and weak inter-regional linkages.

Table 11.6

Spatial-Specific Multiplier in Indonesian Economy: Output, Income and Employment

Region	Own	Other	Total	Region	Own	Other	Total	Region	Own	Other	Total
SUM	1.863	0.116	1.979	SUM	0.282	0.022	0.304	SUM	0.326	0.025	0.351
JAV	2.112	0.251	2.363	JAV	0.378	0.045	0.423	JAV	0.415	0.052	0.467
KAL	1.631	0.447	2.078	KAL	0.323	0.084	0.407	KAL	0.236	0.101	0.337
NUS	1.657	0.554	2.211	NUS	0.362	0.103	0.465	NUS	0.865	0.107	0.972
OTH	1.736	0.511	2.247	OTH	0.393	0.093	0.486	OTH	0.442	0.106	0.548

Source: Data Processed using IO7 software.

In the island of Sumatra and Java, the two most developed islands in the country, the percentage of multiplier effects that occurred in own region were consistently high. In the island of Sumatra, 94.2 per cent of output multiplier effects occurred in own-region and only 5.8 per cent occurred in other regions. The percentage of multiplier effects that occurred in own-region were 92.9 per cent and 93.1 per cent for income and employment. In the island of Java the percentage of multiplier effects that occurred in own region were 89.4, 89.1 and 89.0 per cent for output, income and employment respectively. The high percentage of multiplier effects occurring in own-region indicates that the regions are highly independent. Spatial linkages to other regions are weak.

For other three groups of islands -the Kalimantan island, the islands of Nusa Tenggara and Other islands- the percentage of multiplier effects occurring in own-region were about 10 - 15 per cent lower. In the Kalimantan island, for instance, the percentage of multiplier effects occurring in own-region were 78.5, 79.4 and 70.2 per cent for output, income and employment respectively. In the islands of Nusa Tenggara, the percentages were 75.0, 77.8, and 89.0 per cent for output, income and employment. In Other island the percentages were 77.3, 80.8 and 80.6 per cent for output, income and multipliers.

c. Total Flow-on Effects

The ten largest ranking sectors for output, income and employment flow-on effects are provided in Table 11.7. Compared to Table 11.5 in which sectors were ranked based on total multipliers, one can see that the ten largest sectors based on output flow-on (Table 11.8) are the same sectors as those for in total multipliers. This is simply because, for total output, the initial effect is unity for all of the spatial-sectors. Since primary input coefficients for income (h_j) and employment (e_j) are different for each spatial-sector, so that each spatial-sector has different intial income and employment effects, one can then expect that different sectors would appear as the ten sectors with largest flow-on effects for income and employment.

Based on the income flow-on effects, the ten largest sectors were KAL-9: Other services in the Kalimantan island (0.335), NUS-3: Manufacturing industry in the islands of Nusa Tenggara (0.328), NUS-9:Other services in the islands of Nusa Tenggara (0.314), OTH-3: Manufacturing industry in Other islands (0.308), NUS-4: Electricity, water and gas services in the islands of Nusa Tenggara (0.305), OTH-9: Other services in Other islands (0.303), JAV-5: Construction industry in the island of Java (0.297), KAL-4: Electricity, water and gas in the Kalimantan island (0.296), OTH-5: Construction industry in Other islands (0.292) and NUS-7: Transportation and communication in the islands of Nusa Tenggara (0.292).

Table 11.7

Ten Largest Total Flow-on Effects in Indonesian Economy: Output, Income and Employment

Multipliers	Total Output		Total Income		Total Employment	
Rank	SECTOR	Value	SECTOR	Value	SECTOR	Value
1	JAV-5	1.866	KAL-9	0.335	NUS-3	0.784
2	NUS-3	1.837	NUS-3	0.328	NUS-9	0.596
3	KAL-4	1.829	NUS-9	0.314	OTH-3	0.515
4	NUS-4	1.819	OTH-3	0.308	NUS-4	0.494
5	KAL-9	1.808	NUS-4	0.305	NUS-7	0.484
6	SUM-4	1.761	OTH-9	0.303	NUS-5	0.465
7	OTH-4	1.647	JAV-5	0.297	NUS-6	0.441
8	JAV-4	1.568	KAL-4	0.296	KAL-9	0.402
9	JAV-9	1.564	OTH-5	0.292	NUS-2	0.393
10	KAL-5	1.561	NUS-7	0.292	OTH-9	0.390

Source: Data Processed using IO7 software**.**

This means than an increase of Rp. 1,000 final demand of KAL-9: Other services in the Kalimantan Island, for example, would generate income flown-on effects into the national economy of Rp. 328. The same sectors as those on total multipliers were KAL-9: Other services in the Kalimantan island, NUS-9: Other services in the islands of Nusa Tenggara, OTH-9: Other services in Other islands, JAV-5: Construction industry in the island of Java and OTH-5: Construction industry in Other island.

The ten sectors with the largest employment flow-on effects were NUS-3: Manufacturing industry in the islands of Nusa Tenggara (0.784), NUS-9: Other services in the island of Nusa Tenggara (0.596), OTH-3: Manufacturing industry in Other islands (0.515), NUS-4: Electricity, water and gas services in the island of Nusa Tenggara (0.494), NUS-7: Transportation and communication in the island of Nusa Tenggara (0.484), NUS-5: Construction industry in the island of Nusa Tenggara (0.465), NUS-6: Trade, hotel and restaurant industry in the islands of Nusa Tenggara (0.441), KAL-9: Other services in the Kalimantan island (0.402), NUS-2: Mining and quarrying industry in the island of Nusa Tenggara (0.393) and OTH-9: Other services in Other islands (0.390).

The same sectors as those for total multipliers were NUS-3: Manufacturing industry in the islands of Nusa Tenggara, NUS-9: Other services in the islands of Nusa Tenggara, NUS-4: Electricity, water and gas services in the islands of

Nusa Tenggara, NUS-7: Transportation and communication industry in the islands of Nusa Tenggara, NUS-5: Construction industry in the islands Nusa Tenggara and NUS-2: Mining and quarrying industry in the islands of Nusa Tenggara.

d. Spatial Distribution of Flow-on Effects

Table 11.8 provides the spatial distribution of output, income and employment flow-on effects. The patterns to what extend the output, income and employment flow-on effects are spatially distributed were similar.

Table 11.8

Spatial Distribution of Low-on Effects (%)

Output

Island \ Island	Sumatra	Java	Kalimantan	Nusa Tenggara	Other Islands	Total
Sumatra	88.8	7.9	1.4	0.5	1.3	100.0
Java	11.5	79.5	4.1	1.2	3.7	100.0
Kalimantan	8.5	21.5	57.4	2.5	10.1	100.0
Nusa Tenggara	15.0	16.7	8.4	52.9	7.0	100.0
Other Island	14.4	11.9	13.4	4.6	55.6	100.0

Income

Island \ Island	Sumatra	Java	Kalimantan	Nusa Tenggara	Other Islands	Total
Sumatra	89.7	7.9	1.1	0.2	1.2	100.0
Java	9.9	81.9	4.0	0.9	3.4	100.0
Kalimantan	6.5	20.7	61.2	1.9	9.7	100.0
Nusa Tenggara	12.8	14.8	8.6	53.9	9.9	100.0
Other Island	18.5	10.3	13.0	2.9	55.3	100.0

Employment

Island \ Island	Sumatra	Java	Kalimantan	Nusa Tenggara	Other Islands	Total
Sumatra	84.5	12.5	0.8	0.9	1.3	100.0
Java	9.6	80.3	2.7	2.8	4.5	100.0
Kalimantan	7.3	23.8	49.6	5.7	13.5	100.0
Nusa Tenggara	7.5	9.4	3.9	74.3	5.0	100.0
Other Island	10.4	16.3	8.6	9.4	55.2	100.0

Source: Data Processed using IO7 software.

If final demand changes in the islands of Sumatra and Java, about 80 per cent of total flow-on effects occurred in own-region. For output, the percentage of flow-on effects that occurred in own-region was 88.8 per cent if final demand changes in the island of Sumatra and 79.5 per cent in the island of Java. For income, 89.7 per cent in the island of Sumatra and 81.9 per cent in the island of Java; and for employment, 84.5 per cent in the island of Sumatra and 80.3 per cent in the island of Java. This is, again, due to weak inter-regional linkages in an island country.

In the Kalimantan Island, the percentage of flow-on effects that occurred in own-region was about 60 per cent or less. More than 20 per cent of flow-on effects generated by changes in final demand of Kalimantan's economy went to the island of Java. The percentages were 21.5, 20.7, and 23.8 per cent for output, income and employment respectively. Flow-on effects occurred in own-region for final demand changes in the island of Nusa Tenggara were about 50 per cent for output and income; 52.9 per cent for output and 53.9 per cent for income. For employment, the percentage of own-region flow-on effect was 74.3 per cent. Finally, if final demand changes in Other islands, the flow-on effects that occurred in own-region were about 55 per cent; 55.6 per cent for output, 55.3 per cent for income, and 55.2 per cent for employment.

The extent to which the percentage of flow-on effects occurred in own-region is mainly determined by the size of inter-regional linkages through the spill-over and feed-back effects. The larger the spill-over effects, the larger the percentage of flow-on effects which occur in other regions, making a smaller percentage of flow-on effects in own-region. The larger the feed-back effect, the larger the percentage of flow-on effects which occur in own-region. In the following section, these two effects are discussed in more detail in turn.

e. Spatial Feed-back and Spill-over Effects of Multipliers

Tabel 11.9 provides total feed-back and spill-over effect indexes for output, income and employment multipliers. From the table, it is evident that at national average IFI were small for all output, income and employment multipliers. The FSI, however, were quite significant due to large spill-over effects of multipliers. Ignoring inter-regional feed-back and spill-over effects would underestimate multipliers by 24.2 per cent for output, 22 per cent for income and 23.0 per cent for employment. Using IFI alone to measure inter-regional linkages could be underestimate because the spill-over effects have not been taken account for analysing the linkages, so that the error of not using inter-regional model in estimating multipliers were relatively small, namely 6.5 per cent for output multipliers, 7.2 per cent for income multipliers and 8.1 per cent for employment multipliers. FSI measure would be more relevant for linkage analysis as it provides more complete analysis that includes not only the feed-back effects but also the spill-over effects.

Table 11.9

Total Feed-Back and Spill-Over Effects Indexes in Indonesian Economy: Output, Income and Employment Multipliers

	Output	Income	Employment
IFI	6.5	7.2	8.1
FSI	24.2	22.5	23.0

Source: Data Processed using IO7 software.

Disaggregated by island; one can see the indices of feed-back and spill-over effects (FSI) for output, income and employment multipliers that is provided in Table 11.14. The values of FSI for the island of Sumatra and Java were relatively small compared to other three groups of islands. For the island of Sumatra the values of FSI were 11.3, 11.2 and 16.3 for output, income and employment multipliers respectively. For the island of Java the values of FSI were 12.2, 10.5 and 11.3 for output, income and employment multipliers respectively. The reasons might be that the two regions were the most independent regions in the country's economy. The index of spatial independence, calculated as a ratio between the intra-regional multipliers and total multipliers (see Cochrane, 1990), for Sumatra was 0.942 and Java was 0.894.

Table 11.10

Spatial Feed-Back and Spill-over Index (FSI) in Indonesian Economy: Output, Income and Employment Multipliers

FSI	Output	Income	Employment
Sumatra	11.3	11.2	16.3
Java	12.2	10.5	11.3
Kalimantan	30.0	26.8	40.6
Nusa Tenggara	36.9	34.6	21.6
Other Island	29.1	25.1	27.1
National	24.2	22.5	23.0

Source: Data Processed using IO7 software.

The three other less developed regions, the Kalimantan island, the islands of Nusa Tenggara and Other islands, were less independent. Their indices of the spatial independence were 0.785, 0.750 and 0.773 for the Kalimantan island, the islands of Nusa Tenggara and Other islands respectively. They were more dependent on the rest of the country, especially the island of Java and to less extend on the island of Sumatra. The Kalimantan island,for instance, was strongly dependent on the island of Java in providing inputs for producing goods and services; about 50 percent of its inputs came from the island of Java. Changes in final demand of Kalimantan would generate a significant amount of spilled-over effects that went to the island of Java. The values of FSI for Kalimantan were 30.0, 26.8 and 40.6 for output, income and employment multipliers consecutively. For the islands of Nusa Tenggara, the values of FSI were 36.9, 34.6 and 21.6 for output, income and employment multipliers. For Other islands, the values of FSI were 29.1, 25.1, and 27.1 for output, income and employment multipliers.

Table 11.11

Ten Largest Spatial Sector Feed-back and Spill-over Index (FSI): Output, Income and Employment Multipliers

Output	Income	Employment
NUS-4 (50.8)	NUS-4 (59.0)	KAL-8 (54.3)
OTH-4 (50.6)	OTH-4 (57.8)	KAL-5 (53.1)
KAL-9 (44.9)	NUS-5 (48.1)	KAL-9 (50.5)
NUS-5 (44.7)	NUS-3 (46.9)	OTH-4 (47.3)
OTH-5 (42.5)	OTH-5 (44.0)	KAL-4 (42.6)
NUS-3 (41.0)	KAL-5 (34.4)	KAL-2 (39.9)
NUS-2 (40.6)	KAL-8 (32.2)	KAL-7 (37.7)
KAL-8 (37.6)	KAL-4 (31.0)	KAL-6 (36.4)
NUS-9 (36.7)	NUS-2 (30.9)	NUS-9 (35.2)
KAL-5 (33.0)	NUS-6 (29.5)	OTH-9 (34.2)

Source: Data Processed using IO7 software.

The above values of FSI indicate the importance of inter-regional linkages in the island economy of Indonesia. Ignoring the spatial linkages would certainly underestimate the impacts occurring in the regional economy. As the single-region model excludes the feed-back and spill-over effects in respond to changes in a region's final demand, it is important to employ an inter-regional model.

Disaggregated measures of FSI describe the sectoral nature of the linkage indices. The ten highest ranking spatial-sectors based on FSI of output, income and employment multipliers are presented in Table 11.11.

As mentioned, the most relevant for impact analysis are the FSI. Among the highest ten sectors for FSI of output multipliers were five sectors of economy in the islands of Nusa Tenggara, namely NUS-4: Electricity, water and gas, NUS-5: Construction, NUS-3: Manufacturing, NUS-2: Mining and quarrying and NUS-9: Other services. For income multipliers, there were also five sectors in the islands of Nusa Tenggara among the highest ten spatial-sector of FSI, namely NUS-4: Electricity, water and gas, NUS-5: Construction, NUS-3: Manufacturing, NUS-2: Mining and quarrying and NUS-6: Trade, hotel and restaurant.

For employment multipliers, seven sectors in the Kalimantan island were among the highest ten spatial-sectors for FSI, namely KAL-8: Bank and other finance services, KAL-5: Construction, KAL-9: Other services, KAL-4: Electricity, water and gas, KAL-2: Mining and quarrying, KAL-7: Transportation and communication and KAL-6: Trade, hotel and restaurant. Identified by sector, three Other services, namely KAL-9, NUS-9 and OTH-9 included in the ten largest spatial-sectors for FSI of employment multipliers. Since the FSI measure is based on elements of the Leontief inverse, these results indicate that, in term of production of output and generation of income, strong linkages occurred between the islands of Nusa Tenggara and the rest of the country mostly through input purchases by utility, construction, manufacturing and service sectors. Agriculture, livestock, forestry and fishery sector relied on local inputs in the island.

In term of employment creation, almost all of the economic sectors in the Kalimantan island had strong employment linkages with the rest of Indonesia, especially the island of Java. Local employment was mainly supplied for agriculture, livestock, forestry and fishery sectors. As mentioned earlier, the use of multipliers in analysing the spatial structure of economy can be misleading due to the existence of intial effects in multiplier calculation. The net-effects of stimuli where the intial effects have been eliminated, the flow-on effects, would be preferred. In the following section, the spatial feed-back and spill-over flow-on effects will be presented.

f. Spatial Feed-back and Spill-over Effects of Flow-on Effects

Table 11.12 provides spatial FSI for output, income and employment flow-on effects. Compared to Table 11.11, one can see that the pattern of spatial linkages is similar to those of total multipliers. The sizes of linkages, however, are larger due to the elimination of the initial effects. Ignoring the spatial linkages in estimating flow-on effects that occurred due to changes in final demand in the island of Sumatra and Java would result in an error of about 20 per cent. The values of FSI of output, income and employment flow-on effects for the island of Sumatra were 21.1, 23.3, and 27.7 respectively. For the island of Java, the values of FSI were 22.9, 21.0 and 20.7 for output, income and employment flow-on effects respectively.

The error of ignoring the spatial linkages was even higher if the final demand changes occurred in the other three groups of islands. The values of FSI of output, income and employment flow-on effects were 53.5, 51.7 and 63.0 if final demand changes occurred in the Kalimantan Island. If final demand changes in the islands of Nusa Tenggara, the values of FSI were 65.5, 66.7 and 49.9 for output, income and employment flow-on effects. In Other island, the values of FSI were 54.8, 59.2 and 50.4 for output, income and employment flow-on effects.

Table 11.12

Spatial Feed-back and Spill-over Index (FSI):
Output, Income and Employment Flow-on Effects

FSI	Output	Income	Employment
Sumatra	21.1	23.3	27.7
Java	22.9	21.0	20.7
Kalimantan	53.5	51.7	63.0
Nusa Tenggara	65.5	66.7	49.9
Other Island	54.8	59.2	50.4
National	44.3	47.3	44.2

Source: Data Processed using IO7 software.

Again, these results confirmed that the three groups of islands, the Kalimantan island, the islands of Nusa Tenggara and Other islands, had very strong spatial linkages with the rest of the country mainly through input purchases in producing goods and services in the region. In more disaggregated form, Table 11.13 lists the ten highest ranking spatial-sectors based on FSI of output, income and employment flow-on effects.

Tabel 11.13

Ten Largest Spatial-Sector Feed-Back and Spill-Over Index (FSI):
Output, Income and Employment Flow-on Effects

Output	Income	Employment
OTH-4 (436.5)	NUS-4 (83.8)	KAL-9 (76.1)
NUS-4 (370.0)	OTH-8 (82.3)	KAL-8 (75.3)
NUS-2 (319.2)	OTH-4 (78.7)	OTH-4 (74.4)
NUS-5 (283.7)	NUS-2 (76.9)	KAL-5 (67.7)
OTH-5 (232.0)	NUS-5 (75.5)	OTH-5 (65.5)
KAL-9 (230.5)	NUS-1 (69.1)	KAL-2 (65.5)
NUS-8 (210.5)	OTH-5 (68.8)	NUS-2 (64.5)
KAL-8 (209.5)	NUS-8 (68.1)	KAL-6 (63.3)
NUS-1 (208.6)	KAL-9 (68.0)	OTH-2 (61.1)
NUS-3 (172.1)	KAL-8 (64.7)	NUS-5 (60.1)

Source: Data Processed using IO7 software.

Similar to the results of analysing the values of FSI for multiplier effects, among the highest ten spatial-sectors for FSI of output flow-on effects were five sectors of the economy in the islands of Nusa Tenggara, namely NUS-4: Electricity, water and gas, NUS-2: Mining and quarrying, NUS-5: Construction, NUS-8: Bank and other finance services, and NUS-1: Agriculture, livestock, forestry and fishery. With slightly different rank order, three sectors were the same as those in multiplier effects analysis. Another two new spatial-sectors, however, emerged in the flow-on analysis.

For income flow-on effects, there were also five sectors in the islands of Nusa Tenggara among the highest ten spatial-sector of FSI, namely NUS-4: Electricity, water and gas, NUS-2: Mining and quarrying, NUS-5: Construction, NUS-1: Agriculture, livestock, forestry and fishery, and NUS-8: Bank and other finance services. As in output flow-on, three sectors were the same as those in multipliers analysis. The two new spatial-sectors were also the same, but different in rank order.

For employment flow-on, compared to seven sectors in multipliers analysis, only five sectors in the Kalimantan island were among the highest ten spatial-sectors for FSI. These sectors were KAL-9: Other services, KAL-8: Bank and other finance services, KAL-5: Construction, KAL-2: Mining and quarrying, and KAL-6: Trade, hotel and restaurant.

The results of the analysis, especially on the spatial feed-back and spill-over effects of multipliers and flow-on, discussed in this section justify the notion that development activities should be focused on the eastern parts of Indonesia that include the Kalimantan island, the islands of Nusa Tenggara (not include

Bali) and Other islands. This reinforces the Indonesian government policies, highlighted in the 1990 presidential address, to list the eastern parts of Indonesia as a priority in Indonesia's development (Soegijoko, 1995). Not only will the eastern parts of Indonesia get benefits from the government policy, but also the rest of the country will improve their economic performance through the spill-over effects and the spatial linkages.

Concentrating economic activities in the island of Java and Sumatra would worsen the inequity problems in the Indonesian economy. It has been showed that, by any measure, Java and Sumatra have dominated the Indonesian economy and in this chapter, it is showed that the spill-over effects of the two islands were small. This shows the net impact of economic development on the two islands would not spread-out into the rest of the country. Conversely, the spill-over effects from development in the eastern parts of Indonesia will flow to the two islands, especially the island of Java.

4. Conclusion

In this chapter, the spatial structure of the island economy of Indonesia was presented in a more predictive manner by analysing the multipliers, flow-on and the spatial linkages.

All spatial-sector of Sector 9: Other services (KAL-9, OTH-9, SUM-9, NUS-9 and JAV-9) were among the ten largest ranking spatial-sectors for income multipliers. Two spatial-sectors of Sector-5: Construction industry (JAV-5 and OTH-5) were also included, as two sectors in the islands of Nusa Tenggara (NUS-2: Mining and quarrying industry, and NUS-7: Transportation and communication industry).

Among the ten largest ranking spatial-sectors in employment multipliers, there were eight sectors of the islands of Nusa Tenggara, namely NUS-2, NUS-1, NUS-3, NUS-4, NUS-7, NUS-9 and NUS-5. The other sectors were Sector-1: Agriculture, livestock, forestry and fishery in the island of Java (JAV-1), and Sector-5: Construction industry in Other islands (OTH-5).

By specifying multipliers into sector and region makes it possible to trace in what sectors (or regions) the respond of changes in final demand occurred. The sector-specific multipliers showed that, for output and income, multiplier effect occurred in own sectors were larger than that in other sectors. In some sectors, however, the multiplier effects in other sectors were larger than that in own-sector due to strong sectoral linkages between the sectors with other sectors through purchasing inputs. For output multipliers, the sectors in which multipliers were larger in other sectors included Sector-4: Electricity, water and gas industry, Sector-5: Construction industry and Sector-9: Other services. For income multipliers, the sectors were Sector-2: Mining and quarrying industry, Sector-6: Trade, hotel and restaurant industry and Sector-7: Transportation and communication industry. For employment multipliers, the opposite results were the case. The multipliers occurred in other sectors were generally larger than that in own-sector. This indicates that strong sectoral employment linkages exist. Except in Sector-1: Agriculture, livestock, forestry and fishery and Sector-2: Mining and quarrying industry, the employment multiplier effects in other sectors were larger than that in own-sector.

All measures of spatial-specific multipliers (output, income and output) showed that, for an island economy, the percentage of multipliers that occurred in the own-region is significantly high. For the island of Sumatra and Java, the two most developed islands in the country, the percentage of output, income and employment multipliers that occurred in the own region were about 90 per cent indicating that the two islands were relatively spatially independent. Only a small proportion of inputs from the rest of the country were required in producing goods and services. For other three groups of islands, the Kalimantan island, the islands of Nusa Tenggara and Other islands, the percentage of multiplier effects in own-region ranged from 70 to 80 per cent of total multiplier effects. This indicated that the three groups of islands were more dependent to the rest of the country. The spatial linkage analysis using the feed-back and spill-over index confirmed that the island of Java and Sumatra were more independent, while the other three groups of islands were less independent. The spatial linkages in the latter were stronger due to the significant size of spill-over and feed-back effects.

The flow-on effects, by which the net-impact of change in final demand is measured, provides more accurate measures than that of total. Based on the flow-on effects of output, income and multipliers, the spatial-sectors were also ranked. On the lists of the ten largest ranking spatial sectors, the same sectors as those in output multipliers also emerged in output flow-on rank order. This is simply because of the same initial unit impact. For income and employment flow-on effects, some different sectors were among the ten largest spatial sectors. Three Sector-9 (rather than five in multiplier effects), two of Sector-3 and two of Sector-4 were among the ten largest spatial sectors of income flow-on, and another Sector-3 on the rank of employment multipliers.

The presentation of sectoral distribution of flow-on effects showed that there were three sectors (Sector-3: Manufacturing industry, Sector-1: Agriculture, livestock, forestry and fishery and Sector-6: Trade, hotel and restaurant industry) in which flow-on effects consistently occurred in significant proportions regardless of the sectors of final demand changes. Similar to those in region-specific multipliers analysis, the proportion of flow-on effects occurred in own-region were significantly high when one inspected the spatial distribution of flow-on effects. This presentation, again, confirms previous analysis that the island of Sumatra and the island of Java were the most independent island in the country. The island of Kalimantan, the islands of Nusa Tenggara and Other islands were less independent. In other words, the latter was spatially more dependent to the rest of the country.

The spatial linkage analysis consistently confirms that the island of Sumatra and the island of Java were more independent with weak spatial linkages. A large proportion of multipliers or flow-on effects would occur in the own-region if the changes of final demand occurred in those islands. This would worsen the spatial inequity problems that have already been the nature of the island economy. Focusing economic activities on these islands would increase the economic growth of the country, but at the same time would make the economic distribution among regions worse.

References

Bayne, B.A., and West, G.R., (1989), **GRIT-Generation of Regional Input-Output Tables: User's Reference Manual**, Australian Government Printing Services, Canberra.

Blair, P.D, and Miller, R.E, (1988), **Spatial Linkages in the US Economy**, Paper to the Thirty-Fifth North American Meetings, Regional Science Association, Toronto.

Cochrane, S.G., (1990), "Input-Output Linkages in a Frontier Region of Indonesia", **International Regional Science Review**, 13(1-2): 183-203

DiPasquale, D., and Polenske, K.R., (1980), "Output, Income and Employment Input-Output Multipliers" in S. Pleeter (Ed), **Economic Impact Analysis: Methodology and Applications**, Studies in Applied Regional Science, 19, Martinus Nijhoff Publishing, Boston, pp: 85-113.

Dietzenbacher, E., (2002), "Interregional Multipliers: Looking Backward, Looking Forward", **Regional Studies**, 36(2): 125-136.

Guccione, A, Gillenm G.J., Blair, P.D., and Miller, R.E., (1988), "Inter-regional Feedbacks in Input-Output Models: The Least Upper Bounds, **Journal of Regional Science**, 28:397-404.

Hartwick, (1971), "Notes on the Isard and Chenery-Moses Inter-regional Input-

Output Models", **Journal of Regional Science**, 11(1):73-86.

Hulu, E., (1990), **Model Input-Output: Teori dan Applikasinya** (*Input-Output Model: Theory and Its Applications*), Pusat Antar Universitas-Studi Ekonomi (*Inter-University Centre-Economics*) Universitas Indonesia (*the University of Indonesia*), Jakarta.

Miller, R.E., (1966), "Inter-regional feedback Effects in Input-Output Models: Some Preliminary Results", **Papers of the Regional Science Association**, 17:105-125.

Miller, R.E., (1969), "Inter-regional Feedback Effects in Input-Output Models: Some Experimental Results", **Western Economic Journal,** 7(1):57-70

Miller, R.E., (1986), "Upper Bounds on the Sizes of Inter-regional Feedback in Multi-regional Input-Output Models", **Journal of Regional Science**, 26(2):285-306.

Miller, R.E., and Blair, P.D., (1985), **Input-Output Analysis: Foundation and Extensions**, Englewood Cliffs, Prentice-Hall, New Jersey.

Muchdie, (2017), "GIRIOT: Revisited, Up-dated and Evaluated", **International Journal of Social Science and Economic Research**, 2 (2): 2377-2396. ISSN: 2455-8834.

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid Procedure for Generation of Inter-Regional Input-Output Tables,**ISBN: 978-3-8454-1847-6, Lambert Academic Publishing, Germany.

Muchdie, (1988), **Spatial Structure of Island Economy of Indonesia: An Inter-Regional Input-Output Study**, unpublished PhD Thesis submitted to the Department of Economics, the University of Queensland, Australia.

Soegijoko, B. Tjahjati, (1995), **Eastern Indonesia's Development in the Second Long-Term Development Plant (1994/1995-2018/2019 and Repelita VI (1994/1995-1998/1999)**, The National Development Planning Agency, Jakarta.

West, G.R and Jensen, R.C., (1980), "Some Reflections on Input-Output Multipliers", **Annals of Regional Science**, 14(2):77-89

West, G.R and Jensen, R.C., Cheeseman, W.E., Bayne, B.A., Robinson, J.J., Jancic, H., and Garhart, R.E., (1989), **Regional and Inter-regional Input-Output Tables for Queensland 1985/86**, Report to the Queensland Treasury Department, Department of Economics, University of Queensland, St. Lucia.

West, G.R, Morison, J.B. and Jensen, R.C., (1982),**An Inter-regional Input-Output Table for Queensland 1978/79: GRIT III**, Report to the Department of Commercial and Industrial Development, Department of Economics, University of Queensland, St. Lucia.

Part-2

TECHNOLOGY AND ECONOMIC DEVELOPMENT

Chapter-12

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Chapter-12

Technical Efficiency and Return to Scale in the Indonesian Economy during the New Order and the Reformation Governments[1]

Ringkasan

Bab ini menganalisis efisiensi teknis dan skala hasil dalam perekonomian Indonesia pada kurun waktu 1967-2013, yaitu pada masa pemerintahan Orde Baru (1966-1998) dan pemerintahan Reformasi (1998-2014). Analisis juga didasarkan pada tahapan-tahapan dalam siklus perekonomian, mencakup Oil Boom (1967-1981), Resesi (1982-1986), Deregeluasi (1987-1996), Krisis Multidimensi (1997-2001) dan Pemulihan Ekonomi (2002-2013). Menggunakan data Produk Domestik Bruto dan Cadangan Modal atas dasar harga konstan tahun 2000 dan data tenaga kerja, fungsi produksi Cobb-Douglas digunakan untuk menghitung efisiensi teknis dan skala hasil menggunakan teknik analisis regresi. Hasil analisis menunjukkan bahwa efisiensi teknis selama pemerintahan Orde Baru lebih baik dibanding pemerintahan Reformasi. Selain itu, efisiensi teknis dalam perekonomian Indonesia beragam pada periode siklus perekonomian Indonesia.

Summary

This chapter analyses technical efficiency and return to scale in the Indonesia economy during the year of 1967 to 2013. These range of years covering two eras of Indonesian government; the New Order era that lasted between the

[1] This chapter has been published in **Jurnal Ekonomi Pembangunan**, 17 (2), December 2016, pp: 136-142, Jurnal Nasional Terakreditasi Kemenristekdikti, http://journals.ums.ac.id; http://journals.ums.ac.id/index.php/JEP/article/vi... ; http://repository.uhamka.ac.id/149/; https://www.researchgate.net/publication/311908212; https://www.academia.edu/30762633/.

year of 1966 to 1998 and the Reformation era during the year 1998 to 2014. The analysis was also based on the Indonesia economy's business cycle those categorised as Oil Booming Phase (1967-1981), Recession Phase (1982-1986), Deregulation Phase (1987-1996), Multidimension Crisis Phase (1997-2001) and Economic Recovery Phase (2002-1013). Using data on Gross Domestic Product based on constant price of the year 2000, capital stock with the same based year and employment (1967-2013), Cobb-Douglas production functions were exercised to calculate technical efficiency and return to scale employing regression analysis tehniques. The results show that technical effiency during the New Order Goverment were better than those during Reformation Goverment. The results also showed that technical efficiencies vary among phases in the Indonesian economy business cycles.

1. Introduction

Since the declaration of Indonesian independence on 17 August 1945, the Indonesian economy has been up and down, experiencing booming and recession (Galih Adhidarma, 2015). Economic cycle such as booming, recession and even economic crisis did exist in the Indonesia economy. Socia Prihawantoro et al., (2009) have indicated that few phases in Indonesia economy during the year of 1967 to year 2013, namely: oil booming (1967-1981), recession (19082-1986), deregulation (1987-1996), multidimension economic crisis (1997-2001), and economic recovery (2002-2013).

Economists have long recognized that technology is a factor of production, and even the most important factor, given its role in labor quality and the design of capital good. Technological advances play a crucial role in improving productivity and thus the standar of living of a system; economic system (Adam, 2006). Measuring the effect of technology on productivity is a difficult pursuit. It is generally approached through metrics such as Gross Domestic Product, GDP per capita and Total Factor Productivity (TFP). The former two attempt to capture the overall output of a given economy from a macro-environmental perspective. The latter is attempting to measure technologically driven advancement through noting increase in overall output without increases in input. This is done through utilizing production function equations and identifying when the output is greater than the supposed input, implying an advance in external technological environment (Boundless, 2016).

Technology can be regarded as primary resource in economic development. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. It was observed that innovation or technological progress is the only determinant of economic progress. However if the level of technology becomes constant the process of growth will stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Debasish, 2016).

In economics, the Cobb-Douglas production function is widely used to represent the relationship of an output to input (Bao Hong, 2008). It was proposed by Knut Wicksell (1851-1926) and tested against statistical evident by Charles Cobb and Paul Douglas in 1928. From Cobb-Douglas production function, technical efficiency also known as total factor productivity, retun to scale, and output-capital elasticity as well as output-labor elasticity can easily be calculated by employing regression analysis (Salvatore, 1996).

Indonesian economy during the era of New Order under Suharto presidency (1966-1998) and during the era of Reformation (1999-2014) run by Habibie Presidency (1998-1999), Wahid Presidency (1999-2001), Megawati Presidency (2001-2004) and Yudhoyono Presidency (2004-2014) has shown clearly the economy's business cycle, up and down over time. Many economic indicators, such as GDP (Gross Domestic Product), Capital Stock and Employment have been published in many publications by National Statistical Agency (BPS, many years).

Previous researchers on technical efficiency return to scale and output elasticities have been conducted, among others by Biresh K. Sahoo, at. al (2014), Krivonozhko, Dvorkovich, Utkin, , Zharkov, Patrin, and Lyche (2007), Gebreselasie (2008), Feng and Serletis (2010), Holyk (2016), Page, Jr (1980), Erkoc (2012) and Yudistira 2004). Another research on measuring Indonesia's sectoral efficiencies has been conducted by Rizaldi Akbar (2015).

The research reported in this paper aimed at analyzing the coefficient of technical efficiency, return to scale and output-capital elasticity as well as output-labor elasticity of the Indonesia economy during the era of New Order and the era of Reformation.

2. Methods

Cobb-Douglas production function, $Q = \gamma K^{\alpha} L^{\beta}$, was employed in this exercise to calculate technical efficiency (γ), return to scale ($\alpha+\beta$), output-capital elasticity (α), and output-labor elasticity (β). This production function was developed and statistically tested by Charles Cobb and Paul Douglas (1928), where :

Q = total production (the real value of all goods and services produced in a year;

K = capital input (the real value of all machinery, equipment, and building;

L = labor input (the total number of person-hours worked in a year;

γ = technical efficiency in production process, known as total factor productivity;

α = output-capital elasticity;

β = output-labor elasticity.

Technical efficiency (γ), or total factor productivity (TFP) is the portion of output not explained by the amount of input used in production (Comin, 2006). This is a method of measuring overall productivity of business, industries or economies. Technical efficiency is the effectiveness by which a given set inputs is used to produce an output. A firm or an economy is said to be technically efficient if a firm or an economy is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. Technical efficiency is related to productive efficiency concerning with producing at the lowest point on the short run average cost curve. Thus productive efficiency required technical efficiency (Pettinger, 2012). The values of α and β are basically determined by available technology. Output elasticity measure the responsiveness of output to a change in levels either capital or labor used in production. Furthermore, if $\alpha + \beta = 1$, the production function has constant return to scale, meaning that doubling the usage of capital (K) and labor (L) will also double output (Q). If $\alpha + \beta < 1$, return to scale are decreasing and if $\alpha + \beta > 1$, return to scale are increasing (Salvatore, D, 1996). The output elasticity of capital, $E_K = \delta Q/\delta K.K/Q = \alpha Q/K.K/Q = \alpha$. Similarly, the output elasticity of labor, $E_L = \delta Q/\delta L.L/Q = \beta Q/L.L/Q = \beta$, and $E_K + E_L = \alpha + \beta =$ return to scale.

Converting the production function from $Q = \gamma K^{\alpha} L^{\beta}$ in to a logarithms form that is, $\ln Q = \ln \gamma + \alpha \ln K + \beta \ln L$. As this is a linier form, then the coefficients (γ, α and β) can easily be estimated by regression analysis (Gaspersz, 1996). The Cobb-Douglas production function can be estimated either from data for a single firm, industry, region or nation over time using time-series analysis or for a single firm, industry, region or national one point in time using cross-sectional data (Salvatore, 1996).

Data needed for this exercise were national data on Gross Domestic Product, Capital Stock and Employment. Yearly data on GDP, Capital Stock and Employment were collected from the Central Bureau of Statistics. Fortunately data were available from the year of 1967 the early year of the New Order Government until the year of 2013 which was the last year of the Reformation Government. Basically most data used for this exercise are data collected by the Project on Technological Change and Economic Growth (2009-2011) and up-dated in 2015 held by the Agency for the Assessment and Application of Technology (Socia Prihawantoro et al., (2009).

Analysis was also classified according to the Indonesian economy business cycle, phase were the economy performance up and down economic; experiencing with booming and recession. Based on available data, the phases of the Indonesian economy were classified into: Oil Booming Phase (1976-1981), Recession Phase (1982-1986), Deregulation Phase (1987-1996), Multidimension Crisis Phase (1997-2001) and Economic Recovery phase (2002-2013) (Alkadri, et al., 2010).

3. Results and Discussion

Figure 12.1 provides a picture on the Indonesia Gross Domestic Product (GDP) over time, 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian GDP in the first year (1967) was Rp 417.76 Billion and GDP at the last year (2013) was Rp. 2,686.49 Billion. On average, Indonesian GDP grows at 5.23%. It was noted that when multi dimension of economic crisis (known as monetary crisis) occurred in 1998, the Indonesian GDP grew at minus 13.13%, from Rp. 1,555.32 Billion in 1997 to Rp. 1,351.16 Billion in 1998.

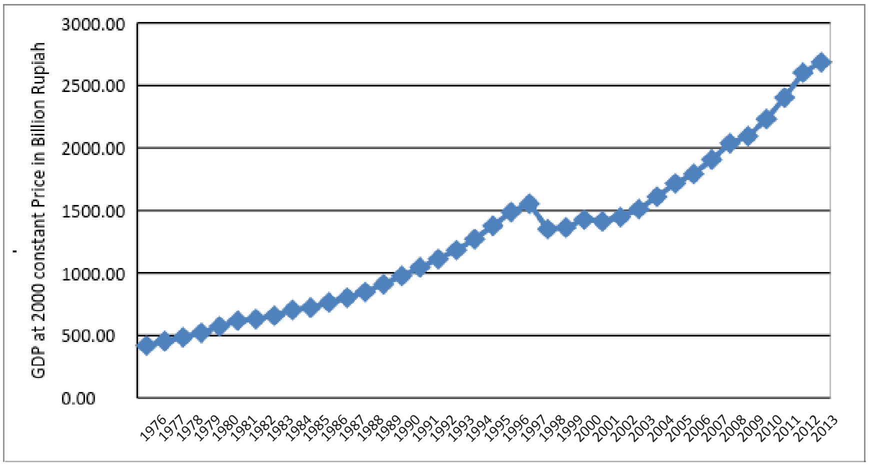

Figure 12.1

Indonesian Gross Domestic Product, 1967-2013

Figure 12.2 provides a picture on the Indonesia Capital Stock (1967-2013), 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian Capital Stock in the first year (1967) was Rp. 60,341 Billion and GDP at the last year (2013) was Rp. 653,23 Billion. On average, Indonesian Capital Stock grows at 7.17%, higher than the growth of GDP. It was noted that there were some years when the Capital Stock had negative growth. In 1983-1984, the growth of Capital Stock was -6.02%, and in 1997-1998 the growth of Capital Stock was -33% and in 1998-1999 was -19.38%. It was the same time when Indonesia and other Asian countries experienced monetary crisis.

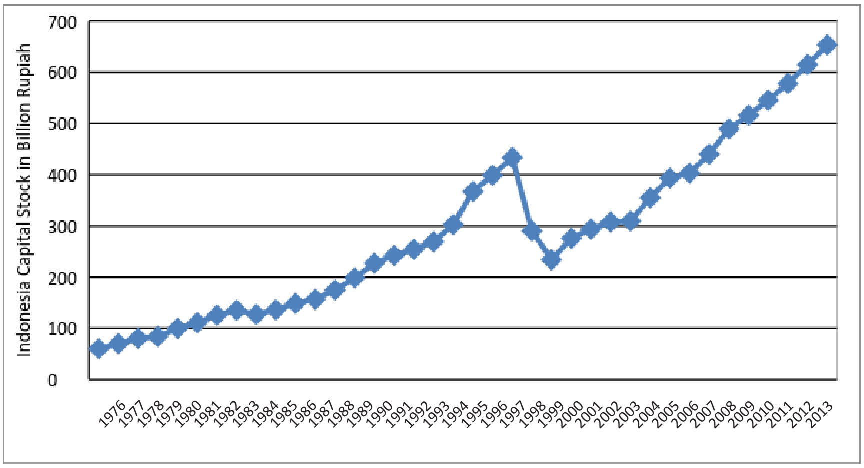

Figure 12.2

Indonesian Capital Stock, 1967-2013

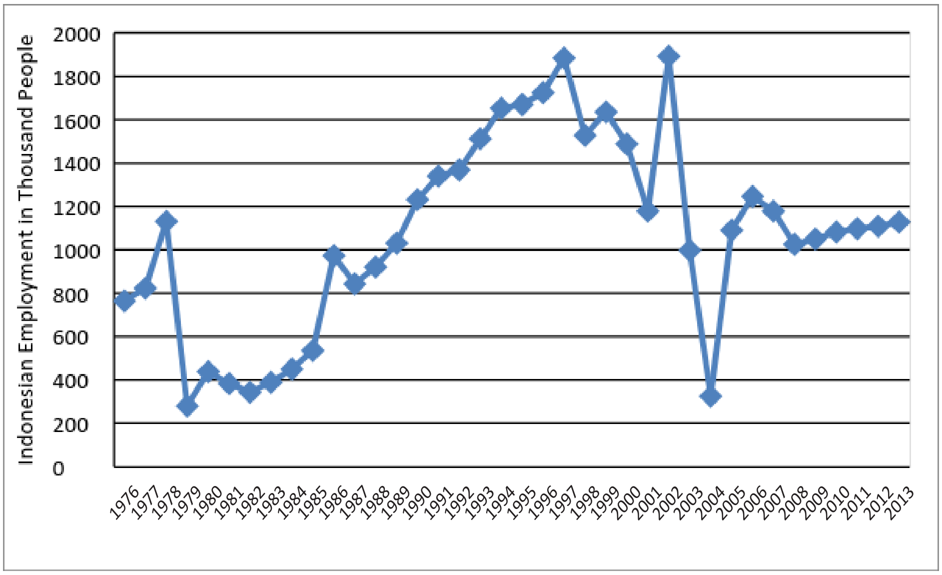

Figure 12.3

Indonesian Employment, 1967-2013

Figure 13.3 provides a picture on the Indonesian employment (1967-2013), 1967, the early year of the New Order Government to 2013 almost the end of the Reformation Era. Indonesian employment in the first year (1967) was 675 thousand people and at the last year (2013) was 1,128 thousand people. On average, Indonesian Capital Stock grew at 9.45% %, higher than the growth of GDP as well as the growth of Capital Stock. However, there were some years when the growths of employment were negative, namely the years of: 1979 (-75.18%), 1981 (-2.54%), 1982 (-10.41%), 1988 (-18.95%), 2000 (-9%), 2001 (-20.18%), 2003 (-47.31%), 2004 (-67.45%), 2007 (-5.41%) and 2008 (-13.01%).

Table 12.1

The Coeffients of Technical Efficiency, Return to Scale and Output Elasticities during the New Order and the Reformation Governments

Indonesian Economy	γ	α	β	RTS= α + β
All Period (1967-2013	2.78	0.80	-0.02	0.78
New Order Government (1967-1998)	3.08	0.67	0.03	0.70
Reformation Era Government (1999-2013)	2.98	0.72	0.03	0.75

Source : Data Analysis, Using Regression Analysis by Excell of Microsoft Office

Table 13.1 provided results of calculation using an easy and user frendly Excell sofware of Microsoft Office. Technical efficiency, or total factor productivity of the Indonesia economy during the year 1967 to year 2013, was 2.78. In the New Order era the coefficient was 3.08 which was higher than that of the Reformation Government, 2.98. It means that technological progress during the New Order era was better than that of the Reformation Goverment. Even, the progress of technical production was higher than that at the national level.

Table 13.1 also showed that both during the two eras of Indonesian Government have experienced the decreasing return to scale, as the summation of α dan β, the coeffients of return to scale were less than unity. The coefficients of return to scale during the Reformation Government was 0.75 a bit higher than that of the New Order Government, 0.70. Both were a slihgtly lower compared to that at the national level (0.78).

As also shown at Table 1, the coefficients of output elasticity of capital during the New Order and the Reformation governments (0.67 and 0.72) was lower than that at the national level (0.80). It can be marked easily, that the coefficient of output-capital elasticity during the Reformation government (0,75) was higher than that during the New Order government (0.67).

Finally, Table 1 indicates that the coeffients of output-labor elasticity during the Reformation government (0.03) as well the New Order government (0.03) were higher than that at national level (-0.02). Again, the coefficient of output-labor elasticity during the Reformation era (0,032) was higher than that during the New Order government (0.03).

Table 13.2 provides results of calculation from regression analysis. All the coefficients of technical efficiency during the Indonesia economy's business cycle were higher than that at national level (2.78). The technical efficiency coefficient at the Recession Phase (1982-1986) was 6.88 and at the Multidimension Crisis Phase (1997-2011) was 5.86. These two coefficients were the highest. Except the coefficient of technical efficiency at the Economic Recovery Phase (2.70) all of these coefficients were higher than that at the national level (2.78).

Table 13.2 also shows that all phases of the Indonesia economy business cycle were at the stage of decreasing return to scale, where the return to scale coefficients were less than unity. The coefficient of return to scale, namely the summation of (+ , at the Economic Recovery Phase was the higher (0.80) than those of the whole phases, including the phases of Multi dimension crisis (0.24), the Oil Boom (0.57), Deregulations (0.57). There was one phase where the value of return to scale coefficient that was negative. It was at the phase of Recessions (-0.35). Although the value of the coefficient of elasticity of capital was negative, the value of the coefficient of output elasticity of labor was non-negative.

Table 12.2

The Coeffients of Technical Efficiency, Return to Scale and Output Elasticities Based on the Indonesia Economy's Cycles

Indonesia Economy's Cycle	γ	α	β	RTS
All Phases (1967-2013)	2.78	0.80	-0.02	0.78
Oil Boom Phase (1976-1981)	3.78	0.60	-0.03	0.57
Recession Phase (1982-1986)	6.88	-0.35	0.22	-0.13
Deregulation Phase (1987-1996)	2.80	0.56	0.15	0.71
Multidimension Crisis Phase (1997-2001)	5.86	0.21	0.03	0.24
Economic Recovery Phase (2002-2013)	2.70	0.79	0.01	0.80

Source : Data Analysis, Using Regression Analysis by Excell of Microsoft Office.

All values of the coefficient of output elasticity of capital were lower than that at the national level (0.80).The smallest value of the coefficient were at Recessions Phase (-0.35) and Multidimension Crisis Phases (0.21). There was likely a bit odd, as the value of coefficient of output labor elasticity were negative, namely at the phase of Oil Boom (-0.03) and at the whole phase, the national level (-0.02). The other values of the elasticity of output of labor were 0.22; 0.15; 0.03 and 0.01 respectively for the coefficients of output-labor elasticity at Resession Phase, Deregulation Phase, Multidimension Crisis Phase and Economic Recovery Phase.

4. Conclusion

From discussion, it can be concluded that technical efficiency in Indonesian economy was higher during the New Order Government (3.08) than that in the Reformation Government(2.98). Decreasing return to scale exhibited in both goverment eras; the coefficients of return to scale were 0.70 and 0.75 consecutively during the New Order and the Reformation. Output elasticities were higher in the Reformation than those in the New Order, as output-capital elasticity was 0.72 in the Reformation compared to 0.67 in the New Order; meanwhile output-labor elasticity was 0.03 in the Reformation and 0.03 in the New Order. At all phases of the Indonesian economy's business cycle, the coefficients of technical efficiency were higher than that of the national average. All phases were also experienced the decreasing return to scale. The coefficients of output elasticity of capital were lower than those at national average. On the contrary, the coefficients of output elasticity of labor were generally higher than those at the national level, except the one at the Oil Booming Phase.

References

Adams, J., (2006), "The Contibution of Science and Technology to Production", National Bureau of Economic Research, Cambridge Massachusetts.

Bao Hong, Tan., (2008), "Cobb-Douglas Production Function", http://docentes.fe.unl.pt/jamador/Macro/cobb-douglas.pdf, acessed on retrive on 22 June 2016.

Biresh K. Sahoo, Joe Zhu , Kaoru Tone, Bernhard M. Klemen, (2014), "Decomposing technical efficiency and scale elasticity in two-stage network DEA"**, European Journal of Operational Research**, 23(3): 584–594.

Boundless, (2016), "Impacts of Technological Change on Productivity," **Boundless economics,** https://www.boundless.com/economics/texbook/boundless-economics-texbook/economic-growth-20/productivity-98/impacts-of-technological-change-on-productivity-370-12467/, acessed on 26 June 2016.

Cobb C.W, and Douglas, P.H., (1928), "A Theory of Production", **American Economic Review,** 18 (Supplement): 139-165.

Comin, D. 2006, **Total Factor Productivity**, New York University, New York.

Debasish., (2016), "Role of Technology in Economic Development" **Economicsdiscussion.net**,

http://www.economicsdiscussion.net/articles/role-of-technoloy-in-economic-development/4455, accessed on 22 June 2016.

Erkoc, T. E., (2012), "Estimation Methodology of Economic Efficiency: Stochastic Frontier Analysis versus Data Envelopment Analysis", **International Journal of Academic Research in Economics and Management Sciences,** 1(1): 1-23.

Feng, G, and Serletis, A,. (2010), "Efficiency, Technical Change, and Returns to Scale in Large US Banks: Panel Data Evidence from an Output Distance Function Satisfying Theoretical Regularity", **Journal of Banking & Finance**, 34(1): 127-138.

Galih Adhidarma, (2015), "Analisis Siklus Bisnis dan Indikator Ekonomi

Pendahulu Indonesia Tahun 2000:Q2 – 2012:Q3", **MacroEconomics DashBoard**, Fakultas Ekonomika dan Bisnis UGM, Available at :

http://macroeconomicdashboard.feb.ugm.ac.id/analisis-siklus-bisnis-dan-indikator-ekonomi-pendahulu-indonesia-tahun-2000q2-2012q3/, accessed on 4 Juni 2016.

Gaspersz. V., 1996**, Ekonomi Manajerial, Penerapan Konsep-Konsep Ekonomi Dalam Manajemen Bisnis Total (Managerial Economics : Application of Economic Concepts in Total Business Management)**, PT Gramedia Pustaka Utama, Jakarta, pp: 222-233.

Gebreselasie, T.G., (2008), "Sectoral Elasticity of Substitution and Returns to Scale in South Africa", **South African Journal of Economics**, Special Issue: Industrial growth and employment in South Africa. 76 (Issue Supplement s2): S110–S125.

Holyk, S., (2016), "Measuring Technical Efficiency and Economy on Scale in Finnish Food Processing Industry", **International Journal of Science: Basic and Applied Research,** 27 (3): 226-238.

Krivonozhko, V. E. , Dvorkovich, A. V. , Utkin, O. B. , Zharkov I. D, Patrin, M. V. and Lyche A. V., (2007), "Computation of elasticity and scale effect in technical efficiency analysis of complex systems", **Computational Mathematics and Modeling,** 18(4): 432-452.

Page, J. M. Jr, (1980), "Technical Efficiency and Economic Performance: Some Evidence from Ghana", **Oxford Economic Papers**, New Series, 32(2): 319-339.

Pettinger, T., (2012), "Technical Efficiency Definition", **Get Economic Help** in http://www.economichelp.org/blog/glossary/technical-efficiency, accessed on 15 June 2015.

Salvatore, D., (1996), **Managerial Economic in a Global Economy**, Irwin McGraw Hill, Boston, pp: 251.

Socia Prihawantoro, Alkadri, Mien Askinatin, Andi Tabrani, Supomo, Abd Azis Wasil, (2009), **Peran Teknologi dalam Pertumbuhan Ekonomi Indonesia (The Role of Technology in the Indonesian Economic Growth)**, Badan Pengkajian dan Penera*pan Teknologi*, Jakarta.

Yudistira, D., (2004),"Efficiency in Islamic Banking: An Empirical Analysis of Eighteen Banks", **Islamic Economic Studies***,* 12(1): 1-19.

Chapter-13

Sectoral Variation on Technical Efficiency and Return to Scale in the Indonesian Economy[1]

Ringkasan

Bab ini membahas keragaman sektoral dari koefisien efisiensi teknis dan skala hasil dalam perekonomian Indonesia. Menggunakan analisis regresi terhadap fungsi produksi Cobb-Douglas, koefisien-koefisien tersebut telah dihitung. Ada sembilan sektor dalam perekonomian Indonesia dalam kajian ini, meliputi: Pertanian, Pertambangan dan Galian, Industri, Listrik, Gas dan Air Minum, Konstruksi, Perdagangan, Hotel dan Restoran, Angkutan dan Komunikasi, Jasa Keuangan Persewaan dan Perusahaan, dan Jasa-jasa. Data produk domestik bruto dan cadangan modal atas harga konstan tahun 2000 serta tenaga kerja dari setiap sektor untuk tahun 1967 sampai 2007 diambil dari berbagai terbitan Badan Pusat Statistik. Hasil analisis menunjukkan bahwa terdapat keragaman dalam hal koefisien efisiensi teknis dan skala hasil berdasarkan sektor. Sektor-sektor dengan koefisien efisiensi teknis di atas rata-rata nasional mengalami skala hasil yang menurun. Sebaliknya, sektor-sektor dengan koefisien efisiensi teknik di bawah rata-rata nasional mengalami skala hasil yang meningkat.

Summary

This chapter discusses on sectoral variations of technical effciency and return to scale in the Indonesian economy. Employing regression analysis of Cobb-Douglas production function, these coefficients were calculated. Nine economic sectors

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[1] This chapter has been published in **Signifikan: Jurnal Ilmu Ekonomi**, ISSN: P-ISSN: 2087-2046, E-ISSN: 2476-9223, 5(2): 119-132, Jurnal Nasional Terakreditasi Kemenristekdikti. DOI: 10.15408/sjie.v5i2.3400; http://www.journal.uinjkt.ac.id/index.php/signifikan/article/view/3400; http://repository.uhamka.ac.id/126/; https://www.researchgate.net/publication/308486849; https://www.academia.edu/30641560/.

in the Indonesian economy: Agriculture, Mining and Quarying, Manufacturing, Electricity, Gas and Drinking Water, Construction, Trade, Hotel and Restaurant, Transportation and Communication, Finance, Rental and Corporate Services, and Services, were exercised to study the variation of those coefficiens. Sectoral data on gross domestic product, capital stock and employment are those from the years 1967 to 2007 collected from many documents available at the National Statistics Agency. The result shows that the coeffiecients of technical efficiency do vary among sectors. Those sectors in which the coefficients were above that at the national level, experienced decreasing return to scale. On the contrary, those sectors in which the coeffiecients were below that at national level, experienced increasing return to scale.

1. Introduction

Since it has been declared its independence on 17 August 1945, the Indonesian economy has been up and down, experiencing booming and recession (Anonymous, 1998, 2004, 2010). Economic cycle such as booming, recession, and even crisis do exist in Indonesian economy. Economists have long recognized that technology is a factor of production, and even the most important factor, given its role in labor quality and the design of capital good. Technological advances play a crucial role in improving productivity and thus the standar of living of a system; economic system (Adams, J. 2006).

Most economists today agree with the hypothesis that both innovation and technological spill-overs are the main engine for explaining productivity growth. Neoclassical economists tend to give all sectors of the economy equal weight for explaining productivity behavior, but structuralism economists argue that manufacturing sector is the main force for explaining the aggregate productivity. Although economic development is basically determined by technical progress, the productive structure of developed economies continues to be much more complex and diversified than that of developing economies. It means that economic development can be understood as a process through which a deep structural change occurs in the economy, in such a way that there is a reallocation of resources from primary sectors (agriculture and mining) to the manufacturing sector, and then as soon as an economy has achieved high level of income per capita, from manufacturing to service sector (Nassif A., & Feijo C, 2013).

Measuring the effect of technology on productivity is a difficult pursuit.

It is generally approached through metrics such as Gross Domestic Product, GDP per capita and Total Factor Productivity (TFP). The former two attempt to capture the overall output of a given economy from a macro-environmental perspective. The latter is attempting to measure technologically driven advancement through noting increase in overall output without increases in input. This is done through utilizing production function equations and identifying when the output is greater than the supposed input, implying an advance in external technological environment (Boundless, 2016). The technology can be regarded as primary resource in economic development. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. It was observed that innovation or technological progress is the only determinant of economic progress. But if the level of technology becomes constant the process of growth will stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Debasish, 2016).

In economics, the Cobb-Douglas production function is widely used to represent the relationship of an output to input (Bao Hong, T., 2008). It was proposed by Knut Wicksell (1851-1926) and tested against statistical evident by Charles Cobb and Paul Douglas in 1928 (Cobb C.W, and Douglas, P.H.1928). From Cobb-Douglas production function, technical efficiency also known as total factor productivity, retun to scale, and output-capital elasticity as well as output-labor elasticity can easily be calculated by employing regression analysis (Salvatore, D. 1996).

Previous research on technical efficiency, return to scale and output elasticities has been conducted, among others by Biresh K. Sahoo, at all (2014), V. E. Krivonozhko, A. V. Dvorkovich, O. B. Utkin, I. D. Zharkov, M. V. Patrin and A. V. Lyche (2007), Tewodros G. Gebreselasie (2008), Feng, G and Serletis, A (2010), Holyk, S. (2016), Page, John M. Jr (1980), Erkoc, T. E., (2012), Yudistira, D (2004). Measuring Indonesia's sectoral efficiencies has been conducted by Rizaldi Akbar (2015).

Structural transformation process in the Indonesian economy is indicated initially by the dominance of agricultural sector both in output and in employment. The primary sector, namely: Agriculture and Mining and quarrying dominated the Indonesian economy until 1987-1988, but Secondary (Manufacturing) and

Tertiary Sectors (Trade, Hotel and Restaurant) have replaced this position after 1999 in term of output. But, in term of employment, data show that during the year of 1967 to 2007, Agriculture has still dominated the Indonesian economy.

The research reported in this paper aimed to analyze the sectoral variations of the coefficients of technical efficiency, return to scale and output-capital elasticity as well as output-labor elasticity in the Indonesia economy during the year of 1967 to 2007.

2. Methods

Cobb-Douglas production function, $Q = \gamma\ K^{\alpha}L^{\beta}$, was employed in this exercise to calculate technical efficiency (γ) return to scale ($\alpha+\beta$), output-capital elasticity (α) and output-labor elasticity (β) This production function was developed and statistically tester by Charles Cobb and Paul Douglas during 1927-1947 (Cobb C.W, and Douglas, P.H., 1928), where:

Q = total production (the real value of all goods and services produced in a year;

K = capital input (the real value of all machinery, equipment, and building;

L = labor input (the total number of person-hours worked in a year;

γ = technical efficiency in production process, known as total factor productivity;

α = output-capital elasticity;

β = output-labor elasticity.

Technical efficiency (γ), or total factor productivity (TFP) is the portion of output not explained by the amount of input used in production (Comin, D., 2006). This is a method of measuring overall productivity of business, industries or economies. Technical efficiency is the effectiveness with which a given set inputs is used to produce an output. A firm or an economy is said to be technically efficient if a firm or an economy is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. Technical efficiency is related to productive efficiency which is concern with producing at the lowest point on the short run average cost curve. Thus productive efficiency required technical efficiency (Pettinger, T. (2012).

The values of α and β are basically determined by available technology. Output elasticity measure the responsiveness of output to a change in levels either capital or labor used in production. Furthermore, if $\alpha + \beta = 1$, the production function has constant return to scale, meaning that doubling the usage of capital (K) and labor (L) will also double output (Q). If $\alpha + \beta < 1$, return to scale are decreasing and if $\alpha + \beta > 1$, return to scale are increasing.

The output elasticity of capital, $E_K = \delta Q/\delta K.K/Q = \alpha Q/K.K/Q = \alpha$. Similarly, the output elasticity of labor, $E_L = \delta Q/\delta L.L/Q = \beta Q/L.L/Q = \beta$ and $E_K + E_L = \alpha + \beta$ = return to scale (Salvatore, D., 1996). Converting the production function from $Q = \gamma K^\alpha L^\beta$ in to a logarithms form that is, $\ln Q = \ln \gamma + \alpha \ln K + \beta \ln L$. As this is a linier form, then the coefficients (γ, α and β) can easily be estimated by regression analysis (Gaspers, V., (1996).

The Cobb-Douglas production function can be estimated either from data for a single firm, industry, region or nation over time using time-series analysis or for a single firm, industry, region or national one point in time using cross-sectional data (Salvatore, D., (1996).

Data needed for this exercise were sectoral data on Gross Domestic Product, Capital Stock and Employment. Yearly data on GDP, Capital Stock and Employment were collected from the Central Bureau of Statistics. Fortunately data were available from the year of 1967-2007[2].

3. Results and Discussion

Figure 13.1 provides data on GDP (Gross Domestic Product in Billion Rupiah) in the Indonesia economy during 1967 to 2007. In 1967, the GDP in 1967, the early year of Suharto regime, was Rp 417.76 Billion and GDP at the last year (2007) was Rp. 2,686.49 Billion. On average, Indonesian GDP during 30 years grows at 5.11%. It was noted, however, that when multi-dimensional economic crisis (known as monetary crisis or IMF crisis) occurred in 1998, the Indonesian GDP grows at negative (-13.13%), from Rp. 1,555.32 Billion in 1997 to Rp. 1,351.16 Billion in 1998.

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[2] Special thanks to Dr. Socia Prihawantoro, (then Program Director) on the Project on *Technological Change and Economic Growth 2009-2010-2011*, Agency for the Assessment and Application of Technology, who provide such a raw data to analyze, I my self was the Program Director of the 2009 Project.

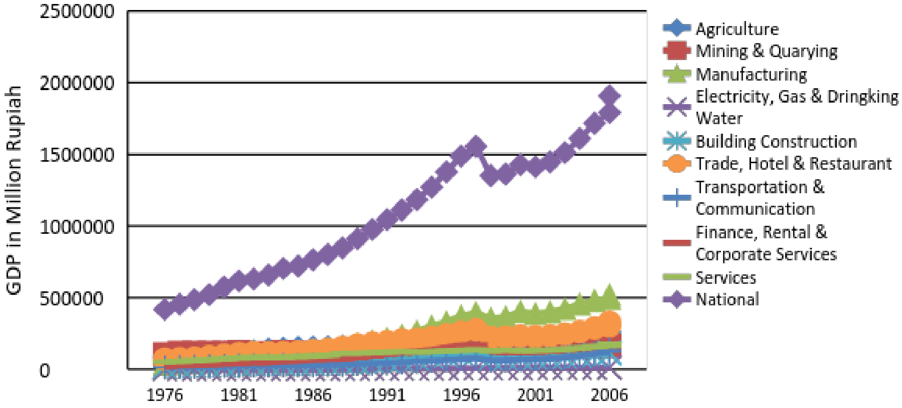

Figure 13.1

Gross Domestic Product in the Indonesian Economy

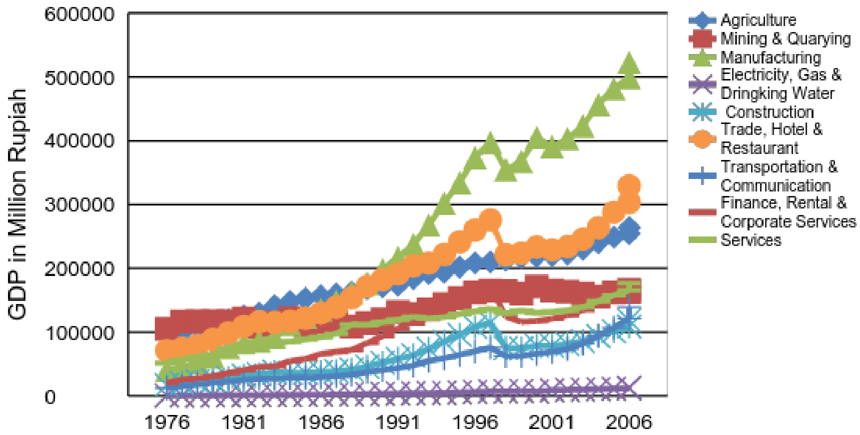

Figure 13.2

Sectoral Gross Domestic Product in the Indonesia Economy

Figure 13.2 provides sectoral GDP in more detail. In 1967, sectoral GDP were dominated by Mining and Quarying (Rp. 105,076 Million) and Agriculture (Rp. 99,642 Million), followed by Trade, Hotel and Restaurant (Rp. 71,104 Million), Services (Rp. 51,468 Million), Manufacturing (Rp. 40,359 Million), Financial, Rental and Corporate Services (Rp.20,212 Million), Building Construction (Rp. 16,794 Million), Transportation and Communication (Rp. 12,490 Million) and Electricity, Gas and Drinking Water (Rp. 617 Million). At the year of 2007, sectoral GDP was dominated by Manufacturing (secondary industry) with GDP of Rp. 522,651 Million and followed by Trade, Hotel and Restaurant

(Rp. 329,228 Million), Agriculture (Rp. 263,800 Million), Financial, Rental and Corporate Services (Rp. 178,394 Million), Services (Rp. 176,755 Million), Mining and Quarying (Rp. 166,449 Million), Transportation and Communication (Rp. 138,846 Million), Building and Construction (Rp. 118,406 Million), and Electricity, Gas and Drinking Water (Rp. 13,137 Million).

Agriculture GDP grows in average 3.21%, with the lowest growth of 0.03% in the year of 1967 and 0.51% in the year of 2000, and the highest growth of 8.39% in the year of 1982 and 8.37% in the year of 1968. No negatice growth experienced by the sector, even in the time when multidimension of economic crisis in the 1998.Mining and Quarying GDP grows in average 1.63%. This sector experienced many negative growth for instance in the years of 1981 (-10.78%), 1984 (-10.22%), 1987 (-5.71%), 1991 (-2.45%), 1997 (-0.50%), 1998 (-2.57%), 2000 (-3.71%), 2001 (-0.99%), 2002 (-1.72%), and 2003 (3.08%).

Manufacturing GDP grows in average 8.81% the second highest growth in the Indonesian economy during 30 years period. The highest growth occurred in the year of 1979, still in Oil Boom phase, as 23.92%, as well as in 1983 (22.19%). Some negative growth occurred in the year of 1997, early year of monetary crisis (-10.73%), and the year of 2000 (-3.55%).GDP of Electricity, Gas and Drinking Water sector growth in average at 10.67% the highest sectoral GDP growth in Indonesia economy. This sector has the smallest value of GDP among sectors in the Indonesia economy during the period of 30 years. The highest GDP growth of this sector was 31.99% occurred in 1978, in the period of Oil Boom. In 1999, this sector experienced negative economic growth, 11.70%.

GDP of Construction sector grows in average at 7% with the highest growth (18.87%) occurred in 1967. This sector experienced with negative GDP growth three time, namely in 1983 (-4.32%), 1997 (-34.67%) and 1998 (-0.95%). Monetary crisis had very significant impact on construction sector. In average, the sector of Trade, Hotel and Restaurant grows at 5.24%, the 6th rank in the growth of sectoral GDP. The highest growth occurred in the years of 1978 (12.60%), 1979(10.90%, 1980 (10.66%), 1987 (10.55%) and 1988 (11.64%). Negative growth of GDP occurred in the years of 1982 (-1.06%), 1997 (-9.70%) and 2000 (-1.86%).

Transportation and Communication sector grows in average at 8.32%, the third highest sectoral growth in the Indonesian economy during 1967 to

2007. The highest growth occurred in the years of 1976 (22.99%) and 1978 (17.08%). Negative growth occurred in the year of 1997 (-17.86%).The sector of Financial, Rental and Corporate Services grows in average at 7.7%, with the highest growth occurred in 1976 (26.91%). Negative GDP growth of this sector occurred in years of 1997 (-28.48%) and 1998 (-6.42%), the years when monetary crisis exist. The services sector grows in average at 4.14% which was the highest growth occurred in the year of 1987 (15.10%). Negative growth of this sector occurred in the year of 1982 (-0.05%), 1988 (-0.50%), 1992 (-1.97%), 1997 (-5.10%), and 1999 (-2.44%).

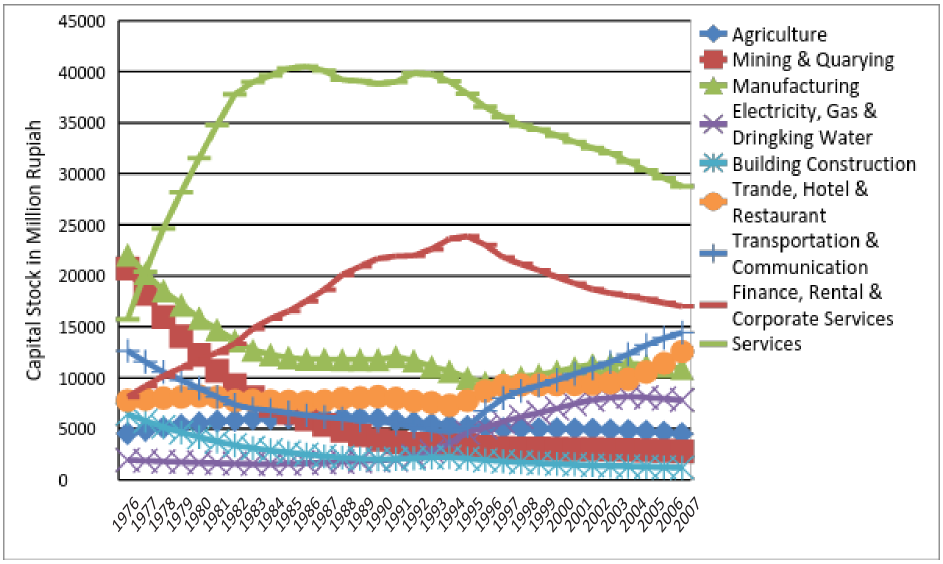

Figure 13.3

Capital Stock in the Indonesia Economy

Figure 13.3 presents sectoral capital stock in the Indonesian economy 1967-2007. In 1967, sectoral capital stock were dominated by Manufacturing (Rp. 22,070 Million), followed by Mining and Quarying (Rp. 20,730 Million), Services (Rp. 15,740 Million), Transportation and Communication (Rp. 12,640 Million), Financial, Rental and Corporate Services (Rp. 8,120 Million), Trade, Hotel and Restaurant (Rp.7,770 Million), Construction (Rp. 6,450 Million), Agriculture (Rp. 4,550 Million) and Electricity, Gas and Drinking Water (Rp. 1,940 Million). At the year of 2007, 30 years later, sectoral capital stock was dominated by Services (Rp. 28,770 Million) and followed by Financial, Rental and Corporate Services (Rp. 17,010 Million), Transportation and Communication

(Rp. 14,420 Million), Trade, Hotel and Restaurant (Rp. 12,750 Million), Manufacturing (Rp. 10,950 Million), Electricity, Gas and Drinking Water (Rp. 7,820 Million), Agriculture (Rp. 4.510 Million), Mining and Quarying (Rp. 2,770 Million), and Construction (Rp. 1,190 Million).

Agriculture capital stock grows in average at 0.00%, with the highest growth of 6.59% in the year of 1967. The growth of this sector continually declaine afterward and the growth expereienced negative after the year 1987. Only in the year 1997 and 1998 the growth back to positive growth. After the year of 1998, negative growth occured. Mining and Quarying capital stock experienced negative growth. In average, this sector grows in average at -6.16%. From 30 years period, only 2 years in which this sector had a positive growth in capital stock, namely year : 1992 (0.85%) and 2001(0.00%). Manufacturing capital stock also grows in average at -2.16%. The lowest growth (mean the highest negative growth) occured in the year 1976 (-8.25%). More than a half of the 30 years period experinced negative growth.

There are some more year, though, with positive growth such as : the year of 1988 (0.25%), 1990 (2.63%), 1996 (2.09%), 1997 (3.49%), 1998 (2.08%), 1999 (3.20%), 2000 (3.57%), 2001 (2.45%), and 2002 (0.89%). Capital stock of Electricity, Gas and Drinking Water sector growth in average at 4.93% the highest sectoral capital stock growth in Indonesian economy during 1967-2007. The highest capital stock growth of this sector was 29.69% occurred in 1994. Negative growth experienced by this sector were in 1976 to 1982 and during 2004 to 2007. Capital stock of Construction sector grows in average at negative growth (-5.23%). Almost the whole year experienced negative growth, expect in the year of 1990 (3.03%), 1991 (3.43%), 1992 (4.27%) and 1993 (1.82%). In average, capital stock ofHotel and Restaurant grows only at 1.63%). The highest growth occurred in the years of 1995 (12.10%). Negative growth of capital stock of this sector occurred in sveral years, namely: the years of 1980 (-1.46%) 1981(-4.20%), 1983 (-0.64%), 1984 (-0.52%), 1985 (-0.78%), 1990 (-2.09%), 1991 (-3.38%), 1992 (-1.82%) and 1993 (-3.43%).

Transportation and Communication sector grows in average at 0.78%. The highest growth occurred in the years of 1995 (29.17%). More than a half of the study period were negative in growth of capital stock, that was the period of year 1967 to 1994. After 1995, the growth of capital stock of this sector were positive. The sector of Financial, Rental and Corporate Services grows in average at 2.54%, with the highest growth occurred in 1976 (13.18%). Positive growth occured during 1967 to 1994. Meanwhilenegative capital stock growth of this sector occurred during the year 1995 to 2007.

The services sector grows in average at 2.20% which was the highest growth occurred in the year of 1967 (29.48%). Positive growth of this sector occurred during the year 1967 to 1985 and during 1990 to 1991. Negative growth occurred during 1986 to 1989 and during the year of 1992 to 2007.

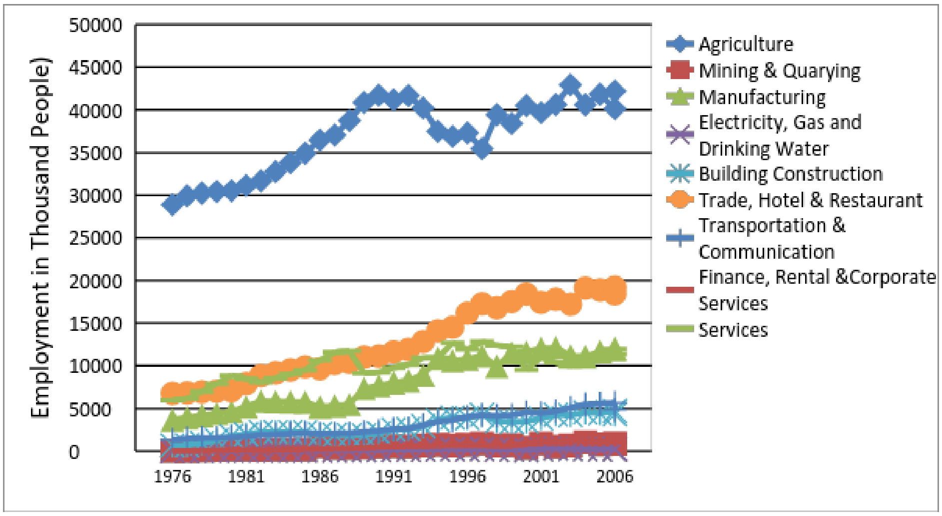

Figure 13.4

Employment in the Indonesia Economy (1967-2007)

From Figure 13.4, it is clearly shown that Agriculture has dominated the Indonesia economy in term of employment. It was then followed by Trade, Hotel and Restaurant. In 1967, employment in Agriculture sector was 28,879 thousand people. Employment in Trade, Hotel and Restaurant was 6,773 thousand people. In 2007, people work in Agriculture sector was 42,200 thousand, and in Trade, Hotel and Restaurant was 18,441 thousand.

In term of growth in employment, the highest growth was Mining and Quarying (average at 21.08%), followed by Financial, Rental and Corporate Service (average at 18.81%), Electricity, Gas and Drinking Water (average at 11.57%), Construction (average at 7.01%), Transportation and Communication (4.50%), Manufacturing (4.24%), Trade, Hotel and Restaurant (3.39%), Services (2.69%) and Agriculture (1.30%). All sectors experienced with positive and negative growth.

Tabel 13.1 shows the coefficients of technical efficiency (γ) return to scale (α + β), output-capital elasticity (α), and output-labor elasticity (β) in the Indonesian economy during 1967 to 2007 both at national level and sectoral level. Technical efficiency in Indonesian economy during the year 1967 to 2007 was 2.775174. At sectoral perspective the coefficients of technical efficiency vary among sectors. From 9 economic sectors, 4 sectors had coefficient of technical efficiency which were above of that at national level, and other 5 sectors were below that at the national level. The sectors which the coefficients of technical efficiency above of that at national level were: Electricity, Gas and Drinking Water (12.040516), Mining and quarrying (5.298335), Construction (4.910134), and Manufacturing (4.313086). The sectors which the coefficient of technical efficiency below of that at national level were : Financial, Rental and Corporate Services (-1.470291), Agriculture (-0.687019), Services (1.925433), Trade, Hotel and Restaurant (2.487391) and Transportation and Communication (2.717723). It means that the technical efficiency of 4 sectors earlier were better than that at the national level. Meanwhile the technical efficiency of 5 other sector was worse than that at the national level. These 5 sectors should have get more attention by policy makers, especially those that the values of the coefficient were negative.

At national level, Indonesian economy experienced decreasing return to scale as the coefficient of return to scale which is the summation of coefficient of output-capital elasticity (α) with coefficient of output-labor elasticity (β) less than unity (0.781624). The coefficients of return to scale vary among sectors, where 5 sectors were increasing return to scale and 4 sectors were decreasing return to scale. Five increasing return to scale sectors were: Financial, Rental and Corporate Services (2.133502), Services (1.316292), Agriculture (1.196886), Transportation and Communication (1.186697), and Trade, Hotel and Restaurant (1.031584). These 5 sectors experiencing increasing return to scale were the sectors in which their coefficients of technical efficiency were below of that at the national level. Four decreasing return to scale sectors were: Manufacturing (0.671741), Mining and quarrying (-0.226299), Electricity, Gas, and Drinking Water (-0.337864), and Construction (-1.136262). Again, those sectors that had the coefficient of technical efficiency above that at national level experiencing decreasing return to scale.

Tabel 13.1

Coefisiens of Technical Efficiency, Return to Scale, and Ouput Elasticities

Sectoral Analysis	γ	α	β	RTS
National Average	2.775174	0.797882	-0.016258	0.781624
Agriculture	-0.687019	-0.790724	1.987609	1.196886
Mining and quarrying	5.298335	-0.219114	-0.007185	-0.226299
Manufacturing	4.313086	-0.865074	1.536815	0.671741
Electricity,Gas, Drinking Water	12.040516	2.353230	-2.691094	-0.337864
Construction	4.910134	-1.159027	0.022766	-1.136262
Trade, Hotel & Restaurant	2.487391	-0.214749	1.246332	1.031584
Transportation & Communication	2.717723	-0.157543	1.344240	1.186697
Financial, Rental & Coorp Services	-1.470291	2.236066	-0.102564	2.133502
Services	1.925433	-0.214449	1.530741	1.316292

The coefficients of output-capital elasticity (α) in the Indonesian economy was 0.797882. Sectoral coeffient of output-capital elasticity vary among sectors. Only two sectors in which coefficient of output-capital elasticity above that of the national average, namely: Electricity, Gas and Drinking Water (2.353230) and Financial, Rental and Corporate Services (2.236066). Seven sectors with the coefficients of output-capital elasticity below that at the national level, namely : Agriculture (-0.790724), Mining and Quarying (-0.219114), Manufacturing (-0.865074), Construction (-1.159027), Trade, Hotel and Restaurant (-0.214749), Transportation and Communication (-0.157543) and Services (-0.214449).

The coefficients of output-labor elasticity (β) in the Indonesian economy was -0.016258. Sectoral coeffient of output-labor elasticity vary among sectors. There were five sectors in which coefficient of output-labor elasticity above that of the national average, namely : Agriculture (1.987609), Manufacturing (1.536815), Trade, Hotel and Restaurant (1.246332), Transportation and Communication (1.334240) and Services (1.530741). Four sectors with the coefficients of output-capital elasticity below that at the national level, namely : Mining and Quarying (-0.007185), Electricity, Gas and Drinking Water (-2.691094), Construction (0.022766), and Financial, rental and Corporate Service (-0.102564).

Technical Efficiency/ Return to Scale	Increasing Return to Scale	Decreasing Return to Scale
Above National Average		Mining and quarrying Manufacturing Electricity, Gas and Drinking Water Construction
Below National Average	Financial, Rental and Corporate Services Services Agriculture Transportation and Communication Trade, Hotel and Restaurant	

Figure 13.5

The Quadrant of Technical Efficiency and Return to Scale

Figure 13.5 presents the Quadrant of Technical Efficiency (Above Versus Below National Average) and Return to Scale (Increasing Versus Decreasing Return to Scale). Four sectors in which the coefficients of technical efficiency were above that at national level also exhibiting decreasing return to scale. Those sectors were: Mining and Quarrying, Manufacturing, Electricity, Gas and Drinking Water and Construction. Other five sectors in which the coefficients of technical efficiency were below that at national level exhibiting increasing return to scale. Those sectors were: Financial, Rental and Corporate Services, Services, Agriculture, Transportation and Communication, and Trade, Hotel and Restaurant.

4. Conclusion

Sectorally, there were 4 sectors that had coefficient of technical efficiency above of that at national level, namely: Electricity, Gas and Drinking Water, Mining and quarrying, Construction, and Manufacturing. These were the sectors that experienced decreasing return to scale. Other five sectors that had the coefficient of technical efficiency below of that at the national level, namely: Financial, Rental and Corporate Services, Agriculture, Services, Trade, Hotel and Restaurant and Transportation and Communication. These were the sectors that had experienced increasing return to scale. There was an inverse relationship between technical efficiency and return to scale.

References

Adams, J., (2006), **The Contribution of Science and Technology to Production**, the National Bureau of Economic Research, Cambridge Massachusetts.

Anonymous, (1998; 2004; 2010), **National Product Domestic Bruto**, National Statistics Agency, Jakarta.

Bao Hong, Tan, (2008), **Cobb-Douglas Production Function**, retrieve on 22 June 2016 from http://docentes.fe.unl.pt/jamador/Macro/cobb-douglas.pdf.

Biresh K. Sahoo, Joe Zhu, Kaoru Tone, Bernhard M. Klemen, (2014), "Decomposing technical efficiency and scale elasticity in two-stage network DEA", **European Journal of Operational Research, 233(**3): 584–594.

Boundless, (2016), "Impacts of Technological Change on Productivity", **Boundless economics**, Retrieved 22 June 2016 from

https://www.boundless.com/economics/texbook/boundless-economics-texbook/economic-growth-20/productivity-98/impacts-of-technological-change-on-productivity-370-12467/

Cobb C.W, and Douglas, P.H., (1928), "A Theory of Production", **American Economic Review** 18 (Supplement): 139-165.

Comin, D., (2006), **Total Factor Productivity**, New York University, New York.

Debasish, (2016), "Role of Technology in Economic Development" **Economicsdiscussion.net**, retrieve 22 June 2016 from

http://www.economicsdiscussion.net/articles/role-of-technoloy-in-economic-development/4455.

Erkoc, T. E, (2012), "Estimation Methodology of Economic Efficiency: Stochastic Frontier Analysis versus Data Envelopment Analysis", **International Journal of Academic Research in Economics and Management Sciences**, 1(1): 1-23, January 2012.

Feng, G and Serletis, A., (2010), "Efficiency, Technical Change, and Returns to Scale in Large US Banks: Panel Data Evidence from an Output Distance Function Satisfying Theoretical Regularity", **Journal of Banking & Finance,** 34(1):127-138, January 2010.

Gaspersz. V. (1996), **Ekonomi Manajerial, Penerapan Konsep-Konsep Ekonomi Dalam Manajemen Bisnis Total (Managerial Economics: Application**

of Economics Concepts in Total Business Management), PT Gramedia Pustaka Utama, Jakarta, pp; 222-233.

Gebreselasie, T.G., (2008), "Sectoral Elasticity of Substitution and Returns to Scale in South Africa", **South African Journal of Economics, Special Issue: Industrial growth and employment in South Africa, 76(Supplement S2:** S110–S125.

Holyk, S., (2016), "Measuring Technical Efficiency and Economy on Scale in Finnish Food Processing Industry", **International Journal of Science: Basic and Applied Research**, 27(3): 226-238.

Krivonozhko, V. E., Dvorkovich, A. V., Utkin, O. B., Zharkov I. D, Patrin, M. V., and Lyche A. V., (2007), "Computation of elasticity and scale effect in technical efficiency analysis of complex systems", **Computational Mathematics and Modeling**, 18(4): 432-452.

Page, J. M. Jr., (1980), "Technical Efficiency and Economic Performance: Some Evidence from Ghana", **Oxford Economic Papers, New Series**, 32 (2): 319-339.

Pettinger, T., (2012), "Technical Efficiency Definition", **Get Economic Help** in www.economichelp.org/blog/glossary/technical-efficiency.

Salvatore, D., (1996), **Managerial Economics in a Global Economy**, Irwin McGraw Hill, Boston, pp: 251.

Wikipedia, Post Suharto Era, retrieve on 22 June 2016 from https:en.wikipedia.org/wiki/Post-Suharto_era.

Yudistira, D., (2004), "Efficiency in Islamic Banking: An Empirical Analysis of Eighteen Banks", **Islamic Economic Studies,** 12(1): 1-19.

Chapter-14

Spatial Variations in Technical Efficiency and Return to Scale in the Indonesian Economy[1]

Ringkasan

Bab ini melaporkan suatu analisis tentang efisiensi teknis dan skala hasil dalam perekonomian Indonesia, selama 1983-2013 dengan perhatian khusus pada dimensi spasial perekonomian. Kajian difokuskan pada tujuh kelompok besar pulau-pulau: Sumatera (10 Provinsi), Jawa (6 Provinsi), Kalimantan (4 Provinsi), Sulawesi (6 Provinsi), Bali-Nusa Tenggara (3 Provinsi), dan Maluku (2 Provinsi), serta Papua (2 Provinsi). Fungsi produksi Cobb-Douglass digunakan untuk analisis efisiensi teknis dan skala hasil melalui analisis regresi. Data deret waktu selama 1983-2013 tentang Produk Domestik Bruto, Cadangan Modal dan Tenaga Kerja pada tingkat Provinsi dikumpulkan dari berbagai sumber pada Badan Pusat Statistik. Hasil analisis menunjukkan bahwa efisiensi teknis dalam produksi beragam antar wilayah; antar pulau; antar Provinsi. Provinsi-provinsi dengan koefisien efisiensi teknis di bawah rata-rata nasional memiliki skala hasil yang meningkat. Sebaliknya, Provinsi-provinsi dengan koefisien efisiensi teknis di atas rata-rata nasional memiliki skala hasil yang menurun.

Summary

This chapter reports an analysis of technical efficiency and returns to scale in the Indonesia economy during 1983-2013 with special attention to the spatial dimension of the economy. The study focused on seven group of islands: Sumatera (10 Provinces), Java (6 Provinces), Kalimantan (4 Provinces), Sulawesi (6 Provinces), Bali-Nusa Tenggara (3 Provinces), and Maluku (2 Provinces) and Papua (2 Provinces). Cobb Douglass production function was employed to calculate technical efficiency and return to scale using regression analysis.

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[1] This chapter has been published in **International Journal of Recent Scientific Research**, ISSN: 0976-3031, Vol. 7, Issue, 10, pp. 13625-13629, October, 2016. Available Online at http://www.recentscientific.com/spatial-variations-technical-efficiency-and-return-scale-indonesian-economy; http://repository.uhamka.ac.id/129/; https://www.researchgate.net/publication/311587438; https://www.academia.edu/30641571/

Time series data during 1983-2013 on Gross Regional Domestic Bruto, Capital Stock, and Employment were collected from many sources at the National Statistics Agency. The results show that technical efficiency in production varies among regions. Provinces with coefficients of technical efficiency below that at national level exhibited increasing return to scale. Otherwise, the Provinces with coefficients of technical efficiency above that at national level exhibited decreasing return to scale.

1. Introduction

Economists have long recognized that technology is a factor of production, and even the most important factor, given its role in labor quality and the design of capital good. Technological advances play a crucial role in improving productivity and thus the standard of living of a system; economic system (Adam, 2006).

Most economists today agree with the hypothesis that both innovation and technological spill-overs are the main engine for explaining productivity growth. According to the theory of location, it is reasonable to view that economic growth unevenly happened in a national economy. Regional disparities do exist in Indonesia economy. There are some regions that grow very fast and there are others that grow very slowly. In Indonesia, some provinces grow very fast such as provinces in Java Island and those in Sumatera Island. Some others grow very slowly, such as in West Nusa Tenggara and in East Nusa Tenggara.

Measuring the effect of technology on productivity is a difficult pursuit. It is generally approached through metrics such as Gross Domestic Product, GDP per capita and Total Factor Productivity (TFP). The former two attempts to capture the overall output of a given economy from a macro-environmental perspective. The latter is attempting to measure technologically driven advancement through noting increase in overall output without increasing in input. This is done through utilizing production function equations and identifying when the output is greater than the supposed input, implying an advance in external technological environment (Boundless, 2016). The technology can be regarded as a primary resource in economic development. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. It was observed that innovation or technological progress is the only determinant of economic progress. But if the level of technology is constant the process of growth will stop. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Debasish, 2016).

In economics, the Cobb-Douglas production function is widely used to represent the relationship of an output to input (Bao Hong, 2008). It was proposed by Knut Wicksell (1851-1926) and tested againstt statistical evident by Cobb, C and Douglas, P (1928). From Cobb-Douglas production function, technical efficiency also known as total factor productivity, retun to scale, and output-capital elasticity as well as output-labor elasticity can easily be calculated by employing regression analysis (Salvatore, 1996).

Previous research on technical efficiency, return to scale and output elasticities has been conducted, among others by Biresh K. Sahoo, at al., (2014), Krivonozhko, V. E, at al., (2007), Tewodros G. Gebreselasie (2008), Feng, G and Serletis, A (2010), Nondo, C (2014), Holyk, S., (2016), Jatto. N. A., (2013), Page, John M. Jr., (1980), Erkoc, T. E., (2012), Kui-Wai Li, at al., (2007), and Yudistira, D., (2004). Measuring Indonesia's sectoral efficiencies has been conducted by Rizaldi Akbar (2015). As far, no study on Indonesian's regional technical efficiency has been done.

The objective of this chapter is to report an analysis of technical efficiency and returns to scale in the Indonesia economy during 1983-2013 with special attention to the spatial dimension of the economy.\

2. Methods

Cobb-Douglas production function, $Q = \gamma K^{\alpha} L^{\beta}$, was employed in this exercise to calculate technical efficiency (γ), return to scale ($\alpha+\beta$), output-capital elasticity (α), and output-labor elasticity (β). This production function was developed and statistically tester by Cobb &Douglas during 1927-1947, where :

Q = total production (the real value of all goods and services produced in a year;

K = capital input (the real value of all machinery, equipment, and building;

L = labor input (the total number of person-hours worked in a year;

γ = technical efficiency in production process, known as total factor productivity;

α = output-capital elasticity;

β = output-labor elasticity.

Technical efficiency (γ), or total factor productivity (TFP) is the portion of output not explained by the amount of input used in production (Comin, 2006). This is a method of measuring overall productivity of business, industries or economies. Technical efficiency is the effectiveness with which a given set inputs is used to produce an output. An economy is said to be technically efficient if an economy is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. Technical efficiency is related to productive efficiency which is a concern with producing at the lowest point on the short run average cost curve. Thus productive efficiency required technical efficiency (Pettinger, 2012).

The values of α and β are basically determined by available technology. Output elasticity measure the responsiveness of output to a change in levels either capital or labor used in production. Furthermore, if $\alpha + \beta = 1$, the production function has a constant return to scale, meaning that doubling the usage of capital (K) and labor (L) will also double output (Q). If $\alpha + \beta < 1$, return to scale are decreasing and if $\alpha + \beta > 1$, return to scale are increasing.

The output elasticity of capital, $E_K = \delta Q/\delta K.K/Q = \alpha Q/K.K/Q = \alpha$. Similarly, the output elasticity of labor, $E_L = \delta Q/\delta L.L/Q = \beta Q/L.L/Q = \beta$ and $E_K + E_L = \alpha + \beta$ = return to scale (Salvatore, D., 1996). Converting the production function from $Q = \gamma K^\alpha L^\beta$ in to a logarithms form that is, $\ln Q = \ln \gamma + \alpha \ln K + \beta \ln L$. As this is a linear form, then the coefficients (γ, α and β) can easily be estimated by regression analysis (Gaspersz, V., 1996). The Cobb-Douglas production function can be estimated either from data for a single firm, industry, region or nation over time using time-series analysis or for a single firm, industry, region or national one point in time using cross-sectional data (Salvatore, 1996).

Data needed for this exercise were sectoral data on Gross Domestic Regional Product, Regional Capital Stock, and Regional Employment. Yearly data on GDRP, Regional Capital Stock, and Regional Employment were collected from the Central Bureau of Statistics. Fortunately, data were available from the year of 1983-2013.

3. Results and Discussion

Figure 14.1 presents Gross Domestic Regional Bruto (GDRB) by Island in million Rupiah during 1983 to 2013, thirty year period. Java and Sumatera Islands dominated Indonesian economy, followed by the Island of Kalimantan, Sulawesi, Bali-Nusa Tenggara Barat, and Maluku-Papua. There were no spatial changes in economic structure in term of GDRB among islands during that period. Even, disparities between Java and the rest of Indonesia became worse and worse. For instance, in 1983, the shares of Java Island to Indonesian GDP were 58.19 per cent and in 2013 have increased to 61.24 per cent. Meanwhile the shares of Sumatera Island have decrease from 25.10 per cent in 1983 to 21.15 per cent. Kalimantan Island also experienced decreasing share from 9.63 per cent in 1983 to 8.13 per cent in 2013. The share of Sulawesi Island, Bali-Nusa Tenggara Island and Maluku-Papua Islands experienced in increasing share.

In term of growth of GDRB, Sulawesi Island had the highest growth during that period, in average of 6.97 per cent, followed by Maluku-Papua Island (6.02%), Bali-Nusa Tenggara Island, (5.95%), Java Island (5.66%), Kalimantan Island (4.81%) and Sumatera Island (4.79%).

In term of growth of capital stock, Maluku-Papua Island had the highest growth during that period, in average of 8.33 per cent, followed by Bali-Nusa Tenggara Island (7.76%), Sulawesi Island, (7.51%), Sumatera Island (6.93%), Kalimantan Island (6.79%) and Java Island (6.63%).

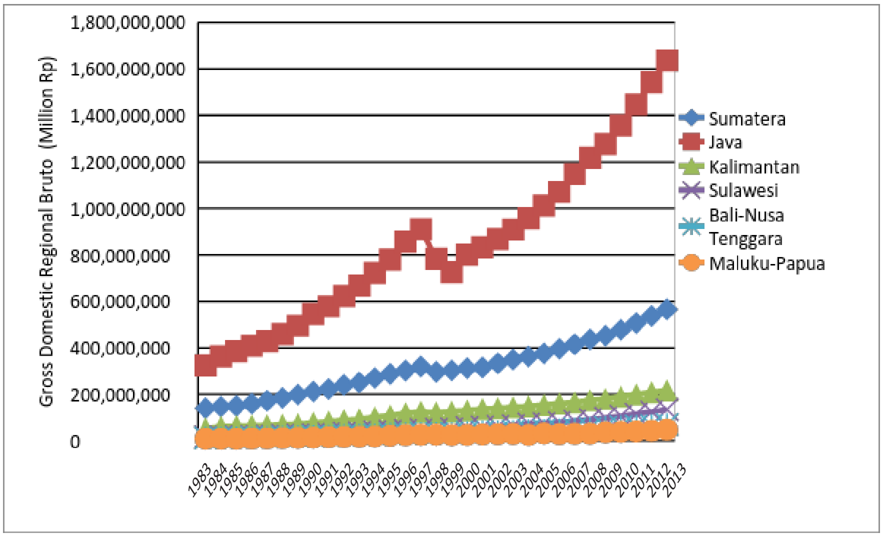

Figure 14.1
Gross Domestic Regional Bruto by Island (1983-2013)

Figure 14.2 presents the trend of capital stock in Indonesian economy during 1983 to 2013. Again, Java and Sumatera Island dominated capital stock of Indonesia, followed by Kalimantan Island, Sulawesi Island, Bali-Nusa Tenggara Island, and Maluku-Papua Island. There were no signinificant spatial change in economic structure in term of capital stock among islands during that period. Even, the share of Java Island decreasing from 68.9 per cent in 1983 to 65.98 per cent in 2013. The share of Java Island in term of capital stock still three times more than of that at Sumatera Island (19.21% in 1983 to 20.20% in 2013). Meanwhile, the Kalimantan Island and the rest of Indonesia experienced no significant increase in the share of capital stock. The share of capital stock of Kalimantan island increase from 6.23 per cent in 1983 to 6.26 per cent in 2013. The share of Sulawesi Island, Bali-Nusa Tenggara Island and Maluku-Papua Islands have increased from 2.34 per cent to 2.88 per cent, 1.99 per cent to 2.64 per cent, and 1.32 per cent to 2.05 per cent consecutively from 1983 to 2013.

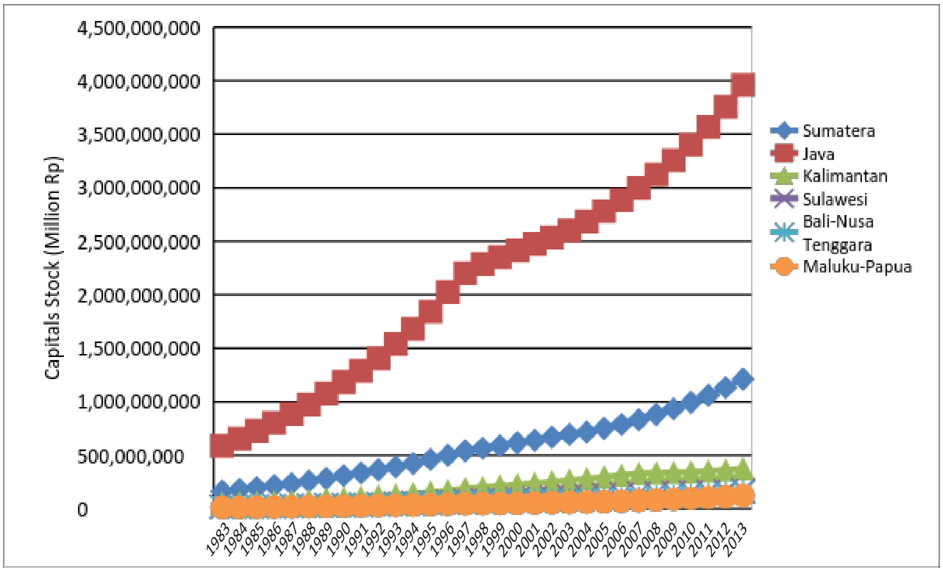

Figure 14.2
Capital Stock by Island (1983-2013)

Figure 14.3 presents the employment trends by Island during 1983 to 2013. Java and Sumatera Islands have dominated the Indonesian economy in term of employment, followed by Kalimantan and sometimes Sulawesi, Bali-Nusa Tenggara and Maluku-Papua. During the period, there were no significant spatial change in employment. As Java Island dominated the economy indicated by 62.41 per cent share of Java Island in Indonesian employment in 1983 and decrease to 57.3 per cent in 2013. The share of Sumatera Island was 19.10 per cent in 1983 and 21.49 per cent in 2013. Followed by the share of Sulawesi Island of 6.16 per cent in 1983 to 6.83 per cent in 2013, Kalimantan Island of 4.33 per cent in 1983 to 6.10 per cent in 2013. The Island of Bali-Nusa Tenggara experienced decreasing share from 6.58 per cent in 1983 to 5.65 per cent in 2013. Meanwhile, the share of employment of Maluku-Papua Island have increased slightly from 1.42 per cent in 1983 to 2.63% in 2013.

In term of growth of employment, Maluku-Papua Island had the highest growth during that period, in an average of 4.40 per cent followed by Kalimantan Island (3.41%), Sumatera Island, (2.63%), Sulawesi Island (2.58%), Java Island (1.93%) and Bali-Nusa Tenggara Island (1.71%).]

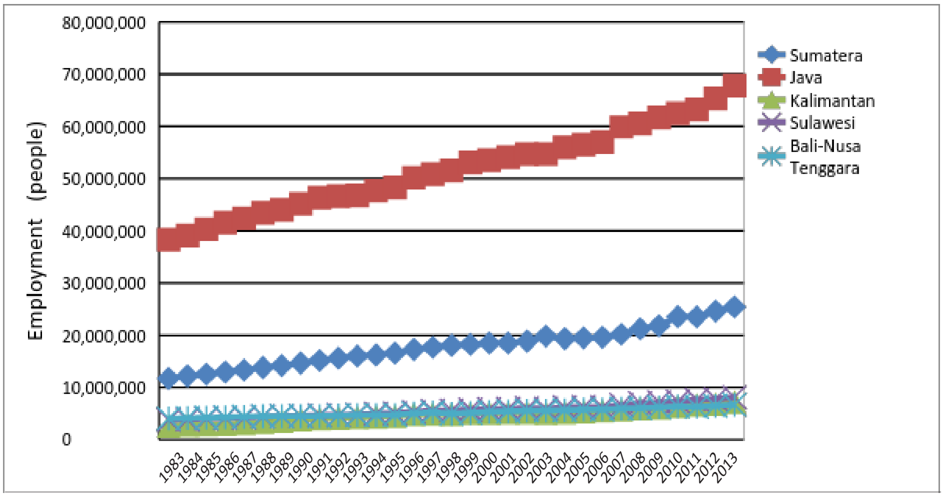

Figure 14.3
Employment by Island (1983-2013)

The coefficient of technical efficiency in Indonesian production function from 1983 to 2013 was negative (-4.0073), with α = 0.2715 and β = 1.2413 resulting the coefficient of return to scale (α + β) =1.5128. It means that the production function of the Indonesian economy from 1983 to 2013 exhibiting increasing return to scale. Three group of islands in wich the coefficients of technical efficiency above that at the national level were Kalimantan, Maluku and Papua. These Islands have exhibited decreasing return to scale as the sum of the coefficients of output-capital elasticity (α) and the coefficients of output-labor elasticity (α) were more than unity; Kalimantan Island (α + β) = 0.6997, Maluku Island (α+ β) =0.5692, and Papua Island (α + β) = 0.6175. Another four groups of islands in which the coefficients of technical efficiency below that at the national level were Sumatera, Java, Sulawesi and Bali-Nusa Tenggara. These group of islands in turn exhibiting increasing return to scale as the summation of the coefficients of output-capital elasticity (α) and the coefficients of output-labor elasticity (α) were less than unity; Sumatera Island with (α + β) =1.1819, Java Island (α + β) = 2.0449, Sulawesi (α + β) = 2,1467 and Bali-Nusa Tenggara Island (α + β) = 1.2373.

Tabel 14.1 presents the kuadrant of technical efficiency's coefficient (above and below that at the national level) and return to scale (increasing and decreasing return to scale). The group of islands with the coefficients of technical efficiency that was higher than that at the national level also exhibited decreasing return to scale. These group of islands were Kalimantan, Maluku and Papua. The others with the coefficient of technical efficiency less than that at the national level and exhibited increasing return to scale were Sumatera, Java, Sulawesi and Bali-Nusa Tenggara.

In Sumatera Islands, there were six provinces in which the coefficients of technical efficiency were higher than that at the national level. The provinces were Nangroe Aceh Darussalam, North Sumatera, Riau, The Islands of Riau, South Sumatera and Bangka-Belitung. But these provinces exhibited decreasing return to scale as the sum of the coefficient of output-capital elasticity (α) and the coefficient of output-labor elasticity (β) were less than unity. Nangroe Aceh Darussalam with (α + β) = 0.7756, North Sumatera with (α + β) = 0.9185, Riau with (α + β) = 0.5948, The Islands of Riau with (α + β) = 0.7553, South Sumatera with (α + β) = 0.3435 and Bangka-Belitung with (α + β) = 0.6142. Another four provinces in the Island of Sumatera, that were West Sumatera, Jambi, Bengkulu and Lampung in which the coefficients of technical efficiency were less than that at the national level. These provinces exhibited increasing return to scale as the sum of the coefficient of output-capital elasticity (α) and the coefficient of output-labor elasticity (β) were more than unity. The sum of (α + β) at West Sumatera was 1.5466, at Jambi was 1.6472, at Bengkulu was 1.8314 and at Lampung was 1.8369.

Tabel 14.1

Technical Efficiency and Return to Scale : Seven Big Islands

Technical efficiency/ RTS	Incerasing Return to Scale	Decreasing Return to Scale
Above national		Kalimantan Island Maluku Islands Papua Island
Below national	Sumatera Island Java Island Sulawesi Island Bali-Nusa Tenggara Islands	

In the Island of Java, five out of six provinces in which the coefficients of technical efficiency below that at the national level, namely: Special Region of Jakarta the Capital City, Banten, West Java, Central Java and East Java. Only the Province of Yogyakarta that had the coefficient of technical efficiency higher than that at the national level. The earlier five provinces exhibited increasing return to scale, meanwhile the latter exhibited decreasing return to scale. The sum of (α + β) for Jakarta was 1.3789, for Banten was 1.0197, for West Java 1.7006, Central Java was 1.0680, and East Java was 2.6049. Meanwhile the sum of (α + β) for Yogyakarta was 0.6930.

In Kalimantan Island, there were two provinces in which the coefficients of technical efficiency above that at the national level, namely South Kalimantan and East Kalimantan. These two provinces exhibit decreasing return to scale as the summation of (α + β) less than unity. The return to scale coefficient of the Province of South Kalimantan was 0.8837 and the Province of East Kalimantan was 0.8469. The other two provinces, namely West Kalimantan and Central Kalimantan had the coefficients of technical efficiency that less than that at the national level. These two provinces also exhibited increasing return to scale as the summation of (α + β) greater than unity. The summation of (α + β) for West Kalimantan was 1.6099 and for Central Kalimantan was 1.2459.

In the Island of Sulawesi, five out of six provinces had the coefficients of technical efficiency that less than that at the national level. These provinces were North Sulawesi, Central Sulawesi, South-East Sulawesi, West Sulawesi and South Sulawesi. Only the province of Gorontalo with the coefficient of technical efficiency greater than that at the national level. The first 5 provinces exhibited increasing return to scale, meanwhile, the latter exhibited decreasing return to scale. The summation of (α + β) for North Sulawesi was 1.8151, for Central

Sulawesi was 1.6135, for South-East Sulawesi was 2.5249, for West Sulawesi was 1.1959 and for South Sulawesi was 2.5249. Meanwhile, the summation of ($\alpha + \beta$) for the Province of Gorontalo was 0.8154.

In the Island of Bali and Nusa Tenggara, all provinces in Nusa Tenggara, namely Nusa Tenggara Barat and Nusa Tenggara Timur had the coefficient of technical efficiency in which less than that at the national level. The Province of Bali (Bali Island) had the coefficient of technical efficiency greater than that at the national level. The first two provinces, Nusa Tengara Barat and Nusa Tenggara Timur exhibited increasing return to scale as the summation of ($\alpha + \beta$) for Nusa Tenggara Barat was 1.1946 and for Nusa Tenggara Timur was 1.4549. Meanwhile, the Province of Bali Island exhibited decreasing return to scale as the summation of ($\alpha + \beta$) for that province was 0.7954.

There are two provinces in Maluku Island, Maluku and North Maluku had the coefficient of technical efficiency above that at the national level. These two provinces also exhibited decreasing return to scale as the summation ($\alpha + \beta$) less than unity; for Maluku the summation of ($\alpha + \beta$) was 0.5146 and for North Maluku was 0.5804.

In the island of Papua, there were two provinces, namely the Province of Papua and the the West Papua Province. The Province of Papua had the coefficient of technical efficiency above that at the national level and exhibiting decreasing retun to scale with the summation of ($\alpha + \beta$) was 0.1681. Meanwhile the West Papua Province had the coefficient of technical efficiency below that at the national level, and exhibiting increasing return to scale as the summation of ($\alpha + \beta$) greater than unity, for West Papua Province was 1.8827.

As shown in Table 2, provinces in which the coefficient of technical efficiency above that at the national level and exhibiting decreasing return to scale were : Nangro Aceh Darussalam, North Sumatera, Riau, The Island of Riau, South Sumatera, Bangka-Belitung, Yogyakarta, South Kalimantan, East Kalimantan, Gorontalo, Bali, Maluku, North Maluku and Papua. Other provinces in which the coefficients of technical efficiency below that at the national level and exhibiting increasing return to scale were: West Sumatera, Jambi, Bengkulu, Lampung, Jakarta Capital City, Banten, West Java, Central Java, East Java, West Kalimantan, Central Kalimantan, North Sulawesi, Central Sulawesi, South-East Sulawesi, West Sulawesi, South Sulawesi, West Nusa Tenggara, East Nusa Tenggara, and West Papua.

There are two limitations of the study. Firstly, the time covered in this study was limited to thirty years period; 1983-2013, meanwhile, the Indonesian economy have lasted for seventy years. Secondly, the scope of the study was aggregated in a macro environment. The study of technical efficiency and return to scale usually conducted in a firm or industry as technical production was more homogeneus at the firm level. In the national economy, there might be a risk in aggregating technology.

Tabel 14.2

Technical Efficiency and Return to Scale : Provincial Levels

Technical efficiency/ RTS	**Incerasing Return to Scale**	**Decreasing Return to Scale**
Above national		Nangro Aceh Darussalam North Sumatera Riau The Island of Riau South Sumatera Bangka-Belitung Yogyakarta South Kalimantan East Kalimantan Gorontalo Bali Maluku North Maluku Papua
Below national	West Sumatera Jambi Bengkulu Lampung Jakarta Capital City Banten West Java Central Java East Java West Kalimantan Central Kalimantan North Sulawesi Central Sulawesi South-East Sulawesi West Sulawesi South Sulawesi West Nusa Tenggara East Nusa Tenggara West Papua	

4. Conclusion

Spatial variations in technical efficiency do exist in the Indonesian economy. The group of islands in which the coefficient of technical efficiency above that at the national level, exhibited decreasing return to scale. On the contrary, the group of island in which the coefficients of technical efficiency below that at the national level, exhibited increasing return to scale. At the provincial level, the provinces in which the coefficients of technical efficiency above that at the national level, exhibited decreasing return to scale. The provinces in which the coefficients of technical efficiency below that at the national level, exhibited increasing return to scale.

It could be suggested that the provinces with the coefficients of technical efficiency higher than that at the the national level to not increase the inputs of production as the economy experiencing decreasing return to scale. Meanwhile, the provinces that had the coefficients of technical efficiency lower than that at the national level to increase all inputs in production in order to increase output as the economy experiencing increasing return to scale.

References

Adams, J., (2006), "The Contribution of Science and Technology to Production", the **National Bureau of Economic Research**, Cambridge Massachusset.

Bao Hong, Tan, (2008), "Cobb-Douglas Production Function" retrieve on 22 June 2016 from http://docentes.fe.unl.pt/jamador/Macro/cobb-douglas.pdf

Biresh K. Sahoo, Joe Zhu , Kaoru Tone, Bernhard M. Klemen, (2014), "Decomposing technical efficiency and scale elasticity in two-stage network DEA", **European Journal of Operational Research,** 233(3): 584–594.

Boundless, (2016), "Impacts of Technological Change on Productivity ", **Boundless economics,** Retrieved 22 June 2016 from

https://www.boundless.com/economics/texbook/boundless-economics-texbook/economic-growth-20/productivity-98/impacts-of-technological-change-on-productivity-370-12467/

Cobb C.W., and Douglas, P.H., (1928), "A Theory of Production". **American Economic Review:** 18 (Supplement)**:** 139-165.

Comin, D., (2006), **Total Factor Productivity**, New York University, New York.

Debasish, (2016), "Role of Technology in Economic Development", Economicsdiscussion.net, retrieve on 22 June 2016 from

http://www.economicsdiscussion.net/articles/role-of-technoloy-in-economic-development/4455.

Erkoc, T. E., (2012), "Estimation Methodology of Economic Efficiency: Stochastic Frontier Analysis versus Data Envelopment Analysis", **International Journal of Academic Research in Economics and Management Sciences,** 1 (1): 1-23.

Feng, G. and Serletis, A., (2010), "Efficiency, Technical Change, and Returns to Scale in Large US Banks: Panel Data Evidence from an Output Distance Function Satisfying Theoretical Regularity", **Journal of Banking & Finance,** 34(1): 127-138.

Gaspersz, V., (1996), **Ekonomi Manajerial, Penerapan Konsep-Konsep Ekonomi Dalam Manajemen Bisnis Total (Managerial Economics: Application of Economic Concepts in Total Business Management)**, PT Gramedia Pustaka Utama, Jakarta.

Gebreselasie, T.G., (2008), "Sectoral Elasticity of Substitution and Returns to Scale in South Africa", **South African Journal of Economics, Special Issue: Industrial growth and employment in South Africa**, 76(Issue Supplement s2): S110–S125.

Holyk, S., (2016), "Measuring Technical Efficiency and Economy on Scale in Finnish Food Processing Industry", **International Journal of Science: Basic and Applied Research**, 27 (3): 226-238.

Jatto, N.A., (2013), "Assessing the Return to Scale: Evidence from Fish Farmers in Ilorin, Kwara State", **Russian Journal of Agricultural and Socio-Economic Sciences**, 1(13), 56-59.

Krivonozhko, V. E. , Dvorkovich, A. V. , Utkin, O. B. , Zharkov I. D, Patrin, M. V. and Lyche A. V., (2007), "Computation of elasticity and scale effect in technical efficiency analysis of complex systems", **Computational Mathematics and Modeling,** 18 (4): 432-452.

Kui-Wai Li, Tung Liu, and Lihong Yun., (2007), "Technology Progress, Efficiency, and Scale of Economy in Post-reform China", **Working Paper**, Department of Economics and Finance, City University of Hong Kong, Hong Kong.

Nondo, C., (2014), "Evaluating the technical efficiency of African economies using DEA and the bootstrap approach", **African Journal of Economic**

and Sustainable Development, 3 (2): 156-178.

Ondrej, M., (2012), “Data Issued in Total Factor Productivity Benchmarking: A Central European Perspective”, **Faculty of Business Administration Working Paper**, University Economics in Praque, pp: 219-225.

Page, J. M. Jr., (1980), “Technical Efficiency and Economic Performance: Some Evidence from Ghana”, **Oxford Economic Papers, New Series**, 32(2): 319-339.

Pettinger, T., (2012), “Technical Efficiency Definition”, **Get Economic Help** in www.economichelp.org/blog/glossary/technical-efficiency.

Rizaldi Akbar, (2015), “Measuring Indonesia’s Sectoral Efficiencies: A Data Envelopment Analysis Approach”, **Working Paper**, University of Western Australia.

Salvatore, D, (1996), **Managerial Economic in a Global Economy**, Irwin McGraw Hill, Boston.

Wikipedia (2016), “Post Suharto Era”, retrieve on 22 June 2016 from https:en.wikipedia.org/wiki/Post-Suharto_era.

Yudistira, D., (2004),”Efficiency in Islamic Banking: An Empirical Analysis of Eighteen Banks”, **Islamic Economic Studies**, 12 (1): 1-19.

Chapter-15

Technical Efficiency in Indonesian Economy at National, Sectoral and Spatial Perspectives[1]

Ringkasan

Bab ini menyajikan hasil gabungan Bab-12, Bab-13 dan Bab-14 tentang analisis efisiensi teknis dan skala hasil pada tingkat nasional, sektoral dan spasial. Analisis pada tingkat nasional berdasarkan pada siklus ekonomi makro, yaitu: masa berkelimpahan minyak (1967-1981), masa resesi (1982-1986), masa deregulasi ekonomi (1987-1996), masa krisis multi dimenasi (1997-2001) dan masa pemulihan ekonomi (2002-2013). Analisis sektoral didasarkan pada analisis klasifikasi 9 sektor, yaitu: Pertanian, Pertambangan dan galian, Industri manufaktur, Listrik, gas dan air minum, Konstruksi, Perdagangan, hotel dan restoran, Angkutan dan komunikasi, Jasa keuangan, persewaan dan perusahaan, dan Jasa-jasa lain. Analisis spasial difokuskan pada 7 kelompok besar pulau: Sumatera, Java, Kalimantan, Sulawesi, Bali-Nusa Tenggara, Maluku dan Papua. Fungsi produksi Cobb-Douglas digunakan untuk menghitung efisiensi teknis dan skala usaha menggunakan analisis regresi. Data Produk Domestik Bruto, Cadangan modal dan tenaga kerja tahun 1967-2013 digunakan untuk analisis pada tingkat nasional, data 1967-2007 untuk analisis sektoral dan data 1983-2013 untuk analisis spasial. Hasilnya menunjukkan bahwa pertama, efisiensi teknis semasa pemerintahan Orde Baru lebih baik dibandingkan pada masa reformasi. Kedua, sektor-sektor yang efisiensi teknisnya di atas rata-rata nasional mengalami skala hasil yang menurun. Sebaliknya, sektor-sektor yang efisiensi teknisnya di bawah rata-rata nasional mengalami skala hasil yang meningkat. Ketiga, provinsi-provinsi dengan koefisien efisiensi teknis di bawah rata-rata nasional

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mengalami skala hasil yang menaik, dan sebaliknya provinsi-provinsi dengan efisiensi teknis di atas rata-rata nasional mengalami skala hasil menurun.

Summary

This chapter presents the results of analysis on technical efficiency and return to scale in the Indonesia at the national, sectoral and spatial perspectives. National analysis was based on a macroeconomicscycles: oil booming phase (1967-1981), recession phase (1982-1986), deregulation phase (1987-1996), multi-dimension crisis phase (1997-2001) and economic recovery phase (2002-2013).Sectoral analysis was based on the 9 sectors classification, namely: Agriculture, Mining and Quarrying, Manufacturing, Electricity, Gas and Drinking Water, Construction, Trade, Hotel and Restaurant, Transportation and Communication, Finance, Rental and Corporate Services, and Services. Spatial analysis focused on provincial level. Cobb Douglass production function was employed to calculate technical efficiency and return to scale using regression analysis. Data on Gross Domestic Product, Capital stock and Employment of the year of 1967-2013 used for national analysis, data of year 1967-2007 for sectoral analysis and data of 1983-2013 for spatial analysis. The results show that firstly, technical efficiency during the New Order Government was better than those during Reformation Government. Secondly, those sectors in which the coefficients were above that at the national level, experienced decreasing return to scale. On the contrary, those sectors in which the coefficients were below that at national level, experienced increasing returns to scale. Thirdly, the provinces with coefficients of technical efficiency below that at national level exhibited increasing return to scale. Otherwise, the provinces with coefficients of technical efficiency above that at national level exhibited decreasing return to scale.

1. Introduction

Economists have long recognized that technology is a factor of production, and even the most important factor, given its role in labor quality and the design of capital good. Technological advances play a crucial role in improving productivity and thus the standard of living of a system; economic system (Adam, 2006). Most economists today agree with the hypothesis that both innovation and technological spillovers was the main engine for explaining productivity growth.

Measuring the effect of technology on productivity is a difficult pursuit. It is generally approached through metrics such as Gross Domestic Product, GDP per capita and Total Factor Productivity (TFP). The former two attempt to capture the overall output of a given economy from a macro-environmental perspective. The latter is attempting to measure technologically driven advancement through noting increase in overall output without increases in input. This is done through utilizing production function equations and identifying when the output is greater than the supposed input, implying an advance in external technological environment (Boundless, 2016).

Technology can be regarded as primary resource in economic development. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. It was observed that innovation or technological progress is the only determinant of economic progress. However if the level of technology becomes constant the process of growth will stops. Thus, it is the technological progress which keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Debasish, 2016).

In economics, the Cobb-Douglas production function is widely used to represent the relationship of an output to input (Bao Hong, 2008). It was proposed by Knut Wicksell (1851-1926) and tested against statistical evident by Charles Cobb and Paul Douglas in 1928. From Cobb-Douglas production function, technical efficiency also known as total factor productivity, returns to scale, and output-capital elasticity as well as output-labor elasticity can easily be calculated by employing regression analysis (Salvatore, 1996).

Since the declaration of Indonesian independence on 17 August 1945, the Indonesian economy has been up and down, experiencing booming and recession (Galih Adhidarma, 2015). Economic cycle such as booming, recession and even economic crisis did exist in the Indonesia economy. Socia Prihawantoro et al., (2009) has indicated that few phases in Indonesia economy during the year of 1967 to year 2013, namely: oil booming (1967-1981), recession (19082-1986), deregulation (1987-1996), multi-dimension economic crisis (1997-2001), and economic recovery (2002-2013). Indonesian economy during the era of New Order under Suharto presidency (1966-1998) and during the era of Reformation (1999-2014) run by Habibie Presidency (1998-1999), Wahid Presidency (1999-2001), Megawati Presidency (2001-2004) and Yudhoyono Presidency (2004-2014) has shown clearly the economy's business cycle, up and down over time.

Structural transformation process in the Indonesian economy is indicated initially by the dominance of agricultural sectorboth in output and in employment. The primary sector, namely: Agriculture and Mining-Quarrying dominated the Indonesian economy until 1987-1988, but Secondary (Manufacturing) and Tertiary Sectors (Trade, Hotel and Restaurant) have replaced this position after 1999 in term of output. But, in term of employment, data show that during the year of 1967 to 2007, Agriculture has still dominated the Indonesian economy.

According to the theory of location, it is reasonable view that economic growth unevenly happened in a national economy. Regional disparities do exist in Indonesia economy. There are some regions that grow very fast and there are others that grow very slowly. In Indonesia, some provinces grow very fast such as provinces in Java Island and those in Sumatera Island. Some others grow very slowly, such as in West Nusa Tenggara and in East Nusa Tenggara. Previous research on technical efficiency and return to scale, among others:Biresh K. Sahoo, at. al. (2014), Krivonozhko,V. E. at al., (2007),Tewodros G. G., (2008), Feng, G and Serletis, A., (2010), Nondo, C., (2014), *Holyk, S., (2016),* Jatto. N. A., (2013), Page, John M. Jr., (1980), Erkoc, T. E., (2012), Kui-Wai Li, at al., (2007), and Yudistira, D., (2004). Measuring Indonesia's sectoral efficiencies has been conducted by Rizaldi Akbar (2015) and Muchdie (2016). As far, no study on Indonesian's regional technical efficiency has been conducted.

The research reported in this paper aimed at analyzing the coefficient of technical efficiency and return to scale of the Indonesia economy during the era of New Order (1967-1998) and the era of Reformation (1999-2013). This time frame is also disaggregated into the phases of economic cycles, such oil booming phase (1967-1981), recession phase (1982-1986), deregulations Phase (1987-1996), multi-dimension Crisis Phase (1997-2001) and economic recovery phase (2002-1013). At sectoral level the, study focus on 9 sectors classification, namely : Agriculture, Mining and Quarrying, Manufacturing, Electricity,Gas and Drinking Water, Construction, Trade, Hotel and Restaurant, Transportation and Communication, Finance, Rental and Corporate Services, and Services. At spatial aspect, this study focus on seven groups of Island, namely : Sumatera, Java, Kalimantan, Sulawesi, Bali-NusaTenggara, and Maluku and Papua.

2. Methods of Analysis

Cobb-Douglas production function, $Q = \gamma K^{\alpha} L^{\beta}$, was employed in this exercise to calculate technical efficiency (γ), returns to scale ($\alpha+\beta$), output-capital elasticity (α), and output-labor elasticity (β). This production function was developed and statistically tested by Cobb, C. W., and Douglas, P. H., (1927-1947), where:

Q = total production (the real value of all goods and services produced in a year;

K = capital input (the real value of all machinery, equipment, and building;

L = labor input (the total number of person-hours worked in a year;

γ = technical efficiency in production process, known as total factor productivity;

α = output-capital elasticity;

β = output-labor elasticity.

Technical efficiency (γ), or total factor productivity (TFP) is the portion of output not explained by the amount of input used in production (Comin, 2006). This is a method of measuring overall productivity of business, industries or economies. Technical efficiency is the effectiveness with which a given set inputs is used to produce an output (Ondrej, M., (2012). An economy is said to be technically efficient if an economy is producing the maximum output from the minimum quantity of inputs, such as labor, capital and technology. Technical efficiency is related to productive efficiency which is concern with producing at the lowest point on the short run average cost curve. Thus productive efficiency required technical efficiency (Pettinger, 2012).

The values of α and β are basically determined by available technology. Output elasticity measure the responsiveness of output to a change in levels either capital or labor used in production. Furthermore, if $\alpha + \beta = 1$, the production function has constant returns to scale, meaning that doubling the usage of capital (K) and labor (L) will also double output (Q). If $\alpha + \beta < 1$, returns to scale are decreasing and if $\alpha + \beta > 1$, returns to scale are increasing.

The output elasticity of capital, $E_K = \delta Q/\delta K.K/Q = \alpha Q/K.K/Q = \alpha$. Similarly, the output elasticity of labor, $E_L = \delta Q/\delta L.L/Q = \beta Q/L.L/Q = \beta$, and $E_K + E_L =$

$\alpha + \beta$ = return to scale (Salvatore, 1996). Converting the production function from $Q = \gamma K^{\alpha} L^{\beta}$ in to a logarithms form that is, $\ln Q = \ln \gamma + \alpha \ln K + \beta \ln L$. As this is a linier form, then the coefficients (γ, α and β) can easily be estimated by regression analysis (Gaspersz, 1996). The Cobb-Douglas production function can be estimated either from data for a single firm, industry, region or nation over time using time-series analysis or for a single firm, industry, region or national one point in time using cross-sectional data (Salvatore, 1996).

Data needed for this exercise were sectoral data on Gross Domestic Regional Product, Regional Capital Stock and Regional Employment. Yearly data on GDRP, Regional Capital Stock and Regional Employment were collected from the Central Bureau of Statistics. Data for analyzing technical efficiency at national level were for the year of 1967-2013. Meanwhile data for analyzing technical efficiency at sectoral level were data for the year of 1967-2007 and data for analyzing technical efficiency at spatial level were data for the year 2003-2013.

3. Results and Discussions

Table 15.1 provided results of calculation using an easy and user friendly Excelss of tware of Microsoft Office. Technical efficiency, or total factor productivity of the Indonesia economy during the year 1967 to year 2013, was 2.78. In the New Order era the coefficient was 3.08 which were higher than that of the Reformation Government, 2.98. It means that technological progress during the New Order era was better than that of the Reformation Government. Even, the progress of technical production was higher than that at the national level. Table 1 also showed that both during the two eras of Indonesian Government have experienced the decreasing return to scale. The coefficients of return to scale during the Reformation Government were 0.75 a bit higher than that of the New Order Government, 0.70. Both were a slightly lower compared to that at the national level (0.78).

Table 15.1

Coefficient of Technical Efficiency (TE) and Returns to Scale (RTS)
During The New Order and the Reformation Governments

Indonesian Economy	TE	RTS
All Period (1967-2013)	2.78	0.78
New Order Government (1967-1998)	3.08	0.70
Reformation Era Government (1999-2013)	2.98	0.75

Source: Data Analysis

Table 15.2

Coefficient of Technical Efficiency (TE) and Returns to Scale (RTS)
Based on the Indonesia Economy's Cycles

Indonesia Economy's Cycle	TE	RTS
All Phases (1967-2013)	2.78	0.78
Oil Boom Phase (1976-1981)	3.78	0.57
Recession Phase (1982-1986)	6.88	-0.13
Deregulation Phase (1987-1996)	2.80	0.71
Multi-dimension Crisis Phase (1997-2001)	5.86	0.24
Economic Recovery Phase (2002-2013)	2.70	0.80

Source: Data Analysis

Table 15.2 provides results of calculation from regression analysis. All the coefficients of technical efficiency during the Indonesia economy's business cycle were higher than that at national level (2.78). The technical efficiency coefficient at the recession phase (1982-1986) was 6.88 and at the multi-dimension crisis phase (1997-2011) was 5.86. These two coefficients were the highest. Except the coefficient of technical efficiency at the economic recovery phase (2.70), all of these coefficients were higher than that at the national level (2.78).

Table 15.3 presents the coefficients of technical efficiency and returns to scale during 1967 to 2007 both at national level and sectoral level.Technical efficiency in Indonesian economy during the year 1967 to 2007 was 2.77. At sectoral perspective the coefficients of technical efficiency vary among sectors. From 9 economic sectors, 4 sectors had coefficients of technical efficiency which were above of that at national level, and other 5 sectors were below that at the national level. The sectors which the coefficient of technical efficiency above of that at national level was: Electricity, Gas and Drinking Water (12.04), Mining and Quarrying (5.30), Construction (4.91), and Manufacturing (4.31). The sectors which the coefficient of technical efficiency below of that at national level were: Financial, Rental and Corporate Services (-1.47), Agriculture (-0.69), Services (1.93), Trade, Hotel and Restaurant (2.49) and Transportation and Communication (2.72). It means that the technical efficiency of 4 sectors earlier were better than that at the national level. Meanwhile the coefficients of technical efficiency of 5 other sectors were worse than that at the national level. These 5 sectors should have got more attention by policy makers, especially those that the values of the coefficient were negative.

Table 15.3

Coefficient of Technical Efficiency (TE) and Return to Scale (RTS)
Based on Economic' Sectoral Activities

Sectoral Analysis	*TE*	*RTS*
National Average	2.77	0.78
Agriculture	-0.69	1.20
Mining and Quarrying	5.30	-0.23
Manufacturing	4.31	0.67
Electricity GasDrinking Water	12.04	-0.38
Construction	4.91	-1.17
Trade, Hotel & Restaurant	2.49	1.03
Transportation & Communication	2.72	1.19
Financial, Rental & Coorporate Services	-1.47	2.13
Services	1.93	1.32

Source: Data Analysis

Technical Efficiency	Increasing Returns to Scale	Decreasing Returns to Scale
Above National		Mining and Quarrying Manufacturing Electricity, Gas and Drinking Water Construction
Below National	Financial, Rental and Corporate Services Services Agriculture Transportation and Communication Trade, Hotel and Restaurant	

Figure 15.1

The Quadrant of Technical Efficiency (TE) and Returns to Scale (RTS): Sectoral Level

At national level, Indonesian economy experienced decreasing returns to scale. The coefficients of returns to scale vary among sectors, where 5 sectors were increasing return to scale and 4 sectors were decreasing returns to scale. Five increasing return to scale sectors were: Financial, Rental and Corporate Services (2.13), Services (1.32), Agriculture (1.20), Transportation and Communication (1.19), and Trade, Hotel and Restaurant (1.03). These 5 sectors experiencing increasing returns to scale were the sectors in which their coefficients of technical efficiency were below of that at the national level. Four decreasing return to scale sectors were: Manufacturing (0.67), Mining and Quarrying (-0.23), Electricity, Gas, and Drinking Water (-0.34), and Construction (-1.14). Again, those sectors that had the coefficient of technical efficiency above that at national level experiencing decreasing returns to scale.

Figure 15.1 presents the Quadrant of Technical Efficiency (Above Versus Below National Average) and Return to Scale (Increasing Returns to Scale Versus Decreasing Returns to Scale). Four sectors in which the coefficients of technical efficiency were above that at national level also exhibiting decreasing returns to scale. Those sectors were: Mining and Quarrying, Manufacturing, Electricity, Gas and Drinking Water and Construction. Other five sectors in which the coefficients of technical efficiency were below that at national level, exhibiting increasing returns to scale. Those sectors were: Financial, Rental and Corporate Services, Services, Agriculture, Transportation and Communication, and Trade, Hotel and Restaurant.

Technical efficiency	*Increasing Returns to Scale*	*Decreasing Returns to Scale*
Above national		Kalimantan Island Maluku Islands Papua Island
Below national	Sumatera Island Java Island Sulawesi Island Bali-Nusa Tenggara Islands	

Figure 15.2

The Quadrant Technical Efficiency (TE) and Returns to Scale (RTS): Seven Big Islands

Figure 15.2 presents the quadrant of technical efficiency's coefficient (above and below that at national level) and returns to scale (increasing and decreasing returns to scale). The group of islands with the coefficients of technical efficiency that was higher than that at national level also exhibited decreasing returns to scale. These groups of islands were Kalimantan, Maluku and Papua. The others with the coefficient of technical efficiency less than that at national level and exhibited increasing returns to scale were Sumatera, Java, Sulawesi and Bali-Nusa Tenggara.

As shown in Figure 15.3, provinces in which the coefficient of technical efficiency above that at national level and exhibiting decreasing returns to scale were: Nangro Aceh Darussalam, North Sumatera, Riau, The Island of Riau, South Sumatera, Bangka-Belitung, Yogyakarta, South Kalimantan, East Kalimantan, Gorontalo, Bali, Maluku, North Maluku and Papua. Other provinces in which the coefficients of technical efficiency below that at national level and exhibiting increasing returns to scale were : West Sumatera, Jambi, Bengkulu, Lampung, Jakarta Capital City, Banten, West Java, Central Java, East Java, West Kalimantan, Central Kalimantan, North Sulawesi, Central Sulawesi, South-East Sulawesi, West Sulawesi, South Sulawesi, West Nusa Tenggara, East Nusa Tenggara, and West Papua.

The study of technical efficiency and returns to scale usually conducted in a firm or industry as technical production was more homogeneous at the firm level. In the national economy, there might be a risk in aggregating technology. The different time fame of the study is another limitation of the study.

Technical efficiency	*Incerasing Returns to Scale*	*Decreasing Returns to Scale*
Above national		Nangro Aceh Darussalam North Sumatera Riau The Island of Riau South Sumatera Bangka-Belitung Yogyakarta South Kalimantan East Kalimantan Gorontalo Bali Maluku North Maluku Papua

Technical efficiency	*Incerasing Returns to Scale*	*Decreasing Returns to Scale*
Below national	West Sumatera Jambi Bengkulu Lampung Jakarta Capital City Banten West Java Central Java East Java West Kalimantan Central Kalimantan North Sulawesi Central Sulawesi South-East Sulawesi West Sulawesi South Sulawesi West Nusa Tenggara East Nusa Tenggara West Papua	

Figure 15.3

The Quandrant of Technical Efficiency (TE) and Returns to Scale (RTS): Provincial Level

4. Conclusion

From above discussions, it could be concluded that firstly, at national perspective, technical efficiency during the New Order Government was better than those during Reformation Government. Secondly, at sectoral level, those sectors in which the coefficients were above that at the national level, experienced decreasing returns to scale. On the contrary, those sectors in which the coefficients were below that at national level, experienced increasing returns to scale. Thirdly, at spatial perspective,the provinces with coefficients of technical efficiency below that at national level exhibited increasing returns to scale. Otherwise, the provinces with coefficients of technical efficiency above that at national level exhibited decreasing returns to scale.

It could be suggested that the sectors or provinces with the coefficients of technical efficiency higher than that at the national level to not increase the inputs of production as the economy experiencing decreasing returns to scale. Meanwhile the sector or provinces that had the coefficients of technical efficiency lower than that at the national level to increase all inputs in production in order to increase output as the economy experiencing increasing returns to scale.

References

Adams, J. (2006), **The Contribution of Science and Technology to Production**, the National Bureau of Economic Research, Cambridge Massachusett.

Bao Hong, Tan, (2008), "Cobb-Douglas Production Function", retrive on 22 June 2016 from http://docentes.fe.unl.pt/jamador/Macro/cobb-douglas.pdf

Biresh K. Sahoo, Joe Zhu, Kaoru Tone, Bernhard M. Klemen, (2014), "Decomposing technical efficiency and scale elasticity in two-stage network DEA", **European Journal of Operational Research**, 23(3): 584–594.

Boundless, (2016), "Impacts of Technological Change on Productivity," **Boundless economics**, https://www.boundless.com/economics/texbook/boundlesseconomics-texbook/economic-growth-20/productivity-98/impacts-of-technological-change-on-productivity-370-12467/, acessed on 26 June 2016.

Cobb C.W, and Douglas, P.H., (1928), "A Theory of Production", **American Economic Review,** 18 (Supplement): 139-165.

Comin, D., (2006), **Total Factor Productivity**, New York University, New York.

Debasish., (2016), "Role of Technology in Economic Development" Economics-discussion.net,

Erkoc, T. E., (2012), "Estimation Methodology of Economic Efficiency: Stochastic Frontier Analysis versus Data Envelopment Analysis", **International Journal of Academic Research in Economics and Management Sciences**, 1(1): 1-23.

Feng, G, and Serletis, A,. (2010), "Efficiency, Technical Change, and Returns to Scale in Large US Banks: Panel Data Evidence from an Output Distance Function Satisfying Theoretical Regularity", **Journal of Banking & Finance**, 34(1): 127-138.

Galih Adhidarma, (2015), "Analisis Siklus Bisnis dan Indikator Ekonomi Pendahulu Indonesia Tahun 2000:Q2 – 2012:Q3", **Macro Economics DashBoard**, Fakultas Ekonomika dan Bisnis UGM, Available at :

http://macroeconomicdashboard.feb.ugm.ac.id/analisis-siklus-bisnis-dan-indikator-ekonomi-pendahulu-indonesia-tahun-2000q2-2012q3/, accessed on 4 Juni 2016.

Gaspersz. V., 1996, **Ekonomi Manajerial, Penerapan Konsep-Konsep Ekonomi DalamManajemen Bisnis Total (Managerial Economics : Application of Economic Concepts in Total Business Management)**, PT Gramedia Pustaka Utama, Jakarta, pp: 222-233.

Gebreselasie, T.G., (2008), "Sectoral Elasticity of Substitution and Returns to Scale in South Africa",**South African Journal of Economics**, Special Issue: Industrial growth and employment in South Africa. 76 (Issue Supplement s2):S110–S125.

Holyk, S., (2016), “Measuring Technical Efficiency and Economy on Scale in Finnish Food Processing Industry”, I**nternational Journal of Science: Basic and Applied Research**, 27 (3):226-238.

Jatto, N.A., (2013),Assessing the Return to Scale: Evidence from Fish Farmers in Ilorin, Kwara State, **Russian Journal of Agricultural and Socio-Economic Sciences**, 1(13): 56-59.

Krivonozhko, V. E. , Dvorkovich, A. V. , Utkin, O. B. , Zharkov I. D, Patrin, M. V. and Lyche A. V., (2007), “Computation of elasticity and scale effect in technical efficiency analysis of complex systems”,**Computational Mathematics and Modeling**, 18(4):432-452.

Kui-Wai Li, Tung Liu, and Lihong Yun, (2007), “Technology Progress, Efficiency, and Scale of Economy in Post-reform China”,**Working Paper**, Department of Economics and Finance, City University of Hong Kong, Hong Kong.

Muchdie, M., (2016), “Sectoral Variation on Technical Efficiency and Return to Scale in the Indonesian Economy”, **Signifikan Jurnal Ilmu Ekonomi**, 5 (2): 119-132.

Nondo, C., (2014), “Evaluating the technical efficiency of African economies using DEA and the bootstrap approach”, **African Journal of Economic and Sustainable Development**, 3(2): 156-178.

Ondrej, M., (2012), “Data Issued in Total Factor Productivity Benchmarking: A Central European Perspective”,**Working Paper**, Faculty of Business Administration, University Economics in Praque, pp: 219-225.

Page, J. M. Jr., (1980), “Technical Efficiency and Economic Performance: Some Evidence from Ghana”,**Oxford Economic Papers**, New Series, 32(2): 319-339.

Pettinger, T., (2012), “Technical Efficiency Definition”, **Get Economic Helpin** http://www.economichelp.org/blog/glossary/technical-efficiency, accessed on 15 June 2015.

Rizaldi Akbar., (2015), “Measuring Indonesia’s Sectoral Efficiencies : A Data Envelopment Analysis Approach”, **Working Paper**, University of Western Australia.

Salvatore, D.,(1996), **Managerial Economic in a Global Economy**, Irwin McGraw Hill, Boston, pp: 251.

Socia Prihawantoro, Alkadri, Mien Askinatin, Andi Tabrani, Supomo, Abd Azis Wasil, 2009, **Peran Teknologi dalam Pertumbuhan Ekonomi Indonesia (The Role of Technology in the Indonesian Economic Growth)**, Badan Pengkajian dan Penera*pan* Teknologi, Jakarta.

Wikipedia (2016), “Post Suharto Era”, retrieve on 22 June 2016 from https:en.wikipedia.org/wiki/Post-Suharto_era.

Yudistira, D., (2004),”Efficiency in Islamic Banking: An Empirical Analysis of Eighteen Banks”, **Islamic Economic Studies**,12(1): 1-19.

Chapter-16

Technological Progress and Economic Growth in Indonesia[1]

Ringkasan

Bab ini menguji hubungan antara kemajuan tekonologi, diukur dengan pertumbuhan TFP dengan pertumbuhan ekonomi, diukur dengan pertumbuhan GDP, baik pada tingkat nasional maupun pada tingkat regional yang dialami Indonesia. Secara spasial, Indonesia dibagi menjadi 7 gugus pulau-pulau besar seperti: Sumatera, Jawa, Kalimantan, Nusa Tenggara, Sulawesi dan Papua. Koefisien korelasi dihitung menggunakan model regresi sederhana. Data yang dihasilkan dari kajian yang dilakukan oleh Badan Pengkajian dan Penerapan Teknologi 1984-2010 digunakan dalam kajian ini. Hasilnya menunjukkan bahwa baik pada tingkat nasional maupun pada tingkat regional, korelasi antara kemajuan teknologi dan pertumbuhan ekonomi adalah positive dan sangat kuat. Ini kemudian, disarankan agar program-program pengembangan teknologi terus dilanjutkan untuk mendorong pertumbuhan ekonomi secara berkelanjutan.

Summary

This chapter examined the relationship between technological progress, measured by TFP growth, and economic growth, measured by GDP growth, both at national and regional levels experienced by Indonesia. Spatially, Indonesia was disaggregated into 7 groups of Island: Sumatera, Java, Kalimantan, Sulawesi, Nusa Tenggara dan Maluku-Papua. Coefficients of correlation were calculated using simple regression model. Data resulted from a study at the Agency for the Assessment and Application of Technology of the Government of Indonesia,

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1984-2010, were used for this study. The results showed that both at national level as well as at regional level the correlation between technological progress and economic growth was positive and very strong. It is then suggested that programs of technology development should continually be pushed in order to maintain sustainable economic growth.

1. Introduction

Economic growth, by definition, is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in realgross domestic product (real GDP), usually in per capita terms (IMF, 2012).Growth is usually calculated in *real* terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, G.J., 1999), Solow-Swan Model developed by Sollow, R., (1956) and Swan, T., (1956), Endogenous Growth Theory which focus on what increases human capital or technological change (Helpman, E., 2004), Unified Growth Theory developed by Galor, O., (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory (Acemoglu, at.al., 2001), Human Capital and Growth Theory (Barro & Lee, 2001), and Energy Consumption and Growth Theory (Committee on Electricity in Economic Growth Energy Engineering, 1986).

Historically, technology has played a central role in raising living standards across the region. The Green Revolution and various innovations of modern medicine and public health have been instrumental in improving nutrition, health, and livelihoods of millions of poor people. Agricultural and medical biotechnology hold tremendous promise but also bring with them new risks and concerns that need to be addressed before their full potential can be realized. New information technologies are only beginning to diffuse widely in developing Asia and the Pacific, but ultimately these too can have profound impacts on the lives of the poor, empowering them with access to information that once was the preserve of the privileged few (OECD,2002).

Advances in science and technology have continuously accounted for most of the growth and wealth accumulation in leading industrialized economies. In recent years, the contribution of technological progress to growth and welfare improvement has increased even further, especially with the globalization process which has been characterized by exponential growth in exports of manufactured goods. Hippolyte, F., 2008) shows that the widening income and welfare gap between Sub-Saharan Africa and the rest of world is largely accounted for by the technology trap responsible for the poverty trap.

Technological progress, technological development, technological achievement, or technological change is the overall process of invention, innovation and diffusion of technology or processes. In essence technological progress is the invention of technologies and their commercialization via research and development, the continual improvement of technologies, and the diffusion of technologies throughout industry or society. In short, technological progress is based on both better and more technology. In economics, change in a production function that alters the relationship between inputs and outputs. Normally it is understood to be an improvement in technology, or technological progress. Technological change is a change in the set of feasible production possibilities (Hicks, J.R.,1963). Total factor productivity is used to measure technological progress (Crespo, R.J., 2005). Study on total factor productivity for Indonesia was intensively conducted by Sigit, Hananto (2004).

Technological progress and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries. It has been observed that major part of increased productivity is due to technological progress. Technological progress is one of the most important determinants of the shape and evolution of the economy.Boskin & Lau (1992) indicated that in developed countries, technological progress contributed about 49 to 76 per cent on economic growth. According to Solow (1957) the contribution of technological progress on American economic growth was 87.5 per cent.

Technological progress has improved working conditions, permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded as primary source in economic development and the various technological progress contribute significantly in the development of underdeveloped countries. The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased. On the one hand, consumption of the household rises, while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases.

Objective of this paper is to examine empirically the correlation between technological progress on economic growth for Indonesia both at national level as well as at regional level.

2. Methods

Simple regression analysis was employed to calculate correlation coefficients between technological progress and economic growth. Economic growth was measured by the growth of gross domestic products (GDP) and technological progress was measured by total factor productivity (TFP) growth.

The OECD defines GDP as "an aggregate measure of production equal to the sum of the gross values added of all resident and institutional units engaged in production, plus any taxes, and minus any subsidies, on products not included in the value of their outputs"(IMF, 2014). An IMF (2016) publication states that "GDP measures the monetary value of final goods and services - that is, those that are bought by the final user - produced in a country in a given period of time, for instance for a year".The modern concept of GDP was first developed by Simon Kuznets for a US Congress report in 1934 (Kuznets, S., 1934). In this report, Kuznets warned against its use as a measure of welfare. After the Bretton Woods conference in 1944, GDP became the main tool for measuring a country's economy (Dickinson, E., 2012).GDP can be determined in three ways, all of which should, in principle, give the same result. They are the production or output or value added approach, the income approach, or the expenditure approach. The most direct of the three is the production approach, which sums the outputs of every class of enterprise to arrive at the total. The expenditure approach works on the principle that all of the product must be bought by somebody, therefore the value of the total product must be equal to people's total expenditures in buying things. The income approach works on the principle that the incomes of the productive factors must be equal to the value of their product, and determines GDP by finding the sum of all producers' incomes (World Bank, 2009).

Growiec, J., (2009) proposed four alternative methods for computing technological progress, sorted according to increasing methodological sophistication, namely: 1.TFP growth rate from a Cobb–Douglas production function, computed using only physical capital and labour as inputs, 2. Potential TFP growth rate from a Cobb–Douglas production function, computed using either only physical capital and labour as input, 3. Rate of technological progress at the world technology frontier (WTF), computed from a production function constructed with the non-parametric DEA algorithm, and 4. The Malmquist productivity index, computed from a production function constructed with the non-parametric DEA algorithm.

Data of TFP growth and economic growth from the year 1984 to 2010 collected from the results of a research report published by the Agency for Assessment and Application of Technology (Socia Prihawantoro et. al., 2009; 2013).

Regression analysis was used to calculate the correlation coefficients, coefficients determination, regression coefficients and their significant level. Easy and user friendly software of MS-Excel was used to calculate those coefficients, where y = economic growth (GDP growth) and x = technological progress (TFP growth).

3. Results and Discussions

Figure 16.1 (left panel) provides picture of Indonesian regional GDP growth. The islands of Maluku-Papua had the highest economic growth, followed by Sulawesi, Bali-Nusa Tenggara, Kalimantan, Java and Sumatera. National economy during 1984-2010 grows at average 5.6 percent per year. The highest growth was 8.89 percent at the year 2000, two years after multi-dimension economic crisis in 1998 and 1999. In 1998-1999, Indonesian economic growth was negative, -6.95% and -1.86%.

At regional level, as a whole, the highest economic growth was in the Island of Maluku-Papua, followed by Sulawesi Island, Bali- Nusa Tenggara Islands, Kalimantan Island, Java Island and Sumatera Island. On Average, the highest economic growth was at Sulawesi Island (6.48%), followed by the Island of Bali-Nusa Tenggara (6.19%), Java Island (5.35%), Kalimantan Island (5.31%), Maluku-Papua Island (5.23%) and Sumatera Island (5.05%).

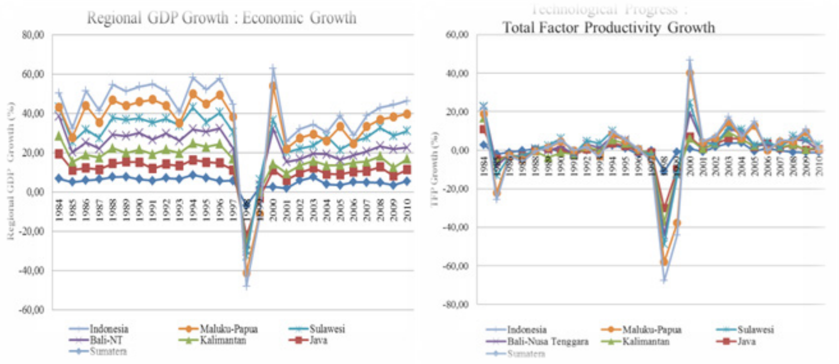

Figure 16.1

Regional Economic Growth (left) and Regional TFP Growth (right), Indonesia 1984-2010.

In Figure 16.1(right panel) the growth of total factor productivity, a measurement of technological progress, was presented. As a whole, the highest total factor productivy was at Sulawesi Island, followed by Maluku-Papua Island, Kalimantan Island, Bali-Nusa Tenggara Island, Java Island and Sumatra Island. In average, the growth of TFP in national economy was 0.05 percent, about 10 percent of national economic growth. The highest TFP growth was 6.68 percent in the year of 2000. The lowest TFP growth, -9.67 per cent, was in the year of 1998 when monetary crisis experienced by Indonesia. Many negative TFP growths were in the year of 1985 (-3.68%), 1986 (-0.43%), 1987 (-0.83%), 1988 (-0.10%), 1991 (-0.01%), 1993(-0.52%), 1997(-0.81%), 1998(-9.67%), 1999(-6.29%), and 2006 (-0.02%).

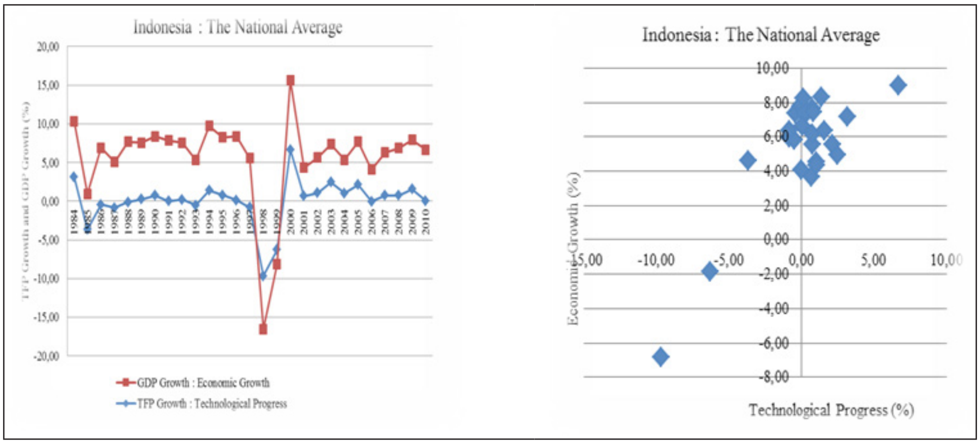

Figure 16.2

Technological Progress and Economic Growth: National Level, Indonesia 1984-2010

Figure 16.2 (right panel) presents scatter diagram between technological progress and economic growth at national level. The trend was linier, as technological progress increase, and then the economic will also increase. In Figure 16.2 (left panel) the TFP growth line was below the economic growth line, except in year of financial crisis, year 1998 and 1999.

The same trend was also shown by Figure 16.3 (left panel) where TFP growth line for Sumatra Island was lower than Sumatra's economic growth line, except for the year of 1998. The trend was also linier as scatter diagram indicated (right panel).

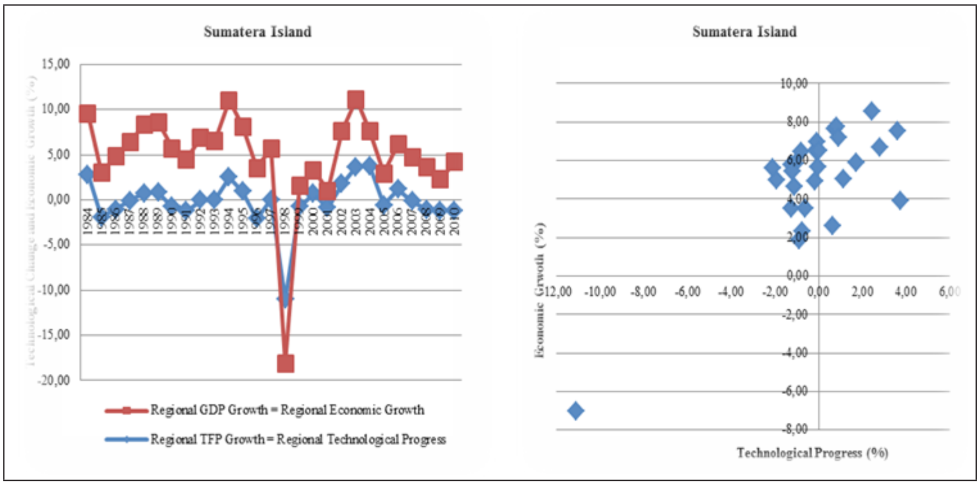

Figure 16.3

Technological Progress and Economic Growth:Regional Level, Sumatera Island 1984-2010

Again, in the Island of Java, the trend between technological progress and economic growth was also linier as indicated by the scatter diagram at Figure 16.4 (right panel). The pattern of correlation between technological progress and economic growth in Java Island was similar with that at Sumatra Island (Figure 16.4, left panel).

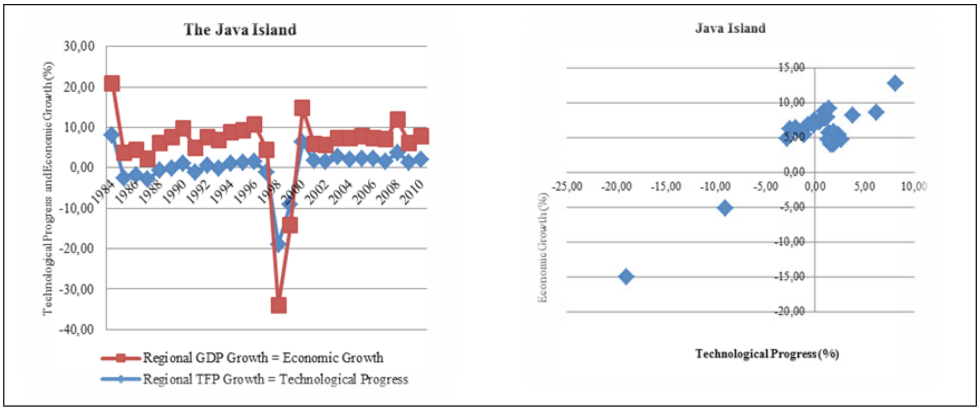

Figure 16.4

Technological Progress and Economic Growth: Regional Level, Java Island 1984-2010

In Kalimantan Island, TFP growth line was also located below the economic growth lines, except for the year 1998 (Figure 16.5, left panel). In Figure 16.5 (right panel), the trend between technological progress and economic growth at Kalimantan Island was still linier, even though the scatter diagram a bit more spread.

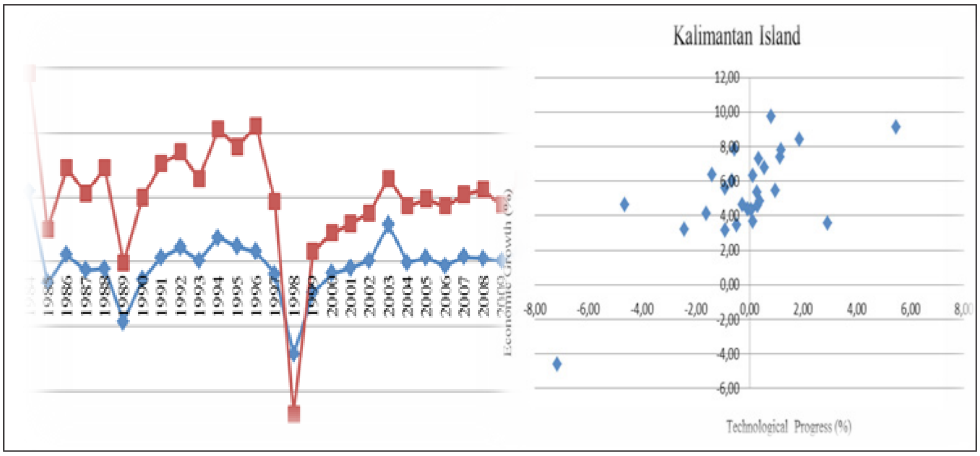

Figure 16.5

Technological Progress and Economic Growth:Regional Level, Kalimantan Island 1984-2010

Figure 16.6 presents the trend of correlation between technological progress and economic growth at the Island of Bali-Nusa Tenggara. The line of economic growth was above that of TFP growth, except at the year when financial crisis was experienced. The trend between technological change and economic growth was also similar with those at Sumatera Island, Java Island and Kalimantan Island.

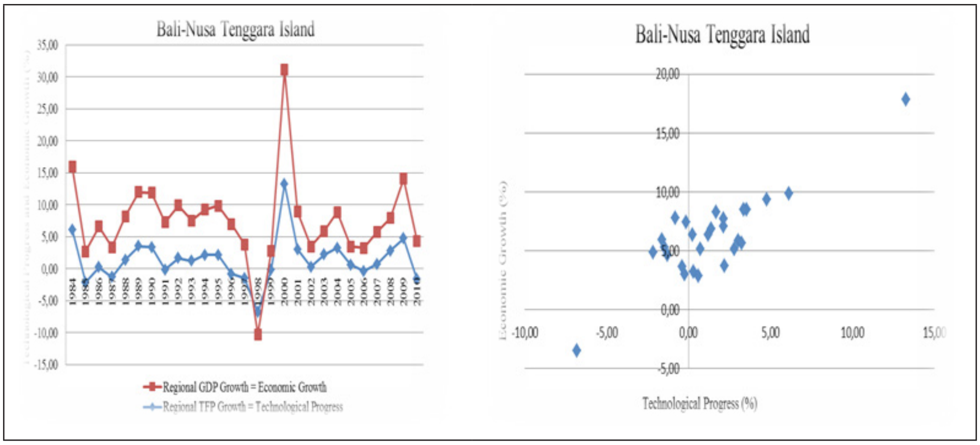

Figure 16.6

Technological Progress and Economic Growth:Regional Level, Bali-Nusa Tenggara Island 1984-2010

Figure 16.7 presents the trend between technological progress and economic growth at the Island of Sulawesi. Similar with the other island, the TFP growth line was located below the line of economic growth. The trend of correlation between technological progress and economic growth in Sulawesi Island was positive and linier as indicated in Figure 16.7 (right panel).

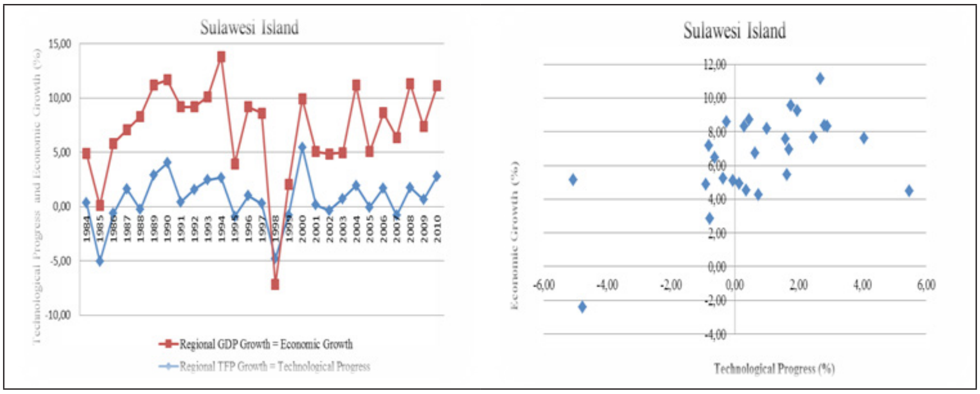

Figure 16.7

Technological Progress and Economic Growth: Regional Level, Sulawesi Island 1984-2010

Finally, Figure 16.8 (right panel) presents scatter diagram between technological progress and economic growth at national level. The trend was linier, as technological progress increase, and then the economic will also increase. In Figure 16.8 (left panel) the TFP growth line was below the economic growth line, except in year of financial crisis, year 1998 and 1999.

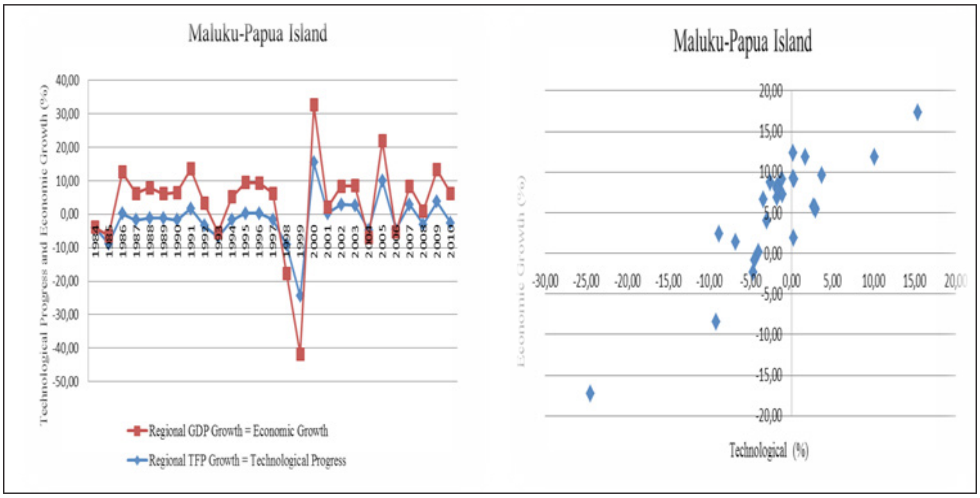

Figure 16.8

Technological Progress and Economic Growth: Regional Level,
Maluku-Papua Island 1984-2010

Table 16.1 provides the results of regression analysis between technological progress and economic growth in Indonesian economy, both at national and regional level. At the national level, coefficient of correlation between technological progress and economic growth was 0.81. It was a positive and very strong relation. The coefficient of determination, R-square, was 0.65. It means that at national level, 65 per cent of economic growth variations can be explained by technological progress. Other 35 per cent was the responsible of other factors. Regression analysis showed that the intercept between technological progress on economic growth was -3.99, means that if the growth of technological progress is zero per cent, then the economic growth would be negative, -3.99 per cent. Statistically this intercept coefficient was significant, indicated by the value of t-statistic. The slope of regression or the regression coefficient was 0.72, means that 1 per cent increase in the growth of technological progress would increase economic growth of 0.72 per cent. Regression analysis indicated that the regression coefficient was statistically significant.

Table 16.1

Results of Regression Analysis: Technological Progress on Economic Growth

	Indonesia	Sumatera	Java	Kalimantan	Bali-Nusa Tenggara	Sulawesi	Maluku Papua
R	0.81	0.78	0.90	0.71	0.86	0.55	0.86
R-Square	0.65	0.61	0.81	0.50	0.74	0.30	0.74
F	46.12	38.81	108.74	25.05	71.10	10.82	71.07
Significant	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intercept	-3.99	-3.76	-4.60	-3.29	-3.83	-2.32	-5.98
t-Intercept	-5.82	-5.71	-7.50	-4.72	-5.40	-2.35	-6.89
X Var1	0.72	0.71	0.88	0.59	0.84	0.47	0.85
t-X Var1	6.79	6.23	10.43	5.01	8.43	3.29	8.43
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00

At the regional level, coefficient of correlation between technological progress and economic growth varies where in the Java Island the coefficient was the highest (0.90) and in the Sulawesi Island the coefficient was the lowest (0.55). The coefficient of determination, R-square, was also follow the pattern, the highest was in the Island of Java (0.81) and the lowest was in the Sulawesi Island (0.30). It means that in the Java Island, 81 per cent of economic growth variations can be explained by technological progress. Another 19 per cent was the responsible of other factors. Meanwhile in the Sulawesi Island, only 30 percent of economic behavior can be explained by technological progress. Another 70 per cent was the responsible of other factors in economic growth. Regression analysis showed that the intercept between technological progresses on economic growth at regional levels varies, even though they all had negative value. These mean that when the growth of technical progress was zero, the value of economic growth would be negative. Statistically these intercept coefficients were significant, indicated by the value of t-statistic. The slopes of regression or the regression coefficients at regional level also vary among the Island where the Island of Java had the highest regression coefficient (0.88) and the Sulawesi Island has the smallest coefficient (0.47). In Java Island, 1 per cent increase in the growth of technological progress would increase economic growth of 0.88 per cent. In the Sulawesi Island, 1 per cent increase in technological progress would increase economic growth of 0.47 per cent. Regression analysis indicated that all the regression coefficients were statistically significant.

Conclusion

It could be concluded that technological progress had significant contribution on Indonesian economic growth, both at national as well as at regional levels.

The correlation coefficients between technological progress and economic growth indicate the strength relation between the two. At national level, the relationship between technological progress and economic growth was positive and very strong (0.81). At regional level, the stronger correlation between technological progress and economic growth happened in the Java Island (0.90) and at the Sulawesi Island the strength correlation coefficient between technological progress and economic growth was categorised as moderate (0.55).

The coefficients of determination explain the variations of economic growth due to the growth of technological progress. At the national level, the highest coefficient existed in the Java Island (0.81) and the lowest existed in the Island of Sulawesi.

Finally, the regression coefficients or the slope of regression line between technological progress and economic growth both at national and regional levels were positive and statistically significant. At national level, the coefficient of regression was 0.72. At regional levels, the coefficients of regression vary. The highest regression coefficient was in the Island of Java (0.88) and the smallest coefficient of regression was in the Sulawesi Island (0.47).

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001),"The colonial origins of economic development: an empirical investigation",**American Economic Review**, 91(5): 1369–1401.

Barro, R. J., and Lee J.W., (2001),"International data on educational attainment: Updates and implications",**Oxford Economic Papers,** 53(3): 541–563.

Bjork, G.J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**,ISBN 0-275-96532-5, Westport, CT, Praeger,, London.pp: 251.

Boskin, M.J., and Lau, L.J., (1992),"Capital, Technology and Economic Growth", In Rosenberg, R., Landau, R., and Mowery, D.C., (Eds), **Technology and the Wealth of Nations**, Stanford University Press Stanford, California.

Callen, T., (2016),**Gross Domestic Product: An Economy's All**, International

Monetary Fund, Retrieved 3 June 2016.

Committee on Electricity in Economic Growth Energy Engineering Board Commission on Engineering and Technical Systems National Research Council, (1986), **Electricity in Economic Growth**,ISBN 0-309-03677-1, National Academy Press, Washington DC,pp: 16-40.

Crespo, R. J., (2005),"Total Factor Productivity: An Unobserved Components Approach",**Discussion Paper No. 05/579**, University of Bristol, University of Bristol, Bristol.

Dickinson, E., (2012),"GDP: a Brief History", **ForeignPolicy.com**, and Retrieved 25 April 2012.

Galor, O., (2005),"From Stagnation to Growth: Unified Growth Theory",**Handbook of Economic Growth**, Elsevier.

Growiec, J., (2009),"On the Measurement of Technological Progress across Countries",**MRA Paper No. 19321**, Online at http://mpra.ub.uni-muenchen.de/19321/ MPRA Paper No. 19321, posted 15, December 2009 07:59 UTC.

Helpman, E., (2004),**The Mystery of Economic Growth**, Harvard: Harvard University Press.

Hippolyte, F., (2008),"Technology trap and poverty trap in Sub-Saharan Africa",**Policy Research Working Paper, No. WPS 4582**, World Bank, Washington, DC.http://worldbank.org/curated/en/169021468198874707/Technology-trap-and-poverty-trap-in-Sub-Saharan-Africa.

IMF, (2012),**Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Hicks, J.R., (1963),**The Theory of Wages**, Ch. VI, Appendix, and Section III. Macmillan.

Kuznets, S., (1934),"National Income 1929–1932", 73rd US Congress 2d session, **Senatedocument no. 124**, pp: 5-7 https://fraser.stlouisfed.org/scribd/?title_id=971& filepath = /docs/ publications/natincome_1934/19340104_nationalinc.pdf

OECD, (2002),"Technology and Poverty Reduction in Asia and the Pacific",**OECD Development Centre**, .

Philippe, A., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality",**Econometrica**, 70(3): 855–882.

Sigit, Hananto, (2004),"Total Factor Productivity Growth: Survey Report", **Part II National Report: Indonesia,** Asian Productivity Organization, Tokyo.

Socia Prihawantoro, Alkadri, Mien Askinatin, Andi Tabrani, Supomo and Abdul Azis Wasil., (2009),**Peranan Teknologi Dalam Pertumbuhan Ekonomi Indonesia, (The Role of Technology in Indonesian Economic Growth),** Pusat Pengkajian Kebijakan Inovasi Teknologi (Centre for Innovation Technology Policy), Badan Pengkajian dan Penerapan Teknologi (The Agency for the Assessment and Application of Technology*),* Jakarta.

Socia Prihawantoro, Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana (2013**), Peranan Teknologi Dalam Pertumbuhan Ekonomi Koridor–Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity**, Pusat Pengkajian Kebijakan Inovasi Teknologi (Centre for Innovation Technology Policy), Badan Pengkajian dan Penerapan Teknologi (The Agency for the Assessment and Application of Technology*)*. Jakarta.

Solow, R. M., (1956),"A Contribution to the Theory of Economic Growth**",Quarterly Journal of Economics**,70(1): 65-94.

Swan, T.W., (1956),"Economic Growth and Capital Accumulation",**Economic Record**, **32**: 334–361, Doi: 10.1111/j.1475-4932.1956.tb00434.x.

World Bank, (2009),**Measuring the Economy: A Primer on GDP and the National Income and Product Accounts(PDF)**,Statistic Manual, Bureau of Economic Analysis.

http://www.dictionarycentral.com/definition/technological-change.html

http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

http://www.excel-easy.com/examples/regression.html

Chapter-17

Technological Progress and Poverty Reduction in Indonesia[1]

Ringkasan

Bab ini menyajikan hasil pengujian dampak kemajuan teknologi untuk pengurangan kemiskinan, dengan pengangguran dan pertumbuhan ekonomi sebagai variabel antara, di Indonesia dalam kurun waktu 2004-2013. Kemajuan teknologi diukur dengan pertumbuhan TFP, pengangguran diukur dengan tingkat pengangguran terbuka, pertumbuhan ekonomi diukur dengan pertumbuhan GDP harga konstan tahun 2000, dan pengurangan kemiskinan diukur dengan persentase orang miskin. Analisis dampak dilakukan menggunakan teknik analisis jalur. Data diperoleh dari Badan Pusat Statistik, kecuali data pertumbuhan TFP. Hasil analisis menunjukkan bahwa, pertama kemajuan teknologi, secara langsung, mempunyai dampak positive yang tidak signifikan terhadap pengurangan kemiskinan (Jalur-1). Kedua, kemajuan teknologi secara tidak langsung mempunyai dampak positive yang signifikan terhadap pengurangan kemiskinan (Jalur-2). Ketiga, kemajuan teknologi secara tidak langsung mempunyai dampak positive yang signifikan terhadap pengurangan kemiskinan (Jalur-3). Keempat, kemajuan teknologi secara tidak langsung mempunyai dampak positive yang signifikan terhadap pengurangan kemiskinan (Jalur-4). Kemajuan teknologi merupakan faktor penting untuk pengurangan kemiskinan, tetapi bukan syarat yang mencukupi.

Summary

This chapter examined the impact of technological progress on poverty reduction, with unemployment rate and economic growth as moderating variables, in

[1] This chapter has been presented in The 2nd International Multidisciplinary Conference, 2016 November 15th, Universitas Muhammadiyah Jakarta, pp: 157-169, ISBN: 978-602-17688-7-7. It has also been published in **International Journal of Research in Social Sciences,** Vol. 7 (3), March 2017, pp: 248-265, ISSN: 2249-2496, Impact Factor: 7.081; http://www.ijmra.us, http://repository.uhamka.ac.id/186/; https://www.researchgate.net/publication/314363254

Indonesia during the period of 2004-2013. Technological progress was measured by total factor productivity (TFP) growth, unemployment was measured by open unemployment rate, economic growth was measured by the growth of Gross Domestic Product based on the year of 2000 constant price, and poverty reduction was measured by the percentage of poor people. Impact analysis was conducted using SEM-Path Analysis techniques. Most data were directly gathered from the National Statistics Agency, except data on TFP growth. The results showed that first**,** technological progress, directly, had a not significant positive impact on poverty reduction (Path-1). Second**,** technological progress, indirectly, had a positive significant impact on poverty reduction (Path-2). Third**,** technological progress, indirectly, had a positive significant impact on poverty reduction (Path-3). Fourth**,** technological progress, indirectly, had positive significant impact on poverty reduction (Path-4). Technological progress was important factor for poverty reduction but it was not sufficient conditions.

1. Introduction

Despite its abundance resources, Indonesia is listed among the lower middle income countries. Efforts on protecting the poor through targeted social safety net on health, education and rice consumption as well as the community empowerment programs and micro-enterprise empowerment programs have signified Indonesia's development policy agenda. In the National Medium-Term Development Plan of 2004-2009, the Yudhoyono administration targeted to reduce the percentage of Indonesian living below poverty line from 17.42% in 2004 to 8.20% in 2009. The 2010-2014 National Medium-Term Development Plan has targeted a poverty rate of 8% in 2014 (Bappenas, 2009).

Although only a few developing countries have succeeded in sustaining rapid growth for a long period and in reducing poverty significantly, the evidence does suggest an association between episodes of rapid growth and poverty reduction. Some policies and factors do seem to promote growth and reduction in poverty, such as: openness to international trade and capital, conditions conducive to the creation of a disciplined and adequately educated and healthy labor force, macroeconomic stability and an environment of low transaction costs (Asian Development Bank, 2001).

The last few decades witnessed a rapid economic growth in developing countries is not sufficient for poverty reduction. The debate surrounding growth and human development resurfaced when the absolute poverty in the developing world dropped to 21% in 1990 from 43% in 2010, lifting 280 Million above the poverty line.

Unprecedented growth of China, India, Latin America and few African countries contributed to this massive poverty reduction. Oyewale & Musiliu (2015) have examined empirical assessment of economic growth on poverty reduction in Nigeria. Growth alone may not be sufficient to achieve poverty reduction. Other factors may need to be in place before growth has a poverty-reducing impact. Besley & Cord (2007) present conclusive arguments through cross country empirical evidence that on average, 1 per cent increase in per capita income reduced poverty by 1 per cent. Richard, A.H Jr (2003) argued that economic growth reduces poverty because growth has little impact on income inequality. In the data set income inequality rises on average less than 1.0 per cent a year. Since income distributions are relatively stable over time, economic growth tends to raise incomes for all members of society, including the poor.

Unemployment and poverty are the two major challenges that are facing the world economy at present. Unemployment leads to financial crisis and reduces the overall purchasing capacity of a nation. This in turn results in poverty followed by increasing burden of debt. Now, poverty can be described in several ways. As per the World Bank definition, poverty implies a financial condition where people are unable to maintain the minimum standard of living. It is true that unemployment and poverty are mostly common in the less developed economies (Baker, D., 2014).A full employment policy is a tremendously effective way to increase the income and opportunities available to the poor and near poor. But the high unemployment policy we currently have in place is one that redistributes income upward and denies people the jobs they need to escape poverty.

Historically, technology has played a central role in raising living standards across the region, including those of the poor. The Green Revolution and various innovations of modern medicine and public health have been instrumental in improving nutrition, health, and livelihoods of millions of poor people. Agricultural and medical biotechnology hold tremendous promise but also bring with them new risks and concerns that need to be addressed before their full potential can be realized. New information technologies are only beginning to diffuse widely in developing Asia and the Pacific, but ultimately these too can have profound impacts on the lives of the poor, empowering them with access to information that once was the preserve of the privileged few (OECD & ADB,2002).

Advances in science and technology have continuously accounted for most of the growth and wealth accumulation in leading industrialized economies. In recent years, the contribution of technological progress to growth and welfare improvement has increased even further, especially with the globalization process which has been characterized by exponential growth in exports of manufactured goods. Hippolyte (2008) shows that the widening income and welfare gap between Sub-Saharan Africa and the rest of world is largely accounted for by the technology trap responsible for the poverty trap.

The powerful force of technological change for poverty reduction in agriculture has been studied by Janvry, *et al.* (2005). They explore how biotechnology, as a potentially important new source of technological progress in agriculture, could also be made to fulfill this role. They also distinguish between direct effects of technology and poverty that affect adopters and indirect effects that affect others through employment, growth, and consumer price effects.

The objective of this paper is to examine the impact of technological progress on poverty reduction both directly and indirectly through economic growth and unemployment.

2. Reviews of Literature

a. Poverty

Poverty is general scarcity, dearth, or the state of one who lacks a certain amount of material possessions or money (Merriam-Webster, 2016). It is a multifaceted concept,which includes social, economic, and political elements (Ricardo, S, 2008). Many definitions have been introduced, for instance, United Nations and World Bank. According to United Nations (2016), poverty is the inability of having choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to, not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living in marginal or fragile environments, without access to clean water or sanitation.

According to World Bank (2011), poverty is pronounced deprivation in well-being, and comprises many dimensions. It includes low incomes and the inability to acquire the basic goods and services necessary for survival with dignity. Poverty also encompasses low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of voice, and insufficient capacity and opportunity to better one's life.

Poverty may be defined as either absolute or relative. Absolute poverty refers to a set standard which is consistent over time and between countries. First introduced in 1990, the dollar a day poverty line measured absolute poverty by the standards of the world's poorest countries. The World Bankdefined the new international poverty line as $1.25 a day in 2008 for 2005 (Martin R, *et al,* 2008). In October 2015, they reset it to $1.90 a day.

The poverty line threshold of $1.90 per day, as set by the World Bank, is a bit controversial. Each nation has its own threshold for absolute poverty line; in the United States, for example, the absolute poverty line was US$15.15 per day in 2010 (US$22,000 per year for a family of four), while in India it was US$1.0 per day, in Indonesia the poverty line was equat to US$ 0.84 per day and in China the absolute poverty line was US$0.55 per day, each on PPP basis in the year of 2010.

Absolute poverty, extreme poverty, or abject poverty is "a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services". The term of "absolute poverty" is usually synonymous with "extreme poverty". Robert McNamara, the former president of the World Bank, described absolute or extreme poverty as, "a condition so limited by malnutrition, illiteracy, disease, squalid surroundings, high infant mortality, and low expectancy as to be beneath any reasonable definition of human decency" (Raphael, D., 2009).

Relative poverty views poverty as socially defined and dependent on social context, hence relative poverty is a measure of income inequality. Usually, relative poverty is measured as the percentage of the population with income less than some fixed proportion of median income. There are several other different income inequality metrics, for example, the Gini coefficient or the Theil Index. Relative poverty measure is used by the United Nations Development Program (UNDP), the United Nations Children's Fund(UNICEF), the Organisation for Economic Co-operation and Development (OECD) and Canadian poverty researchers OECD, 2008). In the European Union, the "relative poverty measure is the most prominent and most–quoted of the EU social inclusion indicators (Marx, & van den Bosch,2016).

Various poverty reduction strategies are broadly categorized here based on whether they make more of the basic human needs available or whether they increase the disposable income needed to purchase those needs. Some strategies such as building roads can both bring access to various basic needs, such as fertilizer or healthcare from urban areas, as well as increase incomes, by bringing better access to urban markets. In case of Indonesia, during Yudhoyono administration (2004-2013) there were three major clusters of poverty reduction programs. First, the social assistance cluster of government's poverty reduction programs including protecting staple food consumption of the poor, protecting health of the poor, protecting education of the poor and protecting financial liquidity of the poor. Second, the community empowerment cluster of government's policy reduction. Third, the micro-enterprise empowerment cluster government's policy reduction programs (Asep Suryahadi*, at. al.,* 2010). Efforts to reduce poverty related with other variables such as: economic growth, unemployment, and technological progress.

b. Economic Growth

Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in realgross domestic product, or real GDP, usually in per capita terms (IMF, 2012).Growth is usually calculated in *real* terms – i.e., inflation-adjusted terms – to eliminate the distorting effect of inflation on the price of goods produced. Measurement of economic growth uses national income accounting (Bjork, G.J., 1999). Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The "rate of economic growth" refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use (is called extensive growth (Bjork, G.J., 1999).

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, G.J., 1999).Solow-Swan Model developed by Robert Sollow (1956) and Trevor Swan (1956), Endogenous Growth Theory which focus on what increases human capital or technological progress (Helpman, 2004), Unified Growth Theory developed by Oded Galor (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P.,2002), Institutions and Growth Theory (Acemoglu, D.,*et al*, 2001),Human Capital and Growth Theory (Barro, R. J., & Lee J.W., 2001).

c. Unemployment

Unemployment occurs when people who are without work are actively seeking paid work (ILO, 1982). The unemployment rate is a measure of the prevalence of unemployment and it is calculated as a percentage by dividing the number of unemployed individuals by all individuals currently in the labor force. During periods of recession, an economy usually experiences a relatively high unemployment rate (The Saylor Foundation, 2012).

Theories of unemployment include: Classical unemployment theory (Vedder, R. & Gallaway, L., 1997), Cyclical unemployment theory (Harris, S. E., 2005),Marxian theory of unemployment (Marx, K, 2009),Structural unemployment theory (Marx, K, 2009), and Frictional unemployment theory (Marx, K, 2009).Unemployment and economic growth are dependent on one another in many ways, and often times unemployment leads to slower economic growth. Since unemployment is very dependent on economic activity, when economic activity is high there is increased production and a healthy demand for individuals to help produce higher amounts of services and goods. Unemployment usually has negative corellation with economic growth.

Unemployment and poverty are the two major challenges that are facing the world economy at present. Unemployment leads to financial crisis and reduces the overall purchasing capacity of a nation. Unemployment, theoritically, has a positive corellation with poverty.

d. Technological progress

Technological progress, technological development, technological achievement, or technological progress is the overall process of invention, innovation and diffusion of technology or processes. In essence technological progress is the invention of technologies and their commercialization via research and development, the continual improvement of technologies, and the diffusion of technologies throughout industry or society. In short, technological progress is based on both better and more technology (Jaffe et al., 2002). Ineconomics, change in a production function that alters the relationship between inputs and outputs. Normally it is understood to be an improvement in technology, or technological progress. Technological progress is a change in the set of feasible production possibilities (Hicks, J.R., 1963).

(1). Technological progress and economic growth

Technological progress and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Anonymous, 2017).

It has been observed that major part of increased productivity is due to technological progresss. Technological progress is one of the most important determinants of the shape and evolution of the economy. Technological progress has improved working conditions, permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded as primary source in economic development and the various technological progresss contribute significantly in the development of underdeveloped countries (Anonymous, 2017).

The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased. On the one hand, consumption of the household rises, while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases (Anonymous, 2017).

(2). Technological progress and unemployment

Technological progress may produce short-run employment-adjustment problems overstate those problems. They also often fail to mention that the short-run unemployment that occurs is primarily the result of artificial imperfections in certain labor and product markets. The amount of short-run unemployment created by advancing technology is directly related to the degree of artificiality in the particular labor markets affected. It will be argued that the workers harmed by technological advancement are those who have been receiving wages in excess of the amount they would receive in a fully competitive labor market (Mabry, R.H. & Sharplin, A.D, 1986). Even though technological progress may adversely affect the demand for labor in some labor markets, the overall effect of technological progress on total employment may be positive. Technological progress tends to increase the rate of economic growth. Higher rates of economic growth are generally associated with lower unemployment rates. Baumol, W.J., & Wolff, E.N., (1998) addressed the issue of structural unemployment that results from a more rapid pace of technological progress. They note that a higher rate of technological progress generally results in higher rates of structural unemployment. Technological progress tends to create more jobs than are lost (OECD, 2016).

3. Methods

In analyzing direct and indirect impacts of technological progress on poverty reduction, this study employed path analysis model, which was developed in 1918 by Sewall Wright (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics. Basically, the path model can be used to analysis two types of impacts: direct and indirect impacts. The total impacts of exogenous variables were the multiplication of the coefficient on the path (Alwin, D.F., & Hauser, R.M., 1975). In this study the path model is depicted in Figure 17.1: where technological progress, unemployment and were the exogenous variables. How does technological progress influence poverty reduction?

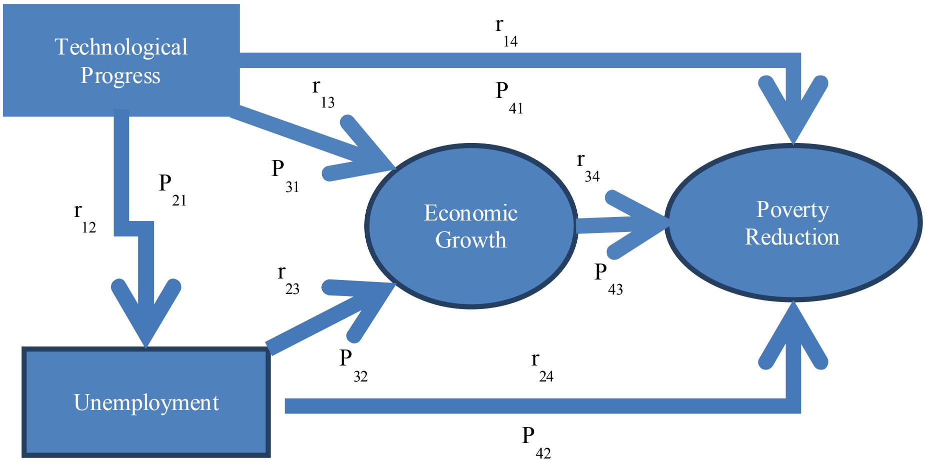

Figure 17.1

Model for Analyzing Impact of Technological Progress on Poverty Reduction.

Direct impact of technological progress on poverty reduction would be analyzed using Path-1, hyphotezing that technological progress has direct impact on poverty reduction. The path coefficient would be calculated as P_{41}. Indirect impact of technological progress on poverty reduction would be examined through Path-2, proofing thattechnological progress has indirect impact on poverty reduction, via economic growth. The indirect path coefficient P_{41} would be calculates as P_{43} x P_{31}. Indirect impact of technological progress on poverty reduction would be examined through Path-3, that technological progress has indirect impact on poverty reduction, via economic growth and unemployment. The indirect path coefficient P_{41} calculated as multiplication of P_{43} x P_{32} x P_{21}. Finally, the indirect impact of technological progress on poverty reduction through Path-4, technological progress has indirect impact on poverty reduction, via unemployment. The path coefficient P_{41} calculated as multiplication of P_{42} x $P_{21.}$

Calculation of path coefficients employing the following path equation[2]:

1. $r_{12} = P_{21}$
2. $r_{13} = P_{31} + P_{32}\, r_{12}$
3. $r_{23} = P_{31}\, r_{12} + P_{32}$
4. $r_{14} = P_{41} + P_{42}\, r_{12} + P_{43}\, r_{13}$

[2] http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

5. $r_{24} = P_{41}\, r_{12} + P_{42} + P_{43}\, r_{23}$
6. $r_{34} = P_{41}\, r_{13} + P_{42}\, r_{23} + P_{43}$

As coefficients of correlation (r_{14}, r_{24}, r_{34}, r_{13}, r_{23}, and r_{12}) can be calculated provided data of technological change, unemployment, economic growth and percentage of the poor are available. The path equation can be solved simultaneously, so that path coefficients of P_{41}, P_{42}, P_{43}, P_{31}, P_{32}, P_{21}) could easily be calculated.

Data needed to examine the impact of technological progress on poverty reduction, with unemployment and economic growth as intervening variables were : 1. total factor productivity growth (%) as indicator of technological progress, 2. percentage of poor people (%) to measure poverty reduction, 3. the rate of open unemployment (%) and 4. the growth of Gross Domestic Product (%) to measure economic growth.

Except data on the growth of total factor productivity, all data were gathered from National Statistics Agency. Data source on total factor productivity was from a study project conducted by the Agency for Assessment and Application of Technology entitle The Role of Technology in Indonesia Economic Growth (Prihawantoro, *et al*, 2010).

4. Results and Discussions

Correlation coefficients among variables were calculated and the results were presented in Table 1. Correlation between technological progress and unemployment, noted as r_{12}, correlation between technological progress and economic noted as r_{13} and correlation between technological progress and poverty reduction, noted as r_{14}, correlation between unemployment and economic growth, noted as r_{23} and correlation between unemployment and poverty reduction, noted as r_{24}, and correlation between economic growth and poverty reduction noted as r_{34}. From Table 1, we can read that correlation coefficient between technological progress and unemployment, $r_{12} = 0.34$ means that correlation between technological progress and unemployment was positive and categorized as weak relation. Technological progress had positive correlation with unemployment. How was the impact of technological progress on unemployment rate?

From equation 1, $P_{21} = r_{12}$, means that the impact of technological progress on unemployment was 0.34. As $0.34 > 0.05$, technological progress has significant impact on unemployment. It means that if technological progress increase then it would increase the rate of unemployment; 1 per cent increase in technological progress will increase 0.34 per cent of unemployment rate. This empirical evidence supported theory hypothesizing that technological progress would lessen employment opportunity.

The correlation coefficient between technological progress and economic growth r_{13} was 0.63, a positive strong correlation. Solving equation 2 and equation 3 simultaneously, P_{31}, was calculated equal to 0.80. It means that the impact of technological progress on economic growth was positive and significant as $P_{31} > 0.05$. One percent increase of technological progress would increase economic growth as 0.80 per cent. This empirical evidence supported theoretical frame that technological progress increase economic growth.

Table 17.1

Results of Analysis Correlation Coefficients

Correlation Coefficients	Technological Progress (%)	Unemployment Rate (%)	Economic Growth (%)	The Poor People (%)
Technological Progress (%)	1.00	-	-	-
Unemployment Rate (%)	0.34	1.00	-	-
Economic Growth (%)	0.63	-0.22	1.00	-
The Poor People (%)	0.30	0.96	-0.23	1.00

The coefficient correlation between technological progress and poverty reduction, r_{14}, was 0.30, a weak positive correlation. It might comply with the theory, saying that technology could handle the poverty problems. Unfortunately, the direct impact was not statistically significant as the path coefficient, P_{41} = 0.02, was less than 0.05.

Correlation between unemployment and economic growth was negative, r_{23} = -0.22, a weak negative correlation. An increase the rate of unemployment will decrease the economic growth. Meanwhile, correlation between unemployment and poverty reduction was positive and significant. It means that the higher unemployment rate, the more the percentage of the poor. It is in line with the theory. The impact of unemployment on economic growth was negative and significant, as P_{32}> = [-0.50] > 0.05. On the other hand, the impact of unemployment on poverty reduction was positive and significant, P_{42} = 0.81.

Correlation between economic growth and percentage of the poor was also negative and weak as r_{34} = -0.23. Economic growth made the percentage of the poor declined. The path coefficient, P_{43} was -0.33. It means that the impact of economic growth on poverty reduction statistically significant as P_{43} = -0.33I > 0.05. One percent increase in economic growth will reduce the percentage of the poor 0.33 per cent.

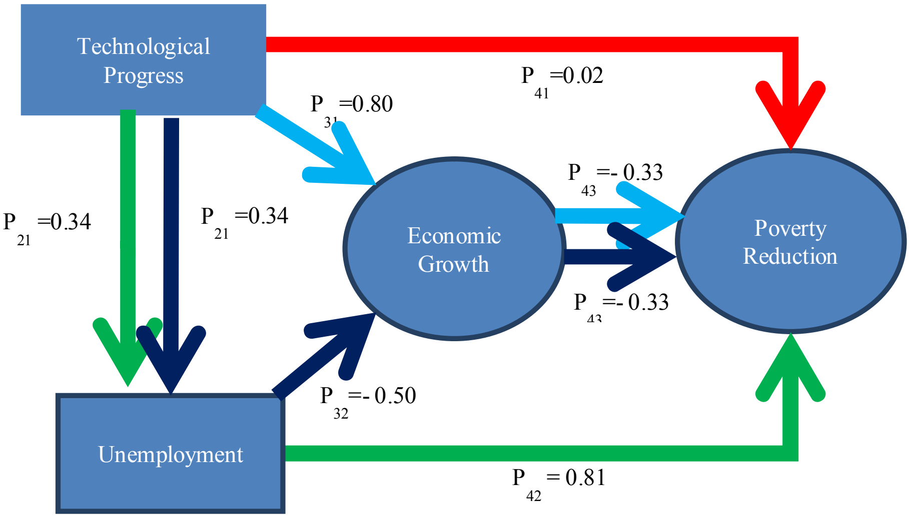

Figure 17.2

Path Coefficients: Direct and Indirect Impact of Technological progress on Poverty Reduction

Figure 17.2 presents the path coefficients and therefore give evidences of the hypothesis on the impact of technological change on poverty reduction; direct and indirect. In Path-1, technological progress had positive direct impact on poverty reduction. But this impact was not statistically significant as P_{41} =0.02, which was less than 0.05. In Path-2, technological progress had negative indirect impact, through economic growth, on poverty reduction. This negative indirect impact was statistically significant as P_{43} x P_{31} = (-0.33 x 0.80) = $|-0.26|$ > 0.05.

In Path-3, technological progress had positive indirect impact, through economic growth and unemployment, on poverty reduction. This positive indirect impact was statistically significant as P_{43} x P_{32} x P_{21}= (-0.33 x -0.5 x 0.34) = 0.06 > 0.05. Finally, in Path-4, technological progress had positive indirect impact, through unemployment, on poverty reduction. This positive indirect impact was statistically significant as P_{42} x P_{21} = (0.81 x 0.34) =0.28 > 0.05.

5. Conclusion

From above discussion, it could be concluded that:

1. Directly, technological progress had a positive impact on poverty reduction. But this impact was not statistically significant, Path-1: P_{41}.
2. Indirectly, technological progress had a negative significant impact on poverty reduction, through, Path-2 :P_{43} x P_{31}.
3. Indirectly, technological progress had a positive significant impact on poverty reduction, through Path-3: (P_{43} x P_{32} x P_{21}).
4. Indirectly, technological progress had a positive significant impact on poverty reduction, through Path-4: (P_{42} x P_{21}).

References

Aghion, P., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality", **Econometrica**, 70(3): 855–882.

Alwin, D. F., and Hauser, R. M., (1975),"The Decomposition of Effects in Path Analysis", **American Sociological Review**, 40(1): 37-47.

Anonymous, (2014),**Jumlah Penduduk Miskin, Presentase Penduduk Miskin dan Garis Kemiskinan (Number of Poor, Percentage of the Poor and Poverty Line) 1970-2013,** Badan Pusat Statistik (National Statistic Agency), Jakarta.

http://bps.go.id/kemiskinan.

Anonymous, (2015),**Laju Pertumbuhan PDB Atas Dasar Harga Konstan 2000 Menurut Lapangan Usaha, (Growth of Domestic Product at 2000 Constant Price by Sector),**Badan Pusat Statistik (National Statistic Agency), Jakarta,http://bps.go.id/ekonomi.

Anonymous, (2016),**Tingkat Pengangguran Terbuka Menurut Provinsi (Open Unemployment Rate by Province) 1986 – 2015**, Badan Pusat Statistik (National Statistic Agency), Jakarta, http://bps.go.id/tenagakerja.

Anonymous,(2017),http://www.yourarticlelibrary.com/economics/technical-progress-and-economic-development/47501/

Asep Suryahadi, Athia Yumna, Umbu Reku Raya, Deswanto Marbun., (2010**), Review of Government's Poverty Reduction Strategies, Policies and Programs in Indonesia**,Research Report, The SMERU Research Institute, Jakarta.

Asian Development Bank, (2001),**Growth and Poverty Alleviation: Lessons from Development Experience,** Available at ADB on line http://www.adb.org/ publications/growth-and-poverty-alleviation-lessons-development-experience and http://www.studymode.com/essays/Economic-Growth-And-Poverty-Alleviation-43775731.html

Baker, D., (2014),**The Full Employment Route to Poverty Reduction**, Available at http://billmoyers.com/2014/06/13/the-full-employment-route-to-poverty-reduction/

Bappenas, (2009),**Laporan Penyelenggaraan Musrenbangnas RPJMN 2010–2014di Jakarta pada Desember 2009**, [*Minutes on National Development Consultation for Mid-term National Development Plan 2010–2014*, Jakarta [online 26 February 2010]

Barro, R. J. and Lee J.W., (2001), "International data on educational attainment: Updates and implications", **Oxford Economic Papers**, 53 (3): 541–563.

Baumol, W. J., and Wolff, E.N., (1998), "Side Effects of Progress",**Public Policy Brief**,Available at http://www.levy.org/docs/hili/41a.html.

Besley and Cord, (2007),**Delivering on the Promise of Pro-Poor Growth: Insights and Lessons from Country Experience,** World Bank, Washington DC.

Bhide, S. and Kapur M.A., (2008), "Economic Growth and Poverty Dynamics", **CPRC Working Paper No. 120**, Chronic Poverty Research Centre, London, ISBN: 978-1-906433-21-5, 33 pp: 2008.

Bjork, G.J., (1999),**The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport, CT; London.

Helpman, E., (2004),**The Mystery of Economic Growth,**Harvard University Press, Harvard.

Galor O., (2005),"From Stagnation to Growth: Unified Growth Theory", **Handbook of Economic Growth**, Elsevier.

Harris, S. E., (2005),**The New Economics: Keynes' Influence on Theory and**

Public Policy, Kessinger Publishing, Whitefish MT, United States.

Hicks, J.R., (1963),***The Theory of Wages,*** 2nd Edition, Macmillan.

Hippolyte, F., (2008), "Technology trap and poverty trap in Sub-Saharan Africa",***Policy Research WorkingPaper No. WPS 4582,***World Bank, Washington,

http://documents.worldbank.org/curated/en/169021468198874707/ Technology-trap-and-poverty-trap-in-Sub-Saharan-Africa.

ILO, (2016),"Resolution concerning statistics of the economically active population, employment, unemployment, and underemployment", Adopted by **the Thirteenth International Conference of Labor Statisticians** 1982,Retrieved 26 July 2016.

Janvry, A, Graff, G, Sadoulet, E, and Zilberman, D., (2005), "Technological Change in Agriculture and Poverty Reduction: The Potential Role of Biotechnology", in **Agricultural Biodiversity and Biotechnology in Economic Development**, Volume 27 of the series *Natural Resource Management and Policy*: 361-386

Jerome, H., (1934), **Mechanization in Industry**, National Bureau of Economic Research.

Merriem-Webster Dictionary,Retrieved on 3 January, 2017. https://www.merriam-webster.com/

Mabry, R. H, and Sharplin, A.D., (1986) "Does More Technology Create Unemployment?" **Cato Institute Policy Analysis No. 68**.

Martin, R., Chen, S., and Prem, S., (2016),**A Dollar A Day Revisited**, The World Bank, Washington DC,Retrieved 10 Augustus 2016.

Marx, Karl, (2009),**Capital: An Abridged Edition**, Edited by David McLellan, Oxford Paperbacks, Oxford, UK.

Marx, I., and van den Bosch, K., (2016), "How poverty differs from inequality on poverty management in an enlarged EU context: Conventional and alternate approaches",**Centre for Social Policy**, Antwerp, Belgium. Available and retrived http://ec.europa.eu/eurostat/documents/1001617/4577263/1-1-I-MARX.pdf

OECD, (2016), "The OECD Jobs Study: Facts, Analysis, and Strategies", Retrieved on 16 August 2016. http://www1.oecd.org/sge/min/job94/part2c.htm

OECD and ADB,(2002),"Technology and Poverty Reduction in Asia and the Pacific"**Development Centre Seminars, OECD Development Centre.** Available at http://www.oecd-ilibrary.org/development/technology-and-poverty-reduction-in-asia-and-the-pacific_9789264176171-en.

Oyewale, F., and Musiliu B.A., (2015), "Empirical assessment of economic growth on poverty reduction in Nigeria",**American Journal of Economics,** 5(6): 565-573.

Raphael, D., (2009), "Poverty, Human Development, and Health in Canada: Research, Practice, and Advocacy Dilemmas", **Canadian Journal of Nursing Research (CJNR),**41 (2): 7–18.

Ricardo, S., (2008), "The Impact of Lifelong Learning on Poverty Reduction", **IFLL Public Value Paper 1**, Latimer Trend, Plymouth, UK.

Richard, A.H. Jr., (2003), "Economic Growth, Inequality, and Poverty: Findings from a New Data Set",**Policy Research Working Paper**, World Bank Group. Available at http://www.economywatch.com/unemployment/poverty.html

Prihawantoro, S., Alkadri, Mien Askinatin, Andi Tabrani, Supomo and Abdul Azis Wasil, (2010),**Peranan Teknologi Dalam Pertumbuhan Ekonomi Indonesia, (*The Role of Technology in Indonesian Economic Growth*),**Pusat Pengkajian Kebijakan Inovasi Teknologi (*Centre for Innovation Technology Policy*), Badan Pengkajian dan Penerapan Teknologi (*The Agency for the Assessment and Application of Technology)*, Jakarta.

Solow, R.M., (1956), "A Contribution to the Theory of Economic Growth",**Quarterly Journal of Economics,** 70(1):65-94, 1956.

Swan, T.W., (1956), "Economic Growth and Capital Accumulation",**Economic Record**, 32: 334–61.

The Saylor Foundation, (2016),Unemployment Rate, pp: 1, Retrieved 20 June 2016.

UN (2016),"Indicators of Poverty & Hunger",**United Nations***,*Retrieved 14 Augustus 2016.

UNDP, (2008),"Capacity Development: Empowering People and Institutions",**Human Development Report**, Geneva.

Vedder, R. and Gallaway, L., (1997)**,Out of Work: Unemployment and Government in the Twentieth-Century America,** New York University

Press, New York.

Word Bank, (2011),**Poverty and Inequality Analysis**,Worldbank.org. Retrieved on 27 May 2016.

Wright, S., (1921),"Correlation and Causation",**Journal Agricultural Research**, 20: 557-585.

Wright, S., (1934), "The Method of Path Coefficients",**Annals of Mathematical Statistics**, 5(3): 161-215, DOI:10.1214/aoms/1177732676.

Chapter-18

The Contribution of Technology on Indonesia Economy[1]

Ringkasan

Bab ini melaporkan hasil riset yang bertujuan untuk analisis kontribusi teknologi dalam perekonomian Indonesia pada tingkat nasional, sektoral dan spasial. Teknik perhitungan dekomposisi pertumbuhan digunakan untuk menghitung kontribusi faktor produksi dalam perekonomian. Hasil analisis menunjukkan bahwa, secara rata-rata, kontribusi teknologi dalam perekonomian Indonesia, dalam arti pertumbuhan TFP, terlalu rendah (8.79%) jika dibandingkan dengan pertumbuhan TFP negara-negara lain, khususnya negara-negara maju. Bahkan jika dibandingkan dengan kontribusi faktor produksi lain seperti modal (74.1%) dan tenaga kerja (17.1%). Secara sektoral, kontribusi teknologi dalam perekonomian Indonesia beragam antar sektor. Yang paling tinggi kontribusinya adalah sektor Jasa lain (72.6%) dan Industri manufaktur (52.6%). Yang paling rendah bahkan kontribusinya negative adalah sektor Pertanian (-55.1%) dan Jasa Keuangan, Sewa dan Korporat (-38.7%). Secara spasial, kontribusi teknologi dalam perekonomian Indonesia juga beragam. Yang paling tinggi adalah kontribusi pulau Jawa (47.9%) dan pulau Bali-Nusa Tenggara (30.4%). Yang paling rendah dan bahkan kontribusinya negative adalah pulau Maluku-Papua (-95.4%) dan pulau Kalimantan (-24.7%).

Summary

This chapter reports a research that aimed to analysis the contribution of technology on Indonesian economy at national, sectoral and spatial perspectives.

[1] This chapter has been published in **International Journal of Advanced Research**, cited as Muchdie, Prihawantoro S., Alkadri, and Sugema, (2016), "The Contribution of Technology on Indonesian Economy: National, Sectoral and Spatial Perspectives", **Int. J. Adv. Res.**, ISSN: 2320-5407, 4(11): 2149-2156, DOI:10.21474/IJAR01/2319, http://repository.uhamka.ac.id/142/; http://www.journalijar.com/article/13565/the-contribution-of-technology-on-indonesian-economy:-national,-sectoral-and-spatial-perspectives./; https://www.researchgate.net/publication/311545994;

Growth accounting decomposition technique was employed to calculate the contribution of factors production in the economy. The results showed that, on average, technology contribution to Indonesian economy, in term of TFP growth, was too small (8.79%) if compared to the TFP growth of other countries, especially in the developed countries. Even if compared with the contribution of other factors contribution, such as capital (74.1%) and labor (17.1%). Sectorally, the contribution of technology on Indonesian economy varied among sector. The highest and gave positive contribution were Other Services (72.6%) and Manufacturing (52.6%). The lowest and gave negative contribution were Agriculture (-55.1%) and Financial, Rental and Corporate Services (-38.7%). Spatially, the contribution of technology on Indonesian economy also varied. The highest and gave positive contribution were the Island of Java (47.9%) and Bali-Nusa Tenggara Island (30.4%). The lowest and gave negative contributions were Maluku-Papua Islands (-95.4%) and Kalimantan Island (-24.7%).

1. Introduction

Indonesia is one of the largest economies in Southeast Asia and is one of the emerging market economies of the world. The country is also a member of G-20 major economies and classified as a newly industrialized country. It is the sixteenth largest economy in the world by nominal GDP and is the eighth largest in terms of GDP (PPP). Indonesia still depends on domestic market, and government budget spending and its ownership of state-owned enterprises and the administration of prices of a range of basic goods including, rice, and electricity plays a significant role in Indonesia market economy, but since the 1990s, 80 percent of the economy has been controlled by private Indonesians and foreign companies. In the aftermath of the financial and economic crisis that began in mid1997 the government took custody of a significant portion of private sector assets through acquisition of nonperforming bank loans and corporate assets through the debt restructuring process and the companies in custody has been sold out by privatization several years later. Since 1999 the economy has recovered and growth hasaccelerated to over 4–6% in recent years; Indonesian economy grows on average at 5.06 per cent per year at period between 1967- 2011 (Prihawantoro, et al, 2013).

Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real

GDP, usually in per capita terms. Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Measurement of economic growth uses national income accounting (Bjork, G, J., 1999).

Economic growth has traditionally been attributed to the accumulation of human and physical capital and the increase in productivity arising from technological innovation (Lucas, R. E. 1988). Before industrialization technological progress resulted in an increase in the population, which was kept in check by food supply and other resources, which acted to limit per capita income, a condition known as the Malthusian trap (Galor, O, 2005; Clark, G., 2007). The rapid economic growth that occurred during the Industrial Revolution was remarkable because it was in excess of population growth, providing an escape from the Malthusian trap (Clark, G., 2007). Countries that industrialized eventually saw their population growth slow-down, a phenomenon known as the demographic transition.Most of the economic growth in the 20th century was due to increased output per unit of labor, materials, energy, and land (less input per widget). The balance of the growth in output has come from using more inputs. Both of these changes increase output. The increased output included more of the same goods produced previously and new goods and services (Kendrick, J. W. 1961). During the Industrial Revolution, mechanization began to replace hand methods in manufacturing, and new processes streamlined production of chemicals, iron, steel, and other products (Landes, D, S.,1969). Machine tools made the economical production of metal parts possible, so that parts could be interchangeable (Hounshell, D, A., 1984)

In Ricardian economics, the theory of production and the theory of growth are based on the theory or law of variable proportions, whereby increasing either of the factors of production (labor or capital), while holding the other constant and assuming no technological change, will increase output, but at a diminishing rate that eventually will approach zero. These concepts have their origins in Thomas Malthus's theorizing about agriculture. Malthus's examples included the number of seeds harvested relative to the number of seeds planted (capital) on a plot of land and the size of the harvest from a plot of land versus the number of workers employed (Bjork, G, J, 1999). Solow, R, M., (1956) and Swan, T. W., (1956) developed what eventually became the main model used in growth economics in the 1950s. This model assumes that there are diminishing returns to capital and labor. Capital accumulates through investment, but its level or stock continually decreases due to depreciation. Due to the diminishing returns to capital, with increases in capital/worker and absent technological progress, economic output/worker eventually reaches a point where capital per worker and economic output/worker remains constant because annual investment in capital equals annual depreciation.The Solow-Swan model is considered an exogenous growth model because it does not explain why countries invest different shares of GDP in capital nor why technology improves over time. Instead the rate of investment and the rate of technological progress are exogenous. The value of the model is that it predicts the pattern of economic growth once these two rates are specified. Its failure to explain the determinants of these rates is one of its limitations.

Unsatisfied with the assumption of exogenous technological progress in the Solow-Swan model, economists worked to endogenize technology in the 1980s. They developed the endogenous growth theory that includes a mathematical explanation of technological advancement (Lucas, 1988). This model also incorporated a new concept of human capital, the skills and knowledge that make workers productive. Unlike physical capital, human capital has increasing rates of return. Research done in this area has focused on what increases human capital, for instanceeducation or technological change, for exampleinnovation (Helpman, E., 2004). Three sources of economic growth were capital accumulation growth, labour growth and technological progress.

Solow's (1957) paper was a landmark in the development of growth accounting. It was not the first paper to make an explicit decomposition of the sources of growth into contributions from factor inputs and from output per unit of total input. This had been done several times since the pioneering paper by Fabricant (1954), and with more detail, by Abramovitz (1956), and Kendrick (1961).But it was Solow (1957) that put the growth economics into growth accounting making clear its interpretation in terms of the distinction between shifts of and moves along the aggregate production function. Another major development in the practice of growth accounting was the publication of Jorgenson and Griliches (1967). These authors made revisions to the crude measure of TFP that reduced it from1.6 to 0.1 per cent per year for the United States during 1945-1965. They focused on the measurement of capital services and produced a much more sophisticated index of capital input growth while also correcting labour quality for changes in education in a conceptually similar way to Denison (1962).

Previousresearch on technology contribution, using growth accounting method that have been published, among others, by Carre et al., (1975) on France, Ohkawa and Rosovsky (1972) on Japan, and Matthews et al. (1982) for the UK together with a succession of papers from the study of the United States culminating in Abramovitz &David (2001). As further useable historical national income accounts have become available, the country coverage of longrun historical growth accounting has expanded and papers in this tradition continue to be published. In recent years, these have included Schulze (2007) on Austria-Hungary, Lains (2003) on Portugal, and Prados de la Escosura &Roses (2007) on Spain.

Employing growth accounting method, the objective of this paper is to analysis on the contribution of technology on Indonesian economy at national, sectoral and spatialperspectives.

2. Method of Analysis

The method for calculating TFP, as a measure of technology contribution, in this research was growth accounting method. This method has been used in many countries to calculate TFP. So the results can easily be compared with other countries. Using the production function of Cobb-Douglas, as:

$$Q_t = A_t F(K_t L_t) \tag{1}$$

where Q_t is output in year-t, $K_t$is Capital and L_t is Labor. Hananto Sigit (2004) calculated TFP with formulating trans-log production function as:

$$lnQ_t = ln\alpha_0 + \alpha_t T + \alpha_k lnK_t + \alpha_l lnL_t + \tfrac{1}{2}\beta_{kk}(lnK_t)^2 + \beta_{kl} lnK_t lnL_t + \tfrac{1}{2}\beta_{ll}(lnL_t)^2 + \beta_{kT} TlnK_t + \beta_{Tl} TlnL_t + \tfrac{1}{2}\beta_{TT} T^2 \tag{2}$$

If equation (2), differentiated toward time, then :

$$Q_t^* = \alpha_t + \alpha_k K_t^* + \alpha_l L_t^* + \beta_{kk}(lnK_t) K_t^* + \beta_{lk}(K_t^* lnL_t + L_t^* ln K_t) + \beta_{ll}(lnL_t) L_t^* + \beta_{kT}(TK_t^* + lnK_t) + \beta_{lT}(TL_t^* + lnL_t) + \beta_{TT} T \tag{3}$$

Equation (3) is a growth equation. Start notasion, *, indicate a continum growth. Equation (3) can be rewritten as

$$Q_t^* = TFP_t^* + S_k K_t^* + S_l L_t^* \tag{4}$$

Based on equation (4), the value of TFP can be calculated. As the equation (4) is a continum equation, but the values needed are discrit TFP then the equation of TFP growth reformulated as:

$$TFPG_t = \tfrac{1}{2}(TFP_t^* + TFP_{t-1}^*)$$

$$= (lnQ_t - lnQ_{t-1}) - ½ (S_{kt} + S_{kt-1})(ln\ K_t - lnK_{t-1})$$
$$- ½ (S_{lt} + S_{lt-1})(lnL_t - lnL_{t-1}) \quad (5)$$

With the equation (5), the TFP growth at year can easily be calculated.

Data needed for this study were: 1. Gross Domestic Product and/or Gross Regional Domestic Product, 2. Capital Stock, 3. Labour, 4. Wage/Salary, and 5. Depreciation. Data adjusted by excluding indirect tax, so data of GDP and or GRDP are data at factors cost. For national analysis data are available for the year of 1967-2011, for sectoral analysis data are available for the year of 1977-2007 and for spatial analysis data are available for year 202-2010.

After data adjustment process, steps in calculation TFP growth using *growth accounting method* are as follows:

1. Calculate labor income share year-t (LIS_t) with formula :

$$LIS_t = \frac{Wage/Salary\ at\ year\text{-}\ t}{GDP\ year\text{-}\ t} \quad (6)$$

2. Calculate average labor income share at year-t *($LISA_t$)*:

$$LISA_t = ½ (LIS_t + LIS_{t-1}) \quad (7)$$

where:

LIS_t = Labor income share at year-t

LIS_{t-1} = Laborincome share at year t-1

3. Calculate capital income share at year-t (KIS_t) with formula:

$$KIS_t = 1 - LIS_t \quad (8)$$

4. Calculate average capital income shareat year- t ($KISA_t$):

$$KISA_t = ½ (KIS_t + KIS_{t-1}) \quad (9)$$

where:

KIS_t =Capital income share year-t

KIS_{t-1} =Capital income shareyear t-1

5. Calculate the rate of economic growth at year-t (EG_t):

$$EG_t = (ln\ GDP_t - ln\ GD_{t-1})\ x\ 100 \quad (10a)$$

where:

GDP_t = GDP at constant price at year-t

GDP_{t-1} = GDP at constant price at year t-1

For sectoral calculation:

$$SGi_t = (ln\ VAi_t - ln\ VAi_{t-1}) \times 100 \quad (10b)$$

where:

VAi_t = Value-Added sector i at constant price at year-t

VAi_{t-1} = Value-Added sector i at constant price at year t-1

6. Calculate the rate of capital stock growth at year -t (KG_t) :

$$KG_t = (ln\ K_t - ln\ K_{t-1}) \times 100 \quad (11)$$

where :

K_t = Capitak stock at year-t

K_{t-1} = Capital stock at yeat-t-1

7. Calculate weigthed average the growth rate of capital stock at year-t (KGA_t) :

$$KGA_t = ½\ (KIS_t + KIS_{t-1}) \times (ln\ K_t - ln\ K_{t-1}) \times 100 \quad (12)$$

8. Calculate the growth rate of labor at year-t (LG_t) :

$$LG_t = (ln\ L_t - ln\ L_{t-1}) \times 100 \quad (13)$$

where:

L_t = Labor at year-t

L_{t-1}= Labor at year- t-1

9. Calculate weigthed average of the labor growth at year-t (LGA_t) :

$$LGA_t = ½\ (LIS_t + LIS_{t-1}) \times (ln\ L_t - ln\ L_{t-1}) \times 100 \quad (14)$$

10. The growth rate of TFP at year-t ($TFPG_t$) can be calculated as follow:

$$TFPG_t = EG_t - KGA_t - LGA_t \quad (15)$$

Further more, contribution of factors such as labor, capital and TFP on economic growth are calculated as:

11. Contribution of capital $= \dfrac{\text{Equation (12)}}{\text{Equation (10)}}$ X 100 (16)
12. Contribution of labor $= \dfrac{\text{Equation (14)}}{\text{Equation (10)}}$ X 100 (17)
13. Contribution of TFP $= \dfrac{\text{Equation (15)}}{\text{Equation (10)}}$ X 100 (18)

3. Results and Discussions

Table 18.1

Contribution of Factors Production on Indonesian Economy, National Dimension, 1967-2011

Phase	Year	PDB Growth	Contribution to PDB Growth (%)		
			Capital	Labour	TFP
Oli Boom	1976-1981	7.62 (100%)	72,46	19,09	8,45
Recession	1982-1986	4.24 (100%)	161.42	33.94	-95,36
Deregulation	1987-1996	6.67 (100%)	72.15	17.05	10.80
Multi-crisis	1997-2001	-1.03 (100%)	21.86	3.82	74.32
Economic Revitalization	2002-2011	5.38 (100%)	59.62	14.08	26.30
Indonesia	1976-2011	5.06 (100%)	74.13	17.07	8.79

Source : Prihawantoro, S., et al (2013)

Table 18.1 presents the contribution of factors production in Indonesian economy at national level. On average Indonesian economy grows at 5.06 per cent per year for period 1976 to 2011. The highest economic growth happened at oil-boom phase (7.62%) that occurred between 1976-1981. Negative growth happened at multi-crisis phase (-1.03 %) that occurred between 1997-2001. Technology contribution, indicated by TFP, nationally was only 08.79 per cent. It was too small compared with the contribution of technology on American economy (26 % average from 1799-1979, and at private bussiness reached 52 per cent in raverage at period 1948-1996 as well as other advanced countries (Hulten, 2000). In Austria, Schulze (2007) found that technology contribution was 14.4 per cent in period of 1870-1890 and 30.5 per cent in 1891-1910. Broadberry (1998) reported that technology contribution to German economy was 32.3 per cent for the period of 1871-1991 and 33.5 per cent in period of 1892-1911. Craft (1995) and Mattews et al (1982) reported that contribution of technology on Great Britain economiy was, on average for period 1700-1913, 33.9 per cent. In Italy Rossi et al (1992) reported that TFP growth was 32.2 per cent for period of 1920-1973. As Kranzt and Schon (2007) reported, the contribution of technology on Sweeden economy was 22.3 per cent in the period of 1850-1973. This small percentage of technology contribution on Indonesian economy were also confirmed by other studies. For instance, Aswicahyono et.al. (1996) found that the TFP growth in the manufacturing sector was only positive for the periods 1976-1981, 1982-1985, and 1986-1991, findings which were also confirmed by Abimanyu (1995) and Osada (1994). It is also too small compared to contribution of labour (17.1%) and capital (74.1%). In recession phase, the contribution of technology on Indonesian economy was, even, negative (-95.36%). The highest contributuion of technology in Indonesian economy occurred in multi-crisis phase (74.32%) because of negative economic growth, followed by economic revitalization phase (26.3%) and oil-boom phase (8.45%).

Table 18.2

Contribution of Factors Production on Indonesian Economy, Sectoral Dimension, 1977-2007

Sector	PDB Growth	Contribution to PDB Growth (%)		
		Capital	Labour	TFP
Agriculture	3.14 (100%)	4.51 (143.6%)	0.36 (11.5%)	1.73 (-55.1%)
Minging and Quarrying	1.48 (100%)	-0.17 (-11.5%)	1.51 (102.0%)	0.14 (9.5%)
Manufacturing	8.26 (100%)	2.57 (31.1%)	1.35 (16.3%)	4.34 (52.6%)
Electricity, Gas and Drinking Water	9.87 (100%)	7.09 (71.8%)	3.08 (31.2%)	-0.30 (-3.0%)
Construction	6.30 (100%)	-0.21 (1-.3%)	6.21 (98.7%)	0.29 (4.6%)
Trade, Hotel and Restaurant	4.94 (100%)	5.29 (107.1%)	0.95 (19.2%)	-1.30 (-26.3%)
Transfortation and Communication	7.77 (100%)	3.63 (46.7%)	1.85 (23.8%)	2.29 (29.5%)
Financial, Rental and Services	7.02 (100%)	6.22 (88.6%)	3.52 (51.1%)	-2.71 (-38.7%)
Other Services	3.98 (100%)	-1.57 (-39.4%)	2.66 (66.7%)	2.89 (72.6%)
Indonesia	5.08 (100%)	2.79 (74.13%)	0.73 (17.07%)	1.56 (8.79%)

Source : Prihawantoro, S., et al (2013)

Sectorally, the contribution of technology on Indonesian economy for period of 1977-2007 is presented in Table 18.2. The highest contribution was occurred at Other Services (72.6%), followed by Manufacturing (52.6%) and Transportation and Communication (29.5%). Negative contribution occurred in Agriculture (-55.1%), followed by Financial, Rental and Corporate Service (-38.7%), Trade, Hotel and Restaurant (-26.3%) and Electricity, Gas and Drinking Water (-3.0%). In terms of the TFP by industry, Timmer (1999) estimated that TFP performance varied greatly across industries. During the period 1975-1981, TFP growth rates ranged from very high (12 %) in the wood industry to low (-5%) for chemicals. In 1982-1985, the basic metals industry performed best (14%), while TFP in nonmetallic minerals slumped (-8%). The log export ban seems to have had an adverse impact on efficiency in the wood industry, with TFP growth becoming negative (-2%). The period 1986-90 showed annual TFP growth rates of over 5 per cent for all industries except chemicals. Furthermore, between 1991 and 1995, TFP levels appeared to be rising very rapidly particularly for food, beverages, tobacco and the metal product and machinery industries, while there was a marked slump in the basic metal industry. Therefore, all industries - except chemicals and non-metallic minerals - experienced a TFP growth of at least 2 per cent between 1975 and 1995. The low level of TFP growth in the area of non-metallic minerals (especially cement manufacturing) was perhaps due to government regulations aimed at improving efficiency levels in this industry.

Table 18.3 provides results at regional perspective, based on 6 big Island aggregations. Technology contribution on Indonesian economy was 8.79%. Technology contribution varies among Island; there were positive contribution and negative contributions. There were two Islands in which the contributions of technology were negative, namely in Kalimantan (-0.24.7%) and in Maluku-Papua (-95.4%). Island with positive technological contributions were Sumatera (17.7%), Java (47.9%), Sulawesi (25.1%) and Bali-Nusa Tenggara (30.4%). Java Island had the highest of percentage in technology contribution on Indonesia economy. It is followed by Bali-Nusa Tenggara (30.4%), Sulawesi (25.1%) and Sumatera (17.7%). But, on average, the contribution of technology in Indonesian economy still very small.

Table 18.3

Contribution of Factors Production on Indonesian Economy, Regional Dimension, 2002-2010

Phase	PDB Growth	Contribution to PDB Growth (%)		
		Capital	Labour	TFP
Sumatera	4.57 (100%)	2.88 (63.0)	0.88 (19.3)	0.81 (17.7)
Java	5.42(100%)	2.30 (42.5)	0.52 (9.6)	2.60 (47.9)
Kalimantan	3.65 (100%)	3.92 (107.3)	0.64 (17.4)	-0.90 (-24.7)
Sulawesi	6.41 (100%)	3.69 (57.5)	1.11 (17.4)	1.61 (25.1)
Bali, Nusa Tenggara	5.01 (100%)	2.51 (50.2)	0.97 (19.4)	1.73 (30.4)
Maluku-Papua	3.42 (100%)	4.65 (135.9)	2.03 (59.5)	-3.26 (-95.4)
Indonesia	5.08 (100%)	2.79 (74.13)	0.73 (17.07)	1.56 (8.79)

Source: Prihawantoro, S., et al., (2013)

4. Conclusion

From the results, it could be concluded that, firstly, the contribution of technology on Indonesian economy (8.79%) was relatively small compared to the contribution of technology on developed countries. It also small compared to the contribution other factor of production, such as capital (74.13%) and labor (17.7%). Secondly, the contribution of technology on Indonesian economy sectorally varied from negative to positive. Negative contribution was given by Agriculture (-55.1%), Financial, Rental and Corporate Service (-38.7%), Trade, Hotel and Restaurant (-26.3%) and Electricity, Gas and Drinking Water (-3.0%). Positive contribution was given by Other Services (72.6%), Manufacturing (52.6%), Transportation and Communication (29.5%), Mining and Quarrying (9.5%) and Construction (4.6%). Thirdly, spatially the contribution of technology on Indonesian economy also varied among Island. Maluku-Papua Island give negative contribution (-95.4%) as well as Kalimantan Island (-24.7%). Other Island that contributes positively was Java Island (47.9%), Bali-Nusa Tenggara Island (30.4%), Sulawesi Island (25.1%) and Sumatera Island (17.7%).

References

Abimanyu, A., (1995), "The Indonesian Economy and Total factor Productivity", **Singapore Economic Review**, 40(1): 25-40.

Abramovitz, M. and David, P, A., (1973), "Reinterpreting Economic Growth: Parables and Realities", **American Economic Review Papers and Proceedings**, 63: 428-39.

Abramovitz, M., (1956), "Resource and Output Trends in the United States since 1870", **American Economic Review Papers and Proceedings**, 46: 5-23.

Albers, R., and Groote, P., (1996), "The Empirics of Growth", **De Economist,** 144: 429-444.

Aswicahyono, H., Bird, K., and Hal, H., (1996), " What Happens to Industrial Structure When Countries Liberalise? Indonesia since the Mid-1980s**", Journal of Development Studies**, 32(3): 340-363.

Bjork, G, J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport, CT, London, pp: 2, 67, ISBN: 07596532-5.

Broadberry, S.N., (1998), "How Did the United States and Germany Overtake

Britain? A Sectoral Analysis of Comparative Productivity Levels", **Journal of Economic History**, 58: 375-407.

Carre, J-J., Dubois, P., and Malinvaud, E., (1975),**French Economic Growth**, Stanford University Press, Stanford.

Clark, G., (2007), **A Farewell to Alms: A Brief Economic History of the World**, Princeton University Press, Princeton, ISBN: 978-0-691-12135-2.

Crafts, N., (1995),"Exogenous or Endogenous Growth? The Industrial Revolution Reconsidered", **Journal of Economic History**, 55: 745-772.

Denison, E. F., (1962),**The Sources of Economic Growth in the United States and the Alternatives Before Us**, Committee for Economic Development, New York.

Fabricant, S., (1954), "Economic Progress and Economic Change",**In NBER 34th Annual Report**, New York.

Galor, O., (2005),"From Stagnation to Growth: Unified Growth Theory",**Handbook of Economic Growth**, Elsevier, pp: 171–293.

Hananto, S., (2004),"Total Factor Productivity Growth: Survey Report", **Part II National Report on Indonesia**, APO, Tokyo.

Helpman, E., (2004),**The Mystery of Economic Growth**, Harvard University Press, Harvard.

Hounshell, D, A., (1984), **From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States**, Johns Hopkins University Press, Baltimore, Maryland, ISBN: 978-0-8018-2975-8, LCCN: 8301626.

Hulten, C. R., (2000), "Total Factor Productivity: A Short Biography", **Working Paper 7471**,National Bureau of Economic Research, Cambridge-Massachusset.

Jorgenson, D. W., and Griliches, Z., (1967), "The Explanation of Productivity Change"**Review of Economic Studies,** 34: 249-83.

Kendrick, J. W., (1961), **Productivity Trends in the United States,** Princeton University Press, Princeton.

Krantz, O. and Schon, L., (2007),**Swedish Historical National Accounts, 1800-2000**, Almqvist and Wiksell International, Lund.

Lains, P., (2003),"Catching Up to the European Core: Portuguese Economic Growth, 1910-1990",**Explorations in Economic History**, 40: 369-86.

Lucas, R. E., (1988), “On the mechanics of economic development”, **Journal of monetary economics,**22(1): 3–42

Matthews, R. C. O., Feinstein, C, H., and Odling-Smee, J.C., (1982),**British Economic Growth 1856-1973**,Stanford University Press, Stanford.

Ohkawa, K. and Rosovsky, H., (1972), **Japanese Economic Growth: Trend Acceleration in the Twentieth Century**, Stanford University Press, Stanford.

Osada, H., (1994),“Trade Liberalization and FDI Incentives in Indonesia: The Impact on Industrial Productivity”, **The Developing Economies**, 32(4),: 479-491.

Prados de la Escosura, L. and Roses, J., (2007), “The Sources of Long-Run Growth in Spain, 1850-2000”**,Discussion Paper No. 6189**, Centre for Economic Policy Research.

Prihawantoro, S., Alkadri, Mien Askinatin, Andi Tabrani, Supomo and Abdul Azis Wasil., (2009),**Peranan Teknologi Dalam Pertumbuhan Ekonomi Indonesia, (The Role of Technology in Indonesian Economic Growth)**, Pusat Pengkajian Kebijakan Inovasi Teknologi (Centre for Innovation Technology Policy), Badan Pengkajian dan Penerapan Teknologi (The Agency for the Assessment and Application of Technology), Jakarta.

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana (2013),**Peranan Teknologi Dalam Pertumbuhan Ekonomi Koridor–Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity**, Pusat Pengkajian Kebijakan Inovasi Teknologi (Centre for Innovation Technology Policy), Badan Pengkajian dan Penerapan Teknologi (The Agency for the Assessment and Application of Technology), Jakarta.

Rossi, N., Sorgato, A., and Toniolo, G., (1992),“Italian Historical Statistics, 1890-1990”,**Working Paper No. 18,** University of Venice Dipartimento di Scienze Economiche.

Schulze, M. S., (2007),“Origins of Catch-Up Failure: Comparative Productivity Growth in the Habsburg Empire, 1879-1910”, **European Review of Economic History,** 11: 189-218.

Solow, R. M., (1956),“A Contribution to the Theory of Economic Growth”, **Quarterly Journal of Economics**, 70(1): 65–94.

Solow, R. M., (1957), “Technical Change and the Aggregate Production Function”,

Review of Economics and Statistics, 39: 312-20.

Swan, T, W., (1956), "Economic Growth and Capital Accumulation", **Economic Record**, 32: 334–61, doi:10.1111/j.1475-4932.1956.tb00434.x.

Timmer, M.P., (1999), "Indonesia Ascent on the technology Ladder: Capital Stock and Total factor productivity in Indonesian Manufacturing, 1975-1995", **Bulletin of Indonesian Economic Studies**, 35(1): 75-97.

Chapter-19

Technology Contribution to Indonesian Regional Economy[1]

Ringkasan

Bab ini bertujuan untuk melaporkan hasil analisis kontribusi teknologi dalam perekonomian wilayah di Indonesia. Metoda "growth accounting" digunakan menggunakan data Produk Domestik Regional Bruto, akumulasi modal wilayah/provinsi dan tenaga kerja wilayah/provinsi tahun 2001-2010. Kontribusi faktor-faktor produksi dan kontribusi teknologi dalam perekonomian wilayah di Indonesia dianalisis dan disajikan. Hasil analisis memperlihatkan bahwa kontribusi teknologi dalam perekonomian Indonesia, secara rata-rata pada periode 2002-2010, pada tingkat nasional sebesar 24.4 persen. Secara spasial, kontribusi teknologi dalam perekonomian wilayah bervariasi antar pulau dan juga antar provinsi. Kontribusi tertinggi oleh pulau Jawa (39.77%) diikuti oleh kepulauan Bali-Nusa Tenggara (35.39%). Kontribusi terendah oleh pulau Kalimantan (12.82%). Di pulau Jawa, kontribusi tertinggi oleh Provinsi Jawa Timur (49.63%) dan yang terendah di Daerah Istimewa Yogyakarta (28.35%). Di kepulauan Bali-Nusa Tenggara, kontribusi tertinggi di Provinsi Nusa Tenggara Timur (51.71%), dan yang terendah di Provinsi (25.89%). Di pulau Kalimantan, kontribusi tertinggi di Provinsi Kalimantan Barat (41.91%) dan yang terendah di Provinsi Kalimantan Selatan (24.25%).

Summary

This chapter reports a research that aimed to analyze the contribution of technology to Indonesian regional economy. Growth accounting method was employed using data on GDRP, regional/provincial capital accumulation and

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regional/provincial employment from during the year of 2002 to 2010. The contribution of factors and technology to Indonesian regional economy were analyzed and presented. The results show that the contribution of technology to Indonesian economy, on average during 2002-2010 at national level, was 24.4 per cent. Spatially, the contribution of technology to Indonesian regional economy varies among Island as well as among provinces within island. The highest contribution of technology was by Java Island (39.77%) followed by Bali-Nusa Tenggara Island (35.39%). The lowest technology contribution was in Kalimantan Island (12.82%). In Java Island, the highest contribution of technology was in the East Java Province (49.63%) and the lowest contribution was in the Special Province of Yogyakarta (28.35%). In Bali-Nusa Tenggara, the highest contribution of technology was in East Nusa Tenggara Province (51.71%), and the lowest contribution was in the Province of Bali (25.89%). In Kalimantan Island, the highest contribution of technology was in West Kalimantan Province (41.91%) and the lowest contribution was in South Kalimantan Province (24.25%).

1. Introduction

Situated between the Indian and Pacific oceans, Indonesia is the world's largest island country, with more than thirteen thousand islands (United Nations Economic and Social Council, 2012). At 1,904,569 square kilometres (735,358 square miles), Indonesia is the world's 14th-largest country in terms of land area and world's 7th-largest country in terms of combined sea and land area. It has an estimated population of over 260 million people and is the world's fourth most populous country, the most populous Austronesian nation, as well as the most populous Muslim-majority country. The world's most populous island of Java contains more than half of the country's population (World Bank, 2016).

Indonesia has 33 provinces, three of which have Special Administrative status, such as Special Province of Aceh, now Nangroe Aceh Darussalam, Special Province of Capital City of Jakarta and Special Province of Yogyakarta. Muchdie (2011) divided Indonesian spatial structure into 6 Big-Island, namely Sumatera: 10 provinces, Java: 6 provinces, Kalimantan: 4 provinces, Bali-Nusa Tenggara Barat: 3 provinces, Sulawesi: 6 provinces and Maluku-Papua: 4 provinces. Its capital and most populous city is Jakarta. The country shares land borders with Papua New Guinea, East Timor, and the eastern part of Malaysia. Other neighboring countries include Singapore, the Philippines, Australia, Palau, and the Indian territory of the Andaman and Nicobar Islands. Despite its large population and densely populated regions, Indonesia has vast areas of wilderness that support the world's second highest level of biodiversity. The country has abundant natural resources like oil and natural gas, tin, copper and gold. Agriculture mainly produces rice, palm oil, tea, coffee, cacao, medicinal plants, spices and rubber (0EC, 2014).

Indonesia consists of hundreds of distinct native ethnic and linguistic groups. The largest – and politically dominant – ethnic group is the Javanese. A shared identity has developed, defined by a national language, ethnic diversity, religious pluralism within a Muslim-majority population, and a history of colonialism and rebellion against it. Indonesia's national motto, "Bhinneka Tunggal Ika" ("Unity in Diversity" literally, "many, yet one"), articulates the diversity that shapes the country (Hall, H., 1991).

Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the per cent rate of increase in real gross domestic product, or real GDP, usually in per capita terms. Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Measurement of economic growth uses national income accounting (Bjork, G, J., 1999).

The Indonesian economy is the world's 16th largest by nominal GDP and the 8th largest by GDP at PPP, and considered as Emerging markets and newly industrialized country. As reported by Muchdie (2016), during 1976- 2013, on average Indonesian GDP grows at 5.1 per cent per year. There was no spatial change in economic structure in term of GDRB among islands during that period. Even, disparities between Java and the rest of Indonesia became worse and worse. For instance, in 1983, the share of Java Island to Indonesian GDP was 58.19 % and in 2013 has increased to 61.24%. Meanwhile the share of Sumatera Island has decreased from 25.10% in 1983 to 21.15%. Kalimantan Island also experienced decreasing share from 9.63% in 1983 to 8.13% in 2013. The share of Sulawesi Island, Bali-Nusa Tenggara Island and Maluku-Papua Islands experienced in increasing share. In term of growth of GDRB, Sulawesi Island had the highest growth during that period, in average of 6.97%, followed by Maluku-Papua Island (6.02%), Bali-Nusa Tenggara Island, (5.95%), Java

Island (5.66%), Kalimantan Island (4.81%) and Sumatera Island (4.79%).

Economic growth has traditionally been attributed to the accumulation of human and physical capital and the increase in productivity arising from technological innovation (Lucas, R. E. 1988). Before industrialization technological progress resulted in an increase in the population, which was kept in check by food supply and other resources, which acted to limit per capita income, a condition known as the Malthusian trap (Galor, O, 2005; Clark, G., 2007). The rapid economic growth that occurred during the Industrial Revolution was remarkable because it was in excess of population growth, providing an escape from the Malthusian trap (Clark, G., 2007). Countries that industrialized eventually saw their population growth slow-down, a phenomenon known as the demographic transition. Most of the economic growth in the 20th century was due to increased output per unit of labor, materials, energy, and land (less input per widget). The balance of the growth in output has come from using more inputs. Both of these changes increase output. The increased output included more of the same goods produced previously and new goods and services (Kendrick, J. W. 1961). During the Industrial Revolution, mechanization began to replace hand methods in manufacturing, and new processes streamlined production of chemicals, iron, steel, and other products (Landes, D, S., 1969).

In Ricardian economics, the theory of production and the theory of growth are based on the theory or law of variable proportions, whereby increasing either of the factors of production (labor or capital), while holding the other constant and assuming no technological change, will increase output, but at a diminishing rate that eventually will approach zero. These concepts have their origins in Thomas Malthus's theorizing about agriculture. Malthus's examples included the number of seeds harvested relative to the number of seeds planted (capital) on a plot of land and the size of the harvest from a plot of land versus the number of workers employed (Bjork, G, J, 1999). Solow, R, M., (1956) and Swan, T. W., (1956) developed what eventually became the main model used in growth economics in the 1950s. This model assumes that there are diminishing returns to capital and labor. Capital accumulates through investment, but its level or stock continually decreases due to depreciation. Due to the diminishing returns to capital, with increases in capital/worker and absent technological progress, economic output/worker eventually reaches a point where capital per worker and economic output/worker remains constant because annual investment in capital equals annual depreciation. The SolowSwan model is considered an exogenous growth model because it does not explain why countries invest different shares of GDP in capital nor why technology improves over time. Instead the rate of investment and the rate of technological progress are exogenous. The value of the model is that it predicts the pattern of economic growth once these two rates are specified. Its failure to explain the determinants of these rates is one of its limitations.

Unsatisfied with the assumption of exogenous technological progress in the Solow-Swan model, economists worked to endogenize technology in the 1980s. They developed the endogenous growth theory that includes a mathematical explanation of technological advancement (Lucas, 1988). This model also incorporated a new concept of human capital, the skills and knowledge that make workers productive. Unlike physical capital, human capital has increasing rates of return. Research done in this area has focused on what increases human capital, for instance education or technological change, for example innovation (Helpman, E., 2004). Three sources of economic growth were capital accumulation growth, labour growth and technological progress.

Solow's (1957) paper was a landmark in the development of growth accounting. It was not the first paper to make an explicit decomposition of the sources of growth into contributions from factor inputs and from output per unit of total input. This had been done several times since the pioneering paper by Fabricant (1954), and with more detail, by Abramovitz (1956), and Kendrick (1961). But it was Solow (1957) that put the growth economics into growth accounting making clear its interpretation in terms of the distinction between shifts of and moves along the aggregate production function. Another major development in the practice of growth accounting was the publication of Jorgenson & Griliches (1967). These authors made revisions to the crude measure of TFP that reduced it from 1.6 to 0.1 per cent per year for the United States during 1945-1965. They focused on the measurement of capital services and produced a much more sophisticated index of capital input growth while also correcting labour quality for changes in education in a conceptually similar way to Denison (1962).

Previous research on technology contribution, using growth accounting method that have been published, among others, by Carre et.al., (1975) on France, Ohkawa & Rosovsky (1972) on Japan, and Matthews et.al, (1982) for the UK together with a succession of papers from the study of the United States culminating in Abramovitz & David (2001). As further useable historical national income accounts have become available, the country coverage of long run historical growth accounting has expanded and papers in this tradition continue to be published. In recent years, these have included Schulze (2007) on Austria-Hungary, Lains (2003) on Portugal, and Prados de la Escosura & Roses (2007) on Spain. Muchdie, et.al, (2016) reported a study on the contribution of technology on Indonesian economy both at national and sectoral levels.

Employing growth accounting method, the objective of this paper is to report of analysis on the contribution of technology to Indonesian regional economy at Island and Provincial levels.

2. Method of Analysis

The method for calculating TFP, as a measure of technology contribution, in this research was growth accounting method. This method has been used in many countries to calculate TFP. So the results can easily be compared with other countries. Using the production function of Cobb-Douglas, as:

$$Q_t = A_t\, F\,(K_t\, L_t) \qquad (1)$$

where Q_t is output in year-t, K_t is Capital and L_t is Labor. Hananto Sigit (2004) calculated TFP with formulating trans-log production function as:

$$\begin{aligned} lnQ_t &= ln\alpha_0 + \alpha_t T + \alpha_k lnK_t + \alpha_l lnL_t + ½\, \beta_{kk}(lnK_t)^2 + \beta_{kl} lnK_t lnL_t \\ &+ ½\, \beta_{ll}(lnL_t)^2 + \beta_{kT} TlnK_t + \beta_{Tl} TlnL_t + ½\, \beta_{TT} T^2 \end{aligned} \qquad (2)$$

If equation (2), differentiated toward time, then :

$$\begin{aligned} Q_t^* &= \alpha_t + \alpha_k K_t^* + \alpha_l L_t^* + \beta_{kk}(lnK_t)\, K_t^* + \beta_{lk}(K_t^* lnL_t + L_t^*\, ln\, K_t) \\ &+ \beta_{ll}(lnL_t)\, L_t^* + \beta_{kT}(TK_t^* + lnK_t) + \beta_{lT}(TL_t^* + lnL_t) + \beta_{TT} T \end{aligned} \qquad (3)$$

Equation (3)is a growth equation. Start notasion, *, indicate a continum growth. Equation (3) can be rewritten as

$$Q_t^* = TFP_t^* + S_k K_t^* + S_l L_t^* \qquad (4)$$

Based on equation (4), the value of TFP can be calculated. As the equation (4) is a continum equation, but the values needed are discrit TFP then the equation of TFP growth reformulated as:

$$\begin{aligned} \mathrm{TFPG}_t &= ½\, (\mathrm{TFP}_t^* + \mathrm{TFP}_{t-1}^*) \\ &= (lnQ_t - lnQ_{t-1}) - ½\, (S_{kt} + S_{kt-1})(ln\, K_t - lnK_{t-1}) \\ &\quad - ½\, (S_{lt} + S_{lt-1})(lnL_t - lnL_{t-1}) \end{aligned} \qquad (5)$$

With the equation (5), the TFP growth at year can easily be calculated.

Data needed for this study were: 1. Gross Domestic Product and/or Gross Regional Domestic Product, 2. Capital Stock, 3. Labour, 4. Wage/Salary, and 5. Depreciation. Data adjusted by excluding indirect tax, so data of GDP and or GRDP are data at factors cost. For national analysis data are available for the year of 1967-2011, for sectoral analysis data are available for the year of 1977-2007 and for spatial analysis data are available for year 202-2010.

After data adjustment process, steps in calculation TFP growth using *growth accounting method* are as follows:

1. Calculate labor income share year-t (LIS_t) with formula :

$$LIS_t = \frac{Wage/Salary\ at\ year\text{-}\ t}{GDP\ year\text{-}\ t} \tag{6}$$

2. Calculate average labor income share at year-t $(LISA_t)$:$LISA_t = ½ (LIS_t + LIS_{t-1})$ (7)

   where:

   LIS_t = Labor income share at year-t

   LIS_{t-1} = Laborincome share at year t-1

3. Calculate capital income share at year-t (KIS_t) with formula:

   $KIS_t = 1 – LIS_t$ (8)

4. Calculate average capital income shareat year- t ($KISA_t$):

   $KISA_t = ½ (KIS_t + KIS_{t-1})$ (9)

   where:

   KIS_t = Capital income share year-t

   KIS_{t-1} = Capital income shareyear t-1

5. Calculate the rate of economic growth at year-t (EG_t):

   $EG_t = (ln\ GDP_t – ln\ GD_{t-1}) x\ 100$ (10a)

   where:

   GDP_t = GDP at constant price at year-t

   GDP_{t-1} = GDP at constant price at year t-1

   For sectoral calculation:

   $SGi_t = (ln\ VAi_t – ln\ VAi_{t-1}) x\ 100$ (10b)

   where:

   VAi_t = Value-Added sector i at constant price at year-t

   VAi_{t-1} = Value-Added sector i at constant price at year t-1

6. Calculate the rate of capital stock growth at year -t (KG_t) :

   $$KG_t = (ln\ K_t - ln\ K_{t-1})\ x\ 100 \tag{11}$$

   where :

   K_t = Capitak stock at year-t

   K_{t-1} = Capital stock at yeat- t-1

7. Calculate weigthed average the growth rate of capital stock at year-t (KGA_t) :

   $$KGA_t = ½\ (KIS_t + KIS_{t-1})\ x\ (ln\ K_t - ln\ K_{t-1})\ x\ 100 \tag{12}$$

8. Calculate the growth rate of labor at year-t (LG_t) :

   $$LG_t = (ln\ L_t - ln\ L_{t-1})\ x\ 100 \tag{13}$$

   where:

   L_t = Labor at year-t

   L_{t-1}= Labor at year- t-1

9. Calculate weigthed average of the labor growth at year-t (LGA_t) :

   $$LGA_t = ½\ (LIS_t + LIS_{t-1})\ x\ (ln\ L_t - ln\ L_{t-1})\ x\ 100 \tag{14}$$

10. The growth rate of TFP at year-t ($TFPG_t$) can be calculated as follow:

    $$TFPG_t = EG_t - KGA_t - LGA_t \tag{15}$$

    Further more, contribution of factors such as labor, capital and TFP on economic growth are calculated as:

11. Contribution of capital $= \dfrac{\text{Equation (12)}}{\text{Equation (10)}}$ X 100 (16)
12. Contribution of labor $= \dfrac{\text{Equation (14)}}{\text{Equation (10)}}$ X 100 (17)
13. Contribution of TFP $= \dfrac{\text{Equation (15)}}{\text{Equation (10)}}$ X 100 (18)

3. Results and Discussions

On average during 2002-2010, the contribution of technology, in-term of TFP growth, to Indonesian economic growth was 24.40 per cent. This contribution was higher than the contribution of labour (15.11%), but lower than the contribution of capital (64.49%). The dynamics of factors contribution to Indonesian economy is depicted in Figure 19.1 (left panel). In the year 2002, technology contribution to Indonesian economy was the smallest, but in 2003, the contribution of technology was the same as with capital contribution. In 2004 and 2005, the contribution of technology was the highest among factors in Indonesian economy. But eventually decreasing and reach the lowest in 2009.

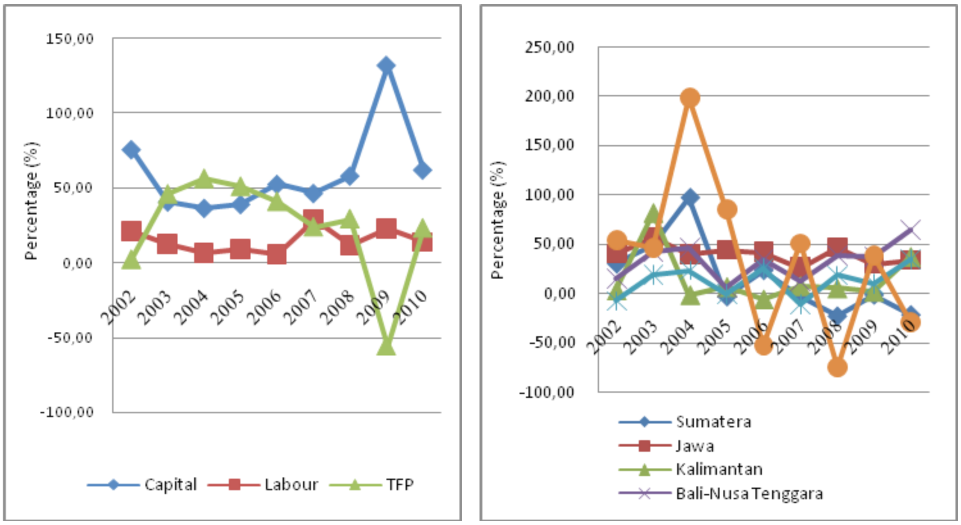

Figure 19.1

Factors and Technology Contribution to Indonesian Regional Economy, 2002-2010

Spatially among Island, on average during 2002-2010, the highest contribution of technology occurred in Java Island (39,77%) followed by Bali-Nusa Tenggara Island (35.39%), Sumatera Island (16,73%), Maluku-Papua (15.50%), Sulawesi Island (13.72%) and Kalimantan Island (12.82%). Figure 1 (right panel) presents the fluctuation of technology contribution among Island. The highest fluctuation occurred in Maluku-Papua Island. The most consistence and stable contribution of technology occurred in Java Island economy, followed by Bali-Nusa Tenggara Island.

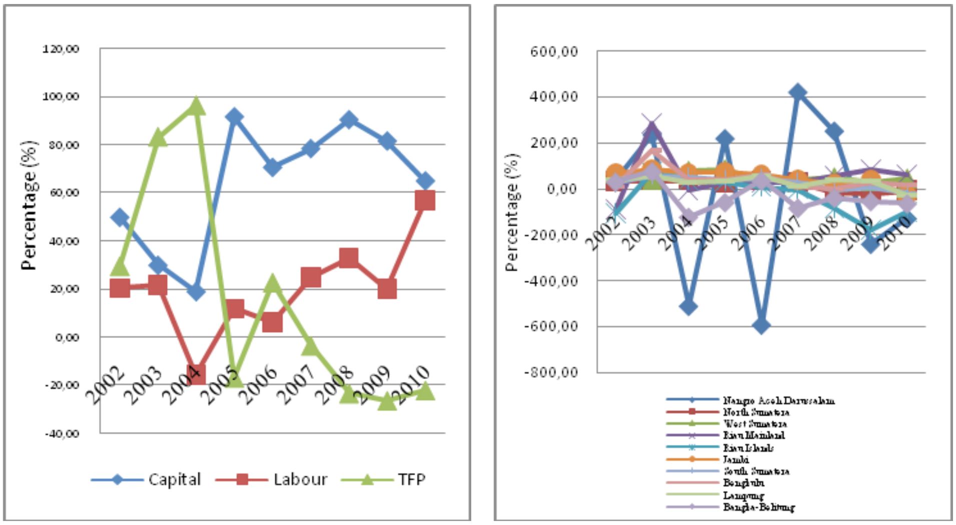

Figure 19.2

Factors and Technology Contribution to Sumatera Island Economy, 2002-2010

In Sumatera Island economy, the contribution of technology to economic growth was the smallest (13.56%) among the contribution of factors of production, such as labour (22.07%) and capital (64.33%). Figure 19.2 (left panel) depicts the contribution of factors in Sumatera Island economy. In 2003, the contribution of technology was the highest among factors, but the year of 2005, 2007-2010 the contribution of technology was the lowest among factors.

Spatially among provinces in Sumatera Island, 2 provinces gave negative technology contribution, namely Nangro Aceh Darussalam (-32.61%) and the Province of Riau Islands (-4.78%). The province that gave highest technology contribution to the province economy was the Province of West Sumatera (54.38%), followed by Jambi Province (44.89%) and Bengkulu Province (42.93%). In the Province of Lampung, the contribution of technology to province economy was 31.13 per cent. In North Sumatera Province, the contribution of technology to province economy was 28.17 per cent. In the Province of South Sumatera, the contribution of technology was 27.47 per cent and in Riau Mainland Province was 16.47 per cent. In Bangka-Belitung Province, the contribution of technology to it province economy was the lowest (9.97%) after the Province of Riau Islands and Nangroe Aceh Darussalam. Figure 19.2 (right panel) presents the graph of technology contribution to the province economy in Sumatera Island.

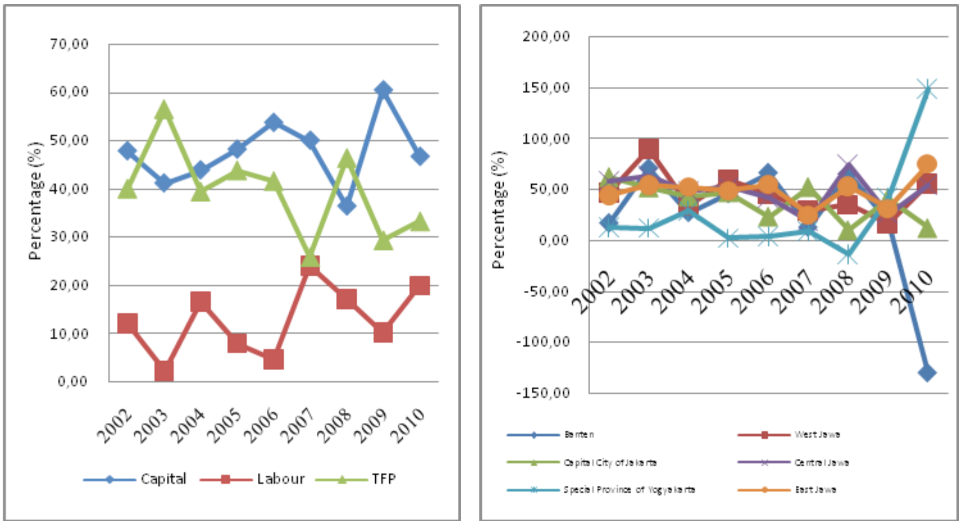

Figure 19.3

Factors and Technology Contribution to Java Island Economy, 2002-2010

In Java Island economy, the contribution of technology to economic growth was 39.77 per cent; that was lower than the contribution of capital (46.87%), but it was higher than the contribution of labour (13.40%). Figure 19.3 (left panel) depicts the contribution of factors in Java Island economy. In 2003 and 2008, the contribution of technology was the highest among factors, but the year of 2004-2007 and 2009-2010 the contribution of technology was the lowest among factors.

Spatially among provinces in Java Island, all provinces gave positive technology contribution. The province that gave highest technology contribution to the province economy was the East Java Province (49.63%), followed by Central Java Province (48.61%) and West Java Province (44.90%). In Capital City of Jakarta, the contribution of technology to province economy was 37.19 per cent. In Banten Province, the contribution of technology was 31.30 per cent and in the Special Province of Yogyakarta, the contribution of technology to it province economy was 28.35 per cent. Figure 19.3 (right panel) presents the graph of technology contribution to the province economy in Java Island.

In Kalimantan Island economy, the contribution of technology to economic growth was only 12.82 per cent; that was the lowest the contribution of factors of production; the contribution of capital was 69.47 per cent and the contribution of labour was 17.82 per cent. Figure 19.4 (left panel) depicts the contribution of factors in Kalimantan Island economy. In 2003 and 2008, the contribution of technology was the highest among factors, but in other years the contribution of technology was in between the contribution of capital and the contribution of labour in Kalimantan economy.

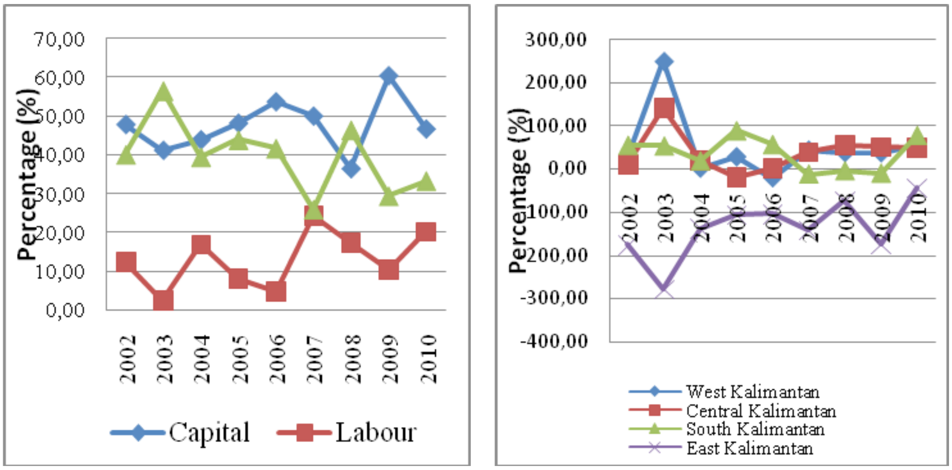

Figure 19.4

Factors and Technology Contribution to Kalimantan Island Economy, 2002-2010

Spatially among provinces in Kalimantan Island, one province, namely East-Kalimantan Province gave negative technology contribution; along the year during 2002-2010, the contributions of technology were negative. The province that gave highest technology contribution to the regional economy was the West Kalimantan Province (41.91%), followed by Central Kalimantan Province (36.88%) and South Kalimantan Province (24.25%). Figure 19.4 (right panel) presents the graph of technology contribution to the province economy in Kalimantan Island.

In Bali-Nusa Tenggara Island economy, the contribution of technology to economic growth was 35.39 per cent; it was lower than the contribution capital (53.89) but higher than the contribution of labour (10.65%). Figure 19.5 (left panel) depicts the contribution of factors in Bali-Nusa Tenggara Island economy. In three years, 2002, 2005 and 2007, the contribution of technology was the lowest among factors, but in other years, the contribution of technology was in between the contribution of capital and the contribution of labour in Bali-Nusa Tenggara economy.

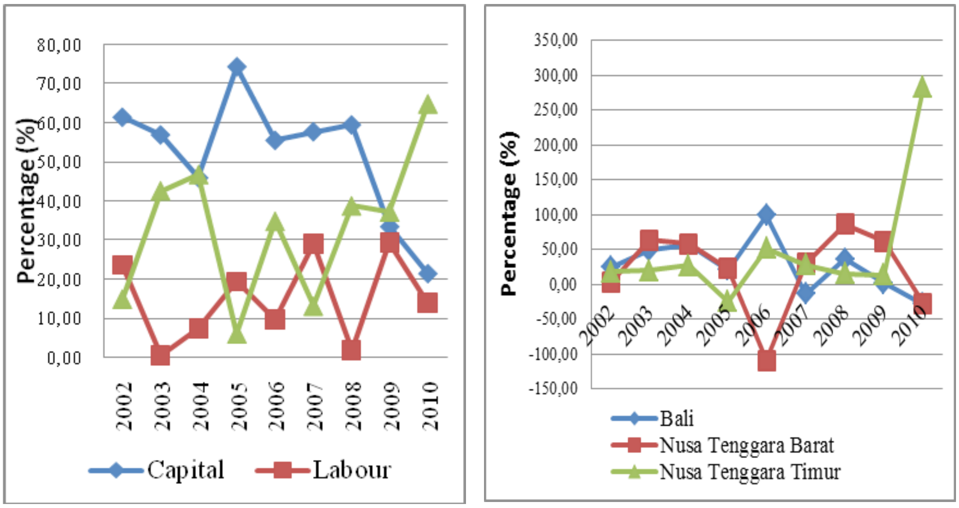

Figure 19.5

Factors and Technology Contribution to Bali-Nusa Tenggara Island Economy, 2002-2010

Spatially among provinces in Bali-Nusa Tenggara Island, all provinces gave positive technology contribution. The province that gave highest technology contribution to the regional economy was the East Nusa Tenggara Province

(51.71%), followed by West Nusa Tenggara Province (28.25%) and the Province of Bali (25.89%). Figure 19.5 (right panel) presents the graph of technology contribution to the province economy in Bali-Nusa Tenggara Island.

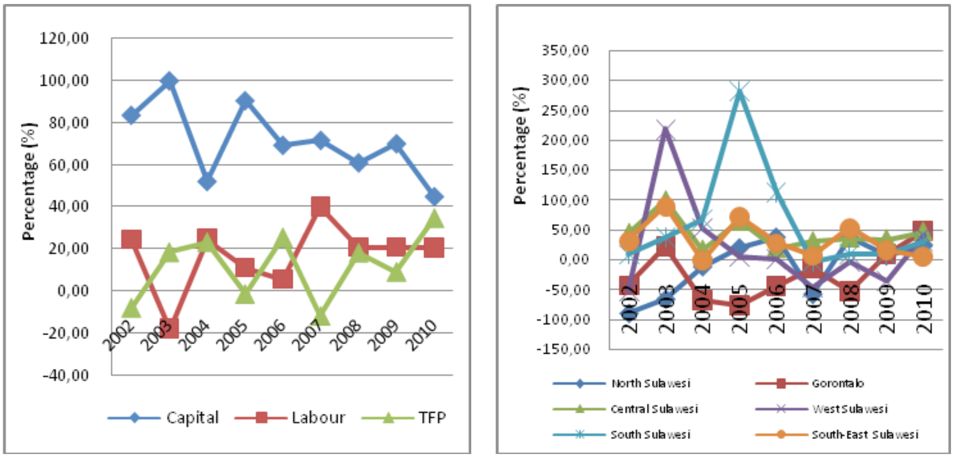

Figure 19.6

Factors and Technology Contribution to Sulawesi Island Economy, 2002-2010

In Sulawesi Island economy, the contribution of technology to economic growth was 13.72 per cent; it was the lowest contribution among factors, where the contribution of capital was 67.47 per cent and the contribution of labour was 18.78 per cent. Figure 19.6 (left panel) depicts the contribution of factors in Sulawesi Island economy. In three year, 2003, 2006 and 2010, the contribution of technology was higher than the contribution of labour, but in other years, the contribution of technology was the lowest contribution to Sulawesi Island economy.

Spatially among provinces in Sulawesi Island, all provinces gave positive technology contribution, except the Province of Gorontalo (-22.29%) and West Sulawesi Province (-9.87%) that gave negative technology contribution. The province that gave highest technology contribution to the regional economy was Central Sulawesi Province (43.23%), followed by South-East Sulawesi Province (35.17%) and North-Sulawesi Province (1.93%). Figure 19.6 (right panel) presents the graph of technology contribution to the province economy in Sulawesi Island.

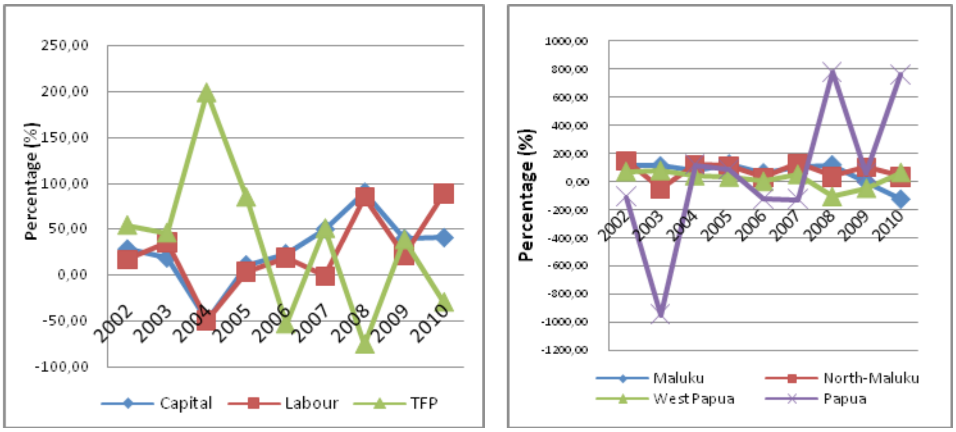

Figure 19.7

Factors and Technology Contribution to Maluku-Papua Island Economy, 2002-2010

In Maluku-Papua Island economy, the contribution of technology to economic growth was 15.50 per cent; it was the lowest contribution among factors, where the contribution of capital was 44.04 per cent and the contribution of labour was 40.46 per cent. Figure 19.7 (left panel) depicts the contribution of factors in Sulawesi Island economy. In three year, 2002, 2003, 2004 and 2005, the contribution of technology was higher than the contribution of labour and capital, but in year of 2006, 2008 and 2010, the contribution of technology was the lowest contribution to Maluku-Papua Island economy.

Spatially among provinces in Maluku-Papua Island, the Province of Papua gave negative technology contribution (-522.83%). The province that gave highest technology contribution to the regional economy was North-Maluku Province (70.62%), followed by Maluku Province (55.56%) and West-Papua Province 36.32%). Figure 19.6 (right panel) presents the graph of technology contribution to the province economy in Maluku-Papua Islands.

4. Conclusion

The contribution of technology to Indonesian economy, on average during 2002-2010 at national level, was 24.4 per cent. The contribution of technology to Indonesian regional economy varies among Island as well as among provinces within island. The highest contribution of technology was by Java Island (39.77%) followed by Bali-Nusa Tenggara Island (35.39%). The lowest technology contribution was in Kalimantan Island (12.82%). In

Sumatra Island, the highest contribution of technology was in Province of West Sumatera (54.38%) and the lowest contribution of technology was in Nangroe Aceh Darussalam (-32.61%). In Java Island, the highest contribution of technology was in the East Java Province (49.63%) and the lowest contribution was in the Special Province of Yogyakarta (28.35%). In Kalimantan Island, the highest contribution of technology was in West Kalimantan Province (41.91%) and the lowest contribution was in South Kalimantan Province (24.25%). In Bali-Nusa Tenggara, the highest contribution of technology was in East Nusa Tenggara Province (51.71%), and the lowest contribution was in the Province of Bali (25.89%). In Sulawesi Island, the highest contribution of technology was in the Province of Central-Sulawesi (43.23%), and the lowest contribution was in Gorontalo Province (-22.29%). In Maluku-Papua Island, the highest contribution of technology was in the Province of North-Maluku (70.62%) and the lowest contribution was in Papua Province (-522.83%).

References

Abramovitz, M., (1956), "Resource and Output Trends in the United States since 1870", **American Economic Review Papers and Proceedings,** 46: 5-23.

http://www.nber.org/chapters/c5650

Abramovitz, M., and David, P, A., (1973), "Reinterpreting Economic Growth: Parables and Realities", **American Economic Review Papers and Proceedings**, 63: 428-39. http://citeseerx.ist.psu.edu/showciting?cid=493200

Bjork, G, J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport CT, London,pp: 2, 67. ISBN: 07596532-5.

https://www.researchgate.net/publication/257234305_The_Way_It_Worked_and_Why_It_Won%27t_Structural_Change_and_the_Slowdown_of_US_Economic_Growth_Gordon_C_Bjork_West_Port_CT_Praeger_1999_242_pp_Appendix_48_pp_6950_hb_2795_pb

Carre, J-J., Dubois, P., and Malinvaud, E., (1975), **French Economic Growth**, Stanford University Press, Stanford.

https://www.researchgate.net/publication/274773362_French_Economic_Growth_ByJJ_Carre_P_Dubois_and_E_Malinvaud_translated_by_John_P_Hatfield_Stanford_Calif_Stanford_University_Press_1975_Pp_ xviii_581_2250

Clark, G., (2007), **A Farewell to Alms: A Brief Economic History of the World**, Princeton University Press, Princeton;ISBN: 978-0-691-12135-2.

http://press.princeton.edu/titles/8461.html

Denison, E. F, (1962), **the Sources of Economic Growth in the United States and the Alternatives before Us**,Committee for Economic Development, New York.

https://ideas.repec.org/a/cup/jechis/v23y1963i03p352-352_10.html

Fabricant, S, (1954), "Economic Progress and Economic Change", In **NBER 34th Annual Report,** New York. http://papers.nber.org/books/annu54-1

Galor, O, (2005), "From Stagnation to Growth: Unified Growth Theory",**Handbook of Economic Growth**, Elsevier, pp: 171–293.

http://www.oalib.com/references/5326760

Hall, H., (1991), **Unity in Diversity: Regional Economic Development in Indonesia since 1970**, Singapore: Oxford University Press.

Hananto, S, (2004), "Total Factor Productivity Growth: Survey Report", **Part II National Report on Indonesia,**Asian Productivity Organization, Tokyo.

http://www.apo-tokyo.org/00e-books/IS-04_TFPGrowth/IS-04_TFPGrowth.pdf

Helpman, E, (2004), **The Mystery of Economic Growth**, Harvard University Press, pp: 16. https://www.researchgate.net/publication/37713224_The_Mystery_of_Economic_Growth

Hounshell, D, A, (1984), **From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States**, Johns Hopkins University Press, Baltimore, Maryland, ISBN: 978-0-8018-2975-8, LCCN: 8301626.

http://www.worldcat.org/title/from-the-american-system-to-mass-production-1800-1932-the-development-of-manufacturing-technology-in-the-united-states/oclc/9830352

Jorgenson, D. W, and Griliches, Z, (1967), "The Explanation of Productivity Change", **Review of Economic Studies**, 34: 249-83.

https://fraser.stlouisfed.org/files/docs/publications/SCB/pages/1965-1969/7391_1965-1969.pdf

Kendrick, J. W, (1961), **Productivity trends in the United States**, Princeton

University Press,Princeton;http://www.worldcat.org/title/productivity-trends-in-the-united-states/oclc/174529

Lains, P., (2003), "Catching Up to the European Core: Portuguese Economic Growth, 1910-1990",**Explorations in Economic History**, 40: 369-86.

http://econpapers.repec.org/article/eeeexehis/v_3a40_3ay_3a2003_3ai_3a4_3ap_3a369-386.htm

Landes, D.S., (1969**), The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present,** Cambridge University Press, London.

http://quod.lib.umich.edu/cgi/t/text/text-idx?c=acls;cc=acls;q1=industrial;rgn=title;view=toc;idno=heb01145.0001.001

Lucas, R. E., (1988), 'On the Mechanics of Economic Development", **Journal of Monetary Economics**, 22(1): 3–42.

http://web.stanford.edu/~klenow/Lucas_Mechanics.pdf

Matthews, R. C. O., Feinstein, C. H, and J. C., Odling-Smee, J.C, (1982), **British Economic Growth 1856-1973**,Stanford University Press, Stanford.

http://www.oxfordscholarship.com/view/10.1093/0198284535.001.0001/acprof-9780198284536

Muchdie, (2011), **Spatial Structure of Island Economy of Indonesia: A New Hybrid Procedure for Generation Inter-Regional Input-Output Tables**, Lambert Academic Publishing, ISBN 978-3-8454-1847-6.

http://repository.uhamka.ac.id/139/

Muchdie, (2016), "Spatial Variations in Technical Efficiency and Return to Scale in the Indonesian Economy", **Intl. J. Recent Sci. Res**, 7(10): 13625-13629.

http://www.recentscientific.com/spatial-variations-technical-efficiency-and-return-scale-indonesian-economy.

Muchdie, Prihawantoro, S, Alkadri and Sugema, (2016), "The Contribution of Technology on Indonesian Economy: National, Sectoral and Spatial Perspectives", **Intl. J. of Adv. Res**, 4(11): 2149-2156. DOI:10.21474/IJAR01/2319. http://www.journalijar.com/.

Ohkawa, K. and Rosovsky, H., (1972), **Japanese Economic Growth: Trend Acceleration in the Twentieth Century**, Stanford University Press, Stanford.

Prados de la Escosura, L. and Roses, J., (2009), "The Sources of Long-Run Growth in Spain, 1850-2000",**Journal of Economic History**, 69(4): 1063-1091.

https://www.cambridge.org/core/journals/journal-of-economic-history/article/div-classtitlethe-sources-of-long-run-growth-in-spain-1850-2000div/CF139858C0256773C45A74FB981BB598

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana, (2013), **Peranan Teknologi Dalam Pertumbuhan Ekonomi Koridor–Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity**, Pusat Pengkajian Kebijakan Inovasi Teknologi (Centre for Innovation Technology Policy), Badan Pengkajian dan Penerapan Teknologi (The Agency for the Assessment and Application of Technology). Jakarta.

Schulze, M. S., (2007), "Origins of Catch-Up Failure: Comparative Productivity Growth in the Habsburg Empire, 1879-1910",**European Review of Economic History**, 11: 189-218. https://doi.org/10.1017/S1361491607001955

https://academic.oup.com/ereh/article/11/2/189/500727/Origins-of-catch-up-failure-Comparative

Solow, R. M, (1957), "Technical Change and the Aggregate Production Function",**Review of Economics and Statistics**, 39: 312-320.

http://faculty.georgetown.edu/mh5/class/econ489/Solow-Growth-Accounting.pdf

Solow, R. M., (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics**, 70(1): 65–94.

http://faculty.smu.edu/tosang/pdf/Solow_1956.pdf

Swan, T, W, (1956), "Economic Growth and Capital Accumulation", **Economic Record**, 32: 334–61. doi:10.1111/j.1475-4932.1956.tb00434.x.

http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4932.1956.tb00434.x/abstract

United Nations Economic and Social Council, (2012), "The Naming Procedures of Indonesia's Islands", **Tenth United Nations Conference on the Standardization of Geographical Names**, New York, 31 July – 9 August 2012.

http://unstats.un.org/unsd/geoinfo//UNGEGN/docs/10th-uncsgn-docs/econf/E_CONF.101_134_The%20Naming%20Procedures%20%20Of%20Indonesia%20%20Islands.pdf

World Bank, (2016), http://data.worldbank.org/country/indonesia

Chapter-20

The Impact of Technological Progress on Human Development[1]

Ringkasan

Penelitian ini bertujuan untuk menganalisis dampak kemajuan teknologi terhadap pembangunan manusia, baik secara langsung maupun tidak langsung, menggunakan data Indonesia 2004-2013. Kemajuan teknologi diukur menggunakan pertumbuhan TFP (%), pertumbuhan ekonomi diukur dengan pertumbuhan GDP (%), pengurangan kemiskinan diukur dengan persentase orang miskin (%), dan pembangunan manusia diukur dengan indeks pembangunan manusia. Kecuali data pertumbuhan TFP, semua data dikumpulkan dari Badan Pusat Statistik. Analisis model jalur digunakan untuk menguji dampak langsung dan tidak langsung. Empat hipotesis sudah diuji. Hasil analisis memperlihatkan bahwa dampak kemajuan teknologi terhadap pembangunan manusia beragam tergantung jalur yang dilalui. Pertama, pada Jalur-1, kemajuan teknologi mempunyai dampak langsung negative yang signifikan terhadap pembangunan manusia. Kedua, pada Jalur-2, kemajuan teknologi secara tidak langsung, melalui pengurangan kemiskinan, mempunyai dampak negative yang signifikan terhadap pembangunan manusia. Ketiga, kemajuan teknologi secara tidak langsung melalui pengurangan kemiskinan dan pertumbuhan ekonomi mempunyai dampak positive yang secara statistik signifikan. Terakhir, pada Jalur-4, secara tidak langsung melalui pertumbuhan ekonomi, kemajuan teknologi mempunyai dampak positive yang secara statistik signifikan.

[1] This chapter has been published in **International Journal of Economic and Research**, cited as Muchdie, (2016),"The Impact of Technological Progress on Human Development: Evidence from Indonesia", **Int. J. Eco. Res**, 2016, v7i5, 14 - 28 ISSN:2229-6158, Available http://ijeronline.com/Vol7issue5.php; http://repository.uhamka.ac.id/130/; https://www.researchgate.net/publication/311534432;

Summary

The research reported in this paper aimed to analyze the impacts of technological progress on human development, directly and indirectly, using Indonesian data 2004-2013. Technological progress was measured by Total Factor Productivity growth (%), Economic growth was measured by GDP growth (%), Poverty reduction was measured by percentage of poor people (%), and Human development was measured by human development index. Except data on total factor productivity growth, all data were collected from National Statistic Agency. A path model analysis was employed to examine direct and indirect impacts. Four hypotheses had been tested. The results showed that the impact of technological progress on human development varied depend on the path. Firstly, on Path-1, technological progress had significant direct negative impact on human development. Secondly, on Path-2, technological progress indirectly had negative significant impact on human development, through poverty reduction. Thirdly, on Path-3, technological progress had positive significant indirect impact on human development, through poverty reduction and economic growth. Finally, on Path-4, technological progress indirectly had positive impact on human development, through economic development.

1. Introduction

Human development is a concept within a field of international development. The human development approach, developed by the economist Mahbub Ul-Haq (2003), is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Sen, A., 2005), often framed in terms of whether people are able to "be" and "do" desirable things in life. It involves studies of the human condition with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Martha Nussbaum (2005),,Ingrid Robeyns, and others (Sabina Alkire, 1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices (Yulia Shirokova, 2012). Fundamental to enlarging these choices is building human capabilities —the range of things that people can do or be in life. Capabilities are "the substantive freedoms a person enjoys to lead the kind of life they have reason to value" (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions(Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities (Human Development Foundation, 2009). The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable (e.g., to be educated), to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible (UNDP, 2015).

The United Nations Development Programme has been defined human development as "the process of enlarging people's choices", allowing them to "lead a long and healthy life, to be educated, to enjoy a decent standard of living", as well as "political freedom, other guaranteed human rights and various ingredients of self-respect" (UNDP, 1997).One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015).The index encompasses statistics such as life expectancy at birth,an education index (calculated using mean years of schooling and expected years of schooling), and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (UNDP, 2015).

Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product, or real GDP, usually in per capita terms (IMF, 2012).Growth is usually calculated in real terms – i.e., inflation-adjusted terms – to eliminate the distorting effect of inflation on the price of goods produced. Measurement of economic growth uses national income accounting (Bjork, G.J., 1999). Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The "rate of economic growth" refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth (Bjork, G.J., 1999).

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, 1999), Solow-Swan Model developed by Sollow (1956) and Swan (1956), Endogenous GrowthTheory which focus on what increases human capital or technological change (Helpman, 2004), Unified Growth Theory developed by Galor (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory, and Human Capital and Growth Theory (Barro &Lee, 2001).

Poverty is general scarcity, dearth, or the state of one who lacks a certain amount of material possessions or money (Merriam Webster, 2016). It is a multifaceted concept, which includes social, economic, and political elements (Ricardo, 2008). Many definitions have been introduced, for instance, United Nations and World Bank. According to United Nations (2016), poverty is the inability of having choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go, not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living in marginal or fragile environments, without access to clean water or sanitation.

According to World Bank (2011), poverty is pronounced deprivation in well-being, and comprises many dimensions. It includes low incomes and the inability to acquire the basic goods and services necessary for survival with dignity. Poverty also encompasses low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of voice, and insufficient capacity and opportunity to better one's life.

Poverty may be defined as either absolute or relative. Absolute poverty refers to a set standard which is consistent over time and between countries. Absolute poverty, extreme poverty, or abject poverty is "a condition characterized by severe deprivation of basic humanneeds, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services" (UN Declaration, 1995). The term of "absolute poverty" is usually synonymous with "extreme poverty". Robert McNamara, the former president of the World Bank, described absolute or extreme poverty as, "a condition so limited by malnutrition, illiteracy, disease, squalid surroundings, high infant mortality, and low expectancy as to be beneath any reasonable definition of human decency (World Bank, 2016).

Relative poverty views poverty as socially defined and dependent on social context, hence relative poverty is a measure of income inequality. Usually, relative poverty is measured as the percentage of the population with income less than some fixed proportion of median income. There are several other different income inequality metrics, for example, the Gini coefficient or the Theil Index. Relative poverty measure is used by the United Nations Development Program (UNDP), the United Nations Children's Fund(UNICEF), the Organisation for Economic Co-operation and Development (OECD) and Canadian poverty researchers (Raphael, 2009). In the European Union, the "relative poverty measure is the most prominent and most–quoted of the EU social inclusion indicators" (Marx & Bosch, 2016).

Various poverty reduction strategies are broadly categorized here based on whether they make more of the basic human needs available or whether they increase the disposable income needed to purchase those needs. Some strategies such as building roads can both bring access to various basic needs, such as fertilizer or healthcare from urban areas, as well as increase incomes, by bringing better access to urban markets. In case of Indonesia, during Yudhoyono administration

(2004-2013) there were three major clusters of poverty reduction programs. First, the social assistance cluster of government's poverty reduction programs including protecting staple food consumption of the poor, protecting health of the poor, protecting education of the poor and protecting financial liquidity of the poor. Second, the community empowerment cluster of government's policy reduction. Third, the microenterprise empowerment cluster government's policy reduction programs (Asep Suryahadi, at al., (2010).

Historically, technology has played a central role in raising living standards across the region, including those of the poor. The Green Revolution and various innovations of modern medicine and public health have been instrumental in improving nutrition, health, and livelihoods of millions of poor people. Agricultural and medical biotechnology hold tremendous promise but also bring with them new risks and concerns that need to be addressed before their full potential can be realized. New information technologies are only beginning to diffuse widely in developing Asia and the Pacific, but ultimately these too can have profound impacts on the lives of the poor, empowering them with access to information that once was the preserve of the privileged few (OECD & ADB, 2002).

Advances in science and technology have continuously accounted for most of the growth and wealth accumulation in leading industrialized economies. In recent years, the contribution of technological progress to growth and welfare improvement has increased even further, especially with the globalization process which has been characterized by exponential growth in exports of manufactured goods. Hippolyte, F., (2008), shows that the widening income and welfare gap between Sub-Saharan Africa and the rest of world is largely accounted for by the technology trap responsible for the poverty trap.

Technological progress and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries.

It has been observed that major part of increased productivity is due to technological progress. Technological progress is one of the most important determinants of the shape and evolution of the economy. Technological progress has improved working conditions,permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded as primary source in economic development and the various technological progresses contribute significantly in the development of underdeveloped countries.

The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased. On the one hand, consumption of the household raises, while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases.

The objective of this paper is to examine the impacts of technological progress, directly and indirectly, on human development, with poverty reduction and economic growth as moderating variables. It is providing empirical evidence from Indonesia.

2. Methods of Analysis

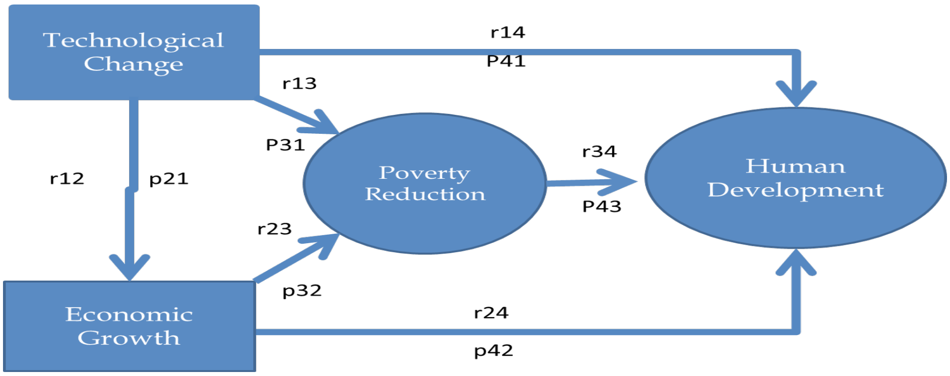

Figure 20.1

Path Model of the Impacts of Technological Progress on Human Development

Figure 20.1 provides path analysis model for analyzing the impacts of technological progress on human development, through 4 paths. Path-1, P_{41}, is analyzing direct impact of technological progress on human development. Path-2, P_{43}-P_{31}, is analyzing indirect impact of technological progress on human development, through poverty reduction. Path-3, P_{43}-$P_{32}P_{21}$, is analyzing indirect impact of technological progress on human development, through poverty reduction and economic growth. Path-4, P_{42}-P_{21}, is analyzing indirect impact of technological progress on human development, through economic growth.

Path coefficients in the path model will be calculated using path equation as formulated as follow[2]:

$r_{12} = P_{21}$ (1)

$r_{13} = P_{31} + P_{32}\, r_{12}$ (2)

$r_{23} = P_{31}\, r_{12} + P_{32}$ (3)

$r_{14} = P_{41} + P_{42}\, r_{12} + P_{43}\, r_{13}$ (4)

$r_{24} = P_{41}\, r_{12} + P_{42} + P_{43}\, r_{23}$ (5)

$r_{34} = P_{41}\, r_{13} + P_{42}\, r_{23} + P_{43}$ (6)

As the coefficients of correlation among technological progress, economic growth, poverty reduction and human development can easily be calculated, provided data for those variables are available.

Table 20.1

Data on Indonesian TFP Growth, Economic Growth, Percentage of the Poor and Human Development Index, 2004-2013.

Year	Technological Change, % (TFP Growth)[1] (X1)	Technological Change, % (TFP Growth)[2] (X2)	Poverty Reduction, % (TFP Growth)[3] (X3)	Human Development Index[4] (X4)
2004	3.59	6,35	16,66	68.70
2005	3.25	6.35	15,97	69.57
2006	1.73	4,31	17,75	70.10
2007	1.52	6,29	16,58	70.59
2008	1.94	6,55	15,42	71.17
2009	-1.57	2,82	14,15	71.76
2010	1.47	6,34	13,33	72.27
2011	2.85	8,07	12,36	72.77
2012	3.22	6,26	11,66	73.29
2013	-1.71	5,73	11,47	73.81

1) Socia Prihawantoro, Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan dan Muhammad Yorga Permana. (2013). Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (*The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach*). Badan Pengkajian dan Penerapan Teknologi, Jakarta.
2) BPS (2015). Laju Pertumbuhan PDB Atas Dasar Harga Konstan 2000 Menurut Lapangan Usaha *(Gross National Product by Sectors at Constant Price 2000*).http://bps.go.id/ekonomi.
3) BPS (2014). Jumlah Penduduk Miskin, Persentase Penduduk Miskin dan Garis Kemiskinan 1970-2013 (*Number of Poor People, Percentage of Poor People and Poverty Line 1970-2013*). http://bps.go.id/kemiskinan.
4) BPS(2014). Indeks Pembangunan Manusia Menurut Provinsi 1996-2013 (*Human Development Index by Province 1970-2013*). *http://bps.go.id/pembangunan_manusia*.

[2] http://faculty.cas.edu/mbrannick/regression/Pathan.html

Technological progress is measured by total factor productivity growth, calculated by Socia Prihawantoro et al., (2013). Economic growth is measured by the growth of gross national product provides by the National Statistics Agency, Poverty reduction is measured by the percentage of the poor provides by National Statistic Agency and Human development is measured by human development index provides by National Statistics Agency.

3. Results and Discussions

Coefficient of correlation between technological progress and poverty was a weak and positive correlation, with r_{13}=0.30. It means that if TFP growth was increase, then percentage of the poor also increase. Technological progress would make the poor worse. Correlation coefficient between technological progress and human development was negative and weak, r_{14}=-0.46. It means that if TFP growth was increase then the index of human development was decrease. Further, the coefficient of correlation between economic growth and poverty was negative and weak, as r_{23}=-0.23. It means that if economic growth increase then the percentage of the poor would decrease. The correlation coefficient between poverty and human development was very weak and positive. Finally, the coefficient of correlation between economic growth and human development was very strong and negative, r_{34}=-0.92. It means that if the percentage of the poor was increase then the index of human development would decrease.

Table 20.2

Correlation Coefficients among Technological Progress, Economic Growth, Percentage of the Poor and Human Development

	Technological Change	Economic Growth	Percentage of Poor	Human Development Index
Technological Change	1,00			
Economic Growth	0,63	1,00		
Percentage of Poor	0,30	-0,23	1,00	
Human Dev Index	-0,46	0,10	-0,92	1,00

Solving equation (1) through (6) given the correlation coefficients were available, path coefficients can be calculated. Figure 20.2 provides path coefficients for every path.

In path-1, for instance the path coefficient, P_{41} was -0.26. It means that technological progress directly had a negative impact on human development. This impact was statistically significant, as P_{41} (in absolute number) > 0.05.

The increase of technological progress will decrease the index of human development.In path-2, technological progress directly had a positive impact on poverty; through P_{43} and P_{31}.This impact was statistically significant as P_{31}=0.30 which was higher than 0.05. It means that technological progress will increase the percentage of the poor. The higher was the technological progress the higher was the percentage of the poor. Meanwhile, the impact of poverty on human development was also negative and significant, P_{43}=-0.83. It means that the increase of percentage of the poor would decrease the index of human development. It is also true; if one says that the decrease of the percentage of the poor would increase the index of human development. Through path-2, technological progress indirectly had a negative significant impact on human development.

In path-3, technological progress directly had a positive significant impact on economic growth, with P_{21}=0.63. The increase of TFP growth would increase the growth of output in economy. Further, economic growth had a negative and significant impact on poverty, as P_{32}=-0.69. It means that economic growth would decrease the percentage of the poor. As already shown that the decrease of the percentage of the poor would increase the index of human development, and then in path-3, technological progress had indirect positive and significant impact on human development; through P_{43}-P_{32}-P_{21}.

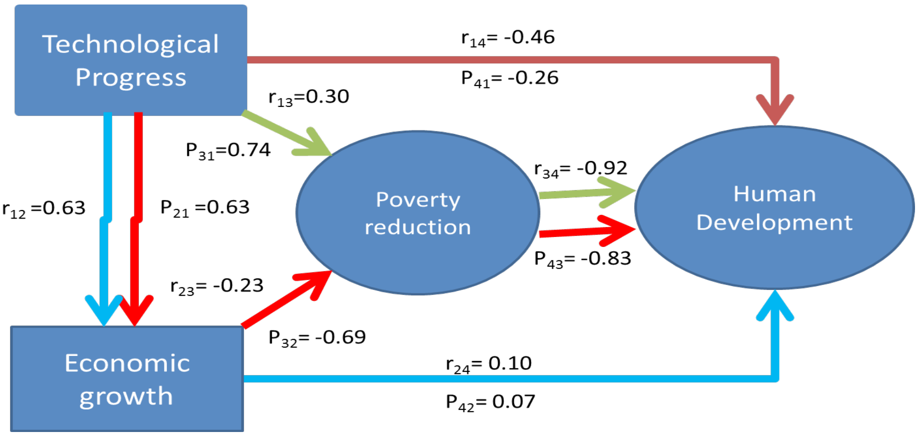

Figure 20.2
Path Coefficients in Path Model

In path-4, technological progress indirectly had a positive impact on human development, through economic growth. This indirect impact was not statistically significant, as P_{42} x P_{21}=0.63 x 0.07 < 0.05. In this path, technological progress, as it had been shown, that technological progress had a positive significant direct impact on economic growth. Meanwhile, economic growth had direct positive impact on human development.

4. Conclusions

From discussion above, it could be concluded that the impact of technological progress on human development varied depend on the path.

Firstly, in path-1, technological progress directly had negative and significant impact on human development as P_{41}= [- 0.26] > 0.05. It means that technological progress in term of TFP growth would directly reduce Human Development Index.

Secondly, in path-2, technological progress indirectly had negative and significant impact on human development, through poverty reduction, as the path coefficients P_{43}x P_{31} = (-0.83) x (0.74) = [-0.614] >0.05. It means that technological progress woud indirectly reduce HDI through poverty reduction.

Thirdly, in path-3, technological progress indirectly had positive and significant impact on human development, through poverty reduction and economic growth, as the path coefficients P_{43} x P_{32} x P_{21} = (-0.83) x (-0.23) x (0.63) =0.120> 0.05. It means that technological progress would indirectly increase Human Development Index.

Finally, in path-4, technological progress indirectly had positive and not significant impact on human development, through economic growth, as the path coefficients P_{42} x P_{21} = (0.07 x 0.63) = 0.044< 0.05. Technological progress would indirectly increase Human Development Index, through economic growth. But this impact not statistically significant.

References

Alkire, Sabina (1998), **Operationalizing Amartya Sen's capability approach to human development: a framework for identifying valuable capabilities** (D.Phil thesis), *University of Oxford. OCLC 43087376.*

Asep Suryahadi, Athia Yumna, Umbu Reku Raya, Deswanto Marbun, (2010**), Review of Government's Poverty Reduction Strategies, Policies and Programs in Indonesia**, Research Report, The SMERU Research Institute, Jakarta.

Barro, R. J., and Lee J.W., (2001), "International data on educational attainment: Updates and implications", **Oxford Economic Papers**, 53(3): 541–563.

Bjork, G. J, (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger,Westport CT,London, pp: 251, ISBN 0-275-96532-5.

BPS, (2014),**Jumlah Penduduk Miskin, Persentase Penduduk Miskin dan Garis Kemiskinan 1970-2013 (*Number of Poor People, Percentage of Poor People and Poverty Line 1970-2013*),**http://bps.go.id/kemiskinan.

BPS, (2014**), Indeks Pembangunan Manusia Menurut Provinsi 1996-2013 (*Human Development Index by Province 1970-2013*),** *http://bps.go.id/pembangunan_manusia*.

BPS, (2015), **Laju Pertumbuhan PDB Atas Dasar Harga Konstan 2000 Menurut Lapangan Usaha (*Gross Domestic Product at Constant Price 2000 by Sector*s)**, Jakarta.

Galor O., (2005), "From Stagnation to Growth: Unified Growth Theory", **Handbook of Economic Growth**, Elsevier.

Helpman, E (2004), **The Mystery of Economic Growth**, Harvard University Press, Harvard.

Hippolyte, F., (2008), "Technology trap and poverty trap in Sub-Saharan Africa",**Working Paper No. WPS 4582**, Policy Research, World Bank, Washington, DChttp://documents.worldbank.org/curated/en/169021468198874707/Technology-trap-and-poverty-trap-in-Sub-Saharan-Africa.

Human Development at hps://en.wikipedia.org/wiki/Human_development_(humanity)

IMF, (2012), **Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Marx, I. and van den Bosch, K., (2016), "How poverty differs from inequality on poverty management in an enlarged EU context: Conventional and alternate approaches",**Centre for Social Policy**, Antwerp, Belgium.Available and retrived athttp://ec.europa.eu/eurostat/documents/1001617/4577263/1-1-I-MARX.pdf

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach.**Harvard University Press, Cambridge, pp: 33–

34. ISBN: 0674072359.

Nussbaum, M., (2000), **Women and human development: the capabilities approach,** Cambridge University Press, Cambridge New York, ISBN: 9780521003858.

OECD and ADB, (2002, "Technology and Poverty Reduction in Asia and the Pacific", Development Centre Seminars, OECD Development Centre, <http://www.oecd-ilibrary.org/development/technology-and-poverty-reduction-in-asia-and-the-pacific_9789264176171-en>

Philippe A., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality", **Econometrica,** 70(3): 855–882.

Raphael, D., (2009), "Poverty, Human Development, and Health in Canada: Research, Practice, and Advocacy Dilemmas", **Canadian Journal of Nursing Research (CJNR),**41 *(2): 7–18.*

Ricardo, S., (2008), "The Impact of Lifelong Learning on Poverty Reduction". **IFLL Public Value Paper 1. Latimer Trend,**Plymouth, UK: 5–6, ISBN: 978 1 86201 3797.

Socia Prihawantoro, Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana.,(2013), **Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (*The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach*)**, Badan Pengkajian dan Penerapan Teknologi, Jakarta.

Solow, R.M., (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics,** 70(1): 65-94.

Srinivasan, T.N. (1994), "Human Development: A New Paradigm or Reinvention of the Wheel",**Human Development**, (84(2): 238–243.

Streeten, P., (1994), "Human Development: Means and Ends",**Human Development**, (84.2): 232–237.

Swan, T. W., (1956), "Economic Growth and Capital Accumulation", **Economic Record,** 32: 334–61. Doi: 10.1111/j.1475-4932.1956.tb00434.x.

United Nations, (2016), "Indicators of Poverty & Hunger", **United Nations,** Retrieved on 14 Augustus 2016.

United Nations Development Programme, (1997), "*Human Development Report 1997".* Human Development Report, pp: 15,ISBN: 978-0-19-

511996-1.

United Nations Development Programme, (2015), **Human Development Reports** at http://hdr.undp.org/en/2015-report.

Word Bank (2011), “Poverty and Inequality Analysis”, **Worldbank.org,** Retrieved 27 May 2016.

Chapter-21

The Impact of Technological Progress on Indonesia's Global Competitiveness[1]

Ringkasan

Bab ini bertujuan melakukan analisis dampak langsung dan tidak langsung kemajuan teknologi terhadap daya saing global Indonesia, dengan pertumbuhan ekonomi dan pembangunan manusia sebagai variabel moderator. Data deret waktu tentang kemajuan teknologi, pertumbuhan ekonomi, pembangunan manusia dan daya saing global Indonesia dikumpulkan dari berbagai sumber dan model jalur digunakan untuk analisis. Hasilnya menunjukkan bahwa kemajuan teknologi mempunyai dampak langsung negative yang secara statistik signifikan terhadap daya saing global Indonesia. Kemajuan teknologi juga mempunyai dampak langsung negative yang secara statistik signifikan terhadap pembangunan manusia. Kemajuan teknologi mempunyai dampak langsung negative yang secara statistik signifikan terhadap pertumbuhan ekonomi. Sementara pertumbuhan ekonomi mempunyai dampak langsung positive terhadap pembangunan manusia, tetapi mempunyai dampak langsung yang negative terhadap daya saing global. Secara tidak langsung, dampak kemajuan teknologi terhadap daya saing global beragam, tergantung jalurnya. Pada Jalur P_{43}-P_{31}, secara tidak langsung melalui pembangunan manusia, dampak kemajuan teknologi terhadap daya saing global adalah negative dan signifikan. Tetapi, pada Jalur P_{43}-P_{32}-P_{21}, dampak tidak langsung kemajuan teknologi, melalui pembangunan manusia dan pertumbuhan, terhadap daya saing global adalah positive dan signifikan. Terakhir, pada Jalur P_{42}-P_{21}, dampak tidak langsung kemajuan teknologi, melalui pertumbuhan ekonomi, terhadap daya saing global Indonesia adalah negative dan secara statistik signifikan.

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Summary

This chapter analyzes direct and indirect impact of technological progress on Indonesia's global competitiveness, with economic growth and human development as moderator variables. Time series data on technological progress, economic growth, human development and global competitiveness of Indonesia were collected many sources and employed in a path analysis model. The results showed that technological progress had a negative and significant direct impact on the global competitiveness. Technological progress had also negative and significant direct impact on human development. Furthermore, technological progress had a positive and significant direct impact on economic growth, and economic growth had positive impact on human development and negative impact on global competitiveness. Indirectly, the impacts of technological progress on global competitiveness varied depend on the path. At P_{43}-P_{31}, indirect impact through human development, the impact was negative and significant. At P_{43}-P_{32}-P_{21}, indirect impact through human development and economic growth, the impact was positive and significant. Finally, at P_{42}-P_{21}, indirect impact through economic growth, the impact was negative and significant.

1. Introduction

According to Porter (2009), fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services. However, competitiveness hasbeen defined and understood diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to IMD (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (WEF, 1996). But According to Feurer, R. and Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes.

National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R. and Lodge, G. C., 1985). Competitiveness includes both efficiency; reaching goals at the lowest possible cost and effectiveness; having the right goals. It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et al, 1998).

The concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report 2009-2010 of the World Economic Forum (2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum (2003), in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook.

The Global Competitiveness Report is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the GlobalCompetitiveness Index (World Economic Forum, 2015), developed by Xavier, S, M., and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index. Up to 2009, the GCI provides a holistic overview of factors that are critical to driving productivity and competitiveness, and groups them into nine pillars: Institutions, Infrastructure, Macro-economy, Health and primary education, Higher education and training, Market efficiency, Technological readiness, Business sophistication, and Innovation The selection of these pillars and the factors underlying them is based on the latest theoretical and empirical research. It is important to note that none of these factors alone can ensure competitiveness (World Economic Forum, 2009). From 2010, the pillars adjusted into 12 and grouped into 3 keys, namely key for factor driven consist of pillars: Institutions, Infrastructure, Macroeconomic environment, and Health and primary education; key for efficiency driven consist of pillars: Higher education and training, Goods market efficiency, Labor market efficiency, Financial market development, Technological readiness, and Market size; key for innovation driven, consist of pillars: Business sophistication, and Innovation (World Economic Forum, 2010).

The position of Indonesian in global competitiveness rank was 72 from104 countries in 2003, 69 from 104 countries in 2004, 50 from 125 countries in 2006, 56 from131 countries in 2007, 55 from133 countries in 2008, 54 from139 countries in 2009, 44 from139 countries in 2010, 46 from139 countries in 2011, 50 from 144 countries in 2012, and 38 from148 countries in 2013, with overall index score ranging from 3.72 in 2014 to 4.53 in 2012. The stage of development the Indonesian position was in transition from stage-1 (factor driven economies) to stage-2 (efficiency driven economies).

One key of global competitiveness index is the key for innovation driven with 2 pillars: business sophistication and innovation, which are important indicators for technological advancement. Historically, technology has played a central role in raising living standards across the region, including those of the poor. The Green Revolution and various innovations of modern medicine and public health have been instrumental in improving nutrition, health, and livelihoods of millions of poor people. Agricultural and medical biotechnology hold tremendous promise but also bring with them new risks and concerns that need to be addressed before their full potential can be realized. New information technologies are only beginning to diffuse widely in developing Asia and the Pacific, but ultimately these too can have profound impacts on the lives of the poor, empowering them with access to information that once was the preserve of the privileged few (OECD & ADB, 2002).

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Technological change, technological development, technological achievement, or technological progress is the overall process of invention, innovation and diffusion of technology or processes. In essence technological change is the invention of technologies and their commercialization via research and development, the continual improvement of technologies, and the diffusion of technologies throughout industry or society. In short, technological change is based on both better and more technology (Jaffe, et al, 2002). In economics, change in a production function that alters the relationship between inputs and outputs. Normally it is understood to be an improvement in technology, or technological progress. Technological change is a change in the set of feasible production possibilities (Hick, J.R., 1963).

One of other the factors related to global competitiveness was the levels of Gross Domestic Product (GDP), which is the measure of economic growth. By definition, economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Technological change and economic growth are truly related to each other. The level of technology is also an important determinant of economic growth. The rapid rate of growth can be achieved through high level of technology. The technological progress keeps the economy moving. Inventions and innovations have been largely responsible for rapid economic growth in developed countries (Çalışkan, 2015).

It has been observed that major part of increased productivity is due to technological changes. Technological change is one of the most important determinants of the shape and evolution of the economy. Technological change has improved working conditions, permitted the reduction of working hours and provided the increased flow of products. The technology can be regarded as primary source in economic development and the various technological changes contribute significantly in the development of underdeveloped countries (Fagerberg, J., 2000).

The contribution of technical progress to economic development among others, that technical progress leads to the growth of output and productivity. As a result, per capita income is increased (Muchdie, et al., 2016). On the one hand, consumption of the household rises (Gupta, A., 2006), while, entrepreneurs start saving, generating more and more surplus. They are encouraged to make more and more investment in the economy. It helps to generate capital formation and the rate of growth automatically increases (Boucekkiney, R., & Cruz, B, O., 2015).

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, G.J., 1999), Solow-Swan Model developed by Sollow, R., (1956) and Swan, T., (1956), Endogenous Growth Theory which focus on what increases human capital or technological change (Helpman, E., 2004), Unified Growth Theory developed by Galor, O., (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory (Acemoglu, at.al., 2001), and Human Capital and Growth Theory (Barro & Lee, 2001).

Last factor in this study that seems related global competitiveness is human development, a development approach developed by the economist Ul-Haq (2003), is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum, M., (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015).The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nations Development Programme, 2015).

The objective of this paper is to report the results of analyses on the impact of technological progress on Indonesia's global competitiveness, with economic growth and human development as moderator variables.

2. Methods of Analysis

In analyzing direct and indirect impacts of technological progress on global competitiveness, this study employed path analysis model, that was developed in 1918 by Sewall Wright, who wrote about it extensively in the 1920s and 1930s (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics. Basically, the path model can be used to analysis two types of impacts: direct and indirect impacts. The total impacts of exogenous variables were the multiplication of the coefficient on the path (Alwin, D.F., & Hauser, R.M., 1975). In this study the path model is depicted in Figure 21.1: where technological progress, economic growth and human development were the exogenous variables.

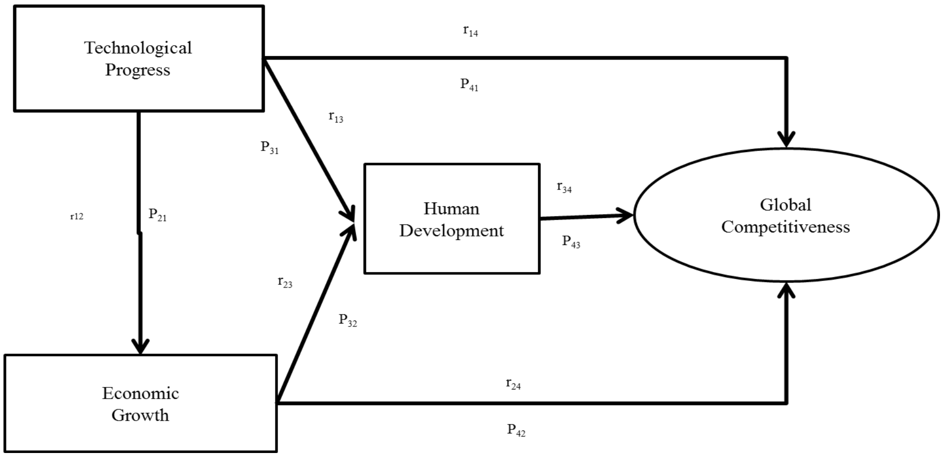

Figure 21.1

Path Model to Analysis the Technological Progress on Global Competitiveness

Table 21.1

Path Equations

1). $r_{12} = P_{21}$ Direct Effect (DE)	4). $r_{14} = P_{41}+p_{42}+r_{12}+p_{43}r_{13}$ Direct Effect + Indirect Effect (IE)
2). $r_{13} = P_{31}+p_{32}r_{123}$ Direct Effect (DE) + Indirect Effect (IE)	5). $r_{24} = p_{41}r_{12}+p_{42}+p_{43}r_{23}$ Direct Effect + Indirect Effect (IE) + Spurious (S)
3). $r_{23} = p_{31}r_{12}+p_{32}$ Spurious (S) + Direct Effect (IE)	4). $r_{34} = p_{41}r_{13}+p_{42}r_{23}+ p_{43}$ Direct Effect + Spurious (S)

Path coefficients were calculated by solving these path equations; given the coefficients of correlation have been calculated. P_{31} was direct impact of technological progress on global competitiveness, P_{31} was direct impact of technological progress on human development; P_{21} was direct impact of technological progress on global competitiveness, P_{32} was direct impact of economic growth on human development, and P_{42} was direct impact of economic growth on global competitiveness. Indirect impacts there were three paths; path P_{43}-P_{31} was indirect impact of technological progress on global competitiveness, through human development. Path P_{43}-P_{32}-P_{21} was indirect impact of technological progress on global competitiveness through human development and economic growth, and finally path P_{42}-P_{21} was indirect impact of technological progress on global competitiveness, through economic growth.

Global competitiveness was measured by the global competitiveness index, technological progress was measured by TFP growth, economic growth was measured by GDP growth and human development was measured by human development index. Data on Indonesia global competitiveness 2004-2013 were downloaded from several global competitiveness reports at http://reports.weforum.org/global-competitiveness-index/. Data on Indonesia technological progress provides by Prihawantoro, S., (2013). Data on Indonesia economic growth 2004-20013 was also provided by Prihawantoro, S., (2013). Data on Indonesia human development index 2004-2013 was downloaded from National Statistic Agency at http:bps.go.id/.

3. Results and Discussions

Figure 21.2 depicts technological progress in term of TFP growth (%), economic growth in term of GDP growth (%), human development index as well as global competitiveness index of Indonesia 2004-2013. The lowest

TFP growth was -1.71 per cent (2013) and the highest TFP growth was 3.59 per cent (2004). Average TFP growth index in term of statistic mean was 1.64 per cent (2006, 2007), and median was 1.86 per cent (2008). The lowest economic growth was 2.82 % (2009), and the highest economic growth was 8.07% (2011). The lowest human development index was 68.7 (2004) and the highest human development index was 73.8 (2013). Average index of human development in term of statistic mean was 71.4 (2008, 2009), and median was 71.41 (2008, 2009). Finally, the lowest global competitiveness index was 3.53 (2005) and the highest global competitiveness index was 4.53 (2013). Average index of global competitiveness in term of statistic mean was 4.20 (2007), and median was 4.26 (2009).

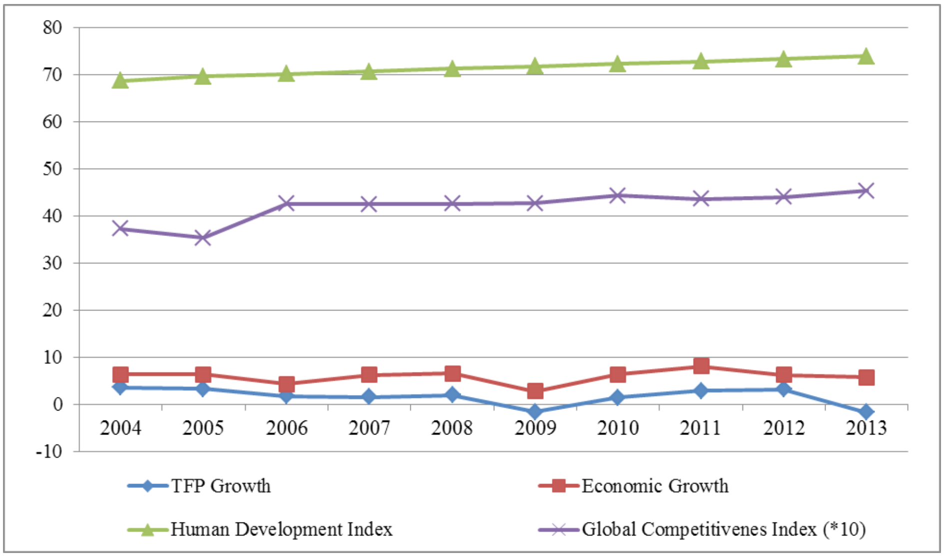

Figure 21.2

Technological Progress, Economic Growth, Human Development Indexand Global Competitiveness Index

Table 21.2

Correlation Coefficients

	TFP Growth	Economic Growth	Human Devel-opment	Global Competitive-ness
TFP Growth	1,00			
Economic Growth	0,63	1,00		
Human Development	-0,46	0,10	1,00	
Global Competitiveness	-0,52	-0,07	0,84	1,00

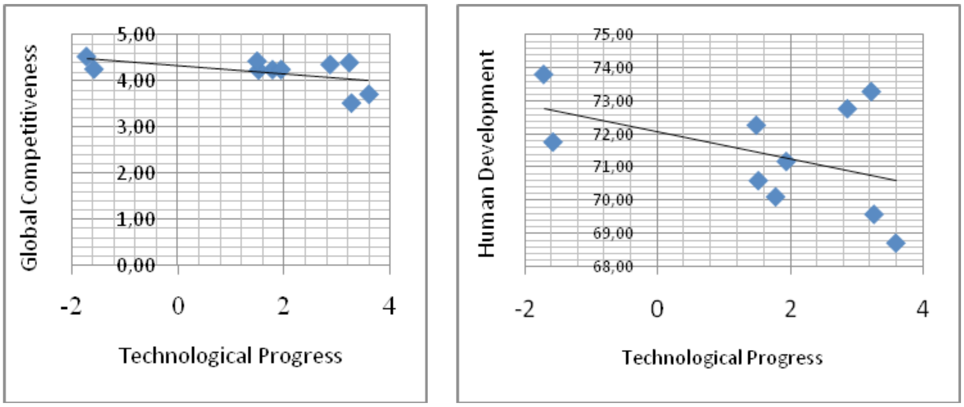

Figure 21.3

Scatter Diagram Technological Progress versus Global Competitiveness (left) and Technological Progress versus Human Development (right).

Table 21.2 presents correlation coefficients among variables being studied. Coefficient of correlation between technological progress and global competitiveness was negative and moderate as r_{14}= -0.52. Scatter diagram in Figure 21.3: (left) indicates the relation; as TFP growth increase, Indonesia's global competitiveness index would decrease. Regression analysis showed that regression coefficient was also negative, -0.09. But statistically, this regression coefficient was not significant as t-statistic (1.73) less than t-table (1.81) at a = 0.05 and n=10. Correlation coefficient between technological progress and human development was also negative and moderate, as r_{13} = -0.46. Scatter diagram in Figure 21.3: (right) indicates the relation; as TFP growth increase, Indonesia's human development index would decrease. Regression analysis showed that regression coefficient was negative, -0.41. But statistically, this regression coefficient was not significant as t-statistic (1.47) less than t-table (1.81) at a = 0.05 and n=10.

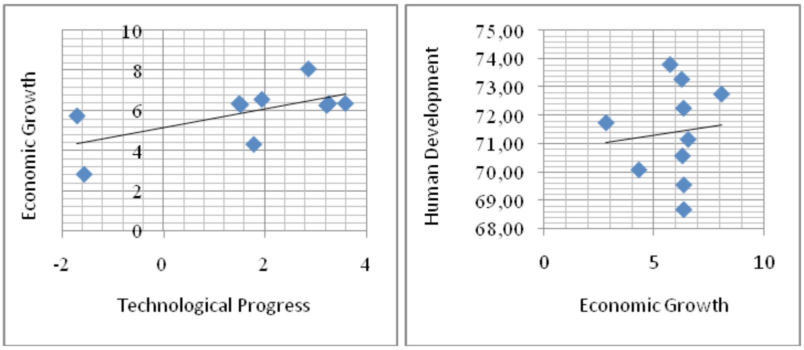

Figure 21.4

Scatter Diagram Technological Progress versus Economic Growth (left) and Economic Growth versus Human Development (right)

Correlation coefficients between technological progress and economic growth positive and strong, as r_{12} = 0.63. Scatter diagram in Figure 21.4: (left) indicates the relation; as TFP growth increase, Indonesia's economic growth would increase. Regression analysis showed that regression coefficient was positive, 0.47. Statistically, this regression coefficient was significant as t-statistic (2.29 greater than t-table (1.81) at a = 0.05 and n=10.Coefficient of correlation between economic growth and human development was positive, but this relation was very weak as r_{23} = 0.10. Scatter diagram in Figure 21.4: (right) indicates the relation; as economic growth increase, Indonesia's human development index would also increase. Regression analysis showed that regression coefficient was positive, 0.12. But statistically, this regression coefficient was not statistically significant as t-statistic (0.28) less than t-table (1.81) at a = 0.05 and n=10.

Correlation coefficients between economic growth and global competitiveness was negative and very weak, as r_{14} = -0.07. Scatter diagram in Figure 21.5: (left) indicates the relation; as economic growth increase, Indonesia's global competitiveness would decrease. Regression analysis showed that regression coefficient was negative, -0.01. Statistically, this regression coefficient was not significant as t-statistic (0.19) less than t-table (1.81) at a = 0.05 and n=10. Coefficient of correlation between human development and global competitiveness was positive and very strong as r_{34} = 0.84. Scatter diagram in Figure 21.5: (right) indicates the relation; as human development index increase, Indonesia's global competitiveness index would also increase. Regression analysis showed that regression coefficient was positive, 0.16. This regression coefficient was statistically significant as t-statistic (4.35) greater than t-table (1.81) at a = 0.05 and n=10.

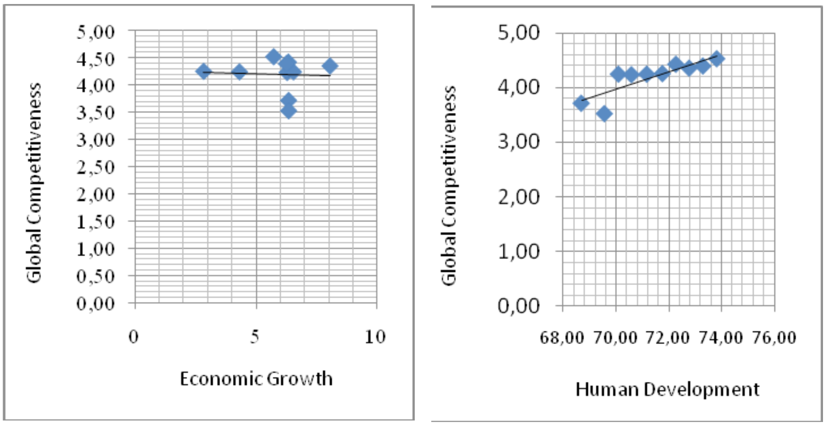

Figure 21.5

Scatter Diagram Economic Growth versus Global Competitiveness (left) and Human Development versus Global Competitiveness (right).

Table 21.3

Path Coefficients

	TFP Growth	Economic Growth	Human Development	Global Competitiveness
TFP Growth	1.00			
Economic Growth	0.63	1.00		
Human Development	-0.87	0.65	1.00	
Global Competitiveness	-0.09	-0.10	0.81	1.00

Direct impact of technological progress on Indonesia's global competitiveness was negative and significant as P_{41} = -0.09. It means that an increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.09 per cent. It is an odd finding that should be explained. Direct impact of technological progress on human development was also negative and significant as P_{31} = -0.87. An increase of 1 per cent TFP growth would decrease Indonesia's human development index by 0.87 per cent. Direct impact of TFP growth on economic growth was positive and significant as P_{21}= 0.63. It means that an increase of 1 per cent TFP growth would increase GDP growth by 0.63 per cent.

Direct impact of economic growth on human development was positive and significant as P_{32} = 0.65 meaning that 1 per cent increase of GDP growth would increase human development index by 0.65 per cent. Direct impact of economic growth on Indonesia's global competitiveness was negative and significant as P_{42} = -0.10. As economic growth increase by 1 per cent, Indonesia's global competitiveness index would decrease by 0.1 per cent. Direct impact of human development on global competitiveness was positive and significant as P_{43} = 0.81. It means that the increase of 1 per cent of human development index would increase Indonesia's global competitiveness index by 0.81 per cent.

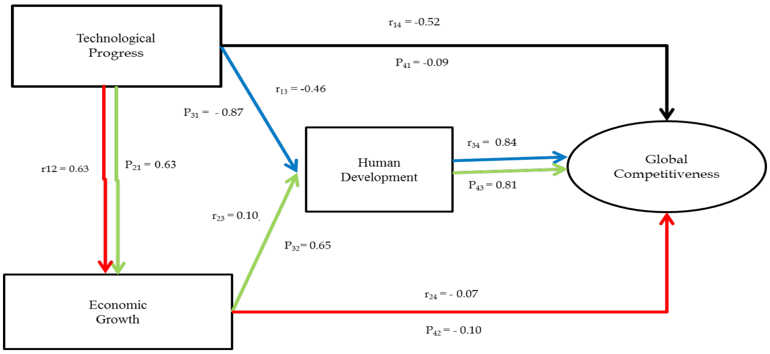

Figure 21.6

Path Coefficients and Path Analysis

Indirectly, the impact of technological progress on Indonesia's global competitiveness through human development was negative and significant as P_{43} x P_{31} = (0.81 x -0.87) = -0.70. It means that indirectly, the increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.70 per cent. The decreasing impact due to negative impact of technological progress on human development, even though the impact of human development on global competitiveness was positive and significant (see the blue path, P_{43}-P_{31}). Indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development was positive and significant as P_{43} x P_{32} x P_{21} = (0.81 x 0.65 x 0. 63) = 0.33. It means that the increase of 1 per cent TFP growth would increase the Indonesia's global competitiveness index by 0.33 per cent. Green path in Figure 21.6 (P_{43}-P_{32}-P_{21}) showed the indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development. The impact of technological progress on economic growth was positive and significant; the impact of economic growth on human development was also positive and significant, as well as the impact of human development on global competitiveness was positive and significant. Finally, the indirect impact of technological progress on Indonesia's global competitiveness through economic growth was negative and significant, as P_{42} x P_{21} = (-0.10 x 0.63) = -0.06. An increase of 1 per cent TFP growth would decrease global competitiveness index by 0.06 per cent. Red path in Figure 21.6 showed the impact of technological progress on Indonesia's global competitiveness through economic growth. Although the impact of technological progress on economic growth was negative, the indirect impact on Indonesia's global competitiveness was negative and significant as the impact of economic growth on global competitiveness was negative.

4. Conclusions

From discussion, it could be concluded that the direct impact of technological progress on global competitiveness was negative and significant. An increase of TFG growth would decrease global competitive index. The indirect impacts of technological progress on global competitiveness varied depend on the path. On the blue path, P_{43}-P_{31}, the impact of technological progress on Indonesia's global competitiveness was negative and significant. Although the impact of human development on global competitiveness was positive and significant; but the impact of technological progress on human development was negative and significant. The blue path coefficient was negative, -0.70. It means that an increase of TFP growth by 1 per cent would indirectly decrease global competitiveness index by 0.70 per cent. On the green path, P_{43}-P_{32}-P_{21}, the indirect impact of technological progress on global competitiveness was positive and significant as green path coefficient 0.33. It means that indirectly an increase of 1 per cent TFP growth would increase 0.33 per cent global competitiveness index. Finally, on the red path, P_{42}-P_{21}, the impact of technological progress on global competitiveness was negative and significant as red path coefficient was -0.06 meaning that 1 per cent increase of TFP growth would decrease Indonesia's global competitiveness index. Implications of these findings were technological progress would give different impact on competitiveness. It was suggested that application of technology should follow the right path. Technological progress would increase the growth of GDP; GDP growth would increase human development index and human development index would increase Indonesia's global competitiveness index.

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001),"The colonial origins of economic development: an empirical investigation", **American Economic Review**, 91(5): 1369–1401.

Aghion, P., (2002),"Schumpeterian Growth Theory and the Dynamics of Income Inequality, Econometrica", 70(3): 855–882.

Alkire, S., (1998), **Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities**, University of Oxford, Oxford, OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975), "The Decomposition of Effects in Path Analysis" **American Sociological Review**, 40(1): 37-47.

Barro, R. J. and Lee J.W., (2001),"International data on educational attainment: Updates and implications",**Oxford Economic Papers**, 53(3): 541–563.

Bjork, G. J, (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport CT, London.pp: 251, ISBN: 0-275-96532-5.

Boucekkiney, R., & Cruz, B, O., (2015), "Technological Progress and Investment: A Non-Technical Survey", Available at https://www.researchgate.net/publication/281048124_Technological_Progress_and_Investment_A_Non-Technical_Survey.

Buckley, P.J, Le Pass, C and Prescott, K., (1988), "Measures of International Competitiveness: A Critical Survey", **Journal of Marketing Management**, 4(2): 175-200.

Çalışkan, H, K., (2015),"Technological Change and Economic Growth", **Procedia - Social and Behavioral Sciences**, 195: 649 – 654.

Fagerberg, J., (2000), "Technological progress, structural change and productivity growth: a comparative", **Structural Change and Economic Dynamics**, 11(4): 393-411.

Galor O., (2005),"From Stagnation to Growth: Unified Growth Theory", **Handbook of Economic Growth**, Elsevier.

Gupta, A., (2006), "Technological Progress on Consumption Side: Consolidation and Prevalence of Complements", Available at SSRN:

https://ssrn.com/abstract=1145825; http://dx.doi.org/ 10.2139/ssrn.1145825

Helpman, E., (2004), **The Mystery of Economic Growth**,Harvard University Press, Harvard.

Hicks, J.R., (1963),**The Theory of Wages**, 2nd Edition, Macmillan.

Hippolyte, F., (2008), "Technology trap and poverty trap in Sub-Saharan Africa",**Working Paper**, No. WPS 4582, Policy Research, World Bank, Washington, DC. Available at:http://documents.worldbank.org/curated/en/169021468198874707/Technology-trap-and-poverty-trap-in-Sub-Saharan-Africa.

IMD, (2003), **World Competitiveness Yearbook 2003**, available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking/; https://worldcompetitiveness.imd.org.

IMF (2012),**Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Jaffe, A.B., Newell, R.G. & Stavins, R.N., (2002),"Environmental Policy and Technological Change", **Environment Resource Economics**, 22: 41. DOI: 10.1023/A: 1015519401088

Muchdie, Prihawantoro, S., Alkadri and Sugema (2016), "The Contribution of Technology on Indonesian Economy: National, Sectoral and Spatial

Perspectives", **Int. J, Adv. Res**, 4(12):2149-2156.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006),**A New Deal for Effective European Research Policy**, Springer, ISBN: 978-1-40205550-8.

Nussbaum, M., (2000),**Women and human development: the capabilities approach,** Cambridge University Press, Cambridge, New York. ISBN: 9780521003858.

Nussbaum, M., (2011),**Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, New York. pp. 33–34. ISBN: 0674072359.

OECD and ADB, (2002), "Technology and Poverty Reduction in Asia and the Pacific", **Development Centre Seminars, OECD Development Centre**, <http://www.oecd-ilibrary.org /development/technology-and-poverty-reduction-in-asia-and-the-pacific

Porter, M., (2009), "Clusters and Economic Policy"**ISC White Paper**, available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Prihawantoro, S., Irawan Suryawijaya, Ramos Hutapea, Ugay Sugarmansyah, Alkadri, Wawan Rusiawan, dan Muhammad Yorga Permana (2013), **Peranan Teknologi Dalam Pertumbuhan Koridor-Koridor Ekonomi Indonesia: Pendekatan Total Factor Productivity (*The Role of Technology in Economic Growth in Indonesian Economic Corridors: Total Factor Productivity Approach*),** Badan Pengkajian dan Penerapan Teknologi, Jakarta.

Rainer Feurer, R., and Chaharbaghi, K., (1995),"Strategy development: past, present and future",**Management Decision**, 33(6): 11 – 21.

Scott, B. R. and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston, Mass, USA.

Sen, A., (2005),"Human Rights and Capabilities",**Journal of Human Development**, 6 (2): 151– 166. Doi: 10.1080/14649880500120491.

Solow, R. M., (1956),"A Contribution to the Theory of Economic Growth",**Quarterly Journal of Economics**, 70(1): 65-94.

Srinivasan, T.N., (1994),"Human Development: A New Paradigm or Reinvention of the Wheel"?,**Human Development**, 84(2): 238–243.

Stajano, A., (2010),**Research, Quality, Competitiveness**, EU Technology Policy for the Knowledge-based Society, Springer ISBN 978-0-387-79264-4

Streeten, P., (1994),"Human Development: Means and Ends",**Human Development**, 84(2): 232– 237.

Swan, T. W., (1956), "Economic Growth and Capital Accumulation", **Economic Record,** 32: 334–61. Doi: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003),"The Human Development Paradigm". In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. (Eds),**Readings in Human Development: Concept, Measures and Policies for Development Paradigm**, Oxford University Press, New Delhi,pp:17-34.

United Nations Development Programme (1997), **Human Development Report 1997,**Human Development Report, pp: 15,ISBN: 978-0-19-511996-1.

United Nations Development Programme, (2015), **Human Development Reports** at http://hdr.undp.org/en/2015-report.

World Economic Forum, (1996),**Global Competitiveness Report 1996**, World Economic Forum, Geneva, pp.: 19.

World Economic Forum, (2003),**Global Competitiveness Report 2002-2003**, Available at https://www.scribd.com/document/6293577/World-Economic-Forum-Annual-Report-2002-2003

World Economic Forum, (2010),**The Global Competitiveness Report 2009–2010**, pp: 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum, (2011),**Global Competitiveness Report 2010-2011,** Available at http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2010-11.pdf

World Economic Forum, (2015),**Global Competitiveness Report 2014-2015**, Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015.

Wright, S., (1921),"Correlation and Causation",**Journal Agricultural Research**, 20: 557-585.

Wright, S., (1934),"The Method of Path Coefficients",**Annals of Mathematical Statistics**, 5(3): 161-215, DOI:10.1214/aoms/1177732676.

Xavier, S.M. and Artadi, E. A., (2004), "The Global Competitiveness Index",**Global Competitiveness Report,** Global Economic Forum.

Chapter-22

Does the Philip Curve Exist in the Short-Run?: Evidence from all over the World[1]

Ringkasan

Bab ini menyajikan bukti-bukti bahwa kurva Philips memang ada dalam perekonomian dunia. Kurva Philips menggambarkan hubungan negative antara tingkat inflasi and tingkat pengangguran; dilemma yang selalu dihadapi oleh rezim pemerintah manapun. Inflasi tidak dapat dikurangi tanpa kenaikan pengangguran, paling kurang dalam jangka waktu tertentu dan mengurangi tingkat pengangguran tidak bisa dilakukan secara tajam tanpa resiko meningkatnya inflasi. Inflasi tidak bisa dikurangi tanpa penciptaan resesi. Sudah ada bukti bahwa kurva Philips memang ada dalam jangka pendek. Menggunakan data tingkat inflasi dan tingkat pengangguran antar-negara tahun 2015 dari 182 negara di dunia: 49 negara di Asia, 52 negara di Afrika, 39 negara di Eropa dan 29 negara di Amerika, Bab ini membuktikan bahwa terdapat hubungan negative antara tingkat inflasi dan tingkat pengangguran. Ini berarti bahwa kurva Philips memang ada perekonomian dunia. Sayangnya, hubungan tersebut secara statistik tidak signifikan.

Summary

This chapter provides evidences that the Philips curve exists in the world's economy. The Philips curve depicted a negative correlation between the rate of inflation and unemployment rate. This dilemma has been a big problem faced by any

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government. Inflation cannot be eliminated without raising unemployment, at least for some time and moderate unemployment cannot be cut sharply without the risk of raising inflation. It was empirically evidence that this curve exist in the short-run. Inflation cannot be reduced without creating a recession. Using cross-nation data on inflation rate and rate of unemployment at the year of 2015 from 182countries all over the world: 49 countries in Asia, 52 countries in Africa, 39 countries in Europe and 29 countries in America, this chapter proved that there was a negative correlation between the rate of inflation and unemployment rate. It means that the Philipscurve do exists in economy, but the relationship between them was not statistically significant.

1. Introduction

In economics, inflation is a sustained increase in the general price level of goods and services in an economy over a period of time(Blanchard, 2000; Dornbusch & Fischer, 1994). When the price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money – a loss of real value in the medium of exchange and unit of account within the economy(Walgenbach, P.H.,et al, 1973). Achief measure of price inflation is the inflation rate, the annualized percentage change in a general price index, usually the consumer price index, over time (Mankiw, *2002).* Inflation affects economies in various positive and negative ways. The negative effects of inflation include an increase in the opportunity cost of holding money, uncertainty over future inflation which may discourage investment and savings, and if inflation were rapid enough, shortages of goods as consumers begin hoarding out of concern that prices will increase in the future. Positive effects include reducing the real burden of public and private debt, keeping nominal interest rates above zero so that central banks can adjust interest rates to stabilize the economy, and reducing unemployment due to nominal wage rigidity (Mankiw, *2002).*

Economists generally believe that high rates of inflation and hyperinflation are caused by an excessive growth of the money supply (Barro& Grilli, 1994). However, money supply growth does not necessarily cause inflation. Some economists maintain that under the conditions of a liquidity trap, large monetary injections are like "pushing on a string"(Makin*, 2010;* Krugman*&* Eggertsson, 2014). Views on which factors determine low to moderate rates of inflation are more varied. Low or moderate inflation may be attributed to fluctuations in realdemand for goods and services, or changes in available supplies such as during scarcities. However, the consensus view is that a long sustained period of inflation is caused by money supply growing faster than the rate of economic growth(Mankiw,*2002; Abel&*Bernanke, *2005).*

Today, most economists favor a low and steady rate of inflation(Hummel, 2007). Low inflation reduces the severity of economic recessions by enabling the labor market to adjust more quickly in a downturn, and reduces the risk that a liquidity trap prevents monetary policy from stabilizing the economy(Lars, 2003).The task of keeping the rate of inflation low and stable is usually given to monetary authorities. Generally, these monetary authorities are the central banks that control monetary policy through the setting of interest rates, through open market operations, and through the setting of banking reserve requirements(*Taylor, 2008).*

Unemployment occurs when people who are without work are actively seeking paid work(ILO,1982). The unemployment rate is a measure of the prevalence of unemployment and it is calculated as a percentage by dividing the number of unemployed individuals by all individuals currently in the labor force. During periods of recession, an economy usually experiences a relatively high unemployment rate (ILO, 2013).According to International Labour Organization (2013) report, more than 200 million people globally or 6% of the world's workforce were without a job in 2012.

There remains considerable theoretical debate regarding the causes, consequences and solutions for unemployment. Classical economics, New classical economics, and the Austrian School of economics argue that market mechanisms are reliable means of resolving unemployment. These theories argue against interventions imposed on the labor market from the outside, such as unionization, bureaucratic work rules, minimum wage laws, taxes, and other regulations that they claim discourage the hiring of workers.Keynesian economics emphasizes the cyclical nature of unemployment and recommends government interventions in the economy that it claims will reduce unemployment during recessions. This theory focuses on recurrent shocks that suddenly reduce aggregate demand for goods and services and thus reduce demand for workers. Keynesian models recommend government interventions designed to increase demand for workers; these can include financial stimuli, publicly funded job creation, and expansionist monetary policies. Its namesake, economist John

Maynard Keynes, believed that the root cause of unemployment is the desire of investors to receive more money rather than produce more products, which is not possible without public bodies producing new money (Dornbusch & Fisher, 1994).

The Phillips curve is a single-equation empirical model, named after A. W. Phillips, describing a historical inverse relationship between rates of unemployment and corresponding rates of inflation that result within an economy. Stated simply, decreased unemployment, in an economy will correlate with higher rates of inflation.While there is a short run tradeoff between unemployment and inflation, it has not been observed in the long run (Chang, 1997). In 1968, Milton Friedman asserted that the Phillips curve was only applicable in the short-run and that in the long-run, inflationary policies will not decrease unemployment(*Friedman,1968; Phelan, 2012)*. Friedman then correctly predicted that, in the 1973–75 recession, both inflation and unemployment would increase (*Phelan, 2012)*. The long-run Phillips Curve is now seen as a vertical line at the natural rate of unemployment, where the rate of inflation has no effect on unemployment.Accordingly, the Phillips curve is now seen as too simplistic, with the unemployment rate supplanted by more accurate predictors of inflation based on velocity of moneysupply measures such as the MZM ("money zero maturity") velocity, which is affected by unemployment in the short but not the long term(Hossfeld, 2010).

This paper is aimed to examine the existence of Philips curve in the world's economy using cross section data from Asian economies (49 countries), African economies (52 countries), European economies (39 countries) and American economies (29 countries).

2. Literature Reviews

a. Inflation

The term "inflation" originally referred to increases in the amount of money in circulation(*Chisholm, ed.,1922)*and some economists still use the word in this way. However, most economists today use the term "inflation" to refer to a rise in the price level. An increase in the money supply may be called monetary inflation, to distinguish it from rising prices, which may also for clarity be called "price inflation".Economists generally agree that in the long run, inflation is caused by increases in the money supply.

Conceptually, inflation refers to the general trend of prices, not changes in any specific price. For example, if people choose to buy more cucumbers than tomatoes, cucumbers consequently become more expensive and tomatoes cheaper. These changes are not related to inflation, they reflect a shift in tastes. Inflation is related to the value of currency itself. When currency was linked with the gold, if new gold deposits were found, the price of gold and the value of currency would fall, and consequently prices of all other goods would become higher.Rapid increases in quantity of the money or in the overall have occurred in many different societies throughout history, changing with different forms of money used (*Dobson, 2002;* Harl, *1996).* For instance, when gold was used as currency, the government could collect gold coins, melt them down, mix them with other metals such as silver, copper or lead, and reissue them at the same nominal value. By diluting the gold with other metals, the government could issue more coins without also needing to increase the amount of gold used to make them. When the cost of each coin is lowered in this way, the government profits from an increase in seigniorage. This practice would increase the money supply but at the same time the relative value of each coin would be lowered. As the relative value of the coins becomes lower, consumers would need to give more coins in exchange for the same goods and services as before. These goods and services would experience a price increase as the value of each coin is reduced.

Song Dynasty China introduced the practice of printing paper money in order to create fiat currency(*von Glahn, 1996)*. During the Mongol Yuan Dynasty, the government spent a great deal of money fighting costly wars, and reacted by printing more money, leading to inflation(*Ropp, 2010)*. Fearing the inflation that plagued the Yuan dynasty, the Ming Dynasty initially rejected the use of paper money, and reverted to using copper coins (*Bernholz,2003)*.

Historically, large infusions of gold or silver into an economy also led to inflation. From the second half of the 15th century to the first half of the 17th, Western Europe experienced a major inflationary cycle referred to as the "price revolution" (Hamilton, 1934; Munro, 2009) with prices on average rising perhaps sixfold over 150 years. This was largely caused by the sudden influx of gold and silver from the New World into Habsburg Spain(*Walton, 1994)*. The silver spread throughout a previously cash-starved Europe and caused widespread inflation (*Tracy, J.D., 1994)*. Demographic factors also contributed to upward pressure on prices, with European population growth after depopulation caused by the Black Death pandemic.By the nineteenth century, economists categorized three separate factors that cause a rise or fall in the price of goods: a change in the value or production costs of the good, a change in the price of money which then was usually a fluctuation in the commodity price of the metallic content in the currency, and currency depreciation resulting from an increased supply of currency relative to the quantity of redeemable metal backing the currency. Following the proliferation of private banknote currency printed during the American Civil War, the term "inflation" started to appear as a direct reference to the currency depreciation that occurred as the quantity of redeemable banknotes outstripped the quantity of metal available for their redemption. At that time, the term inflation referred to the devaluation of the currency, and not to a rise in the price of goods.

This relationship between the over-supply of banknote and a resulting depreciation in their value was noted by earlier classical economists, who would go on to examine and debate what effect monetary inflation has on the price of goods,later termed as inflation.

The inflation rate is widely calculated by calculating the movement or change in a price index, usually the consumer price index(Blanchard, 2000). The inflation rate is the percentage rate of change of a price index over time. The Retail Prices Index is also a measure of inflation that is commonly used in the United Kingdom. It is broader than the CPI and contains a larger basket of goods and services.To illustrate the method of calculation, in January 2007, the U.S. Consumer Price Index was 202.416, and in January 2008 it was 211.080. The formula for calculating the annual percentage rate inflation in the CPI over the course of the year is: The resulting inflation rate for the CPI in this one-year period is 4.28 per cent, meaning the general level of prices for typical U.S. consumers rose by approximately four percent in 2007.Other widely used price indices for calculating price inflation include Producer Price Indices(PPIs) and Commodity Price Indices (CPI). PPIsmeasures average changes in prices received by domestic producers for their output. This differs from the CPI in that price subsidization, profits, and taxes may cause the amount received by the producer to differ from what the consumer paid. There is also typically a delay between an increase in the PPI and any eventual increase in the CPI. Producer price index measures the pressure being put on producers by the costs of their raw materials. This could be "passed on" to consumers, or it could be absorbed by profits, or offset by increasing productivity. In India and the

United States, an earlier version of the PPI was called the Wholesale Price Index. Commodity price indices measure the price of a selection of commodities. In the present commodity price indices are weighted by the relative importance of the components to the "all in" cost of an employee.

b. Unemployment

The state of being without any work both for educated & uneducated person for earning one's livelihood is meant by unemployment.Economists distinguish between various overlapping types of and theories of unemployment, including cyclical or Keynesian unemployment, frictional unemployment, structural unemployment and classical unemployment. Some additional types of unemployment that are occasionally mentioned are seasonal unemployment, hardcore unemployment, and hidden unemployment.

Many economists have argued that unemployment increases with increased governmental regulation. For example, minimum wage laws raise the cost of some low-skill laborers above market equilibrium, resulting in increased unemployment as people who wish to work at the going rate cannotas the new and higher enforced wage is now greater than the value of their labor (*Hayek,1960). Law* restricting layoffs may make businesses less likely to hire in the first place, as hiring becomes more risky(*Anderton, 2006)*.However, this argument overly simplifies the relationship between wage rates and unemployment, ignoring numerous factors, which contribute to unemployment(*Garegnani, 1970; Vienneau, 2005; Opocher Steedman, 2009; Anyadike-Danes& Godley, 1989; White, 2001)*.Some, such as Murray Rothbard, suggest that even social taboos can prevent wages from falling to the market-clearing level (*Rothbard, 1963)*.

Vedder&Gallaway (1997) argue that the empirical record of wages rates, productivity, and unemployment in American validates classical unemployment theory. Their data shows a strong correlation between adjusted real wage and unemployment in the United States from 1900 to 1990. However, they maintain that their data does not take into account exogenous events.

Cyclical unemployment occurs when there is not enough aggregate supply in the economy to provide jobs for everyone who wants to work. Demand for most goods and services falls, less production is needed and consequently fewer workers are needed, wages are sticky and do not fall to meet the equilibrium level, and mass unemployment results(*Keynes, 2007).* Its name is derived from the frequent shifts in the business cycle. Keynesian economists see the lack of supply for jobs as potentially resolvable by government intervention. One suggested interventions involves deficit spending to boost employment and demand. Another intervention involves an expansionary monetary policy that increases the supply of money which should reduce interest rates which should lead to an increase in non-governmental spending*(Harris, 2005)*.

Marxists also share the Keynesian viewpoint of the relationship between economic demand and employment, but with the caveat that the market system's propensity to slash wages and reduce labor participation on an enterprise level causes a requisite decrease in aggregate demand in the economy as a whole, causing crises of unemployment and periods of low economic activity before the capital accumulation (investment) phase of economic growth can continue(*Marx, 1863)*.According to Karl Marx (2009), unemployment is inherent within the unstable capitalist system and periodic crises of mass unemployment are to be expected. The function of the proletariat within the capitalist system is to provide a "reserve army of labour" that creates downward pressure on wages. This is accomplished by dividing the proletariat into surplus labour and under-employment(Marx, 2009). This reserve army of labour fight among themselves for scarce jobs at lower and lower wages.According to Marx, the only way to permanently eliminate unemployment would be to abolish capitalism and the system of forced competition for wages and then shift to a socialist or communist economic system. For contemporary Marxists, the existence of persistent unemployment is proof of the inability of capitalism to ensure full employment.

There are also different ways national statistical agencies measure unemployment. These differences may limit the validity of international comparisons of unemployment data(Sorrentino, C., 2000).To some degree these differences remain despite national statistical agencies increasingly adopting the definition of unemployment by the International Labour Organization. To facilitate international comparisons, some organizations, such as the OECD, Eurostat, and International Labor Comparisons Program, adjust data on unemployment for comparability across countries.Though many people care about the number of unemployed individuals, economists typically focus on the unemployment rate. This corrects for the normal increase in the number of people employed due to increases in population and increases in the labour force relative to the population. The unemployment rate is expressed as a percentage, and is calculated as : unemployment rate = (unemployment workers/total labour force) x 100 per cent.

As defined by the International Labour Organization, “unemployed workers” are those who are currently not working but are willing and able to work for pay, currently available to work, and have actively searched for work.Individuals who are actively seeking job placement must make the effort to be in contact with an employer, have job interviews, contact job placement agencies, send out resumes, submit applications, respond to advertisements, or some other means of active job searching within the prior four weeks. Simply looking at advertisements and not responding will not count as actively seeking job placement. Since not all unemployment may be “open” and counted by government agencies, official statistics on unemployment may not be accurate(*Zuckerman, 2002)*. In the United States, for example, the unemployment rate does not take into consideration those individuals who are not actively looking for employment, such as those still attending college(Coy, 2012).

The ILO describes 4 different methods to calculate the unemployment rate, namely : Labour Force Sample Surveys, Official Estimates*,* Social Insurance Statisticsand Employment Office Statistics.This method also includes unemployed who are not unemployed per the ILO definition.

c. Philips Curve

William Phillips (1958) wrote a paper untittle *The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957*, which was published in the quarterly journal.In the paper Phillips describes how he observed an inverse relationship between money wage changes and unemployment in the British economy over the period examined. Similar patterns were found in other countries and Samuelson&Solow (1960) took Phillips’ work and made explicit the link between inflation and unemployment: when inflation was high, unemployment was low, and vice versa.In the 1920s, an American economist Fisher (1973) noted this kind of Phillips curve relationship. However, Phillips’ original curve described the behavior of money wages.In the years following Phillips’ 1958 paper, many economists in the advanced industrial countries believed that his results showed that there was a permanently stable relationship between inflation and unemployment.One implication of this for government policy was that governments could control unemployment and inflation with a Keynesian policy. They could tolerate a reasonably high rate of inflation as this would lead to lower unemployment – there would be a trade-off between inflation and unemployment. For example, monetary policy and/or fiscal policy could be used to stimulate the economy, raising gross domestic product and lowering the unemployment rate. Moving along the Phillips curve, this would lead to a higher inflation rate, the cost of enjoying lower unemployment rates. Economist James Forder(2014) argues that this view is historically false and that neither economists nor governments took that view and that the Phillips curve myth was an invention of the 1970s(*Forder, 2014)*.Since 1974, seven Nobel Prizes have been given to economists for, among other things, work critical of some variations of the Phillips curve. Some of this criticism is based on the United States' experience during the 1970s, which had periods of high unemployment and high inflation at the same time. The authors receiving those prizes include Thomas Sargent, Christopher Sims, Edmund Phelps, Edward Prescott, Robert A. Mundell, Robert E. Lucas, Milton Friedman, and F.A. Hayek(*Domitrovic, 2011).*

Most economists no longer use the Phillips curve in its original form because it was shown to be too simplistic (Hossfeld, 2010). This can be seen in a cursory analysis of US inflation and unemployment data from 1953–92. There is no single curve that will fit the data, but there are three rough aggregations—1955–71, 1974–84, and 1985–92—each of which shows a general, downwards slope, but at three very different levels with the shifts occurring abruptly. The data for 1953–54 and 1972–73 do not group easily, and a more formal analysis posits up to five groups/curves over the period (Chang 1997).But still today, modified forms of the Phillips Curve that take inflationary expectations into account remain influential. The theory goes under several names, with some variation in its details, but all modern versions distinguish between short-run and long-run effects on unemployment. Modern Phillips curve models include both a short-run Phillips Curve and a long-run Phillips Curve. This is because in the short run, there is generally an inverse relationship between inflation and the unemployment rate; as illustrated in the downward sloping short-run Phillips curve. In the long run, that relationship breaks down and the economy eventually returns to the natural rate of unemployment regardless of the inflation rate*(Reed, 2016).*

The "short-run Phillips curve" is also called the "expectations-augmented Phillips curve", since it shifts up when inflationary expectations raise (Friedman, M., 1968). In the long run, this implies that monetary policy cannot affect unemployment, which adjusts back to its "natural rate", or "long-run Phillips curve". However, this long-run "neutrality" of monetary policy does allow for short run fluctuations and the ability of the monetary authority to temporarily decrease unemployment by increasing permanent inflation, and vice versa. The popular textbook of Blanchard (2000) gives a textbook presentation of the expectations-augmented Phillips curve.An equation like the expectations-augmented Phillips curve also appears in many recent New Keynesiandynamic stochastic general equilibrium models. In these macroeconomic models with sticky prices, there is a positive relation between the rate of inflation and the level of demand, and therefore a negative relation between the rate of inflation and the rate of unemployment. This relationship is often called the "New Keynesian Phillips curve". Like the expectations-augmented Phillips curve, the New Keynesian Phillips curve implies that increased inflation can lower unemployment temporarily, but cannot lower it permanently. Two influential papers that incorporate a New Keynesian Phillips curve Galí&Gertler (1999), and Blanchard&Galí (2007).

3. Data and Method of Analysis

Data for this cross-section study were collected from http://www.tradingeconomics.com/ country-list/inflation-rate for inflation rate data and from for unemployment rate data. In Asian data on inflation rate and unemployment rate were collected from 49 countries. In Africa, data on inflation rate and unemployment rate were collected from 52 countries, in Europe data on inflation rate and unemployment rate were collected from 39 countries and in America data on inflation rate and unemployment rate were collected from 29 countries.

To prove the existence of the Philips curve in each economy, regression analysis was employed. If Y = inflation rate, and X = unemployment rate, the $y= x^{-e}$, so ln Y = -ln X, as data of Y and X were available, regression analysis could easily be calculated. Regression coefficients and their t-statistic were then analyzed to prove the existence of the Philips curve.

4. Results and Discussions

In Asian countries, the scatter diagram between inflation rate and the rate of unemployment (49 countries) is presented in Figure 22.1. Regression analysis between inflation rate (%) and the rate of unemployment (%) showed that there was a negative relation between them, as indicated by a negative regression coefficient (-0.04). This correlation was not statistically significant as P-value more than 0.05 and t-statistics (-0.22) less than t-table (2.02 at 95% confident level, n=49).

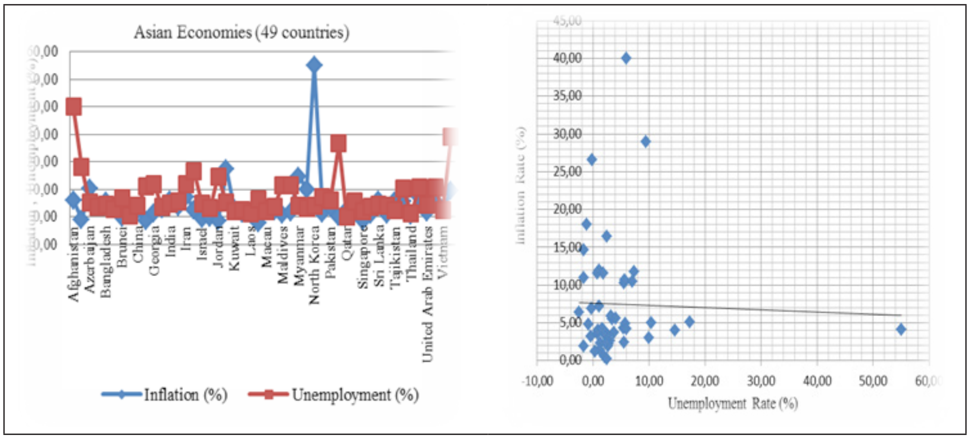

Figure 22.1

Asian Countries: Inflation Rate, Unemployment Rate and
Scatter Diagrambetween Inflation Rate and the Rate of Unemployment

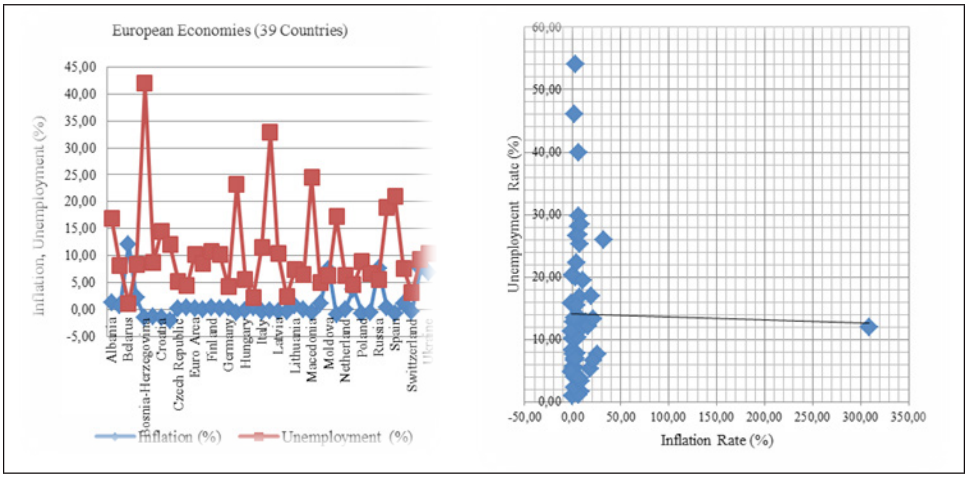

Figure 22.2

African Countries: Inflation Rate, Unemployment Rate and
Scatter Diagram between Inflation Rate and the Rate of Unemployment

Figure 22.2 presents the scatter diagram between inflation rate and the rate of unemployment in Africa (52 countries). Regression analysis between inflation rate (%) and the rate of unemployment (%) showed that there was a negative relation between them, as indicated by a negative regression coefficient (-2.17). This correlation was not statistically significant as P-value more than 0.05 and t-statistics (-0.32) less than t-table (2.01 at 95% confident level, n=52).

In European countries, the scatter diagram between inflation rate and the rate of unemployment (39 countries) is presented in Figure 22.3. Regression analysis between inflation rate (%) and the rate of unemployment (%) showed that there was a negative relation between them, as indicated by a negative regression coefficient (-0.12). This correlation was not statistically significant as P-value more than 0.05 and t-statistics (-2.14) less than t-table (2.03, at 95% confident level, n=39).

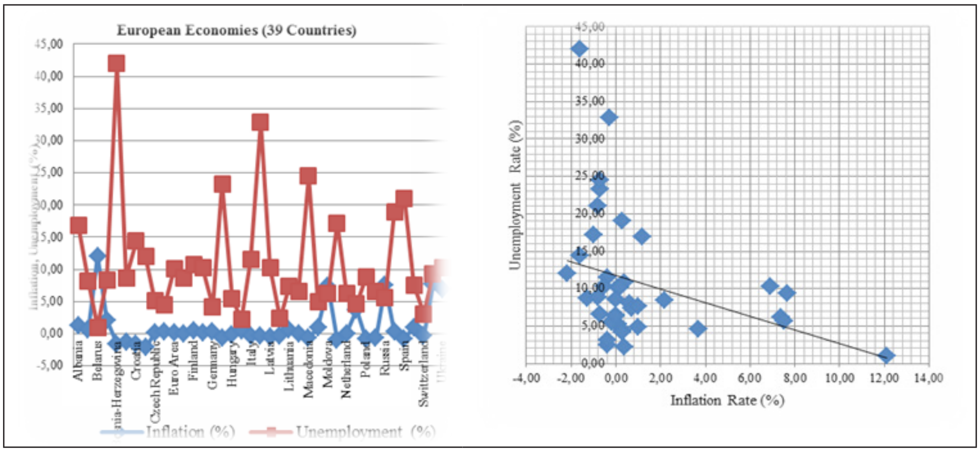

Figure 22.3

European Countries: Inflation Rate, Unemployment Rate and
Scatter Diagram between Inflation Rate and the Rate of Unemployment

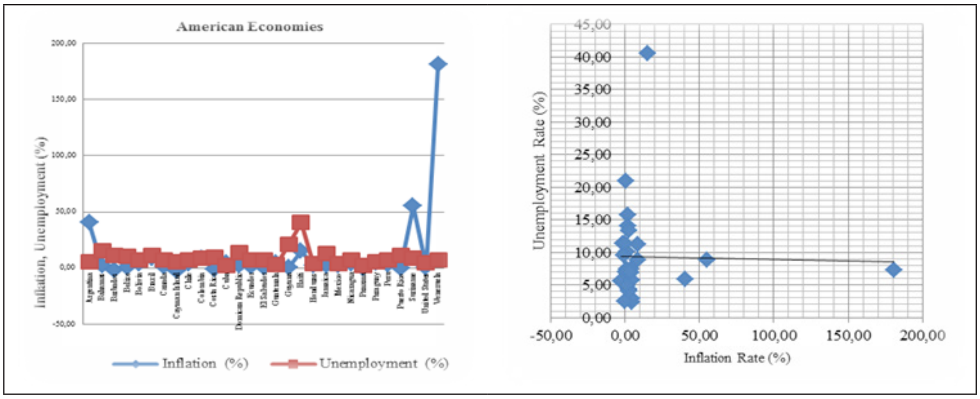

Figure 22.4

American Countries: Inflation Rate, Unemployment Rate and
Scatter Diagram between Inflation Rate and the Rate of Unemployment

Figure 22.4 presents the scatter diagram between inflation rate dan the rate of unemployment in the American economies (29 countries). Regression analysis between inflation rate (%) and the rate of unemployment (%) showed that there was a negative relation between them, as indicated by a negative regression coefficient (-0.64). This correlation was not statistically significant as P-value more than 0.05 and t-statistics (-0.06) less than t-table (2.05 at 95% confident level, n=29).

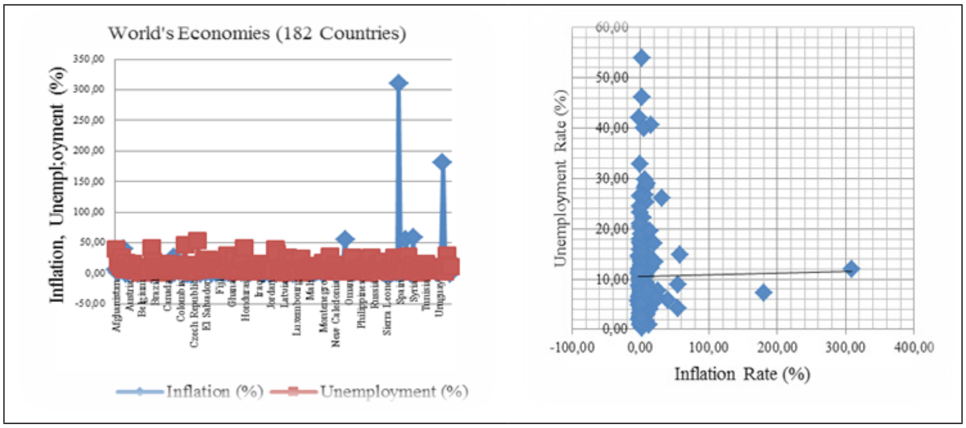

Figure 22.5

All Over Countries: Inflation Rate, Unemployment Rate and
Scatter Diagram between Inflation Rate and the Rate of Unemployment

Finally, Figure 22.5 provides scatter diagram between inflation rate and the rate of unemployment for all over the world's economies (182 countries). Regression analysis between inflation rate (%) and the rate of unemployment (%) showed that there was a negative relation between them, as indicated by a negative regression coefficient (-1.59). This correlation was not statistically significant as P-value more than 0.05 and t-statistics (-0.67) less than t-table (1.96 at 95% confident level, n=182).

5. Conclusions

It could be concluded that firstly the Philips curve exist in Asian economies as indicated by a negative correlation between the rate of inflation and unemployment rate.The regression coefficient was -0.04; t-test showed that the regression coefficient was not statistically significant. Secondly, in African economies, the Philip curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -2.17; t-test showed that the regression coefficient was not statistically significant. Thirdly, in European countries, the Philip curve also exists as there was a negative correlation between the rate of inflation andunemployment rate. The regression coefficient was -0.12; t-test showed that the regression coefficient was not statistically significant. Fourthly, in American economy, the Philip curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -0.64; t-test showed that the regression coefficient was not statistically significant. Finally, it could be concluded that the Philip curve does exists in the world's economy, but the existence was not statistically significant.

References

Abel, A., and Bernanke, B., (2005*),* **Macroeconomics**, 5th ed*,* Ch. 2, pp: 45–50; Ch. 7: pp: 266–269; and Ch. 9: 308–348.

Anderton, A., (2006), **Economics**, Fourth ed., Causeway, Ormskirk.

Anyadike-Danes, M., and Godley, W., (1989), "Real Wages and Employment: A Skeptical View of Some Recent Empirical Work", **The Manchester School**, 62(2): 172–187.doi*:*10.1111/j.1467-9957.1989.tb00809.x.

Barro, R., and Grilli, V., (1994), **European Macroeconomics**,Ch. 8: 139, Fig. 8.1, Macmillan, ISBN 0-333-57764-7.

Bernholz, P., (2003), **Monetary Regimes and Inflation: History, Economic and Political Relationships,**Edward Elgar Publishing, pp: 53–55,ISBN 978-1-84376-155-6.

Blanchard, O., and Galí, J., (2007), "Real Wage Rigidities and the New Keynesian Model", **Journal of Money Credit and Banking,**39(s1): 35–65. doi*:*10.1111/j.1538-4616.2007.00015.x.

Blanchard, O., (2000),**Macroeconomics**, 2nd ed,Prentice Hall. pp. 149–155,ISBN 0-13-013306-X.

Chang, R., (1997), "Is Low Unemployment Inflationary?", **Federal Reserve Bank of Atlanta Economic Review**, 1Q97:4-13

Clarida, R., Galí, J., and Gertler, M., (1999), "The science of monetary policy: a New-Keynesian perspective", **Journal of Economic Literature**,American Economic Association,37 (4): 1661–1707. doi*:*10.1257/jel.37.4.1661. JSTOR 2565488.

Dobson, R., (2002), “How Alexander caused a great Babylon inflation”,**The Independent**, Archived fromthe original on April 12, 2012,Retrieved April 12, 2016.

Domitrovic, B., (2011), “The Economics Nobel Goes to Sargent & Sims: Attackers of the Phillips Curve”, **Forbes.com,**Retrieved 12 October 2015.

Dornbusch, R. and Fishers, S., (1994),**Macro Economics**, Sixth ed, McGraw-Hill Inc. New York.

Fisher, I., (1973), “I discovered the Phillips curve: A statistical relation between unemployment and price changes”,**Journal of Political Economy**, The University of Chicago Press. 81 (2): 496–502. doi:10.1086/260048. JSTOR 1830534. Reprinted from 1926 edition of International Labour Review.

Forder, J., (2014), “Macroeconomics and the Phillips Curve Myth”,**Oxford University Press**,ISBN 978-0-19-968365-9.

Friedman, M., (1968), “The role of monetary policy”,**American Economic Review**,68 (1): 1–17, JSTOR 1831652.

Garegnani, P., (1970),“Heterogeneous Capital, the Production Function and the Theory of Distribution”, **Review of Economic Studies,**37 (3): 407–436,doi:10.2307/2296729,JSTOR 2296729.

Hamilton, E.J., (1934), “American Treasure and the Price Revolution in Spain, 1501–1650”,**Harvard Economic Studies**, 43, Harvard University Press, Cambridge, Massachusetts.

Harl, K. W.,(1996),**Coinage in the Roman Economy, 300 B.C. to A.D. 700,** The Johns Hopkins University Press,Baltimore,ISBN 0-8018-5291-9.

Harris, S. E., (2005),**The New Economics: Keynes' Influence on Theory and Public Policy**,Kessinger Publishing,ISBN 1-4191-4534-7.

Hayek, F. A., (1960),**The Constitution of country**, University of Chicago Press, Chicago.

Hossfeld, O., (2010), “US Money Demand, Monetary Overhang, and Inflation Prediction”, **International Network for Economic ResearchWorking Paper,**No. 2010.4

Hummel, J. R., (2007),**Death and Taxes, Including Inflation: the Public versus Economists**, (January 2007),pp: 56.

International Labor Organization, (1982), “Resolution concerning statistics of the economically active population, employment, unemployment, and underemployment", adopted by the Thirteenth International Conference of Labor Statisticians; see page 4 *(PDF).* Retrieved 26 November 2007.

International Labor Organization,(2013),**Global employment trends 2013*(PDF)***. International Labour Organization. 21 January 2013.

Keynes, J.M, (2007) [1936], **The General Theory of Employment, Interest and Money**. Palgrave Macmillan, Basingstoke.Hampshire,ISBN 0-230-00476-8. Archived from the originalon 16 March 2009.

Lars E.O. S., (2003),"Escaping from a Liquidity Trap and Deflation: The Foolproof Way and Others",**Journal of Economic Perspectives**, 17(4) Fall 2003: 145–166

Mankiw, N. G., (2002*),***Macroeconomics,** 5th ed., Worth, Ch. 2: 22–32; Ch. 4: 81–107; and Ch. 9: 238–255.

Marx, K., (1863*),* **Theorien über den Mehrwert (Theory of Surplus Value)**, pp: 478 or at MEW, 26.3, 300.

Marx, K., (2009), **Capital: An Abridged Edition**, Edited by David McLellan, Oxford Paperbacks, Oxford, UK. ISBN 978-0-19-953570-5.

Munro, J., (2009),**The Monetary Origins of the Price Revolution:South Germany Silver Mining, Merchant Banking, and Venetian Commerce, 1470–1540**, Toronto 2003Archived March 6, 2009, at the Wayback Machine.

Murray , R.,(1963), **America's Great Depression,** Van Nostrand, Princeton, pp: 45.

Opocher, A., and Steedman, I., (2009)*,* "Input Price-Input Quantity Relations and the Numéraire",**Cambridge Journal of Economics,**3(5): 937–948. DOI: 10.1093/cje/bep005.

Phelan, J., (2012),"Milton Friedman and the rise and fall of the Phillips Curve",**Thecommentator.com**, Retrieved September 29, 2014.

Phillips,A.W., (1958),"The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957",**Economica,**25(100): 283–299, doi*:*10.1111/j.1468-0335.1958.tb00003.x.

Reed, J., (2016), "AP Macroeconomics Review: Phillips Curve", **APEconReview.com**.

Ropp, P. S., (2010), **China in World History,**Oxford University Press, pp: 82,ISBN 978-0-19-517073-3.

Samuelson, P.A., and Solow, R. M., (1960),"Analytical Aspects of Anti-Inflation Policy",**American Economic Review,** 50(2): 177–194, JSTOR 1815021.

Sorrentino, C., (2000),"International Unemployment Rates: How Comparable are They?", **Monthly Labor Review**, June 2000: 3–20.

Tracy, J. D., (1994), **Handbook of European History 1400–1600: Late Middle Ages, Renaissance, and Reformation***,*Brill Academic Publishers,Boston, pp: *655,*ISBN 90-04-09762-7.

Vedder, Rand Gallaway, L.,(1997),**Out of Work: Unemployment and Government in the Twentieth-Century America,**NYU Press, New York. ISBN 0-8147-8792-4.

Vienneau, R.L., (2005),"On Labour Demand and Equilibria of the Firm",**The Manchester School,**73(5): 612–619, doi*:*10.1111/j.1467-9957.2005.00467.x.

von Glahn, R., (1996), **Fountain of Fortune: Money and Monetary Policy in China, 1000–1700,**University of California Press,pp: 48,ISBN 978-0-520-20408-9.

Walgenbach,P. H., Dittrich ,N. E., and Hanson,E. I., (1973), **Financial Accounting**, Harcourt Brace Javonovich, Inc, New York,pp: 429.

Walton, T.R., (1994),**The Spanish Treasure Fleets***,*Pineapple Press (FL), pp: 85. ISBN 1-56164-049-2.

White, G., (2001),"The Poverty of Conventional Economic Wisdom and the Search for Alternative Economic and Social Policies", **The Drawing Board: An Australian Review of Public Affairs,** 2(2): 67–87.

Zuckerman, S., (2002), "Official unemployment numbers omit discouraged seekers, part-time workers", **San Francisco Chronicle**, Archived from the originalon 29 June 2011. Retrieved 27 July 2016.

Chapter-23

The Existence of the Philips-Curve in the Long-Run: Evidences from Australia, South-Korea and Indonesia[1]

Ringkasan

Bab ini memberikan bukti adanya kurva Philips dalam perekonomian jangka panjang. Kurva Philips menggambarkan hubungan negative antara tingkat inflasi dan tingkat pengangguran. Pengurangan inflasi akan menyebabkan kenaikan pengangguran. Ada bukti-bukti empiris bahwa dalam jangka pendek kurva Philips memang ada. Dalam jangka panjang banyak penelitian membuktikan bahwa tidak ada hubungan negative antara tingkat inflasi dan tingkat pengangguran. Data tingkat inflasi dan tingkat pengangguran dari Australia (1980-2015), Korea Selatan (1980-2015) dan Indonesia (1995-2015) digunakan untuk membuktikan adanya kurva Philips dalam jangka panjang, menggunakan analysis regresi. Hasilnya membuktikan bahwa ada hubungan negative antara tingkat inflasi dengan tingkat pengangguran. Ini berarti bahwa dalam jangka panjang, kurva Philips memang ada, meski secara statistik hubungan negative ini tidak signifikan.

Summary

This chapter providesevidences on the existence of the Philips curve in an economy in the long run.The Philips curve depicted a negative correlation between the rate of inflation and unemployment rate. Decreasing inflation rate will increasing the rate of unemployment. It was empirically evidence that

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this curve exist in the short-run. In the short run, inflation cannot be reduced without creating a recession. In the long run, many research proved that there was not any trade-off between inflation and unemployment. Data from Australia (1980-2015), South Korea (1980-2015) and Indonesia (1995-2015) have been used to provide evidences on the existence of Philips curve in the long run, using regression analysis. The results provide evidences that there were negative correlation between the rate of inflation and unemployment rate.It means that in the long run, the Philips curve do exist in the economy, even though the relationship between them was not statistically significant.

1. Introduction

In economics, inflation is a sustained increase in the general price level of goods and services in an economy over a period of time (Blanchard, 2000; Dornbusch & Fischer, 1994). When the price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money –a loss of real value in the medium of exchange and unit of account within the economy (Walgenbach, P.H. et al., 1973). A chief measure of price inflation is the inflation rate, the annualized percentage change in a general price index, usually the consumer price index, over time (Mankiw, 2002). Inflation affects economies in various positive and negative ways. The negative effects of inflation include an increase in the opportunity cost of holding money, uncertainty over future inflation which may discourage investment and savings, and if inflation were rapid enough, shortages of goods as consumers begin hoarding out of concern that prices will increase in the future. Positive effects include reducing the real burden of public and private debt, keeping nominal interest rates above zero so that central banks can adjust interest rates to stabilize the economy, and reducing unemployment due to nominal wage rigidity (Mankiw, 2002).

Economists generally believe that high rates of inflation and hyperinflation are caused by an excessive growth of the money supply (Barro& Grilli, 1994). However, money supply growth does not necessarily cause inflation. Some economists maintain that under the conditions of a liquidity trap, large monetary injections are like “pushing on a string”. Views on which factors determine low to moderate rates of inflation are more varied. Low or moderate inflation may be attributed to fluctuations in real demand for goods and services, or changes in available supplies such as during scarcities. However, the consensus view is that a long sustained period of inflation is caused by money supply growing faster than the rate of economic growth (Mankiw, 2002; Abel & Bernanke, 2005).

Today, most economists favor a low and steady rate of inflation (Hummel, 2007). Low inflation reduces the severity of economic recessions by enabling the labor market to adjust more quickly in a downturn, and reduces the risk that a liquidity trap prevents monetary policy from stabilizing the economy (Lars, 2003). The task of keeping the rate of inflation low and stable is usually given to monetary authorities. Generally, these monetary authorities are the central banks that control monetary policy through the setting of interest rates, through open market operations, and through the setting of banking reserve requirements.

Unemployment occurs when people who are without work are actively seeking paid work (ILO,1982). The unemployment rate is a measure of the prevalence of unemployment and it is calculated as a percentage by dividing the number of unemployed individuals by all individuals currently in the labor force. During periods of recession, an economy usually experiences a relatively high unemployment rate (ILO, 2013). According to International Labour Organization report (2013), more than 200 million people globally or 6% of the world's workforce were without a job in 2012.

There remains considerable theoretical debate regarding the causes, consequences and solutions for unemployment. Classical economics, New classical economics, and the Austrian School of economics argue that market mechanisms are reliable means of resolving unemployment. These theories argue against interventions imposed on the labor market from the outside, such as unionization, bureaucratic work rules, minimum wage laws, taxes, and other regulations that they claim discourage the hiring of workers. Keynesian economics emphasizes the cyclical nature of unemployment and recommends government interventions in the economy that it claims will reduce unemployment during recessions. This theory focuses on recurrent shocks that suddenly reduce aggregate demand for goods and services and thus reduce demand for workers. Keynesian models recommend government interventions designed to increase demand for workers; these can include financial stimuli, publicly funded job creation, and expansionist monetary policies. Its name sake, economist John Maynard Keynes, believed that the root cause of unemployment is the desire of investors to receive more money rather than produce more products, which is not possible without public bodies producing new money (Dornbusch & Fisher, 1994).

The Phillips curve is a single-equation empirical model, named after A. W. Phillips (1958), describing a historical inverse relationship between rates of unemployment and corresponding rates of inflation that result within an economy. Stated simply, decreased unemployment, in an economy will correlate with higher rates of inflation.While there is a short run trade-off between unemployment and inflation, it has not been observed in the long run (Chang, 1997). In 1968, Milton Friedman asserted that the Phillips curve was only applicable in the short-run and that in the long-run, inflationary policies will not decrease unemployment (Friedman, 1968; Phelan, 2012). Friedman then correctly predicted that, in the 1973–75 recession, both inflation and unemployment would increase (Phelan, 2012).. The long-run Phillips Curve is now seen as a vertical line at the natural rate of unemployment, where the rate of inflation has no effect on unemployment.Accordingly, the Phillips curve is now seen as too simplistic, with the unemployment rate supplanted by more accurate predictors of inflation based on velocity of moneysupply measures such as the MZM ("money zero maturity") velocity, which is affected by unemployment in the short but not the long term (Hossfeld, 2010).

Phillips (1958) wrote a paper entitle "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957", which was published in the quarterly journal. In the paper Phillips describes how he observed an inverse relationship between money wage changes and unemployment in the British economy over the period examined. Similar patterns were found in other countries and Samuelson & Solow (1960) took Phillips' work and made explicit the link between inflation and unemployment: when inflation was high, unemployment was low, and vice versa. In the 1920s, an American economist Fisher (1973) noted this kind of Phillips curve relationship. However, Phillips' original curve described the behavior of money wages. In the years following Phillips' paper, many economists in the advanced industrial countries believed that his results showed that there was a permanently stable relationship between inflation and unemployment. One implication of this for government policy was that governments could control unemployment and inflation with a Keynesian policy. They could tolerate a reasonably high rate of inflation as this would lead to lower unemployment; there would be a trade-off between inflation and unemployment. For example, monetary policy and/or fiscal policy could be used to stimulate the economy, raising gross domestic product and lowering the unemployment rate. Moving along the Phillips curve, this would lead to a higher inflation rate, the cost of enjoying lower unemployment rates. Economist Forder, J., (2014) argues that this view is historically false and that neither economists nor governments took that view and that the 'Phillips curve myth' was an invention of the 1970s. Since 1974, seven Nobel Prizes have been given to economists for, among other things, work critical of some variations of the Phillips curve. The authors receiving those prizes include Thomas Sargent, Christopher Sims, Edmund Phelps, Edward Prescott, Robert A. Mundell, Robert E. Lucas, Milton Friedman, and F.A. Hayek (Domitrovic, 2011).

Most economists no longer use the Phillips curve in its original form because it was shown to be too simplistic (Hossfeld, 2010). This can be seen in a cursory analysis of US inflation and unemployment data from 1953–92. There is no single curve that will fit the data, but there are three rough aggregations1955–71, 1974–84, and 1985–92—each of which shows a general, downwards slope, but at three very different levels with the shifts occurring abruptly. The data for 1953– 54 and 1972–73 do not group easily, and a more formal analysis posits up to five groups/curves over the period (Chang, 1997). But still today, modified forms of the Phillips Curve that take inflationary expectations into account remain influential. The theory goes under several names, with some variation in its details, but all modern versions distinguish between short-run and long-run effects on unemployment. Modern Phillips curve models include both a short-run Phillips Curve and a long-run Phillips Curve. This is because in the short run, there is generally an inverse relationship between inflation and the unemployment rate; as illustrated in the downward sloping short-run Phillips curve. In the long run, that relationship breaks down and the economy eventually returns to the natural rate of unemployment regardless of the inflation rate (Reed, 2016).

The "short-run Phillips curve" is also called the "expectationsaugmented Phillips curve", since it shifts up when inflationary expectations raise (Friedman, M., 1968). In the long run, this implies that monetary policy cannot affect unemployment, which adjusts back to its "natural rate", or "long-run Phillips curve". However, this long-run "neutrality" of monetary policy does allow for short run fluctuations and the ability of the monetary authority to temporarily decrease unemployment by increasing permanent inflation, and vice versa. The popular textbook of Blanchard (2000) gives a textbook presentation of the expectations-augmented Phillips curve.

This chapter aimed to provide evidences on the existence of the Philips curve in the long run, using time series data from Australia, South Korea and Indonesia.

2. Data and Method of Analysis

Data for this time series study were collected from www.rateinflation.com/inflation-rate/australia-historical-inflation-rate?start-year=1985&end-year=2015 for Australia inflation rate data and data for Australian unemployment ratehttps://ycharts.com/indicators/australia_unemployment_rate_annual. Inflation data for South Korean were collected from https://ycharts.com/indicators/south_korea_inflationand for unemployment rate were collected from https://ycharts.com/indicators/south_korea_unemployment and for inflation and unemployment data of Indonesia were collected from Central Bank of Indonesia and National Statistic Agency.

To prove the existence of the Philips curve in each country, regression analysis was employed. If Y = inflation rate, and X = unemployment rate, then y= x-e, so ln Y = -ln X, as data of Y and X were available, regression analysis could easily be calculated. Regression coefficients and their t-statistic were then analyzed to prove the existence of the Philips curve.

3. Results and Discussions

Figure 23.1 (left panel) provides data on inflation rate and the rate of unemployment for Australian economy 1980-2015 (35 years). In general the rate of unemployment was higher than the rate of inflation, except for the year 1980-1983 and 1985-1989. In the right panel, the scatter diagram between inflation rate and the rate of unemployment. From diagram, the trend of the existence of the Philips curve could be predicted. As provided in Table 1, the regression coefficient between inflation and unemployment was -1.1392 (negative) and t-statistics indicated that the regression coefficient was not statistically significant as t-table for a =0.05, n=35 was 1.690. Meanwhile, P-value for regression coefficient was 0.58 > 0.05, means that the regression line was not statistically significant. It means that, in the long run, the Philips curve exist in Australian economy, but the existence of the Philips curve in Australian economy was not statistically significant.

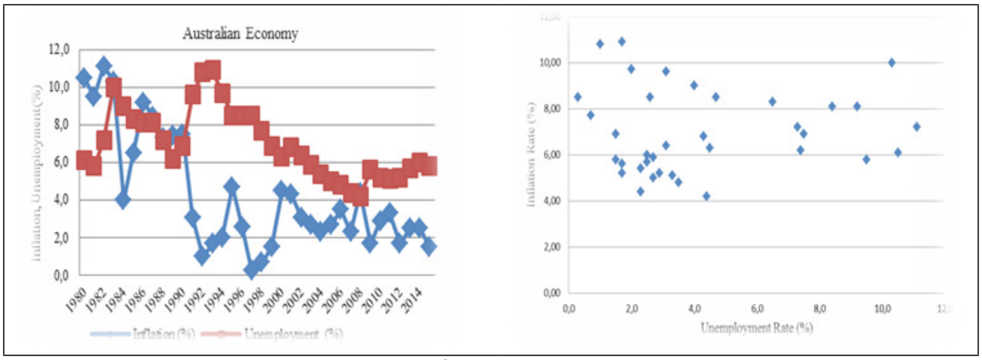

Figure 23.1

Inflation Rate, Unemployment Rate and the Scatter Diagram:
Australian Economy (1980-2015).

Table 23.1

Regression Analysis : Inflation Rate (X) and Unemployment (Y) in Australia

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Inflation	2.1317	3.9759	0.5361	0.5954
Unemployment	-1.1392	2.0604	-0.5529	0.5840

Figure 23.2 (left panel) provides data on inflation rate and the rate of unemployment for South Korea economy 1980-2015 (35 years). In some time the rate of unemployment was lower than the rate of inflation. In the right panel provides the scatter diagram between inflation rate and the rate of unemployment. From diagram, the trend of the existence of the Philips curve could be predicted. As provided in Table 2, the regression coefficient between inflation and unemployment was -3.0349 (negative) and t-statistics indicated that the regression coefficient was not statistically significant as t-table for a =0.05, n=35 was 1.690. Meanwhile, P-value for regression coefficient was 0.3669 > 0.05, means that the regression line was not statistically significant. It means that in the long run, the Philips curve exist in South Korean economy, even though the existence of the Philips curve in South Korean, in the long run, was not statistically significant.

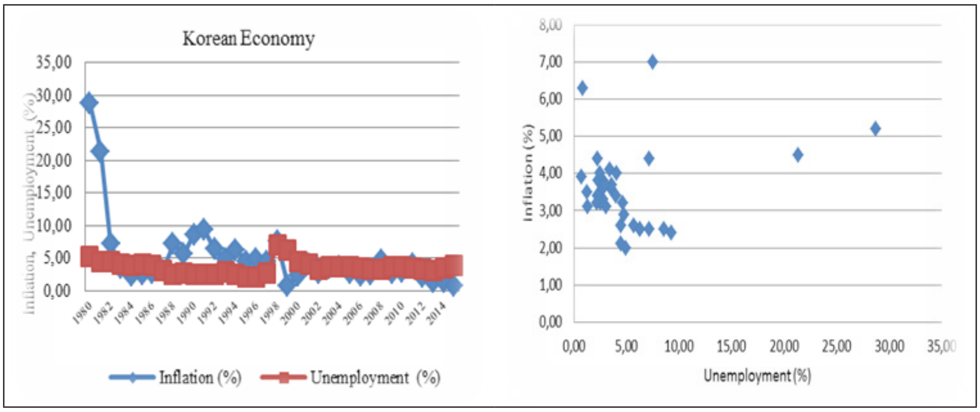

Figure 23.2

Inflation Rate, Unemployment Rate and the Scatter Diagram,
South Korea (1980-2015).

Table 23..2

Regression Analysis : Inflation Rate (X) and Unemployment (Y) in South Korea

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Inflation	1.4134	4.1736	0.3387	0.7369
Unemployment	-3.0349	3.3186	-0.9145	0.3669

Figure 23.3 (left panel) provides data on inflation rate and the rate of unemployment for Indonesian economy 1995-2015 (20 years). In some time the rate of unemployment was lower than the rate of inflation. In the right panel provides the scatter diagram between inflation rate and the rate of unemployment. From diagram, the trend of the existence of the Philips curve could be predicted. As provided in Table 23.3, the regression coefficient between inflation and unemployment was -1.3328 (negative) and t-statistics indicated that the regression coefficient was not statistically significant as t-table for a =0.05, n=35 was 1.690. Meanwhile, P-value for regression coefficient was 0.3669 > 0.05, means that the regression line was not statistically significant. Negative regression coefficient indicates the existence of the Philips curve in the long run in the Indonesian economy, but the regression coefficient was not statistically significant.

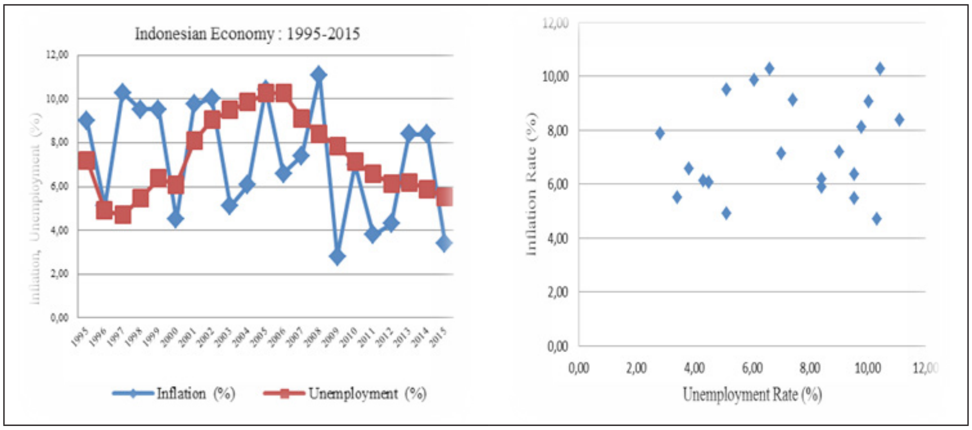

Figure 23.3

Inflation Rate, Unemployment Rate and the Scatter Diagram, Indonesia (1995-2015).

Table 23.3

Regression Analysis : Inflation Rate and Unemployment Rate in Indonesia

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	4.6405	4.8512	0.9566	0.3508
X Variable 1	-1.3328	2.4472	-0.5446	0.5924

4. Conclusions

It could be concluded that firstly, in the long run, the Philips curve exist in Australian economy as indicated by a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -1.1392; t-test showed that the regression coefficient was not statistically significant. Secondly, in South Korea economy in the long run, the Philips curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -3.0349; t-test showed that the regression coefficient was not statistically significant. Thirdly, in Indonesian economy in the long run, the Philips curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -1.3328; t-test showed that the regression coefficient was not statistically significant. Finally, it could be concluded that the Philips curve do exists in the long run as experienced in Australia, South Korea and Indonesia, but the existences were not statistically significant.

References

Abel, A., and Bernanke, B., (2005), **Macroeconomics**, 5th ed., Ch. 2: 45–50; Ch. 7: 266–269; and Ch. 9: 308–348.

Barro, R., and Grilli, V., (1994),**European Macroeconomics**, Ch. 8, p: 139, Fig. 8.1., Macmillan, ISBN: 0-333-57764-7.

Blanchard, O., (2000), **Macroeconomics,** (2nd ed), Prentice Hall, pp: 149–55, ISBN 0-13-013306-X.

Chang, R., (1997),"Is Low Unemployment Inflationary?",**Federal Reserve Bank of Atlanta Economic Review**, 1Q97:4-13.

Domitrovic, B., (2011),"The Economics Nobel Goes to Sargent & Sims: Attackers of the Phillips Curve",**Forbes.com**, Retrieved 12 October 2015.

Dornbusch, R., and Fischers, S., (1994), **Macroeconomics,** Sixth ed. McGraw-Hill Inc. New York.

Forder, J., (2014),**Macroeconomics and the Phillips Curve Myth**, Oxford University Press, ISBN 978-0-19-968365-9.

Friedman, M., (1968),"The role of monetary policy",**American Economic Review**, 68(1): 1–17, JSTOR 1831652.

Hossfeld, O., (2010),"US Money Demand, Monetary Overhang, and Inflation Prediction", **International Network for Economic Research Working Paper**, No. 2010.4

Hummel, J. R., (2007),"Death and Taxes, Including Inflation: the Public versus Economists" (January 2007), pp: 56.

International Labor Organization, (1982),"Resolution concerning statistics of the economically active population, employment, unemployment, and underemployment", adopted by the **Thirteenth International Conference of Labor Statisticians**; see page 4 (PDF), Retrieved 26 November 2007.

International Labor Organization, (2013),**Global employment trends 2013(PDF).** International Labour Organization, 21 January 2013.

Keynes, J.M., (2007) [1936],**The General Theory of Employment, Interest and Money**,Palgrave Macmillan, Basingstoke, Hampshire: ISBN 0-230-00476-8, Archived from the original on 16 March 2009.

Lars E.O. S., (2003),"Escaping from a Liquidity Trap and Deflation: The Foolproof Way and Others",**Journal of Economic Perspectives**, 17(4) Fall 2003: 145–166.

Mankiw, N. G., (2002),**Macroeconomics**, 5th ed., Worth, Ch. 2: 22–32; Ch. 4: 81–107; and Ch. 9: 238–255.

Phelan, J., (2012),"Milton Friedman and the rise and fall of the Phillips Curve",**thecommentator.com**, Retrieved September 29, 2014.

Phillips, A.W., (1958),"The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957",**Economica**, 25(100): 283–299, doi:10.1111/j.1468-0335.1958.tb00003.x.

Reed, J., (2016),"AP Macroeconomics Review: Phillips Curve",**APEconReview.com**.

Ropp, P. S., (2010),**China in World History**, Oxford University Press, pp: 82, ISBN 978-0-19-517073-3.

Walgenbach, P. H., Dittrich , N. E. and Hanson, E. I., (1973), **Financial Accounting**, Harcourt Brace, Inc., New York, pp: 429.

www.rateinflation.com/inflation-rate/australia-historical-inflation-rate?start-year=1985&end-year=2015

https://ycharts.com/indicators/australia_unemployment_rate_annual

https://ycharts.com/indicators/south_korea_inflation

https://ycharts.com/indicators/south_korea_unemployment

Part-3

ISLAMICITY, DEVELOPMENT AND HAPPINESS

Chapter-24
Islamicity, Human Development and Global Competitiveness

Chapter-25
Economic Growth, Human Development and Happiness

Chapter-26
Human Development, Global Competitiveness and Happiness

Chaper-27
Economic Growth, Human Development and Global Competitiveness

Chapter-28
Economic Growth, Human Development, Global Competitiveness and Happiness

Chapter 29
Islamicity, Economic Growth, Human Development and Happiness

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Conclusion

Chapter-24

Islamicity, Human Development and Global Competitiveness[1]

Ringkasan

Bab ini menganalisis dampak langsung dan tidak langsung ke-Islaman terhadap daya saing global yang indikator-indikatornya Kinerja kunci Persyarikatan Muhammadiyah, sebagai variabel antara. Data antar-negara tentang indeks ke-Islaman, indeks Pembangunan Manusia dan indeks Daya saing global dikumpulkan dari 123 negara. Analisis dampak menggunakan model analisis jalur. Hasil analisis menunjukkan ke-Islaman mempunyai dampak langsung positive yang secara statistik signifikan terhadap daya saing global. Selanjutnya, pembangunan manusia juga mempunyai dampak langsung positive yang secara statistik signifikan terhadap daya saing global. Akhirnya, ke-Islaman, secara tidak langsung melalui pembangunan manusia, mempunyai dampak positive yang secara statistik signifikan. Penelitian ini menyarankan agar ajaran-ajaran Islam seperti terimplementasi dalam amal-usaha Muhammadiyah terus ditingkatkan agar daya saing global terus meningkat.

Summary

This chapter analyzes the impact, direct and indirect impacts, of Islamicity on Global competitiveness, with Human development as moderator variable. Cross-section data on Islamicity index, Human development index and Global competitiveness index were collected from 123 countries and employed in a path analysis model. The results show that Islamicity had a positive and significant direct impact on global competitiveness. Islamicity had also positive and significant direct impact on human development. These direct impacts were statistically significant. Furthermore, human development had a positive and

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significant direct impact on the global competitiveness. Finally, Islamicity had a positive and significant indirect impact on the global competitiveness, through human development. It is suggested that Islamic teaching be implemented in daily life in order to maintain competitiveness globally.

1. Introduction

Competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services, is the fundamental goal of economic policy (Porter, 2009). In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report of the World Economic Forum (2009-2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C., has published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum, in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook (2003).

The Global Competitiveness Report is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index (GCR, 2014-2015), developed by Martin and Artadi (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index.

Islam is the religion that is a complete way of life. Nothing is too small or too big to be covered by the teachings of Islam. Rejoice and be happy, remain positive and be at peace. This is what Islam teaching about happiness (Al Qarni, 2003). Every single one of God's commandments aims to bring happiness to the individual. This applies in all aspects of life, worship, economics, and society (Stacey, A, 2011). Rehman, S.S., & Askari, H., (2010a; 2010b) develop an index to measure the "Islamicity" of 208 countries adherence to Islamic principles using four sub-indices related to economics, legal and governance, human and political rights, and international relations. Further, Askari, H., Mohammadkhan, H., and Mydin, L (2016) continue to measure Islamicity index and published Islamicity ranking for 2015. In order to measure the Islamicity of the countries in their study, Aksari et al., (2016) divided Islamic teachings into the following four dimensions: economic Islamicity, legal and governance, human and political right and international relation with overall Islamicity representing the fifth. So far, no study has been conducted to test the correlation between competitiveness and Islamicity; vice versa.

Other factor that seems related global competitiveness is human development, a development approach developed by the economist Ul-Haq (2003), is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Sen, A., 2005). It involves studies of the human condition with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms a person enjoys to lead the kind of life they have reason to value (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994).

By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015).The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (UNDP, 2015).

This chapter aimed to analyze the impact, direct and indirect, of Islamicity on global competitiveness with human development as moderating variable, using path analysis model.

2. Method of Analysis

In analyzing direct and indirect impacts of Islamicity on global competitiveness, this study employed path analysis model, that was developed around 1918 by Sewall Wright, who wrote about it extensively in the 1920s and 1930s (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y., 2003). Basically, the path model can be used to analysis two types of impacts:

direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin, D.F., & Hauser, R.M., 1975). In this study, the path model is depicted in Figure 24.1, where Islamicity and human development were the exogenous variables.

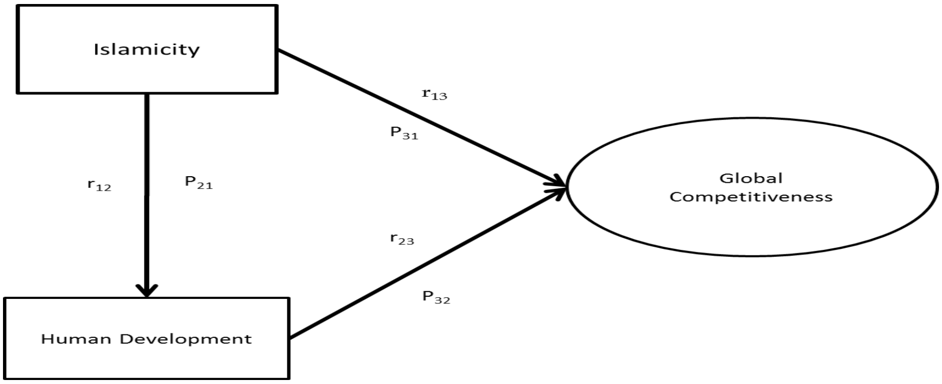

Figure 24.1

Path Model to Analysis the Impact of Islamicity on Global Competitiveness

Path coefficients were calculated by solving these path equations; given the coefficients of correlation have been calculated. P31 was direct impact of Islamicity global competitiveness, P21 was direct impact of Islamicity on human development; P32 was direct impact of human development on global competitiveness, and indirectly through P21 and P32 were the impacts of Islamicity on global competitiveness.

Table 24.1

Path Equations

1). $r_{12} = P_{21}$
2). $r_{13} = P_{31} + P_{32}\, r_{12}$
3).$r_{23} = P_{31}\, r_{12} + P_{32}$

Source:http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

Competitiveness was measured by the Global competitiveness index, Islamicity was measured by Islamicity index and human development was measured by Human development index. Data on global competitiveness index from 138 countries were downloaded from http://reports. weforum.org/global-competitiveness-index/. Data on Islamicity from 153 countries (115 countries from Islamic countries) downloaded from Islamicity Index.org that available on line at http://islamicity-index.org/wp/islamicity-indices. Data on human development index from 155 countries download from UNDP (2016) Human Development Report 2015: Work for Human Development Web Version and available at http://hdr.undp.org/en/data. Problems of missing data were solved by deleting countries with incomplete data. Finally, data on the happiness, economic growth and human development used in this study were from 123 countries.

3. Results and Discussions

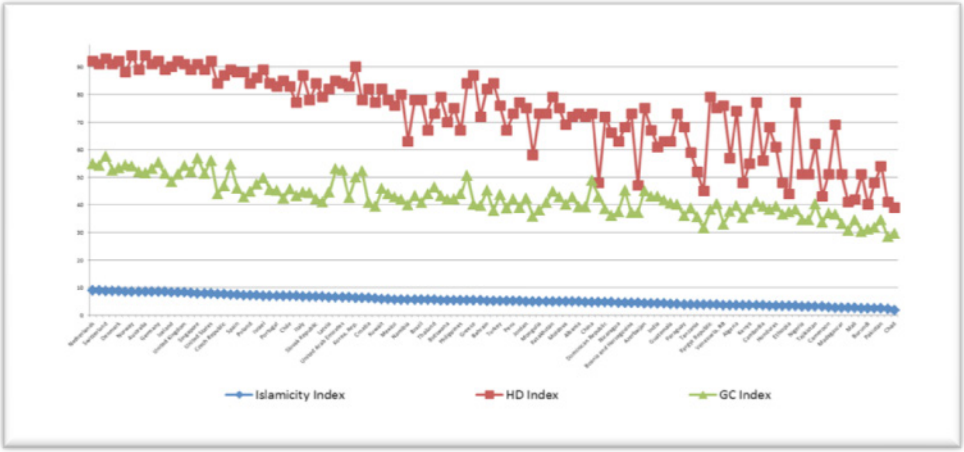

Figure 24.2

Islamicity Index, Human Development Index and Global Competitiveness Index

Figure 24.2 depicts the Islamicity index, human development index as well as global competitiveness index from 123 countries being studied. The lowest Islamic index happened in Chad (1.82) and the highest Islamicity was the Netherland (8.91). Average Islamicity index in term of statistic mean was 5.40 (Saudi Arabia), median 5.16 (Turkey, Argentina) and mode 8.44 (Australia, Canada). The lowest human development index was Chad (39.00) and the highest human development index was Australia (94.00). Average index of human development in term of statistic mean was 72.98 (Jamaica, Columbia, Tunisia, Dominican Republic, and Belize), median was 75.50 (Mexico), Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine) and mode was 73.00 (the Netherland, Sweden, New Zealand, and Australia). Finally, the highest global competitiveness index was 5.76 (Switzerland) and the lowest global competitiveness index was 2.84 (Guinea).

Table 24.2

Countries with the Levels of Islamicity Index and Global Competitiveness Index

	Islamicity: Low	**Islamicity: Medium**	**Islamicity: High**
Global Competitiveness: High	Azerbaijan (1)	Malaysia, Kuwait, Thailand, Saudi Arabia, Bahrain, Kazakhstan, China, Indonesia, (8)	Netherlands, Sweden, Switzerland, New Zealand, Denmark, Finland, Norway, Luxembourg, Australia, Canada, Germany, Austria, Iceland, Ireland, United Kingdom, Belgium, Singapore, France, United States, Czech Republic, Japan, Spain, Poland, Estonia, Israel, Lithuania, Portugal, Chile, Italy, Qatar, United Arab Emirates, Korea Republic. (32)
Global Competitiveness: Medium	Vietnam, India, Morocco, Guatemala, Armenia, Ukraine, Algeria, Iran Islamic Republic, Honduras, Tajikistan, (10)	Croatia, Panama, Mexico, Montenegro, Namibia, Bulgaria, Brazil, South Africa, Romania, Botswana, Georgia, Philippines, Greece, Jamaica, Turkey, Peru, Jordan, Ecuador, Macedonia, Moldova, Colombia, Rwanda, (22)	Malta, Slovenia, Cyprus, Costa Rica, Mauritius, Slovak Republic, Uruguay, Latvia, Hungary, (9)
Global Competitiveness: Low	Bosnia and Herzegovina, Senegal, Paraguay, Zambia, Tanzania, Malawi, Kyrgyz Republic, Venezuela RB, Bangladesh, Benin, Kenya, Cambodia, Gabon, Uganda, Ethiopia, Lebanon, Nigeria, Zimbabwe, Liberia, Cameroon, Egypt Arab Republic, Madagascar, Sierra Leone, Mali, Mauritania, Burundi, Haiti, Pakistan, Guinea, Chad (30)	Trinidad and Tobago, Argentina, El Salvador, Serbia, Ghana, Mongolia,Albania, Tunisia, Dominican Republic, Bolivia, Nicaragua (11)	

Table 24.2 presents the countries at various levels Islamicity index related to global competitiveness index. Both were ranked into three levels: low, medium and high. According to the levels of the Islamicity index, 41 countries classified as the low Islamicity index countries, 41 countries classified as the medium Islamicity index countries, and 41 countries classified as the high Islamicity index countries. The same number of countries was also classified as low, medium and high human development index countries.

From 41 countries with the low Islamicity index, there were 30 countries that also had low global competitiveness index, namely: Bosnia and Herzegovina, Senegal, Paraguay, Zambia, Tanzania, Malawi, Kyrgyz Republic, Venezuela RB, Bangladesh, Benin, Kenya, Cambodia, Gabon, Uganda, Ethiopia, Lebanon, Nigeria, Zimbabwe, Liberia, Cameroon, Egypt Arab Republic, Madagascar, Sierra Leone, Mali, Mauritania, Burundi, Haiti, Pakistan, Guinea, and Chad. Another 10 countries had medium global competitiveness index, namely: Vietnam, India, Morocco, Guatemala, Armenia, Ukraine, Algeria, Iran Islamic Republic, Honduras, and Tajikistan. Only one country had high global competitiveness index, namely Azerbaijan.

From 41 countries with medium Islamicity index, 11 countries had low global competitiveness index, namely: Trinidad and Tobago, Argentina, El Salvador, Serbia, Ghana, Mongolia, Albania, Tunisia, Dominican Republic, Bolivia, and Nicaragua. Meanwhile, 22 countries were classified as medium global competitiveness index countries, namely: Croatia, Panama, Mexico, Montenegro, Namibia, Bulgaria, Brazil, South Africa, Romania, Botswana, Georgia, Philippines, Greece, Jamaica, Turkey, Peru, Jordan, Ecuador, Macedonia, Moldova, Colombia, and Rwanda. Another 8 countries were classified as high global competitiveness index countries, namely: Malaysia, Kuwait, Thailand, Saudi Arabia, Bahrain, Kazakhstan, China, and Indonesia

From 41 countries with high Islamicity index, no countries had low global competitiveness index. Meanwhile, 9 countries were classified as medium global competitiveness index, namely: Malta, Slovenia, Cyprus, Costa Rica, Mauritius, Slovak Republic, Uruguay, Latvia, and Hungary. Another 32 countries were classified as high global competitiveness index countries, namely: Netherlands, Sweden, Switzerland, New Zealand, Denmark, Finland, Norway, Luxembourg, Australia, Canada, Germany, Austria, Iceland, Ireland, United Kingdom, Belgium, Singapore, France, United States, Czech Republic, Japan, Spain, Poland, Estonia, Israel, Lithuania, Portugal, Chile, Italy, Qatar, United Arab Emirates, and

Korea Republic.

Figure 24.3 presents Scatter Diagram between Islamicity index and global competitiveness index that shows a positive trend. It means that Islamicity had positive correlation on global competitiveness. Countries with high global competitiveness index were also the countries with high Islamicity index. The opposite apply; countries with low global competitiveness index were also the countries with low Islamicity index. The higher the Islamicity indexes of a country, the higher the index of global competitiveness in that country. Regression coefficient resulted from regression analysis was a positive, 3.16. This regression coefficient was statistically significant as t-calculated (19.89) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

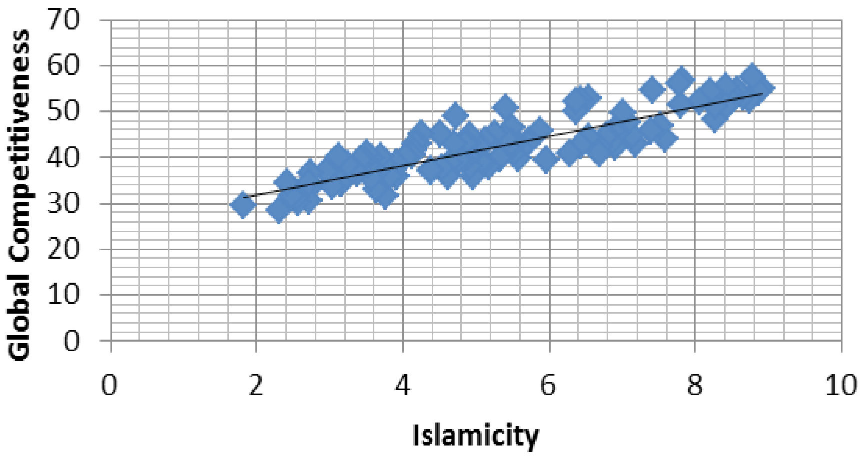

Figure 24.3

Scatter Diagram and Regression Analysis: Islamicity versus Global Competitiveness

Table 24.3 presents the countries at various levels Islamicity index related to the human development index. Both were ranked into three levels: low, medium and high. According to the levels of the Islamicity index, 41 countries classified as the low Islamicity index countries, 41 countries classified as the medium Islamicity index countries, and 41 countries classified as the high Islamicity index countries. The same number of countries was also classified as low, medium and high human development index countries.

From 41 countries with the low Islamicity index, there were 32 countries that also had low human development index, namely: Egypt Arab Republic, Paraguay, Gabon, Vietnam, Morocco, Guatemala, Tajikistan, India, Honduras, Zambia, Bangladesh, Cambodia, Kenya, Pakistan, Tanzania, Nigeria, Zimbabwe, Cameroon, Madagascar, Mauritania, Benin, Uganda, Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Another 9 countries had medium human development index, namely: Kyrgyz Republic, Iran Islamic Republic, Lebanon, Venezuela RB, Azerbaijan, Ukraine, Algeria, Bosnia and Herzegovina, and Armenia. No one country had high human development index.

From 41 countries with the medium Islamicity index, there were 9 countries that had low human development index, namely: Indonesia, South Africa, Philippines, El Salvador, Bolivia, Namibia, Nicaragua, Ghana, and Rwanda. Another 29 countries had medium human development index, namely: Croatia, Kuwait, Bahrain, Montenegro, Romania, Kazakhstan, Malaysia, Panama, Bulgaria, Brazil, Trinidad and Tobago, Serbia, Mexico, Turkey, Georgia, Jordan, Macedonia, Thailand, Peru, Mongolia, Ecuador, Albania, China, Jamaica, Colombia, Tunisia, Dominican Republic, Botswana, and Moldova. Only 3 countries had high human development index, namely: Greece, Saudi Arabia, and Argentina.

Table 24.3

Countries with the Levels of Islamicity Index and

	Islamicity: Low	**Islamicity: Medium**	**Islamicity: High**
Human Development: High		Greece, Saudi Arabia, Argentina (3)	Norway, Australia, Switzerland,Netherlands, Denmark, Germany, Ireland, United States, Sweden, New Zealand, Canada, United Kingdom,
			Singapore, Iceland, Korea Republic, Luxembourg, Austria, Belgium,France, Japan, Israel, Finland, Spain, Slovenia, Czech Republic,Italy, Estonia, Cyprus, Qatar,Malta, Poland, Lithuania, Lithuania, Slovak Republic, United Arab Emirates, Portugal, Chile, Hungary, Latvia (38)

	Islamicity: Low	Islamicity: Medium	Islamicity: High
Human Development: Medium	Kyrgyz Republic, Iran Islamic Republic, Lebanon, Venezuela RB, Azerbaijan, Ukraine, Algeria, Bosnia and Herzegovina, Armenia (9)	Croatia, Kuwait, Bahrain, Montenegro, Romania, Kazakhstan, Malaysia, Panama, Bulgaria, Brazil, Trinidad and Tobago, Serbia, Mexico, Turkey, Georgia, Jordan, Macedonia, Thailand, Peru, Mongolia, Ecuador, Albania, China, Jamaica, Colombia, Tunisia, Dominican Republic, Botswana, Moldova, (29)	Uruguay, Mauritius, Costa Rica (3)
Human Development: Low	Egypt Arab Republic, Paraguay, Gabon, Vietnam, Morocco, Guatemala, Tajikistan, India, Honduras, Zambia, Bangladesh, Cambodia, Kenya, Pakistan, Tanzania, Nigeria, Zimbabwe, Cameroon, Madagascar, Mauritania, Benin, Uganda, Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, Chad (32)	Indonesia, South Africa, Philippines, El Salvador, Bolivia, Namibia, Nicaragua, Ghana, Rwanda (9)	

From 41 countries with the high Islamicity index, there was no country that had low human development index. Meanwhile, there were only 3 countries that had medium human development index, namely: Uruguay, Mauritius, and Costa Rica. Another 38 countries had high development index, namely: Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden, New Zealand, Canada, United Kingdom, Singapore, Iceland, Korea Republic, Luxembourg, Austria, Belgium, France, Japan, Israel, Finland, Spain, Slovenia, Czech Republic, Italy, Estonia, Cyprus, Qatar, Malta, Poland, Lithuania, Lithuania, Slovak Republic, United Arab Emirates, Portugal, Chile, Hungary, and Latvia.

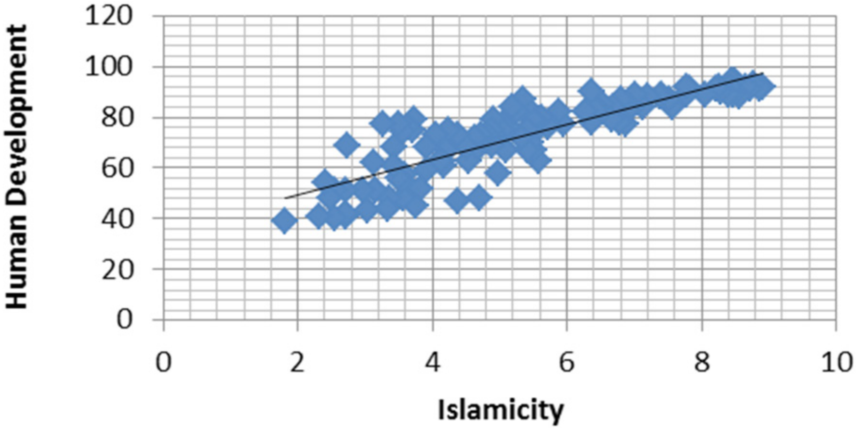

Figure 24.4

Scatter Diagram and Regression Analysis: Islamicity versus Human Development

Figure 24.4 presents Scatter Diagram between Islamicity index and human development index that shows a positive trend. It means that Islamicity had positive correlation on the human development. The countries with low Islamicity index were the counties with low human development index. The countries with high Islamicity index were the counties with high human development index. The higher the Islamicity indexes of a country, the higher the index of human development in that country. Regression coefficient resulted from regression analysis was a positive, 6.95. This regression coefficient was statistically significant as t-calculated (18.81) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

Table 24.4 presents the countries at various levels human development index related to the global competitiveness index. Both were ranked into three levels: low, medium and high. According to the levels of human development index, 41 countries classified as the low human development index countries, 41 countries classified as the medium human evelopment index countries, and 41 countries classified as the high development index countries. The same number of countries was also classified as low, medium and high global competitiveness index countries.

Table 24.4

Countries with the Levels of Human Development Index and Global Competitiveness Index

	Human Development: Low	**Human Develop-ment: Medium**	**Human Develop-ment: High**
Global Competi-tiveness: High	Indonesia (1)	Malaysia, China, Thailand, Kuwait, Bahrain, Azerbai-jan, Kazakhstan (7)	Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, Norway, Den-mark, Canada, Qatar, New Zealand, United Arab Emirates,, Luxembourg, Belgium, Aus-tralia, France, Austria, Ireland, Saudi Arabia, Korea Republic, Israel, Iceland, Estonia, Czech Republic, Spain, Chile, Lithuania, Portugal, Poland, Italy (33)
Global Com-petitiveness: Medium	South Africa, Philippines, India, Vietnam, Rwanda, Morocco, Guatemala, Tajikistan, Namibia, Honduras (10)	Mauritius, Panama, Tur-key, Costa Rica, Bulgaria, Romania, Mexico, Mace-donia, Colombia, Jordan, Georgia, Peru, Montene-gro, Botswana, Uruguay, Iran Islamic Republic, Brazil, Croatia, Ecuador, Ukraine, Armenia, Mol-dova, Jamaica, Algeria (24)	Latvia, Malta, Slovenia, Hungary, Cyprus, Slovak Republic, Greece (7)
Global Competi-tiveness: Low	Cambodia, El Salvador, Zambia, Kenya, Gabon, Bangladesh, Nicara-gua, Ethiopia, Senegal,Cameroon, Uganda, Egypt Arab Republic, Bolivia, Paraguay, Ghana, Tanza-nia, Benin, Nigeria, Zimbabwe, Pakistan, Mali, Liberia, Madagas-car, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, Guinea (30)	Trinidad and Tobago, Albania, Tunisia, Serbia, Dominican Republic, Lebanon, Kyrgyz Republic, Mongolia, Bosnia and Herzegovina, Venezuela RB (10)	Argentina (1)

From 41 countries with the low human development index, there were 30 countries that also had low global competitiveness index, namely: Cambodia, El Salvador, Zambia, Kenya, Gabon, Bangladesh, Nicaragua, Ethiopia, Senegal, Cameroon, Uganda, Egypt Arab Republic, Bolivia, Paraguay, Ghana, Tanzania, Benin, Nigeria, Zimbabwe, Pakistan, Mali, Liberia, Madagascar, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea. Another 10 countries had medium global competitiveness index, namely: South Africa, Philippines, India, Vietnam, Rwanda, Morocco, Guatemala, Tajikistan, Namibia, and Honduras. Only one country, Indonesia, which had high global competitiveness index.

From 41 countries with the medium human development index, there were 10 countries that had low global competitiveness index, namely: Trinidad and Tobago, Albania, Tunisia, Serbia, Dominican Republic, Lebanon, Kyrgyz Republic, Mongolia, Bosnia and Herzegovina, and Venezuela RB. Another 24 countries had medium global competitiveness index, namely: Mauritius, Panama, Turkey, Costa Rica, Bulgaria, Romania, Mexico, Macedonia, Colombia, Jordan, Georgia, Peru, Montenegro, Botswana, Uruguay, Iran Islamic Republic, Brazil, Croatia, Ecuador, Ukraine, Armenia, Moldova, Jamaica, and Algeria. Another 7 countries had high global competitiveness index, namely: Malaysia, China, Thailand, Kuwait, Bahrain, Azerbaijan, and Kazakhstan.

From 41 countries with the high human development index, there was only one country, Argentina, which had low global competitiveness index. Meanwhile, there were 7 countries that had medium global competitiveness index, namely: Latvia, Malta, Slovenia, Hungary, Cyprus, Slovak Republic, and Greece. Another 33 countries had high global competitiveness index, namely: Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, Norway, Denmark, Canada, Qatar, New Zealand, United Arab Emirates, Luxembourg, Belgium, Australia, France, Austria, Ireland, Saudi Arabia, Korea Republic, Israel, Iceland, Estonia, Czech Republic, Spain, Chile, Lithuania, Portugal, Poland, and Italy.

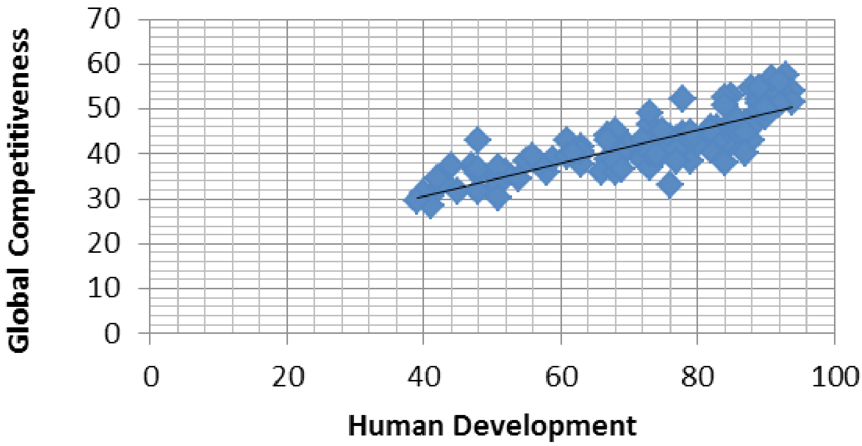

Figure 24.5

Scatter Diagram and Regression Analysis: Human Development versus Global Competitiveness

Figure 24.5 presents Scatter Diagram between human development index and global competitiveness index that shows a positive trend. It means that human development had positive correlation on global competitiveness. The countries with low human development index were the countries with low global competitiveness index. The countries with high human development index were the countries with high global competitiveness index. The higher the human development indexes of a country, the higher the index of global competitiveness in that country. Regression coefficient resulted from regression analysis was a positive, 0.37. This regression coefficient was statistically significant as t-calculated (16.11) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

Table 24.5

Correlation and Path Coefficients

Coefficients of Correlation		Path Coefficients	
r_{12}	= 0.86	P_{21}	= 0.86
r_{13}	= 0.88	P_{31}	= 0.64
r_{23}	= 0.83	P_{32}	= 0.28

Table 24.5: presents correlation and path coefficients.The coefficient correlation between Islamicity and global competitiveness was positive and very strong, r_{13} = 0.88. The coefficient correlation between Islamicity and human development was also positive and very strong, r_{12} = 0.86. Meanwhile, the coefficient correlation between human development and global competitiveness was positive and very strong, r_{23} = 0.83.

Solving the path equation proposed in Method of Analysis above, path coefficients have been calculated, the results: path coefficient in Path-1, $P_{31,}$ was 0.64 meaning there was positive direct effect of Islamicity on global competitiveness. The increase of 1 per cent Islamicity would increase 0.64 per cent global competitiveness index. Path coefficient in Path-2, $P_{21,}$ was also positive 0.86 meaning that there was positive direct impact of Islamicity on human development. The increase of 1 per cent economic growth will increase 0.86 per cent human development index. Finally, path coefficient in Path-3, P_{32}, was 0.28 meaning that there was a positive direct impact of human development on global competitiveness. The increase of 1 per cent human development index will increase 0.28 per cent the index of global competitiveness.

Figure 24.6 provides path model for analysing direct and indirect impact of economic growth on global competitiveness. In Path-1, direct impact of economic growth on global competitiveness was positive and significant, with P_{31}= 0.64. The higher the increase of the growth of economy, the higher the global competitiveness index would be. One per cent increase in economic growth would increase 0.64 per cent in global competitiveness index. In Path-2, direct impact of Islamicity on human development was positive and significant, with P_{21}= 0.86. An increase of the Islamicity would increase the index of human development. One per cent increase in Islamicity would decrease 0.86 per cent in human development index. In Path-3, direct impact of human development on global competitiveness was positive and significant, with P_{32}= 0.28. The higher the increase of human development, the higher the index of global competitiveness would be. One per cent increase in human development index would increase 0.28 per cent in global competitiveness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of economic growth on global competitiveness was negative and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.28) x(0.86) = 0.24 >0.05. The higher the increase of the Islamicity, the higher the index of global competitiveness would be. One per cent increase in economic growth would decrease 0.24 per cent in global competitiveness index.

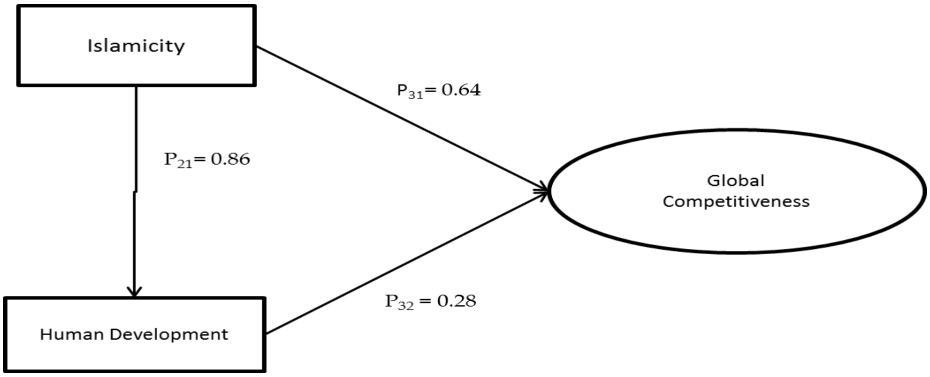

Figure 24.6

Path Coefficients in Path Analysis

Conclusions

Three conclusions could be drawn; firstly Islamicity had positive and significant direct impact on global competitiveness. Secondly, Islamicity had positive and significant direct impact on human development. Thirdly, Islamicity had positive and significant indirect impact on global competitiveness, through human development. The implications were Islamicity and human development were important factors in maintaining and improving global competitiveness. It is then suggested that Islamic teaching be implemented in daily life for a country to compete globally.

References

Al Qarni, Aaidh Ibn Abdullah, (2003),**Don't be Sad**, International Islamic Publishing House, Saudi Arabia.

Alkire, S., (1998),**Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities**, University of Oxford, Oxford, OCLC 43087376.

Alwin, D. F., and Hauser, R. M., (1975),"The Decomposition of Effects in Path Analysis",**American Sociological Review**, 40(1), 37-47.

Askari, H. and Mohammadkhan, H., (2016),**Islamicity Indices: The Seed for Change**, Palgrave Macmillan USA, ISBN: 978-1-137-58769-5

Askari, H., Mohammadkhan, H., and Mydin, L (2016), **Islamicity Indices 2015**, available on line at http://islamicity-index.org/wp/islamicity-indices/

IMD, (2003),**World Competitiveness Yearbook 2003**, available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking/; https://worldcompetitiveness. imd.org/

IMF, (2012),**Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006),**A New Deal for Effective European Research Policy**, Springer, ISBN 978-1-4020-5550-8.

Nussbaum, M., (2000), **Women and human development: the capabilities approach**, Cambridge University Press,Cambridge New York, ISBN 9780521003858.

Nussbaum, M., (2011),**Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, MA: 33–34, ISBN 0674072359.

Porter, M., (2009), "Clusters and Economic Policy", **ISC White Paper**,availableathttp://www.hbs.edu/faculty/Publication%20Files/

Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Rainer Feurer, R., and Chaharbaghi, K., (1995),"Strategy development: past, present and future",**Management Decision**, 33(6): 11 – 21.

Rehman, S. S., and Askari, H., (2010a),"How Islamic are Islamic Countries?",**Global Economy Journal**, 10(2): 1-37, http://www.bepress.com/gej /vol10/iss2/2 DOI: 10.2202/1524-5861.1614.

Rehman, S. S., and Askari, H., (2010b),"An Economic Islamicity Index (EI2)",**Global Economy Journal**, 10(3): 1-37, http://www.bepress.com/gej/ vol10/iss3/1 DOI: 10.2202/1524-5861.1680.

Scott, B. R. and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston, Mass, USA.

Sen, A., (2005),"Human Rights and Capabilities",**Journal of Human Development**, 6 (2): 151–166. Doi: 10.1080/14649880500120491.

Srinivasan, T.N., (1994),"Human Development: A New Paradigm or Reinvention of the Wheel?",**Human Development**, 84(2): 238–243.

Stacey, A., (2011),**Happiness in Islam: Happiness is found in Sincere Worship**, http://www.islamreligion.com/articles/435/viewall/happiness-in-islam.

Stajano, A., (2010),"Research, Quality, Competitiveness",**EU Technology Policy for the Knowledge-based Society,** Springer, ISBN 978-0-387-79264-4.

Streeten, P., (1994),"Human Development: Means and Ends", **Human Development,** 84(2): 232–237.

Ul-Haq, M., (2003),"The Human Development Paradigm" In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. (Eds),**Readings in Human Development: Concept, Measures and Policies for Development Paradigm**, Oxford University Press,New Delhi: 17-34.

United Nations Development Programme, (1997),**Human Development Report**, Oxford University Press, Oxford, pp: 15, ISBN 978-0-19-511996-1.

United Nations Development Programme, (2015),**Human Development Reports,** at http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2016),**Human Development Report 2015: Work for Human Development,** Web Version available at http://hdr.undp.org/ en/data.

United Nations Development Programme, (2016),**World Happiness Report on Chapter 2: The Distribution of World Happiness,** Available at http://

worldhappiness. report/wp-content/uploads/sites/2/2016/03/HR-1Ch2_web.pdf.

United Nations Development Programme, (2015), **Human Development Reports**, at http:http://hdr.undp.org/eandevn/hum

World Economic Forum, (1996), Global Competitiveness Report 1996, World Economic Forum,Geneva,pp: 19.

World Economic Forum, (2010), **The Global Competitiveness Report 2009–2010**, pp: 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum, (2015), **Global Competitiveness Report 2014-2015**, Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015

World Health Organization, (2016), **Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks**, Retrieved 4 August 2016.

Wright, S., (1921), "Correlation and Causation", **Journal Agricultural Research**, 20: 557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical Statistics**, 5(3): 161-215. DOI: 10.1214 aoms/1177732676.

Xavier, S.M., and Artadi, E.A., (2004), "The Global Competitiveness Index", **Global Competitiveness Report,** Global Economic Forum.

Chapter-25

Economic Growth, Human Development and Happiness[1]

Ringkasan

Bab ini menguji dampak, langsung dan tidak langsung, pertumbuhan ekonomi terhadap kebahagiaan, dengan pembangunan manusia sebagai variabel antara. Data antar negara tentang pertumbuhan ekonomi, indeks pembangunan manusia dan indeks kebahagiaan dari 124 negara diambil dari berbagai sumber dan dianalisis menggunakan model analisis jalur. Hasil analisis menunjukkan bahwa pertumbuhan ekonomi mempunyai dampak langsung negative dan secara statistik signifikan terhadap pembangunan manusia. Sementara, pembangunan manusia mempunyai dampak langsung positive dan secara statistik signifikan terhadap kebahagiaan. Secara tidak langsung, melalui variabel antara pembangunan manusia, pertumbuhan ekonomi juga mempunyai dampak negative yang secara statistik signifikan terhadap kebahagiaan. Implikasi dari temuan ini adalah bahwa pertumbuhan ekonomi tidak lagi merupakan faktor penting pembangunan. Dengan demikian dapat disarankan bahwa pembangunan manusia, dibanding pertumbuhan ekonomi, terus didorong agar setiap orang terus merasa bahagia.

Summary

This chapter directly and indirectly examines the impact of economic growth on happiness, with human development as moderator variable. Cross-nations data on economic growth, human development, and happiness indices were collected from 124 countries and employed in a path analysis model. The results show that economic growth had a direct negative and significant impact on both happiness

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and human development. Meanwhile, human development had a positive and significant direct impact on happiness. Indirectly, through moderator variable human development, economic growth again had a negative and significant impact on happiness. An implication of this finding was that economic growth is no longer a single important factor of a development indicator. It is then suggested that human development, rather than economic growth, sustainably be promoted in order to make everyone always feels happy.

1. Introduction

Happiness is a mental or emotional state of well-being defined by positive or pleasant emotions ranging from contentment to intense joy (Hornby, A.S, 1985). Happy mental states may also reflect judgments by a person about their overall well-being (Anand, P., 2016). Happiness is a fuzzy concept and can mean many different things to many people. Related concepts are well-being, quality of life, and flourishing. At least one author defines happiness as contentment (Graham, M. C., 2014). Some commentators focus on the difference between the hedonistic tradition of seeking pleasant and avoiding unpleasant experiences, and the eudaimonic tradition of living life in a full and deeply satisfying way (Deci, E.L. & Ryan, R. M., 2006). Algoe, S. & Haidt, J., (2009) say that happiness may be the label for a family of related emotional states, such as joy, amusement, satisfaction, gratification, euphoria, and triumph.

The United Nations Development Programme updated the World Happiness Report 2016, which is a landmark survey of the state of global happiness (Helliwell, J. et.al, 2016). The report was released on March 20th, UN Happiness Day. The first World Happiness Report was published in April 2012, in support of the High Level Meeting at the United Nations on happiness and well-being, chaired by the Prime Minister of Bhutan. The report outlined the state of world happiness, causes of happiness and misery, and policy implications highlighted by case studies. In September 2013, the second World Happiness Report offered the first annual follow-up, and reports are now issued every year.

There have also been some studies that indicate that happiness is related to many things: money (Dunn, et. Al., 2008), religion (among others: Routledge, C., 2012; Baetz, M.,& Toews, J., 200; Ellison, C. G.,& George, L.K., 1994), and health (Steptoe, A. et al., 2005; Frey, B. S., 2011).

One of the factors related to happiness is the levels of Gross Domestic Product (GDP), which is the measure of economic growth (Frey, B. S.,& Stutzer, A., 2001). Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. This growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Theories and models of economic growth include: Classical Growth Theory of Ricardian, which was originally Thomas Maltus' theory about agriculture (Bjork, G.J., 1999); Solow-Swan Model, developed by Sollow, R., (1956) and Swan, T., (1956); Endogenous Growth Theory, which focus on what increases human capital or technological change (Helpman, E., 2004); Unified Growth Theory, developed by Galor, O., (2005); The Big Push Theory, which was popular in the 1940s; Schumpeterian Growth Theory, which is where entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002); Institutions and Growth Theory (Acemoglu, at.al., 2001); Human Capital and Growth Theory (Barro & Lee, 2001).

Another factor that seems related to happiness is human development, which is a concept within a field of international development. The human development approach, developed by the economist Mahbub Ul-Haq (2003), is anchored in Nobel Laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition, with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms people enjoy; to lead a kind of life they have reason to value (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994).

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015). The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (UNDP, 2015).

The objective of this paper is to analyze the impacts, direct and indirect, of economic growth on happiness, using path analysis model.

2. Method of Analysis

In analyzing direct and indirect impacts of economic growth on happiness, this study employed the path analysis model that was developed around 1920an by Sewall Wright (1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y., (2003). Basically, the path model can be used to analysis two types of impacts: direct and indirect. The total impact of exogenous variables is the multiplication of direct and indirect impacts (Alwin, D.F., & Hauser, R.M., 1975). In this study, the path model is depicted in Figure 25.1, where economic growth and human development were the exogenous variables.

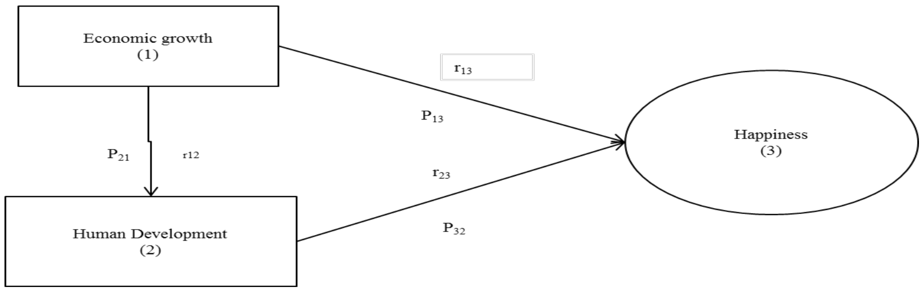

Figure 25.1

Path Model to Analysis the Impact of Economic Growth on the Happiness

Table 25.1: Path Equations

1). $r_{12} = P_{21}$
2). $r_{13} = P_{31} + P_{32}\, r_{12}$
3).$r_{23} = P_{31}\, r_{12} + P_{32}$

Four hypotheses to be tested were: firstly, whether economic growth had a direct impact on happiness; secondly, whether economic growth had a direct impact on human development; thirdly, whether human development had a direct impact on happiness; and fourthly, whether economic growth had an indirect impact on happiness, through human development.

Path coefficients were calculated by solving these path equations; given that the coefficients of correlation have been calculated. P31 was direct impact of economic growth on the happiness, P21 was direct impact of economic growth on human development; P32 was direct impact of human development on the happiness, and indirectly through P21 and P32were the impacts of economic growth on the happiness.

Happiness was measured by the happiness index, economic growth was measured by the growth of GDP and human development was measured by human development index. Data on the happiness index from 156 countries were downloaded from UNDP (2016) World Happiness Report on Chapter 2: The Distribution of World Happiness written by John F. Helliwell, Haifang Huang and Shun Huang. Data are available at http://worldhappiness.report/ wp-content/ uploads/ sites /2/2016/03/HR-V1Ch2_web.pdf. Data on economic growth from 178 countries downloaded from World Bank (2016) Annual Gross Domestic Product Growth (%) and available at http://data.worldbank.org/ indicator/ NY.GDP.MKTP.KD.ZG. Data on human development index from 155 countries download from UNDP (2016) Human Development Report 2015: Work for Human Development Web Version and was accessed at http:// hdr.undp. org/en/data. Problems of missing data have been solved by deleting countries with incomplete data. Finally, data on happiness, economic growth and human development used in this study were from 124 countries.

3. Results and Discussion

Figure 25.2 depicts the dynamic of economic growth, human development index as well as the happiness index from 124 countries being studied. The lowest economic growth happened in Sierra Leone (-20.3%) and the highest economic growth was in Mauritania (15.5%). Average growth in term of statistic mean was 2.9% (Bahrain), median 2.9% (Bahrain) and mode 3.0% (Thailand). The lowest human development index was in Chad (39.00) and the highest human development index was in Australia (94.00). Average index of human development in term of statistic mean was 72.98 (Jamaica, Columbia, Tunisia, Dominican Republic, and Belize), median was 75.50 (Mexico), Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine) and mode was 73.00 (The Netherland, Sweden, New Zealand, and Australia). Meanwhile, the lowest index of the happiness was in Burundi (29.05) and the highest index of the happiness was in Denmark. Average index of the happiness in term of statistic mean was 55.4 (Paraguay), median was 55.23 (Cyprus, Latvia, Croatia, Romania, Jamaica, and Paraguay) and mode was 58.35 (Poland, Ethiopia, Lithuania, Korea Republic, Peru, Moldova, and Bolivia).

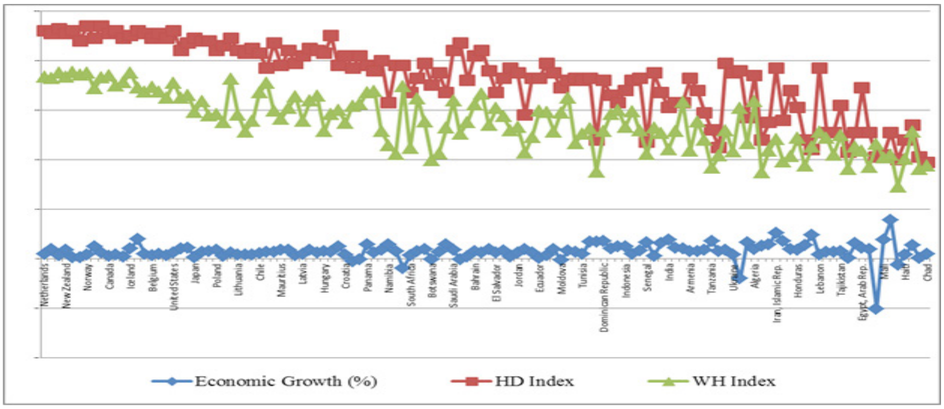

Figure 25.2

Economic Growth, Human Development and the Happiness

Table 25.2 presents the countries at various levels of economic growth related to the happiness index. Both were ranked into three levels: low, medium and high. According to the levels of the happiness index, 42 countries classified as the low happiness index countries, 41 countries classified as the medium happiness index countries, and 41 countries classified as the high happiness index countries. The same number of countries was also classified as low, medium and high economic growth countries.

Table 25.2

Countries at Various Levels of Economic Growth and the Happiness

	Economic Growth: Low	**Economic Growth: Medium**	**Economic Growth: High**
Happiness: High	Denmark, Switzerland, Norway, Finland, Canada, Netherlands, Austria, Germany, Brazil, Belgium, Singapore, United Kingdom, Uruguay, France, Kuwait, Trinidad &Tobago, Venezuela RB. (17)	New Zealand, Australia, Israel, United States, Costa Rica, Mexico, Chile, Argentina, United Arab Emirates, Colombia, Thailand, Saudi Arabia, Qatar, Spain, Bahrain. (15)	Iceland, Sweden, Ireland, Luxembourg, Panama, Czech Republic, Malta, Algeria, Guatemala. (9)
Happiness : Medium	Ecuador, Belize, Japan, Kazakhstan, Moldova, Lithuania, Latvia, Cyprus, Estonia, Jamaica, Croatia, Azerbaijan, Serbia, Lebanon, Portugal. (15)	Slovak Republic, El-Salvador, Italy, Poland, Korea Republic, Slovenia, Peru, Mauritius, Paraguay, Jordan, Kyrgyz Republic, Bosnia & Herzegovina, Hungary, and Mexico. (14)	Malaysia, Nicaragua, Bolivia, Romania, Turkey, Indonesia, Philippines, China, Dominican Republic, Morocco, Pakistan, Macedonia. (12)
Happiness: Low	Greece, Sierra Leone, South Africa, Ukraine, Haiti, Botswana, Chad, Liberia, Guinea, Burundi. (10)	Tunisia, Tajikistan, Mongolia, Nigeria, Honduras, Zambia, Albania, Armenia, Georgia, Zimbabwe, Malawi. (11)	Vietnam, Iran Islamic Rep., Bangladesh, Namibia, Cameroon, Ethiopia, India, Egypt Arab Rep., Kenya, Ghana, Senegal, Mauritania, Gabon, Mali, Cambodia, Uganda, Madagascar, Tanzania, Rwanda, Benin. (20)

From 42 countries with the low happiness index, there were 10 countries also had low economic growth, namely: Greece, Sierra Leone, South Africa, Ukraine, Haiti, Botswana, Chad,Liberia, Guinea, and Burundi.From 42 countries with the low happiness index, 11 countries had medium economic growth, namely: Tunisia, Tajikistan, Mongolia, Nigeria, Honduras, Zambia, Albania, Armenia, Georgia, Zimbabwe, and Malawi. Meanwhile, 20 countries that classified as low level happiness had high levels of economic growth, namely: Vietnam, Iran Islamic Republic, Bangladesh, Namibia, Cameroon, Ethiopia, India, Egypt Arab Republic, Kenya, Ghana, Senegal, Mauritania, Gabon, Mali, Cambodia, Uganda, Madagascar, Tanzania, Rwanda, and Benin.

From 41 countries with medium happiness index, 15 countries had low economic growth, namely: Ecuador, Belize, Japan, Kazakhstan, Moldova, Lithuania, Latvia, Cyprus, Estonia, Jamaica, Croatia, Azerbaijan, Serbia, Lebanon, and Portugal. Meanwhile, 14 countries were classified as medium economic growth country: Slovak Republic, El- Salvador, Italy, Poland, Korea Republic, Slovenia, Peru, Mauritius, Paraguay, Jordan, Kyrgyz Republic, Bosnia &Herzegovina, Hungary, and Mexico. Another 12 countries were classified as high economic growth country, namely: Malaysia, Nicaragua, Bolivia, Romania, Turkey, Indonesia, Philippines, China, Dominican Republic, Morocco, Pakistan, and Macedonia.

From 41 countries with high happiness index, 17 countries had low economic growth; most of them were developed countries, namely: Denmark, Switzerland, Norway, Finland, Canada, Netherlands, Austria, Germany, Brazil, Belgium, Singapore, United Kingdom, Uruguay, France, Kuwait, Trinidad &Tobago, and Venezuela RB. Meanwhile, 15 countries were classified as medium economic growth country: New Zealand, Australia, Israel, United States, Costa Rica, Mexico, Chile, Argentina, United Arab Emirates, Colombia, Thailand, Saudi Arabia, Qatar, Spain, and Bahrain. Only 9 countries with high economic growth: Iceland, Sweden, Ireland, Luxembourg, Panama, Czech Republic, Malta, Algeria, and Guatemala.

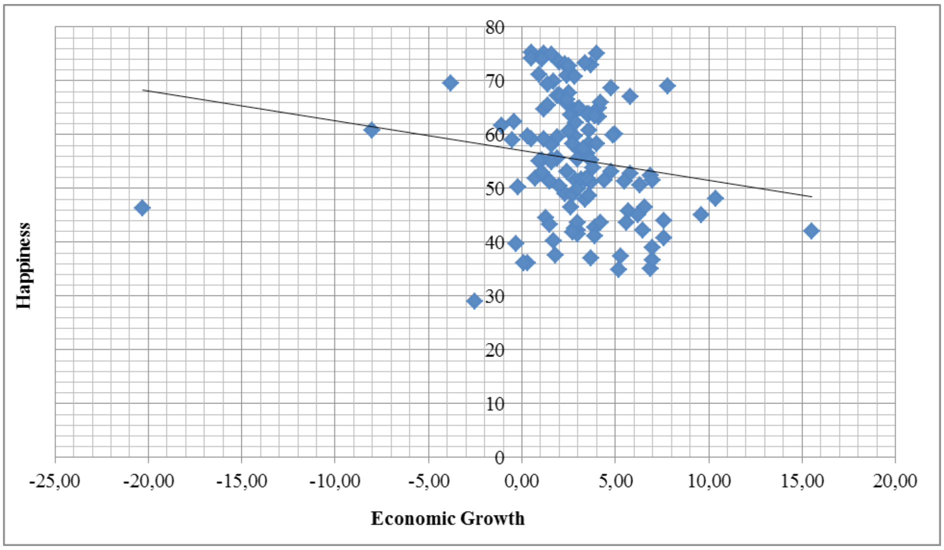

Figure 25.3

Scatter Diagram: Economic Growth and the Happiness

Figure 25.3 presents Scatter Diagram between Economic growth and the Happiness that shows a negative trend. It means that economic growth had negative correlation on the happiness. The higher the growth of economy of a country, the less happy the people are. Regression analysis resulted a negative regression coefficient, -0.55. But, the regression coefficient was statistically not significant as t-calculated (-1.87) was less than t-table (1.98) n=124, at 95% significant level, and P-value (0.06) was more than 0.05.

Table 25.3

Countries at Various Levels of Economic Growth and Human Development

	Human Development: Low	**Human Development : Medium**	**Human Development: High**
Economic Growth: High	Mauritania, Ethiopia, Mali, India, Tanzania, Cambodia, Rwanda, Bangladesh, Senegal, Vietnam, Cameroon, Philippines, Namibia, Kenya, Pakistan, Uganda, Benin, Nicaragua, Indonesia, Morocco, Egypt Arab Republic, Guatemala, Bolivia, Ghana, Gabon, Madagascar. (26)	Iran Islamic Republic, Dominican Republic, China, Panama, Malaysia, Algeria, Turkey, Romania, Macedonia. (9)	Ireland, Luxembourg, Czech Republic, Malta, Iceland, Sweden. (6)

	Human Development: Low	Human Development : Medium	Human Development: High
Economic Growth:Medium	Honduras, Zambia, Tajikistan, Paraguay, Malawi, Zimbabwe, Nigeria, El-Salvador. (8)	Mauritius, Kyrgyz Republic, Montenegro, Peru, Bosnia & Herzegovina, Colombia, Thailand, Bulgaria, Armenia, Bahrain, Georgia,Costa Rica, Albania, Mexico, Jordan, Mongolia, Tunisia. (17)	Slovak Republic, Qatar, Poland, Saudi Arabia, New Zealand, Slovenia, Hungary, Italy, Korea Republic, Spain, Israel, United States, United Arab Emirates, Argentina, Australia, Chile. (16)
Economic Growth: Low	Chad, Haiti, South Africa, Liberia, Guinea, Moldova, Burundi, Sierra Leone. (8)	Belize, Croatia, Ukraine, Lebanon, Uruguay, Kazakhstan, Azerbaijan, Jamaica, Serbia, Ecuador, Botswana, Kuwait, Trinidad & Tobago, Brazil, Venezuela RB. (15)	Singapore, Netherlands, United Kingdom, Latvia, Germany, Norway, Lithuania, Cyprus, Portugal, Belgium, Switzerland, France, Estonia, Canada, Austria, Japan, Finland, Denmark, Greece. (19)

Table 25.3 provides list of country with levels of economic growth and human development. There were 42 countries with low economic growth, 41 countries with medium economic growth and 41 countries with high economic growth. Human development levels were also classified as low, medium and high human development levels with same number of countries, respectively: 42, 41, and 41 countries.

From 42 countries classified as low economic growth, 8 countries had low development index, namely: Chad, Haiti, South Africa, Liberia, Guinea, Moldova, Burundi, and Sierra Leone. Meanwhile, 15 countries had medium human development index, namely: Belize, Croatia, Ukraine, Lebanon, Uruguay, Kazakhstan, Azerbaijan, Jamaica, Serbia, Ecuador, Botswana, Kuwait, Trinidad & Tobago, Brazil, and Venezuela RB. Another 19 countries had high human development index such as: Singapore, Netherlands, United Kingdom, Latvia, Germany, Norway, Lithuania, Cyprus, Portugal, Belgium, Switzerland, France, Estonia, Canada, Austria, Japan, Finland, Denmark, and Greece.

From 41 countries classified as medium economic growth, 8 countries had low human development index, namely:Honduras, Zambia, Tajikistan, Paraguay, Malawi, Zimbabwe, Nigeria, and El-Salvador. Meanwhile, 17 countries had medium human development index: Mauritius, Kyrgyz Republic, Montenegro, Peru, Bosnia & Herzegovina, Colombia, Thailand, Bulgaria, Armenia, Bahrain, Georgia, Costa Rica, Albania, Mexico, Jordan, Mongolia, and Tunisia. Another

16 countries had high human development index, such as: Slovak Republic, Qatar, Poland, Saudi Arabia, New Zealand, Slovenia, Hungary, Italy, Korea Republic, Spain, Israel, United States, United Arab Emirates, Argentina, Australia, and Chile.

From 41 countries classified as high economic growth, 26 countries had low human development index, such as: Mauritania, Ethiopia, Mali, India, Tanzania, Cambodia, Rwanda, Bangladesh, Senegal, Vietnam, Cameroon, Philippines, Namibia, Kenya, Pakistan, Uganda, Benin, Nicaragua, Indonesia, Morocco, Egypt Arab Republic, Guatemala, Bolivia, Ghana, Gabon, and Madagascar. Meanwhile, 19 countries had medium human development index, namely: Iran Islamic Republic, Dominican Republic, China, Panama, Malaysia, Algeria, Turkey, Romania, and Macedonia. Another 6 countries had high human development index: Ireland, Luxembourg, Czech Republic, Malta, Iceland, and Sweden.

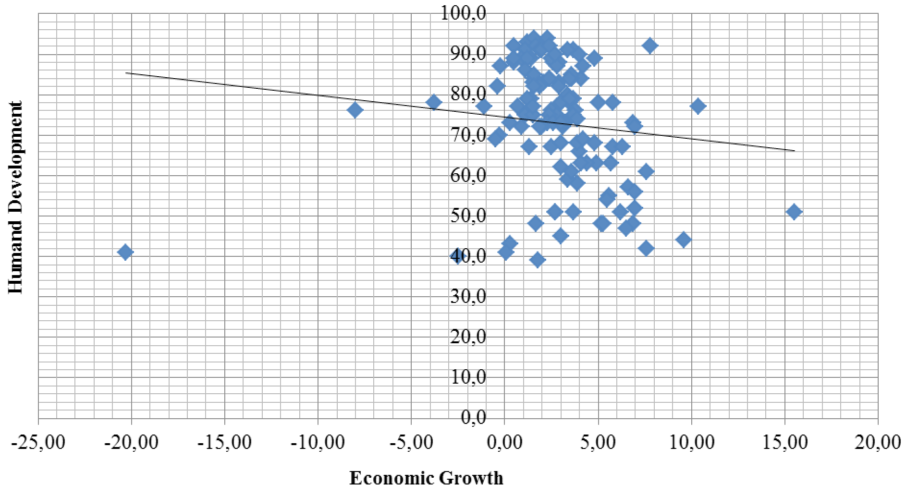

Figure 25.4

Scatter Diagram: Economic Growth and Human Development

Figure 25.4 presents Scatter Diagram between Economic growth and Human Development that shows a negative trend. It means that economic growth had negative correlation on the human development. The higher the growth of economy of a country, the less happy the people are. Regression analysis resulted a negative regression coefficient, -0.54. But, the regression coefficient was statistically not significant as t-calculated (-1.38) was less than t-table (1.98) n=124, at 95% significant level, and P-value (0.17) was more than 0.05.

Table 25.4

Countries at Various Levels of Human Development and the Happiness

	Happiness: Low	**Happiness: Medium**	**Happines: High**
Human Development: High	Greece. (1)	Korea Republic, Japan, Slovenia, Italy, Estonia, Cyprus, Poland, Lithuania, Slovak Republic, Portugal, Hungary, Latvia. (12)	Norway, Australia, Switzerland,Netherlands, Denmark, Germany, Ireland, United States, Sweden, New Zealand, Canada, United Kingdom, Singapore,Iceland, Luxembourg, Austria,Belgium, France, Israel, Finland, Spain, Czech Republic, Qatar, Malta, United Arab Emirates, Saudi Arabia, Argentina, Chile. (28)
Human Development: Medium	Bulgaria, IranIslamic Republic, Georgia, Ukraine, Mongolia, Albania, Armenia, Tunisia, Botswana. (9)	Croatia, Montenegro, Romania, Kazakhstan, Kyrgyz Republic, Mauritius,Malaysia, Serbia, Lebanon, Turkey,Jordan, Macedonia, Azerbaijan, Peru, Ecuador, China, Bosnia & Herzegovina, Jamaica, Belize. (20)	Kuwait, Bahrain, Uruguay, Panama, Brazil, Costa Rica, Trinidad &Tobago, Mexico, Venezuela RB, Algeria, Thailand, Colombia. (12)
Human Development: Low	EgyptArab Republic, Gabon, South Africa, Vietnam, Namibia, Tajikistan, India, Honduras, Zambia, Ghana, Bangladesh, Cambodia, Kenya, Tanzania, Nigeria, Zimbabwe, Cameroon, Madagascar, Mauritania, Rwanda, Benin, Uganda, Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, Chad. (32)	Moldova, Indonesia, Paraguay, Philippines, El Salvador, Bolivia, Nicaragua, Morocco, Pakistan. (9)	Guatemala (1)

Table 25.4 provides list of country with levels of human development and the happiness. There were 42 countries with low human development index, 41 countries with medium human development index and 41 countries with high human development index. The happiness levels were also classified as low, medium and high happiness levels with same number of countries, respectively: 42, 41, and 41 countries.

From 42 countries classified as low human development index, 32 countries had low happiness index, namely: Egypt Arab Republic, Gabon, South Africa, Vietnam, Namibia, Tajikistan, India, Honduras, Zambia, Ghana, Bangladesh, Cambodia, Kenya, Tanzania, Nigeria, Zimbabwe, Cameroon, Madagascar, Mauritania, Rwanda, Benin, Uganda, Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Meanwhile, 9 countries had medium happiness index, namely: Moldova, Indonesia, Paraguay, Philippines, El-Salvador, Bolivia, Nicaragua, Morocco, and Pakistan. Only one country had high happiness index: Guatemala.

From 41 countries classified as medium human development, 9 countries had low happiness index, namely: Bulgaria, IranIslamic Republic, Georgia, Ukraine, Mongolia, Albania, Armenia, Tunisia, and Botswana. Meanwhile, 20 countries had medium happiness index: Croatia, Montenegro, Romania, Kazakhstan, Kyrgyz Republic, Mauritius,Malaysia, Serbia, Lebanon, Turkey, Jordan, Macedonia, Azerbaijan, Peru, Ecuador, China, Bosnia & Herzegovina, Jamaica, and Belize. Another 12 countries had high happiness index, such as: Kuwait, Bahrain, Uruguay, Panama, Brazil, Costa Rica, Trinidad &Tobago, Mexico, Venezuela RB, Algeria, Thailand, and Colombia.

From 41 countries classified as high human development, only one country, Greece, had low happiness index. Meanwhile, 12 countries had medium happiness index, namely: Korea Republic, Japan, Slovenia, Italy, Estonia, Cyprus, Poland, Lithuania, Slovak Republic, Portugal, Hungary, and Latvia. Finally, another 28 countries had high happiness index: Norway, Australia, Switzerland,Netherlands, Denmark, Germany, Ireland, United States, Sweden, New Zealand, Canada, United Kingdom, Singapore, Iceland, Luxembourg, Austria,Belgium, France, Israel, Finland, Spain, Czech Republic, Qatar, Malta, United Arab Emirates, Saudi Arabia, Argentina, and Chile.

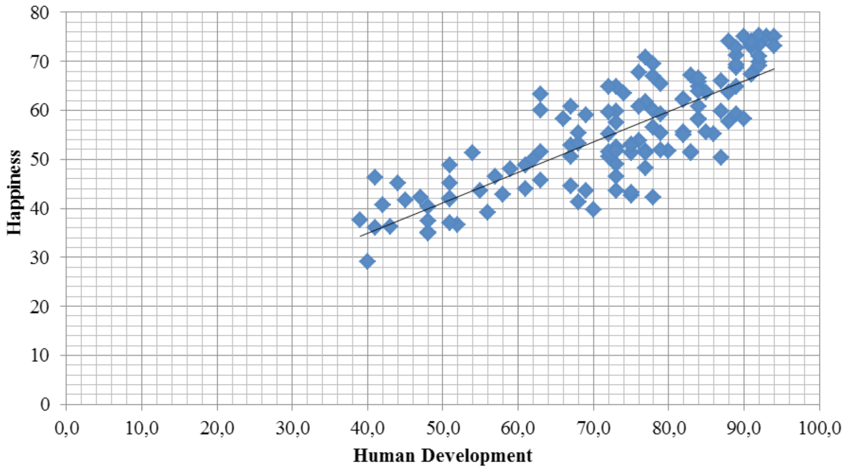

Figure 25.5

Scatter Diagram: Human Development and the Happiness

Figure 25.5 presents Scatter Diagram between Human Development and the Happiness that shows a positive trend. It means that human development had positive correlation on the happiness. The higher the human development index of a country, the happier the people are. Regression analysis have resulted a positive regression coefficient, 0.62. The regression coefficient was statistically significant as t-calculated (15.58) was higher than t-table (1.98) n=124, at 95% significant level, and P-value (0.00) were far less than 0.05.

Table 25.5

Correlation Coefficient and Path Coefficient

Regression Statistics Multiple R, R_{13} -0,17 R Square 0,03 Adjusted R Square 0,02 Standard Error 11,16 Observations 124 Economic Growth and the Happiness	*Regression Statistics* Multiple R,R_{12} -0,12 R Square 0,02 Adjusted R Square 0,01 Standard Error 14,77 Observations 124 Economic Growth and Human Development	*Regression Statistics* Multiple R, R_{23} 0,82 R Square 0,67 Adjusted R Square 0,66 Standard Error 6,55 Observations 124 Human Development and the Happiness
P_{31} = -0.07	P_{21} = -0.12	P_{32} = 0.83

Note: Path coefficient, P_{ij}>0.05 statistically significant, otherwise the opposite.

Table 25.5: presents the results of regression analysis, mainly for correlation analysis among variables being studied. The coefficient correlation between

economic growth and the happiness was very weak and negative, -0.17. The coefficient correlation between economic growth and human development was also very weak and negative, -0.12. Meanwhile, the coefficient correlation between human development and the happiness was very strong and positive, 0.82.

Solving the path equation proposed in Method of Analysis above, path coefficients have been calculated, the results: path coefficient in Path-1, $P_{31,}$ was -0.07 meaning there was negative direct effect of economic growth on the happiness. The increase of 1 per cent economic growth would decrease 0.17 per cent the happiness index. Path coefficient in Path-2, $P_{21,}$ was -0.12 meaning that there was negative direct impact of economic growth on human development. The increase of 1 per cent economic growth will decrease 0.12 per cent human development index.

Finally, path coefficient in Path-3, P_{32}, was 0.83 meaning that there was a positive direct impact of human development on the happiness. The increase of 1 per cent human development index will increase 0.82 per cent the happiness index.

Figure 25.6: provides path model for analysing direct and indirect impact of economic growth on the happiness. In Path-1, direct impact of economic growth on the happiness was negative and significant, with P_{31}= -0.07. The higher the increase of the growth of economy, the less happy the people would be. One per cent increase in economic growth would decrease 0.07 per cent in happiness index. In Path-2, direct impact of economic growth on human development was also negative and significant, with P_{21}= -0.12. An increase of the growth of economy would decrease the index of human development. One per cent increase in economic growth would decrease 0.12 per cent in human development index. In Path-3, direct impact of human development on the happiness was positive and significant, with P_{32}= 0.83. The higher the increase of human development, the happier the people would be. One per cent increase in human development index would increase 0.83 per cent in happiness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of economic growth on the happiness was negative and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.83) x –(0.12) = - 0.10 >0.05. The higher the increase of the growth of economy, the less happy the people would be. One per cent increase in economic growth would decrease 0.10 per cent in happiness index.

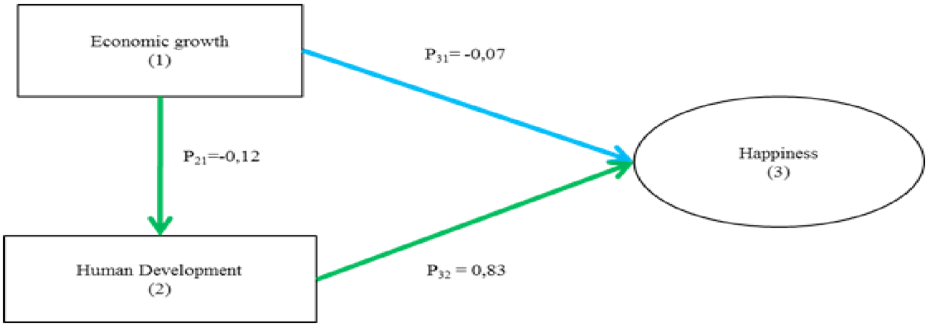

Figure 25.6

Path Analysis and Path Coefficients

4. Conclusion

From results and discussion, it could be concluded that, firstly in Path-1, economic growth measured by GDP growth had a negative and significant direct impact on happiness, measured by happiness index. Secondly, in Path-2, economic growth had a negative and significant direct impact on human development, measured by human development index. Thirdly, in Path-3, human development had positive and significant direct impact on the happiness. Finally, through Path-2 and Path-3, economic growth had negative and significant indirect impact on the happiness. The implication from this finding was that economic growth alone was no longer important variable in development, especially when development focus was human and their happiness. Development programs that give special attention on human development should be prioritised.

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001), "The colonial origins of economic development: an empirical investigation",**American Economic Review**, 91(5): 1369–1401.

Aghion, P., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality",**Econometrica**, 70 (3): 855–882.

Algoe,S.B.,andHaidt,J.,(2009),"Witnessingexcellenceinaction:the'other-praising' emotions of elevation, gratitude, and admiration",**The Journal of Positive Psychology**, 4 (2): 105–127. Doi:10.1080/17439760802650519.

Alkire, S., (1998),**Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities,**University of Oxford, Oxford,OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975), "The Decomposition of Effects in Path Analysis",**American Sociological Review**, 40(1): 37-47.

Anand, P., (2016),**Happiness Explained**, Oxford University Press, Oxford.

Baetz, M., and Toews, J., (2009), "Clinical implications of research on religion, spirituality, and mental health",**Canadian Journal of Psychiatry**, 54 (5): 292–301.

Barro, R. J., and Lee J.W., (2001), "International data on educational attainment: Updates and implications",**Oxford Economic Papers,** 53 (3): 541–563.

Bjork, G.J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger,Westport, CT, London: 251, ISBN 0-275-96532-5.

Deci, E. L., and Ryan, R. M., (2006), "Hedonia, Eudaimonia, and Well-being: An introduction",**Journal of Happiness Studies**, 9 (1): 1–11. Doi:10.1007/s10902-006-9018-1.

Dickinson, E., (2012), "GDP: a Brief History", **ForeignPolicy.com**, and Retrieved 25 April 2012.

Dodge, Y., (2003), **The Oxford Dictionary of Statistical Terms**, OUP,ISBN 0-19-920613-9.

Dunn, E. W., Aknin, L. B., and Norton, M. I., (2008), "Spending Money on Others Promotes Happiness",**Science**, 319 (5870): 1687–8. DOI:10.1126/science.1150952

Ellison, C.G., and George, L.K., (1994), "Religious Involvement, Social Ties, and Social Support in a Southeastern Community",**Journal for the Scientific Study of Religion**, 33 (1): 46–61. DOI: 10.2307/1386636,JSTOR 1386636.

Frey, B. S., and Stutzer, A., (2001),**Happiness and Economics**,Princeton University Press,Princeton,ISBN 0-691-06998-0.

Frey, B. S., (2011). "Happy People Live Longer",**Science**, 331 (6017): 542–3. DOI:10.1126/science.1201060

Galor, O., (2005),"From Stagnation to Growth: Unified Growth Theory",**Handbook of Economic Growth**, Elsevier.

Graham, M. C., (2014),**Facts of Life: Ten Issues of Contentment**, Outskirts Press: 6–10,ISBN 978-1-4787-2259-5.

Helliwell, J., Layard, R., and Sachs, J., (2016), "World Happiness Report",**United Nations Development Programme**.

Helpman, E., (2004),**The Mystery of Economic Growth,**Harvard University Press, Harvard.

Hornby, A.S., (1985),**Oxford Advanced Learner's Dictionary of Current English**, Twenty Second Impression, Oxford University Press, Oxford.

Human Development, at https://en.wikipedia.org/wiki/Human_development_(humanity).

IMF, (2012), "Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013".

Nussbaum, M., (2000), **Women and human development: the capabilities approach**, Cambridge University Press, Cambridge New York, ISBN 9780521003858.

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, MA: 33–34, ISBN 0674072359.

Routledge, C., (2012),"Are Religious People Happier Than Non-religious People?" **Psychology Today**, Retrieved 24 January 2014.

Sen, A., (2005), "Human Rights and Capabilities", **Journal of Human Development**, 6 (2): 151–166, DOI:10.1080/14649880500120491.

Solow, R. M., (1956), "A Contribution to the Theory of Economic Growth",**Quarterly Journal of Economics**, 70 (1): 65-94.

Srinivasan, T.N., (1994). "Human Development: A New Paradigm or Reinvention of the Wheel?" **Human Development**, 84 (2): 238–243.

Steptoe, A., Wardle, J., and Marmot, M., (2005), "Positive affect and health-related neuroendocrine, cardiovascular, and inflammatory processes",**Proceedings of the National Academy of Sciences***,* 102(18): 6508–12,Bibcode:2005PNAS..102.6508S. DOI:10.1073/pnas.0409174102.

Streeten, P., (1994), "Human Development: Means and Ends",**Human Development**, 84(2): 232–237.

Swan, T.W., (1956), "Economic Growth and Capital Accumulation",**Economic Record**, 32: 334–361, DOI: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003), "The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S.,(Eds),**Readings in Human Development**: 17-34.Oxford, Oxford University Press,UK.

United Nations Development Programme, (2015), "Human Development

Reports: at http: http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2015), "Human Development Reports" at http://hdr.undp.org/eandevn/hum

United Nations Development Programme, (1997), "Human Development Report", pp: 15. ISBN 978-0-19-511996-1

United Nations Development Programme, (2016), "Human Development Report 2015: Work for Human Development", Web Version available at http://hdr.undp.org/en/data.

World Bank, (2016), "Annual Gross Domestic Product Growth (%)", Available on line at http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

World Health Organization, (2016), "Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks", Available at http://www.eho.org/ Retrieved 4 August 2016

Wright, S., (1921), "Correlation and Causation", **Journal Agricultural Research**, 20, 557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical Statistics**, 5(3), 161-215.

Chaper-26

Economic Growth, Human Development and Global Competitiveness[1]

Ringkasan

Bab ini menganalisis dampak langsung dan dampak tidak langsung pertumbuhan ekonomi terhadap daya saing global, dengan pembangunan manusia sebagai variabel moderator. Data silang antar negara tentang pertumbuhan ekonomi, pembangunan manusia dan indeks daya saing global diambil dari 123 negara dan analisis dilakukan menggunakan model analisis jalur. Hasil analisis menunjukkan bahwa pertumbuhan ekonomi mempunyai dampak langsung positive yang secara statistik signifikan terhadap daya saing global. Tetapi, pertumbuhan ekonomi mempunyai dampak langsung negative yang secara statistik signifikan terhadap pembangunan manusia. Sementara, pembangunan manusia mempunyai dampak langsung positive yang secara statistik signifikan. Secara tidak langsung, melalui variabel pembangunan manusia, pertumbuhan ekonomi mempunyai dampak negative yang secara statistik signifikan terhadap daya saing global. Implikasi dari temuan ini adalah bahwa pertumbuhan ekonomi bukanlah faktor tunggal dalam pembangunan yang bertujuan mencapai daya saing global. Kemudian, penelitian ini menyarankan agar pembangunan manusia secara berkelanjutan terus didorong untuk membuat negara dapat bersaing secara global.

Summary

This chapter analyzes direct and indirect impact of economic growth on global competitiveness, with human development as moderator variable. Cross-section

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data on economic growth, human development and global competitiveness indices were collected from 123 countries and employed in a path analysis model. The results show that economic growth had positive and significant direct impact on global competitiveness. Economic growth had negative and significant direct impact on human development. Meanwhile, human development had positive and significant direct impact on global competitiveness. Indirectly, through moderator variable human development, economic growth had negative and significant impact on global competitiveness. Implications of this finding were that economic growth no longer a single important factor in development indicator for achieving global competitiveness. It is then suggested that human development sustainably be promoted in order to make nations globally competitive.

1. Introduction

Basically, the fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services (Porter, 2009). However, competitiveness has been defined diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to IMD (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (WEF, 1996). But According to Feurer, R. and Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes. National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R. and Lodge, G. C., 1985). Competitiveness includes both efficiency (reaching goals at the lowest possible cost) and effectiveness (having the right goals). It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et al, 1998).

In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report of the World Economic Forum (2009-2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities.

Some countries are increasingly looking at their competitiveness on global markets and they have advisory bodies or special government agencies that tackle competitiveness issues, such as Ireland (1997), Saudi Arabia (2000), Greece (2003), Croatia (2004), Bahrain (2005), and the Philippines (2006). Even regions or cities, such as Dubai are considering the establishment of such a body.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum, in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook (2003).

The Global Competitiveness Report (GCR, 2014-2015) is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index (GCR, 2014-2015), developed by Martin, X., S. and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index.

One of the factors related to global competitiveness was the levels of Gross Domestic Product (GDP), which is the measure of economic growth (Frey, B. S.

& Stutzer, A., 2001). Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Theories and models of economic growth include: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture (Bjork, G.J., 1999), Solow-Swan Model developed by Sollow, R., (1956) and Swan, T., (1956), Endogenous Growth Theory which focus on what increases human capital or technological change (Helpman, E., 2004), Unified Growth Theory developed by Galor, O., (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory (Acemoglu, at.al., 2001), Human Capital and Growth Theory (Barro & Lee, 2001), and Energy Consumption and Growth Theory (Committee on Electricity in Economic Growth Energy Engineering, 1986).

Other factor that seems related global competitiveness is human development, a development approach developed by the economist Mahbub Ul-Haq (2003), is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress.

The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire

(1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms a person enjoys to lead the kind of life they have reason to value (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015).The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (UNDP, 2015).

The objective of this paper is to analyses the impacts, direct and indirect, of economic growth on global competitiveness, using path analysis model.

2. Methods of Analysis

In analyzing direct and indirect impacts of economic growth on global competitiveness, this study employed path analysis model, that was developed around 1918 by Sewall Wright, who wrote about it extensively in the 1920s and 1930s (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y. (2003). Basically, the path model can be used to analysis two types of impacts: direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin, D.F., & Hauser, R.M., 1975). In this study, the path model is depicted in Figure 26.1, where economic growth and human development were the exogenous variables.

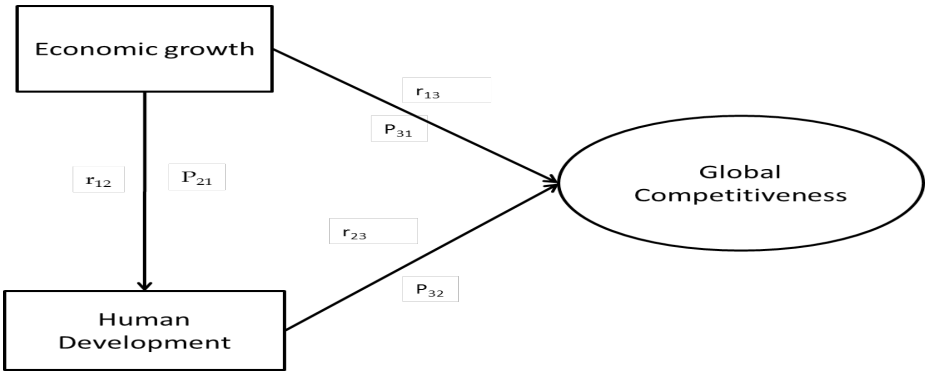

Figure 26.1

Path Model to Analysis the Impact of Economic Growth on Global Competitiveness

Four hypotheses to be tested were: firstly, economic growth had direct impact on the happiness; secondly, economic growth had direct impact on human development and thirdly, human development had direct impact on the happiness. Finally, economic growth had indirect impact on the happiness, through human development. Path coefficients were calculated by solving these path equations; given that the coefficients of correlation have been calculated. P31 was direct impact of economic growth on global competitiveness, P21 was direct impact of economic growth on human development; P32 was direct impact of human development on global competitiveness, and indirectly through P21 and P32 were the impacts of economic growth on global competitiveness.

Table 26.1

Path Equations

1	$r_{12} = P_{21}$
2	$r_{13} = P_{31} + P_{32}\, r_{12}$
3	$r_{23} = P_{31}\, r_{12} + P_{32}$

Source :http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

Global competitiveness was measured by the global competitiveness index, economic growth was measured by the growth of GDP and human development was measured by human development index. Data on global competitiveness index from 138 countries were downloaded from http://reports.weforum.org/global-competitiveness-index/. Data on economic growth from 178 countries downloaded from World Bank (2016) Annual Gross Domestic Product Growth (%) and available at NY.GDP.MKTP.KD.ZG. Data on human development index from 155 countries download from UNDP (2016) Human Development Report 2015: Work for Human Development Web Version and was accessed at http://hdr.undp.org/en/data. Problems of missing data have been solved by deleting countries with incomplete data. Finally, data on global competitiveness, economic growth and human development used in this study were from 123 countries.

3. Results and Discussions

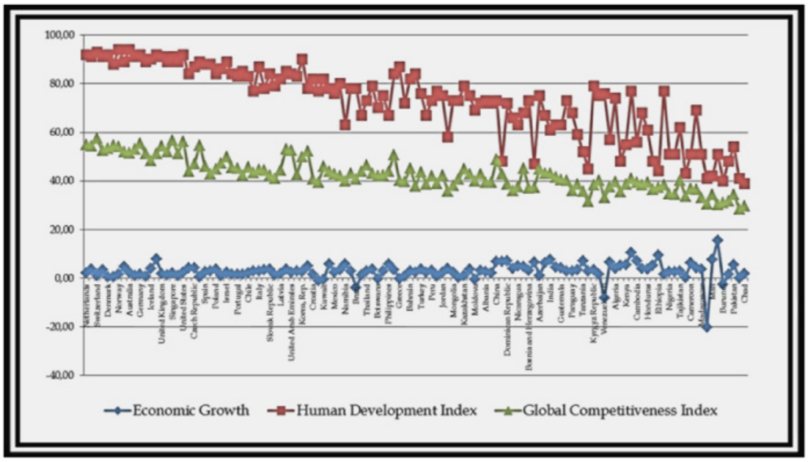

Figure 26.2

Economic Growth, Human Development and Global Competitiveness

Figure 26.3 depicts the dynamic of economic growth, human development index as well as global competitiveness index from 123 countries being studied. The lowest economic growth happened at Siera Leone (-20.3%) and the highest economic growth was at Mauritania (15.5%). Ten countries with the highest economic growth were Mauritania, Iran Islamic Republic, Ethiopia, Ireland, India, Mali, Cambodia, Dominican Republic, Tanzania, and China. Ten countries with the lowest economic growth were Guinea, Greece, Botswana, Kuwait, Moldova, Trinidad and Tobago, Burundi, Brazil, Venezuela RB and Sierra Leone. Average growth in terms of statistical mean was 2.91% (Bahrain), median 2.9% (Bahrain), and mode 3.0% (Thailand). The highest human development index was in Australia (94.00)and the lowest human development index was in Chad (39.00). The ten countries with the highest human development index were Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden and New Zealand. The ten countries with the lowest human development index were Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Average index of human development in terms of statistical mean was 72.99 (Jamaica, Colombia, Tunisia, Dominican Republic, and Belize), median was 76.00 (Mexico, Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine), and mode was 73.00 (The Netherland, Sweden, New Zealand, and Australia). Finally, the highest global competitiveness index was 5.76 (Switzerland) and the lowest global competitiveness index was 2.84 (Guinea). Ten countries with highest global competitiveness index were Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, and Norway.Ten countries with lowest global competitiveness index were Liberia, Madagascar, Venezuela RB, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea.

Table 2 presents the countries at various levels of economic growth related to global competitiveness index. Both were ranked into three levels: low, medium and high. According to the levels of global competitiveness, 41 countries classified as the low global competitiveness index countries, 41 countries classified as the medium global competitiveness index countries, and 41 countries classified as the high global competitiveness index countries. The same number of countries was also classified as low, medium and high economic growth countries.

From 41 countries with low global competitiveness index, 11 countries also had low economic growth, namely: Tunisia, Chad, Haiti, Lebanon, Serbia, Liberia, Guinea, Trinidad and Tobago, Burundi, Venezuela RB, and Sierra Leone.

Meanwhile, 11 countries had medium economic growth, namely: Kyrgyz Republic, Zambia, Bosnia and Herzegovina, Malawi, Paraguay, Nigeria, Zimbabwe, Albania, El Salvador, Argentina, and Mongolia. Finally, 19 countries had high economic growth, namely: Mauritania, Ethiopia, Mali, Cambodia, Dominican Republic, Tanzania, Bangladesh, Senegal, Cameroon, Kenya, Pakistan, Uganda, Benin, Nicaragua, Egypt Arab Republic, Bolivia, Gabon, Ghana, and Madagascar.

Table 26.2

Countries at Various Levels of Economic Growth and the Happiness

	Global Competitiveness: Low	Global Competitiveness: Medium	Global Competitiveness: High
Economic growth: High	Mauritania, Ethiopia, Mali, Cambodia, Dominican Republic, Tanzania, Bagladesh, Senegal, Cameroon, Kenya, Pakistan, Uganda, Benin, Nicaragua, Egypt Arab Republic, Bolivia, Cabon, Ghana, Madagascar (19)	Iran Islamic Republic, India, Rwanda, Vietnam, Panama, Philippines, Namibia, Marocco, Guatemala, Malta, Algeria, Turkey, Macedonia, Romania (14)	Ireland, China, Malaysia, Iceland, Sweden, Indonesia, Luxembourg (7)
Economic growth: Medium	Kyrgyz Republic, Zambia, Bosnia and Herzegovina, Malawi, Zimbabwe, Albania, El Salvador, Argentina, Mongolia. (11)	Honduras, Slovak Republic, Mauritius,Montenegro, Peru, Columbia, Armenia, Bulgaria, Tajikistan, Hungary, Slovenia, Costa Rica, Georgia, Mexico, Jordan (15)	Poland, Qatar, Saudi Arabia, New Zealand, Thailand, Bahrain, Italy, Korea Republic, Spain, Israel, United Arab Emiates, United States, Australi, Chile, Netherlands (15
Economic growth: Low	Tunisia, Chad, Haiti, Lebanon, Serbia, Liberia, Guinea, Trinidad and Tobago, Burundi, Venezuela RB, Sierra Leone (11)	Latvia, Croatia, Cyprus, Ukraine, Uruguay, South Africa, Jamaica, Ecuador, Greece, Botswana, Moldova, Brazil (12)	Singapore, United Kingdom, Germany, Kithuania, Roway, Portugal, Belgium, France, Kazakhstan, Switzerland, Azerbaijan, Canada, Estonia, Austria, Tamaicu, Jamaica, Denmark, Finlad, Japan, Kuwait (19)

From 41 countries with medium global competitiveness index, 12 countries had low economic growth, namely: Latvia, Croatia, Cyprus, Ukraine, Uruguay, South Africa, Jamaica, Ecuador, Greece, Botswana, Moldova, and Brazil. Meanwhile, 15 countries had medium economic growth, namely: Honduras, Slovak Republic, Mauritius, Montenegro, Peru, Colombia, Armenia, Bulgaria, Tajikistan, Hungary, Slovenia, Costa Rica, Georgia, Mexico, and Jordan. Another 14 countries had the highest, namely: Iran Islamic Republic, India, Rwanda, Vietnam, Panama, Philippines, Namibia, Morocco, Guatemala, Malta, Algeria, Turkey, Macedonia, and Romania.

From 41 countries with high global competitiveness index, 19 countries had low economic growth, namely: Singapore, United Kingdom, Germany, Lithuania, Norway, Portugal, Belgium, France, Kazakhstan, Switzerland, Azerbaijan, Canada, Estonia, Austria, Jamaica, Denmark, Finland, Japan, and Kuwait. Meanwhile, 15 countries had medium economic growth, namely: Poland, Qatar, Saudi Arabia, New Zealand, Thailand, Bahrain, Italy, Korea Republic, Spain, Israel, United Arab Emirates, United States, Australia, Chile, and Netherlands. Another 7 countries had high economic growth, namely: Ireland, China, Malaysia, Iceland, Sweden, Indonesia, and Luxembourg.

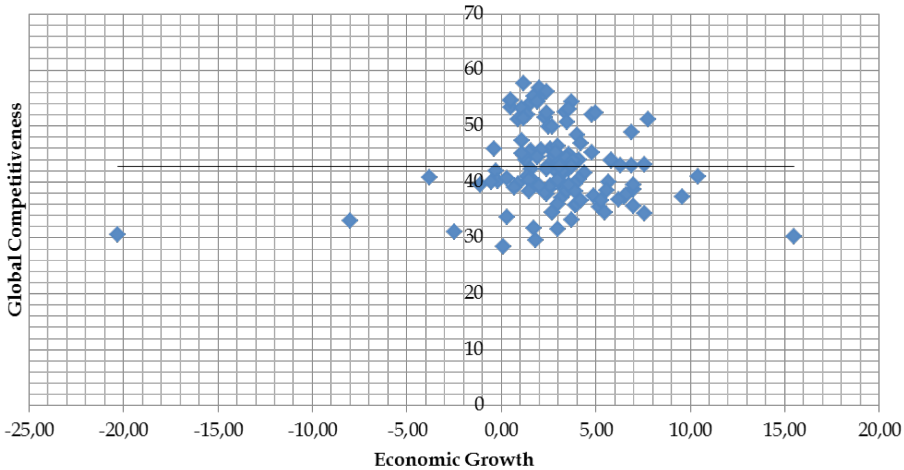

Figure 26.3

Scatter Diagram Economic Growth and Global Competitiveness

Figure 26.3 presents Scatter Diagram between Economic growth and Global competitiveness that shows a positive trend. It means that economic growth had positive correlation on global competitiveness. The higher the growth of economy of a country, the more competitive globally is the country. Regression coefficient resulted from regression analysis was positive, 0.0006. But, the regression coefficient was statistically not significant as t-calculated (0.0036) was less than t-table (1.98) n=123, at 95% significant level.

Table 26.3 provides list of country with levels of economic growth and human development. There were 41 countries with low economic growth, 41 countries with medium economic growth and 41 countries with high economic growth. Human development levels were also classified as low, medium and high human development levels with same number of countries, respectively: 41, 41, and 41 countries.

From 41 countries classified as low economic growth, 7 countries also had low development index, namely: Chad, Haiti, South Africa, Liberia, Guinea, Burundi and Sierra Leone. Meanwhile, 16 countries had medium human development index, namely: Tunisia, Croatia, Lebanon, Ukraine, Uruguay, Kazakhstan, Azerbaijan, Jamaica, Serbia, Ecuador, Botswana, Kuwait, Moldova, Trinidad and Tobago, Brazil, and Venezuela. Another 18 countries had high human development index, namely: Singapore, Latvia, United Kingdom, Germany, Cyprus, Lithuania, Norway, Portugal, Belgium, France, Switzerland, Canada, Estonia, Austria, Denmark, Finland, Japan, and Greece.

Table 26.3

Countries at Various Levels of Economic Growth and Human Development

	Human Competitiveness: Low	Human Competitiveness: Medium	Human Competitiveness: High
Economic growth: High	Mauritania, Ethiopia, India, Mali, Cambodia, Tanzania, Rwanda, Bangladesh, senegal, Vietnam, Cameroon, Philippines, Uganda, Benin, Nicaragua, Indonesia, Morocco, Egypt Arab Republic, Gabon Guatemala, Bolivia, Chana, Madagascar (26)	Iran Islamic Republic, Dominican Republic, China, Panama, Malaysia, Algeria, Turkey, Macedonia, Romania (9)	Ireland, Luxembourg, Czech Republic, Malta, Iceland, Sweden (6)
Economic growth: Medium	Honduras, Zambia, Malawi, Parguay, Tajikistan, Nigeria, Zimbabwe, El Salvadon (8)	Kyrgyz Republic, Mauritius, Montenegro, peru, Bosnia and Herzegovina, Colombia, Armenia, Bulgaria, Thailand, Bahrain, Costa Rica, Georgia, Albania, Mexico, Jordan, Mongolia (16)	Poland, Qatar, Slovak Republic, Saudi Arabia, New Zealand, Hungary, Slovenia, Italy, Korea Republic, Spain, Israel, Argentina, United Arab Emirates, United States, Australi, Chile, Netherlands (17)

Economic growth: Low	Chad, Haiti, South Africa, Liberia, Guinea, Burundi, Sierra Leone (7)	Tunisia, Croatia, Lebanon, Ukraine, Uruguay, Kazakhstan, Azerbaijan, Jamaica, serbia, Ecuador, Botswana, Kuwait, Moldova, Trinidad and Tobago, Brazil, Venezuela RB (16)	Singapore, Latvia, United Kingdom, Germany, Cyprus, Lithuania, Norway, Portugal, Belgium, France, Switzerland, Canada, Estonia, Austria, Denmark, Finland, Japan, Greece (18)

From 41 countries classified as high economic growth, 26 countries had low human development index, such as: Mauritania, Ethiopia, Mali, India, Tanzania, Cambodia, Rwanda, Bangladesh, Senegal, Vietnam, Cameroon, Philippines, Namibia, Kenya, Pakistan, Uganda, Benin, Nicaragua, Indonesia, Morocco, Egypt Arab Republic, Guatemala, Bolivia, Ghana, Gabon, and Madagascar. Meanwhile, 9 countries had medium human development index, namely: Iran Islamic Republic, Dominican Republic, China, Panama, Malaysia, Algeria, Turkey, Romania, and Macedonia. Another 6 countries had high human development index: Ireland, Luxembourg, Czech Republic, Malta, Iceland, and Sweden.

Figure 26.4 presents Scatter Diagram between Economic growth and Human Development that shows a negative trend. It means that economic growth had negative correlation on the human development. The higher the growth of economy of a country, the smaller the index of human development was. Regression analysis resulted a negative regression coefficient, -0.5359. But, the regression coefficient was statistically not significant as t-calculated (-1.38) was less than t-table (1.98) n=123, at 95% significant level, and P-value (0.17) was more than 0.05.

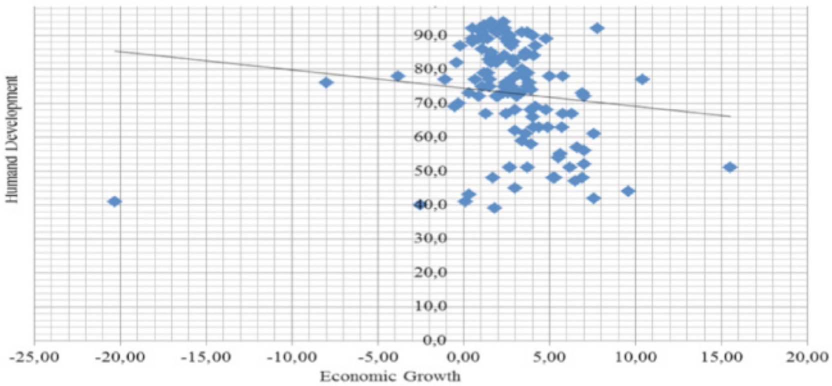

Figure 26.4

Scatter Diagram Economic Growth and Human Development

Table 26.4: provides list of country with levels of human development and global competitiveness index. There were 41 countries with low human development index, 41 countries with medium human development index and 41 countries with high human development index. The global competitiveness levels were also classified as low, medium and high global competitiveness levels with same number of countries, respectively: 41, 41, and 41 countries.

Table 26.4
Countries at Various Levels of Human Development and Global Competitiveness

	Human Competitiveness: Low	Human Competitiveness: Medium	Human Competitiveness: High
Global Competitiveness: High	Indonesia (1)	Malaysia, China, Thailand, Kuwait, Bahrain, Azerbaijan, Kazakhstan (7)	Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, Norway, Denmark, Canada, Qatar, New Zealand, United Arab Emirates, Luxembourg, Belgium, Australia, France, Austria, Ireland, Saudi Arabia, Korea Republic, Israel, Iceland, Estonia, Czech Republic, Spain, Chile, Lithuania, Portugal, Poland, Italy (33)
Global Competitiveness: Medium	South Africa, Philippines, India, Vietnam, Rwanda, Morocco, Guatemala, Tajikistan, Namibia, Honduras (10)	Mauritius, Panama, Turkey, Costa Rica, Bulgaria, romania, Mexico, Macedonia, Colombia, Jordan, Georgia, Peru, Montenegro, Botswana, Uruguay, Iran Islamic Republic, Brazil, Croatia, Ecuador, Ukraine, Armedia, Moldova, Jamaica, Algeria (24)	Latvia, Malta, Slovenia, Hungary, Cyprus, Slovak Republic, Greece (7)

Global Competitiveness: Low	Cambodia, El Salvador, Zambia, Kenya, Gabon, Bangladesh, Nicaragua, Ethiopia, Senegal, Cameroon, Uganda, Egypt, Arab Republic, Bolivia, Paraguay, Ghana, Tanzania, Benin, Nigeria, Zimbabwe, Pakistan, Maly, Liberia, Madagascar, Haitu, Malawi, Burundi, Sierra Leone, Mauritania, Chad, Guinea (30)	Trinidad adn Tobago, Albania, Tunisia, Serbia, Dominican Republic, Lebanon, Kyrgyz Republic, Mongolia, Bosnia anda Herzegovina, Venezuela RB (10)	Argentina (1)

From 41 countries classified as low human development index, 30 countries had low global competitiveness index, namely: Cambodia, El Salvador, Zambia, Kenya, Gabon, Bangladesh, Nicaragua, Ethiopia, Senegal, Cameroon, Uganda, Egypt Arab Republic, Bolivia, Paraguay, Ghana, Tanzania, Benin, Nigeria, Zimbabwe, Pakistan, Mali, Liberia, Madagascar, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea. Meanwhile, 10 countries had medium global competitiveness index, namely: Trinidad and Tobago, Albania, Tunisia, Serbia, Dominican Republic, Lebanon, Kyrgyz Republic, Mongolia, Bosnia and Herzegovina, and Venezuela RB. Only one country had high global competitiveness index: Argentina.

From 41 countries classified as medium human development, 10 countries had low global competitiveness index, namely: South Africa, Philippines, India, Vietnam, Rwanda, Morocco, Guatemala, Tajikistan, Namibia, and Honduras. Meanwhile, 24 countries had medium global competitiveness index, namely: Mauritius, Panama, Turkey, Costa Rica, Bulgaria, Romania, Mexico, Macedonia, Colombia, Jordan, Georgia, Peru, Montenegro, Botswana, Uruguay, Iran Islamic Republic, Brazil, Croatia, Ecuador, Ukraine, Armenia, Moldova, Jamaica, and Algeria. Another 7 countries had high global competitiveness index, such as: Latvia, Malta, Slovenia, Hungary, Cyprus, Slovak Republic, and Greece.

From 41 countries classified as high human development, only one country, Indonesia, had low global competitiveness index. Meanwhile, 7 countries had medium global competitiveness index, namely: Malaysia, China, Thailand, Kuwait, Bahrain, Azerbaijan, and Kazakhstan. Finally, another 33 countries had high global competitiveness index, namely: Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, Norway, Denmark, Canada, Qatar, New Zealand, United Arab Emirates, Luxembourg, Belgium, Australia, France, Austria, Ireland, Saudi Arabia, Korea Republic, Israel, Iceland, Estonia, Czech Republic, Spain, Chile, Lithuania, Portugal, Poland, and Italy.

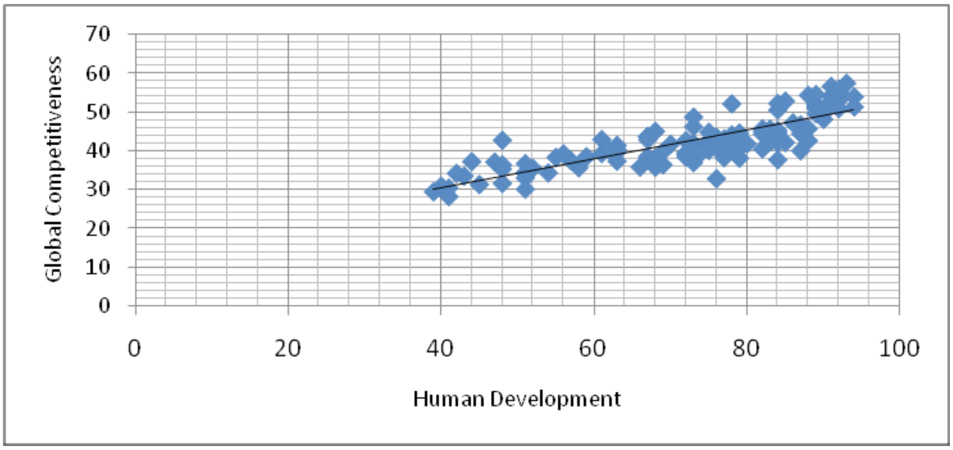

Figure 26.5

Scatter Diagram Human Development and Global Competitiveness

Figure 26.5 presents Scatter Diagram between Human Development and the global competitiveness that shows a positive trend. It means that human development had positive correlation on global competitiveness. The higher the human development index of a country, the higher the index of global competitiveness was. Regression coefficient resulted by regression analysis was positive, 0.3706. The regression coefficient was statistically significant as t-calculated (16.11) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) were far less than 0.05.

Table 26.5
Correlation Coefficient and Path Coefficient

Regression Statistics: EG-GC		Regression Statistics: EG-HD		Regression Statistics: HD-GC	
Multiple R	0,0003	Multiple R	0,8259	Multiple R	0,8259
R Square	0,0000	R Square	0,6821	R Square	0,6821
Adjusted R Square	0,0083	Adjusted R Square	0,6794	Adjusted R Square	0,6794
Standard Error	6,7085	Standard Error	3,7827	Standard Error	3,7827
Observations	123	Observations	123	Observations	123

Table 26.5 presents the results of regression analysis, mainly for correlation analysis among variables being studied. The coefficient correlation between economic growth and the global competitiveness was positive but very weak, 0.0003. The coefficient correlation between economic growth and human development was also very weak and negative, -0.1244. Meanwhile, the coefficient correlation between human development and global competitiveness was very strong and positive, 0.8259.

Solving the path equation proposed in Method of Analysis above, path coefficients have been calculated, the results: path coefficient in Path-1, $P_{31,}$ was 0.10 meaning there was positive direct effect of economic growth on global competitiveness. The increase of 1 per cent economic growth would increase 0.10 per cent global competitiveness index. Path coefficient in Path-2, $P_{21,}$ was negative, -0.1244 meaning that there was negative direct impact of economic growth on human development. The increase of 1 per cent economic growth will decrease 0.12 per cent human development index. Finally, path coefficient in Path-3, P_{32}, was 0.8134 meaning that there was a positive direct impact of human development on global competitiveness. The increase of 1 per cent human development index will increase 0.81 per cent the index of global competitiveness.

Figure 26.6: provides path model for analysing direct and indirect impact of economic growth on global competitiveness. In Path-1, direct impact of economic growth on global competitiveness was positive and significant, with P_{31}= 0.10. The higher the increase of the growth of economy, the higher the global competitiveness index would be. One per cent increase in economic growth would increase 0.10 per cent in global competitiveness index. In Path-2, direct impact of economic growth on human development was negative and significant, with P_{21}= -0.12. An increase of the growth of economy would decrease the index of human development. One per cent increase in economic growth would decrease 0.12 per cent in human development index. In Path-3, direct impact of human development on global competitiveness was negative and significant, with P_{32}= 0.81. The higher the increase of human development, the higher the index of global competitiveness would be. One per cent increase in human development index would increase 0.81 per cent in global competitiveness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of economic growth on global competitiveness was negative and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.81) x –

(0.12) = - 0.10 >0.05. The higher the increase of the growth of economy, the lower the index of global competitiveness would be. One per cent increase in economic growth would decrease 0.10 per cent in global competitiveness index.

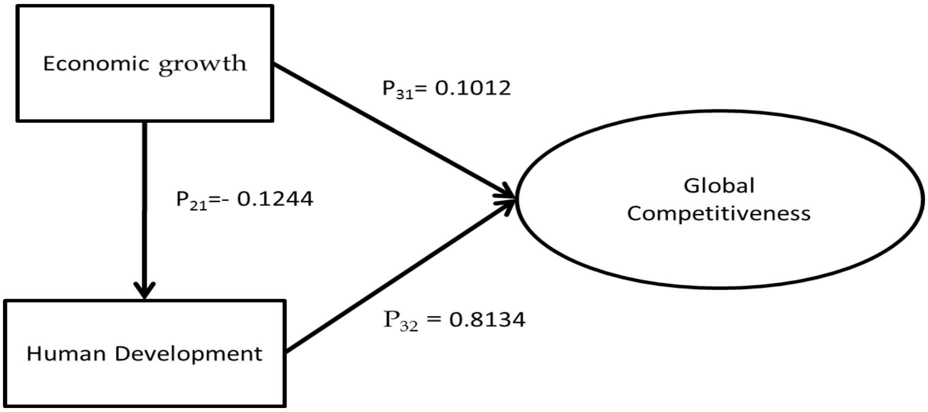

Figure 26.6
Path Analysis and Path Coefficients

4. Conclusions

From results and discussion, it could be concluded that, firstly in Path-1, economic growth measured by GDP growth had a positive and significant direct impact on global competitiveness, measured by global competitiveness index. Secondly, in Path-2, economic growth had a negative and significant direct impact on human development, measured by human development index. Thirdly, in Path-3, human development had positive and significant direct impact on global competitiveness. Finally, through Path-2 and Path-3, economic growth had negative and significant indirect impact on global competitiveness. The implication from this finding was that economic growth alone was no longer important variable in development, especially when development was focused on human and global competitiveness. Development programs that give special attention on human development should be then prioritized.

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001),"The colonial origins of economic development: an empirical investigation",**American Economic Review**, 91(5): 1369–1401.

Aghion, P., (2002), "Schumpeterian Growth Theory and the Dynamics of

Income Inequality”,**Econometrica**, 70(3): 855–882.

*Alkire, S., (1998),***Operationalizing Amartya Sen’s Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities***,*University of Oxford, Oxford,OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975),“The Decomposition of Effects in Path Analysis”,**American Sociological Review***, 40*(1), 37-47.

Barro, R. J., and Lee J.W., (2001),“International data on educational attainment: Updates and implications”,**Oxford Economic Papers,** 53(3): 541–563.

Bjork, G.J., (1999), “The Way It Worked and Why It Won’t: Structural Change and the Slowdown of U.S. Economic Growth”, Praeger, Westport CT, London, pp: 251, ISBN 0-275-96532-5.

Buckley, P.J, Le Pass, C and Prescott, K., (1988), “Measures of International Competitiveness: A Critical Survey”, **Journal of Marketing Management**, 4(2): 175-200.

Committee on Electricity in Economic Growth Energy Engineering Board Commission on Engineering and Technical Systems National Research Council, (1986), **Electricity in Economic Growth**,National Academy Press, Washington DC. pp: 16-40, ISBN: 0-309-03677-1<Available as free.pdf download>.

Dickinson, E., (2012),“GDP: a Brief History”, **ForeignPolicy.com**, Retrieved on 25 April 2012.

Galor, O., (2005),“From Stagnation to Growth: Unified Growth Theory”,**Handbook of Economic Growth**, Elsevier.

Helpman, E., (2004), **The Mystery of Economic Growth**, Harvard University Press, Harvard.

IMD, (2003),**World Competitiveness Yearbook 2003**, available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking/; https://worldcompetitiveness. imd.org/.

IMF, (2012),**Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006),**A New Deal for Effective European Research Policy**. Springer, ISBN: 978-1-4020-5550-8.

Nussbaum, M., (2000), **Women and human development: the**

capabilities approach, *Cambridge University Press,* Cambridge, New York, ISBN: 9780521003858.

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, Massachusset, pp: 33–34, ISBN 0674072359.

Porter, M., (2009), "Clusters and Economic Policy**",ISC White Paper**. Availableathttp://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Rainer Feurer, R., and Chaharbaghi, K., (1995),"Strategy development: past, present and future", **Management Decision**, 33(6):11 – 21.

Scott, B. R., and Lodge, G. C., (1985), **US Competitiveness in the World Economy**,Harvard Business School Press, Boston, Mass, USA.

Sen, A., (2005), "Human Rights and Capabilities", **Journal of Human Development**, 6(2): 151–166. Doi:10.1080/14649880500120491.

Solow, R. M., (1956),"A Contribution to the Theory of Economic Growth",**Quarterly Journal of Economics**,70(1): 65-94.

*Srinivasan, T.N., (1994),"Human Development: A New Paradigm or Reinvention of the Wheel?",***Human Development***, 84(2): 238–243.*

Stajano, A., (2010), "Research, Quality, Competitiveness",**EU Technology Policy for the Knowledge-based Society**, Springer,ISBN: 978-0-387-79264-4

*Streeten, P., (1994),"Human Development: Means and Ends",***Human Development,** *84(2): 232–237.*

Swan, T.W., (1956),"Economic Growth and Capital Accumulation",**Economic Record,**32: 334–361, Doi: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003),"The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. (Eds),**Readings in Human Development: Concept, Measures and Policies for Development Paradigm**, Oxford University Press,New Delhi, pp: 17-34.

United Nations Development Programme, (2015),**Human Development Report** at http://hdr.undp.org/en/2015-report.

*United Nations Development Programme, (1997),***Human Development Report***, Oxford University Press,* Oxford, *pp: 15,ISBN 978-0-19-511996-1.*

United Nations Development Programme, (2016),**Human Development Report 2015: Work for Human Development,**Web Version available at http:// hdr.undp.org/ en/data.

World Bank, (2016), **Annual Gross Domestic Product Growth (%),** Available on line at http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

World Economic Forum, (2010),**The Global Competitiveness Report 2009–2010**, pp: 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum, (2015),**Global Competitiveness Report 2014-2015**, Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015

World Economic Forum, (1996),**Global Competitiveness Report 1996**, World Economic Forum, Geneva, pp.: 19.

Wright, S., (1921),"Correlation and Causation",**Journal Agricultural Research**, 20:557-585.

Wright, S., (1934),"The Method of Path Coefficients", **Annals of Mathematical Statistics,** 5(3): 161-215, DOI:10.1214/ aoms/1177732676.

Xavier, S.M. and Artadi, E.A, (2004),"The Global Competitiveness Index",**Global Competitiveness Report,** Global Economic Forum.

Chapter-27

Human Development, Global Competitiveness and Happiness[1]

Ringkasan

Bab ini bertujuan untuk melaporkan hasil sebuah penelitian yang menganalisis hubungan antara pembangunan manusia, daya saing global dan kebahagiaan, sebagaimana juga analisis dampak pembangunan manusia, langsung dan tidak langsung, terhadap kebahagiaan dengan daya saing global sebagai variabel antara. Data antar negara tentang pembangunan manusia, daya saing global dan kebahagiaan dikumpulkan dari 123 negara dan digunakan dalam model analisis Jalur. Hasilnya memperlihatkan bahwa terdapat hubungan yang positive dan sangat kuat antara pembangunan manusia dan kebahagiaan. Negara-negara dengan tingkat kebahagiaan yang tinggi adalah negara-negara dengan indeks pembangunan manusia yang juga tinggi. Hubungan antara pembangunan manusia dan daya saing global juga positive dan sangat kuat. Begitu juga dengan hubungan antara daya saing global dan kebahagiaan. Dampak langsung pembangunan manusia terhadap kebahagiaan adalah positive dan secara statistic signifikan. Dampak tidak langsung pembangunan manusia terhadap kebahagiaan melalui daya saing global juga positive dan signifikan. Implikasi dari temuan ini bahwa pembangunan manusia menjadi prasyarat penting bagi daya saing global dan pencapaian kebahagiaan.

Summary

This chapter isaimed to report a research that analyse the relation between human development, global competitiveness and happiness as well as the impact of human development, both direct and indirect, on happiness, with global

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competitiveness as moderator variable. Cross-nation data on human development, global competitiveness and happiness indices were collected from 123 countries and employed in a path analysis model. The results show that the correlation between human development and happiness was positive and very strong. The countries that had high happiness index were the countries with high human development index. The correlation between human development and global competitiveness was positive and very strong. The correlation between global competitiveness and happiness was also positive and strong. The direct impact of human development on happiness was positive and significant. The indirect impact of human development on happiness, again, was positive and significant. It issuggested that human developmentsustainably be promoted in order to make nations competitive globally and then make the people happy.

1. Introduction

Economic growth is no longer considered as single important factor in measuring development progress. After human development had become a focus of development, now happiness is an important indicator of social progress and development. On April 2012, the first World Happiness Report was published, in support of the High Level Meeting at the United Nations on happiness and well-being, chaired by the Prime Minister of Bhutan. The report outlined the state of world happiness, causes of happiness and misery, and policy implications highlighted by case studies. In September 2013 the second World Happiness Report offered the first annual follow-up and reports are now issued every year. United Nations Development Programme updated the World Happiness Report 2016 which is a landmark survey of the state of global happiness (Helliwell *et al*, 2016). The report was released on March 20th on UN Happiness Day. One factor that related to happiness is global competitiveness, developed and measured by World Economic Forum. Another factor that seems related to happiness is human development, which is a concept within a field of international development.

This paper is aimed to analyses, firstly, the relation between human development, global competitiveness and happiness. Secondly, to analyse the impacts, direct and indirect, of human development on happiness, were using path analysis model.

2. Literature Reviews

a. Happiness

According to Hornby, (1985), happiness is a mental or emotional state of well-being defined by positive or pleasant emotions ranging from contentment to intense joy. The Merriam Webster online dictionary defines happiness as a state of well-being or contentment, a pleasurable or satisfying experience. Happy mental states may also reflect judgments by a person about their overall well-being (*Anand, 2016).* Happiness is a fuzzy concept and can mean many different things to many people. Related concepts are well-being, quality of life and flourishing. At least one author defines happiness as contentment (Graham, 2014). Some commentators focus on the difference between the hedonistic tradition of seeking pleasant and avoiding unpleasant experiences, and the eudaimonic tradition of living life in a full and deeply satisfying way (Deci& Ryan, 2006). Algoe& Haidt, (2009) say that happiness may be the label for a family of related emotional states, such as joy, amusement, satisfaction, gratification, euphoria, and triumph.

It has been argued that happiness measures could be used not as a replacement for more traditional measures, but as a supplement (Weiner, 2007). Several scales have been used to measure happiness, such as: the SHS (Subjective Happiness Scale) is a four-item scale, measuring global subjective happiness (Lyubomirsky &Lepper, 1999). The PANAS (Positive and Negative Affect Schedule) is used to detect the relation between personality traits and positive or negative affects at this moment, today, the past few days, the past week, the past few weeks, the past year, and generally (on average). The SWLS (Satisfaction with Life Scale) is a global cognitive assessment of life satisfaction developed by Diener, et al., (1985).

There have also been some studies that happiness related religion (among others: Routledge, 2012; Baetz & Toews, 2009; Ellison & George, 1994). There are a number of mechanism through which religion may make a person happier, including social contact and support that result from religious pursuits, the mental activity that comes with optimism and volunteering, learned coping strategies that enhance one's ability to deal with stress, and psychological factors such as reason for being. It may also be that religious people engage in behaviors related to good health, such as less substance abuse, since the use of psychotropic substances is sometimes considered abuse (Baetz & Toews, 2009; Ellison & George, 1994; Strawbridge et al., 2001; Burris, 1999). The *Handbook of Religion and Health* describes a survey that examined happiness in Americans who have given up religion, in which it was found that there was little relationship between religious disaffiliation and unhappiness (Koenig et al., 2001). A survey also cited in this handbook, indicates that people with no religious affiliation appear to be at greater risk for depressive symptoms than those affiliated with a religion. A review of studies by 147 independent investigators found, “the correlation between religiousness and depressive symptoms was -0.096”, indicating that greater religiousness is mildly associated with fewer symptoms (Smith et al., 2003).

b. Global Competitiveness

Basically, the fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services (Porter, 2009). However, competitiveness has been defined diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to IMD (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people.

Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (WEF, 1996). But According to Feurer & Chaharbaghi (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes. National competitiveness refers to a country’s ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, &Lodge, 1985). Competitiveness includes both efficiency (reaching goals at the lowest possible cost) and effectiveness (having the right goals). It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley et al., 1998).

In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report of the World Economic Forum

(2010) defines competitiveness as “the set of institutions, policies, and factors that determine the level of productivity of a country”. The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities. Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R & D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur et al., 2006; Stajano, 2010). The International Economic Development Council (IEDC) in Washington, D.C. published the “Innovation Agenda: A Policy Statement on American Competitiveness”. International comparisons of national competitiveness are conducted by the World Economic Forum, in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook (2003). The Global Competitiveness Report (GCR, 2014-2015) is a yearly report published by the World Economic Forum (2015). Since 2004, the *Global Competitiveness Report* ranks countries based on the Global Competitiveness Index (GCR, 2014-2015), developed by Xavier & Artadi, (2004). The *Global Competitiveness Index* integrates the macroeconomic and the micro aspects of competitiveness into a single index.

c. Human Development

The human development approach, developed by the economist Mahbub Ul-Haq (2003), is anchored in Nobel Laureate Amartya Sen’s work on human capabilities (Sen, 2005). It involves studies of the human condition, with its core being the capability approach. It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress. The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people’s choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms people enjoy; to lead a kind of life they have reason to value (WHO, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015a). The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nation Development Program, 2015b).

3. Methods of Analysis

In analysing direct and indirect impacts of human development on happiness, this study employed path analysis model, that was developed by Sewall Wright, who wrote about it extensively in the 1920s and 1930s *(Wright, 1921; 1934).* It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, 2003). Basically, the path model can be used to analysis two types of impacts: direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin & Hauser, 1975). In this study, the path model is depicted in Figure 1, where human development and global competitiveness were the exogenous variables.

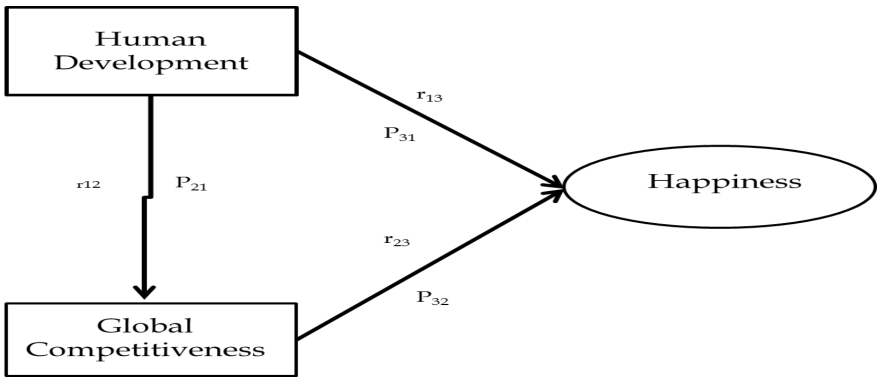

Figure 27.1

Path Model to Analysis the Impact of Human Development on Happiness

Four hypotheses to be tested were: firstly, human development had direct impact on the happiness; secondly, human development had direct impact on global competitiveness and thirdly, global competitiveness had direct impact on happiness. Finally, human development had indirect impact on the happiness, through global competitiveness. Path coefficients were calculated by solving these path equations; given that the coefficients of correlation have been calculated. P_{31} was direct impact of human development on happiness, P_{21} was direct impact of human development on global competitiveness; P_{32} was direct impact of global competitiveness on happiness, and indirectly through P_{21} and P_{32} were the impacts of human development on happiness.

Table 27.1

Path Equations

1). $r_{12} = P_{21}$
2). $r_{13} = P_{31} + P_{32}\, r_{12}$
3).$r_{23} = P_{31}\, r_{12} + P_{32}$

Source :http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

Happiness was measured by happiness index, human development was measured by the human development index and competitiveness was measured by global competitiveness index. Data on the happiness index from 156 countries was downloaded from UNDP (2016) World Happiness Report, Chapter 2: The Distribution of World Happiness written by John F. Helliwell, Haifang Huang and Shun Huang. Data are available at http://worldhappiness.report/ wp-content/ uploads/ sites/2/2016/03/HR-V1Ch2_web.pdf. Data on human development index from 155 countries download from UNDP (2016) Human Development Report 2015: Work for Human Development Web Version and was accessed at http://hdr.undp.org/en/data. Data on global competitiveness index from 138 countries were downloaded from http://reports.weforum.org /global-competitiveness-index/. Problems of missing data have been solved by deleting countries with incomplete data. Finally, data on global competitiveness, economic growth and human development used in this study were from 123 countries.

4. Results and Discussion

a. Data Descriptions

Figure 27.2 depicts the dynamic of human development index, global competitiveness index and happiness index from 123 countries being studied. The lowest index of happiness was in Burundi (29.05) and the highest index of happiness was in Denmark. Ten countries with highest index of happiness were: Denmark, Switzerland, Iceland, Norway, Finland, Canada, Netherlands, New Zealand, Australia and Sweden. Ten countries with lowest index of happiness were: Cambodia, Chad, Uganda, Madagascar, Tanzania, Liberia, Guinea, Rwanda, Benin, and Burundi. Average index of happiness in terms of statistical mean was 55.4 (Paraguay), median was 55.23 (Cyprus, Latvia, Croatia, Romania, Jamaica, and Paraguay), and mode was 58.35 (Poland, Ethiopia, Lithuania, Korea Republic, Peru, Moldova, and Bolivia).

The highest human development index was in Australia (94.00) and the lowest human development index was in Chad (39.00). Ten countries with highest index of human development were: Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden, and New Zealand. Ten countries with lowest human development index were: Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Average index of human development in terms of statistical mean was 72.99 (Jamaica, Colombia, Tunisia, Dominican Republic, and Belize), median was 76.00 (Mexico, Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine), and mode was 73.00 (The Netherland, Sweden, New Zealand, and Australia). Finally, the highest global competitiveness index was 5.76 (Switzerland) and the lowest global competitiveness index was 2.84 (Guinea).Ten countries with highest index of global competitiveness were: Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, and Norway. Ten countries with lowest index of global competitiveness were:

Liberia, Madagascar, Venezuela RB, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea. The average index of global competitiveness in term of statistical mean was 4.27 (Georgia, Jordan, Hungary, Macedonia, Colombia, Rwanda, Mexico), median was 4.22 (Slovak Republic, Georgia, Cyprus, Peru, Jordan) and mode was 4.39 (Turkey, Panama, Philippines, South Africa, Malta).

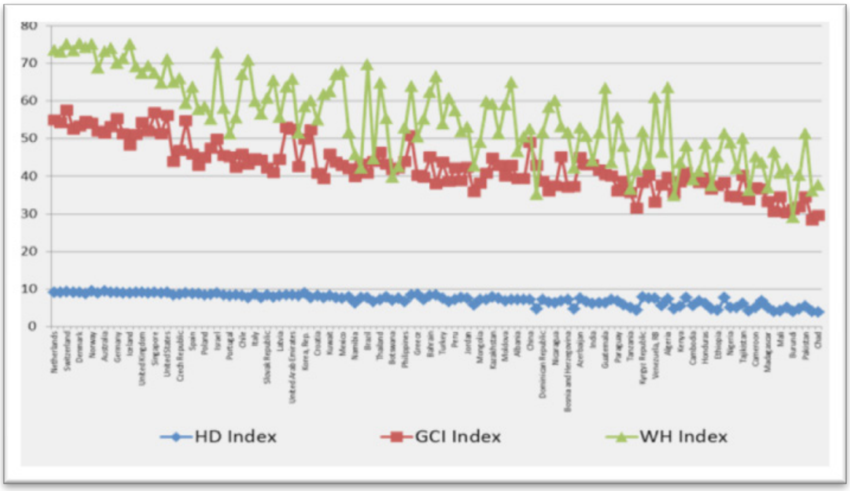

Figure 27.2

Human Development, Global Competitiveness and Happiness

a. Linearity Test

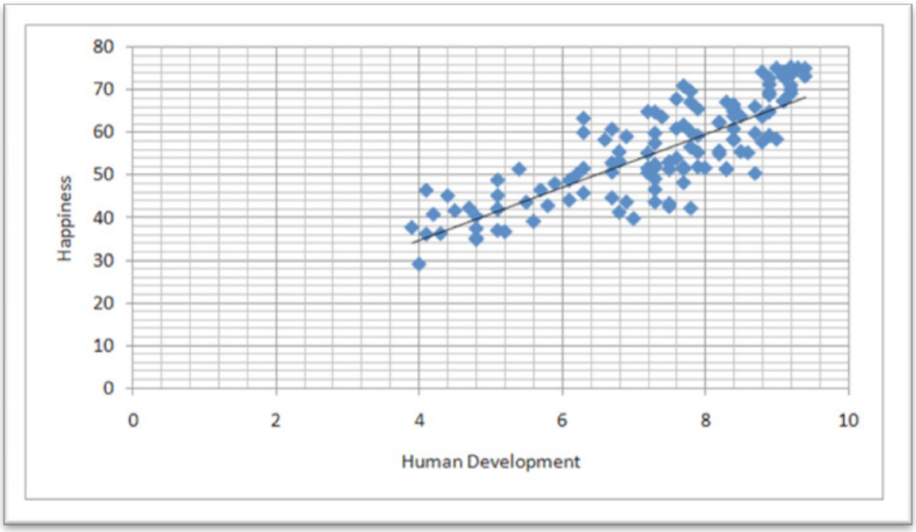

Figure 27.3

Scatter Diagram between Human Development and Happiness

Figure 27.3: presents Scatter Diagram between Human Development and Happiness that shows a positive trend. It means that human development had positive correlation on happiness. The higher the human development index of a country will be the higher the index of happiness of the country. Regression coefficient resulted by regression analysis was positive, 0.62. The regression coefficient was statistically significant as t-calculated (15.55) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) were far less than 0.05.

Figure 27.4 presents Scatter Diagram between Human Development and the Global competitiveness that shows a positive trend. It means that human development had positive correlation on global competitiveness. The higher the human development index of a country, the higher the index of global competitiveness was. Regression coefficient resulted by regression analysis was positive, 0.3706, and it was statistically significant as t-calculated (16.11) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) were far less than 0.05.

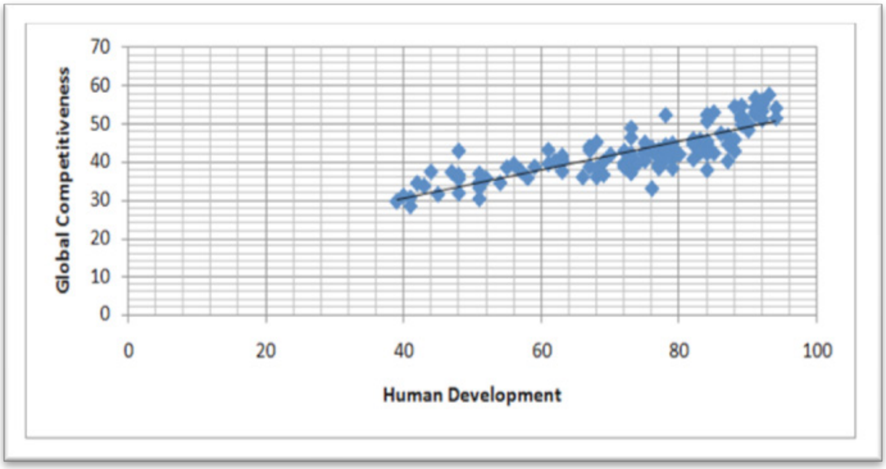

Figure 27.4

Scatter Diagram between Human Development and Global Competitiveness

Figure 27.5 presents Scatter Diagram between the Global competitiveness and Happiness that shows a positive trend. It means that global competitiveness had positive correlation on happiness. The higher the global competitiveness index of a country, the higher the index happiness was. Regression coefficient resulted by regression analysis was positive, 1.29. The regression coefficient was statistically significant as t-calculated (13.00) was higher than t-table (1.98) n=123, at 95%95% significant level, and P-value (0.00) were far less than 0.05.

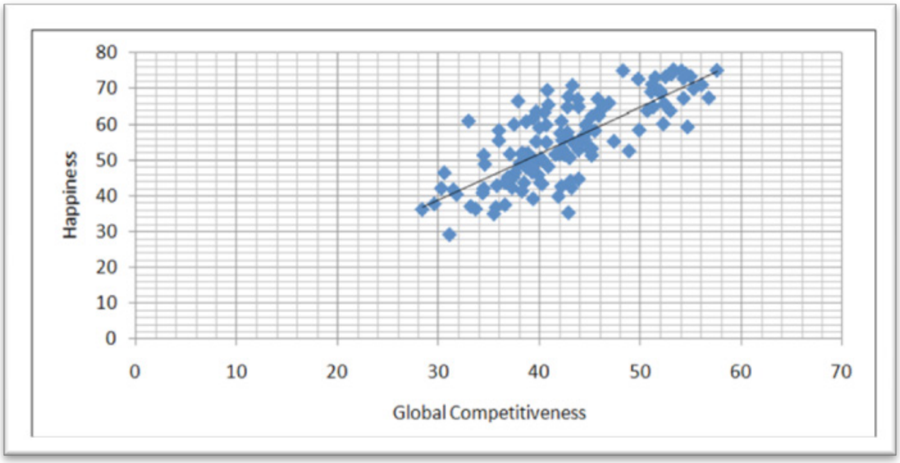

Figure 27.5

Scatter Diagram between Global Competitiveness and Happiness

b. Correlation and Path Coefficients

Table 2 presents the results of regression analysis for correlation analysis among variables being studied. The coefficient correlation between human development and the happiness was positive and very strong, r_{13}= 0.83. The coefficient correlation between human development and global competitiveness was also positive and very strong, r_{12} = 0.83. Meanwhile, the coefficient correlation between global competitiveness and happiness was positive and strong, r_{23} = 0.76.

Table 27.2
Correlation and Path Coefficients

Regression Statistics: EG-GC		*Regression Statistics: HD-GC*		*Regression Statistics: GC-H*	
Multiple R	0,82	Multiple R	0,83	Multiple R	0.76
R Square	0,67	R Square	0,68	R Square	0.58
Adjusted R Square	0,66	Adjusted R Square	0,68	Adjusted R Square	0.58
Standard Error	6,56	Standard Error	3,78	Standard Error	7.34
Observations	123	Observations	123	Observations	123
P_{23}	0.61	P_{23}	0.83	P_{23}	0.26

Solving the path equation proposed in Method of Analysis above, path coefficients have been calculated, the results: path coefficient in Path-1, $P_{31,}$ was 0.61 meaning there was positive direct effect of human development on happiness. The increase of 1 per cent human development index would increase 0.61 per cent happiness index. Path coefficient in Path-2, $P_{21,}$ was 0.83 meaning that there was positive and significant direct impact of human development on global competitiveness. The increase of 1 per cent human development index will increase 0.83 per cent global competitiveness index. Finally, path coefficient in Path-3, P_{32}, was 0.26 meaning that there was a positive direct impact of global competitiveness on happiness. The increase of 1 per cent human development index will increase 0.26 per cent the index of global competitiveness.

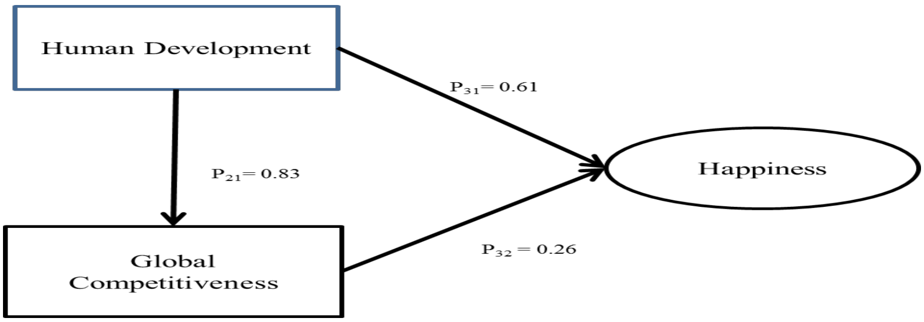

Figure 27.6

Path Analysis and Path Coefficients

Figure 6 provides path model for analysing direct and indirect impact of human development on happiness. In Path-1, direct impact of human development on happiness was positive and significant, with P_{31}= 0.61. The higher the increase of the index of human development will increase the index of happiness. One per cent increase in economic growth would increase 0.61 per cent in happiness index. In Path-2, direct impact of human development on global competitiveness was positive and significant, with P_{21}= 0.83. An increase of the index of human development would increase the index of global competitiveness. One per cent increase in human development would increase 0.83 per cent in global competitiveness index. In Path-3, direct impact of global competitiveness on happiness was also positive and significant, with P_{32}= 0.26. The higher the increase of global competitiveness, the higher the index of happiness would be. One per cent increase in global competitiveness index would increase 0.26 per cent in happiness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of human development on happiness was positive and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.83) x(0.26) = 0.22 >0.05. The higher the increase of the human development, the higher the index of happiness would be. One per cent increase in economic growth would increase 0.22 per cent in happiness index.

5. Conclusions

From results and discussion, it could be concluded that, firstly in Path-1, human development measured by human development index had a positive and significant direct impact on happiness, measured by happiness index. Secondly, in Path-2, human development had a positive and significant direct impact on global competitiveness, measured by global competitiveness index. Thirdly, in Path-3, global competitiveness had positive and significant direct impact on happiness. Finally, through Path-2 and Path-3, human development had positive and significant indirect impact on happiness. The implication from this finding was that human development and global competitiveness were important variables in determining happiness. Implementing development programs based on the concept of human development would keep national competitiveness and then make the people happy.

References

Algoe, S. B., and Haidt, J., (2009), "Witnessing Excellence in Action: the 'other-praising' emotions of elevation, gratitude, and admiration", **The Journal of Positive Psychology**, 4(2): 105–127,DOI: 10.1080/17439760802650519.

Alkire, S., (1998), **Operationalizing Amartya Sen's Capability Approach**

to Human Development: A Framework for Identifying Valuable Capabilities,University of Oxford, Oxford,OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975), "The Decomposition of Effects in Path Analysis",American Sociological Review, 40(1):37-47.

Anand, P., (2016), **Happiness Explained**, Oxford University Press, Oxford.

Baetz, M., and Toews, J., (2009), "Clinical Implications of Research on Religion, Spirituality, and Mental Health", **Canadian Journal of Psychiatry**, 54(5): 292–301.

Buckley, P.J., Le Pass, C., and Prescott, K., (1988), "Measures of International Competitiveness: A Critical Survey", Journal of Marketing Management, 4(2): 175-200.

Burris, C.T., (1999),"Religious Orientation Scale", In Hill, P.C., and Hood, R.W., (Eds),**Measures of Religiosity**, Religious Education Press, Birmingham: 144–53,ISBN 978-0-89135-106-1.

Deci, E. L., and Ryan, R. M., (2006), "Hedonia, Eudaimonia, and Well-being: An introduction", **Journal of Happiness Studies**,9 (1): 1–11,DOI:10.1007/s10902-006-9018-1.

Diener, E., Emmons, R. A., Larsen, R. J. and Griffin, S., (1985),"The Satisfaction with Life Scale",**Journal of Personality Assessment**,49(1): 71–5, DOI: 10.1207/ s15327752jpa4901_13.

Dodge, Y., (2003),**The Oxford Dictionary of Statistical Terms**, OUPISBN: 0-19-920613-9.

Ellison, C.G., and George, L.K., (1994), "Religious Involvement, Social Ties, and Social Support in a Southeastern Community", **Journal for the Scientific Study of Religion**,33 (1): 46–61,DOI: 10.2307/1386636. JSTOR : 1386636.

Feurer, R., and Chaharbaghi, K., (1995), "Strategy Development: Past, Present and Future", **Management Decision**, 33(6):11 - 21

Graham, M. C., (2014), Facts of Life: Ten Issues of Contentment, Outskirts Press: 6–10. ISBN: 978-1-4787-2259-5.

Helliwell, J., Layard, R., and Sachs, J., (2016), **World Happiness Report 2016**, United Nations Development Programme.

Hornby, A.S., (1985),**Oxford Advanced Learner's Dictionary of Current**

English, Twenty Second Impression, Oxford University Press, Oxford.

IMD, (2003),**World Competitiveness Yearbook 2003** available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking; https://worldcompetitiveness. imd.org/

Koenig, H. G., Larson, D. B., and Mcculloug, M. E., (2001),**Handbook of Religion and Health**,: 122, Oxford University Press, Oxford,ISBN: 0-8133-6719-0.

Lyubomirsky, S., and Lepper, H. S., (1999),"A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation",**Social Indicators Research**,46 (2): 137–55,DOI:10.1023/A:1006824100041.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006), **A New Deal for Effective European Research Policy**, Springer, ISBN: 978-1-4020-5550-8.

Nussbaum, M., (2000), **Women and Human Development: the Capabilities Approach**, Cambridge University Press, Cambridge New York, ISBN: 9780521003858.

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, MA: 33–34. ISBN: 0674072359.

Porter, M., (2009), "Clusters and Economic Policy",**ISC White Paper**, Available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf.

Routledge, C., (2012), "Are Religious People Happier Than Non-religious People?",**Psychology Today**, Retrieved on 24 January 2014.

Scott, B. R., and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston MA.

Sen, A., (2005), "Human Rights and Capabilities", **Journal of Human Development**, 6(2): 151–166, DOI:10.1080/14649880500120491.

Smith, T. B., McCullough, M. E., and Poll, J., (2003),"Religiousness and Depression: Evidence for a Main Effect and the Moderating Influence of Stressful Life Events",**Psychological Bulletin,**129 (4): 614–36,DOI:10.1037/0033-2909.129.4.614.

Srinivasan, T.N., (1994),"Human Development: A New Paradigm or Reinvention of the Wheel?",**Human Development**, 84(2): 238–243.

Stajano, A., (2010), **Research, Quality, Competitiveness**, EU Technology Policy for the Knowledge-based Society, Springer ISBN: 978-0-387-79264-4.

Strawbridge, W. J., Shema, S. J., Cohen, R. D., and Kaplan, G. A., (2001), "Religious Attendance Increases Survival by Improving and Maintaining Good Behaviors, Mental Health, and Social Relationships",**Annals of Behavioral Medicine**,23 (1): 68–74,DOI:10.1207/S15324796ABM2301_10. PMID 11302358.

Streeten, P., (1994), "Human Development: Means and Ends", **Human Development**, 84(2): 232–237.

Ul-Haq, M., (2003), "The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S.,(Eds), **Readings in Human Development**: 17-34, Oxford University Press, Oxford, UK.

United Nations Development Programme, (2015a), **Human Development Reports 2015**, available at http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2015b), **Human Development Reports**,available at http://hdr.undp.org/eandevn/hum

United Nations Development Programme, (2016), **Human Development Report 2015: Work for Human Development,** Web Version available at http://hdr.undp.org/en/data.

United Nations Development Programme, (2016), **World Happiness Report on Chapter 2: The Distribution of World Happiness**, Available athttp://worldhappiness.report/wp-content/ uploads/ sites /2/2016/03/HR-V1Ch2_web.pdf.

Weiner, E. J., (2007),**Four months of boom, bust, and fleeing foreign credit**,Los Angeles Times. Archived from the original on December 22, 2007.

World Economic Forum, (1996), **Global Competitiveness Report 1996**, Geneva: World Economic Forum, pp: 19.

World Economic Forum, (2010), **The Global Competitiveness Report 2009–2010**, pp: 3. Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum, (2015), **Global Competitiveness Report 2014-2015**, Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015

World Health Organization,(2016),**Preventing Disease through Healthy Environments: a Global Assessment of the Burden of Disease from Environmental Risks**, Retrieved 4 August 2016.

Wright, S., (1921), "Correlation and Causation", **Journal Agricultural Research**, 20:557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical Statistics,** 5(3): 161-215, DOI: 10.1214/aoms/1177732676.

Xavier, S.M., and Artadi, E.A., (2004), "The Global Competitiveness Index", **Global Competitiveness Report**, Global Economic Forum.

Chapter-28

Economic Growth, Human Development, Global Competitiveness and Happiness[1]

Ringkasan

Bab ini menganalisis dampak, langsung dan tidak langsung, indikator-indikator pembangunan ekonomi yang terdiri atas pertumbuhan ekonomi, pembangunan manusia dan daya saing global terhadap kebahagiaan. Data antar negara tentang pertumbuhan ekonomi, indeks pembangunan manusia, indeks daya saing global dan indeks kebahagiaan dari 123 negara dikumpulkan dari berbagai sumber dan digunakan untuk analisis dampak menggunakan metode analisis jalur. Hasil analisis menunjukkan bahwa secara langsung, Jalur-1, dampak pertumbuhan ekonomi terhadap kebahagiaan adalah negative dan secara statistik signifikan. Secara tidak langsung, dampak pertumbuhan ekonomi terhadap kebahagiaan beragam menurut Jalur. Pada Jalur-7, P_{43}-P_{31}, dampak pertumbuhan ekonomi terhadap kebahagiaan, melalui daya saing global adalah positive dan signifikan. Pada Jalur-8, P_{43}-P_{32}-P_{21}, dampak pertumbuhan ekonomi terhadap kebahagiaan, melalui daya saing global dan pembangunan manusia, adalah negative tetapi secara statistik tidak signifikan. Terakhir pada Jalur-9, P_{42}-P_{21}, dampak pertumbuhan ekonomi terhadap kebahagiaan melalui pembangunan manusia juga negative, tetapi secara statistik tidak signifikan. Implikasi dari temuan ini adalah bahwa pertumbuhan ekonomi tidak lagi merupakan faktor penting dalam pembangunan, khususnya pembangunan yang bertujuan membuat masyarakat bahagia.

Summary

This chapter analyses direct and indirect impacts of economic development

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indicators, that consist of economic growth, human development and global competitiveness, on happiness. Cross-nations data on economic growth, human development, global competitiveness and happiness were collected from 123 countries and employed to a path analysis model. The result showed that directly, in Path-1 the impact of economic growth on happiness was negative and significant. Indirectly, the impacts of economic growth on happiness varied depend on the path. In Path-7, P_{43}-P_{31}, the impact of economic growth on happiness through global competitiveness was positive and significant. In Path-8, P_{43}-P_{32}-P_{21}, the impact of economic growth on happiness through global competitiveness and human development was negative, but statistically was not significant. Finally, in Path-9, P_{42}-P_{21}, the impact of economic growth on happiness through human development was negative but statistically was not significant. The implication of this finding was that economic growth no longer important factor in development, especially when development aimed to make people happy.

14. Introduction

Happiness has become one of important indicators of social progress. Happiness is now the ultimate goal of development. United Nations Development Programme updated the World Happiness Report 2016 which is a landmark survey of the state of global happiness (Helliwell, J. et al., 2016). The report was released on March 20th on UN Happiness Day. The first World Happiness Report was published in April 2012, in support of the High Level Meeting at the United Nations on happiness and well-being, chaired by the Prime Minister of Bhutan. The report outlined the state of world happiness, causes of happiness and misery, and policy implications highlighted by case studies. In September 2013 the second World Happiness Report offered the first annual follow-up and reports are now issued every year.

According to Hornby (1985), happiness is a mental or emotional state of well-being defined by positive or pleasant emotions ranging from contentment to intense joy. The Merriam Webster online dictionary defines happiness as a state of well-being or contentment, a pleasurable or satisfying experience. Happy mental states may also reflect judgments by a person about their overall well-being (Anand, P., 2016). Happiness is a fuzzy concept and can mean many different things to many people. Related concepts are well-being, quality of life and flourishing. At least one author defines happiness as contentment

(Graham, M. C., 2014). Some commentators focus on the difference between the hedonistic tradition of seeking pleasant and avoiding unpleasant experiences, and the eudaimonic tradition of living life in a full and deeply satisfying way (Deci, E.L. & Ryan, R. M., 2006). Algoe, S. & Haidt, J., (2009) say that happiness may be the label for a family of related emotional states, such as joy, amusement, satisfaction, gratification, euphoria, and triumph.

It has been argued that happiness measures could be used not as a replacement for more traditional measures, but as a supplement (Weiner, E. J., 2007). Several scales have been used to measure happiness, such as: the SHS (Subjective Happiness Scale) is a four-item scale, measuring global subjective happiness (Lyubomirsky, S. & Lepper, H. S., 1999).The PANAS (Positive and Negative Affect Schedule) is used to detect the relation between personality traits and positive or negative affects at this moment, today, the past few days, the past week, the past few weeks, the past year, and generally (on average). The SWLS (Satisfaction with Life Scale) is a global cognitive assessment of life satisfaction developed by Diener, E, et al., (1985).

Economic development indicator initially starting with economic growth, then human development focused and competitiveness. The first development indicator related to happiness indicated by Gross Domestic Product (GDP), which is the measure of economic growth (Frey, B. S. & Stutzer, A., 2001). Economic growth is the increase in the inflation-adjusted market value of the goods and services produced by an economy over time. It is conventionally measured as the percent rate of increase in real gross domestic product (real GDP), usually in per capita terms (IMF, 2012). Growth is usually calculated in real terms to eliminate the distorting effect of inflation on the price of goods produced. Since economic growth is measured as the annual percent change of gross domestic product (GDP), it has all the advantages and drawbacks of that measure. The rate of economic growth refers to the geometric annual rate of growth in GDP between the first and the last year over a period of time. Implicitly, this growth rate is the trend in the average level of GDP over the period, which implicitly ignores the fluctuations in the GDP around this trend. An increase in economic growth caused by more efficient use of inputs is referred to as intensive growth. GDP growth caused only by increases in the amount of inputs available for use is called extensive growth.

Theories and models of economic growth among others: Classical Growth Theory of Ricardian which is originally Thomas Maltus theory about agriculture

(Bjork, G.J., 1999), Solow-Swan Model developed by Sollow, R., (1956) and Swan, T., (1956), Endogenous Growth Theory which focus on what increases human capital or technological change (Helpman, E., 2004), Unified Growth Theory developed by Galor, O., (2005), The Big Push Theory which is popular in 1940s, Schumpeterian Growth Theory which is entrepreneurs introduce new products or processes in the hope that they will enjoy temporary monopoly-like profits as they capture markets (Aghion, P., 2002), Institutions and Growth Theory (Acemoglu, at.al, 2001), Human Capital and Growth Theory (Barro & Lee, 2001).

Economic growth had been a single development indicator for many years before the concept of human development was introduced. Human development is a concept within a field of international development. The human development approach, developed by the economist Mahbub Ul-Haq (2003), is anchored in Nobel Laureate Amartya Sen's work on human capabilities (Sen, 2005). It involves studies of the human condition, with its core being the capability approach. The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations Development Programme (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress. The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives that they value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities. Capabilities are the substantive freedoms people enjoy; to lead a kind of life they have reason to value (World Health Organization, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015a). The index encompasses statistics such as life expectancy at birth, an education index calculated using mean years of schooling and expected years of schooling, and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own well-being. The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable, and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nation Development Program, 2015b).

Basically, the fundamental goal of economic development policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services (Porter, 2009). However, competitiveness has been defined diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to Institute for Management Development (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (World Economic Forum, 1996). But According to Feurer, R. and Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes. National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R.

and Lodge, G. C., 1985). Competitiveness includes both efficiency (reaching goals at the lowest possible cost) and effectiveness (having the right goals). It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et.al, 1998).

In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets. The Global Competitiveness Report of the World Economic Forum (2010) defines competitiveness as "the set of institutions, policies, and factors that determine the level of productivity of a country". The term is also used to refer in a broader sense to the economic competitiveness of countries, regions or cities. Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et.al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum, in its Global Competitiveness Report, and the IMD (2003), in its World Competitiveness Yearbook (2003). The Global Competitiveness Report (GCR, 2014-2015) is a yearly report published by the World Economic Forum (2015). Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index (GCR, 2014-2015), developed by Xavier, M, S., and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index.

The impact of technological progress, economic growth and human development on Indonesia's global competitiveness has been reported by Muchdie, et.al, (2016). The impact of technological progress and economic growth on human development, using Indonesian data, has also been analyzed by Muchdie (2016a). Using cross-nations data, Muchdie (2016b) has analyzed the correlation as well as the impact of economic growth and human development on global competitiveness.

The objective of this paper is to report a research that is aimed to study the impact of economic development indicators, such as economic growth, human development and global competitiveness on happiness, using a cross-nations path model.

2. Methods of Analysis

In analyzing the impacts of economic development indicators on happiness, this study employed path analysis model, that was developed by Sewall Wright, who wrote about it extensively in the 1920s and 1930s (Wright, S., 1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y., 2003). Basically, the path model can be used to analysis two types of impacts: direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin, D.F., & Hauser, R.M., 1975). In this study, the path model is depicted in Figure 28.1: where human development and global competitiveness were the exogenous variables.

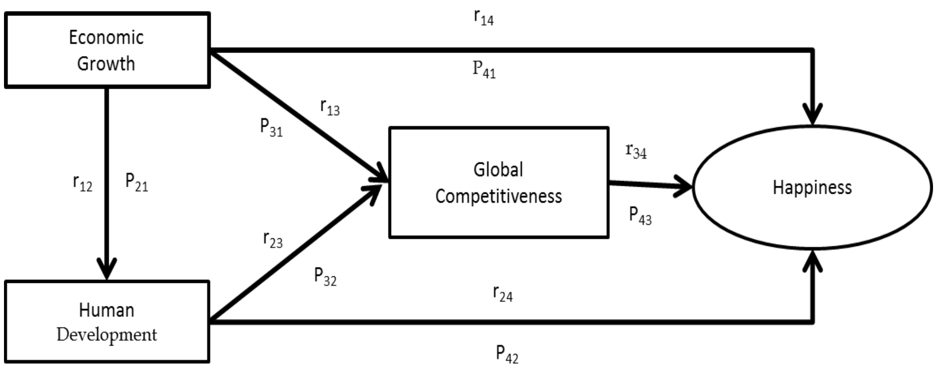


Figure 28.1

Path Model to Analysis the Impact of Economic Development on Happiness

Six hypotheses of direct impacts and three hypotheses on indirect impact to be tested were: first, economic growth had direct impact on the happiness (Path-1); second, economic growth had direct impact on global competitiveness (Path-2); third, economic growth had direct impact on human development (Path-3); fourth, human development had direct impact on global competitiveness (Path-4), fifth, human development had direct impact on happiness (Path-5), and sixth, global competitiveness had direct impact on happiness (Path-6). Indirectly, economic growth had indirect impact on the happiness, through global competitiveness (Path-7); economic growth had indirect impact through global competitiveness and human development (Path-8), and economic growth had indirect impact of happiness, through human development (Path-9).

Path coefficients were calculated by solving these path equations; given that the coefficients of correlation have been calculated. P_{41} was direct impact of economic growth on happiness; P_{31} was direct impact of economic growth on global competitiveness; P_{21} was direct impact of economic growth on human development; P_{32} was direct impact of human development on global competitiveness, and P_{42} was direct impact of human development on happiness. Indirect impact of economic growth on happiness, through global competitiveness was in Path-7 (P_{43} - P_{31}); Path-8 (P_{43} - P_{32} - P_{21}) was indirect impact of economic growth on happiness, through global competitiveness and human development; Path-9 (P_{42} -P_{21}) was indirect impact of economic growth on happiness, through human development.

Table 28.1

Path Equations

1). $r^{12} = p^{21}$ Direct efect (DE)	4). $r^{14} = p^{41} + p^{42} r^{12} + p^{43} r^{13}$ Direct effect + Indirect effect (IE)
2). $r^{13} = p^{31} + p^{32} r^{12}$ Direct effect (DE) + Indirect efect (IE)	5). $r^{24} = p^{41} r^{12} + p^{42} + p^{43} r^{23}$ Direct effect (DE) + Indirect effect (IE) + Spurious (S)
3). $r^{23}= p^{31} r^{12} + p^{32}$ Spuriuos effect (S) + Direct effect (DE)	6). $r^{34} = p^{41} r^{13} + p^{42} r^{23} + p^{43}$ Direct effect (DE) + Spurious (S)

Source: http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

Happiness was measured by happiness index, economic growth was measured by the growth of GDP, human development was measured by the human development index and competitiveness was measured by global competitiveness index. Data on the happiness index from 156 countries was downloaded from UNDP (2016) World

Happiness Report, Chapter 2: The Distribution of World Happiness written by John F. Helliwell, Haifang Huang and Shun Huang. Data are available at http://worldhappiness.report/wp-content/ uploads/ sites /2/2016/03/ HRV1Ch2_web.pdf. Data on economic growth from 178 countries downloaded from World Bank (2016) Annual Gross Domestic Product Growth (%) and available at http: //data. worldbank.org/indicator/NY.GDP.MKTP.KD.ZG. Data on human development index from 155 countries download from UNDP (2016) Human Development Report 2015: Work for Human Development Web Version and was accessed at http://hdr.undp.org/en/data. Data on global competitiveness index from 138 countries downloaded at http://reports.weforum.org/globalcompetitiveness-index/. Problems of missing data have been solved by deleting countries with incomplete data. Finally, data on happiness, global competitiveness, human development, and economic growth used in this study were from 123 countries.

3. Results and Discussions

Figure 28.2 depicts the dynamic of economic growth, human development index, global competitiveness index and happiness index from 123 countries being studied. The lowest economic growth happened at Sierra Leone (-20.3%) and the highest economic growth was at Mauritania (15.5%). Ten countries with the highest economic growth were Mauritania, Iran Islamic Republic, Ethiopia, Ireland, India, Mali, Cambodia, Dominican Republic, Tanzania, and China. Ten countries with the lowest economic growth were Guinea, Greece, Botswana, Kuwait, Moldova, Trinidad and Tobago, Burundi, Brazil, Venezuela RB and Sierra Leone. Average growth in terms of statistical mean was 2.91% (Bahrain), median 2.9% (Bahrain), and mode 3.0% (Thailand).

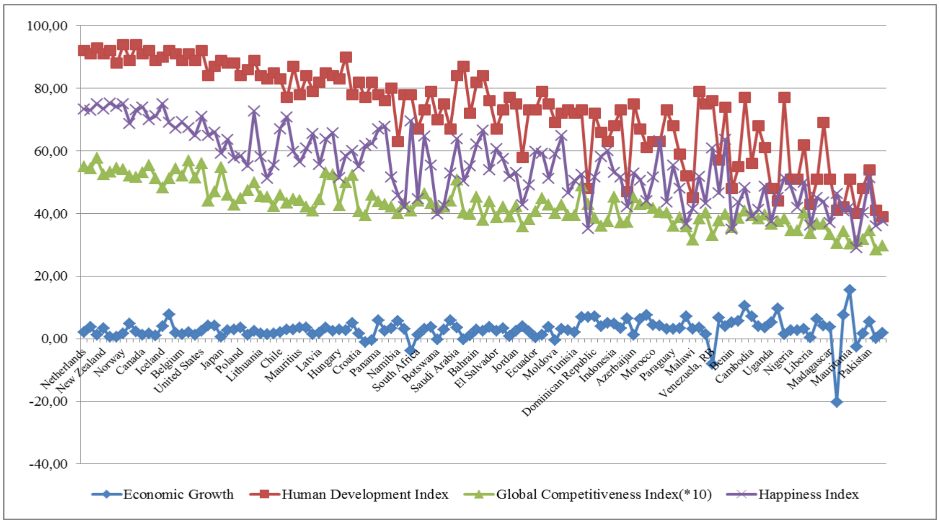


Figure 28.2

Economic Growth, Human Development, Global Competitiveness and Happiness

The highest human development index was in Australia (94.00) and the lowest human development index was in Chad (39.00). Ten countries with highest index of human development were: Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden, and New Zealand. Ten countries with lowest human development index were: Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Average index of human development in terms of statistical mean was 72.99 (Jamaica, Colombia, Tunisia, Dominican Republic, and Belize), median was 76.00 (Mexico, Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine), and mode was 73.00 (The Netherland, Sweden, New Zealand, and Australia).

The highest global competitiveness index was 5.76 (Switzerland) and the lowest global competitiveness index was 2.84 (Guinea). Ten countries with highest index of global competitiveness were: Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, and Norway. Ten countries with lowest index of global competitiveness were: Liberia, Madagascar, Venezuela RB, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea. The average index of global competitiveness in term of statistical mean was 4.27 (Georgia, Jordan, Hungary, Macedonia, Colombia, Rwanda, Mexico), median was 4.22 (Slovak Republic, Georgia, Cyprus, Peru, Jordan) and mode was 4.39 (Turkey, Panama, Philippines, South Africa, Malta).

The lowest index of happiness was in Burundi (29.05) and the highest index of happiness was in Denmark. Ten countries with highest index of happiness were: Denmark, Switzerland, Iceland, Norway, Finland, Canada, Netherlands, New Zealand, Australia and Sweden. Ten countries with lowest index of happiness were: Cambodia, Chad, Uganda, Madagascar, Tanzania, Liberia, Guinea, Rwanda, Benin, and Burundi. Average index of happiness in terms of statistical mean was 55.4 (Paraguay), median was 55.23 (Cyprus, Latvia, Croatia, Romania, Jamaica, and Paraguay), and mode was 58.35 (Poland, Ethiopia, Lithuania, Korea Republic, Peru, Moldova, and Bolivia).

Figure 28.3 (left panel) presents Scatter Diagram between economic growth and happiness that shows a negative trend. It means that economic growth had negative correlation on happiness. The higher the economic growth of a country will be the higher the index of happiness of the country. Regression coefficient resulted by regression analysis was negative, -0.55. The regression coefficient was not statistically significant as t-calculated (1.86) was smaller than t-table (1.98) n=123, at 95% significant level, and P-value (0.07) were more than 0.05.

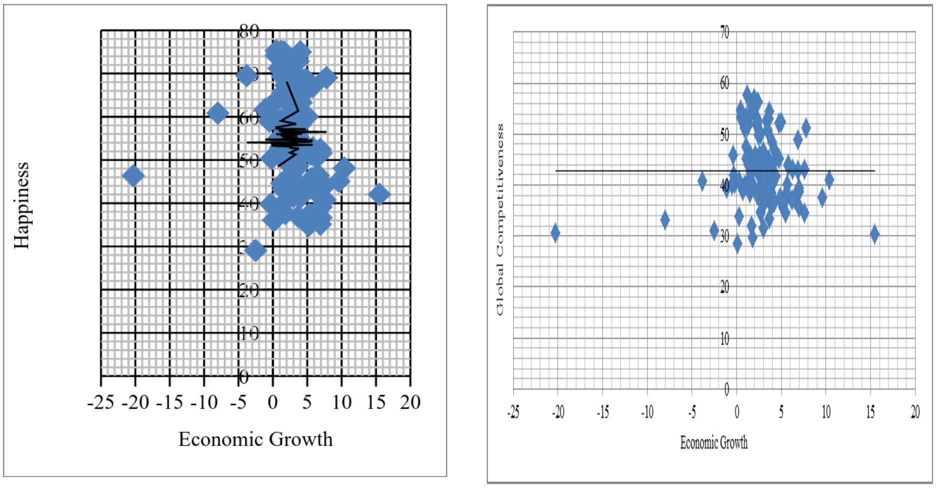


Figure 28.3

Scatter Diagram between Economic Growth and Happiness (Left Panel) and between Economic Growth and Global Competitiveness (Right Panel

Figure 28.3 (right panel): presents Scatter Diagram between economic growth and the global competitiveness that shows a positive trend. It means that human development had positive correlation on global competitiveness. The higher the growth of GDP of a country, the higher the index of global competitiveness was. Regression coefficient resulted by regression analysis was positive, 0.0006. The regression coefficient was not statistically significant as t-calculated (0.004) was far smaller than t-table (1.98) n=123, at 95% significant level, and P-value (0.997) were more than 0.05.

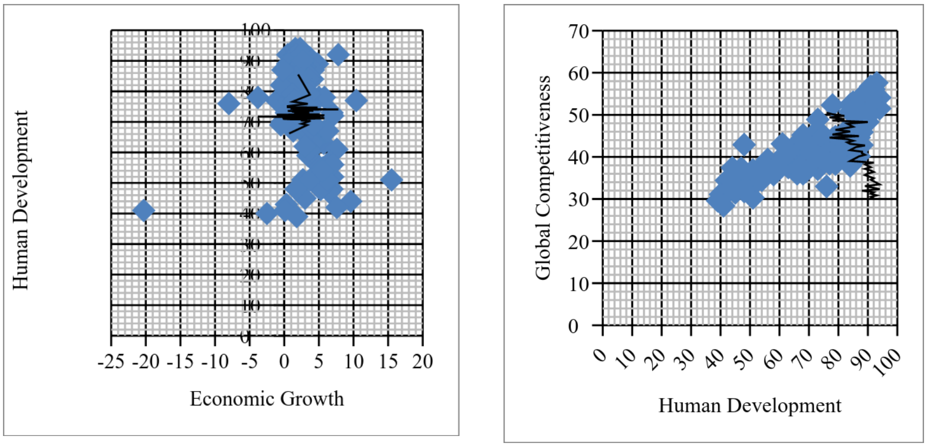


Figure 28.4

Scatter Diagram between Economic Growth and Human Development (Left Panel) and between Human Development and Global Competitiveness (Right Panel)

Figure 28.4 (left panel): presents Scatter Diagram between economic growth and human development that shows a negative trend. It means that economic growth had negative correlation on human development. The higher the growth of GDP of a country, the smaller the index of human development was. Regression coefficient resulted by regression analysis was negative (-0.54), but it was not statistically significant as t-calculated (1.38) was far smaller than t-table (1.98) n=123, at 95% significant level, and P-value (0.17) were more than 0.05.

Figure 28.4 (right panel) presents Scatter Diagram between human development and global competitiveness that shows a positive trend. It means that human development had positive correlation on global competitiveness. The higher the human development index of a country, the higher the index of global competitiveness index was. Regression coefficient resulted by regression analysis was positive, 0.37 and was statistically significant as t-calculated (16.11) was far higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) were more than 0.05.

Figure 28.5 (left panel): presents Scatter Diagram between human development and happiness that shows a positive trend. It means that human development had positive correlation on happiness. The higher the human development index of a country, the higher the index of happiness was. Regression coefficient resulted by regression analysis was positive, 0.37. The regression coefficient was statistically significant as t-calculated (16.11) was far higher than t- table (1.98) n=123, at 95% significant level, and P-value (0.00) were more than 0.05.

Figure 28.5 (right panel): presents Scatter Diagram between global competitiveness and happiness that shows a positive trend. It means that global competitiveness had positive correlation on happiness. The higher the global competitiveness index of a country, the higher the index of happiness was. Regression coefficient resulted by regression analysis was positive (1.29). The regression coefficient was statistically significant as t-calculated (13.00) was far higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) were more than 0.05.

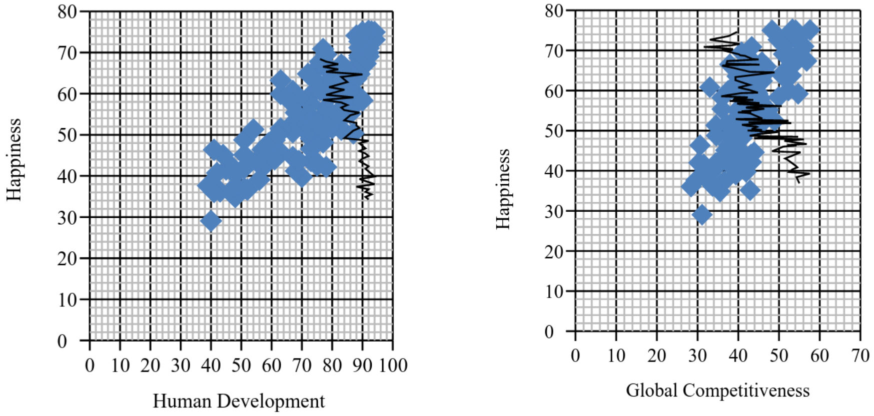


Figure 28.5

Scatter Diagram between Human Development and Happiness (Left Panel) and between Global Competitiveness and Happiness (Right Panel)

Figure 28.6 presents the results of regression analysis for correlation analysis among variables being studied. The coefficient correlation between economic growth and the happiness was negative but very weak as r_{14}= -0.1667. The coefficient correlation between economic growth and global competitiveness was positive, but very weak as r_{13} = 0.0003. Again, the coefficient correlation between economic growth and human development was also negative, but very weak as r_{12} = -0.1244. Coefficient correlation between human development and global competitiveness was positive and very strong as r_{23} = 0.8256. Meanwhile the coefficient correlation between human development and happiness was also positive and very strong as r_{24} = 0.8164. Finally, the coefficient correlation between global competitiveness and happiness was positive and strong as r_{34} = 0.7635.

Solving the path equation proposed in Method of Analysis above, path coefficients have been calculated. In Path-1: the direct impact of economic growth on happiness was negative and significant as P_{41}=-0.11> [0.05]. It means that an increase in economic growth by 1 per cent would decrease the index of happiness by 0.11 per cent. In Path-2: the direct impact of economic growth on global competitiveness was positive and significant as P_{31}= 0.94 > 0.05. It means that an increase of economic growth by 1 per cent would increase the index of global competitiveness by 0.94 per cent. In Path-3: the direct impact of economic growth on human development was negative and significant as P_{21}= -0.12 > [0.05]. It means that an increase of economic growth by 1 per cent would decrease the index of human development by 0.12 per cent. In Path-4: the direct impact of human development on global competitiveness was positive and significant as P_{32}= 0.94 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of global competitiveness by 0.94 per cent. In Path-5: the direct impact of human development on happiness was positive and significant as P_{42}=0.43 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of happiness by 0.43 per cent. Finally, in Path-6: the direct impact of global competitiveness on happiness was positive and significant as P_{43} = 0.42 > 0.05. An increase of global competitiveness index by 1 per cent would increase the index of happiness by 0.42 per cent.

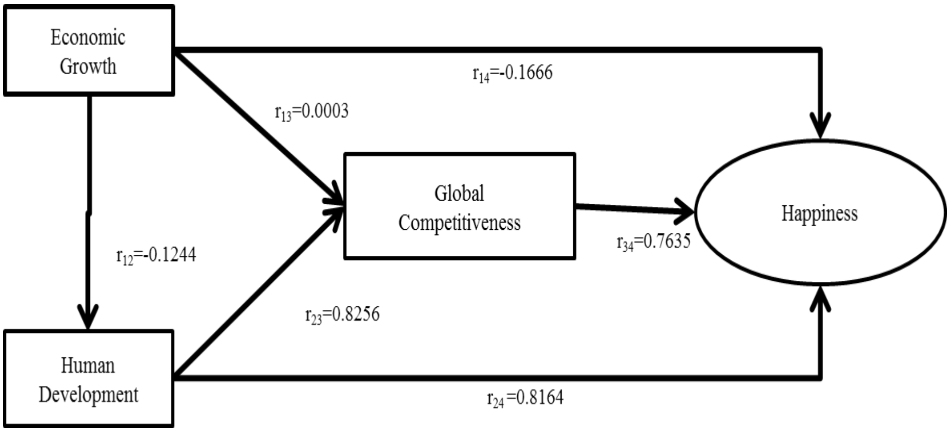


Figure 28.6

Correlation Coefficients among Economic Growth, Human Development, Global Competitiveness and Happiness

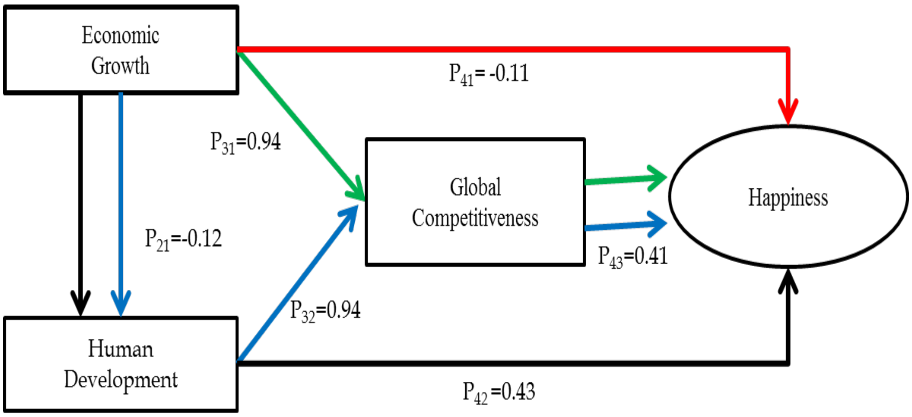


Figure 28.7

Path and Path Coefficients for Analyzing Direct and Indirect Impact of Economic Growth on Happiness

Figure 28.7 provides path model for analysing direct and indirect impact of human development on happiness. In Path-1 (red-path), direct impact of economic growth on happiness was negative and significant, with P_{41}= -0.11. The higher the increase of the index of economic growth will decrease the index of happiness. One per cent increase in economic growth would decrease by 0.11 per cent in happiness index. In Path-7 (green-path), indirect impact of economic growth on happiness, through global competitiveness was positive and significant P_{43}x P_{31}=0.41 x 0.94 = 0.38 > 0.05. It means that indirectly through global competitiveness, an increase of 1 per cent of economic growth would increase the index of happiness by 0.38 per cent. In Path-8 (the blue-path), indirect impact of economic growth on happiness through global competitiveness and human development was negative but statistically not significant as P_{43}xP_{32}xP_{21}= 0.41 x 0.94 x -0.12= -0.046 <= 0.05. An increase of economic growth by 1 per cent would, indirectly decrease the index of happiness by 0.05 per cent. Finally, in Path-9 (black-path), the indirect impact of economic on happiness through human development was negative and statistically significant as P_{42}xP_{21} = 0.43 x -0.12 = -0.052 < = 0.05.

4. Conclusions

Two conclusions could be drawn, firstly, in Path-1 (red-path); economic growth had negative and significant direct impact on happiness. Secondly, indirectly, the impacts of economic growth on happiness varied depend on the path. On Path-7 (green path), the indirect impact of economic growth on happiness through global competitiveness was positive and statistically significant. On Path-8 (blue-path), the indirect impact of economic growth on happiness through global competitiveness and human development was negative but statistically not significant. Path-9 (black-path), the indirect impact of economic growth on happiness through human development was negative and statistically significant. The implication of this finding was that economic growth no longer important indicator of economic development. Human development and global competitiveness were two important development indicators that improve and maintenance the level of happiness.

References

Acemoglu, D., Johnson, S. and Robinson, J., (2001), "The colonial origins of economic development: an empirical investigation", **American Economic Review**, 91(5): 1369–1401.

Aghion, P., (2002), "Schumpeterian Growth Theory and the Dynamics of Income Inequality", **Econometrica**, 70(3): 855–882.

Algoe, S. B., and Haidt, J., (2009), "Witnessing excellence in action: the 'other-praising' emotions of elevation, gratitude, and admiration", **The Journal of Positive Psychology**, 4(2): 105–127, Doi: 10.1080/17439760802650519.

Alkire, S., (1998), **Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities**, University of Oxford, Oxford, OCLC: 43087376.

Alwin, D. F., and Hauser, R. M., (1975), "The Decomposition of Effects in Path Analysis", **American Sociological Review**, 40(1): 37-47.

Anand, P., (2016), **Happiness Explained**, Oxford University Press, Oxford.

Barro, R. J., and Lee J.W., (2001), "International data on educational attainment: Updates and implications", **Oxford Economic Papers,** 53(3): 541–563.

Bjork, G.J., (1999), **The Way It Worked and Why It Won't: Structural Change and the Slowdown of U.S. Economic Growth**, Praeger, Westport CT, London, pp: 251, ISBN 0-275-96532-5.

Buckley, P.J., Le Pass, C., and Prescott, K., (1988), "Measures of International Competitiveness: A Critical Survey", **Journal of Marketing Management**, 4(2): 175-200.

Deci, E. L., and Ryan, R. M., (2006), "Hedonia, Eudaimonia, and Well-being: An introduction", **Journal of Happiness Studies,** 9(1): 1–11, DOI: 10.1007/s10902-006-9018-1.

Diener, E., Emmons, R. A., Larsen, R. J., and Griffin, S., (1985), "The Satisfaction with Life Scale", **Journal of Personality Assessment**, 49(1): 71–5, DOI: 10.1207/ s15327752jpa4901_13.

Dodge, Y., (2003), **The Oxford Dictionary of Statistical Terms**, OUP ISBN: 0-19-920613-9.

Feurer, R., and Chaharbaghi, K., (1995), "Strategy development: past, present and future", **Management Decision**, 33(6): 11- 21.

Frey, Bruno S., and Stutzer, A., (2001), **Happiness and Economics**, Princeton University Press, Princeton, ISBN 0-691-06998-0.

Galor, O., (2005), “From Stagnation to Growth: Unified Growth Theory”, **Handbook of Economic Growth**, Elsevier.

Graham, M. C., (2014), **Facts of Life: Ten Issues of Contentment**, Outskirts Press: 6–10. ISBN: 978-1-4787-2259-5.

Helliwell, J., Layard, R., and Sachs, J., (2016), **World Happiness Report**, United Nations Development Programme.

Helpman, E., (2004), **The Mystery of Economic Growth**, Harvard University Press, Harvard.

Hornby, A.S., (1985), **Oxford Advanced Learner’s Dictionary of Current English**, Twenty Second Impression, Oxford University Press, Oxford.

IMD, (2003), **World Competitiveness Yearbook 2003**, available at www.imd.org/wcc, http://www.imd.org/wcc/ news-wcy-ranking/ and https://worldcompetitiveness. imd.org/

IMF, (2012), **Statistics on the Growth of the Global Gross Domestic Product (GDP) from 2003 to 2013**.

Lyubomirsky, S., and Lepper, H. S., (1999), “A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation”, **Social Indicators Research**, 46 (2): 137–55, DOI:10.1023/A:1006824100041

Muchdie, (2016a), “The Impact of Technological Progress on Human Development: Evidence from Indonesia”, Int. J. of Econ Res., 7(5): 14-28, ISSN 2229-6158.

Muchdie, (2016b), “Economic Growth, Human Development and Global Competitiveness”, Int J. of Soc. Sci & Econ Res., 01(10): 1718-1735, ISSN 2455-8834.

Muchdie, Prihawantoro, S., and Sugema, (2016), “The Impact of Technological Progress on Indonesia’s Global Competitiveness”, Int J. of Soc. Sci & Econ Res., 01(11): 1830-1846, ISSN 2455-8834.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006), **A New Deal for Effective European Research Policy,** Springer, ISBN 978-1-4020-5550-8.

Nussbaum, M., (2000), **Women and human development: the capabilities approach**, Cambridge University Press, Cambridge New York, ISBN

9780521003858.

Nussbaum, M., (2011), **Creating Capabilities: The Human Development Approach**, Harvard University Press, Cambridge, MA: 33–34, ISBN 0674072359.

Porter, M., (2009), "Clusters and Economic Policy", **ISC White Paper**, Available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Rainer Feurer, R., and Chaharbaghi, K., (1995), "Strategy development: past, present and future", **Management Decision**, 33(6): 11 – 21.

Scott, B. R., and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston MA.

Sen, A., (2005), "Human Rights and Capabilities", **Journal of Human Development**, 6(2): 151–166, DOI: 10.1080/14649880500120491.

Solow, R. M., (1956), "A Contribution to the Theory of Economic Growth", **Quarterly Journal of Economics**, 70(1): 65-94.

Srinivasan, T.N., (1994), "Human Development: A New Paradigm or Reinvention of the Wheel?", **Human Development**, 84(2): 238–243.

Stajano, A., (2010), **Research, Quality, Competitiveness**, EU Technology Policy for the Knowledge-based Society, Springer ISBN: 978-0-387-79264-4.

Streeten, P., (1994), "Human Development: Means and Ends", **Human Development**, 84(2): 232–237.

Swan, T.W., (1956), "Economic Growth and Capital Accumulation", **Economic Record**, 32: 334–361, DOI: 10.1111/j.1475-4932.1956.tb00434.x.

Ul-Haq, M., (2003), "The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. (Eds), **Readings in Human Development: Concept, Measures and Policies for Development Paradigm**, Oxford University Press, New Delhi: 17-34.

United Nations Development Programme, (2015a), **Human Development Reports,** available at http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2015b), **Human Development Reports,** available at http://hdr.undp.org/eandevn/hum

United Nations Development Programme, (2016), **Human Development Report 2015: Work for Human Development**, Web Version available at http://hdr.undp.org/en/data.

United Nations Development Programme, (2016), **World Happiness Report on** Chapter 2 "The Distribution of World Happiness", Available athttp://worldhappiness.report/wp-content/ uploads/ sites /2/2016/03/HR-V1Ch2_web.pdf.

Weiner, E. J., (2007), "Four months of boom, bust, and fleeing foreign credit", **Los Angeles Times,** Archived from the original on December 22, 2007.

World Bank, (2016), **Annual Gross Domestic Product Growth (%),** Available on line at http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

World Economic Forum, (1996), **Global Competitiveness Report 1996**, World Economic Forum, Geneva: 19.

World Economic Forum, (2010), **The Global Competitiveness Report 2009–2010**: 3, Available at https://www.weforum.org/reports/global-competitiveness-report-2009-2010.

World Economic Forum, (2015), **Global Competitiveness Report 2014-2015**, Available at https://www.weforum.org/reports/global-competitiveness-report-2014-2015.

World Health Organization, (2016)," Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks", Retrieved on 4 August 2016.

Wright, S., (1921), "Correlation and Causation", **Journal Agricultural Research**, 20: 557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical Statistics**, 5(3): 161-215, DOI: 10.1214/aoms/1177732676.

Xavier, S.M., and Artadi, E.A, (2004), "The Global Competitiveness Index", **Global Competitiveness Report,** Global Economic Forum.

Chapter-29

Islamicity, Human Development, Global Competitiveness and Happiness[1]

Ringkasan

Bab ini menganalisis hubungan dan dampak ke-Islaman dengan kebahagiaan, dengan pembangunan manusia dan daya saing global sebagai variabel antara. Data antar negara tentang ke-Islaman, pembangunan manusia, daya saing global dan kebahagiaan dikumpulkan dari 123 negara dan digunakan dalam analisis model jalur. Hasilnya menunjukkan bahwa terdapat hubungan positive dan sangat kuat antara ke-Islaman dan kebahagiaan (r_{14}= 0.81), antara daya saing global dengan kebahagiaan (r_{34}= 0.76), dan antara pembangunan manusia dan kebahagiaan (r_{24}= 0.82). Koefisien-koefisien jalur mengindikasikan bahwa dampak langsung ke-Islaman terhadap kebahagiaan adalah positive dan signifikan (P_{41}= 0.36), dampak langsung daya saing global terhadap kebahagiaan juga positive dan signifikan (P_{43}= 0.06), dampak langsung pembangunan manusia terhadap kebahagiaan juga positive dan signifikan (P_{42}= 0.46). Secara tidak langsung, dampak ke-Islaman terhadap kebahagiaan, melalui daya saing global, positive tetapi secara statistik tidak (P_{43}-P_{31}= 0.04), dampak ke-Islaman terhadap kebahagiaan, melalui daya saing global dan pembangunan manusia, adalah positive tetapi secara statistik tidak signifikan (P_{43}-P_{32}-P_{21}= 0.01) dan dampak ke-Islaman terhadap kebahagiaan, melalui pembangunan manusia, adalah positive dan signifikan (P_{42}-P_{21}=0.39). Implikasi dari temuan ini adalah penerapan ajaran-ajaran Islam dan praktek pembangunan manusia menjadi sangat penting untuk membuat dan merawat kebahagiaan.

[1] This paper has been published in**International Journal of Recent Scientific Research**, 8 (2), ISSN 0976 3031, 8(2): 15213-15222;http://www.recentscientific.com/happinessand-islamicity; http://repository.uhamka.ac.id/187/.

Summary

This paper analyzes relation and impacts of Islamicity on happiness, with human development and global competitiveness as moderating variables. Cross-nations data on Islamicity, human development, global competitiveness and happiness were collected from 123 countries and employed in a path analysis model. The result showed that there were positive and very strong correlations between Islamicity and happiness (r_{14}= 0.81), between global competitiveness and happiness (r_{34}= 0.76), and between human development and happiness (r_{24}= 0.82). Path coefficients indicated that direct impact of Islamicity on happiness was positive and significant (P_{41}= 0.36), direct impact of global competitiveness on happiness was positive and significant (P_{43}= 0.06), direct impact of human development on happiness was positive and significant (P_{42}= 0.46). Indirectly, the impact of Islamicity on happiness, through global competitiveness was positive, but statistically not significant (P_{43}-P_{31}= 0.04), the impact of Islamicity on happiness through global competitiveness and human development was positive, but statistically not significant (P_{43}-P_{32}-P_{21}= 0.01) and the impact of Islamicity on happiness through human development was positive and significant (P_{42}-P_{21}=0.39). Implication of this finding was that applying Islamic teaching and implementing the practice of human development would be very important to make people happy and to maintain happiness.

1. Introduction

In April 2012, the first World Happiness Report was published in support of the High Level Meeting at the United Nations on happiness and well-being, chaired by the Prime Minister of Bhutan. The report outlined the state of world happiness, causes of happiness and misery, and policy implications highlighted by case studies. In September 2013 the second World Happiness Report offered the first annual follow-up and reports are now issued every year (Helliwell, J, et al., 2016). On March 2016 on UN Happiness Day, United Nations Development Programme updated the World Happiness Report 2016 which is a landmark survey of the state of global happiness (United Nations Development Programme, 2016).

Happiness is a mental or emotional state of well-being defined by positive or pleasant emotions ranging from contentment to intense joy (Hornby, A.S., 1985). The Merriam Webster online dictionary defines happiness as a state of well-being or contentment, a pleasurable or satisfying experience. Happy mental states may also reflect judgments by a person about their overall well-being (Anand, P., 2016). Happiness is a fuzzy concept and can mean many different things to many people. Related concepts are well-being, quality of life and flourishing. At least one author defines happiness as contentment (Graham, M. C., 2014). Some commentators focus on the differencebetween the hedonistic tradition of seeking pleasant and avoiding unpleasant experiences, and the eudaimonic tradition of living life in a full and deeply satisfying way (Deci, E.L. & Ryan, R. M., 2006). Algoe, S.,& Haidt, J., (2009) stated that happiness may be the label for a family of related emotional states, such as joy, amusement, satisfaction, gratification, euphoria, and triumph.

It has been argued that happiness measures could be used not as a replacement for more traditional measures, but as a supplement (Weiner, E. J., 2007). Several scales have been used to measure happiness, such as: the SHS (Subjective Happiness Scale) is a four-item scale, measuring global subjective happiness (Lyubomirsky, S. & Lepper, H. S., 1999). The PANAS (Positive and Negative Affect Schedule) is used to detect the relation between personality traits and positive or negative affects at this moment, today, the past few days, the past week, the past few weeks, the past year, and generally (on average). The SWLS (Satisfaction with Life Scale) is a global cognitive assessment of life satisfaction developed by Diener, E., et al., (1985).

There have also been some studies that happiness related religion (among others: Baetz, M & Toews, J, 2009; Ellison, C. G. & George, L.K., 1994). There are a number of mechanisms through which religion may make a person happier, including social contact and support that result from religious pursuits, the mental activity that comes with optimism and volunteering, learned coping strategies that enhance one's ability to deal with stress, and psychological factors such as reason for being. It may also be that religious people engage in behaviors related to good health, such as less substance abuse, since the use of psychotropic substances is sometimes considered abuse (Baetz & Toews, 2009; Ellison & George, 1994; Strawbridge, W. J., et al., 2001; Burris, C.T., 1999).The Handbook of Religion and Health describes a survey that examined happiness in Americans who have given up religion, in which it was found that there was little relationship between religious disaffiliation and unhappiness (Koenig, H. G. et al., 2001). A survey also cited in this handbook, indicates that people with no religious affiliation appear to be at greater risk for depressive symptoms than those affiliated with a religion. A review of studies by 147 independent investigators found, "the correlation between religiousness and depressive symptoms was -0.096, indicating that greater religiousness is mildly associated with fewer symptoms (Smith, T. B., et al., 2003).

Some religion teaching on the happiness, such as from Buddhist view that happiness forms a central theme of Buddhist teachings (O'Brien, B., 2016). Happiness in Judaism is considered an important element in the service of God (Yanklowitz, S, 2012). The primary meaning of happiness in various European languages involves good fortune, chance or happening. In Catholicism, the ultimate end of human existence consists in felicity blessed happiness (Thomas, A., 2010).

Islam is the religion that is a complete way of life. Nothing is too small or too big to be covered by the teachings of Islam. Rejoice and be happy, remain positive and be at peace. This is what Islam teaching about happiness (Al Qarni, 2003). Every single one of God's commandments aims to bring happiness to the individual. This applies in all aspects of life, worship, economics, and society (Stacey, A, 2011). Rehman, S.S., & Askari, H., (2010a; 2010b) develop an index to measure the "Islamicity" of 208 countries adherence to Islamic principles using four sub-indices related to economics, legal and governance, human and political rights, and international relations. Further, Askari, H, et al, (2016) continue to measure Islamicity index and published Islamicity ranking for 2015. Muchdie (2016a) examined the relation between Islamicity and human development and global competitiveness. So far, no study has been conducted to test the correlation between happiness and Islamicity; vice versa.

Two moderating variables between Islamicity and happiness are human development and global competitiveness. Human development is an approach in international development, developed by the economist Mahbub Ul-Haq (2003). He is anchored in the Nobel laureate Amartya Sen's work on human capabilities (Nussbaum, 2011). The inequality adjusted Human Development Index is used as a way of measuring actual progress in human development by the United Nations Development Programme (1997). It is an alternative approach to a single focus on economic growth, and focused more on social justice, as a way of understanding progress. The concept of human developments was first laid out by Zaki Bade, a 1998 Nobel Laureate, and expanded upon by Nussbaum (2000; 2011), and Alkire (1998). Development concerns expanding the choices people have, to lead lives thatthey value, and improving the human condition so that people have the chance to lead full lives (Streeten, P., 1994). Thus, human development is about much more than economic growth, which is only a means of enlarging people's choices. Fundamental to enlarging these choices is building human capabilities, the range of things that people can do or be in life. Capabilities are the substantive freedoms a person enjoys to lead the kind of life they have reason to value (World Health Organization, 2016). Human development disperses the concentration of the distribution of goods and services that underprivileged people need and center its ideas on human decisions (Srinivasan, T.N., 1994). By investing in people, we enable growth and empower people to pursue many different life paths, thus developing human capabilities. The most basic capabilities for human development are: to lead long and healthy lives, to be knowledgeable, to have access to the resources and social services needed for a decent standard of living, and to be able to participate in the life of the community. Without these, many choices are simply not available, and many opportunities in life remain inaccessible.

The United Nations Development Programme (1997) has been defined human development as the process of enlarging people's choices, allowing them to lead a long and healthy life, to be educated, to enjoy a decent standard of living, as well as political freedom, other guaranteed human rights and various ingredients of self-respect. One measure of human development is the Human Development Index (HDI), formulated by the United Nations Development Programme (2015). The index encompasses statistics such as life expectancy at birth, an education index (calculated using mean years of schooling and expected years of schooling), and gross national income per capita. Though this index does not capture every aspect that contributes to human capability, it is a standardized way of quantifying human capability across nations and communities. Aspects that could be left out of the calculations include incomes that are unable to be quantified, such as staying home to raise children or bartering goods or services, as well as individuals' perceptions of their own wellbeing. The HDI is a summary measure of average achievement in key dimensions of human development: a long and healthy life, being knowledgeable and have a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions (United Nations Development Programme, 2015).

According to Porter, M., (2009), the fundamental goal of economic policy is to enhance competitiveness, which is reflected in the productivity with which a nation or region utilizes its people, capital, and natural endowments to produce valuable goods and services. However, competitiveness has been defined diversely. Scholars and institutions have been very prolific in proposing their own definition of competitiveness. According to Institute for Management Development (2003), competitiveness was a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people. Competitiveness is the ability of a country to achieve sustained high rates of growth in GDP per capita (World Economic Forum, 1996). But According to Feurer, R. & Chaharbaghi, K., (1995) competitiveness is relative, not absolute. It depends on shareholder and customer values, financial strength which determines the ability to act and react within the competitive environment and the potential of people and technology in implementing the necessary strategic changes. National competitiveness refers to a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources (Scott, B. R. & Lodge, G. C., 1985). Competitiveness includes both efficiency and effectiveness. It is this choice of industrial goals which is crucial. Competitiveness includes both the ends and the means towards those ends (Buckley, P. J. et al, 1998). In recent years, the concept of competitiveness has emerged as a new paradigm in economic development. Competitiveness captures the awareness of both the limitations and challenges posed by global competition, at a time when effective government action is constrained by budgetary constraints and the private sector faces significant barriers to competing in domestic and international markets.

Competitiveness is important for any economy that must rely on international trade to balance import of energy and raw materials. The European Union (EU) has enshrined industrial research and technological development (R&D) in her Treaty in order to become more competitive. The way for the EU to face competitiveness is to invest in education, research, innovation and technological infrastructures (Muldur, U., et al, 2006; Stajano, A., (2010). The International Economic Development Council (IEDC) in Washington, D.C. published the "Innovation Agenda: A Policy Statement on American Competitiveness". International comparisons of national competitiveness are conducted by the World Economic Forum, in its Global Competitiveness Report, and the Institute for Management Development (2003), in its World Competitiveness Yearbook 2003.

The Global Competitiveness Report 2014-2015 is a yearly report published by the World Economic Forum. Since 2004, the Global Competitiveness Report ranks countries based on the Global Competitiveness Index 2014-2015, developed by Martin, X., S. and Artadi, E.V., (2004). The Global Competitiveness Index integrates the macroeconomic and the micro aspects of competitiveness into a single index. Study on economic growth, human development and global competitiveness has been reported by Muchdie (2016b).

The objective of this chapter is to analyze the relation dan the impacts, both direct and indirect, of Islamicity and human development as well as global competitiveness on happiness, using path analysis model.

2. Methods of Analysis

In analyzing direct and indirect impacts of Islamicity on happiness, this study employed path analysis model that was developed by Sewall Wright (1921; 1934). It has since been applied to a vast array of complex modeling areas, including biology, psychology, sociology, and econometrics (Dodge, Y., 2003). Basically, the path model can be used to analysis two types of impacts: direct and direct impacts. The total impacts of exogenous variables are the multiplication (Alwin, D.F., & Hauser, R.M., 1975). In this study, the path model is depicted in Figure 29.1, where human development and global competitiveness were the exogenous variables.

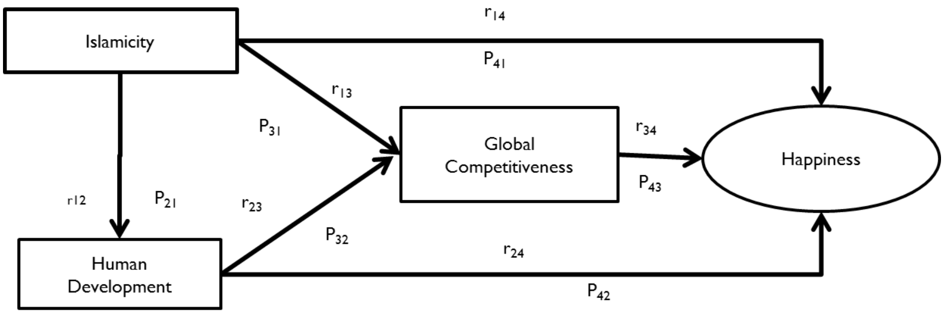


Figure 29.1

Path Model to Analysis the Impact of Islamicity on Happiness

Path coefficients were calculated by solving these path equations; given that the coefficients of correlation have been calculated. P_{41} was direct impact of Islamicity on happiness; P_{31} was direct impact of Islamicity on global competitiveness; P_{21} was direct impact of Islamicity on human development; P_{32} was direct impact of human development on global competitiveness, and P_{42} was direct impact of human development on happiness. Indirect impact of Islamicity on happiness, through global competitiveness was in Path-7 (P_{43} - P_{31}); Path-8 (P_{43} - P_{32} - P_{21}) was indirect impact of Islamicity on happiness, through global competitiveness and human development; Path-9 (P_{42}-P_{21}) was indirect impact of Islamicity on happiness, through human development.

Table 29.1

Path Equations

1). $r_{12}= p_{21}$ Direct efect (DE)	4). $r_{14} = p_{41} + p_{42}r_{12} + p_{43}\, r_{13}$ Direct effect + Indirect effect (IE)
2). $r_{13} = p_{31} + p_{32}\, r_{12}$ Direct effect (DE) + Indirect efect (IE)	5). $r_{24}= p_{41}\, r_{12} + p_{42}+ p_{43}r_{23}$ Direct effect (DE) + Indirect effect (IE) + Spurious (S)
3). $r_{23}= p_{31}\, r_{12} + p_{32}$ Spuriuos effect (S) + Direct effect (DE)	6). $r_{34} = p_{41}\, r_{13} + p_{42}r_{23} + p_{43}$ Direct effect (DE) + Spurious (S)

Source: http://faculty.cas.usf.edu/mbrannick/regression/Pathan.html

Happiness was measured by happiness index, Islamicity was measured by the Islamicity index, human development was measured by the human development index and competitiveness was measured by global competitiveness index. Data on the happiness index from 156 countries was downloaded from United Nations Development Programme (2016) World Happiness Report, Chapter 2: The Distribution of World Happiness written by John F. Helliwell, Haifang Huang and Shun Huang. Data are available at http://worldhappiness.report/wp-content/uploads/ sites/2/ 2016/ 03/HR-V1Ch2_web.pdf. Data on Islamicity from 153 countries (115 countries from Islamic countries) downloaded from Islamicity Index.org that available on line at http://islamicityindex.org/wp/islamicity-indices.

Data on human development index from 155 countries download from United Nations Development Programme (2016b) Human Development Report 2015: Work for Human Development Web Version and was accessed at http://hdr.undp.org/en/data. Data on global competitiveness index from 138 countries were downloaded from http://reports.weforum.org/global-competitiveness-index/. Problems of missing data have been solved by deleting countries with incomplete data. Finally, data on happiness, global competitiveness, human development, and economic growth used in this study were from 123 countries.

3. Results and Discussion

Figure 29.2 depicts the Islamicity index, human development index, global competitiveness index and happiness index from 123 countries being studied. The lowest Islamic index happened in Chad (1.82) and the highest Islamicity was the Netherland (8.91). Average Islamicity index in term of statistic mean was 5.40 (Saudi Arabia), median 5.16 (Turkey, Argentina) and mode 8.44 (Australia, Canada).

The highest human development index was in Australia (94.00) and the lowest human development index was in Chad (39.00). Ten countries with highest index of human development were: Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden, and New Zealand. Ten countries with lowest human development index were: Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, and Chad. Average index of human development in terms of statistical mean was 72.99 (Jamaica, Colombia, Tunisia, Dominican Republic, and Belize), median was 76.00 (Mexico, Georgia, Turkey, Jordan, Macedonia, Azerbaijan, and Ukraine), and mode was 73.00 (The Netherland, Sweden, New Zealand, and Australia).

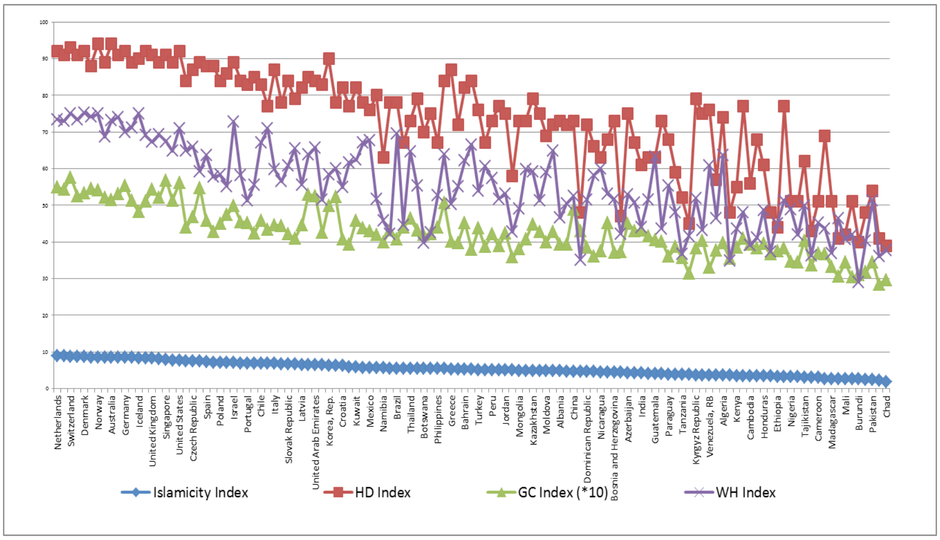


Figure 29.2

Islamicity, Human Development, Global Competitiveness and Happiness

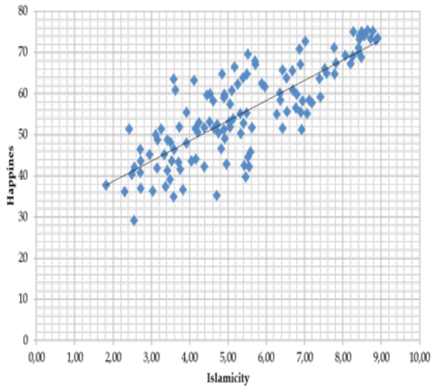
The highest global competitiveness index was 5.76 (Switzerland) and the lowest global competitiveness index was 2.84 (Guinea). Ten countries with highest index of global competitiveness were: Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, and Norway. Ten countries with lowest index of global competitiveness were: Liberia, Madagascar, Venezuela RB, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, and Guinea. The average index of global competitiveness in term of statistical mean was 4.27 (Georgia, Jordan, Hungary, Macedonia, Colombia, Rwanda, Mexico), median was 4.22 (Slovak Republic, Georgia, Cyprus, Peru, Jordan) and mode was 4.39 (Turkey, Panama, Philippines, South Africa, Malta).

The lowest index of happiness was in Burundi (29.05) and the highest index of happiness was in Denmark. Ten countries with highest index of happiness were: Denmark, Switzerland, Iceland, Norway, Finland, Canada, Netherlands, New Zealand, Australia and Sweden. Ten countries with lowest index of happiness were: Cambodia, Chad, Uganda, Madagascar, Tanzania, Liberia, Guinea, Rwanda, Benin, and Burundi. Average index of happiness in terms of statistical mean was 55.4 (Paraguay), median was 55.23 (Cyprus, Latvia, Croatia, Romania, Jamaica, and Paraguay), and mode was 58.35 (Poland, Ethiopia, Lithuania, Korea Republic, Peru, Moldova, and Bolivia).

Figure 29.3 (left panel) presents the countries at various levels Islamicity index related to happiness index. Both were ranked into three levels: low, medium and high. According to the levels of the Islamicity index, 41 countries classified as the low Islamicity index countries, 41 countries classified as the medium Islamicity index countries, and 41 countries classified as the high Islamicity index countries. The same number of countries was also classified as low, medium and high happiness index countries.

From 41 countries with the low Islamicity index, there were 30 countries that also had low happiness index. Another 10 countries had medium happiness index, and only one country had high happiness index, namely Azerbaijan. From 41 countries with medium Islamicity index, 11 countries had low happiness index, 22 countries were classified as happiness index countries, and another 8 countries were classified as high happiness index countries. From 41 countries with high Islamicity index, no countries had low happiness index. Meanwhile, 9 countries were classified as medium happiness index, and another 32 countries were classified as high happiness index countries.

	Islamicity : Low	Islamicity: Medium	Islamicity: High
Happiness: High	Guatemala, Venezuela, RB, Algeria. (3)	Trinidad and Tobago, Kuwait, Panama, Mexico, Brazil, Thailand, Saudi Arabia, Bahrain, Argentina, Colombia (10)	Netherlands, Sweden, Switzerland, New Zealand, Denmark, Finland, Norway, Luxembourg, Australia, Canada, Germany, Austria, Iceland, Ireland, United Kingdom, Belgium, Singapore, France, United States, Malta, Czech Republic, Spain, Israel, Chile, Costa Rica, Uruguay, Qatar, United Arab Emirates (28)
Happiness: Medium	Bosnia and Herzegovina, Azerbaijan, Morocco, Paraguay, Kyrgyz Republic, Lebanon, Pakistan, Senegal, (8)	Malaysia, Croatia, Montenegro, Romania, Philippines, Jamaica, Turkey, El Salvador, Peru, Serbia, Jordan, Ecuador, Kazakhstan, Macedonia, Moldova, China, Dominican Republic, Bolivia, Nicaragua, Indonesia (20)	Japan, Slovenia, Poland, Estonia, Lithuania, Portugal, Cyprus, Italy, Mauritius, Slovak Republic, Latvia, Hungary, Korea, Rep. (13)
Happiness: Low	Vietnam, India, Armenia, Zambia, Tanzania, Malawi, Ukraine, Bangladesh, Benin, Kenya, Iran, Islamic Rep., Cambodia, Gabon, Honduras, Uganda, Ethiopia, Nigeria, Zimbabwe, Tajikistan, Liberia, Cameroon, Egypt, Arab Rep., Madagascar, Sierra Leone, Mali, Mauritania, Burundi, Haiti, Guinea, Chad (30)	Namibia, Bulgaria, South Africa, Botswana, Georgia, Greece, Ghana, Mongolia, Albania, Tunisia, Rwanda (11)	



	Coefficients	*Standard Error*	*t Stat*	*P-value*
Happiness	28.79	1.87	15.39	0.00
Islamicity	4.93	0.33	15.02	0.00

Figure 29.3

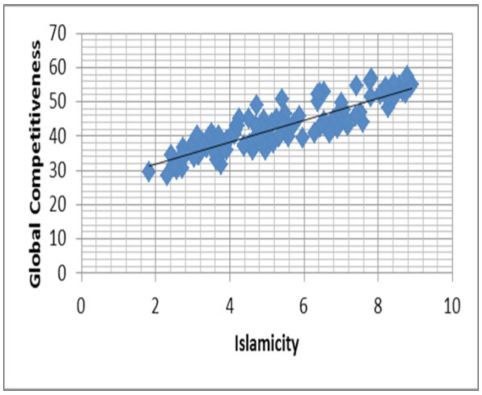
Islamicity and Happiness

Figure 29.3 (right panel) presents Scatter Diagram between Islamicity index and happiness index that shows a positive trend. It means that Islamicity had positive correlation on happiness. Countries with high happiness index were also the countries with high Islamicity index. The opposite applies; countries with low happiness index were also the countries with low Islamicity index. The higher the Islamicity indexes of a country, the higher the index of happiness in that country. Regression coefficient resulted from regression analysis was a positive, 4.93. This regression coefficient was statistically significant as t-calculated (15.02) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

Figure 29.4 (left panel) presents the countries at various levels Islamicity index related to global competitiveness index. Both were ranked into three levels: low, medium and high. According to the levels of the Islamicity index, 41 countries classified as the low Islamicity index countries, 41 countries classified as the medium Islamicity index countries, and 41 countries classified as the high Islamicity index countries. The same number of countries was also classified as low, medium and high human development index countries.

From 41 countries with the low Islamicity index, there were 30 countries that also had low global competitiveness index, another 10 countries had medium global competitiveness index and only one country had high global competitiveness index, namely Azerbaijan. From 41 countries with medium Islamicity index, 11 countries had low global competitiveness index, 22 countries were classified as medium global competitiveness index countries, and another 8 countries were classified as high global competitiveness index countries. From 41 countries with high Islamicity index, no countries had low global competitiveness index. Meanwhile, 9 countries were classified as medium global competitiveness index and another 32 countries were classified as high global competitiveness index countries.

	Islamicity: Low	Islamicity: Medium	Islamicity: High
Global Competitiveness: High	Azerbaijan (1)	Malaysia, Kuwait, Thailand, Saudi Arabia, Bahrain, Kazakhstan, China, Indonesia. (8)	Netherlands, Sweden, Switzerland, New Zealand, Denmark, Finland, Norway, Luxembourg, Australia, Canada, Germany, Austria, Iceland, Ireland, United Kingdom, Belgium, Singapore, France, United States, Czech Republic, Japan, Spain, Poland, Estonia, Israel, Lithuania, Portugal, Chile, Italy, Qatar, United Arab Emirates, Korea Republic. (32)
Global Competitiveness: Medium	Vietnam, India, Morocco, Guatemala, Armenia, Ukraine, Algeria, Iran Islamic Republic, Honduras, Tajikistan, (10)	Croatia, Panama, Mexico, Montenegro, Namibia, Bulgaria, Brazil, South Africa, Romania, Botswana, Georgia, Philippines, Greece, Jamaica, Turkey, Peru, Jordan, Ecuador, Macedonia, Moldova, Colombia, Rwanda, (22)	Malta, Slovenia, Cyprus, Costa Rica, Mauritius, Slovak Republic, Uruguay, Latvia, Hungary. (9)
Global Competitiveness: Low	Bosnia and Herzegovina, Senegal, Paraguay, Zambia, Tanzania, Malawi, Kyrgyz Republic, Venezuela RB, Bangladesh, Benin, Kenya, Cambodia, Gabon, Uganda, Ethiopia, Lebanon, Nigeria, Zimbabwe, Liberia, Cameroon, Egypt Arab Republic, Madagascar, Sierra Leone, Mali, Mauritania, Burundi, Haiti, Pakistan, Guinea, Chad (30)	Trinidad and Tobago, Argentina, El Salvador, Serbia, Ghana, Mongolia, Albania, Tunisia, Dominican Republic, Bolivia, Nicaragua (11)	



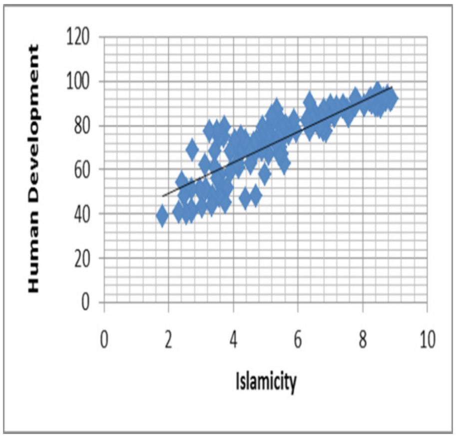
	Coefficients	*Standard Error*	*t Stat*	*P-value*
Global Competitiveness	25.63	0.91	28.22	0.00
Islamicity	3.16	0.16	19.89	0.00

Figure 29.4: Islamicity and Global Competitiveness

Figure 29.4 (right panel) presents Scatter Diagram between Islamicity index and global competitiveness index that shows a positive trend. It means that Islamicity had positive correlation on global competitiveness. Countries with high global competitiveness index were also the countries with high Islamicity index. The opposite apply; countries with low global competitiveness index were also the countries with low Islamicity index. The higher the Islamicity indexes of a country, the higher the index of global competitiveness in that country. Regression coefficient resulted from regression analysis was a positive, 3.16. This regression coefficient was statistically significant as t-calculated (19.89) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

Figure 29.5 (left panel) presents the countries at various levels Islamicity index related to the human development index. Both were ranked into three levels: low, medium and high. According to the levels of the Islamicity index, 41 countries classified as the low Islamicity index countries, 41 countries classified as the medium Islamicity index countries, and 41 countries classified as the high Islamicity index countries. The same number of countries was also classified as low, medium and high human development index countries.

	Islamicity: Low	Islamicity: Medium	Islamicity: High
Human Development: High		Greece, Saudi Arabia, Argentina (3)	Norway, Australia, Switzerland, Netherlands, Denmark, Germany, Ireland, United States, Sweden, New Zealand, Canada, United Kingdom, Singapore, Iceland, Korea Republic, Luxembourg, Austria, Belgium, France, Japan, Israel, Finland, Spain, Slovenia, Czech Republic, Italy, Estonia, Cyprus, Qatar, Malta, Poland, Lithuania, Lithuania, Slovak Republic, United Arab Emirates, Portugal, Chile, Hungary, Latvia (38)
Human Development: Medium	Kyrgyz Republic, Iran Islamic Republic, Lebanon, Venezuela RB, Azerbaijan, Ukraine, Algeria, Bosnia and Herzegovina, Armenia (9)	Croatia, Kuwait, Bahrain, Montenegro, Romania, Kazakhstan, Malaysia, Panama, Bulgaria, Brazil, Trinidad and Tobago, Serbia, Mexico, Turkey, Georgia, Jordan, Macedonia, Thailand, Peru, Mongolia, Ecuador, Albania, China, Jamaica, Colombia, Tunisia, Dominican Republic, Botswana, Moldova, (29)	Uruguay, Mauritius, Costa Rica (3)
Human Development: Low	Egypt Arab Republic, Paraguay, Gabon, Vietnam, Morocco, Guatemala, Tajikistan, India, Honduras, Zambia, Bangladesh, Cambodia, Kenya, Pakistan, Tanzania, Nigeria, Zimbabwe, Cameroon, Madagascar, Mauritania, Benin, Uganda, Haiti, Senegal, Malawi, Ethiopia, Liberia, Mali, Sierra Leone, Guinea, Burundi, Chad (32)	Indonesia, South Africa, Philippines, El Salvador, Bolivia, Namibia, Nicaragua, Ghana, Rwanda (9)	



	Coefficients	Standard Error	t Stat	P-value
Human Development	35.52	2.10	16.90	0.00
Islamicity	6.94	0.37	18.83	0.00

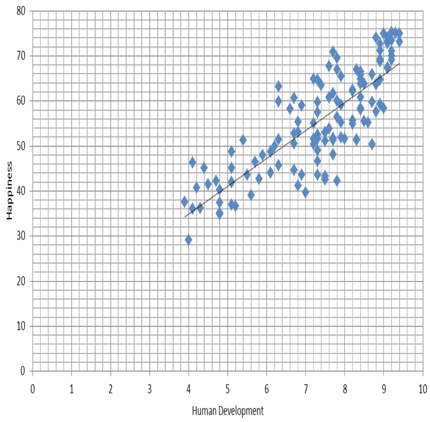
Figure 29.5

Islamicity and Human Development

From 41 countries with the low Islamicity index, there were 32 countries that also had low human development index, 9 countries had medium human development index, and no one country had high human development index. From 41 countries with the medium Islamicity index, there were 9 countries that had low human development index, 29 countries had medium human development index, and only 3 countries had high human development index, namely: Greece, Saudi Arabia, and Argentina. From 41 countries with the high Islamicity index, there was no country that had low human development index. Meanwhile, there were only 3 countries that had medium human development index, and another 38 countries had high development index.

Figure 29.5 (right panel) presents Scatter Diagram between Islamicity index and human development index that shows a positive trend. It means that Islamicity had positive correlation on the human development. The countries with low Islamicity index were the counties with low human development index. The countries with high Islamicity index were the counties with high human development index. The higher the Islamicity indexes of a country, the higher the index of human development in that country. Regression coefficient resulted from regression analysis was a positive, 6.94. This regression coefficient was statistically significant as t-calculated (18.83) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

	Human Development: Low	Human Development: Medium	Human Development: High
Happiness: High	Guatemala (1)	Costa Rica, Brazil, Mexico, Panama, Uruguay, Colombia, Thailand, Algeria, Kuwait, Bahrain, Trinidad and Tobago, Venezuela RB (12)	Denmark, Switzerland, Iceland, Norway, Finland, Canada, Netherlands, New Zealand, Australia, Sweden, Israel, Austria, United States, Germany, Belgium, Ireland, Luxembourg, Singapore, United Kingdom, Chile, Argentina, Czech Republic, United Arab Emirates, Malta, France, Saudi Arabia, Qatar, Spain (28)
Happiness: Medium	El Salvador, Nicaragua, Bolivia, Paraguay, Indonesia, Philippines, Morocco, Pakistan, Vietnam (9)	Malaysia, Ecuador, Kazakhstan, Moldova, Peru, Mauritius, Romania, Jamaica, Croatia, Turkey, Jordan, Azerbaijan, China, Kyrgyz Republic, Serbia, Bosnia and Herzegovina, Montenegro, Dominican Republic, Lebanon, Macedonia (20)	Slovak Republic, Italy, Japan, Poland, Korea Republic, Lithuania, Slovenia, Latvia, Cyprus, Estonia, Hungary, Portugal (12)
Happiness: Low	Tajikistan, Nigeria, Honduras, Zambia, Bangladesh, Sierra Leone, Namibia, Cameroon, Ethiopia, South Africa, India, Egypt Arab Republic, Kenya, Ghana, Senegal, Mauritania, Zimbabwe, Malawi, Gabon, Mali, Haiti, Cambodia, Chad, Uganda, Madagascar, Tanzania, Liberia, Guinea, Rwanda, Benin, Burundi. (31)	Tunisia, Mongolia, Iran Islamic Republic, Albania, Armenia, Ukraine, Georgia, Bulgaria, Botswana (9)	Greece (1)



	Coefficients	*Standard Error*	*t Stat*	*P-value*
Happiness	10.13	2.97	3.41	0.00
Human Development	0.62	0.04	15.58	0.00

Figure 29.6

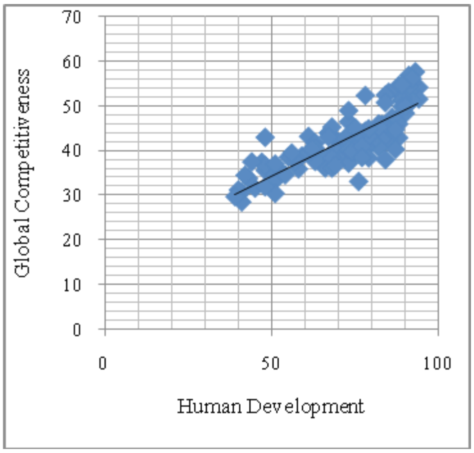
Human Development and Happiness

Figure 29.6 (left panel) presents the countries at various levels human development index related to the happiness index. Both were ranked into three levels: low, medium and high. According to the levels of the human development index, 41 countries classified as the low human development index countries, 41 countries classified as the medium human development index countries, and 41 countries classified as the high human development index countries. The same number of countries was also classified as low, medium and high happiness index countries.

From 41 countries with the low human development index, there were 31 countries that also had low happiness index, 9 countries had medium happiness index, and only one country had high happiness index. From 41 countries with the medium human development index, there were 9 countries that had low happiness index, 20 countries had medium happiness index, and another 12 countries had high happiness index. From 41 countries with the high human development index, there was only one country, Greece, which had low happiness index. Meanwhile, there were 12 countries that had medium happiness index, and another 28 countries had high happiness index.

Figure 29.6 (right panel) presents Scatter Diagram between human development index and happiness index that shows a positive trend. It means that human development had positive correlation on happiness. The countries with low human development index were the countries with low happiness index. The countries with high human development index were the countries with high happiness index. The higher the human development indexes of a country, the higher the index of happiness in that country. Regression coefficient resulted from regression analysis was a positive, 0.62. This regression coefficient was statistically significant as t-calculated (15.58) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

	Human Development: Low	Human Development: Medium	Human Development: High
Global Competitiveness: High	Indonesia (1)	Malaysia, China, Thailand, Kuwait, Bahrain, Azerbaijan, Kazakhstan (7)	Switzerland, Singapore, United States, Germany, Netherlands, Japan, Finland, Sweden, United Kingdom, Norway, Denmark, Canada, Qatar, New Zealand, United Arab Emirates,, Luxembourg, Belgium, Australia, France, Austria, Ireland, Saudi Arabia, Korea Republic, Israel, Iceland, Estonia, Czech Republic, Spain, Chile, Lithuania, Portugal, Poland, Italy (33)
Global Competitiveness: Medium	South Africa, Philippines, India, Vietnam, Rwanda, Morocco, Guatemala, Tajikistan, Namibia, Honduras (10)	Mauritius, Panama, Turkey, Costa Rica, Bulgaria, Romania, Mexico, Macedonia, Colombia, Jordan, Georgia, Peru, Montenegro, Botswana, Uruguay, Iran Islamic Republic, Brazil, Croatia, Ecuador, Ukraine, Armenia, Moldova, Jamaica, Algeria(24)	Latvia, Malta, Slovenia, Hungary, Cyprus, Slovak Republic, Greece (7)
Global Competitiveness: Low	Cambodia, El Salvador, Zambia, Kenya, Gabon, Bangladesh, Nicaragua, Ethiopia, Senegal, Cameroon, Uganda, Egypt Arab Republic, Bolivia, Paraguay, Ghana, Tanzania, Benin, Nigeria, Zimbabwe, Pakistan, Mali, Liberia, Madagascar, Haiti, Malawi, Burundi, Sierra Leone, Mauritania, Chad, Guinea (30)	**Trinidad and Tobago, Albania, Tunisia, Serbia, Dominican Republic, Lebanon, Kyrgyz Republic, Mongolia, Bosnia and Herzegovina, Venezuela RB (10)**	Argentina (1)



	Coefficients	*Standard Error*	*t Stat*	*P-value*
Global Competitiveness	15.67	1.71	9.15	0.00
Human Development	0.37	0.02	16.11	0.00

Figure 29.7

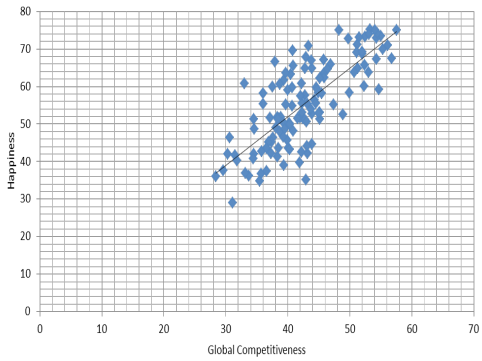
Human Development and Global Competitiveness

Figure 29.7 (left panel) presents the countries at various levels human development index related to the global competitiveness index. Both were ranked into three levels: low, medium and high. According to the levels of human development index, 41 countries classified as the low human development index countries, 41 countries classified as the medium human evelopment index countries, and 41 countries classified as the high development index countries. The same number of countries was also classified as low, medium and high global competitiveness index countries.

From 41 countries with the low human development index, there were 30 countries that also had low global competitiveness index, 10 countries had medium global competitiveness index, and only one country had high global competitiveness index, namely Indonesia. From 41 countries with the medium human development index, there were 10 countries that had low global competitiveness index, 24 countries had medium global competitiveness index, and another 7 countries had high global competitiveness index. From 41 countries with the high human development index, there was only one country, Argentina, which had low global competitiveness index. Meanwhile, there were 7 countries that had medium global competitiveness index, and another 33 countries had high global competitiveness index.

Figure 29.7 (right panel) presents Scatter Diagram between human development index and global competitiveness index that shows a positive trend. It means that human development had positive correlation on global competitiveness. The countries with low human development index were the countries with low global competitiveness index. The countries with high human development index were the countries with high global competitiveness index. The higher the human development indexes of a country, the higher the index of global competitiveness in that country. Regression coefficient resulted from regression analysis was a positive, 0.37. This regression coefficient was statistically significant as t-calculated (16.11) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

	Global Competitiveness: Low	Global Competitiveness: Medium	Global Competitiveness: High
Happiness: High		Malta, Slovenia, Cyprus, Costa Rica, Mauritius, Slovak Republic, Uruguay, Latvia, Hungary (9)	Netherlands, Sweden, Switzerland, New Zealand, Denmark, Finland, Norway, Luxembourg, Australia, Canada, Germany, Austria, Iceland, Ireland, United Kingdom, Belgium, Singapore, France, United States, Czech Republic, Japan, Spain, Poland, Estonia, Israel, Lithuania, Portugal, Chile, Italy, Qatar, United Arab Emirates, Korea Republic. (32)
Happiness: Medium	Trinidad and Tobago, Argentina, El Salvador, Serbia, Ghana, Mongolia, Albania, Tunisia, Dominican Republic, Bolivia, Nicaragua (11)	Croatia, Panama, Mexico, Montenegro, Namibia, Bulgaria, Brazil, South Africa, Romania, Botswana, Georgia, Philippines, Greece, Jamaica, Turkey, Peru, Jordan, Ecuador, Macedonia, Moldova, Colombia, Rwanda (22)	Malaysia, Kuwait, Thailand, Saudi Arabia, Bahrain, Kazakhstan, China, Indonesia (8)
Happiness: Low	Bosnia and Herzegovina, Senegal, Paraguay, Zambia, Tanzania, Malawi, Kyrgyz Republic, Venezuela RB, Bangladesh, Benin, Kenya, Kenya, Cambodia, Gabon, Uganda, Ethiopia, Lebanon, Nigeria, Zimbabwe, Liberia, Cameroon, Egypt Arab Republic, Madagascar, Sierra Leone, Mali, Mauritania, Burundi, Haiti, Pakistan, Guinea, Chad (30)	Vietnam, India, Morocco, Guatemala, Armenia, Ukraine, Algeria, Iran Islamic Republic, Honduras, Tajikistan (10)	Azerbaijan (1)



	Coefficients	*Standard Error*	*t Stat*	*P-value*
Happiness	0.12	4.30	0.03	0.98
Global Competitiveness	1.29	0.10	13.00	0.00

Figure 29.8

Global Competitiveness and Happiness

Figure 29.8 (left panel)presents the countries at various levels global competitiveness index related to happiness index. Both were ranked into three levels: low, medium and high. According to the levels of global competitiveness index, 41 countries classified as the low global competitiveness index countries, 41 countries classified as the medium global competitiveness index countries, and 41 countries classified as the high global competitiveness index countries. The same number of countries was also classified as low, medium and high happiness index countries.

From 41 countries with the low global competitiveness index, there were 30 countries that also had low happiness index, 11 countries had medium happiness index, and no one country had high happiness index. From 41 countries with the medium global competitiveness index, there were 10 countries that had low happiness index, 22 countries had medium happiness index, and another 9 countries had high happiness index. From 41 countries with the high global competitiveness index, there was only one country, Azerbaijan, which had low happiness index. Meanwhile, there were 8 countries that had medium happiness index, and another 32 countries had high happiness index.

Figure 29.8 (right panel) presents Scatter Diagram between global competitiveness index and happiness index that shows a positive trend. It means that global competitiveness had positive correlation with happiness. The countries with low global competitiveness index were the countries with low happiness index. The countries with high global competitiveness index were the countries with high happiness index. The higher the global competitiveness indexes of a country, the higher the index of happiness in that country. Regression coefficient resulted from regression analysis was a positive, 1.29. This regression coefficient was statistically significant as t-calculated (13.00) was higher than t-table (1.98) n=123, at 95% significant level, and P-value (0.00) was less than 0.05.

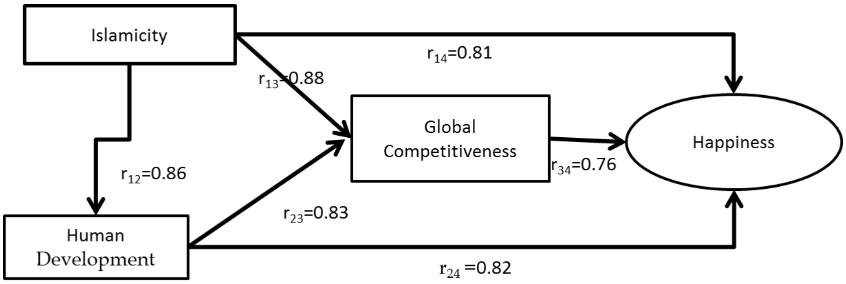


Figure 29.9

Coefficients of Correlation among Islamicity, Human Development, Global Competitiveness and Happiness

Figure 29.9 presents the results of regression analysis for correlation analysis among variables being studied. The coefficient correlation between Islamicity and the happiness was positive but very strong as r_{14}= 0.81. The coefficient correlation between Islamicity and global competitiveness was also positive, and very strong as r_{13} = 0.88. Again, the coefficient correlation between Islamicity and human development was also positive, and very strong as r_{12} = 0.86. Coefficient correlation between human development and global competitiveness was positive and very strong as r_{23} = 0.83. Meanwhile the coefficient correlation between human development and happiness was also positive and very strong as r_{24} = 0.82. Finally, the coefficient correlation between global competitiveness and happiness was positive and strong as r_{34} = 0.76.

Solving the path equation presented in Methods of Analysis, path coefficients have been calculated. In Path-1: the direct impact of Islamicity on happiness was positive and significant as P_{41}= 0.36>0.05. It means that an increase in Islamicity index by 1 per cent would decrease the index of happiness by 0.36 per cent. In Path-2: the direct impact of Islamicity on global competitiveness was positive and significant as P_{31}= 0.64 > 0.05. It means that an increase of Islamicity index by 1 per cent would increase the index of global competitiveness by 0.64 per cent. In Path-3: the direct impact of Islamicity on human development was also positive and significant as P_{21}= 0.86 > 0.05. It means that an increase of Islamicity index by 1 per cent would increase the index of human development by 0.86 per cent. In Path-4: the direct impact of human development on global competitiveness was positive and significant as P_{32}= 0.28 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of global competitiveness by 0.28 per cent. In Path-5: the direct impact of human development on happiness was positive and significant as P_{42}=0.46 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of happiness by 0.43 per cent. Finally, in Path-6: the direct impact of global competitiveness on happiness was positive and significant as P_{43} = 0.06 > 0.05. An increase of global competitiveness index by 1 per cent would increase the index of happiness by 0.06 per cent.

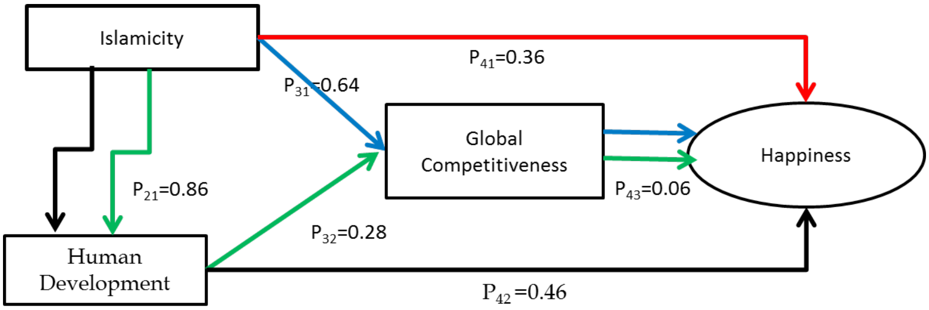


Figure 29.10
Path Coefficients

In Path-7 (blue-path), indirect impact of Islamicity on happiness, through global competitiveness was positive, but statistically not significant as P_{43}x P_{31}=0.06 x 0.64 = 0.03 < 0.05. It means that indirectly through global competitiveness, an increase of 1 per cent of Islamicity would increase the index of happiness by only 0.03 per cent. In Path-8 (green-path), indirect impact of Islamicity on happiness through global competitiveness and human development was positive but statistically not significant as P_{43}xP_{32}xP_{21}= 0.06 x 0.28 x 0.86 = 0.01 < 0.05. An increase of Islamicity by 1 per cent would, indirectly increase the index of happiness by 0.01 per cent. Finally, in Path-9 (black-path), the indirect impact of Islamicity on happiness through human development was positive and significant as P_{42}xP_{21} = 0.46 x 0.86 = 0.39 > 0.05. Any indirect impact of Islamicity on happiness through global competitiveness would be statistically not significant as the impact of global competitiveness on happiness was very small, P_{43} = 0.06.

4. Conclusion

From the results and discussion above, three conclusions could be drawn. First, correlation among Islamicity, human development, global competitiveness with happiness was positive and very strong. It means that countries with high index of happiness were also the countries with high index of global competitiveness, high index of human development and high index of Islamicity. The opposite applies that countries with low index of happiness were also the countries with low index of global competitiveness, low index of human development and low index of happiness. Second, the direct impact of Islamicity on happiness was positive and significant; the direct impact of Islamicity on global competitiveness was also positive and significant, as well as the direct impact of Islamicity on human development was also positive and significant. Third, all indirect impacts of Islamicity on happiness were positive, but the statistical significance would depend on the path. All paths where indirect impacts of Islamicity on happiness go through global competitiveness were statistically not significant. Meanwhile, the indirect impact of Islamicity on happiness through human development was statistically significant. Implication of this finding is that to reach and maintain happiness as well as to compete globally, it is necessary to practice Islamic teaching and consistently implement the program of human development.

References

Algoe, S. B. and Haidt, J., (2009), "Witnessing excellence in action: the 'other-praising' emotions of elevation, gratitude, and admiration", **The Journal of Positive Psychology**, Vol 4 (2): 105–127. DOI: 10.1080/17439760802650519.

Al Qarni, Aaidh Ibn Abdullah, (2003). **Don't be Sad**. Saudi Arabia: International Islamic Publishing House.

Alkire, S, (1998), **Operationalizing Amartya Sen's Capability Approach to Human Development: A Framework for Identifying Valuable Capabilities**, University of Oxford, Oxford, OCLC 43087376.

Alwin, D. F., and Hauser, R. M, (1975), "The Decomposition of Effects in Path Analysis", **American Sociological Review**, 40(1): 37-47.

Anand, P (2016), **Happiness Explained**,Oxford University Press, Oxford.

Askari, H., Mohammadkhan, H., and Mydin, L., (2016), **Islamicity Indices 2015**, available on line at http://islamicity-index.org/wp/islamicity-indices/

Baetz, M., and Toews, J., (2009), "Clinical implications of research on religion, spirituality, and mental health", **Canadian Journal of Psychiatry**, 54 (5): 292–301.

Buckley, P.J., Le Pass, C., and Prescott, K., (1988), "Measures of International Competitiveness: A Critical Survey",**Journal of Marketing Management** ", 4(2): 175-200.

Burris, C.T., (1999), "Religious Orientation Scale", In Hill, P.C., and Hood, R.W., **Measures of Religiosity**, Religious Education Press,Birmingham: 144–53, ISBN 978-0-891351061.

Deci, E. L., and Ryan, R. M., (2006), "Hedonia, Eudaimonia, and Well-being: An introduction", **Journal of Happiness Studies**, 9(1): 1–11, DOI: 10.1007/s10902-006-9018-1.

Diener, E., Emmons, R. A., Larsen, R. J., and Griffin, S., (1985), "The Satisfaction with Life Scale", **Journal of Personality Assessment**, 49(1): 71–5,DOI: 10.1207/ s15327752jpa4901_13.

Dodge, Y., (2003), **The Oxford Dictionary of Statistical Terms**, OUP, ISBN 0-19-920613-9.

Ellison, C. G., and George, L. K., 1994, "Religious Involvement, Social Ties, and Social Support in a Southeastern Community", **Journal for the Scientific Study of Religion**, 33 (1): 46–61, DOI: 10.2307/1386636, JSTOR 1386636.

Feurer, R., and Chaharbaghi, K., (1995), "Strategy development: past, present and future",**Management Decision**, 33(6): 11 – 21.

Graham, M. C., (2014),**Facts of Life: Ten Issues of Contentment**, Outskirts Press: 6–10. ISBN: 978-14787-2259-5.

Helliwell, J., Layard, R., and Sachs, J., (2016), **World Happiness Report**, United Nations Development Programme.

Hornby, A.S., (1985), **Oxford Advanced Learner's Dictionary of Current English**, Twenty Second Impression, Oxford University Press, Oxford.

Institute for Management Development, (2003), **World Competitiveness Yearbook 2003**, Available at www.imd.org/wcc, http://www.imd.org/wcc/news-wcy-ranking/ and https://worldcompetitiveness. imd.org/

Koenig H. G., Larson, D. B., and Mcculloug, M. E., (2001), **Handbook of Religion and Health**, pp: 122, Oxford University Press, Oxford, ISBN: 0-8133-6719-0.

Lyubomirsky, S., and Lepper, H. S., (1999), "A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation", **Social Indicators Research**, 46(2): 137–55. DOI: 10.1023/A: 1006824100041.

Muchdie (2016a), "Islamicity and Global Competitiveness: A Cross-Nations Path Analysis", **Intl. J of Adv. Res**, 4(11): 818-828, ISSN: 2320-5407, DOI: 10.21474/IJAR01/2152.

Muchdie (2016b),"Economic Growth, Human Development and Global Competitiveness", Intl. J. of Soc. Sci & Econ Res,01(11): 1718-1735, ISSN: 2455-8834.

Muldur, U., Corvers, F., Delanghe, H., Dratwa, J., Heimberger, D., Sloan, B., Vanslembrouck, S., (2006), **A New Deal for Effective European Research Policy**, Springer, ISBN: 978-1-40205550-8.

Nussbaum, M., (2011), Creating Capabilities: The Human Development Approach, Harvard University Press, Cambridge, MA: 33–34, ISBN 0674072359.

Nussbaum, M., (2000), **Women and Human Development: the Capabilities Approach**, Cambridge University Press,Cambridge, New York: ISBN 9780521003858.

O'Brien, B., (2016), **The Seven Factors of Enlightenment, About Religion**, on line at http://buddhism.about.com/od/enlightenmentandnirvana/tp/The-Seven-Factors-Of-Enlightenment.htm.

Porter, M. (2009), *Clusters and Economic Policy*. ISC White Paper available at http://www.hbs.edu/faculty/Publication%20Files/Clusters_and_Economic_Policy_White_ Paper_8e844243-aa23-449d-a7c1-5ef76c74236f.pdf

Rehman, S. S., and Askari, H., (2010a), "How Islamic are Islamic Countries?",**Global Economy Journal**,10(2): 1-37, http://www.bepress.com/gej /vol10/iss2/2 DOI: 10.2202/1524-5861.1614.

Rehman, S. S., and Askari, H., (2010b), "An Economic Islamicity Index (EI2)", **Global Economy Journal**, 10(3): 1-37, http://www.bepress.com/gej/ vol10/iss3/1 DOI: 10.2202/1524-5861.1680

Scott, B. R., and Lodge, G. C., (1985), **US Competitiveness in the World Economy**, Harvard Business School Press, Boston, MA, USA.

Smith, T. B., McCullough, M. E. and Poll, J, (2003), "Religiousness and Depression: Evidence for a Main Effect and the Moderating Influence of Stressful Life Events", **Psychological Bulletin**, 129(4): 614–36, DOI:10.1037/0033-2909.129.4.614

Stacey, A., (2011), **Happiness in Islam: Happiness is found in Sincere Worship**, http://www.islamreligion.com/articles/435/viewall/happiness-in-islam.

Stajano, A., (2010), **Research, Quality, Competitiveness, EU Technology Policy for the Knowledge-based Society**, Springer ISBN 978-0-387-79264-4

Strawbridge, W. J., Shema, S. J., Cohen, R. D., and Kaplan, G. A., (2001), "Religious Attendance Increases Survival by Improving and Maintaining Good Behaviors, Mental Health, and Social Relationships", **Annals of Behavioral Medicine**, 23(1): 68–74. DOI: 10.1207/S15324796ABM2301_10. PMID 11302358.

Streeten, P, (1994), "Human Development: Means and Ends", **Human Development**, 84(2): 232–237.

Thomas, A., (2016), **Question 3: What is happiness? Summa Theologiae**, Archived from the original on October 11, 2016.

Ul-Haq, M, (2003), "The Human Development Paradigm", In Fukuda-Parr and A. K. Shiva Kuma, A.K.S. (Eds),**Readings in Human Development: Concept, Measures and Policies for Development Paradigm**, Oxford University Press, New Delhi: 7-34.

United Nations Development Programme, (1997), **Human Development Report**, Oxford University Press, Oxford:15, ISBN 978-0-19-511996-1.

United Nations Development Programme, (2015), **Human Development Reports**, Available at http: http://hdr.undp.org/en/2015-report.

United Nations Development Programme, (2016a), **World Happiness Report** on "Chapter 2: The Distribution of World Happiness", Available at .

United Nations Development Programme, (2016b), **Human Development Report 2015: Work for Human Development**, *Web Version* available at http://hdr.undp.org/ en/data.

Weiner, E. J., (2007), "Four months of boom, bust, and fleeing foreign credit", **Los Angeles Times,** Archived from the original on December 22, 2007.

World Economic Forum, (1996), Global Competitiveness Report 1996, World Economic Forum,Geneva: 19.

World Economic Forum, (2015), **Global Competitiveness Report 2014-2015**, Available at *https://www.weforum.org/reports/global-competitiveness-report-2014-2015*

World Health Organization, (2016), "Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks", Retrieved 4 August 2016.

Wright, S., (1921), "Correlation and Causation",**Journal Agricultural Research**, 20: 557-585.

Wright, S., (1934), "The Method of Path Coefficients", **Annals of Mathematical**

Statistics, 5(3): 161-215, DOI:10.1214/aoms/1177732676.

Martin, S. X., and Artadi, E.A., (2004), "The Global Competitiveness Index",**Global Competitiveness Report**, Global Economic Forum.

Yanklowitz, S., (2012), "Judaism's value of happiness living with gratitude and idealism", **Bloggish**, The Jewish Journal.

Chapter-30

Technology, Development and Happiness in a Spatial Island Economy: Conclusions

1. Introduction

This chapter concludes the results of analysis presented in the chapters of the book.Nine summaries will be presented, namely: technological progress and technical efficiency in Indonesian economy, technology and development in Indonesian economy, technology contribution to Indonesian economy, impact of technological progress on economic development, Islamicity and development, Islamicity and happiness, development and happiness, inflation and unemployment and spatial multipliers and linkages in Indonesia both at national level and at the island level.

2. Technological Progress and Technical Efficiency in Indonesian Economy

From chapter 12-15, it could be concluded that firstly, at national perspective, technical efficiency during the New Order Government was better than those during Reformation Government. Technical efficiency in Indonesian economy was higher during the New Order Government (3.08) than that in the Reformation Government(2.98). Decreasing return to scale exhibited in both goverment eras; the coefficients of return to scale were 0.70 and 0.75 consecutively during the New Order and the Reformation. Output elasticities were higher in the Reformation than those in the New Order, as output-capital elasticity was 0.72 in the Reformation compared to 0.67 in the New Order; meanwhile output-labor elasticity was 0.03 in the Reformation and 0.03 in the New Order. At all phases of the Indonesian economy's business cycle, the coefficients of technical efficiency were higher than that of the national average. All phases were also experienced the decreasing return to scale. The coefficients of output elasticity of capital were lower than those at national average. On the contrary, the coefficients of output elasticity of labor were generally higher than those at the national level, except the one at the Oil Booming Phase.

Secondly, at sectoral level, those sectors in which the coefficients were above that at the national level, experienced decreasing returns to scale. On the contrary, those sectors in which the coefficients were below that at national level, experienced increasing returns to scale.Sectorally, there were 4 sectors that had coefficient of technical efficiency above of that at national level, namely: Electricity, Gas and Drinking Water, Mining and quarrying, Construction, and Manufacturing.These were the sectors that experienced decreasing return to scale. Other five sectors that had the coefficient of technical efficiency below of that at the national level, namely: Financial, Rental and Corporate Services, Agriculture, Services, Trade, Hotel and Restaurant and Transportation and Communication. These were the sectors that had experienced increasing return to scale. There was an inverse relationship between technical efficiency and return to scale.

Thirdly, at spatial perspective,spatial variations in technical efficiency do exist in the Indonesian economy. The group of islands in which the coefficient of technical efficiency above that at the national level, exhibited decreasing return to scale. On the contrary, the group of island in which the coefficients of technical efficiency below that at the national level, exhibited increasing return to scale. At the provincial level, the provinces in which the coefficients of technical efficiency above that at the national level, exhibited decreasing return to scale. The provinces in which the coefficients of technical efficiency below that at the national level, exhibited increasing return to scale.

It could be suggested that the sectors or provinces with the coefficients of technical efficiency higher than that at the national level to not increase the inputs of production as the economy experiencing decreasing returns to scale. Meanwhile the sectors or provinces that had the coefficients of technical efficiency lower than that at the national level to increase all inputs in production in order to increase output as the economy experiencing increasing returns to scale.

3. Technology and Development in Indonesian Economy

Technological progress had significant contribution on Indonesian economic growth, both at national as well as at regional levels. The correlation coefficients between technological progress and economic growth indicate the strength relation between the two. At national level, the relationship between technological progress and economic growth was positive and very strong (0.81). At regional level, the stronger correlation between technological progress and economic growth happened in the Java Island (0.90) and at the Sulawesi Island the strength correlation coefficient between technological progress and economic growth was categorised as moderate (0.55).The coefficients of determination explain the variations of economic growth due to the growth of technological progress. At the national level, the highest coefficient existed in the Java Island (0.81) and the lowest existed in the Island of Sulawesi.Finally, the regression coefficients or the slope of regression line between technological progress and economic growth both at national and regional levels were positive and statistically significant. At national level, the coefficient of regression was 0.72. At regional levels, the coefficients of regression vary. The highest regression coefficient was in the Island of Java (0.88) and the smallest coefficient of regression was in the Sulawesi Island (0.47).

4. Technology Contribution to Indonesian Economy

Contribution of technology on Indonesian economy (8.79%) was relatively small compared to the contribution of technology on developed countries. It also small compared to the contribution other factor of production, such as capital (74.13%) and labor (17.7%). Secondly, the contribution of technology on Indonesian economy sectorally varied from negative to positive. Negative contribution was given by Agriculture (-55.1%), Financial, Rental and Corporate Service (-38.7%), Trade, Hotel and Restaurant (-26.3%) and Electricity, Gas and Drinking Water (-3.0%). Positive contribution was given by Other Services (72.6%), Manufacturing (52.6%), Transportation and Communication (29.5%), Mining and Quarrying (9.5%) and Construction (4.6%). Thirdly, spatially the contribution of technology on Indonesian economy also varied among Island. Maluku-Papua Island give negative contribution (-95.4%) as well as Kalimantan Island (-24.7%). Other Island that contributes positively was Java Island (47.9%), Bali-Nusa Tenggara Island (30.4%), Sulawesi Island (25.1%) and Sumatera Island (17.7%).

The contribution of technology to Indonesian regional economy varies among Island as well as among provinces within island. The highest contribution of technology was by Java Island (39.77%) followed by Bali-Nusa Tenggara Island (35.39%). The lowest technology contribution was in Kalimantan Island (12.82%). In Sumatra Island, the highest contribution of technology was in Province of

West Sumatera (54.38%) and the lowest contribution of technology was in Nangroe Aceh Darussalam (-32.61%). In Java Island, the highest contribution of technology was in the East Java Province (49.63%) and the lowest contribution was in the Special Province of Yogyakarta (28.35%). In Kalimantan Island, the highest contribution of technology was in West Kalimantan Province (41.91%) and the lowest contribution was in South Kalimantan Province (24.25%). In Bali-Nusa Tenggara, the highest contribution of technology was in East Nusa Tenggara Province (51.71%), and the lowest contribution was in the Province of Bali (25.89%). In Sulawesi Island, the highest contribution of technology was in the Province of Central-Sulawesi (43.23%), and the lowest contribution was in Gorontalo Province (-22.29%). In Maluku-Papua Island, the highest contribution of technology was in the Province of North-Maluku (70.62%) and the lowest contribution was in Papua Province (-522.83%).

5. Impact of Technological Progress on Economic Development

The chapter,using path analysis technique, examined the impacts of technological progress, directly and indirectly, on human development, with poverty reduction and economic growth as moderating variables. It is providing empirical evidence from Indonesia.

In path-1, for instance the path coefficient, P_{41} was -0.26. It means that technological progress directly had a negative impact on human development. This impact was statistically significant, as P_{41} (in absolute number) > 0.05. The increase of technological progress will decrease the index of human development.In path-2, technological progress directly had a positive impact on poverty; through P_{43} and P_{31}.This impact was statistically significant as P_{31}=0.30 which was higher than 0.05. It means that technological progress will increase the percentage of the poor. The higher was the technological progress the higher was the percentage of the poor. Meanwhile, the impact of poverty on human development was also negative and significant, P_{43}=-0.83. It means that the increase of percentage of the poor would decrease the index of human development. It is also true; if one says that the decrease of the percentage of the poor would increase the index of human development. Through path-2, technological progress indirectly had a negative significant impact on human development.

In path-3, technological progress directly had a positive significant impact on economic growth, with P_{21}=0.63. The increase of TFP growth would increase the growth of output in economy. Further, economic growth had a negative and significant impact on poverty, as P_{32}=-0.69. It means that economic growth would decrease the percentage of the poor. As already shown that the decrease of the percentage of the poor would increase the index of human development, and then in path-3, technological progress had indirect positive and significant impact on human development; through P_{43}-P_{32}-P_{21}.

In path-4, technological progress indirectly had a positive impact on human development, through economic growth. This indirect impact was not statistically significant, as $P_{42} \times P_{21}=0.63 \times 0.07 < 0.05$. In this path, technological progress, as it had been shown, that technological progress had a positive significant direct impact on economic growth. Meanwhile, economic growth had direct positive impact on human development.

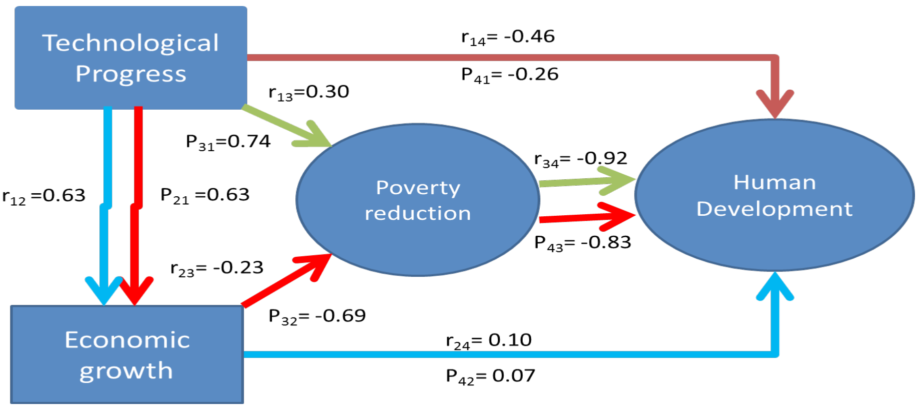


Figure 30.1

Correlation and Path Coefficients: Direct and Indirect Impacts of Technological Progress on Human Development

In path-4, technological progress indirectly had a positive impact on human development, through economic growth. This indirect impact was not statistically significant, as $P_{42} \times P_{21}=0.63 \times 0.07 < 0.05$. In this path, technological progress, as it had been shown, that technological progress had a positive significant direct impact on economic growth. Meanwhile, economic growth had direct positive impact on human development.

In another chapter, the impact of technological progress on Indonesia's global competitive has been discussed.Direct impact of technological progress on Indonesia's global competitiveness was negative and significant as P_{41} = -0.09. It means that an increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.09 per cent. It is an odd finding that should be explained. Direct impact of technological progress on human development was also negative and significant as P_{31} = -0.87. An increase of 1 per cent TFP growth would decrease Indonesia's human development index by 0.87 per cent. Direct impact of TFP growth on economic growth was positive and significant as P_{21}= 0.63. It means that an increase of 1 per cent TFP growth would increase GDP growth by 0.63 per cent.

Direct impact of economic growth on human development was positive and significant as P_{32} = 0.65 meaning that 1 per cent increase of GDP growth would increase human development index by 0.65 per cent. Direct impact of economic growth on Indonesia's global competitiveness was negative and significant as P_{42} = -0.10. As economic growth increase by 1 per cent, Indonesia's global competitiveness index would decrease by 0.1 per cent. Direct impact of human development on global competitiveness was positive and significant as P_{43} = 0.81. It means that the increase of 1 per cent of human development index would increase Indonesia's global competitiveness index by 0.81 per cent.

Indirectly, the impact of technological progress on Indonesia's global competitiveness through human development was negative and significant as P_{43} x P_{31} = (0.81 x -0.87) = -0.70. It means that indirectly, the increase of 1 per cent TFP growth would decrease Indonesia's global competitiveness index by 0.70 per cent. The decreasing impact due to negative impact of technological progress on human development, even though the impact of human development on global competitiveness was positive and significant (see the blue path, P_{43}-P_{31}). Indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development was positive and significant as P_{43} x P_{32} x P_{21} = (0.81 x 0.65 x 0. 63) = 0.33. It means that the increase of 1 per cent TFP growth would increase the Indonesia's global competitiveness index by 0.33 per cent. Green path in Figure 30.6 (P_{43}-P_{32}-P_{21}) showed the indirect impact of technological progress on Indonesia's global competitiveness through economic growth and human development. The impact of technological progress on economic growth was positive and significant; the impact of economic growth on human development was also positive and significant, as well as the impact of human development on global competitiveness was positive and significant. Finally, the indirect impact of technological progress on Indonesia's global competitiveness through economic growth was negative and significant, as P_{42} x P_{21} = (-0.10 x 0.63) = -0.06. An increase of 1 per cent TFP growth would decrease global competitiveness index by 0.06 per cent. Red path in

Figure 30.1 showed the impact of technological progress on Indonesia's global competitiveness through economic growth. Although the impact of technological progress on economic growth was negative, the indirect impact on Indonesia's global competitiveness was negative and significant as the impact of economic growth on global competitiveness was negative.

Other chapter also discussed the relations and impacts of technological progress on poverty reduction in Indonesia. The coefficient correlation between technological progress and poverty reduction, r_{14}, was 0.30, a weak positive correlation. It might comply with the theory, saying that technology could handle the poverty problems. Unfortunately, the direct impact was not statistically significant as the path coefficient, $P_{41} = 0.02$, was less than 0.05.

Correlation between unemployment and economic growth was negative, $r_{23} = -0.22$, a weak negative correlation. An increase the rate of unemployment will decrease the economic growth. Meanwhile, correlation between unemployment and poverty reduction was positive and significant. It means that the higher unemployment rate, the more the percentage of the poor. It is in line with the theory. The impact of unemployment on economic growth was negative and significant, as P_{32}> = [-0.50] > 0.05. On the other hand, the impact of unemployment on poverty reduction was positive and significant, $P_{42} = 0.81$.

Correlation between economic growth and percentage of the poor was also negative and weak as $r_{34} = -0.23$. Economic growth made the percentage of the poor declined. The path coefficient, P_{43} was -0.33. It means that the impact of economic growth on poverty reduction statistically significant as P_{43} = -0.33I > 0.05. One percent increase in economic growth will reduce the percentage of the poor 0.33 per cent.

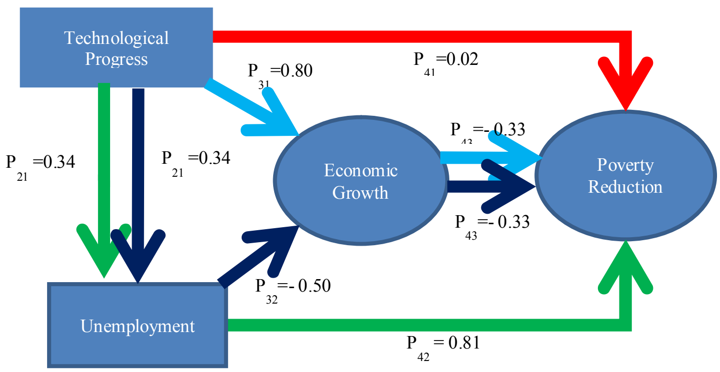


Figure 30.2

Path Coefficients: Direct and Indirect Impact of Technological Progress on Poverty Reduction

Figure 30.2 presents the path coefficients and therefore give evidences of the hypothesis on the impact of technological change on poverty reduction; direct and indirect. In Path-1, technological progress had positive direct impact on poverty reduction. But this impact was not statistically significant as P_{41} =0.02, which was less than 0.05. In Path-2, technological progress had negative indirect impact, through economic growth, on poverty reduction. This negative indirect impact was statistically significant as P_{43} x P_{31} = (-0.33 x 0.80) = $|-0.26|$ > 0.05.

In Path-3, technological progress had positive indirect impact, through economic growth and unemployment, on poverty reduction. This positive indirect impact was statistically significant as P_{43} x P_{32} x P_{21}= (-0.33 x -0.5 x 0.34) = 0.06 > 0.05. Finally, in Path-4, technological progress had positive indirect impact, through unemployment, on poverty reduction. This positive indirect impact was statistically significant as P_{42} x P_{21} = (0.81 x 0.34) =0.28 > 0.05.

6. Islamicity and Development

Path analysis on the impact of Islamicity on human development provided and discussed in Chapter 24. The conclusions were as follow: In Path-1, direct impact of economic growth on global competitiveness was positive and significant, with P_{31}= 0.64. The higher the increase of the growth of economy, the higher the global competitiveness index would be. One per cent increase in economic growth would increase 0.64 per cent in global competitiveness index. In Path-2, direct impact of Islamicity on human development was positive and significant, with P_{21}= 0.86. An increase of the Islamicity would increase the index of human development. One per cent increase in Islamicity would decrease 0.86 per cent in human development index. In Path-3, direct impact of human development on global competitiveness was positive and significant, with P_{32}= 0.28. The higher the increase of human development, the higher the index of global competitiveness would be. One per cent increase in human development index would increase 0.28 per cent in global competitiveness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of economic growth on global competitiveness was negative and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.28) x(0.86) = 0.24 >0.05. The higher the increase of the Islamicity, the higher the index of global competitiveness would be. One per cent increase in economic growth would decrease 0.24 per cent in global competitiveness index.

7. Islamicity and Happiness

More variables included in path analysis on the impact of Islamicity on happiness were discussed in Chapter 29. The conclusions that could be drawn were as follow:In Path-1: the direct impact of Islamicity on happiness was positive and significant as P_{41}= 0.36>0.05. It means that an increase in Islamicity index by 1 per cent would decrease the index of happiness by 0.36 per cent. In Path-2: the direct impact of Islamicity on global competitiveness was positive and significant as P_{31}= 0.64 > 0.05. It means that an increase of Islamicity index by 1 per cent would increase the index of global competitiveness by 0.64 per cent. In Path-3: the direct impact of Islamicity on human development was also positive and significant as P_{21}= 0.86 > 0.05. It means that an increase of Islamicity index by 1 per cent would increase the index of human development by 0.86 per cent. In Path-4: the direct impact of human development on global competitiveness was positive and significant as P_{32}= 0.28 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of global competitiveness by 0.28 per cent. In Path-5: the direct impact of human development on happiness was positive and significant as P_{42}=0.46 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of happiness by 0.43 per cent. Finally, in Path-6: the direct impact of global competitiveness on happiness was positive and significant as P_{43} = 0.06 > 0.05. An increase of global competitiveness index by 1 per cent would increase the index of happiness by 0.06 per cent.

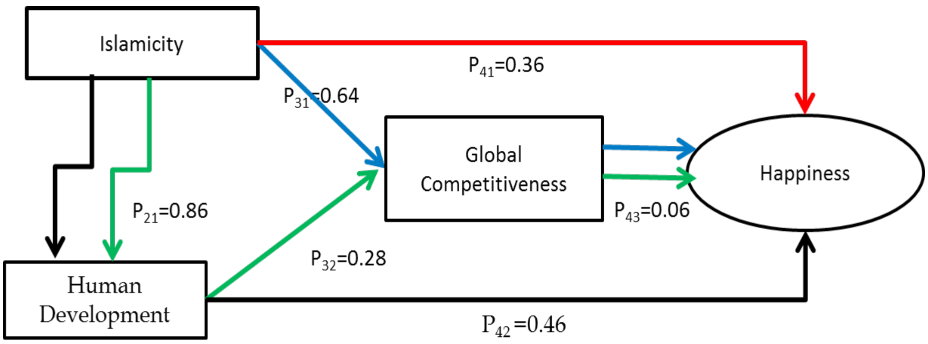


Figure 30.3

ath Coefficients: Direct and Indirect Impact of Islamicity on Happiness

In Path-7 (blue-path), indirect impact of Islamicity on happiness, through global competitiveness was positive, but statistically not significant as P_{43}x P_{31}=0.06

x 0.64 = 0.03 < 0.05. It means that indirectly through global competitiveness, an increase of 1 per cent of Islamicity would increase the index of happiness by only 0.03 per cent. In Path-8 (green-path), indirect impact of Islamicity on happiness through global competitiveness and human development was positive but statistically not significant as $P_{43}xP_{32}xP_{21}$= 0.06 x 0.28 x 0.86 = 0.01 < 0.05. An increase of Islamicity by 1 per cent would, indirectly increase the index of happiness by 0.01 per cent. Finally, in Path-9 (black-path), the indirect impact of Islamicity on happiness through human development was positive and significant as $P_{42}xP_{21}$ = 0.46 x 0.86 = 0.39 > 0.05. Any indirect impact of Islamicity on happiness through global competitiveness would be statistically not significant as the impact of global competitiveness on happiness was very small, P_{43} = 0.06.

8. Development and Happiness

Chapter 26 analysed the impact of economic growth on global competitiveness using world data, employing path analysis. The conclusions that could be drawn were as follow: Path-1, direct impact of economic growth on global competitiveness was positive and significant, with P_{31}= 0.10. The higher the increase of the growth of economy, the higher the global competitiveness index would be. One per cent increase in economic growth would increase 0.10 per cent in global competitiveness index. In Path-2, direct impact of economic growth on human development was negative and significant, with P_{21}= -0.12. An increase of the growth of economy would decrease the index of human development. One per cent increase in economic growth would decrease 0.12 per cent in human development index. In Path-3, direct impact of human development on global competitiveness was negative and significant, with P_{32}= 0.81. The higher the increase of human development, the higher the index of global competitiveness would be. One per cent increase in human development index would increase 0.81 per cent in global competitiveness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of economic growth on global competitiveness was negative and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.81) x –(0.12) = - 0.10 >0.05. The higher the increase of the growth of economy, the lower the index of global competitiveness would be. One per cent increase in economic growth would decrease 0.10 per cent in global competitiveness index.

Chapter 27 analysed the impact of human development on happiness. The conclusions were: In Path-1, direct impact of human development on happiness was positive and significant, with P_{31}= 0.61. The higher the increase of the index of human development will increase the index of happiness. One per cent increase in economic growth would increase 0.61 per cent in happiness index. In Path-2, direct impact of human development on global competitiveness was positive and significant, with P_{21}= 0.83. An increase of the index of human development would increase the index of global competitiveness. One per cent increase in human development would increase 0.83 per cent in global competitiveness index. In Path-3, direct impact of global competitiveness on happiness was also positive and significant, with P_{32}= 0.26. The higher the increase of global competitiveness, the higher the index of happiness would be. One per cent increase in global competitiveness index would increase 0.26 per cent in happiness index. Finally, indirect impact analysis shows that trough Path-2 and Path-3 the impact of human development on happiness was positive and significant, as the path coefficient of indirect impact was P_{32} x P_{21}= (0.83) x(0.26) = 0.22 >0.05. The higher the increase of the human development, the higher the index of happiness would be. One per cent increase in economic growth would increase 0.22 per cent in happiness index.

Chapter 28 analysed the impact of economic growth on Happiness. The results were In Path-1: the direct impact of economic growth on happiness was negative and significant as P_{41}=-0.11> [0.05]. It means that an increase in economic growth by 1 per cent would decrease the index of happiness by 0.11 per cent. In Path-2: the direct impact of economic growth on global competitiveness was positive and significant as P_{31}= 0.94 > 0.05. It means that an increase of economic growth by 1 per cent would increase the index of global competitiveness by 0.94 per cent. In Path-3: the direct impact of economic growth on human development was negative and significant as P_{21}= -0.12 > [0.05]. It means that an increase of economic growth by 1 per cent would decrease the index of human development by 0.12 per cent. In Path-4: the direct impact of human development on global competitiveness was positive and significant as P_{32}= 0.94 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of global competitiveness by 0.94 per cent. In Path-5: the direct impact of human development on happiness was positive and significant as P_{42}=0.43 > 0.05. It means that an increase of human development index by 1 per cent would increase the index of happiness by 0.43 per cent. Finally, in Path-6: the direct impact of global competitiveness on happiness was positive and significant as $P_{43} = 0.42 > 0.05$. An increase of global competitiveness index by 1 per cent would increase the index of happiness by 0.42 per cent.

9. Inflation and Unemployment: Short-run and Long-run

Chapter 22 and Chapter 23 provided evidences on the existence of Philip-curve, a negative correlation between inflation rate and the rate of unemployment both in the short-run and in the long-run. Using world's economic data it could be concluded that firstly the Philips curve does exist in Asian economies in the short-run as indicated by a negative correlation between the rate of inflation and unemployment rate.The regression coefficient was -0.04; t-test showed that the regression coefficient was not statistically significant. Secondly, in African economies,Philip curve also exists in the short-run as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -2.17; t-test showed that the regression coefficient was not statistically significant. Thirdly, in European countries, the Philip curve also exists in the short-run as there was a negative correlation between the rate of inflation andunemployment rate. The regression coefficient was -0.12; t-test showed that the regression coefficient was not statistically significant. Fourthly, in American economy, the Philip curve also exists in the short-run as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -0.64; t-test showed that the regression coefficient was not statistically significant. Finally, it could be concluded that the Philip curve does exists in the world's economy in the short-run, but the existence was not statistically significant.

In the long-run (1980-2015), the Philips curve does exist in Australian economy as indicated by a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -1.1392; t-test showed that the regression coefficient was not statistically significant. Secondly, in South Korea economy in the long-run (1980-2015), the Philips curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -3.0349; t-test showed that the regression coefficient was not statistically significant. Thirdly, in Indonesian economy in the long-run (1995-2015), the Philips curve also exists as there was a negative correlation between the rate of inflation and unemployment rate. The regression coefficient was -1.3328; t-test showed that the regression coefficient was not statistically significant. Finally, it could be concluded that the Philips curve do exists in the long-run as experienced in Australia, South Korea and Indonesia, but the existences were not statistically significant.

10. Spatial Multipliers and Linkages

The spatial structure of the island economy of Indonesia was presented in a more predictive manner by analysing the multipliers, flow-on and the spatial linkages.

All spatial-sector of Sector 9: Other services (KAL-9, OTH-9, SUM-9, NUS-9 and JAV-9) were among the ten largest ranking spatial-sectors for income multipliers. Two spatial-sectors of Sector-5: Construction industry (JAV-5 and OTH-5) were also included, as two sectors in the islands of Nusa Tenggara (NUS-2: Mining and quarrying industry, and NUS-7: Transportation and communication industry).

Among the ten largest ranking spatial-sectors in employment multipliers, there were eight sectors of the islands of Nusa Tenggara, namely NUS-2, NUS-1, NUS-3, NUS-4, NUS-7, NUS-9 and NUS-5. The other sectors were Sector-1: Agriculture, livestock, forestry and fishery in the island of Java (JAV-1), and Sector-5: Construction industry in Other islands (OTH-5).

By specifying multipliers into sector and region makes it possible to trace in what sectors (or regions) the respond of changes in final demand occurred. The sector-specific multipliers showed that, for output and income, multiplier effect occurred in own sectors were larger than that in other sectors. In some sectors, however, the multiplier effects in other sectors were larger than that in own-sector due to strong sectoral linkages between the sectors with other sectors through purchasing inputs. For output multipliers, the sectors in which multipliers were larger in other sectors included Sector-4: Electricity, water and gas industry, Sector-5: Construction industry and Sector-9: Other services. For income multipliers, the sectors were Sector-2: Mining and quarrying industry, Sector-6: Trade, hotel and restaurant industry and Sector-7: Transportation and communication industry. For employment multipliers, the opposite results were the case. The multipliers occurred in other sectors were generally larger than that in own-sector. This indicates that strong sectoral employment linkages exist. Except in Sector-1: Agriculture, livestock, forestry and fishery and Sector-2: Mining and quarrying industry, the employment multiplier effects in other sectors were larger than that in own-sector.

All measures of spatial-specific multipliers (output, income and output) showed that, for an island economy, the percentage of multipliers that occurred in the own-region is significantly high. For the island of Sumatra and Java, the two most developed islands in the country, the percentage of output, income and employment multipliers that occurred in the own region were about 90 per cent indicating that the two islands were relatively spatially independent. Only a small proportion of inputs from the rest of the country were required in producing goods and services. For other three groups of islands, the Kalimantan island, the islands of Nusa Tenggara and Other islands, the percentage of multiplier effects in own-region ranged from 70 to 80 per cent of total multiplier effects. This indicated that the three groups of islands were more dependent to the rest of the country. The spatial linkage analysis using the feed-back and spill-over index confirmed that the island of Java and Sumatra were more independent, while the other three groups of islands were less independent. The spatial linkages in the latter were stronger due to the significant size of spill-over and feed-back effects.

The flow-on effects, by which the net-impact of change in final demand is measured, provides more accurate measures than that of total. Based on the flow-on effects of output, income and multipliers, the spatial-sectors were also ranked. On the lists of the ten largest ranking spatial sectors, the same sectors as those in output multipliers also emerged in output flow-on rank order. This is simply because of the same initial unit impact. For income and employment flow-on effects, some different sectors were among the ten largest spatial sectors. Three Sector-9 (rather than five in multiplier effects), two of Sector-3 and two of Sector-4 were among the ten largest spatial sectors of income flow-on, and another Sector-3 on the rank of employment multipliers.

The presentation of sectoral distribution of flow-on effects showed that there were three sectors (Sector-3: Manufacturing industry, Sector-1: Agriculture, livestock, forestry and fishery and Sector-6:Trade, hotel and restaurant industry) in which flow-on effects consistently occurred in significant proportions regardless of the sectors of final demand changes. Similar to those in region-specific multipliers analysis, the proportion of flow-on effects occurred in own-region were significantly high when one inspected the spatial distribution of flow-on effects. This presentation, again, confirms previous analysis that the island of Sumatra and the island of Java were the most independent island in the country. The island of Kalimantan, the islands of Nusa Tenggara and Other islands were less independent. In other words, the latter was spatially more dependent to the rest of the country.

The spatial linkage analysis consistently confirms that the island of Sumatra and the island of Java were more independent with weak spatial linkages. A large proportion of multipliers or flow-on effects would occur in the own-region if the changes of final demand occurred in those islands. This would worsen the spatial inequity problems that have already been the nature of the island economy. Focusing economic activities on these islands would increase the economic growth of the country, but at the same time would make the economic distribution among regions worse.

More disaggregated analysis by island; the conclusions could also be drawn. Firstly, the important sectors of Sumatra Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services) and SUM-5 (Construction). Based on total income multipliers, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Sumatra Island economy were SUM-1 (Agriculture, livestock, forestry and fishery), SUM-9 (Other services) and SUM-4 (Electricity, water and gas). Based on output flow-on effects, three important sectors in Sumatra Island economy were SUM-4 (Electricity, water and gas), SUM-9 (Other services), and SUM-5 (Construction). Based on income flow-on effects, three important sectors in Sumatra Island economy were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Electricity, water and gas). Based on employment flow-on effects, three important sectors were SUM-9 (Other services), SUM-5 (Construction), and SUM-4 (Manufacturing).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were SUM-2 (Mining and quarrying), SUM-1(Agriculture, livestock, and fishery) and SUM-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were SUM-9 (Other services), SUM-1 (Agriculture, livestock and fishery) and SUM-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were SUM-1

(Agriculture, livestock and fishery), SUM-2 (Mining and quarrying) and SUM-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Sumatra Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were SUM-2 (Mining and quarrying), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were SUM-9 (Other services), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were SUM-1 (Agriculture, livestock and fishery), SUM-6 (Trade, hotel and restaurant) and SUM-8 (Banking and other finance).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Sumatra Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other services) and SUM-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were SUM-8 (Banking and other finance), SUM-9 (Other service) and SUM-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were SUM-3 (Manufacturing), SUM-8 (Banking and other finance) and SUM-6 (Trade, hotel and restaurant).

In the island of Java, firstly, the important sectors could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9 (Other services). Based on total income multipliers, three important sectors in Java Island economy were JAV-9 (Other services), JAV-5 (Construction) and JAV-7 (Transportation and communication). Based on total employment multipliers, three important sectors in Java Island economy were JAV-1 (Agriculture, livestock, forestry and fishery), JAV-9 (Other services) and JAV-5 (Construction). Based on output flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-4 (Electricity, water and gas) and JAV-9 (Other services). Based on income flow-on effects, three important sectors in Java Island economy were JAV-5 (Construction), JAV-9 (Other services) and JAV-7 (Transportation and communication). Based on employment flow-on effects, three important sectors were JAV-5 (Construction), JAV-9 (Other services) and JAV-3 (Manufacturing).

Secondly, important economic sectors in the island of Java could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were JAV-2 (Mining and quarrying), JAV-1 (Agriculture, livestock, and fishery) and JAV-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were JAV-9 (Other services), JAV-1 (Agriculture, livestock and fishery) and JAV-8 (Banking and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-2 (Mining and quarrying) and JAV-6 (Trade, hotel and restaurant).

Thirdly, important economic sectors in the island of Java could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Java Island. Based on output spatial-specific multipliers that occurred in own region, three important sectors were JAV-2 (Mining and quarrying), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own region, three important sectors were JAV-9 (Other services), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were JAV-1 (Agriculture, livestock and fishery), JAV-6 (Trade, hotel and restaurant and JAV-8 (Banking and other finance).

Fourthly, important economic sectors in the island of Java could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Java Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other services) and JAV-6 (Trade, hotel and restaurant). Based on income spatial distribution of low-on that occurred in own region, three important sectors were JAV-8 (Banking and other finance), JAV-9 (Other service) and JAV-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were JAV-3 (Manufacturing), JAV-8 (Banking and other finance) and JAV-6 (Trade, hotel and restaurant).

The conclusions could be drawn from the island of Kalimantan. Firstly, the important sectors of Kalimantan Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Kalimantan Island economy were KAL-4 (Electricity, water and gas), KAL-9 (Other services) and KAL-5 (Construction). Based on total income multipliers, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-8 (Banking and other finance) and KAL-5 (Construction). Based on total employment multipliers, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-4 (Electricity, water and gas). Based on output flow-on effects, three important sectors in Kalimantan Island economy were KAL-4 (Electricity, water and gas), KAL-9 (Other services), and KAL-5 (Construction). Based on income flow-on effects, three important sectors in Kalimantan Island economy were KAL-9 (Other services), KAL-4 (Electricity, water and gas), and KAL-5 (Construction). Based on employment flow-on effects, three important sectors were KAL-9 (Other services), KAL-5 (Construction), and KAL-4 (Electricity, water and gas).

Secondly, important economic sectors could be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were KAl-1(Agriculture, livestock, and fishery), KAL-2 (Mining and quarrying), KAL-3 (Manufacturing) and KAL-6 (Trade, hotel and restaurant). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-2 (Mining and quarrying. Based on employment sector-specific multipliers that occurred in own sector, three important sectors were KAL-1 (Agriculture, livestock and fishery), KAL-6 (Trade, hotel and restaurant), and KAL-2 (Mining and quarrying).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Kalimantan. Based on output spatial-specific multipliers that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-2 (Mining and quarrying), KAL-1 (Agriculture, livestock and fishery), and KAL-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own region, three important sectors were KAL-2 (Mining and quarrying), KAL-7 (Transportation and communication) and KAL-1 (Agriculture, livestock and fishery). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were KAL-1 (Agriculture, livestock and fishery), KAL-3 (Manufacturing) and KAL-7 (Transportation and communication).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Kalimantan Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-3 (Manufacturing) and KAL-1 (Agriculture, livestock and fishery). Based on income spatial distribution of low-on that occurred in own region, three important sectors were KAL-7 (Transportation and communication), KAL-3 (Manufacturing) and KAL-1 (Agriculture, livestock and fishery). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were KAL-3 (Manufacturing), KAL-7 (Transportation and communication) and KAL-1 (Agriculture, livestock and fishery).

The conclusions could be drawn from the island of Nusa Tenggara. Firstly, the important sectors of Nusa Tenggara Island economy could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors in Nusa Tenggara Island economy wereNUS-3 (Manufacturing), NUS-4 (Electricity, Water and Gas) and NUS-5 (Construction). Based on total income multipliers, three important sectors were: NUS-3 (Manufacturing), NUS-9 (Other services)and NUS-2 (Mining and quarrying). Based on total employment multipliers, three important sectors were NUS-2 (Mining and quarrying), NUS-1 (Agriculture, livestock and fishery), and NUS-3 (Manufacturing). Based on output flow-on effects, three important sectors were NUS-3 (Manufacturing), NUS-4 (Electricity, Water and Gas) and NUS-5 (Construction). Based on income flow-on effects, three important sectors were NUS-3 (Manufacturing), NUS-9 (Other services), and NUS-4 (Electricity, Water and Gas). Based on employment flow-on effects, three important sectors were NUS-3 (Manufacturing), NUS-9 (Other services), dan NUS-4 (Electricity, Water and Gas).

Secondly, important economic sectors could also be based on sector-specific multipliers effects. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were NUS-1 (Agriculture, livestock and fishery), NUS-8 (Bank and other finance), NUS-7 (Transportationandcommunication).

Based on income sector-specific multipliers that occurred in own sectors, three important sectors were NUS-1 (Agriculture, livestock and fishery), NUS-9 (Other services), dan NUS-8 (Bank and other finance). Based on employment sector-specific multipliers that occurred in own sector, three important sectors were NUS-1 (Agriculture, livestock and fishery), NUS-2 (Mining and quarrying) and NUS-8 (Bank and other finance).

Thirdly, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions. Based on output spatial-specific multipliers that occurred in own region, three important sectors were NUS-7 (Transportation and communication), NUS-6 (Trade, hotel and restaurant), dan NUS-1 (Agriculture, livestock and fishery). Based on income sector-specific multipliers that occurred in own region, three important sectors were NUS-9 (Other services), NUS-7 (Transportation and communication), andNUS-1 (Agriculture, livestock and fishery). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were NUS-1 (Agriculture, livestock and fishery, NUS-2 (Mining and quarrying) dan NUS-7 (Transportation and communication).

Fourthly, important economic sectors could be based on spatial distribution of flow-on. It could be based on the highest flow-on that occurred in own regions; in Nusa Tenggara Island. Based on output spatial distribution of low-on that occurred in own region, three important sectors were NUS-7 (Transportation and communication), NUS-6 (Trade, hotel and restaurant), and NUS-9 (Other services). Based on income spatial distribution of low-on that occurred in own region, three important sectors were NUS-7 (Transportation and communication), NUS-9 (Other services), dan NUS-6 (Trade, hotel and restaurant). Based on employment spatial distribution of flow-on that occurred in own region, three important sectors were NUS-7 (Transportation and communication), NUS-6 (Trade, hotel and restaurant) dan NUS-9 (Other services).

The conclusions that could be drawn from Eastern Indonesia's economy were: firstly, the important sectors could be based on total multipliers of output, income and employment. Based on total output multipliers, three important sectors were EIR-4 (Electricity, water and gas), EIR-5 (Construction) and EIR-9 (Other services). Based on total income multipliers, three important sectors in Kalimantan Island economy were EIR-9 (Other services), EIR-5 (Construction) and EIR-8 (Banking and other finance). Based on total employment multipliers, three important sectors in Kalimantan Island economy were EIR-5 (Construction), EIR-3 (Manufacturing) and EIR-9 (Other services).

Secondly, based on output flow-on effects, three important sectors were EIR-4 (Electricity, water and gas), EIR-5 (Construction) and EIR-9 (Other services). Based on income flow-on effects, three important sectors were EIR-3 (Manufacturing), EIR-9 (Other services), and EIR-5 (Construction). Based on employment flow-on effects, three important sectors were EIR-3 (Manufacturing), EIR-9 (Other services), and EIR-5 (Construction).

Thirdly, important economic sectors could be based on sector-specific multipliers. It could be based on the highest multipliers that occurred in own sectors. Based on output sector-specific multipliers that occurred in own sector, three important sectors were EIR-1(Agriculture, livestock, and fishery), EIR-2 (Mining and quarrying), and EIR-8 (Banking and other finance). Based on income sector-specific multipliers that occurred in own sectors, three important sectors were KAL-9 (Other services), KAL-1 (Agriculture, livestock and fishery), and KAL-2 (Mining and quarrying. Based on employment sector-specific multipliers that occurred in own sector, three important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-8 (Banking and other finance), and EIR-9 (Other services).

Finally, important economic sectors could be based on spatial-specific multipliers. It could be based on the highest multipliers that occurred in own regions; in Eastern Indonesia. Based on output spatial-specific multipliers that occurred in own region, three important sectors were), EIR-1 (Agriculture, livestock and fishery), EIR-7 (Transportation and communication and EIR-3 (Manufacturing). Based on income sector-specific multipliers that occurred in own region, four important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-7 (Transportation and communication), EIR-8 (Banking and other finance) and EIR-9 (Other services). Based on employment spatial-specific multipliers that occurred in own region, three important sectors were EIR-1 (Agriculture, livestock and fishery), EIR-2 (Mining and quarrying), and EIR-3 (Manufacturing).

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Karya Tulis Akademis Tidak Diterbitkan:

1. Muchdie, 1998, **The Spatial Structure of the Island Economy of Indonesia** : An Inter-regional Input-Output Study, unpublished **PhD Thesis** submitted to the Department of Economics, the University of Queensland (**Supervisors**: Dr. G.R. West and Prof R.C. Jensen).
2. Muchdie, 1986, **Peranan Industri Pengolahan Hasil Pertanian dalam Pengembangan Wilayah Transmigrasi**: Studi Kasus pada Pabrik Pandu (Pilot Plant) Ethanol di Satuan Kawasan Pemukiman Transmigrasi Tulang Bawang I, Lampung, **Tesis Magister** tidak diterbitkan, Fakultas Pascasarjana, Institut Pertanian Bogor, Bogor (**Pembimbing** : Lutfi I. Nasoetion, Isang Gonarsyah dan Bambang S. Utomo).

Karya Tulis dalam Bentuk Buku atau Bagian dari Buku

1. Muchdie, 2011, **Spatial Structure of Island Economy of Indonesia**: A New Hybrid Procedure for Generation Inter-Regional Input-Output Tables, ISBN: 978-3-8454-1847-6, Lambert Academic Publishing, Germany.
2. Muchdie, 2005, "Bab-1 Pendahuluan" **dalam** Atang Sulaiman (Penyunting), **Difusi Teknologi : Teori, Pendekatan dan Pengalaman**, Edisi ke-1 (ISBN: 979-98496-3-2), Pusat Pengkajian Kebijakan Difusi Teknologi, Badan Pengkajian dan Penerapan Teknologi, Jakarta.
3. Muchdie dan M. Agus Widodo, 2005, "Bab-3 Model-model Ekonomi Difusi Teknologi " **dalam** Atang Sulaiman (Penyunting), **Difusi Teknologi: Teori, Pendekatan dan Pengalaman**, Edisi ke-1 (ISBN : 979-98496-3-2), Pusat Pengkajian Kebijakan Difusi Teknologi, Badan Pengkajian dan

Penerapan Teknologi, Jakarta.

4. Mien Askinatin, Yudi Widayanto dan **Muchdie**, 2003, "Konsep Daya Saing Wilayah: Perspektif Teknologi" **dalam** Yudi Widayanto dan Binuko Dani (Penyunting), **Daya Saing Wilayah dalam Perspektif Teknologi**, Edisi Pertama (ISBN: 979-3138-05-X), Pusat Pengkajian Kebijakan Teknologi Pengembangan Wilayah, Badan Pengkajian dan Penerapan Teknologi, Jakarta.
5. Muchdie, 2002, "Kebijakan Teknologi Wilayah di Korea: Teknopolis Generasi Ketiga" **dalam** Adi Saptari (Penyunting), **Bangkitnya Inovasi Korea: Pengalaman Korea Membangun Kemampuan IPTEK**, Edisi Pertama (ISBN:979-970-680-7), Pusat Pengkajian Kebijakan Inovasi Teknologi, Badan Pengkajian dan Penerapan Teknologi, Jakarta.
6. Muchdie, 2002, "Pengantar Manajemen Strategis untuk Pengembangan Wilayah" **dalam** Urbanus M. Ambardi dan Socia Prihawantoro (Penyunting), **Pengembangan Wilayah dan Otonomi Daerah: Kajian Konsep dan Pengembangan**, Edisi Pertama (ISBN: 979-3138-01-7), Pusat Pengkajian Kebijakan Teknologi Pengembangan Wilayah, Badan Pengkajian dan Penerapan Teknologi, Jakarta.
7. Muchdie, 2002, "Aplikasi Model Input-Output dalam Analisis Perekonomian Wilayah" **dalam** Urbanus M. Ambardi dan Socia Prihawantoro (Penyunting), **Pengembangan Wilayah dan Otonomi Daerah: Kajian Konsep dan Pengembangan**, Edisi Pertama (ISBN: 979-3138-01-7), Pusat Pengkajian Kebijakan Teknologi Pengembangan Wilayah, Badan Pengkajian dan Penerapan Teknologi, Jakarta.
8. Socia Prihawantoro dan **Muchdie**, 2000, "Industrialisasi dan Pengaruhnya Terhadap Kesejahteraan Masyarakat Perdesaan" **dalam** Suhandojo, Sri Handoyo Mukti dan Tukiyat (Penyunting), **Pengembangan Wilayah Perdesaan dan Kawasan Tertentu: Sebuah Kajian Elsploratif**, Edisi Pertama (ISBN: 979-95745-3-6), Direktorat KTPW-BPPT, Jakarta.
9. Muchdie, 2000, "Kompetensi Inti Sektor Unggulan di KAPET Manado-Bitung" **dalam** Suhandojo, Sri Handoyo Mukti dan Tukiyat (Penyunting), **Pengembangan Wilayah Perdesaan dan Kawasan Tertentu : Sebuah Kajian Eksploratif**, Edisi Pertama (ISBN: 979-95745-3-6), Direktorat KTPW-BPPT, Jakarta.
10. Muchdie, 1999, **Model Input-Output Antar-Daerah: Prosedur Hibrida untuk Ekonomi Kepulauan**, Edisi Pertama (ISBN: 979-95745-2-8),

Direktorat KTPW-BPPT, Jakarta.

11. Muchdie, 1999, “Dampak Kebijaksanaan Pengembangan Wilayah KTI terhadap Perekonomian Nasional: Kajian Input-Output Antardaerah” **dalam**: Alkadri, Muchdie dan Suhandojo (Penyunting), **Tiga Pilar Pengembangan Wilayah: Sumberdaya Alam, Sumberdaya Manusia dan Teknologi**, Edisi Pertama, (ISBN: 979-95745-1-1), Direktorat KTPW-BPPT, Jakarta.
12. Alkadri, **Muchdie** dan Suhandojo (Penyunting), 1999, **Tiga Pilar Pengembangan Wilayah: Sumberdaya Alam, Sumberdaya Manusia dan Teknologi**, Edisi Pertama, (ISBN: 979-95745-1-1), Direktorat KTPW-BPPT, Jakarta.
13. Alkadri, Dodi Slamet Riyadi, **Muchdie**, Siswanto S., Fathoni M (Penyunting), 1999, **Manajemen Teknologi untuk Pengembangan Wilayah**, Edisi Pertama (ISBN: 979-95745-0-1), Direktorat KTPW-BPPT, Jakarta.

Karya Tulis di Jurnal Internasional Terindex

1. **M**. **Muchdie,** H. **Kurniawan,** 2018, “Import Components and Import Multipliers in Australian Economy: World Input-Output Analysis**”, International Journal of Economics and Financial Issues,** 8(2): 304-314, ISSN: 2146-4138 available at http: https://www.econjournals.com/index.php/ijefi/article/view/6214/pdf.
2. **M. Muchdie,** M. Kusmawan, 2018, “Sector-Specific and Spatial-Specific Multipliers in the USA Economy: World Input-Output Analysis”, **American Journal of Economics**, 8(2): 83-92, p-ISSN: 2166-4951 e-ISSN: 2166-496X, http://article.sapub.org/10.5923.j.economics.20180802.03.html.
3. M. **Muchdie**, S. Sumarso, 2018, “Sector-Specific and Spatial-Specific Multipliers in Japanese Economy: World Input-Output Analysis”, **International Journal of Development and Sustainability**, ISSN: 2186-8662, 7(2): 651-665, https://isdsnet.com/ijds-v7n2-16.pdf.
4. M. Muchdie, 2017, “Islamicity, Human Development and the Happiness: A Cross Section Path Analysis Model”, **Journal Economics and Management Perspectives**, 11 (2): 124-135. http://jemp.org/volume-11-issue-2-124-135.
5. **M Muchdie**, MH Imansyah, M Kusmawan, H Al-Jurfri, 2018, “Import Components and Import Multipliers in Indonesian Economy: Word Input-Output”, **Jurnal Ekonomi dan Studi Pembangunan**, ISSN 2086-1575; E-ISSN 2502-7115, 10 (1), 88-102, http://dx.doi.org/10.17977/um002v10i12018p088.
6. **Muchdie** and Sugema, 2017, “Technical and Trade Coefficients in China

and in the USA Economies: Are They Different?", **International Journal of Advanced Research (IJAR)**, 5(11): 377-390, ISSN: 2320-5407, **DOI:** http://dx.doi.org/10.21474/IJAR01/5780.

7. Muchdie, 2017, "Technical and Trade Coefficients in South Korean and Japanese Economies: Are They the Same?", **International Journal of Science and Research (IJSR)**, 6 (11): 677-686, ISSN: 2319-7064, DOI: http://dx.doi.org/10.21275/ART20178023.
8. Muchdie, 2017, "Technical and Trade Coefficients in Indonesian and Australian Economies: A Comparison", **Global Journal for Research Analysis (GJRA)**, 6 (11): 290-296, ISSN: 2277-8160.
9. Muchdie, 2017, "Sector and Spatial-Specific Multipliers in Nusa Tenggara Islands' Economy: An Inter-Island Input-Output Analysis", **International Journal of Social Science and Economic Research (IJSSER)**, 2 (11): 5084-5101, ISSN: 2455-8834.
10. Muchdie, 2017, "Human Development, Global Competitiveness and Happiness: A Cross-Nation Path Analysis", **International Journal of Advanced Research (IJAR),** 5(10): 779-790, ISSN: 2320-5407, **DOI:** http://dx.doi.org/10.21474/IJAR01/5587.
11. Aam Aminingsih Jumhur, Nik Hasnaa Nik Mahmood and **Muchdie,** 2017, "Manufacturing Strategy and Competitive Advantage: A Mediating role of Organizational Culture (A Case Study of Small Industry Batik Trusmi Indonesia)", **Advanced Science Letters, 23 (11): Scopus Indexed Journal**.
12. Muchdie, 2017, "Spatial Multipliers and Linkages in Indonesian Economy: An Inter-Island Input-Output Analysis", **International Journal of Advanced Research (IJAR)**, 5 (7): 409-421, ISSN: 2320-5407, DOI: http://dx.doi.org/10.21474/IJAR01/4733.
13. Muchdie, 2017, "Spatial Dimension of Multipliers and Flow-on Effects in Java Island Economy: An Inter-Island Input-Output Analysis", **International Journal of Science and Research (IJSR),** 6 (6): 1195-1203, ISSN: 2319-7064, DOI: http://dx.doi.org/10.21275/ART20174473.
14. Muchdie, 2017," Technological Progress and Poverty Reduction in Indonesia", **International Journal of Research in Social Sciences (IJRSS)**, 7 (3): 248-265, ISSN: 2249-2496.
15. Muchdie, 2017, "GIRIOT Revisited: Up-Dated and Evaluated", **International Journal of Social Science and Economic Research (IJSSER)**, 02 (02): 2377-2396, ISSN: 2455-8834.

16. Muchdie, 2017, “Happiness and Islamicity”, **International Journal of Recent Scientific Research (IJRSR)**, 8 (2): 15213-15222, ISSN: 0976-3031.
17. Muchdie, 2017, “Economic Growth and Happiness: A Cross-Nations Path Analysis Model”, International **Journal of Science and Research (IJSR),** 6 (1): 1899-1908, ISSN: 2319-7064, DOI: http://dx.doi.org/10.21275/ART20164527.
18. Muchdie, 2017, “Sector and Spatial-Specific Multipliers in Eastern Indonesia’s Economy: An Inter-Island Input-Output”, **International Journal of Science and Research (IJSR),** 6 (2): 123-131. ISSN: 2319-7064, DOI: http://dx.doi.org/10.21275/ART2017608.
19. Muchdie, 2017, “Spatial Dimensions of Multipliers in Sumatra Island Economy: An Inter-Regional Input-Output Analysis”, **International Journal of Advanced Research (IJAR)**, 5 (1): 1355-1365, ISSN: 2320-5407, DOI: http//dx.doi.org/10.21474/IJAR01/2894.
20. Muchdie, and Bambang D. Hartono, 2016, “Economic Development and Happiness: A Cross Nations Path Analysis”, **International Journal of Advanced Research (IJAR)**, 4(12): 989-998, ISSN: 2320-5407, DOI: http://dx.doi.org/10.21474/IJAR01/2484.
21. Muchdie, 2016, “The Existence of Philips Curve in the Long-Run: Some Evidence from Australia, South Korean and Indonesian Economy”, **International Journal of Current Advanced Research (IJCAR)**, 5 (11): 1422-1426, ISSN: 2319-6505.
22. Muchdie, 2016, “Does Philips Curve Exist: Evidence from All Over the World”, **International Journal of Current Advanced Research (IJCAR)**, 5(10): 1350-1356, ISSN: 2319-6505.
23. Muchdie, 2016, “The Impacts of Technological Progress on Human Development: Evidence from Indonesia”, **International Journal of Economics and Research (IJER)**, 7 (5): 14-28, ISSN: 2229-6158.
24. Muchdie, 2016, “Islamicity and Global Competitiveness: A Cross-Nations Path Analysis”, **International Journal of Advanced Research (IJAR)**, 4 (11): 818-828, ISSN: 2320-5407, DOI: http//dx.doi.org/10.21474/IJAR01/2152/.
25. Muchdie, 2016, “National, Sectoral and Spatial Perspectives on Technical Efficiency and Return to Scale in Indonesian Economy”, **International Journal of Scientific Research and Innovative Technology (IJSRIT)**, 3 (10): 1-10, ISSN: 2313-3759.

26. Muchdie, 2016, "Spatial Variations in Technical Efficiency and Return to Scale in the Indonesian Economy", **International Journal of Recent Scientific Research (IJRSR)**, 7(10): 13625-13629, ISSN: 0976-3031.
27. **Muchdie**, Alkadri and Socia Prihawantoro, 2016, "Technological Progress and Economic Growth in Indonesia: A Regional Perspective", **International Journal of Recent Scientific Research (IJRSR)**, 7 (10): 14033-14039, ISSN: 0976-3031.
28. Muchdie, 2016, "Economic Growth, Human Development and Global Competitiveness", **International Journal of Social Science and Economic Research (IJSSER)**, 01(10): 1718-1735, ISSN: 2455-8834.
29. **Muchdie,** Alkadri, Socia Prihawantoro and Sugema, 2016, "The Impact of Technological Progress on Indonesia's Global Competitiveness: A Time Series Path Analysis", **International Journal of Social Science and Economic Research (IJSSER),** 01 (11): 1830-1846, ISSN: 2455-8834.
30. **Muchdie,** Socia Prihawantoro and Sugema, 2016, The Contribution of Technology on Indonesian Economy: National, Sectoral and Spatial Perspectives**", International Journal of Advanced Research (IJAR)**, 4 (11): 2149-2156, ISSN 2320-5407, DOI: http://dx.doi.org/10.21474/IJAR01/2319.

Karya Tulis di Jurnal Ilmiah Nasional Terakreditasi

1. **M. Muchdie,** M. Nurrasyidin (2018), "Sector-Specific and Spatial-Specific Multipliers in Indonesian Economy: World Input-Output Analysis**", Jurnal Ekonomi Pembangunan, Kajian Masalah Ekonomi dan Pembangunan,** Vol 9 No. 1: 64-79, Jurnal Nasional Terakreditasi, http://journals.ums.ac.id/index.php/JEP/article/view/5661
2. Muchdie, 2017, "Spatial Distribution of Multipliers in Kalimantan Island Economy: An Inter-Regional Input-Output Analysis", **Signifikan: Jurnal Ilmu Ekonomi**, 6 (2): 217-230, ISSN: 2087-2046, DOI: http://dx.doi.org/10.15408/sjie.v6i2.4736, FEB-UIN Jakarta.
3. Muchdie, 2016, "Technical Efficiency and Return to Scale in the Indonesian Economy During the New Order and Reformation Governments", **Jurnal Ekonomi Pembangunan**, 17 (2): 12-18, ISSN: 1411-6081, FE-UM Surakarta.
4. Muchdie, 2016, "Sectoral Variations on Technical Efficiency and Return to Scale in the Indonesian Economy", **Signifikan: Jurnal Ilmu Ekonomi**,

5 (2): 119-132, ISSN: 2087-2046, DOI: 10.15408/sjie.v5i2.3400, FEB-UIN Jakarta.

Karya Tulis di Jurnal Ilmiah Nasional Tidak Terakreditasi

1. Monica, L., **Muchdie** dan Achmadi, U., 2017, "Struktur Modal dan Keputusan Investasi Terhadap Nilai Perusahaan", **Agregat: Jurnal Ekonomi dan Bisnis**, 1(2): 214-222, ISSN: 2549-7243 (FEB-UHAMKA).
2. Muchdie, 2016, "Inflasi, Pengangguran dan Pertumbuhan Ekonomi di Negara-Negara Islam", **Jurnal Ekonomi Islam**, 7(2):27-43, ISSN: 2087-7056 (Fakultas Agama Islam, UHAMKA).
3. **Muchdie** dan Achmad Djazuli, 2003, "Fluktuasi Nilai Tukar Rupiah Terhadap Mata Uang Asean dan Faktor-Faktor Ekonomi Yang Mempengaruhinya", **Jurnal Manajemen dan Akuntansi**, 1(1): 1-13, ISSN 1693-475X (Fakultas Ekonomi, UPDM-B, Jakarta).
4. Muchdie, 2001, "Peran Inovasi dalam Pengembangan Perekonomian Wilayah", **Majalah Analisis Sistem,** No. 15 (8): 83-93, ISSN : 8854-9117 (DB-PKT, BPPT, Jakarta).
5. Soesmarkanto dan **Muchdie**, 2001, "Model Kluster Teknologi untuk Usaha Kecil Menengah", **Majalah Analisis Sistem,** No. 15(8): 14-30, ISSN : 8854-9117 (DB-PKT, BPPT Jakarta).
6. Muchdie, 2000, "Struktur Ruang Perekonomian Indonesia : Analisis Model Input-Output Antardaerah", **Jurnal Studi Indonesia**, 10(2): 30-53, ISSN: 1410-2099 (Lembaga Penelitian, Universitas Terbuka, Jakarta).
7. Muchdie, 2000, "Model Dampak Lokal untuk Menghitung Manfaat Industri Pariwisata Terhadap Perekonomian Wilayah", **Majalah Ilmiah Ilmu dan Wisata,** Edisi Spesial, 17: 27-39, ISSN: 0854-0241 (Lembaga Penelitian dan Pengabdian Masyarakat,Usahid, Jakarta).
8. Muchdie, 1999, "Indonesia's Inter-regional Input-Output Model: A New Hybrid Procedure for an Island Economy", **Jurnal Sains dan Teknologi Indonesia**, 1(4): 203-227, ISSN : 1410-9409 (BPPT, Jakarta).
9. Muchdie, 1999, "Model Input-Output sebagai Metode Analisis Perencanaan Ekonomi Wilayah", **Jurnal Ilmiah Teknologi dan Disain Trisakti**, No. 6/Th III/VII : 75 – 102, ISSN : 0852-9450 (Fakultas Teknik dan Disain, Universitas Trisakti, Jakarta).
10. Muchdie, 1999, Keberartian Sektor Industri di Pulau Jawa Dalam Perekonomian Indonesia: Analisis Input-Output AntarDaerah", **Jurnal Sains dan**

Teknologi Indonesia, 1(5): 124-140, ISSN : 1410-9409 (BPPT, Jakarta).

11. Muchdie, 1998, "Pemodelan Struktur Ruang Ekonomi Indonesia: Penerapan Prosedur GIRIOT untuk Menyusun Tabel Input-Output Antardaerah, **Ekonomi dan Keuangan Indonesia**, 46(3): 279-305, ISSN: 0126-155 X (LPEM-Fakultas Ekonomi, Universitas Indonesia, Jakarta).
12. Muchdie, 1998, "Teknik Hibrida Dalam Penyusunan Tabel Input-Output AntarDaerah: Sebuah Prosedur untuk Ekonomi Kepulauan", **Ekonomi dan Keuangan**, 46(1): 117-145, ISSN: 0126-155 X (LPEM-Fakultas Ekonomi, Universitas Indonesia, Jakarta).
13. Muchdie, 1998, "Penganda Input-Output Sektor-Sektor Pariwisata", **Majalah Ilmu dan Wisata,** 17: 1-15, ISSN: 0854-0241 (Lembaga Penelitian dan Pengabdian Masyarakat, Universitas Sahid, Jakarta).
14. Muchdie, 1998, "Keterkaitan Sektor-Sektor Pariwisata Dalam Perekonomian Bali: Analisis Input-Output"**, Majalah Ilmu dan Wisata,** 18:12-25, ISSN: 0854-0241 (Lembaga Penelitian dan Pengabdian Masyarakat, Universitas Sahid, Jakarta).
15. Muchdie, 1998, "Struktur Produksi dan Pola Konsumsi Pada Budidaya Jagung dan Kedelai: Analisis Input-Output", **Majalah Ilmiah Analisis Sistem**, 11(5): 23 – 34, ISSN: 0854-9117 (Kedeputian Bidang Analisis Sistem, BPPT, Jakarta).
16. Muchdie 1998, "Kandungan Impor Produk-Produk Pertanian, Peternakan, Kehutanan dan Perikanan: Analisis Input-Output", **Jurnal Ekonomi dan Pembangunan,** VI(2): 44-60, ISSN: 0854-526X (Pusat Penelitian Ekonomi Pembangunan-LIPI, Jakarta).
17. Muchdie, 1998, "Keterkaitan Sektor Perikanan dalam Perekonomian Indonesia: Analisis Berpendekatan Sistem"**, Majalah BPP Teknologi**, 49: 132-144, ISSN: ISSN 0216-6569 (BPPT, Jakarta).
18. Muchdie, 1998, "Penerapan Konsep Elastisitas Input-Output Dalam Analisis Sektor Andalan Suatu Perekonomian", **Jurnal Ekonomi, Keuangan dan Perbankan**, 18: 7- 20, ISSN: 0854-4131 (STEKPI, Jakarta).
19. **Muchdie** dan G. Hartono, 1991, "Faktor-Faktor Yang Mempengaruhi Kemampuan Transmigran Untuk Menggarap Lahan Usaha : Kajian Kasus di Satuan Kawasan Pemukiman Transmigrasi Tulang Bawang, Lampung"**, Majalah BPPT**, No. 41: 32-40, ISSN: ISSN 0216-6569 (BPPT, Jakarta).
20. S. Kuncoro dan **Muchdie**, 1991, "Pendekatan Analisis Sistem Dalam Upaya Menanggulangi Kemiskinan di Pedesaan", **Majalah BPPT**, No.

41: 53-63, ISSN: ISSN 0216-6569 (BPPT, Jakarta).
21. Muchdie, 1989, “Kerusakan Tanah dan Beberapa Penyebabnya: Studi Kasus di Kecamatan Cisarua Kabupaten Bogor”, **Majalah BPPT**, No. 38: 64-74, ISSN: ISSN 0216-6569 (BPPT Jakarta).

Karya Tulis di Prosiding:

1. Muchdie, 2016, “The Impact of Technological Change on Poverty Alleviation in Indonesia” In: **International Multidisciplinary Conference 2016 Scientific Solution to Global Crisis**, Universitas Muhammadiyah, Jakarta.
2. **Muchdie** dan M.H.Imansyah, 1995, “Sektor-Sektor Unggulan Dalam Perekonomian Indonesia pada Pembangunan Jangka Panjang Kedua: Penerapan Analisis Input-Output” **dalam** Marjaldi L. dkk, **Proceeding of the Indonesian Students’ First Scientific Paper Competition and Second National Seminar, Perhimpunan Pelajar Indonesia Australia, Melbourne** (Artikel ini memperoleh Juara Pertama pada **Lomba Karya Tulis Ilmiah-I**, diselenggarakan oleh PPI-Australia Pusat, Melbourne).
3. **Muchdie** dan Iding Chaidir, 1988, “Model Alokasi Pemanfaatan Lahan Untuk Memperkirakan Luas Tanaman Ubikayu Sebagai Bahan Baku Pabrik Ethanol”, **dalam Prosiding Presentasi Ilmiah Peneliti BPP Teknologi ke III**, Humas BPPT, Jakarta.

Karya Tulis di Surat Kabar Nasional

1. Muchdie, “Menggembalikan Kepercayaan Kepada Rupiah”**, Bisnis Indonesia**, 30 Desember 1997.
2. Muchdie, “Upaya Negara Asia Menghadapi Tantangan Abad Ke-21”**, Bisnis Indonesia**, 29 Oktober 1991.
3. Muchdie, “Penanggulangan Polusi Sebagai Peluang Bisnis Baru**”, Bisnis Indonesia**, 15 November 1991.
4. Muchdie dan S. Kuncoro, “Menyiasati Kemiskinan Melalui Pendekatan Sistem**”, Suara Pembaruan**, 3 Sepetember 1991.
5. Muchdie, “Sudah Saatnya Deregulasi Asuransi”, **Jayakarta,** 25 Juli 1991.
6. Muchdie, “Sistem Neraca Sosial Ekonomi dan Lingkungan Hidup”, **Bisnis Indonesia**, 9 Juli 1991.
7. Muchdie, “Mengukur Dampak Penghapusan Subsidi BBM**”, Bisnis Indonesia**, 23 Mei 1991.
8. Muchdie, “Pemanasan Global: Isu Internasional Kontroversial”**, Jayakarta**,

22 Mei 1991.
9. Muchdie, "Penanggulangan Kejahatan Dari Sudut Ilmu Ekonomi"**, Bisnis Indonesia,** 10 Mei 1991.
10. Muchdie**, "**Kendala Pengembangan Wisata Kelautan di Intim**", Bisnis Indonesia**, 16 Februari 1991.
11. Muchdie, "Beberapa Masalah Yang Dihadapi Oleh Kawasan Industri", **Bisnis Indonesia**, 23 Oktober 1990.
12. Muchdie, "Mengobarkan Semangat Mengutamakan Buatan Bangsa Indonesia"**, Jayakarta**, 11 September 1990**.**
13. Muchdie, "Mutu dan Daya Saing Industri Dalam Negeri", **Jayakarta**, 11 September 1990.
14. Muchdie**, "**Industri Kuat Pertanian Tangguh", **Jayakarta,** 31 Agustus, 1990.
15. Muchdie, **"**Menuju Penataan Kawasan Industri di Kalsel**", Dinamika Berita Banjarmasin**, 23 Agustus 1990.
16. Muchdie, "Menuju Hari Esok Lebih Baik, Peran Apa yang dapat Dilakukan Warga?"**, Jayakarta**, 9 Juli 1990**.**
17. Muchdie, "Mewujudkan Semangat Pengabdian Membangun Kota Jakarta", **Jayakarta**, 27 Juni 1990, (Artikel ini memperoleh Juara Pertama **Lomba Karya Tulis Dalam Rangka Ulang Tahun Kota Jakarta ke-463**, Tahun 1990**).**
18. Muchdie, "Peremajaan Lingkungan Kumuh Bukan Sekadar Masalah Teknis", **Suara Karya**, 22 Juni 1990.
19. Muchdie, "Pentingnya Industri Kecil di Pedesaan", **Jayakarta**, 21 Juni 1990.
20. Muchdie**, "**Masalah Jakarta Bukan Hanya Tanggung Jawab Pemda DKI**", Jayakarta,** 14 Juni 1990.
21. Muchdie, "Kenaikan Harga BBM: Antara Konservasi dan Inflasi"**, Jayakarta**, 7 Juni 1990.
22. Muchdie, "Upaya Menuntaskan Masalah Asongan", **Media Indonesia**, 2 Juni 1990.
23. Muchdie, "LKMD, Memacu Partisipasi Masyarakat Dalam Pembangunan Desa"**, Jayakarta**, 1 Juni 1990.
24. Muchdie, "Rumah Petak Perlu Ditata"**, Jayakarta**, 29 Mei 1990.
25. Muchdie, "Kunci Sukses Pembangunan Pedesaan", **Suara Karya**, 22 Mei 1990.
26. Soesmarkanto dan **Muchdie**, "Pengembangan Kota Kecil Menahan Calon Urbanis**", Suara Karya**, 21 Mei 1990.

27. Muchdie, "Hari Bebas Tembakau Tak Cukup Dengan Imbauan"**, Jayakarta**, 18 Mei 1990.
28. Muchdie, "Lingkungan Pemukiman Kumuh, Perlu Ditata Bukan Digusur", **Jayakarta,** 12 Mei 1990.
29. Muchdie, "Membendung Arus Balik Pemudik: Perlu Terobosan Dalam Membangun Daerah Pedesaan", **Media Indonesia**, 23 April 1990.
30. Erwina W dan **Muchdie**, "Teknologi Untuk Kaum Wanita di Pedesaan", **Suara Karya**, 19 April 1990.
31. Komarudin dan **Muchdie**, "Pergeseran Pemikiran dalam Kebijaksanaan Pembangunan Perumahan", **Harian Pelita**, 5 September 1989.
32. Muchdie, "Mengatasi Kemacetan Lalu Lintas di DKI", **Media Indonesia**, 13 Mei 1989.
33. Muchdie, "Pasar Khusus Kaki Lima, Apa Betul Diperlukan?", **Harian Kompas,** 9 Mei 1989.
34. Muchdie, "Lingkungan Kumuh, Kemacetan dan Pembangunan Pedesaan**", Suara Karya**, 26 April 1989.
35. Komarudin dan **Muchdie, "**Dari Korsel ke Serpong", **Jayakarta,** 5 April 1989.
36. Muchdie, "Alih Teknologi Untuk Pengembangan Industri Kecil di Pedesaan", **Suara Karya**, 27 Maret 1989.
37. Muchdie, "Kasus Gubuk Derita: Renungan Bagi Perencana Pembangunan Kota"**, Suara Karya**, 1 Maret 1989.
38. **Muchdie** dan Komarudin, "Sistem Koordinasi Modul: Upaya Memenuhi Kebutuhan Perumahan Bagi Masyarakat Berpenghasilan Rendah", **Harian Kompas**, 24 Februari 1989.
39. **Muchdie** dan Komarudin, "Dilema Pembangunan Perumahan Untuk Masyarakat Berpenghasilan Rendah"**, Suara Karya**, 20 Februari 1989.
40. Muchdie, "Membangun Pedesaan Melalui Pengembangan Industri Kecil", **Suara Karya**, 1 Februari 1989, (Artikel ini memperoleh Juara Harapan II pada Lomba Karya Tulis dalam **Pameran "*Indoproduct '89***, diselenggarakan oleh Deperin, Deptan, BPEN-Depdag, Deparpostel, Kadin Indonesia dan Kompass Indonesia**).**
41. **Muchdie** dan Komarudin, "Strategi Pengembangan Kota Baru dan Kota Kecil"**, Suara Karya**, 23 Januari 1989.