Human Capital and Economic Growth in Indonesia

by

Yubilianto

DISSERTATION

Submitted in Partial Fulfillment of the Requirements
for the Degree of

Doctor of Philosophy in International Development

GRADUATE SCHOOL OF INTERNATIONAL DEVELOPMENT
NAGOYA UNIVERSITY

Approved by the Dissertation Committee:

Associate Professor Christian S. OTCHIA (Chairperson)
Professor Shigeru OTSUBO
Professor Tetsuo UMEMURA
Professor Kiyoshi FUJIKAWA

Approved by the GSID Faculty Council, March 3, 2021

ACKNOWLEDGEMENT

First and foremost, I would like to express my highest gratitude to Allah Subhanahu wa ta'ala, Lord of the world, for giving me abundant blessings and guidances on the right path. Prayers and peace be upon Muhammad sholallahu' alaihi wa salam, the last God's messenger, for his efforts delivering the God's revelation.

I am indebted to many people for making writing this dissertation easier and finishing my study at the Graduate School of International Development, Nagoya University joyful and unforgettable experience. Especially, I am deeply indebted to my former and current main academic supervisor, Prof. Kiyoshi FUJIKAWA and Prof. Christian OTCHIA, for their guidance, encouragement, and helpful suggestions when writing this dissertation.

I want to express my deepest gratitude to Prof. Shigeru OTSUBO and Prof. Tetsuo UMEMURA for sharing their knowledge and expertise. Their comments and suggestions broaden the horizon to further improve this dissertation. I also want to thank to all GSID’s faculty members and administrative officers for their helpful support during my study. Special thank to Assistant Professor Adam Smith for his proofreading so that this dissertation improves by leap and bound.

I sincerely would like to thank all of the Republic of Indonesia's people, through Indonesia Endowment Fund -Lembaga Pengelola Pendidikan (LPDP)- Ministry of Finance, for allowing me to continue my doctoral degree in Japan. Especially, I want to express my gratitude to Dr. Anies Said Basalamah, former Head of Education and Training Center for Human Resources Development, Financial Education Training Agency, Ministry of Finance, for his continuous support and guidance from the beginning of my study until finishing it. Furthermore, I am very grateful to Mr. Ganti Lis Ariyadi, Head of Scholarship Management Division, and Ms. Azah Widati, Head of Personnel Division, Mr. Bambang Sukurdi and Mr. Rukmana for their fast response and helpful support during my study.

Most importantly, I would like to thank my beloved mother and father, my mother-in-law, and my sister and brothers for their infinite support and prayers to me to be able to finish this study. I am also very grateful to my beloved wife and my lovely kids, Medina, Nadine, and Fathan, for accompanying me and supporting me throughout everything.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

OLS	: Ordinary Least Square
IFLS	: Indonesia Family Life Survey
IFLS-1	: Indonesia Family Life Survey wave 1
IFLS-2	: Indonesia Family Life Survey wave 2
IFLS-3	: Indonesia Family Life Survey wave 3
IFLS-4	: Indonesia Family Life Survey wave 4
IFLS-5	: Indonesia Family Life Survey wave 5
SWE	: Synthetic Work-Life Earning
IRR	: Internal Rate of Reture
BEP	: Break-Even Point
NPV	: Net Present Value
RAND	: Research and Development
ASEAN	: Association of Southeast Asian Nations
GDP	: Gross Domestic Product

CHAPTER 1 INTRODUCTION

1.1 Background

As one of the developing countries, Indonesia has both abundant natural resources and human resources. From the ’70s to the ’80s, Indonesia depended heavily on oil and gas resources as a primary fund to gear up economic activities. Currently, with around 266.9 million people as of 2019, Indonesia relies more on other potential factors of production, namely the labor force, as an economic growth machine. As a result, human resources management becomes essential so that it can be optimally utilized. Increasing its ability to accumulate human capital through formal education is one of the most popular methods.

According to the United National Development Program (UNDP) Report 2019, the mean years of schooling in Indonesia is around 8.0 since 2016. This number indicates that there was a more than two-folds increased compared to the last two decades. Having higher education means having more knowledge and skills. Therefore, it is supposed to bring positive values.

The increasing number of the mean of years of schooling is mainly due to the role of government’s effort as mandated in the Constitution. Starting from the early 2000s, the government has already provided more spending in the education sector than the previous budgets with an increasing rate. At least around 11.4 percent of the government budget was dedicated to education in the year 2001. The number was gradually increased to 14.3 percent in the following year and 16.0 percent in the next year. At least twenty percent of the government expenditure was allocated to the education sector since 2009 to provide better education for all citizens.

To some extent, the government tries to provide better education because having more educated people in society will give more benefits. Those advantages include increasing efficiency and creating better environment. Accounting for all of the various parameters, sooner or later, the state will obtain better productivity, which leads to higher output. However, there is no clear picture of the extent of human capital investment, especially in terms of education, will affect the country or different regions' economies.

Meanwhile, Badan Pusat Statistik Indonesia (Statistics Indonesia) exhibits that the average percentage of monthly education expenditure to total non-food spending per capita from 2000 to 2015 was around 8%, while the amount increases around 16% per year. This relatively large portion of spending is one of the primary considerations for parents to have their children attained a specific education level, especially for higher education.

This condition worsens when the head of the household has several children that should be nurtured. Having a higher level of education means that a person needs to sacrifice more money and time. On top of that, the cost of having higher education or tertiary education, to some extent, is considerably high. On the other hand, the earnings benefit of having a higher degree is still uncertain, while the expenditure incurred is unavoidable.

1.2 Problem Statement

There are some debatable issues regarding the impact of education on economic growth. While some scholars argue that human capital investment in a form of education significantly improves the economy, some disagree. For example, the prominent studies of Barro (1991), Mankiw et al. (1992), through using ordinary least square (OLS) on a cross-country analysis, found that education, as a human capital investment, significantly improves output. Similarly, a more recent study from Hanushek and Woessmann (2008) also supports the argument that education significantly affects economic growth. While Barro (1991) and Mankiw et al. (1992) use enrollment rate to approximate the human capital stock, the latter depends on average years of schooling. Meanwhile, some scholars such as Benhabib and Spiegel (1994), as well as Pritchett (2001), argue that education did not significantly impact the economy. To some extent, this inconclusiveness needs further study with more recent data to clarify human capital investment's impact on economic growth.

For almost the last two decades, Indonesia has tried to focus on leveraging economic growth by investing human capital by increasing educational spending. To some extent, an in-depth study of the impact of educational investment in Indonesia will be necessary to evaluate the result. Therefore, the government can identify whether or not government expenditure on education has improved Indonesia's economy.

Similarly, what kind of education policy should be made by the government is another critical issue. Basically, education spending consists of two components: either consumption or investment. Therefore, the proper allocation of that expenditure will also determine its optimization. To evaluate that kind of policy, a macroeconometric model for Indonesia’s case concerning human capital investment is essential. To the best of the author’s knowledge, there is no model specially designed to capture the investment in human capital to Indonesia's economy. Therefore, this study also tries to build a macroeconometric model for Indonesia that elaborates on the role of human capital investment in Indonesia's economic growth to evaluate the policy on government educational investment.

Despite the puzzle of the education investment impact on the economy in terms of a macro perspective, as explained previously, the impact of education investment from individuals or micro perspective is also substantial and needs more attention. Card (1999) argued that having a higher level of education will eventually lead to a better career and higher earnings from an individual point of view. To some extent, this is quite reasonable. Despite typical patterns that income increases following the length of work at a decreasing rate, there is also a tendency that skilled workers earn more than unskilled workers (Becker, 1962). This skill can be obtained either through on-the-job-training or schooling. It indicates that investment in education affects income positively to some extent. However, not all people can afford to go for schooling because of financial reasons, especially in developing countries (Chimombo, 2005). Chen (2002) explains that education investment is risky because of the difficulties in predicting estimated income and unemployment possibilities. As a result, parents, like investors, tend to expect a higher rate of return on compensate for this risky investment.

Elaborating those multiple, macro and micro, perspectives, this dissertation is designed to provide some insight into human capital and its impact on the economy from those two angles. To make this study flow more smoothly, the analysis will start from a micro point of view. First, this research will discuss the extent of the advantages of having more education in Indonesia. Therefore, we will focus on the benefit of having more education in both percentage and financial value for the individuals. From a broader perspective, as previously described, this study will try to expose the impact of government education spending on the economy. In this part, this study tries not only to examine the extent of education investment's impact on the economy but also to investigate the impact of education expenditure policy on the economy.

1.3 Objectives and Research Questions

Referring to the title of the dissertation, "human capital and economic growth in Indonesia," the main objective of this research is to analyze the impact of human capital on economic growth in Indonesia. In general, this study will analyze human capital from two different perspectives. First, it will be from the individual point of view: the impact of education on individual earning. The other is from a higher level, that is, from the country level and regional level.

In order to attain those objectives, following questions will be addressed to be answered as follows:

Question 1

To what extent does the investment in education affect individual earning?

a. How much is the return to education in Indonesia?

b. How much is the financial value of higher education in Indonesia?

Question 2

To what extent does human capital investment impact economic growth in South East Asia countries (ASEAN)?

Question 3

What is the impact of government education expenditure on the economy?

1.4 Analytical Framework

This dissertation is designed to discuss and analyze human capital and its impact on the economy through multiple perspectives and different methodologies. Therefore, by observing both micro-perspectives and macro perspectives, this research is expected to provide a thorough and robust contribution to the research on human capital's role in economic growth. Even though other aspects, such as health investment, also contribute to human capital stock accumulation, this dissertation only focuses on education as a primary proxy for the human capital indicator.

Specifically, this research will first find the impact of human capital investment through education on individual earning. This step will analyze and discuss the return to education and the financial value of education in Indonesia. To analyze the return to education in Indonesia, this research implements two methods, namely, the short-cut method and the earnings function method (also known as the Mincer earning equation)[1]. The short-cut method is a simple method to approximate the return to education by comparing the difference of earnings among different levels of education and time spent to attain that additional education. However, constructing an

---

[1] The terminology of the Mincer earning equation is widely used and more prominent in various literature; hence the earning function method will be written as the Mincer earning equation method for the rest of this dissertation.

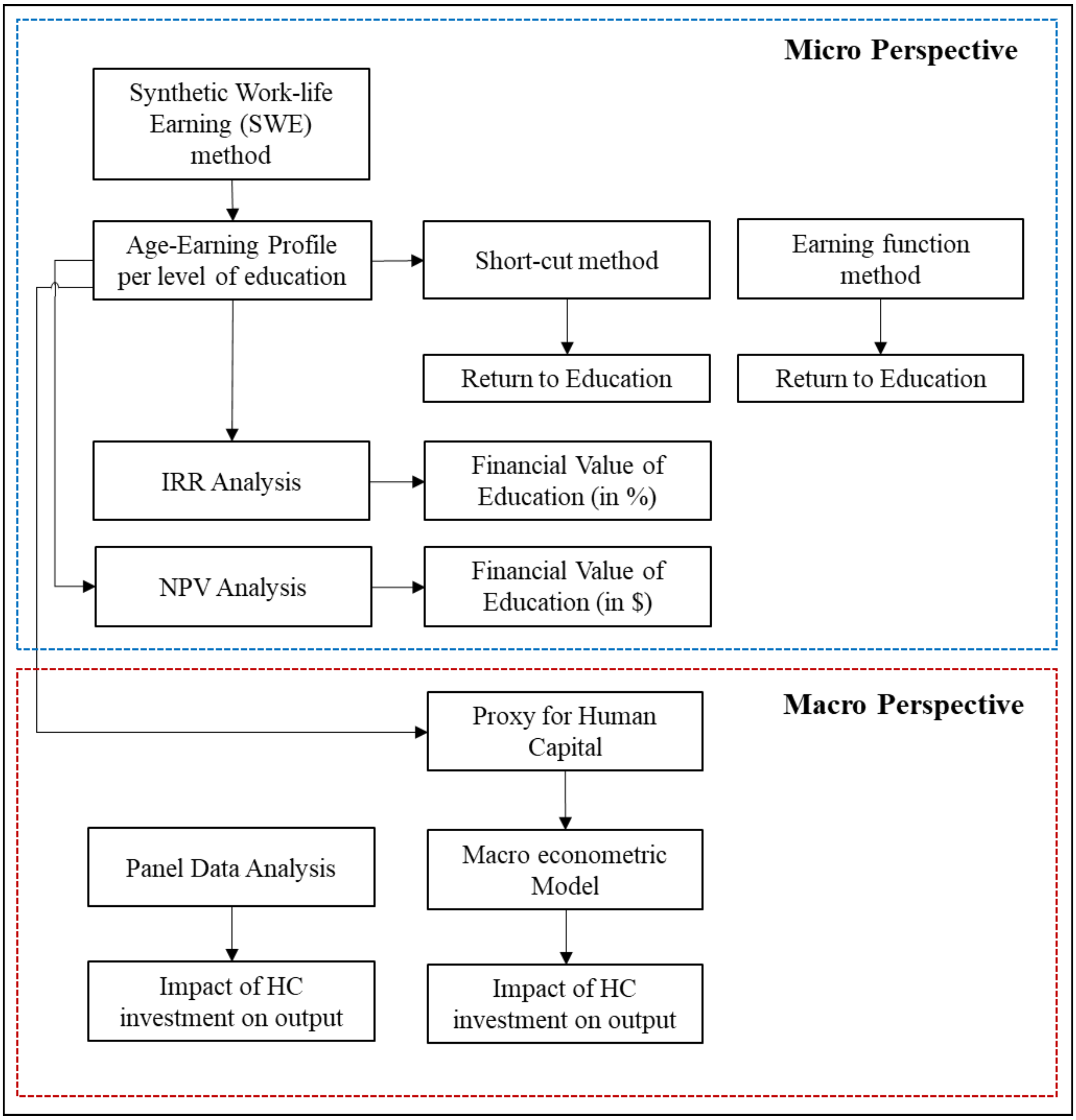
age-earning profile for a different level of education requires the Synthetic Work-life Earning (SWE) method.

On the other hand, to analyze the financial value of education in Indonesia, this study will apply the Internal-Rate of Return (IRR) analysis and Net Present Value (NPV) analysis. Basically, these analyses are an extension of the short-cut methods. These two analyses combine the age-earning profiles per level of education with the real cost of attaining the specific level of education. Considering some limitations of data availability, only higher education will be examined in analyzing the financial value of education in Indonesia. While the short-cut method is more likely a substitution to the Mincer earning equation method, the IRR and NPV analyses can complement the short-cut method. Therefore, altogether they will enhance the analysis of the impact of human capital investment from an individual point of view.

The second step is analyzing human capital investment and its impact on economic growth. In this part, we will focus on a broader perspective. For this part, this study will apply two different approaches. Firstly, this research will employ a panel data analysis. This analysis is used to measure the extent of the impact of education investment on economic growth. Secondly, this research will implement a macroeconometric model analysis to examine the impact of government education spending on Indonesia's economic growth. It helps enhance the analysis from the first approach as the macroeconometric modeling allows us to investigate more detailed information about the transmission mechanism from education spending to the economy. In this step, some simulations will be performed to evaluate the impact of education spending and other variables on the economy in Indonesia.

In sum, Figure 1.1 can guide the readers to visualize the analytical framework of this dissertation.

Figure 1.1 Analytical Framework of the Dissertation



Source: Author's creation

1.5 Research Significance

Education is necessary and inevitable in our daily life. Either governments or individuals allocate parts of their budget for education. However, the amount of education spending from both parties tends to increase. Therefore, the benefits in terms of monetary value might be decreasing. To some extent, the education cost might exceed its benefit. This dissertation examines the impact of education expenditures as a form of human capital investment on the economy from both government and individuals' perspectives.

On the one hand, the study provides new evidence of the importance of human capital investment to the government and the individuals through elaborating new data and methodologies. We apply the newest and currently available data, such as Indonesia Family Life Survey wave 5 (IFLS-5), and combined methodologies to determine the return to education and the impact of government education spending on Indonesia's economy. Therefore, this study serves as an addition to the literature in education and human capital.

On the other hand, due to Indonesia's lack of the macroeconometric model dealing with human capital in Indonesia, the establishment of a simple macroeconometric model dealing with human capital in this dissertation will initiate the understanding of the transmission mechanism of education expenditures to the economy.

1.6 Research Methodology

To obtain the best possible conclusion when answering the objectives, five methodologies will be implemented in this dissertation. These five methodologies will be clustered into three groups to solve three main analysis chapters in this dissertation. They are as follows:

1.6.1 Return to Education and Financial Value of Higher Education in Indonesia

Investing in education should be considered as thoroughly as possible as it implies that some money should be spent and time should be consumed. As a consequence, investing in education can be seen as investing in other assets. Therefore, one should thoroughly calculate the economic value of one's investment.

This dissertation will implement two methods to examine the return to education in Indonesia, namely the short-cut method and Mincer earning equation method (earnings function method). Additionally, we also calculate the financial value of higher education in Indonesia to examine the return to education in monetary value.

1.6.1.1 The Short-Cut Method

Although calculating the return to education using the short-cut method is simple, constructing a proper age-earning profile by the level of education requires more effort. As a consequence, many studies utilize the latter method as this Mincer earnings equation depends on conventional econometric analysis. This research uses the short-cut method analysis, which relies on synthetic work-life earning to construct a proper age-earning profile by different education levels.

1.6.1.2 Mincer Earning Equation Method

This analysis implemented OLS regression on the Mincer earnings equation to examine the return to education in Indonesia. Principally, this method is used as a benchmark for the previous method as the Mincer earning equation method is widely used in many research. Furthermore, we also use Two-Step Heckman Estimates to handle the sample selectivity bias.

1.6.1.3 Financial Value of Higher Education

To investigate the financial value of higher education in Indonesia, this study implements the Internal Rate of Return (IRR) and Net Present Value (NPV) methods. These methods are used to obtain a particular value from the return of future investment in a certain period. While the IRR focuses on the rate of return in percentage, NPV determines the real value of the investment in a certain period after considering a specific interest rate.

1.6.2 Panel Data Analysis on Human Capital and Economic Growth

This part is dedicated to examining the impact of human capital investment on economic growth using data observation in multiple Southeast Asia countries by using panel data analysis. Panel data analysis is also known as cross-sectional time-series data analysis that allows us to observe multiple units in different periods (Kennedy, 2003).

1.6.3 Macroeconometric Model on Human Capital in Indonesia

This study aims to analyze the impact of human capital accumulation on economic growth in Indonesia through macroeconometric modeling analysis. In order to do so, this study will first design a macroeconometric model from the supply side as a neoclassical production function. Analyzing human capital should start from the supply-side. We assume that the human capital investment will increase the quality of labor (L). Moreover, human capital investment is considered as a long-term investment rather than a short-term one as its impact on the economy can be perceived several years later. The demand side function is also utilized using Keynesian analysis, where the government policies can be applied and analyzed.

This model will be a small yet compact macroeconometric model which consists of 54 variables where 32 are endogenous, and 22 are exogenous. These variables are classified into 32 equations, of which 25 are behavioral, and 7 are identities. All of the equations are estimated by using the OLS.

1.7 Data Sources

Overall, there will be three central chapters that in this dissertation. Since each chapter will represent a different perspective to draw the main conclusion, each chapter will use different data sources. Subsection 1.7.1 to 1.7.3 explain the data used in each core chapters.

1.7.1 Return to Education and Financial Value of Higher Education

Mainly, the data sources that will be used are from the IFLS-5, which was conducted in 2014-2015. Initially, the first IFLS was conducted in 1993. It covers a relatively large sample data of 16,204 households spread across 13 provinces out of 34 provinces in Indonesia on the islands of Java, Sumatra, Bali, West Nusa Tenggara, Kalimantan, and Sulawesi. These areas approximately represent 83 percent of the Indonesian population and much of its heterogeneity. The IFLS-5 itself covers 50,148 individuals across those provinces. Its richness in respondents' data makes it useful for data analysis.

Other than IFLS-5 as a primary data source to find the return to education in Indonesia either through the short-cut method or the Mincer earning equation method, this study also combine other data. Other necessary data such as tuition fees from the Ministry of Research, Technology, and Higher Education decree number 22/2015 and various student expenses from Wicaksono and Friawan (2011) will also be implemented.

1.7.2 Panel Data Analysis on Human Capital and Economic Growth

For this analysis, all data are obtained from World Development Indicators published by the World Bank. We also use financial report from the Ministry of Finance of Republic of Indonesia for Indonesia’s case.

1.7.3 Macroeconometric Modelling for Human Capital

In this chapter, we combine several data. Some data are gathered from World Development Indicators, which was published by the World Bank. The other data are extracted from the Statistic Indonesia and the Ministry of Finance of the Republic of Indonesia.

1.8 Structure of the Dissertation

This dissertation will be presented in seven chapters in total. The first chapter is the introduction, which is followed by the literature review in the second chapter. The third chapter will discuss the education system of Indonesia. This chapter will explain the Indonesian education system and higher education costs in Indonesia.

After those three preliminary chapters, another three analytical chapters will be presented from Chapter 4 to Chapter 6. The last chapter is Chapter 7, which concludes all the analysis findings in Chapter 4, Chapter 5, and Chapter 6, and makes some policy recommendations.

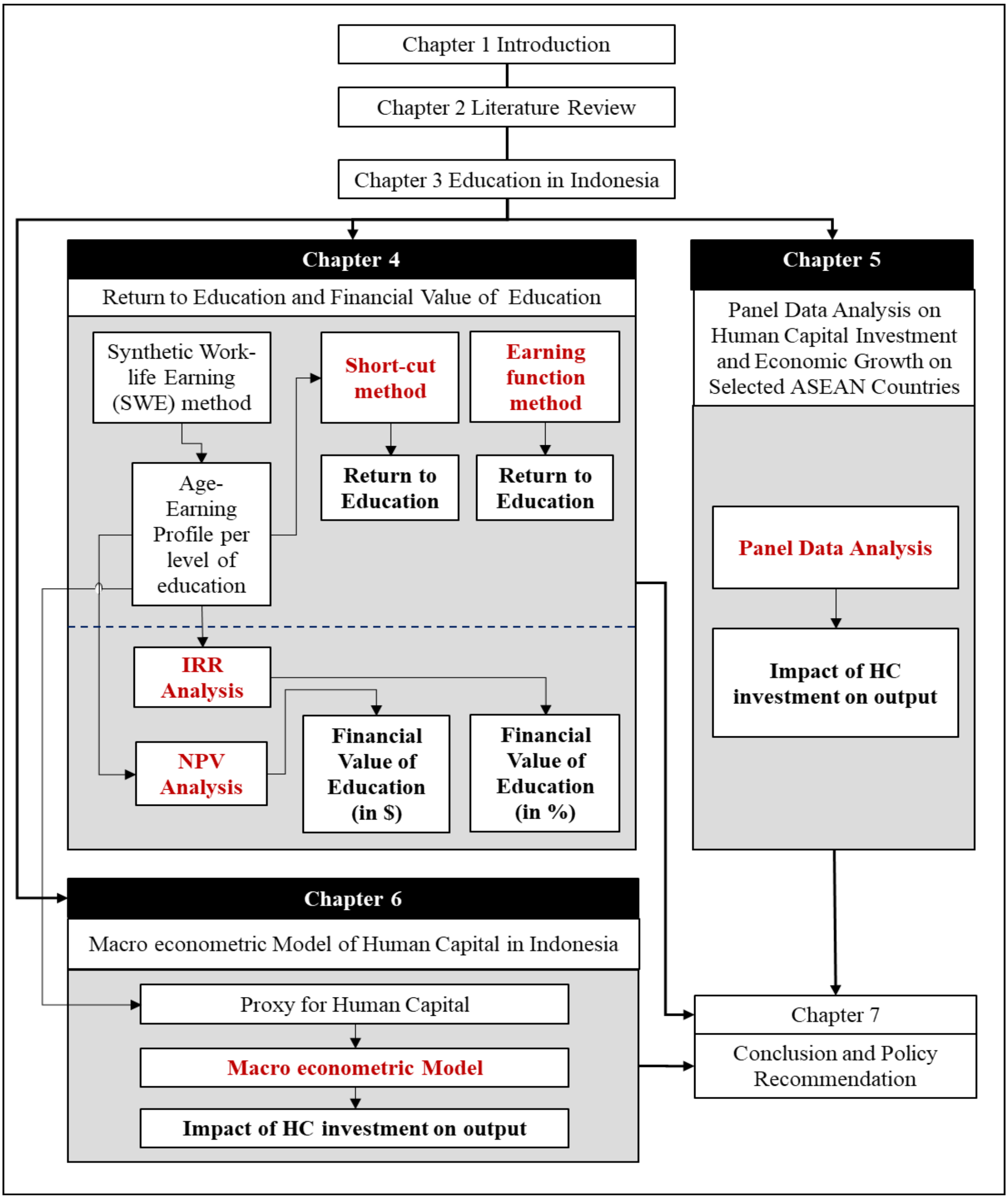
In general, the three analytical chapters are designed to analyze the impact of human capital investment from different perspectives and methods. Chapter 4 is dedicated to examining the impact of human capital investment from an individual perspective through finding the return to education. Two methods will be applied to find the return to education in Indonesia, namely the short-cut method and the Mincer earning equation method. Those two methods act as a substitution as they differ in approaches but have a similar purpose: they are intended to examine the rate of return to education. As a complement, Chapter 4 will also examine the exact value of higher education in Indonesia by finding the yields of all costs invested in higher education.

Meanwhile, Chapter 5 and Chapter 6 are dedicated to examining the impact of human capital investment from a broader perspective. Although both chapters try to investigate the impact of human capital on economic growth, Chapter 6 complements Chapter 5. While Chapter 5 does not clearly explain how education spending affects economic growth as it relies on the reduced-form, Chapter 6 is based on a structural equation. By implementing a structural equation when designing the macroeconometric model in this chapter, we can investigate the transmission mechanism from education spending to the economy. In some points, Chapter 6 also elaborates on the findings in Chapter 4 to approximate the human capital stock.

To sum up, all findings from those three analytical chapters will be elaborated on to form conclusions and policy recommendations. Figure 1.2 describes the detailed structure of the chapters in this dissertation, including the linkage between the three analytical chapters. For additional information, all boxes indicate a chapter in this dissertation. Since there are seven chapters, there are seven main boxes.

The three boxes with bold font and black highlight refer to three analytical chapters. Inside those three boxes, there are other boxes and some arrows explaining the analytical framework, which resembles Figure 1.1. The boxes with bold red font indicate the methods used, while the boxes with bold black font indicate the final purposes or the results.

Figure 1.2 Structure of the Chapters



Source: Author's creation

CHAPTER 2 LITERATURE REVIEW

2.1 Definition and Measurement of Human Capital

Not until the 1960s, did economists elaborate on the concept of human capital with regards to the production function along with land, capital, and labor. The concept of human capital itself might be traced back to the time when Adam Smith profoundly explained the significant aspect of financial spending for individuals in the society to gain some useful skills as it will be embodied as a form of capital within themselves (Smith, 1776).

The terminology of human capital itself became popular as this element is believed to be the most vital variable to describe the unexplained part of production function besides land, capital, and labor. For example, Schultz (1961) argued that human capital investment might explain the difference between the significant increase in output and the increase in land, labor, and capital.

In other cases, the definition of human capital and its measurement is still arguable as there is no consensus among researchers. For example, the World Bank defined human capital as the individuals' ability that gives benefit to economic production (World Bank, 2006). Similarly, OECD introduced human capital as the property attached to human beings in the form of intellectuality, ability, and expertise (OECD, 2007).

Goldin (2016) simply defined that human capital is some of the intangible production factors attached to labor that can stimulate additional output. Those intangible factors refer to a set of skills and knowledge obtained by learning through schooling and working as well as health factors (Becker 1962; Schultz 1961). In this case, the keywords for human capital explained in the literature link to education and health, as these factors are embodied in individuals and determine their capacity in the economy.

With the importance of human capital often considered as a nation's intangible asset, many experts from different nations try to find the standard that can be is easily measured yet capable of identifying the level of human capital accumulation status effectively and efficiently. This factor is crucial for policymakers to analyze policy implications. Therefore, how we measure human capital is another substantial problem.

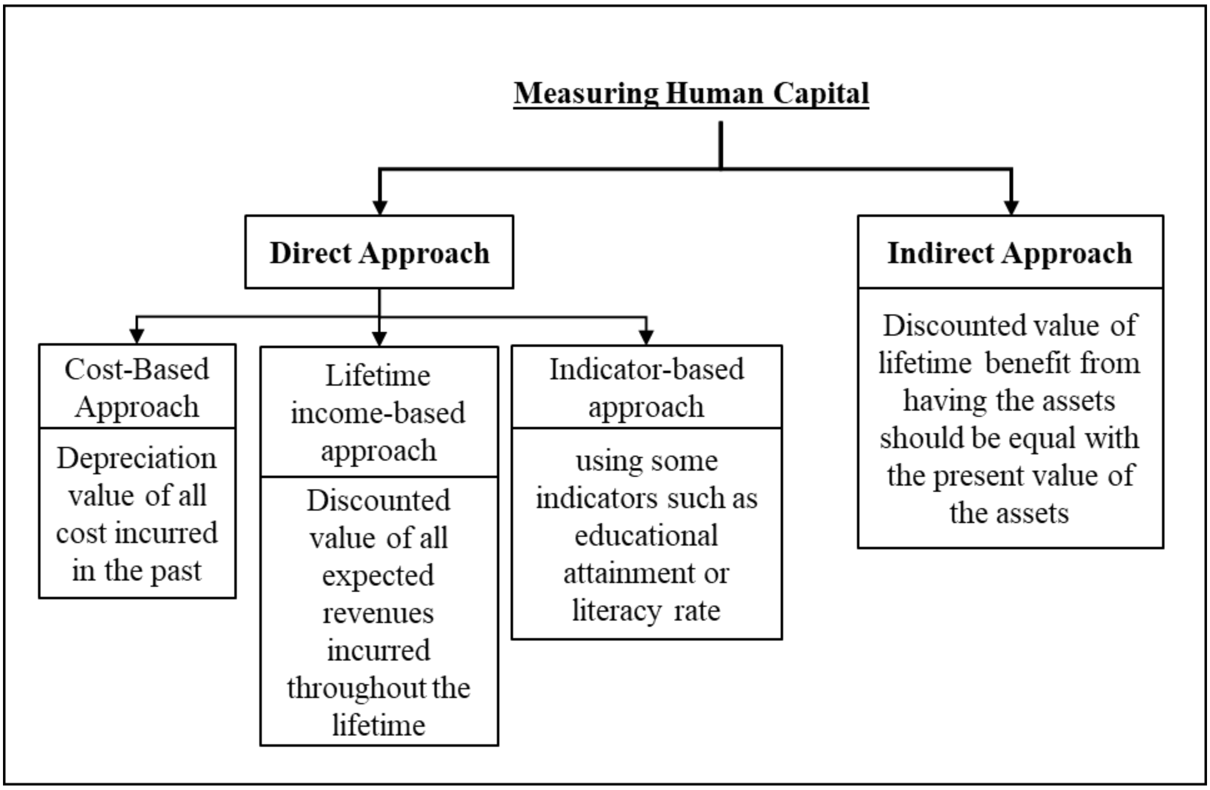
Several approaches can be used as guidelines to measure human capital. UNECE (2016) classified some techniques to measure human capital into two main parts: direct and indirect approaches. While direct approaches consist of multiple methodologies and mainly calculate the human capital stock from various sources, the indirect method is more straightforward.

The latter was advocated by the World Bank (2011), which presumes the break-even value, that is, the discounted value of lifetime benefits from having the assets should be equal with the present value of the assets (see World Bank, 2011). Meanwhile, the direct approaches can be classified into three categories: the cost-based approach, the lifetime income-based approach, and the indicators-based approach.

The cost-based approach measures the human capital stock by calculating the depreciation value of all costs incurred in the past. The keyword is finding the depreciation rate to measure the investment in human capital. On the other hand, the lifetime income-based approach relies on the discounted value of all expected revenues incurred throughout the lifetime of the population. Therefore, this method focuses more on the output generated than input as used in the cost-based approach. Some literature used this method, such as Jorgenson and Fraumeni (1992).

The last is the indicator-based approach. This approach is the most convenient in terms of usability as it only measures the human capital investment by using some indicators such as educational attainment or literacy rate. An example of well-known literature that utilizes this approach is Barro and Lee (2013). Figure 2.1 displays the guidelines to measure human capital published by the UNECE.

Figure 2.1 Guidelines for Measuring Human Capital



Source: UNECE (2016)

2.2 Human Capital and Economic Growth

In the 1950s, some researchers found that investing in human capital brought a more significant result to raise individuals’ wages than other production factors such as land, capital, or labor force (Hornbeck and Salamon, 1991). Consequently, many modern scientists try to find the relationship between human capital and economic growth and its impact on growth.

In fact, based on the Solow Model[2] that is mainly used by many researchers to investigate economic growth, the increase in capital stock as the main component in production function is never capable of explaining the increased output per labor in the long-term. This model mainly tries to explain the production function through some components, namely output

2 This model was also known as Solow-Swan model as in Solow (1956) and Swan (1956)

(Y), capital (K), labor (L), and "labor effectiveness" (A) that can be written in the light of time (t) as follows:

$$Y(t) = F(K(t),A(t)L(t)) \tag{2.1}$$

Based on that equation, the output cannot change over time unless the capital or labor as input factors change. This model posits a conventional neoclassical way of thinking, which presume constant returns to scale and diminishing return on capital. By assuming a fixed number of capital and labor throughout time, the output cannot increase unless there is a change in labor effectiveness (A) as a reflection of the increase in knowledge. Therefore, to some point, there will be no more increase in the output unless there is a productivity improvement. As this model relies on the pace of technological progress to increase labor productivity, this model is also known as labor-augmenting or Harrod-neutral. This productivity, in particular, only counters the decrease of output as the capital wears out. Thus, it simply cannot explain the significant differences in output growth in a cross-countries analysis.

Based on the simple Solow model as previously explained, Mankiw et al. (1992) introduced another component to explain those differences: that component was human capital. By assuming a standard Cobb-Douglas production function, the addition of human capital (H) into the Solow with the labor-augmenting model can be written as follows:

$$Y_t = K_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta} \tag{2.2}$$

where α, β, and (1-α-β) refers to coefficients which explain the magnitude of change in output in light of respective inputs. Similar to the original Solow model, this human-capital augmented Solow model also assumes constant returns to scale and diminishing return on capital. Based on this model, human capital, as one of the main components in the production function, affects the increase in output growth through the accumulation of its stocks[3]. Consequently, the difference in output growth rate in a cross-country analysis will vary primarily due to the different pace of the human capital stock accumulated throughout time.

On the other hand, other studies also reveal the possibility that human capital affects growth through technological advancement[4]. In this case, human capital stock is not treated as a direct factor that affects output as it does in the previous model. Nelson and Phelps (1966) are among the pioneers who argue the importance of educational attainment, which refers to human capital accumulation to deal with technological advancement.

It is still debatable about how and through which channel human capital accumulation enhances total production and growth. However, the importance of human capital investment to promote economic growth is undeniable based on vast literature (Barro and Sala-i-Martin, 2003; Lucas 1988; Mankiw et al. 1992).

Many empirical studies show the positive impact of human capital accumulation on economic growth. Mainly, those researchers conducted their research through cross-countries analyses. For instance, Barro (1991) argues that human capital accumulation significantly supports the production function. Similarly, Mankiw et al. (1992) tested the positive impact of human capital on growth as an essential factor in the production function. Typically, most papers use education as an indicator. By using the panel data, it is mainly found that the difference in the years of schooling positively affects growth (Bloom et al., 2006; Cohen and Soto, 2007).

---

[3] In various literature, the channel of which human capital affects the output in the economy is through accumulation of its stocks, referred to as the "factor-accumulation channel".

[4] Some studies use the terminology "productivity channel" explain the way human capital affects growth indirectly through the improvement of productivity.

However, other studies reveal that there is no clear evidence that human capital accumulation contributes to economic growth for the cross-country analysis. For example, Benhabib and Spiegel (1994) argued that human capital accumulation changes could not explain the change in the change in the economy. The same result was also exposed by Islam (1995) as well as Pritchett (2001). They revealed the change in the stock of human capital failed to demonstrate the variation in economic growth in the cross-country growth rate.

Other than using cross-country data analysis, Li and Wang (2016) used Chinese provincial-level panel data and found no clear evidence of human capital's impact on economic growth neither via the factor-accumulation channel nor through the productivity channel in the Chinese economy.

2.3 Education and Private Rate of Return

Currently, micro-data is abundantly available for some countries to calculate the return to education. The most popular method to derive the rate of return on schooling is by applying an earnings equation, which Mincer (1974) introduced, who argues that one's log earning is a function of years spent on education and the quadratic function of one's experience. Using 1960 US Census data, he found that the return to education is 10% while the experience was around 8%. This equation became a widely-accepted instrument to examine the relationship between education and earnings because of its simplicity. Thus, plenty of researchers apply this methodology.

For instance, George Psacharopoulos, as one of the most prominent researchers on the topic of return to education, frequently uses the Mincer earnings equation. He found that generally, the return to education is positive, around 10% across countries. High-income countries tend to have lower return to education compared to that of low or middle-income countries; and males are likely to have a lower rate of return on schooling compared to their female counterparts (see Psacharopoulos [1985], Psacharopoulos [1994], and Psacharopoulos and Patrinos [2004]).

Montenegro and Patrinos (2014), based on the World Bank's World Development Report, which covered 139 countries from 1970 to 2013, found that the return on schooling is 10.1% on average. In a more recent year, Patrinos (2016), through the Mincer earnings equation and years of schooling as a proxy for education, exhibits that the average returns to education are around 5% to 8% globally. However, by using the level of schooling, he found that higher education's global returns are approximately 17% on average. This tertiary education level yields the highest rate, whereas the second position is the primary level, and the secondary level is the last. One of the latest studies indicates almost a similar result that the world average returns to education are around 8.8% (Psacharopoulos and Patrinos, 2018).

Currently, Indonesia also provides a considerable amount of micro-data, which allows examining the return to education. By combining these micro-data and the prominent Mincer earnings equation, many studies have been conducted to investigate the rate of return to education in Indonesia. For example, Deolalikar (1993) used the combination of the National Socioeconomic Survey (SUSENAS) from 1987 and the Village Potential module of the Economic Census from 1986 to analyze the demand for schooling as well as return to education. In particular, this study found that the return on schooling for primary school is around 10%, while secondary and tertiary education tends to yield higher returns of up to 20%.

Another study was conducted by Duflo (2001), who found that the rate of return to education in Indonesia is about 6.8% to 10.6%. Instead of using years of schooling or educational attainment as a proxy for education, she used variation in education generated by Indonesian government school construction programs during the 1970s. Similarly, Comola and Mello (2013) also uses the same proxy as an instrumental variable to avoid endogeneity issues. They combined those data with the National Socioeconomic Survey (SUSENAS) from 2004 and found that the return to education in Indonesia ranges from 9% to 10.8%.

Patrinos et al. (2006) found that the average return on schooling in Indonesia is around 11.4%, while the average return to education for East Asia is approximately 14.5%. They applied quantile regression to investigate whether an investment in education adversely affects income distribution by analyzing some countries in East Asia and Latin America.

Purnastuti et al. (2011) used two data sets from the IFLS, which was conducted in 1993 (IFLS-1) and 2007-2008 (IFLS-4), to examine the declining rate of return to education. The results showed that the return on schooling slightly decreases across all education levels except for higher education. The return on tertiary education for females rose from around 5.1% in 1993 to 8.7% in 2007/2008 while males slightly increased from 6% to 6.8%. Using the same IFLS 4 data, Dumauli (2015) found that the return to education in Indonesia was between 10% and 12% by using OLS. When she implemented the Household Fixed Effect method using sibling data, the return to education significantly dropped to only 5%.

Other than implementing the Mincer earnings equation, we can also utilize the full discounting method to measure the rate of return to education. The full discounting method is a process of finding the discount rate that satisfies the flow of discounted benefits against the sum of expenditures at a specific point in time (see Psacharopoulos and Mattson, 1998). It follows the typical human capital theory, which indicates that a return determines a person's decision to invest in a specific level of education. The return can be obtained by comparing the discounted value of the expected future benefit from a person with a specific level of education and the costs of enrolling at that education level, including opportunity cost (Becker, 1964).

The main hindrance to implementing the full discounting method is a lack of availability of reliable data. Hitherto, no longitudinal data exists that captures the same individuals with the necessary information to calculate their exact work-life earnings to examine the expected rate of return of investment in education.

However, there are some methods to construct age-earnings patterns to calculate the expected work-life earnings. For example, Psacharopoulos (1995) constructed the total expected work-life earnings by using the mean of earnings at a specific age and level of education. In his research, he used 1,989 household survey data in Venezuela and found that return to education for primary, secondary, and tertiary schools are 29.4%, 10.2%, and 12.4%, respectively.

On the other hand, Kantrowitz (2007) implemented a synthetic work-life earnings (SWE) method to study expected work-life earnings when examining the profitability of investment in tertiary education in the United States (U.S.). In his research, he used the mean of earnings to approximate the work-life earnings. By combining the expected work-life earnings and data of average out-of-pocket cost, he found that investing in higher education yields more than 27% of financial value.

The SWE method was initially designed by the U.S. Census Bureau to approximate the earnings of individuals within groups or sub-groups. This methodology can be used to observe the work-life earnings gap between individuals through education attainment levels.

2.4 Macroeconometric Modeling Analysis

Macroeconometric modeling applies the simultaneous equation method due to its nature. Typically, it contains a set of mathematical equations, either behavioral or identity-based, representing the relationship among macroeconomic variables simultaneously (Valadkhani, 2004). Generally, this macroeconometric modeling technique is designed to analyze a policy implication or predict the trend of some vital elements in macroeconomic indicators. Therefore, macroeconometric modeling can be an ideal and useful tool for policymakers, such as government officers, to analyze and evaluate policy.

Jan Tinbergen first introduced and designed the macroeconometric modeling technique to draw the Dutch economy's business cycle model by using economic theory in 1936 (Kol and Wolff, 1993). Later, the macroeconometric modeling techniques became popular in the early

1950s after Klein (1947) implemented the Cowles Commission approach and designed a small macroeconometric model for the United States.

The techniques became more popular and grew substantially in the United States in the 1960s when large-scale models were developed for forecasting purposes (Bodkin et al., 1991). However, as the model became more massive in the 1970s, it failed to predict the oil crisis's impact in the year 1973. As a result, this methodology got criticized, for example, by Lucas (1976) and was no longer able to maintain its popularity. He claimed that the model's failure to predict the shock was due to the inadequate theoretical framework.

Another critique also fell into the flaws of implementing a pure Keynesian theory into the model, which only focused on the demand side and did not consider the supply side to elaborate on the economy's long-term impact. Therefore, some researchers try to combine supply-side factors to consider production function as a long-term element determinant.

Moreover, since the Computable General Equilibrium (CGE) model emerged, the macroeconometric modeling techniques have become less and less popular. Both the macroeconometric modeling technique and the CGE are almost similar in terms of functionality. They are tools to analyze and evaluate the impact of policies. However, these two methods have a different approach. While macromodeling uses a macro approach, the CGE uses a micro approach.

Although the concept of macroeconometric modeling, which combines economic theory and some econometric methodology, was prevalent in the United States and other developed countries, the development of this model in developing countries has its own barriers. For example, the lack of recording in developing countries makes it more challenging to find proficient and sustainable data. Moreover, some volatile and unstable conditions and ad-hoc policies make it worse to form a robust macroeconometric model for forecasting and analysis. The other issue was related to the limitation of the reliable macroeconometric model in the published papers, as mainly the model was privately made and used by government organizations for their policy analysis tools (Akbar and Ahmad, 2014).

In Indonesia, several macroeconometric models have also been constructed, which are available in the published literature. For example, Fukuchi (1968) first tried to capture the Indonesian economy into a macroeconometric model. In the 1970s, the application of the macroeconometric model in Indonesia also gradually increased. Several researchers tried to develop the model for the Indonesian economy, such as Boediono (1979), who designed a macroeconometric model for the financial sector based on quarterly data. He used OLS when estimating the model, which consists of 32 equations (18 are behavior and 14 are identities) by using quarterly sample data from the second quarter 1969 to third quarter 1976. Despite the different points of view and methodologies among researchers when designing the model, there is a similarity within these works focused on the short-term, demand-side function.

Kobayashi, Tampubolon and Ezaki (1985) established a model for the Indonesian economy, which elaborated supply-side theory, considering long-term properties. It consisted of 73 equations with 55 equations depicting the real sector, and the rest reflecting the monetary sector. This model was estimated by using the OLS.

Other works are mainly designed for a specific purpose in some dissertation or thesis. For example, Pangestu (1986), designed for a small open economy, consisting of 8 behavioral equations and 9 identities in her thesis. Her paper discusses the model for Indonesia as an oil-exporting country and its implications. Another study from Muhdi and Sasaki (2009) also constructed a model to analyze the impact of external and domestic financial obligations by using annual data from 1991 to 2006, through a macroeconometric modeling perspective.

The macroeconometric modeling itself, as previously mentioned, is designed to observe how the economic system works as well as find the relationship between the elements through using some behavioral equations and identities (Akbar and Ahmad, 2014). Therefore, we can use it to analyze policies and make a forecast by applying some policy scenarios.

Pandit (2000) describes some criteria to build an excellent macroeconometric model. First, the design should follow the conventional theory. It means how all elements in the model interact and behave should follow a basic theoretical framework. Second, the model should consider all macroeconomic variables' relationships. Third, to give a robust result, appropriate data input should be utilized. Fourth, choosing the best econometric analysis to estimate the model is essential. By elaborating all of these specifications, researchers and policymakers will be able to construct their model customized based on their own needs while still considering basic economic theory.

CHAPTER 3 EDUCATION IN INDONESIA

3.1 System of Education

In general, education plays a vital role in improving and developing the quality of human resources. In other words, education can be treated as a means for advancing generations. Considering the importance of education for a country, Indonesia pledged the right to access education for all the Indonesian citizens in its constitution. Moreover, several derivative laws below the constitution also regulate citizens' right to obtain and access primary education. These laws are a concrete step to ensure legal certainty for the people to have a proper education.

Based on Article 31 in the Constitution, Indonesian citizens have the right to education. Moreover, several criteria that should be fulfilled by the states to provide education are emphasized. This regulation also explains the exemption of financial obligation for the citizen to obtain primary education. Moreover, it exhibits the government's effort to organize a proper national education system to build faith, piety, and noble character by law as well as advance science and technology without neglecting to uphold the values of religion and national unity. To do so, the government committed to allocating at least 20 percent of the total government expenditures to education.

Currently, The National Education System Law Number 20 (2003) has been implemented to regulate the education system in Indonesia. By this law, the implementation of education must adhere to several principles. At least the education system in Indonesia should be equal and democratic by endorsing all necessary aspects such as religiosity, culture, and national diversity. Moreover, implementing the education system should also ideally promote lifetimes learning by giving cases, building passion, and developing creativity during the learning process. Explicitly, this system should be implemented by developing a fondness for reading and writing involving all community members and promoting both administration’s participation and education services' quality control by empowering all components of the society.

Based on Law Number 20 (2003), Indonesia's education system can be classified into three different categories, namely, basic, middle, and higher education. More explanations will be presented in the following subsection.

3.1.1 Basic Education Level

Among the structure of the education system in Indonesia, basic education is the lowest level. As stipulated in Law Number 20 (2003) about National Education System, this level is dedicated to develop attitudes and abilities and provide essential knowledge and skills to live in society. Moreover, this level also provides the necessary education for the students to continue to the next level, that is secondary education.

Principally, basic education consists of 9-year general education held six years in elementary schools and three years in junior high schools. The elementary school in Indonesia also refers to Islamic primary education or madrasah Ibtidaiyah. On the other hand, madrasah Tsanawiyah refers to Islamic junior high school, equivalent to junior high school. The 9-year compulsory education program provides primary education for all children between 7 to 15 years. The 9-year compulsory basic education program was enacted by the President of the Republic of Indonesia to replace the previous policy, which was only 6-years of primary education. This policy was reflected in the National Education System Law Number 2 (1989).

The forms of the educational system, which refer to a 9-year compulsory basic education program in Indonesia, consist of 10 categories, classified into four groups for both elementary and junior high school level.

First, the elementary and junior high school group. This group consist of "regular" elementary and Junior High School, "small" elementary and junior high school, and "Pamong" elementary and junior high school. Mainly, basic education in Indonesia is provided through regular elementary school and junior high school, which are operated or organized by the government or the community (a private organization). The other type is called the small elementary school and the small junior high school. Some examples under this group are public elementary school or public junior high school which are held in areas with a small population and meet specific requirements. Another type is called the "Pamong" elementary/junior high school. The "Pamong" is the abbreviation from “Pendidikan Anak oleh Masyarakat, Orangtua dan Guru” or “Education for Children from the Community, Parents, and Teachers”. This type of school is a public elementary school established to provide educational services for elementary or junior high school dropouts or other children who cannot regularly attend school to study.

Second, the extraordinary elementary and junior high school group. This group includes extraordinary elementary and junior high school, as well as integrated elementary and junior high school. This school mainly deal with children who have physical or mental disorders with normal children by adopting a particular curriculum.

Third, the out-of-school education group. This group contains “Package A” and “Package B” Study Group Programs. The Study Group of Package A is dedicated to elementary school, while the Study Group Package B deals with junior high school. This group also accommodates elementary and junior high school courses, which are not under the first group’s curriculum.

Fourth, the religious school group. Under this group is madrasah Ibtidaiyah, madrasah Tsanawiyah, and Islamic boarding schools. Unlike the other groups, which are supervised solely by the Ministry of Education, this group is under the Ministry of Religious Affairs supervision. Likewise, the funding and the management are associated with this ministry.

Principally, those four groups, as previously explained, are under the Ministry of Education’s supervision. Practically, in terms of management and organization, these institutions that carry out the 9-year compulsory primary education can be operated or organized by various operators. However, for Islamic elementary schools and Islamic junior high schools, which is is characterized by the Islamic religion, organized by the government or community/private organizations, under the administration of the Ministry of Religious Affairs

3.1.2 Middle Education Level

In Indonesia, middle education is an extension of the basic education level. This level is available in the format of high schools, madrasah Aliyah, vocational high schools, and vocational madrasah Aliyah or other equivalent forms.

Principally, senior high school is a formal education unit as continuation of junior high school, madrasah Tsanawiyah, or other equivalent forms at the similar level. This school type has three levels of classes, which refers to class 10, class 11, and class 12, respectively. Formerly, the school type levels were class 1, class 2, and class 3, which represent the basic, intermediate, and advanced, respectively.

Similarly, vocational secondary school is one form of formal education unit as a continuation of junior high school, madrasah Tsanawiyah, or other equivalent forms at similar level dealing with vocational education. However, for some units, they have more levels than senior high school as they provide more skills to be delivered for specific purposes.

3.1.3 Higher Education Level

Principally, higher education in Indonesia has a different system and different regulation compared to basic and middle education level. While both basic and middle education level refer to Law Number 20 (2003), Indonesia's higher education system associates with Law Number 12 (2012) on Higher Education. Based on Law Number 12 (2012), higher education is defined as a level of education after middle education level. Therefore, higher education is a formal education unit as continuation of middle education level.

Higher education includes diploma programs, undergraduate programs, master's programs, doctoral programs, professional programs, and specialist programs, which are organized by universities based on the nation's culture in Indonesia.

Based on Law Number 12 (2012) Article 15 to 17, higher education is classified into three different types. First, the academic education type. This type is defined as a higher education either undergraduate program or postgraduate program dealing with science and technology. The guidance, coordination, and supervision of academic education for this type is under the Ministry of Higher Education's responsibility.

The second one is vocational education type. As stated in Article 16, vocational education is a higher education diploma program that prepares students for jobs with specific applied skills to the applied undergraduate program. Similar to academic education type, the government can develop vocational education until the applied master program or applied doctoral program. This type also under the coordination, supervision, and responsibility of the Ministry of Higher Education.

The last is professional education. This type of education is defined as a higher education after an undergraduate program that prepares students for jobs that require specialized expertise requirements. Generally, this education is held by universities and in collaboration with ministries, other ministries, Non-Ministerial Government Institutions, or professional organizations responsible for professional services quality.

Practically, those three types of education is classified into several programs corresponding with their purpose. Mainly, the academic education type corresponds with bachelor, master and doctoral programs. Similarly, vocational education type is classified into diploma program, applied master program, and applied doctoral programs. Meanwhile, professional education type correspond with professional and specialist programs.

The bachelor program is an academic education intended for the graduates of secondary or equivalent education to practice Science and Technology through scientific reasoning. It prepares students to be intellectuals or scientists who are cultured, ready to enter the job markets or create jobs, and adequate to develop themselves into professionals.

Meanwhile, the master program is the next stage of academic education intended for graduates of undergraduate or equivalent programs to learn and develop science or technology through the research practically. This program is dedicated to developing students to become more intellectual and practically capable of entering to a higher level in the job markets or create jobs and develop themselves into professionals.

Similarly, the doctoral program is an academic education that is intended for graduates of master or similar programs to find, create, or contribute to the development, as well as the practice of Science and Technology through reasoning and scientific research. The doctoral program develops and consolidates students to become wiser by increasing their ability and independence as philosophers or intellectuals, scientists who are cultured and produce or develop theories through comprehensive and accurate research to advance human civilization.

The diploma program is a vocational education intended for secondary or equivalent education graduates to develop skills and reasoning in the scientific or technological application. This program prepares students to become skilled practitioners to enter the workforce under their fields of expertise. It consists of a diploma I program, diploma II program, diploma III program, and diploma IV. It is also known as the applied bachelor's degree program.

The applied master program is a continuation of vocational education intended for graduates of applied or equivalent degree programs to develop and practice the application of Science or Technology through reasoning and scientific research. This program develops students to become experts who have a high capacity to apply science and technology to their profession.

The applied doctoral program is a continuation for graduates of applied or equivalent master programs to find, create, or contribute to the application, development, and practice of Science and Technology through reasoning and scientific research. This program develops and solidifies Students to be wiser by increasing their ability and independence as experts and producing and developing the application of Science and Technology through comprehensive and accurate research in advancing civilization and human welfare.

Professional programs are special skills education intended for graduates of undergraduate or equivalent programs to develop their talents and abilities to acquire the skills needed in the world of work. Practically, the education unit that deal with professional programs collaborate with the ministry, non-ministerial government department, or professional organizations that responsible for professional services quality.

Specialist program are advanced skills education, which can be graded and intended for graduates of professional programs who have experience as professionals to develop their talents and abilities to become specialists. Similar with professional program, specialist programs may be carried out by universities in collaboration with ministries, non-ministerial government department, or professional organizations that responsible for the quality of professional services. These programs enhance the ability of specialization in particular branches of science.

3.2 Government Expenditure for Education

Indonesia ensures and regulates all attempts to enforce the law for Indonesian citizens aged 7 to 15 years to obtain primary education. In order to do so, the state allocates 20 percent for education expenditures from the State Budget as well from the Regional Budget as mandated by the constitution.

The detail of the obligation as regulated in Law Number 20 (2003) concerning the National Education System is in Article 11 Paragraph (2). Based on that regulation, principally, both the central and local governments must secure and allocate education funds for every citizen aged 7 to 15. Moreover, Article 34 Paragraph (2) and (3) also explain that the implementation of compulsory education, at a minimum on basic education, should be free of charge. However, the implementation of compulsory education is not only the responsibility of the central and local government but also society.

Law Number 20 (2003) Article 46 Paragraph (1) explains that education funding is the joint responsibility of the central and local governments as well as the public. Therefore, the sources of educational funding from the Government are from various parts. Those parts are the State Budget and Regional Budget and sources of educational funding from the community. That includes educational contributions, grants, endowments, alms, votive payments, loans, corporate donations, tax relief, and write offs for education and other legal receipts, as stipulated in this paragraph's explanation. In summary, the implementation process of primary education is a shared responsibility between the central and local government and society. Funding education is a joint responsibility between the Government, Local Government, and society.

Regarding education funding, as stipulated in Government Regulation Number 19 (2005) concerning National Standards Education, financing standards, the components, and the magnitude of the operating costs of education units are valid for one year should be provided annually.

3.3 Cost of Schooling

The education system in Indonesia allows a person to continue to tertiary education after finishing his/her secondary education. Referring to the Law of National Education System Number 20 (2003), a person can generally pursue tertiary education after spending nine years on primary education (elementary school and junior high school) and another three years in secondary education via senior high school. One who is eager to continue to tertiary education will spend around four years to get a bachelor's degree, another two years for a master's degree, and three more years for a doctoral degree. All in all, one shall spend 21 years in a school to be at the pinnacle of the education system.

Based on the Ministry of Research, Technology, and Higher Education Decree Number 22 (2015), public universities are required to classify the tuition fee into a few categories based on the prospective students' financial ability or their sponsors. The tuition fee is a single component cost of education without any additional fees, and the amount varies amongst public colleges and faculty or study programs. The public colleges also disclose the budget allocated for the college to provide education and for each student. Therefore, the difference between the budget and the tuition fee imposed on a student represents the amount of subsidy by either government (if the tuition fee is lower than the budget cost) or the student (if the tuition fee exceeds the budget cost) as shown in Table 3.1.

Table 3.1 discloses the ten best universities based on the Ministry of Research, Technology, and Higher Education’s classification. Under 474 study programs, the college's average budget for giving each student education until he/she finishes his/her study is ranging from around Rp50 million to Rp100 million (about US$4,209 to US$8,419). These ten universities represent the best public colleges since there are no private colleges included in this list. However, the tuition fee that should be paid by prospective students varies from the lowest at only around Rp3.2 million to the highest at not less than Rp91 million (about US$269 to US$7,661). It means that for the prospective student under the category where the government heavily subsidizes them, they will benefit from up to 30 times the amount they pay. On the other hand, prospective students under the category of the most expensive tuition fees should pay almost double the college's budget allocation for providing education.

Unlike public colleges, private universities have the autonomy to determine the tuition fee and other expenses that will be assigned to a prospective student. Therefore, the total cost will vary greatly. Some private universities have various schemes of tuition fees from Rp0 for the full scholarship (full fee exemption) to almost Rp600 million (or about US$50,512) in the years 2014 to 2015. The most expensive one is the tuition fee of Trisakti University under the Medical Faculty for the bachelor's degree program.

Table 3.1 The cost of Education and Tuition Fee from Top 10 Universities for the Year 2014/2015 (in Rupiah)

No.	University	Number of Study Program	Average Cost of Education for Each Student	Tuition Fee/College 4 years		
				Lowest	Mid	Highest
1	Universitas Gadjah Mada	68	70,031,647	4,000,000	26,923,529	47,211,765
2	Institut Teknologi Bandung	43	96,122,791	3,200,000	32,000,000	80,000,000
3	Institut Pertanian Bogor	10	53,812,800	4,000,000	24,680,000	51,040,000
4	Universitas Indonesia	52	64,022,000	4,000,000	20,000,000	40,038,462
5	Institut Teknologi Sepuluh Nopember	24	65,192,000	4,000,000	26,000,000	48,000,000
6	Universitas Diponegoro	51	55,511,059	4,000,000	33,137,255	54,705,882
7	Universitas Airlangga	33	55,289,939	4,000,000	39,000,000	91,757,576
8	Universitas Brawijaya	69	54,887,072	4,000,000	35,492,783	54,232,464
9	Universitas Hasanuddin	69	98,238,377	4,000,000	15,420,290	40,695,652
10	Universitas Negeri Yogyakarta	55	63,123,491	4,000,000	23,563,636	37,136,000
		474	67,623,118	3,920,000	27,621,749	54,481,780

Source: Ministry of Research, Technology and Higher Education Decree Number 22/2015

CHAPTER 4 RETURN TO EDUCATION AND FINANCIAL VALUE OF HIGHER EDUCATION IN INDONESIA[5]

This chapter is the first step to measure the impact of human capital investment from an individual perspective. As the main purpose of this dissertation is to investigate the impact of human capital on economic growth, this part becomes necessary as human capital theory mainly refers to some skills or knowledge obtained through investment in education. Like other investments, investment in education needs a thoughtful decision. Therefore, the amount of money, forgone income, and time that should be spent should be taken into consideration.

There are two sections to support the main conclusion and to draw the policy recommendations. The first section will primarily focus on the return to education in Indonesia which is explained in Section 4.2. Therefore, we can identify to what extent having more education improves one's earning without considering how much money should be spent to attain more education. Section 4.3 complements Section 4.2 by putting the cost into consideration. As previously explained, Section 4.3 only focuses on higher education.

4.1 Methodologies and Data

4.1.1 The Short-Cut Method

To approximate the return to education by using this method, we should compare the earning of a certain level of education with the other education level. In this methodology, all cost incurred to attain more education is neglected as this method only focuses on the benefit of having more education. With the assumption of flat age-earning profiles as in Figure 4.1, we can simply calculate the return to education by using the formula in Equation 4.1 as follows:

[5] This chapter is mainly based on Yubilianto (2020)

$$r_s = \frac{W_s - W_{s-1}}{(t_s - t_{s-1})\, W_{s-1}} \tag{4.1}$$

where

r_s : return to education for *s* level of education

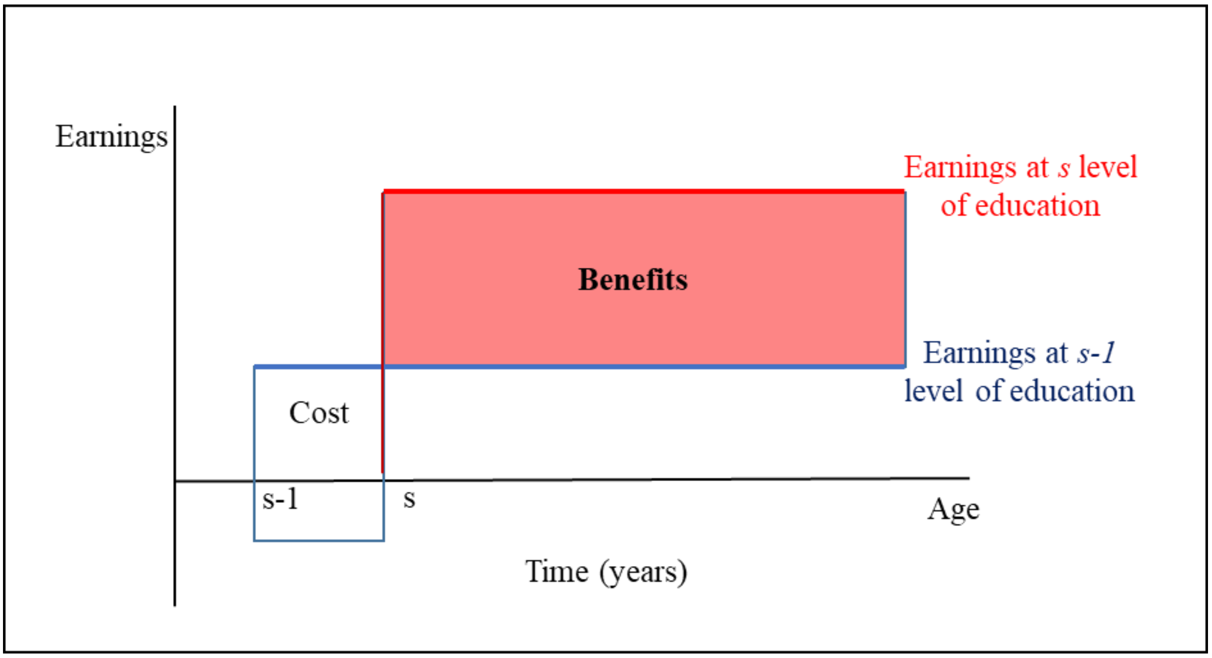
W_s : earning from individuals with *s* level of education

W_{s-1} : earning from individuals with *s-1* level of education

t_s : time spent to attain *s* level education

t_{s-1} : time spent to attain *s-1* level education

Figure 4.1 Flat Age-Earnings Profiles



Source: Modified from International Handbook on the Economics of Education (2004)

However, estimating work-life earnings to construct age-earning profiles by each level of education, is another main issue. Mainly, the main hindrance of constructing the real age-earning profiles for all education levels is the unavailability of real data. However, the U.S. Census Bureau developed the so-called SWE estimate to approximate individuals' earnings within groups or sub-groups. This methodology can be used to observe the work-life earnings gap between individuals through education attainment levels. The terminology of work-life refers to a person's career period. The terminology of work-life is used instead of a lifetime[6] to avoid misunderstanding. Lifetime usually includes real situation information such as real career development, the actual age-life of a person, and the sudden work termination. SWE estimate is a methodology to construct workers' future earnings with specific categories for an entire work-life by only using a single point of cross-sectional data. Although it does not represent actual future earnings, this SWE estimate is reliable in giving clues about the magnitude of earnings differences amongst workers with different educational attainment levels.

To examine earnings by using the SWE estimate is relatively simple. First, all data is classified into a few cohorts where each cohort represents five years of ages with specific educational attainment. Based on Statistics Indonesia, 15 to 64-year-old person is a productive workers. Therefore, we classified the data of 15 to 64-year-old workers into ten different cohorts. Cohort 1 gathers all workers' earnings for each educational attainment level between ages 15 to 20. Cohort 2 compiles workers with the same information between ages 21 to 24 years old until the last cohort (cohort 10), representing a group of workers' earnings with different educational levels between ages 60 to 64 years old.

Secondly, the study finds the median of each cohort. Initially, the first SWE estimate, which the U.S. Census Bureau introduced, is calculated using the average of workers' earnings within each cohort. However, the average earnings within the sample groups do not reflect the real average of workers' earnings because it is easily skewed to the left or right due to outliers. Thus, the median provides a better measurement to estimate the average of workers' earnings within a group since it is more reliable against outliers (Julian and Kominski, 2011). After

[6] In the rest of this dissertation, the terminology lifetime and work-life earning will be used interchangeably as both terminologies refer to the total amount of income earned by individuals from working.

finding the median, the final step is to multiply each median of workers' earnings in each cohort by 5. This procedure acts to calculate the total earnings for a worker within a specific ages group and sums all of the cohorts to derive the SWE estimate, which can be expressed in Equation 4.2 as follows:

$$SWE = \sum_{i=1}^{10} (QuantEarnGr_i \times 5) \tag{4.2}$$

where *SWE* represents Synthetic Work-life Earnings for 50 years of work career, and $QuantEarnGr_i$ is the median of the workers' earnings within-group i. Thus, with each cohort representing five years of ages, the SWE will be calculated as follows:

(Earnings15-19 × 5) + (Earnings20-24 × 5) + (Earnings25-29 × 5) + (Earnings30-34 × 5) + (Earnings35-39 × 5) + (Earnings40-44 × 5) + (Earnings45-49 × 5) + (Earnings50-54 × 5) + (Earnings55-59 × 5) + (Earnings60-64 × 5)

After finding the SWE for each level of education, which represents the number of earning for a person with a specific education level throughout his/her work-life, we can construct age-earning profiles. After that, we compare the gap and divide it with the number of years spent to obtain an additional level of education to find the implicit return of education. This implicit return to education refers to the short-cut method, which assumes flat age-earnings profiles, as explained previously. Applying Equation 4.1, the estimation of the rate of return to education is simply the difference between earnings on educational level *s* minus earnings on educational level *s-1* divided by *t* years of schooling at educational level *s* and earnings on educational level *s-1* [see Psacharopoulos (1995), Yubilianto (2020)].

4.1.2 Mincer Earning Equation Method

This study used years of schooling as a proxy to analyze the return to education. Years of schooling are measured as the total years of one's life spent studying formal education. In Indonesia, a person who completes elementary school has six years of schooling while completing secondary school in senior high school has twelve years of schooling. In this study, a person who graduated from college is considered to have sixteen years of schooling. College students in this study only refer to undergraduate students. The basic Mincer equation is for calculating the return to education in Indonesia is as follows:

$$\log(earnings_i) = \beta_1 + \beta_2 yos_i + \beta_3 exper_i + \beta_4 exper_i^2 + \beta_5 tenure_i + \beta_6 tenure_i^2 + \varepsilon_i \tag{4.3}$$

where *earnings*$_i$ refer to earnings of individual i, *yos*$_i$ denotes years of schooling for individual i, *exper*$_i$ represents the experience of individual i, *tenure*$_i$ corresponds to job tenure for individual i, and ε_i is the error term. Experience in this equation, which is written as *exper*$_i$, indicates the number of years of individual i after graduating from last attended school. The initial year for a child to enroll in elementary school in Indonesia is six years old. Therefore, to derive a person's experience, I utilize the age of individual i subtracted by years of schooling and six years. Additionally, a tenure that is written as *tenure*$_i$ exhibits the present job experience.

Other than years of schooling as a proxy for analyzing return to education, I also implement a similar methodology used by Purnastuti (2013). I apply some dummy variables for different levels of education as a proxy to analyze the difference of impact at each level of education, from primary to tertiary education. This study does not include a person who is not in schooling or has not finished primary school. The equation can be written as follows:

$$\log(earnings)_i = \beta_1 + \sum_{s=1}^{4} \beta_2 Edu_{si} + \beta_3 exper_i + \beta_4 exper_i^2 + \beta_5 tenure_i + \beta_6 tenure_i^2 + \varepsilon_i \tag{4.4}$$

where Edu_{si} comprises the dummies for educational level s. Similar to Equation 4.3, *earnings*$_i$ refer to earnings of individual i, *exper*$_i$ refers to the experience of individual i, *tenure*$_i$ represents job tenure for individual i, and ε_i is the error term.

To calculate the return to education at the s^{th} level of education based on the equation, we can consider the Sakellariou (2003) formula as follows:

$$r_s = \frac{(\beta_2 Edu_{si} - \beta_2 Edu_{(s-1)i})}{dif\ yos_s} \tag{4.5}$$

where r_s refers to return to education at the s^{th} level of education, $\beta_2 Edu_{si}$ refers to a coefficient of s level of education, $\beta_2 Edu_{(s-1)i}$ denotes the coefficient of (s-1) level of education, and $dif\ yos_s$ represents the difference of years of schooling between s level of education and s-1 level of education. Therefore, this equation measures the marginal return of education s by dividing the marginal coefficient of the specific level of education and the difference of years of schooling for s level of education and s-1.

4.1.3 Financial Value of Higher Education

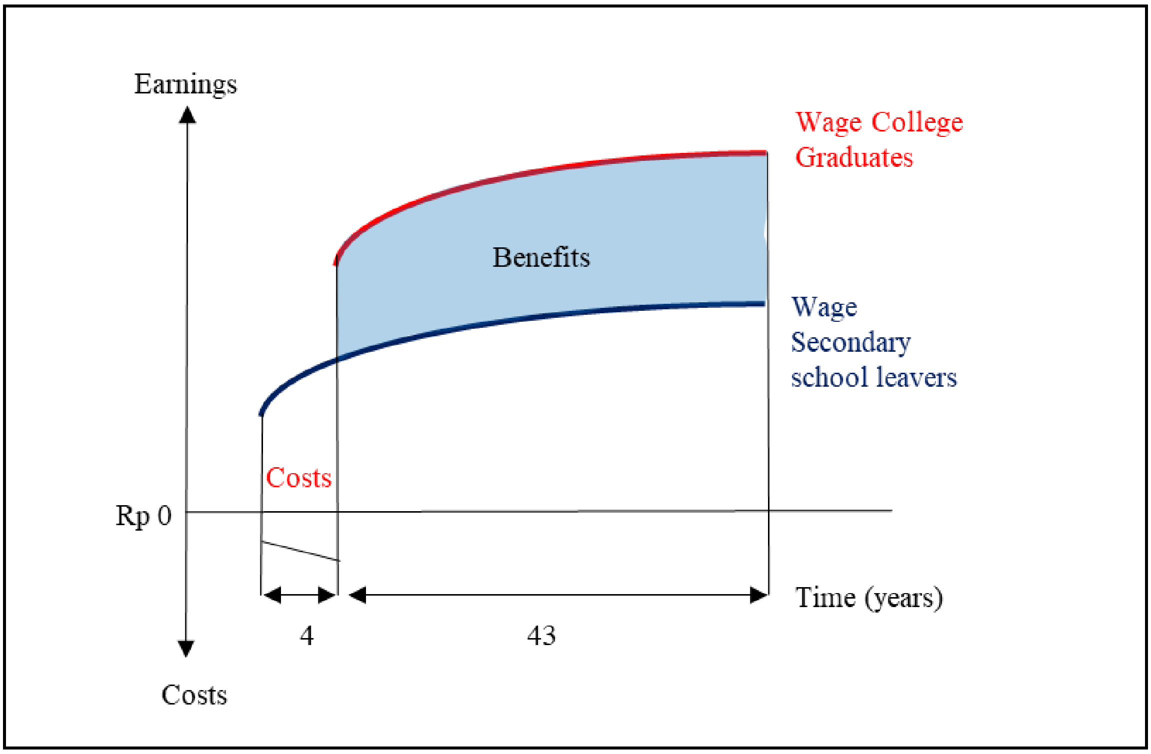
To calculate the rate of return on investment in tertiary education by using this method, we need to identify the cost of college and the wage difference between college graduates and secondary leavers as visualized in stylized age-earnings profiles in Figure 4.2. After identifying the required components, we can calculate the IRR or NPV of the investment in tertiary education by comparing the cost and the benefit at a discounted value.

Technically, this methodology tries to find the rate of a discount that matches the cost of investing money to hold a bachelor's degree and its opportunity cost with the difference of earnings flows between college graduates and secondary school leavers for a specific age. Thus, to find the discount rate of an investment in a college, which assumes that one will spend four years in college and works or lives until 64 years of age, we can use the following equation:

$$\sum_{t=1}^{43} \frac{(W_c - W_h)_t}{(1+r)^t} = \sum_{t=1}^{4} (W_h + C_c)_t (1+r)^{5-t} \tag{4.6}$$

where W_c refers to the age of college graduates, W_h is the age of secondary school leavers, r indicates the rate of return, C_c explains the cost of college, and t represents time.

Figure 4.2 Stylized Age-Earning Profiles



Source: International Handbook on the Economics of Education (2004)

Both IRR and NPV are popular to calculate the feasibility of a project in cost-benefit analysis; that is, to determine whether or not a project will be implemented or rejected. Since the full discounting method is similar to cost-benefit analysis, we can implement both these techniques. Technically, IRR is used by comparing the present value of all costs incurred during the project's life with the present value of all cash inflows or any economic value incurred during the project's life. The result will be represented as a percentage. Similarly, NPV also compares both the present value of cost and cash inflows through the project's life by summing those two factors. The result will be displayed in a monetary term. Additionally, NPV can be used to estimate the break-even point (BEP) or the moment where the cash inflows will fully cover the investment.

4.1.4 Data

Consequently, we need data to identify the earnings for each level of education and the cost of education. This study will utilize two primary data sources. First, to calculate the earnings[7], this study employs IFLS-5, the most recent available data published by Research and Development (RAND) in collaboration with Survey Meter to construct the work-life earnings estimation. RAND itself is an independent non-profit organization established over 70 years ago for dealing with research and analysis throughout the world related to broad issues such as education, energy, and health.

This IFLS-5 is the last survey that was conducted in 2014/2015 to examine the latest condition of individuals, households, and the community in Indonesia. More than 50,000 individuals were respondents in this survey. In general, there are two main questionnaires which were conducted to identify the households and community facility. The questionnaire is designed to understand the location, expenditures, and knowledge of health facilities, economy, education, marriage, and asset ownership for the households. This IFLS-5 is a continuation of the previous Indonesia Family Life Survey (IFLS).

The first survey was the Indonesia Family Life Survey wave 1 (IFLS-1), which was first conducted in 1993/1994. This survey was a longitudinal survey covering over 7,000 households and 30,000 individuals in 13 main provinces in Indonesia out of 27 total provinces. The selection of these provinces to conduct the survey is maximized to represent more than 80% of the Indonesian population. This survey was conducted by interviewing all household members.

[7] The earnings as well as its derivatives, such as educational attainment, age, and experience

The Indonesia Family Life Survey wave 2 (IFLS-2) is a continuation of the IFLS-1, which was conducted in 1997 by tracking the former IFLS-1 respondents. Around 94% of 7,224 households' respondents in the IFLS-1 could be tracked with 878 "split-off" households. Unlike the IFLS-1, IFLS-2 tried to reduce cost by randomly selecting several household members to obtain the other family members' information rather than interviewing all household members.

In 2000, RAND and the Center for Population and Policy Studies (CPPS) of the University of Gadjah Mada conducted the next Indonesia Family Life Survey wave 3 (IFLS-3) with around 10,400 households and 39,000 individuals. Meanwhile, the Indonesia Family Life Survey wave 4 (IFLS-4) was also conducted by both RAND and University of Gadjah Mada as well as Survey Meter. These three organizations altogether conducted the IFLS-4 with funding from the National Institute on Aging (NIA), grant 1R01 AG026676, the National Institute for Child Health and Human Development (NICHD) 1R01 HD050764, and grants from the World Bank, Indonesia Office.

Other than the IFLS-5 to measure the earnings and educational attainment level, this study also requires data on education expenditures to determine the costs of education (for college), which refers to any expenses to get a higher education. In order to do so, this study mainly utilizes data from the Indonesia Ministry of Research, Technology, and Higher Education Decree in general. Moreover, this study also incorporates other sources to estimate other costs which are not part of tuition fee but necessary to get a higher degree such as lodging and transportation cost.

4.2 Return to Education in Indonesia

Currently, Indonesia provides a considerable amount of micro-data, which allows examining the return to education. The most popular method to derive the rate of return on schooling is by applying an earnings equation, which Mincer (1974) introduced, who argues that one's log earning is a function of years spent on education and the quadratic function of one's experience.

Another method is the short-cut method, which assumes flat age-earnings profiles. Consequently, the estimation of the rate of return to education is simply by calculating the difference between earnings on educational level k minus earnings on educational level k-1 divided by n years of schooling at educational level k and earnings on educational level k-1 in equation (1.1). In order to generate proper age-earning profiles for each level of education, which capture the average lifetime earnings for a specific educational, this study will implement the Synthetic Work-life Earning approach.

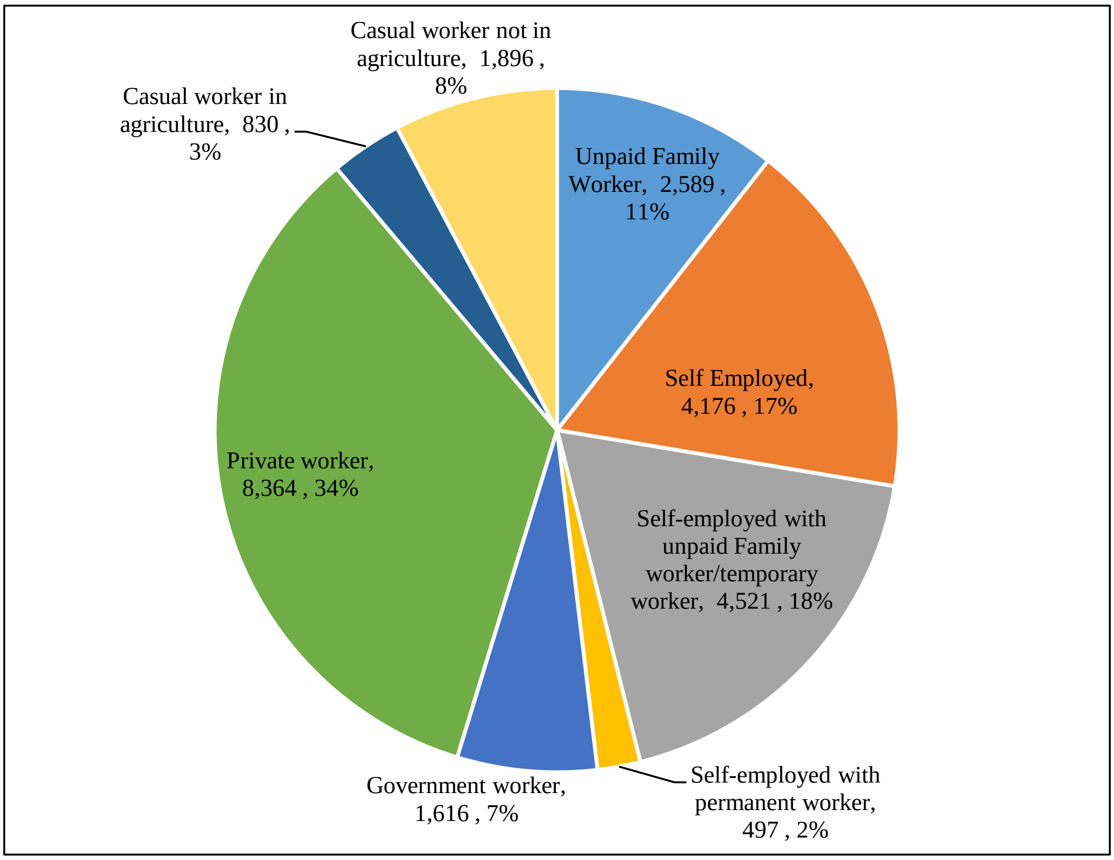
This study will implement both of these methods to calculate the return to education in Indonesia using data from IFLS-5, which covers 50,148 individuals across 13 provinces in Indonesia.

4.2.1 Descriptive Statistics

Although the total respondents reached 50,148 persons from the IFLS-5 raw data, the total number of workers who fall under the category between 15 years old and 64 years old is only less than half of the sample or only 24,489 persons to be precise. Based on the work category and educational attainment, those workers' statistics are shown in Figure 4.3 and Figure 4.4, respectively.

Figure 4.3 shows that mainly workers who meet the criteria are predominantly working as a private worker who covers 34% of total respondents under the category of 15-year-old to 64-year-old. In comparison, only 2% of workers who work as a self-employed with permanent workers represent the smallest portion of this survey. Between those two categories, some workers work as a casual worker in agriculture (3%), government worker (7%), casual worker not in agriculture (8%), unpaid family worker (11%), self-employee (17%), and self-employed with unpaid family worker/temporary worker (18%).

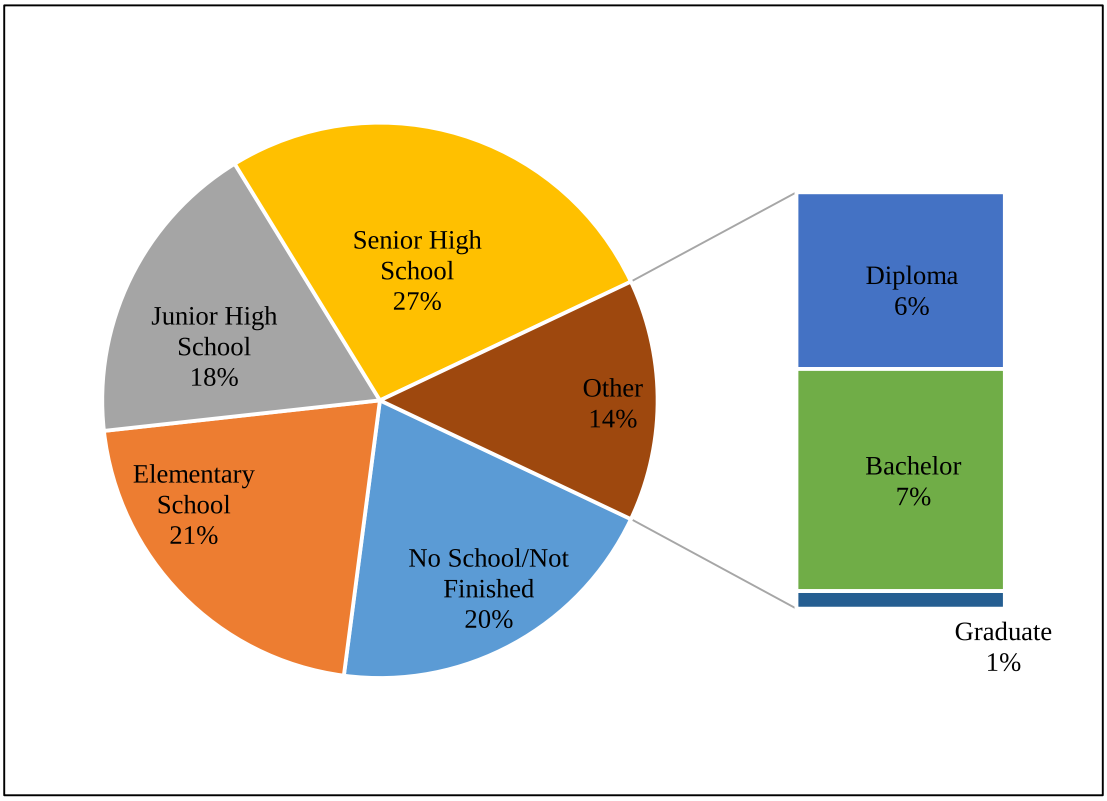
Figure 4.3 The Composition of Workers in IFLS-5 Based on Work Category



Source: Author's calculation using IFLS-5

From the perspective of educational attainment, as shown in Figure 4.4, the category is dominated by senior high school degree workers, with 27% of the total respondents. Meanwhile, the workers who hold at least a diploma degree is only 14%. It comprises of diploma holders (6%), bachelors (7%), and graduates (1%). The remaining workers who did not get a degree or did not attend school and finished only primary education are approximately 20%.

Figure 4.4 The Composition of Workers in IFLS-5 Based on Educational Attainment



Source: Author's calculation using IFLS-5

Since the primary objective is to analyze the return on higher education, there are some critical assumptions and treatments in handling raw data from IFLS-5, specifically when dealing with respondent criteria and the number of wages or salaries. Considering the raw data also consists of unemployment, where the workers do not work or do not have any income, we will make two options to see the unemployment impact. Therefore, the assumptions will be as follows:

a. Only workers age 15-64 years old whom last month received a salary or wage are included in the samples (assumption of full employment)
b. All workers age 15-64 years old with or without any salary or wages are included in the samples (assumption with unemployment)

Other than those two options, the rest assumption that will be applied to examine the return to education in Indonesia as follows:

1. Data for wages are taken from monthly wages only from primary work, which is received by respondents from employers when considering the number of working hours.
2. In order to measure the impact of educational attainment, all wages from individuals have been adjusted to be full-time workers with the assumption of 8 hours of working time and 22 working days in a month as are regular monthly working hours in Indonesia.
3. Data for government employees, which is around 7% of the total sample, are omitted since the salary is predetermined nationally by regulation.

By applying these specifications, the total sample plummets from 24,489 individuals to only 14,852 individuals for the first assumption with full employment and 17,549 individuals with unemployed workers. Lastly, since the number of workers with tertiary education is not sufficient to be analyzed for each group, diploma and bachelor holders are merged under a group of colleges since its nature is similar. However, graduate degree holders are omitted in this research since they mainly represent only upper classes. Therefore, we do not merge graduate with undergraduate degree holder workers.

4.2.2 Return to Education by the Short-Cut Method

Estimating the return to education through the short-cut method is relatively easy and straight-forward by using formula in Equation 4.1. Principally, this method is only comparing earning differences for a level of education with another in the light of study duration. However, there are no available real age-earning profiles for all education levels in Indonesia as constructing this data needs longitudinal data that contain a particular group of individuals with the same level of education throughout their lifetime. Fortunately, the U.S. Census Bureau developed the so-called SWE estimate to approximate individuals' earnings within groups or sub-groups. This methodology can be used to observe the work-life earnings gap between individuals through education attainment levels.

The terminology of work-life refers to a person's career period. The terminology of work-life is used instead of a lifetime to avoid misunderstanding. In this case, a lifetime usually includes real situation information such as real career development, the actual age-life of a person, and the sudden work termination. SWE estimate is a methodology to construct workers' future earnings with specific categories for an entire work-life by only using a single point of cross-sectional data. Although it does not represent actual future earnings, this SWE estimate is reliable in giving indicator about the magnitude of earnings differences amongst workers with different educational attainment levels.

As previously explained, the SWE estimate applied in this research will divide the age-group into 10 cohorts. Each cohort represents five years of age, from age 15 years to 64 years. Therefore, there will be 50 years of age, representing the range of workers' age from a different level of education or simply the total/maximum number of years of a worker earn money from his/her work. Principally, we will utilize Equation 4.2 for constructing age-earning profiles.

However, this SWE formula only employs median (quartile 2) of the workers' earnings within-group i as this 50% of distribution best reflecting the “real average” of individual earning. In real life, some people with the same level of education manage to gain more by having a better job. This type of workers represents high-class workers in the third quartile or 75% distribution. However, the other quartile should struggle with their life due to their low-wages. This type of worker mainly represents the first quartile or 25% of the distribution.

In order to examine the lower and higher level of sample distribution, this study will also utilize the first quartile (quartile 1) and third quartile (quartile 3). By doing so, we can construct age-earning profiles by the level of education in various distributions to examine its variation. In order to capture quartiles other than the quartile 2, the SWE equation will be slightly modified as in Equation 4.7:

$$SWE_q = \sum_{i=1}^{10} \left(QuartEarnGr_{qi} \times 5 \right) \quad (4.7)$$

where SWE_q represents Synthetic Work-life Earnings for 50 years of work career in quartile q and $QuartEarnGr_{qi}$ is the quartile q of the workers' earnings within-group i.

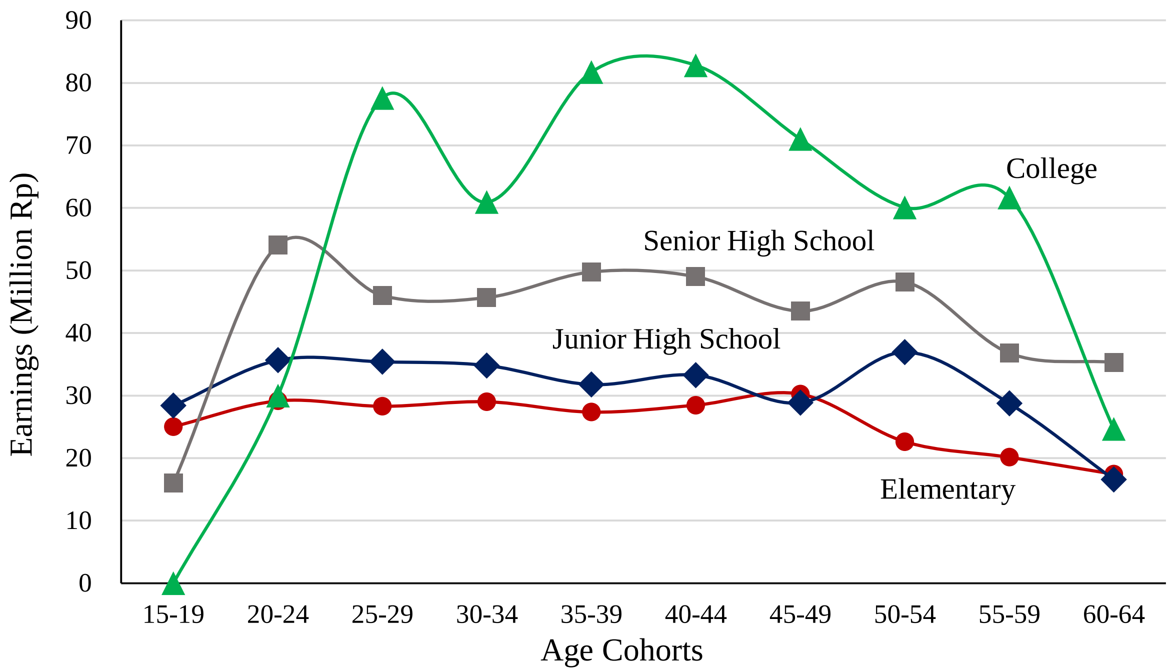
By combining IFLS-5 and the SWE formulation as in Equation 4.1, we can estimate the work-life earning pattern for each level of education in a different part of the distribution. This analysis will focus on 25%, 50%, and 75% of the distribution, which represents the lower, middle, and upper-class workers in the job market. This work-life earning pattern exhibits a lifetime income trajectory for constructing age-earning profiles by the level of education. Since there are four different levels of education[8], there will be four lines for each graph, which represent quartile 1, quartile 2, and quartile 3. We will first discuss the work-life earning pattern with full employment from quartile 1 to quartile 3, as shown in Figure 4.5, Figure 4.6, and Figure 4.7, respectively.

Starting from quartile 1, which represents lower-rank workers, only senior high school and college graduate workers, the earning pattern shows an increasing trend in the first ten years of their work-life and decreasing trend after they reach some point. Meanwhile, the other two education levels, elementary and junior high school, indicate almost flat patterns from the beginning until their retirement age with a decreasing pattern after retirement. Moreover, this trend is relatively normal as college graduates' earnings are the highest among other education levels. Although college graduates start their career slower than their other counterparts, around

[8] This study classifies level of education into Elementary School, Junior High School, Senior High School and College graduates. Due to data limitation, college graduates only consists of Diploma and Bachelor level without Master and Doctoral graduates.

the beginning of their mid-twenties, their earnings exceed the others. Thus, it can compensate for the sacrifices of both time and money to attain higher education.

Figure 4.5 Age-Earning Profiles from the Quartile 1 SWE Estimate (Full Employment)

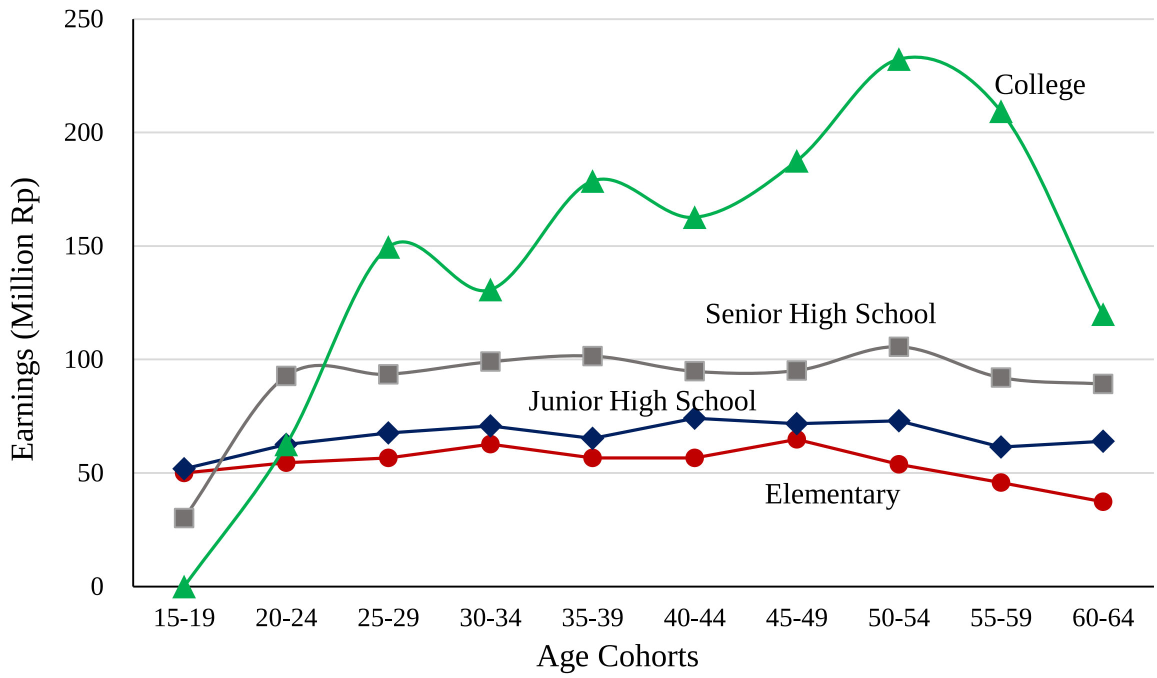


Source: Author's calculation using IFLS-5

This finding confirms that college investment, as the highest degree, gives the maximum benefit compared to other levels of education. To some extent, the peak of earning was in their 40s and starting to decrease in their mid-40s. This condition was surprising, considering a person in this stage is supposedly still productive and able to earn more. Moreover, the retirement age of most employees in Indonesia by regulation is around 55 years old. Meanwhile, elementary school graduates earn the lowest and flat-like-earning curve. The elementary school and junior high school graduate workers also show a flat-line-shaped earning over their life. It means there is no career development for both groups.

Figure 4.6 confirms that the typical pattern of increasing income following the length of work at a decreasing rate with its peak around the age of 50 years old to 54 years old for the middle-class workers. The amount of earning is around Rp232 million (about US$19,553) for the work-life or approximately Rp3.8 million per month (about US$320).

Figure 4.6 Age-Earning Profiles from the Quartile 2 SWE Estimation (Full Employment)



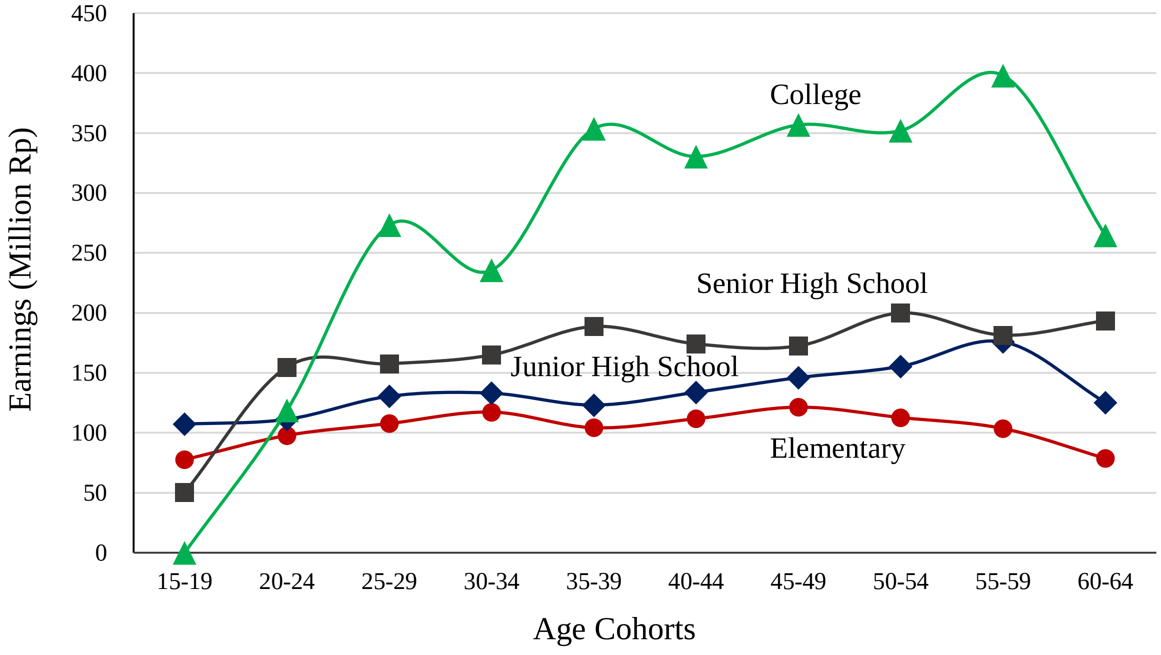
Source: Author's calculation using IFLS-5

The peak as in Figure 4.6 show highest-earning that indicates the top of the career of the workers. It is around 50 to 55, which is the normal retirement age in Indonesia. The figure also shows that the college degree holder workers gain the highest-earnings substantially exceeding the rest of educational attainment level workers. Confirming the suggestion by extensive literature, the result also exhibits that more educated workers tend to earn more than less educated ones.

It clearly shows that a college degree worker earns more than a senior high school degree worker. Besides, senior high school degree workers earn more than primary education degree workers, with elementary school graduates holding the last position in terms of work-life earnings. This finding agrees with Becker (1962) that there is a typical pattern of increasing income following the length of work at a decreasing rate and a tendency for skilled workers to earn more than unskilled workers.

Figure 4.7 gives some information about the upper-class workers' work-life earnings. It exhibits the typical pattern of increasing income following the length of work at a decreasing rate with its peak just before their retirement age around 55 to 59 years old, which reach almost Rp400 million (about US$33,712) or around Rp6.6 million per month (about US$556). Similar to other classes of workers in quartile 1 and quartile 2, college graduates become the most superior among other education levels, where elementary graduates earned the lowest amongst all.

Figure 4.7 Age-Earning Profiles from the Quartile 3 SWE Estimation (Full Employment)



Source: Author’s calculation using IFLS-5

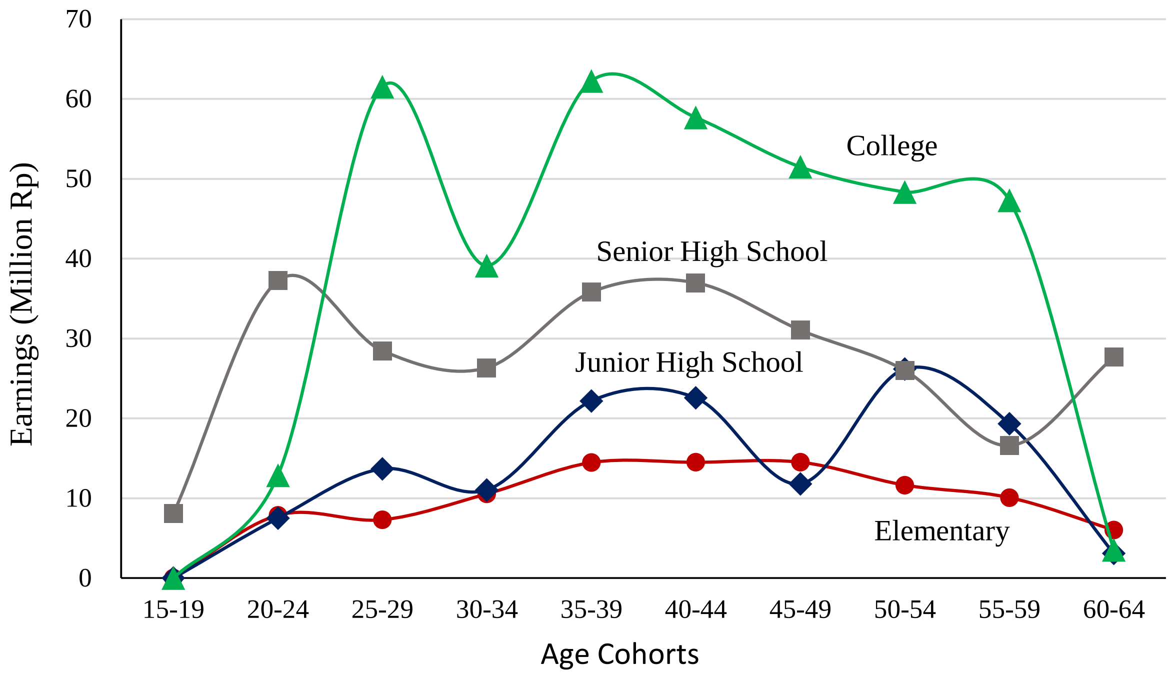
Figure 4.7 also shows that college graduates start their work slower than other educational level graduates. After their graduation age around 20 to 24 years old and starting their work, they earn almost the same as their counterpart junior high school graduates. However, around five to ten years later, when the college graduate workers reach their 30s, their earning is almost double than the junior high school graduate workers. The college graduates' earnings are Rp273 million (about US$23,008) or Rp4.5 million per month (about US$379), while their counterparts only gain Rp157 million (about US$13,232) or approximately Rp2.6 million per month (about US$219). Meanwhile, the elementary school graduate workers for the rest of their life only gain at most around Rp100 million (about US$8,428) every five years or around Rp1.8 million per month (about US$152).

For the second analysis of age-earning profiles with the unemployment factor, we will include respondents from workers that do not work or do not report any income in the IFLS-5 with the same assumption as listed previously. Similar to the first discussion with the full employment assumption, this study will also examine the work-life earning patterns in the age-earning profiles by applying SWE estimation. The analysis from quartile 1, quartile 2, and quartile 3 is shown in Figure 4.8, Figure 4.9, and Figure 4.10, respectively.

Similar to Figure 4.5, Figure 4.8 also exhibits a typical pattern for college graduate workers. The earnings tend to increase at the beginning of their career in the 20s. However, if we include the unemployment factor, the earnings are lower than the previous one, as in Figure 4.5. Elementary school graduate workers tend to have no career development as their earnings almost stay the same for their lifetime. There is a slight increase in their earnings for junior high school graduate workers in the long term. There are some fluctuations in the age-earning profiles that might be due to the limited sample in the IFLS-5.

To some extent, this situation might also be affected by the unemployment factor. Some workers from a certain level of education do not perform as they earn nothing but are included in the calculation. However, Figure 4.8 indicates a relatively normal pattern where the college graduate workers earn the highest income, senior high school graduate workers are in the second position, and primary school graduate workers are the lowest-earning.

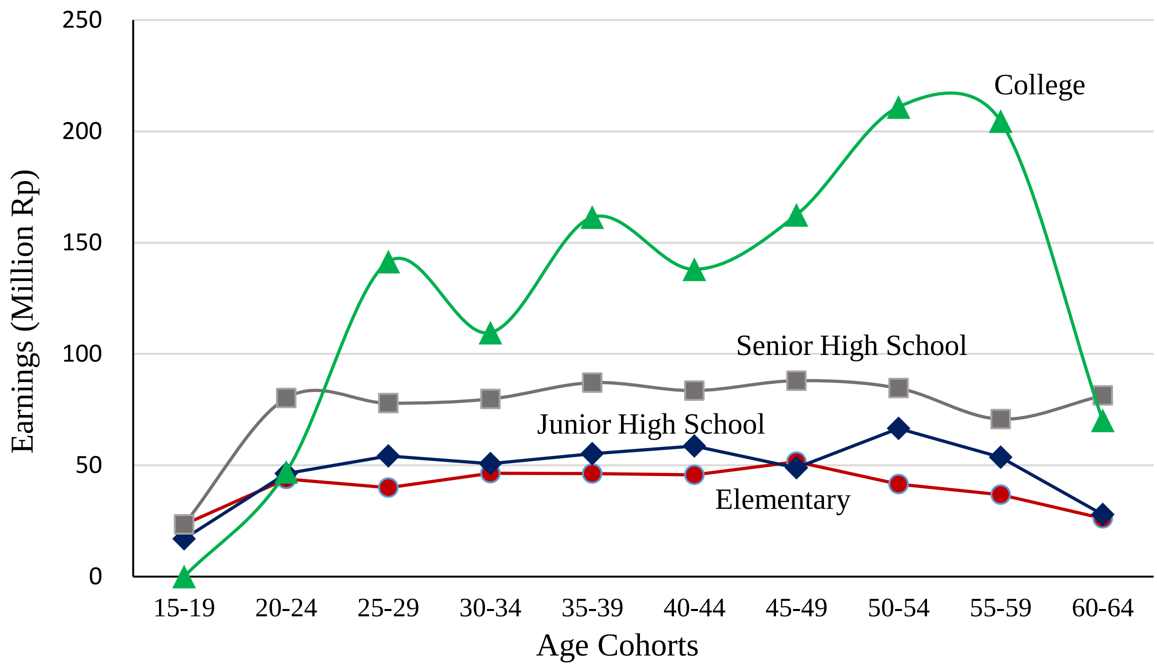
Figure 4.8 Age-Earning Profiles from the Quartile 1 SWE Estimate (Including Unemployment)



Source: Author's calculation using IFLS 5

For the middle-class workers with unemployment factor included in the calculation, almost all pattern in all level of education in Figure 4.9 resembles Figure 4.6. The amount earned for all workers from all education levels is also almost identical compared with the previous scheme with the full employment assumption. The workers' sequence in terms of work-life earning from a different level of education also shows the normal pattern where the college graduate workers earn the highest income and elementary school graduate workers perform worst amongst all. Moreover, the income pattern of both elementary school and junior high school graduate workers tend to stay level in every stage of their life. Both workers gain the same amount of money throughout their life with only around Rp60 million (about US$5,057) every five years or around Rp1 million (about US$84) per month.

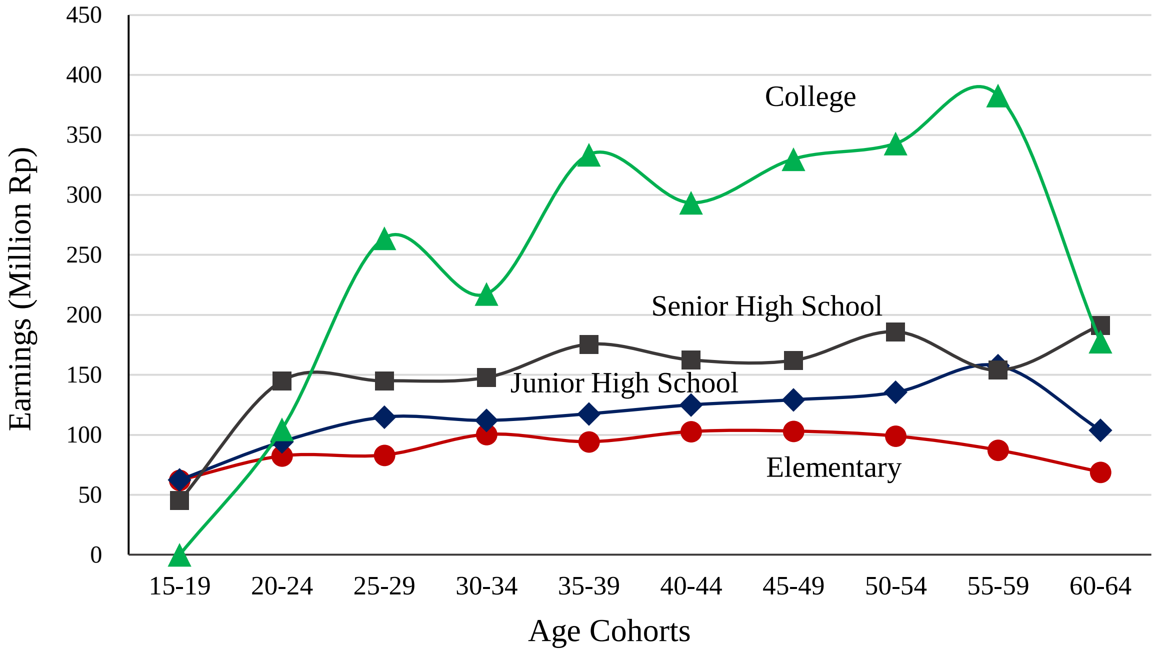
Figure 4.9 Age-Earning Profiles from the Quartile 2 SWE Estimate (Including Unemployment)



Source: Author's calculation using IFLS-5

Meanwhile, for the last age-earning profiles in this analysis, Figure 4.10 exhibits the work-life income trajectories for all workers from a different educational background in the 3rd quartile, including the unemployment factor. Based on this figure, the college graduate workers also become the best performer among other workers from other educational levels. They started to gain earnings similar to junior high school graduate workers at an early stage and gradually increased until it peaked at around 55 to 59 years old, when they started to retire. Again, for this quartile, pursuing a higher education most likely maximizes the length of retirement as well. It seems that within this range, the college graduate workers are capable of having a good position to "bargain" with their retirement age.

Figure 4.10 Age-Earning Profiles from the Quartile 3 SWE Estimate (Including Unemployment)



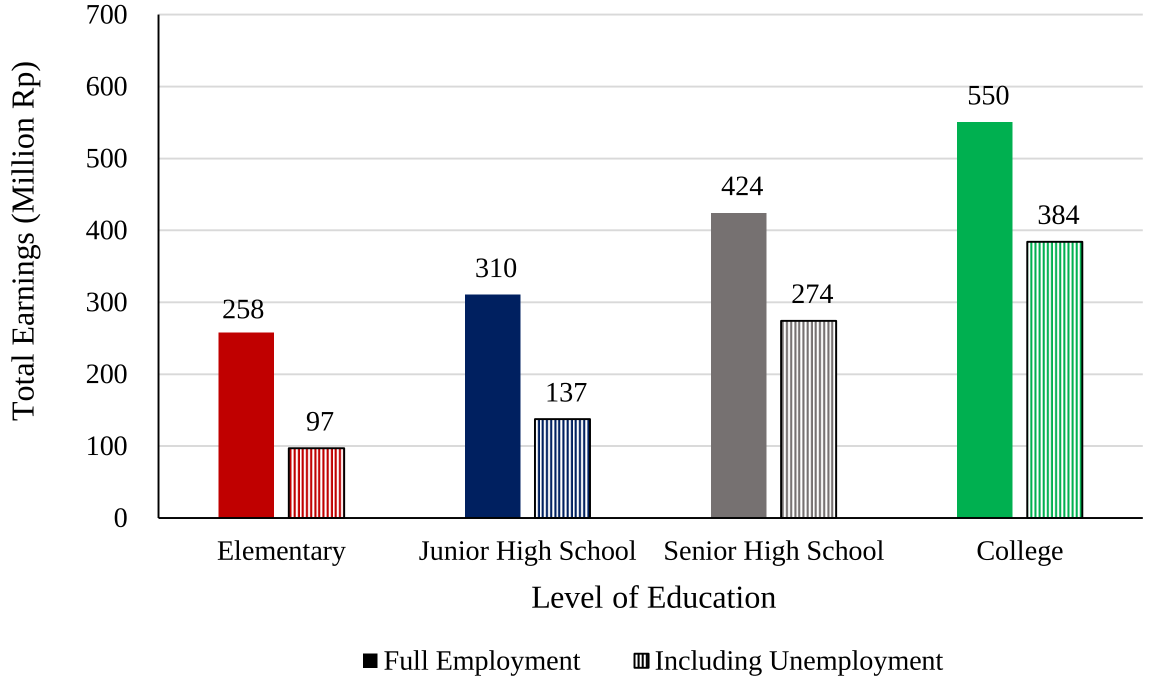
Source: Author's calculation using IFLS-5

On the other hand, their earning patterns are relatively flat for other educational level graduate workers. This implicitly indicates that there is no career development for the workers with the education attainment below tertiary education.

Based on age-earning profiles, as shown in Figure 4.5 to Figure 4.10, which include both assumptions, full employment, and unemployment, we can construct the estimation of their total work-life earning. This number represents the sum of earnings obtained for a lifetime from workers of each level of education. Since the difference between a certain level of education and the other education level reflects the benefit as in flat-age earning as shown in Figure 4.1, we can later proceed with calculating return to education by using the short-cut method as formulated in Equation 4.1.

Figure 4.11, Figure 4.12, and Figure 4.13 show the total lifetime earnings from quartile 1, quartile 2, and quartile 3 from both assumptions altogether, respectively. Figure 4.11 exhibits the total earning from workers from different educational levels in 25% of the distribution, representing the lower-class workers. In general, the projection of total work-life earning with a full employment scenario is higher than the one with the unemployment factor. It is logical, as some of the workers in the second assumption have no income on the one hand, but they are part of the calculation, on the other hand. As a result, the distribution will shift to the left.

Figure 4.11 Total Work-Life Earning from Quartile 1 SWE Estimation



Source: Author’s calculation using IFLS-5

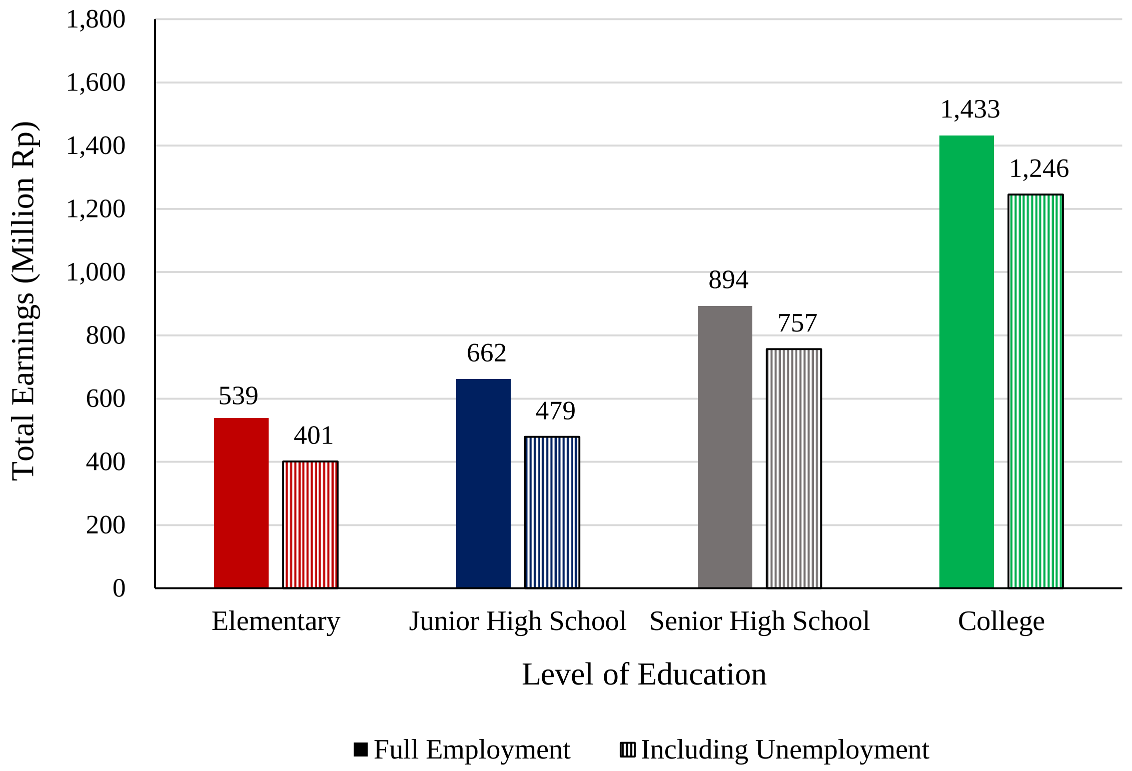
For the first analysis, we will discuss the first assumption with a full employment scenario. In this scheme, referring to the solid-filled bars, the college graduate workers will earn around 30% more than senior high school graduate workers. They earn around Rp550 million (about US$46,354), while senior high school graduate workers only earn Rp424 million (about US$35,735). On the other hand, junior high school graduate and elementary school graduate workers earn around 27% and 39% less than secondary school leaver workers with Rp310 million (about US$26,126) and Rp257 million (About US$21,660), respectively.

Meanwhile, for the second scheme with the unemployment factor, the total amount of lifetime earnings for all educational levels decrease significantly compared to that of the scheme with total employment. We can see that all bars with the line pattern, which refers to the scheme with the unemployment factor, are substantially lower than the solid-filled bars. In fact, for the elementary school graduate workers' case, the difference is around 62%. Nevertheless, the gap tends to narrow as the level of education increases.

For the second scheme that assumes there is unemployment and using senior high school as a base, elementary school and junior high school graduate workers earn 28% and 39% lower, respectively. On the other hand, college graduate workers earn 30% higher than their senior college graduate counterparts. Therefore, both schemes exhibit a similar pattern of total work-life earning.

For the quartile 2 analysis, we will also discuss the first assumption with a full employment scenario. Like the previous one, Figure 4.12 demonstrates the total work-life earning from middle-class workers from different educational backgrounds. In this scheme, the college graduate workers will earn around 60% more than senior high school graduate workers. They earn around Rp1,433 million (about US$120,773), while senior high school graduate workers only earn Rp894 million (about US$75,346). It means, in this 50% of the distribution, college graduate workers double their earnings compare with their colleagues with the same educational attainment in the first quartile. On the other hand, junior high school graduate and elementary school graduate workers earn around 26% and 40% less than secondary school leaver workers with Rp662 million (about US$55,793) and Rp539 million (about US$45,426), respectively.

Figure 4.12 Total Work-Life Earning from Quartile 2 SWE Estimation



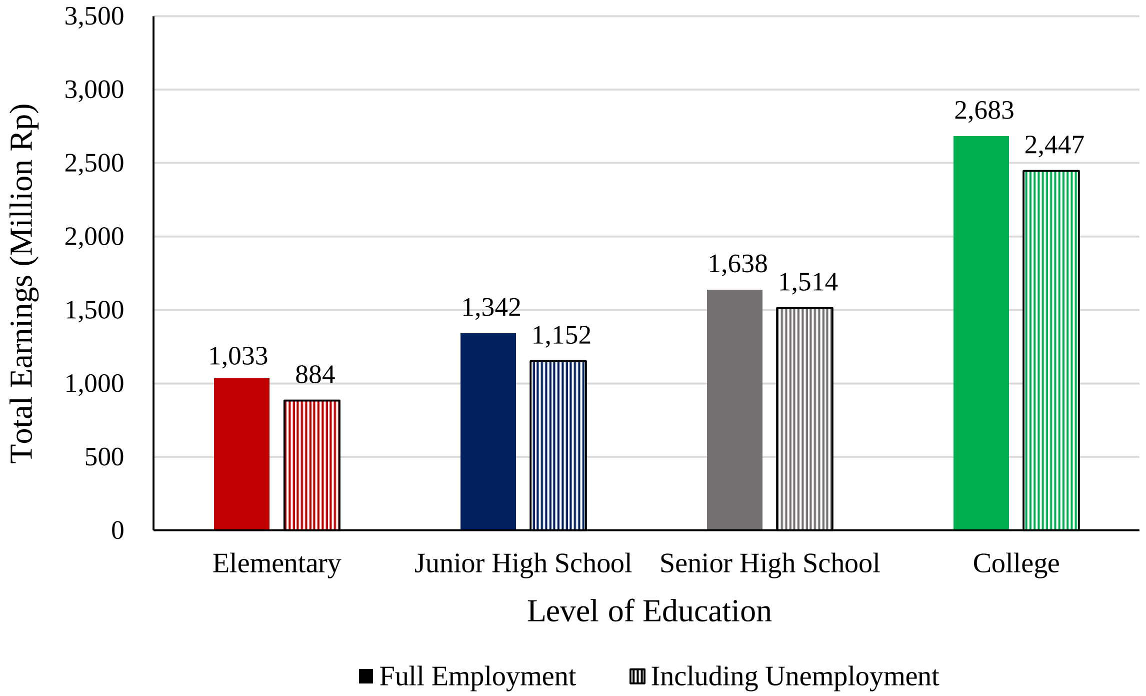
Source: Author's calculation using IFLS-5

For the second assumption with the unemployment factor, we will focus on the line-pattern bars. Similar to Figure 4.11, the red-line-pattern bar, the blue-pattern bar, grey-pattern bar, and green-pattern- bar refer to elementary school graduate, junior high school graduate, senior high school graduate, and college graduate workers, respectively. Compared with the first assumption with full employment, the total amount of work-life earnings decreases slightly. As predicted, college graduate workers earn the highest, where elementary school graduates earn the lowest-earning amongst all. It also tells us that the total work-life earning increases as the level of educational attainment increases. Although there are slight differences in the total earning amongst workers from primary and secondary education graduates, the number significantly increases as the workers go to college.

The green-line-pattern and grey-line-pattern bars in Figure 4.12 shows that the difference in income from secondary leaver with college graduate workers is around 65%. This figure is higher than the previous assumption with full employment. It also indicates that in 50% of the distribution, college graduate workers earn two-folds more compared with their colleagues in the bottom quartile.

Figure 4.13 will be used for the last analysis of the total work-life earning from the SWE estimation in 75% of the distribution, representing the upper-class workers. Similar to Figure 4.11 and Figure 4.12, Figure 4.13 consists of four solid filled bars and four line pattern bars, representing the total work-life earning from full employment assumption and not full employment assumption, respectively. In general, there are only slight differences in the total amount of both the first assumption and the second assumption. It implies that in higher distribution, the unemployment factor does not really affect the earning of the workers.

Figure 4.13 Total Work-Life Earning from Quartile 3 SWE Estimation



Source: Author’s calculation using IFLS-5

For the first analysis with the full employment assumption, we will discuss the solid filled bar in Figure 4.13. According to that figure, elementary school graduate workers, as in a red solid filled bar, accumulate the lowest total earning amongst other workers from a different educational background. With around Rp1,033 million (about US$87,061) of earnings over their lifetime, the elementary school graduate workers earn 37% less than senior high school graduate workers. Meanwhile, with around Rp1,342 million (US$113,104), junior high school graduate workers earn 18% less compared to secondary school leavers. On the contrary, college graduate workers with lifetime earnings of around Rp2,683 million (about US$226,123) gain 64% more compared to that of senior high school workers.

Similarly, the line pattern bars which represent the assumption of the unemployment factor indicate a nearly identical result with the previous findings with the full employment assumption. In this case, the elementary school graduate workers also accumulate the lowest-earning at around Rp883 million (US$74,419). This number only represents 58% of the total income earned from senior high school graduate workers. It means elementary school graduate workers earn 42% less compared to what the senior high school workers obtained. Furthermore, junior high school graduate workers earn about 76% of what senior high school graduate workers obtain over their lifetime. In contrast, college graduate workers are able to accumulate 62% more compared to secondary leavers.

Having the work-life earning from SWE estimation from different educational attainment and different quartiles ready, we can proceed to the next stage to calculate the return to education. In this case, the work-life earning from SWE estimation resemble flat age-earning profiles, as in Figure 4.1. Moreover, we also have two assumptions with regard to the unemployment issues so that we can enrich the analysis. For calculating the return to education, we will apply Equation 4.1. The result of the return to education in Indonesia by using this short-cut method is presented in Table 4.1.

Base on the calculation from Equation 4.1, Table 4.1 presents and classifies the result based on two assumptions, full employment and unemployment. Each assumption is divided into quartile 1, quartile 2, and quartile 3 to explain the variation of return to education in a different distribution. Furthermore, Table 4.1 presents the result of the return to education as the additional benefit of having more education. In this regard, this study uses the elementary school as a base to calculate the return to education for the next level of education. Starting from junior high school, its return to education is calculated as the rate of return of pursuing the next education after elementary school. Similarly, return to education for senior high school refers to the rate of return of having more education after finishing junior high school. Correspondingly, return to education of college degree represents the rate of return of having continued to tertiary education after graduating from secondary education.

Table 4.1 Return on Education by the Short-Cut Method

Level of Education	Full Employment (in %)			Including Unemployment (in %)		
	Quartile 1	Quartile 2	Quartile 3	Quartile 1	Quartile 2	Quartile 3
Junior high school	6.8	7.6	10.0	13.9	6.4	10.1
Senior high school	12.2	11.7	7.4	33.2	19.3	10.5
College	7.4	15.1	15.9	10.0	16.2	15.4

Source: Author's calculation based on IFLS-5

Keep in mind that based on this method the return to education only indicates the benefit of having more education from the additional time necessary to complete studies while putting aside the cost of the studies. In this regard, the time necessary to finish junior high school from elementary school is three years. Likewise, finishing secondary education in senior high school requires another three years. Furthermore, to graduate and obtain a bachelor's degree requires around another four years. The number of years spent on another educational attainment will be utilized in Equation 4.1 to calculate each level of education rate of return.

With full employment assumption, the results imply that having more education ameliorates the earning of the workers. From quartile 1, the return to education of continuing from elementary school to junior high school is 6.8%. The rate of return slightly increases if the workers in this level of education can find a better job in quartile 2 or becomes even higher in quartile 3 with 7.6% and 10%, respectively. On the other hand, the high rate of return of continuing to senior high school in quartile 1 by 12.2% does not improve to a higher rate as the workers can find a better job. In fact, the return to education reduces to 11.7% in quartile 2 and plummets to only 7.4% in quartile 3. Meanwhile, having continued higher education is not really fruitful if the college graduate workers only enter into the lower-class labor market. We can confirm it as the return to education in quartile 1 is only 7.4%. However, the result is different if they can find more decent work in the labor market. In quartile 2, the result shows that the return to education rises significantly by two-folds to 15.1%. There is no significant difference if the workers shift to quartile 3 as the rate of return only increases by 0.8%.

If we analyze vertically, quartile 1, which represents the lower-class worker in the labor market, having continued to senior high school gives the best result as the workers with this educational attainment enjoy the highest return to education amongst others. However, for the middle-class worker, or even higher level, having a bachelor's degree is the best option as its rate of return is the highest amongst other levels of education.

For the next assumption with the unemployment factor, the patterns of return to education in each quartile are almost similar to that in the full employment scheme. In this regard, secondary leavers will bring the optimal result as the return to education at this level is the highest among all with almost 13%. Meanwhile, the return to education of junior high school and college is only 6.4% and 7.5%, respectively. However, if one manages to work as a middle-class or even upper-class worker in the labor market, definitely having a college degree is the best choice as it gains more than 16% of the rate of return. It means that each additional year spent from senior high school to obtain a college degree will generate 16% more earnings for a lifetime.

For interquartile analysis, the non-full employment scheme results indicate a huge difference for the junior high school and senior high school level, if we compare with those in full employment. It implies that for lower education, the impact of unemployment is significant, especially in quartile 1. For both elementary and junior high school graduate workers, having a better job does not necessarily increase the return to education. Unless one can achieve quartile 3 in the job market, moving from quartile 1 to quartile 2 for the elementary and junior high school graduate workers will decrease the return to education by 7.5% and 13.9%, respectively. Furthermore, junior high school graduate workers' return to education worsens by 22.7% as they shift from quartile 1 to quartile 3. In this case, the return to education of Junior High School graduate workers decrease from 33.2% to only 10.5%. Meanwhile, the pattern of the return to education for having a college degree in the non-full employment scheme resembles the one in the full employment scenario, with the rate of return being the highest in quartile 2 at around 16%.

However, keep in mind that this percentage only indicates the marginal value of having more education. To some extent, the result might be misleading, particularly if we want to make a comparison study. In a specific group of observations (e.g., with unemployment), where the marginal earning of having more education is high, the group will tend to have a high rate of return to education. However, it does not necessarily imply that different observations (e.g., with full employment) with lower marginal earning are worse since, in reality, the total earning for all levels of education with full employment is higher than that of the group with unemployment. Similarly, comparing the result of different quartiles should also be done carefully to avoid misunderstanding, as the original purpose is to examine the impact of education within the same group.

4.2.3 Rate of Return Based on Mincer Earning Equation

In this subsection, we will elaborate on the Mincer earning equation as the most widely used formula to estimate the return to education. Unlike the Subsection 4.1.2, when we calculate the return to education using the short-cut method through several steps, applying the Mincer equation to calculate the return to education is relatively more straightforward. Principally, the data source from IFLS-5 will be applied to the following Mincer equation, as in Equation 4.3.

By applying this Mincer equation, basically, we can identify the magnitude of additional years spent in education to obtain higher earning. The result will be on the percentage that represents the return to education by additional years of schooling. Therefore, we can identify to what extent one more additional year spent to have more education has an impact on earning.

However, that equation cannot identify the return to education for having an additional level of education. In order to do so, this study implements a similar methodology used by Purnastuti (2013) by applying some dummy variables for different levels of education as a proxy to analyze the difference of impact at each level of education, as in Equation 4.4. and Equation 4.5.

This study also applies two scenarios: the one is with full employment assumption, and the other is including the unemployment factor. Table 4.2 exhibits the descriptive statistics of the variables use in this regression. All the data analyzed is based on IFLS-5 with similar data handling as with the SWE approach.

Based on Table 4.2, we notice that the earning varies greatly. Earnings are presented in rupiah per hour work from main job. On average, the workers earn around Rp18,065.33 per hour. Assuming that if the workers work for 40 hours per week, they will obtain around Rp722,613.2 per week. Meanwhile, the highest earnings is Rp 9,666,667 per hour or about 500 times higher than the average.

Table 4.2 Descriptive Statistics

Variables	Mean	Max	Min	Std. Dev	Observations
earnings	18,065.33	9,666,667	0	152,748.6	17,549
log *earnings*	8.8937	16.0842	1.0498	1.2561	14,852
yos	10.0495	16	0	3.1615	17,549
edu_{jhs}	0.2455	1	0	0.4304	17,549
edu_{shs}	0.3483	1	0	0.4764	17,549
edu_{coll}	0.1288	1	0	0.3350	17,549
exper	18.7395	52	0	11.0707	17,549
$exper^2$	473.7237	2704	0	515.4210	17,549
tenure	7.0010	55	0	8.2204	17,549
$tenure^2$	116.5858	3025	0	265.1975	17,549
gender	0.5176	1	0	.4997	17,549
marital	0.1913	1	0	.3934	17,549
area	0.4050	1	0	.4909	17,549

Source: Author's calculation using IFLS-5

Years of schooling in this data set is limited only up to bachelor degree. Therefore, the highest year of schooling is 16. Meanwhile, the average years of schooling is around 10 or equivalent to first grade in senior high school. To determine the level of education, we use dummy variable. As in Table 4.2, edu_{jhs} represents dummy variable for junior high school. It is set to 1 if the education level of respondent is junior high school and 0 otherwise. Similarly, edu_{shs} represents dummy variable of senior high school is set to 1 to determine the respondent with senior high school graduate and 0 otherwise. Lastly, edu_{coll} is dummy variable for college graduate. It is set to 1 if college graduate and 0 otherwise. Based on Table 4.2, the respondents comprise of 24.5% from junior high school graduate, 34.8% from senior high school graduate, and 12.9% from college graduate. The remaining of 27.8% is from elementary school graduate. Meanwhile, the average experience and tenure in this sample is around 18 years and 7 years, respectively.

Gender is set to 1 if female and 0 otherwise. Meanwhile, marital status refer to 1 if married and 0 otherwise. Similarly, area is set to 1 if rural and 0 if urban. Based on the data, we can examine that around 51% of the sample is female. Moreover, only 19% if the sample is married and about 40% in rural area.

Table 4.3 exhibits OLS results based on the Mincer earnings equation by applying Equation 4.3 and Equation 4.4 as explained previously. Column (1) contains the result based on Equation 4.3, where the years of schooling are utilized as the proxy. Meanwhile, the column (2) refers to Equation 4.4, where the level of education is applied as the proxy. For OLS regression, we assume of full employment.

Table 4.3 The OLS Estimates of Earning Function Using Years of Schooling and Level of Education

Variable	(Full employment)			
	Years		Level	
	(1)		(2)	
constant	7.8724		8.5125	
	(0.0549)	***	(0.0413)	***
yos	0.0965			
	(0.0035)	***		
edu_{jhs}			0.1777	
			(0.0290)	***
edu_{shs}			0.4705	
			(0.0274)	***
edu_{coll}			0.9619	
			(0.0362)	***
exper	0.0113		0.0128	
	(0.0032)	***	(0.0031)	***
$exper^2$	-0.0003		-0.0004	
	(0.0001)	***	(0.0001)	***
tenure	0.0319		0.0313	
	(0.0032)	***	(0.0033)	***
$tenure^2$	-0.0006		-0.0007	
	(0.0001)	***	(0.0001)	***
gender	-0.3333		-0.3435	
	(0.0198)	***	(0.0199)	***
R-Squared	0.0879		0.0900	
N	14,852		14,852	

Source: Author’s calculation using IFLS-5

Standard error in parentheses. *** significant at 1%

Generally, this sample suffer from sample selectivity bias as many people in Indonesia choose not to work or does not work in formal sectors. Therefore, they do not received regular wages or cannot report their income. Meanwhile, OLS as used in Mincer equation in Table 4.3 is only capable to observe the sample which report their income. In other words, we assume that all persons are working and there is no unemployment. As a consequences, the result tends to be higher and can be adjusted properly to get a better result by using the Two-Step Heckman Estimates (Aslam, 2009).

There are two steps that should be done to estimate this Mincer equation by using the Two-Step Heckman Estimates. First, to determine the variables that affecting the person to work. This variables at the end can be used to estimate sample selectivity correction form (LAMBDA). Second, this LAMBDA is included in the regression to accommodate the sample selectivity bias at the second stage.

In this study, we assume that marital status and area are the most important factors that determine the labor participation rate. Mainly, women who are married tend to stay at home to take care of their children. Meanwhile, people in urban area also tend to either work at home or work as unpaid workers. These factors have significant impact to determine labor participation rate. Table 4.4 shows the result of the 2 step Heckman estimates by using these two factors to correct sample selectivity bias.

By using years of schooling as a proxy, we can observe that one additional year of schooling will increase earnings by 9.6% for the full employment scenario. On the other hand, the result is slightly lower for the other scenario, including the unemployment factor. In this regard, the return to education by years of schooling is around 9.2%. We also notice that both in Table 4.3 and Table 4.4, female workers tend to have a lower income compare to male workers by around 33%.

Table 4.4 The Two-Step Heckman Estimates of Earning Function Using Years of Schooling and Level of Education

Variable	Including unemployment			
	Years		Level	
	(1)		(2)	
constant	8.227		8.838	
	(0.0763)	***	(0.0633)	***
yos	0.0906			
	(0.0036)	***		
edu_{jhs}			0.1627	
			(0.0289)	***
edu_{shs}			0.4325	
			(0.0278)	***
edu_{coll}			0.9086	
			(0.0369)	***
exper	0.0075		0.0089	
	(0.0032)	**	(0.0032)	***
$exper^2$	-.0003		-0.0003	
	(0.0001)	***	(0.0001)	***
tenure	0.0317		0.0311	
	(0.0032)	***	(0.0032)	***
$tenure^2$	-0.0007		-0.0006	
	(0.0000)	***	(0.0001)	***
gender	-0.3385		-0.3491	
	(0.0198)	***	(0.0198)	***
marital	-0.0201	***	-0.2010	***
area	-0.4276	***	-0.4276	***
LAMBDA	-0.9004	***	-0.9166	***
Wald chi square	1,332.90		1,370.90	
N censored	2,697		2,697	
N uncensored	14,852		14,852	

Source: Author’s calculation using IFLS-5

Standard error in parentheses. *** significant at 1% ** significant at 5%

For identifying the return to education by the level of education in both full employment and non-full employment, we should apply the result in Table 4.3 columns 2 and Table 4.4 columns 2 on Equation 4.5. By applying this equation, we can calculate the impact of the additional level of education on earnings, as shown in Table 4.5 as follows:

Table 4.5 Return to Education, Calculated from the Level of Education as a Proxy

Level of Education	Return to Education (in %)	
	Full Employment	Including Unemployment
Junior high school	5.9	5.4
Senior high school	9.8	9.0
College	12.3	11.9

Source: Author's calculation based on data in Table 4.3

From that figure, we find that getting a higher education will give the highest benefit, among other levels of education. In this case, return to education as a college graduate is 12.3%, assuming full employment. Likewise, assuming non-full employment also indicates that the return to education is 11.9%. This number is derived from the assumption of 4 years of schooling in college. In other words, college graduate workers earn 49.2% higher than secondary leaver workers in full employment scenario or around 47.6% in the case of including the unemployment factor.

Similarly, senior high school workers also benefit from continuing to secondary school from junior high school. From Table 4.5, the return to education by using the level of education as a proxy for both full employment and non-full employment scenario is 9.8% and 9%, respectively. Junior high school workers also indicate the same result with the return to education up to 5.9% for the first assumption with full employment and 5.4% for the other scheme with unemployment factor, if they continue to study from primary school to junior high school.

4.3 Financial Value of Higher Education

This section is dedicated to calculating the return of investment in education by using the full discounting method. Unlike Section 4.2, where only time becomes the essential factor deciding the rate of return, we will compare the total benefit of continuing education with all costs borne during the study. The total benefits refer to the difference between the total work-life earning from individuals with *n* level of education and the total work-life earning from individuals with *n-1* level of education based on results in Figure 4.11 to Figure 4.13 previously. However, this study only limits the scope of analysis in tertiary education due to the data limitation.

The tuition fee, which is the main cost of higher education, will refer to Table 4.6. Besides the tuition fee, any other expenses borne by the prospective student are also included to simulate the real expenditure. They include book expenses, lodging, food, and transportation. A prospective student should bear that to continue his/her study to higher education. Table 4.7 describes the estimation of the full and detailed expenses for a student for studying a year in a college. This table shows the differences between public and private college expenditures; that is, it shows the cost differences between public and private colleges. Public colleges are run and subsidized by the government, while private colleges are privately funded.

Table 4.6 The Cost of Education and Tuition Fee from Top 10 Universities for the Year 2014/2015 (in Rupiah)

No.	University	Number of Study Program	Average Cost of Education for Each Student	Tuition Fee/College 4 years		
				Lowest	Mid	Highest
1	Universitas Gadjah Mada	68	70,031,647	4,000,000	26,923,529	47,211,765
2	Institut Teknologi Bandung	43	96,122,791	3,200,000	32,000,000	80,000,000
3	Institut Pertanian Bogor	10	53,812,800	4,000,000	24,680,000	51,040,000
4	Universitas Indonesia	52	64,022,000	4,000,000	20,000,000	40,038,462
5	Institut Teknologi Sepuluh Nopember	24	65,192,000	4,000,000	26,000,000	48,000,000
6	Universitas Diponegoro	51	55,511,059	4,000,000	33,137,255	54,705,882
7	Universitas Airlangga	33	55,289,939	4,000,000	39,000,000	91,757,576
8	Universitas Brawijaya	69	54,887,072	4,000,000	35,492,783	54,232,464
9	Universitas Hasanuddin	69	98,238,377	4,000,000	15,420,290	40,695,652
10	Universitas Negeri Yogyakarta	55	63,123,491	4,000,000	23,563,636	37,136,000
		474	67,623,118	3,920,000	27,621,749	54,481,780

Source: Ministry of Research, Technology and Higher Education decree number 22/2015

Table 4.7 One Year Public and Private Universities’ Cost of College (in Rupiah)

Special 'One-Time' or 'Up-Front' Fees		Public Colleges				Private Colleges		
		Low		High		Low	High	
		2004-2005	2014-2015	2004-2005	2014-2015	2014-2015	2004-2005	2014-2015
Instructional Expenses	Tuition	300,000	980,000	1,000,000	13,620,445	4,339,300	4,000,000	43,393,000
	Books and other educational expenses	900,000	1,688,298	1,350,000	2,532,447	2,110,373	2,250,000	4,220,745
	Subtotal instructional expenses	1,200,000	2,668,298	2,350,000	16,152,892	6,449,673	6,250,000	47,613,745
Student living expenses	Lodging	900,000	1,661,274	9,000,000	16,612,744	9,137,009	10,800,000	19,935,293
	Food	3,600,000	9,984,756	6,300,000	17,473,324	13,729,040	8,100,000	22,465,702
	Transportation	315,000	540,618	450,000	772,312	656,465	2,250,000	3,861,560
	Other personal Expenses	800,000	1,652,355	2,700,000	5,576,697	3,614,526	3,600,000	7,435,596
	Subtotal expenses of student living	5,615,000	13,839,004	18,450,000	40,435,077	27,137,040	24,750,000	53,698,151
	Total cost to parent and student	**6,815,000**	**16,507,302**	**20,800,000**	**56,587,969**	**33,586,713**	**31,000,000**	**101,311,896**

Source: Author’s compilation from various sources

The analysis will implement both the IRR approach and the NPV approach to calculate the return to education. Please bear in mind that both IRR and NPV methods emphasize the rate of return of monetary value invested in education rather than merely analyzing time spent for continuing schooling. For the NPV method, we assume the interest rate is 8.5%, which is derived from Indonesia's average government bond interest rate.

Table 4.8 The result of IRR and NPV for a Full-Employment Scheme

(Million Rp)

Items	**Public Colleges**		**Private Colleges**	
	Low	**High**	**Low**	**High**
Quartile 1				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	-37.6	-37.6	-37.6	-37.6
Benefit (Wc-Ws)	163.8	163.8	163.8	163.8
IRR	11.7%	-9.9%	-1.1%	-19.1%
NPV	60.1	-100.2	-8.1	-279.1
BEP After	22 years	N/A	N/A	N/A
Quartile 2				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	-67.3	-67.3	-67.3	-67.3
Benefit (Wc-Ws)	606.8	606.8	606.8	606.8
IRR	45.3%	17.5%	28.9%	5.5%
NPV	473.5	313.2	405.2	134.3
BEP After	15 years	25 years	20 years	33 years
Quartile 3				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	-112.2	-112.2	-112.2	-112.2
Benefit (Wc-Ws)	1,157.0	1,157.0	1,157.0	1,157.0
IRR	62.3%	32.5%	45.0%	19.4%
NPV	978.8	818.5	910.5	639.6
BEP After	10 years	16 years	14 years	22 years

Source: Author’s calculation

After identifying both total work-life earnings estimation through SWE estimate and expenditures to continue to higher education, we can combine those variables to calculate the rate of return of investment to examine the financial value of tertiary education in Indonesia. By applying both expected income and expenditure into Equation 1.6, we can calculate the value, as shown in Table 4.8 and Table 4.9, for full employment and non-full employment assumption, respectively. Since the total work-life earnings, which are generated through SWE by using IFLS-5 is observed data and not projected income, it is not necessary to estimate the present value as it already represents the real value.

Table 4.8 exhibits the financial value of tertiary education by assuming full-employment. There are three different analyses from different quartiles. Overall, the return of the investment of higher education in Indonesia varies greatly. Starting from quartile 1, which represents the group of lower-income workers, indicates that investing in higher education is rather unprofitable. Unless one manages to achieve higher education through a highly subsidized college with a low-cost scheme, the return of an investment will be negative. From the simulation, the results indicate that investment in higher education is negative, with a value of around 1 to 19% if one cannot enter the “low-cost” college. Moreover, it takes around 22 years for a person to reach break-even point one he or she manages to enter the “low-cost” college.

In quartile 2, the results demonstrate a different pattern. All investments in different types of colleges show positive values with a range of returns are around 5.5% to 45.3%., depending on the choice of college. In this case, for those who are not eligible to enter public college with a large portion of subsidy (e.g., they do not belong to low-income families), then the rate of return of the investment will be lower than 45.3%. However, those who choose private colleges with its "high price" will still obtain more than a 5.5% return on investment. This scheme is highly dependent on the choice of college. Workers who are only capable of graduating from a public college with a higher cost, that is, belong to a group that is not subsidized (or only partially subsidized), will earn about 17.5% return of investment.

If using NPV analysis, the result principally shows the same pattern that the higher NPV is acquired by workers who graduated from public college, which is heavily subsidized. In this case, the investment of the workers for continuing their education to tertiary education is fully paid-back after 14 years of working after graduating from college. The lowest NPV is obtained by the workers who graduated from a high-cost private college with only around Rp134.3 million (about US$11,294) of work-life earnings. Therefore, the cost of college for these workers will be recovered after 33 years of working life.

Meanwhile, quartile 3 provides better results in the return of higher education investment. Typically, as the workers earn more in the higher distribution, the rate of return in higher education increases accordingly. From Table 4.8, the range of rate of return of investment in education improves by around 15.5% on average compared to that of quartile 2. As a result, the workers can pay back their investment at least within 22 years or, at earliest, ten years after starting their work, depending on college choices. All of these results assume there is no unemployment.

If we include the unemployment factor in the calculation, the result will be different. Table 4.9 exhibits the financial value of higher education with this assumption. Similar to the previous analysis, Table 4.9 classifies the result based on different quartiles to examine the variation. In this analysis, the earnings are lower, and the costs are the same compared with the previous full-employment analysis, as shown in Table 4.8. As a result, all the returns of an investment will be lower to some extent.

Based on Table 4.9, the only person who can enroll in a low-cost public college scheme can take advantage of pursuing higher education in quartile 1. Within this framework, he or she will be able to get a 9.6% return on investment in higher education, although it takes more than 28 years to compensate for all the expenses. Those who enroll other than low-cost public colleges will lose their investment by up to 21.7%.

In quartile 2, all the investments seem appealing and profitable. The lowest rate of return is 3.6% or the NPV of Rp83 million (about US$6,995), with more than 34 years to repay the investment. Meanwhile, the workers in this distribution who graduate from low-cost public schools enjoy around 43.6% return on investment in higher education with NPV around Rp423 million (about US$35,650). Moreover, it will only take around 14 years to offset all expenses for pursuing higher education. If we assume the high cost of public college, the rate of return will significantly drop to only 15.5%, with NPV only around Rp263 million (about US$22,166). As a consequence, the payback period also becomes around 13 years longer.

Table 4.9 The Result of IRR and NPV for Non-Full Employment Scheme

(Million Rp)

Items	**Public Colleges**		**Private Colleges**	
	Low	**High**	**Low**	**High**
Quartile 1				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	-23.0	-23.0	-23.0	-23.0
Benefit (Wc-Ws)	132.9	132.9	132.9	132.9
IRR	9.6%	-12.6%	-3.6%	-21.7%
NPV	43.9	-116.4	-24.4	-295.3
BEP After	24 years	N/A	N/A	N/A
Quartile 2				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	-55.5	-55.5	-55.5	-55.5
Benefit (Wc-Ws)	544.6	544.6	544.6	544.6
IRR	43.6%	15.5%	27.0%	3.6%
NPV	423.0	262.7	354.7	83.8
BEP After	14 years	27 years	20 years	34 years
Quartile 3				
Direct Cost	-66.0	-226.4	-134.3	-405.2
Opportunity Cost	103.1	103.1	103.1	103.1
Benefit (Wc-Ws)	1,036.3	1,036.3	1,036.3	1,036.3
IRR	59.4%	29.9%	42.1%	16.9%
NPV	867.1	706.8	798.8	527.9
BEP After	10 years	16 years	13 years	23 years

Source: Author's calculation

Quartile 3, in this regard, refers to the workers who are qualified to enter the upper-class labor market, which offers higher earning. There are no significant differences in the return on investment in education in this group, between the first assumption with full-employment and the other, including the unemployment factor. Overall, the return on investment in higher education is only around 2.7% lower for all scenarios. Meanwhile, the rate of return is around 15% higher compared to that in quartile 2 for all scenarios.

4.4 Summary

This chapter primarily focuses on finding the impact of education on individuals' earning. In other words, we try to find the return on education. There are two main approaches when dealing with examining the impact of investment in education in line with earning improvement. The first approach is only considering the time-variant to determine the rate of return. In this framework, any additional earning gained from having more education will be compared with the time spent to attain the additional education. This approach, is explained in Section 4.2. Additionally, the second approach is not only focused on the time to finish the studies but also considering the financial aspect to attain a higher level of education. This approach is referred to in Section 4.3.

Section 4.2 explained in detail about the benefit of having more education. Starting from applying the SWE estimate on the IFLS-5 database to construct the age-earning pattern by education attainment, it was found that having more education improves earning substantially. Thus, college graduate workers have the highest total work-life earning amongst other workers from a lower educational background. Typically, college graduate workers also have more career development as the income tended to increase gradually and reached a peak just before retirement age of 55-59 years old. Similarly, secondary school leavers also have a similar trend at the beginning. However, the income remained relatively stable after their 20s until they retired. Meanwhile, both workers with elementary and junior high school graduate level show no sign of career development as their income is low and remains stable from the beginning to the end of their working period.

The return on education shows a different pattern in a different distribution. By using the short-cut method, the return to education of higher education indicates the highest rate, with around 15% on average. Meanwhile, the return to education for elementary and junior high school is around 8% and 11%, respectively. When applying the Mincer earning equation, the return to education is slightly different for elementary and junior high schools compared with the short-cut method. By using this method, the return to education for junior high school is around 6%, while senior high school is approximately 10%. On the other hand, the return to education of higher education is around 11%. Meanwhile, using years of schooling as a proxy, the return to education in Indonesia is around 9%.

In Section 4.3, this study gave more detailed information about the extent of having more education. This study only discussed the financial value of higher education. Based on using total work-life earning from the calculation in Section 4.2, this study extends the analysis by combining with the total cost of education as a form of investment. The results show that the rate of return of investment in education is 5.5% to 45.3% in general, assuming full employment for middle-class workers. Furthermore, it takes about 10 years to 33 years to compensate for the investment in higher education.

CHAPTER 5 PANEL DATA ANALYSIS ON HUMAN CAPITAL INVESTMENT AND ECONOMIC GROWTH ON SELECTED ASEAN COUNTRIES

The previous chapter discussed human capital investment and its impact on the individual's economy in Indonesia. In this case, we estimated the return to education in Indonesia from the individual or household expenditures. The results exhibited that the private return to education in Indonesia is relatively high, especially from investment in higher education.

This chapter and the next chapter enhance the study by analyzing the role of this investment in the economy from a broader perspective. We are going to focus on analyzing the impact of government expenditure on the economy. However, before we go further to the Indonesian case, we will take a detour to estimate the production function of human capital in Southeast Asian countries to understand the macro impact. Therefore, this chapter will try to estimate the impact of government expenditure on education, as a sort of human capital investment, to the economy in Southeast Asia.

In Southeast Asia, there are many countries and differences in terms of human capital investment, which can explain the impact of the economy. Moreover, as a place where Indonesia and some developing countries are located, Southeast Asian countries are expected to be suitable for comprehending the impact of government expenditures on education on the economy. Due to the limitation of data availability, only selected countries in Southeast Asia will be chosen.

5.1 Brief History of ASEAN

ASEAN is an abbreviation for the Association of Southeast Asian Nations, a regionally intergovernmental organization that consists of 10 countries located in South East Asia. Southeast Asia itself is home to 11 countries, sorted alphabetically, namely Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor Leste, and Vietnam, sorted alphabetically. Out of 11, only Timor Leste is not part of ASEAN.

On August 8, 1967, this organization was established under the Bangkok Declaration under the initiation of five founding countries, that is, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. This organization's primary purpose is to strengthen the relationship of country members in this region. Hence, better mutual understanding amongst country members will promote economic growth, enrich and preserve cultural diversity, support peacebuilding, and contribute to other fields such as research and development in sciences (Bangkok Declaration, 1967).

The accomplishment of ASEAN, especially in promoting economic growth, resulted in Southeast Asian countries becoming part of this organization. In the early 1980s, Brunei Darussalam declared its intention to become an ASEAN member and officially join in 1984 as the sixth member. The ASEAN members kept expanding as in 1995, Vietnam also followed Brunei Darussalam to become the seventh member in ASEAN. Moreover, in 1997, two other countries in this region, Laos and Myanmar, joined ASEAN member countries. The last country which joined ASEAN was Cambodia in 1999. Therefore, the total number of ASEAN members became ten countries.

5.2 Methodology and Data

This chapter examines the human capital investment and its impact on the economy through analyzing selected ASEAN countries. Hence, we will use panel data analysis. This method provides advantages such as richer information, more efficient, less collinearity amongst variables, and a higher degree of freedom (Baltagi, 2005). Baltagi suggested the standard formulation for panel data analysis regression as follows:

$$P_{it} = \alpha + X'_{it}\beta + u_{it} \quad i = 1, 2, \ldots, N\ ;\ t = 1, 2, \ldots, T \tag{5.1}$$

i represents the cross-section unit, and *t* expresses time-series unit

$$u_{it} = u_i + v_{it}$$

u_{it} refers to the unobservable individual-specific effect, and v_{it} denotes the remaining disturbances or idiosyncratic error.

5.2.1 Model Specification

Many countries are concerned with the importance of human investment in their countries. Mainly, it has become the state's obligation to provide a proper education for their citizens. Some countries pledge and allocate a specific portion of their budget in the education sector as their commitment. Although the individuals also allocate some funds for education, we use government spending in education solely as part of the explanatory variable to represent a country's human capital investment in this chapter.

This chapter will use the reduced-form model. The main focus of this study is to find the impact of education expenditure on the economy. Therefore, government education expenditure will be utilized as an explanatory variable, while GDP represents the output of the economy as the dependent variable. To accommodate the factors of production, we add capital and labor. Therefore, the explanatory variables become government education expenditure, capital, and labor.

The data for education expenditure, capital, and labor will be obtained from the World Development Indicators. The estimation in reduction form as in the following function:

$$GDP = f\,(EDUEXP, K, EL) \qquad (5.2)$$

where GDP represents Gross Domestic Product; EDUEXP denotes government expenditure on education; K refers to capital; EL is for labor.

As investment in education is considered a long-term investment, we expect that it will take at least 5 years for the education investment to give the result. Therefore, in this analysis, we will apply lag 5 years of education expenditure in the model. The current year's output in the economy mainly depends on last year's capital stocks. Thus, we will employ last year's capital stock in the analysis in the regression. Meanwhile, labor refers to the current year's number of employed labor. As we take all the variables in log form, we can write the estimation as follows:

$$\log GDP_{it} = \beta_0 + \beta_1 \log EDUCEXP_{it-5} + \beta_2 \log K_{it-1} + \beta_3 \log EL_{it} + \varepsilon_{it} \tag{5.3}$$

where GDP_{it} refer to output of country *i* at year *t*, $EDUCEXP_{it}$ denotes government education expenditure of country *i* at year *t*, EL_{it} represents employed labor of country *i* at year *t* and ε_{it} is the error term

Pooled OLS is the simplest technique to estimate the model parameter of the panel data. This technique combines both cross-section data and time-series data as one entity without considering the difference in both times and the entities. Meanwhile, the random effects model assumes that every entity has a different intercept, which is random or stochastic. This technique also considers that the error might lie within cross-section and time series. Lastly, the fixed effects assume that the intercept of each entity differs while the slope remains the same. This method uses a dummy variable to obtain the difference of intercepts for each entity.

Basically, the selection of these three models to estimate panel data depends on the research. Since this study focuses on the variables which vary over time for each country in the selected ASEAN countries, we can directly choose the fixed effects model to run the regression. In this case, the fixed effect is more suitable to examine the relationship between dependent and independent variables within an entity. In other words, we assume that each entity in the panel data has its own uniqueness and does not correlate to other entities.

Since we choose fixed effects, it means the individual-specific effects $\alpha_{i,}$, as intercepts, are correlated with the regressors. Therefore, each entity has each own intercepts but the same slope parameters. We can write it as follows:

$$y_{it} = \alpha_i + x'_{it}\beta + u_{it} \tag{5.4}$$

With α_i instead of α, we are allowing that the parameters to vary across the individuals. After we estimate the model, we can recover those individual-specific effects as in Equation 5.4 by removing the time effects from both dependent and independent variables because α_i does not change over time, as follows:

$$\hat{\alpha_i} = \bar{y_i} - \bar{x}'_i\hat{\beta} \tag{5.5}$$

where $\hat{\alpha}_i$ is the predicted value of intercept of individual i, which represents the individual-specific effects. It exhibits the leftover variation in the dependent variable that cannot be explained by the regressors.

5.2.2 Data

The data for this analysis is extracted from World Development Indicators (World Bank, 2019), which was published by the World Bank. Only data on education expenditure for Indonesia was obtained from the Ministry of Finance of Indonesia. All variables are using the year 2010 as the base year in USS$.

The data consist of 5 countries, which represent the number of selected countries in ASEAN, namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Only 5 countries out of 10 ASEAN members are selected due to data limitation. Each country consists of 38 years from 1980 to 2017. Except for capital stocks, all data is obtained directly from the data source. Meanwhile, the capital stocks series are calculated by applying the perpetual inventory method.

5.2.3 Estimating Capital Stocks

Mainly, we can only find data for real investment or gross capital fixed formation. Meanwhile, there is no ready-to-use capital stocks data available. Therefore, to estimate the capital stocks in this chapter, we are going to construct the capital series using the perpetual inventory method. We can write the function of capital stocks as follows:

$$K_{t+1} = (1 - \delta)K_t + X_t \tag{5.6}$$

where

K : capital stocks

δ : depreciation rate of capital stocks

X : gross fixed capital formation/real investment

t : time

By using Equation 5.6, we can find the next year's capital stocks by adding the current year's undepreciated capital stocks and the current year's real investment. Therefore, as long as we have the initial capital stocks, depreciation rate, and real investment, we can find the current year's capital stocks. However, since there is no data on initial capital stocks, we have to make a good guess. In order to do so, we can assume that the capital-output ratio is roughly constant along with the balance of the growth path. We can write the function as follows:

$$\frac{K_{T_0}}{Y_{T_0}} = \frac{1}{10} \sum_{t=T_0+1}^{T_0+10} \frac{K_t}{Y_t} \tag{5.7}$$

where

K_{T_0} : Capital stocks at initial year

Y_{T_0} : GDP at the initial year

K : Capital

Y : GDP

t : time

We can imply that the initial capital stock refers to the average of capital-output ratio of the next 10 years. By combining Equation 5.4 and 5.5 and the iteration method, we can estimate the initial capital stocks and the capital stock series.

5.2.4 Descriptive Statistics

Table 5.1 and Table 5.2 exhibit the data which are used in the regression in the base and log form, respectively. The number in Table 5.1 shows the average value from the year 1980 to 2017 of each variable. It consists of gross domestic product (GDP), government education expenditure (EDUEXP), capital stocks (K), and employed labor (EL).

In Table 5.1, we can find that Indonesia is leading in terms of the total output, with US$509,641 million on average. Meanwhile, the Philippines has the lowest output, with a GDP of US$142,085 million on average. It means Indonesia has around 2.5 times higher output in the economy compared to that of the Philippines. It is in line with the difference in the number of both labor and capital in Indonesia and the Philippines. There are about 88 million workers in Indonesia on average. This number is approximately 2.3 times exceeding the number of workers in the Philippines. Meanwhile, the amount of capital stocks in Indonesia is around US$1,640,241 million on average, while the amount of capital stocks in the Philippines is around US$400,304 million on average. It means the Philippines' average capital stocks are only one-fourth of Indonesia's average capital stocks.

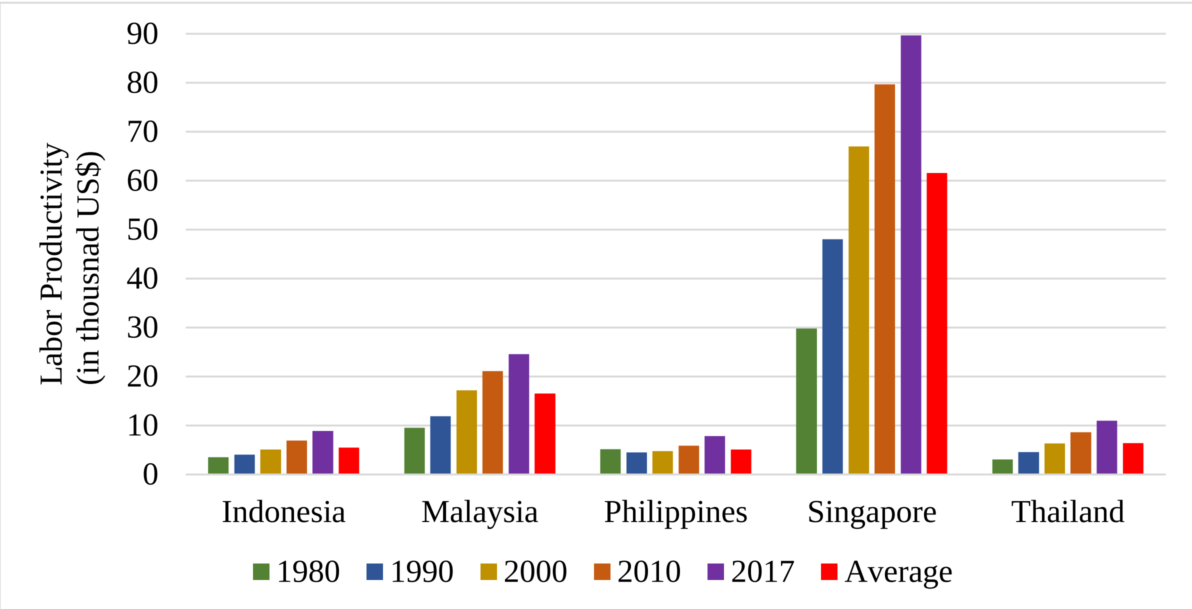
As the most populated country among these five Southeast Asia countries, Indonesia spent the most in terms of education expenditure, as shown in Table 5.1. Around US$10,442 million on average has been spent to support the education system in Indonesia. Meanwhile, with only US$3,722 million, the Philippines spent the lowest education expenditure among these five countries.

Table 5.1 Descriptive Statistics of Panel Regression Variables for Each Country on Average

No	Country	GDP Constant 2010 (Million US$)	EDUEXP Constant 2010 (Million US$)	K Constant 2010 (Million US$)	EL (Thousand persons)
1	Indonesia	509,641	10,442	1,640,241	88,113
2	Malaysia	164,551	8,802	238,228	9,151
3	Philippine	141,868	3,722	400,304	26,925
4	Singapore	142,085	4,538	313,080	2,092
5	Thailand	225,462	8,897	856,691	33,411

Source: Author's calculation using World Development Indicator by World Bank, 2019 and Ministry of Finance of Indonesia Financial Report

Figure 5.1 Labor Productivity in Selected ASEAN Countries



Source: Author's calculation using the World Development Indicator by World Bank, 2019 and Ministry of Finance of Indonesia Financial Report

From the data, we can also estimate the labor productivity. Labor productivity mainly determines the competitiveness of a country. Moreover, labor productivity is also closely related to the standard of living of a country (ILO, 2020). In this study, labor productivity also gives some basic comprehension of labor performance in these countries, which is closely linked to the accumulation of human capital. To measure labor productivity, we can calculate compare the total volume of output produced (GDP) divided by the unit of employed labor (L), as shown in Figure 5.1.

Figure 5.1 shows that labor productivity in those five countries in Southeast Asia increased gradually from 1980 to 2017. Among those five countries, Singapore is a leader in terms of labor productivity of around US$89,699 in 2017. On average, Singapore’s labor productivity was around US$61,596.

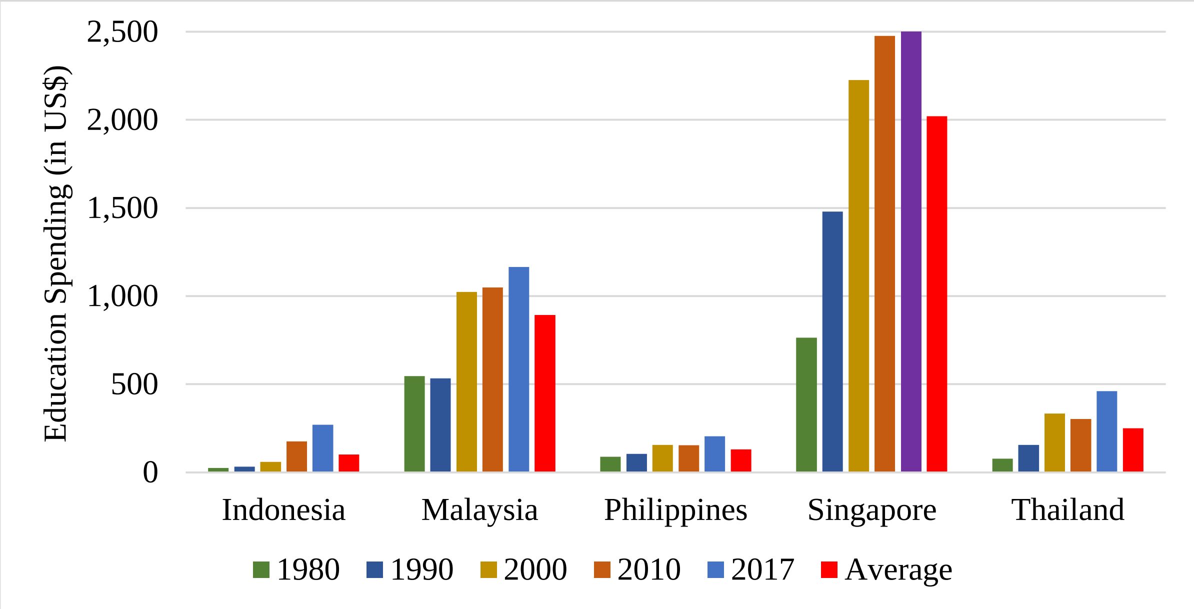
Malaysia, which is the second place in this list of labor productivity, is falling behind Singapore. Based on Figure 5.1, the labor productivity in Malaysia was around US$24,579 in 2017. On average, labor productivity in Malaysia is around US$16,515. Among all those five countries, the Philippines has the lowest labor productivity, around US$7,797 in 2017 or US$5,073 on average. Meanwhile, Thailand and Indonesia took third and fourth place, respectively. In 2017, the labor productivity in Thailand was US$10,960 (or US$6,393 on average), while Indonesia was US$8,894 (US$5,445 on average).

We can further examine the amount of education spending per employed labor to comprehend the investment in human capital in these countries by dividing the amount of education expenditure (EDUEXP) and the number of employed labor (EL). Figure 5.2 shows the graph of the amount of education spending per employed labor from 1980 to 2017.

Based in Figure 5.2, we can observe that there was an increasing trend of education expenditure per employed labor for all these five countries from the year 1980 to 2017. It implies that all countries concern with human capital investment through improving their quality of education. Among these five countries, Singapore has the most outstanding allocation of education expenditure among these five countries. By allocating US$2,515 (or US$2,021 on average) for education expenditure per employed labor in 2017, Singapore investing in human capital is more than 11 times higher than that of the Philippines in the same year. In fact, the

Philippines only spent US$205 or about US$130 on average (from 1980 to 2017) for the education expenditure per employed labor.

Figure 5.2 Education Spending per Employed Labor for Selected ASEAN Countries



Source: Author's calculation using the World Development Indicator by World Bank, 2019 and Ministry of Finance of Indonesia Financial Report

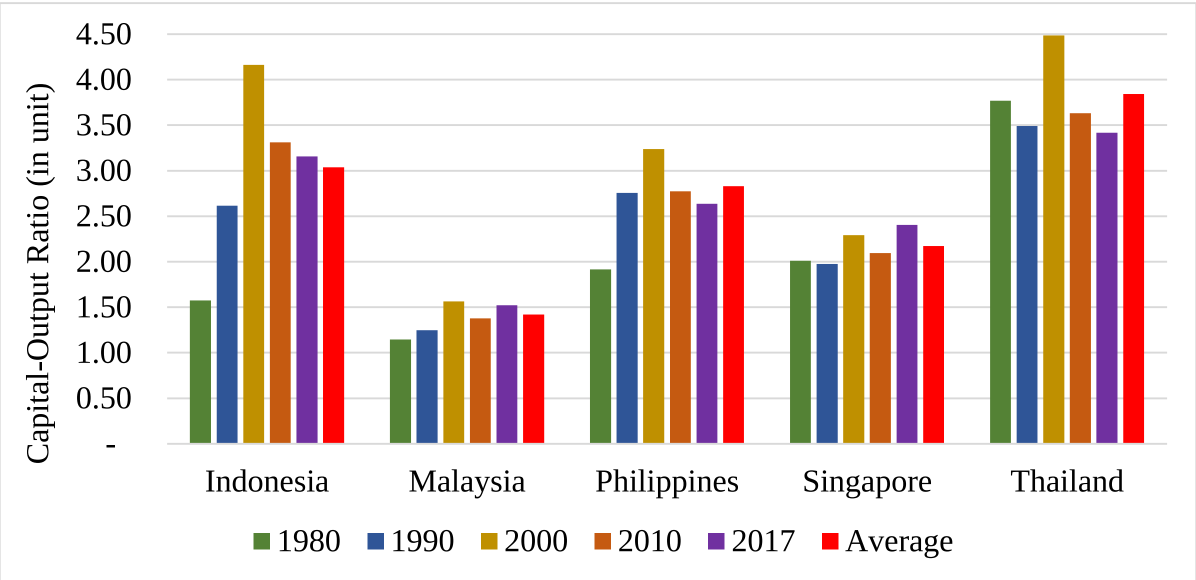
Among all these five countries, on average, Indonesia spent the least education expenditure per employed labor. Although Indonesia manages to spend around US$269 for education expenditure per employed labor in 2017, Indonesia allocated only around US$101 of education expenditure per employed labor on average. Meanwhile, Malaysia, Thailand, and the Philippines are in second, third, and fourth place, with the average education spending per employed labor of US$893, US$250, and US$130, respectively.

Capital stocks for each country in Table 5.1 are calculated by using the perpetual inventory method. The table shows that Indonesia has the highest capital stocks among all of these five countries. It is estimated that the capital stocks in Indonesia are around US$1,640 billion. This amount is around 7 times the amount of capital stocks in Malaysia, which has the lowest capital stocks among these five countries. Malaysia is estimated to have around US$238 billion of capital stocks on average. Meanwhile, Thailand has the second-highest capital stocks (US$ 857 billion on average), the Philippines has the third-highest capital stocks (US$400 billion on average), and Singapore is the fourth highest with around US$313 billion of capital stocks on average.

To extend our comprehension of the role of capital stocks, we can also divide the amount of capital stocks (K) by output (GDP) to obtain the capital-output ratio. This capital-output ratio basically determines the number of capital stocks necessary to produce one unit of output. Therefore, the lower the capital-output ratio indicates higher efficiency and productivity.

Figure 5.3 shows the capital-output ratio in those five selected ASEAN countries from the year 1980 to 2017 and their averages. Theoretically, the capital-output ratio remains stable for in the long term. However, this graph exhibits that except Malaysia and Singapore, the other three countries show the increasing trend from 1980 to 2000, and remain stable afterward.

Figure 5.3 Capital-Output Ratio for Selected ASEAN Countries



Source: Author’s calculation using the World Development Indicator by World Bank, 2019 and Ministry of Finance of Indonesia Financial Report

Based on this graph, Malaysia performs the best among these five countries. The capital-output ratio in Malaysia remains stable for decades, with around 1.4 on average. It means that Malaysia only needs 1.4 units of capital to produce 1 unit of output. On the other hand, Thailand has the lowest efficiency as it needs around 3.8 units of capital to produce one unit output.

Singapore, as the second most efficient in terms of capital-labor ratio needs around 2.2 capital stock units to produce 1 unit of output on average. Meanwhile, the Philippines and Indonesia got third and fourth place with a capital-output ratio of 2.8 and 3.0 on average, respectively.

We can also notice that the capital-output ratio on almost all of these countries reached its peak in the year 2000. Many countries in Southeast Asia suffer during the financial crisis in 1998, which affect their currency values. These capital stocks, which were reported in the World Development Indicator, should be adjusted by using the adjusted currency values, which tend to be lower. As a result, the value of capital stocks in US$ becomes higher.

Meanwhile, Table 5.2 exhibits the descriptive statistics of variables that will be used in the regression in their log form. The data is a summary of 38 years of observations (from 1980 to 2017) from 5 countries, which shows a balanced panel data.

Table 5.2 Descriptive Statistics

Variables	Mean	Max	Min	Std. Dev	Observations
log *GDP*	25.90499	27.71762	24.20971	0.7565084	190
log *EDUEXP*	22.37483	24.25844	20.54466	0.8270966	190
log *K*	27.25491	30.01585	24.91464	1.230417	190
log *L*	2.806772	4.808959	0.0920814	1.328915	190

Source: Author's calculation using World Development Indicator by World Bank, 2019 and Ministry of Finance of Indonesia

5.3 Results and Discussion

Table 5.3 exhibits the data for analyzing the impact of government education expenditure as a form of human capital investment to the economy. There are three different equations to examine the power of each explanatory variable when predicting the dependent variable.

Since the main focus of the study in this chapter to examine the impact of education expenditure on the economy, column 1 exhibits the regression result based only on education expenditure (EDUEXP) and the output (GDP). As previously explained, both variables are in their log form. Moreover, education expenditure is treated as relatively a long term investment. In this equation, we take lag 5 years of education expenditure to explain the current year's GDP.

As predicted, the coefficient value of the log of government education expenditure (log *EDUEXP*) is positive and statistically significant. It indicates that education expenditure positively affects the output in the economy. This regression uses the fixed effect, which is suitable to examine the relationship between dependent and independent variables within an entity. R-squared for within-sample implies that this explanatory variable can explain around 82% of the variation in the output in each country.

Column 2 enhances our specification by adding more explanatory variables. In addition to education expenditure (EDUEXP), we put capital stocks (K), which is one of the most crucial factors to determine the output in the economy based on the production function. Similar to the previous equation, we also use log form for all variables in column 2.

The result in Table 5.3 indicates that the coefficient of both the log of education expenditure (log EDUEXP) and capital stocks (log *K*) is positive and statistically significant. There is a significant drop in the education expenditure's coefficient value, along with the addition of capital stocks as the explanatory variable, from 0.65 to 0.08. In this case, any 1% increase in the previous 5 years of education expenditure can raise the current year's GDP by 0.08%. Meanwhile, 1% increase in last year's capital stocks can increase the current year's output by 0.8%. Moreover, the coefficient of determination, as the indicator for the explanatory variables in determining the outcome variables, increases from 0.82 to 0.95.

Table 5.3 Human Capital Investment and Economic Growth in Selected ASEAN Countries

Dependent variable: log *GDP*						
	(1)		(2)		(3)	
log $EDUCEXP_{t-5}$	0.6485		0.0819		0.1147	
	(0.0240)	***	(0.0307)	***	(0.0231)	***
$Log\ K_{t-1}$			0.8071		0.3874	
			(0.0398)	***	(0.0477)	***
Log L					0.8798	
					(0.0783)	***
Constant	11.6206		2.4842		10.5271	
	(0.5342)	***	(0.5318)	***	(0.8185)	***
Observations	165		165		165	
Countries	5		5		5	
R-squared						
- within	0.8208		0.9503		0.9724	
- between	0.0983		0.8327		0.6722	
- overall	0.4473		0.8753		0.6064	

Standard error in parentheses ***Significant at 1%

Source: Author's calculation

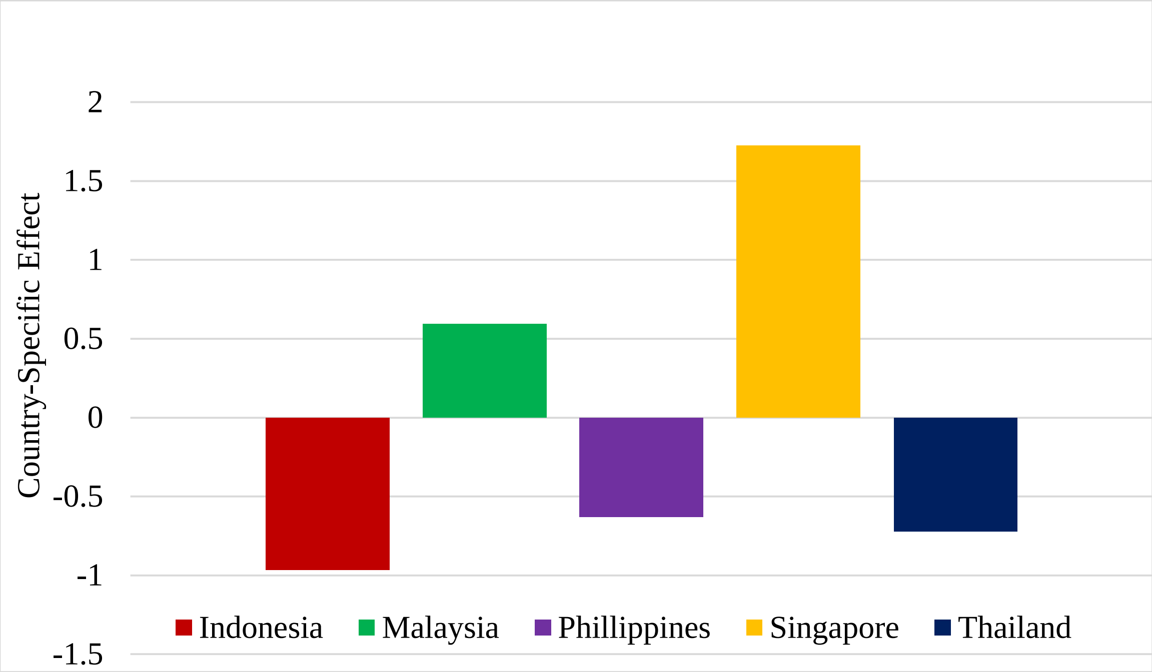
Equation 3 is the last equation, which consists of education expenditures as well as all production factors. In this equation, output (GDP) as the outcome variable is explained by education expenditure (EDUEXP), capital stocks (K), and employed labor (EL). Note that booth explanatory and outcome variables are in the log form. Moreover, we use lag 5 years of education expenditure and last year's capital stocks to explain the current year's output.

Based on equation 3, the R-squared for within indicates that the model fits nicely for each country, and the independent variables can explain about 97% of the variation in the model. Moreover, all coefficients of the regression variables are statistically significant at 1%. Education spending is positively affecting economic growth. It is estimated that a 1% increase in the last 5 year's education spending will increase by 0.11% output in the economy.

Meanwhile, a 1% point of last year's capital stock increase will affect the current year's economy by 0.38% positively. Moreover, 1% of additional employed labor will promote total output in the economy by 0.87%.

Since we use fixed-effect models, we can also find the individual-specific effects which cannot be explained in this model but affect the output in these countries. By applying Equation 5.5, we find that the individual-specific effects for each country as follows:

Figure 5.4 Country-Specific Effects in Selected ASEAN Countries Affecting Output



Source: Author's estimation

Based on Figure 5.4, we can infer that there is something that cannot be explained only by the explanatory variables in this regression except that Singapore, has the highest output among those five countries while Indonesia has the lowest output. It can be due to better law enforcement, governance, or political stability.

5.4 Summary

Southeast Asia is a region that is a home for developing countries. Besides Singapore, other countries such as Indonesia, Thailand, Vietnam, and the Philippines are mainly still developing. Currently, those Southeast Asia countries cooperate within ASEAN.

This chapter tried to examine the impact of human capital investment on the economy by examining this region. Among ten ASEAN members, this study employed five countries, namely, Indonesia, Malaysia, Singapore, the Philippines, and Thailand, due to data availability. In this framework, government education spending was used as a proxy for human capital investment. This analysis used a reduced form, which was straightforward to analyze. The data was obtained from the World Bank. Additionally, the data for education expenditure in Indonesia also refers to the Indonesia Ministry of Finance financial report.

This study was conducted by using fixed-effect panel data. By elaborating capital and labor as production factors, it was found that human capital investment might improve the output in the economy. In general, within the Southeast Asia region, adding 1% of the national budget to education expenditures will stimulate around 0.11% more output in the economy. Meanwhile, Singapore as a developed country has proven that it produce highest output among these five countries in this study which cannot be explained in this model. Similarly, Indonesia produces less than the other four countries that cannot be explained in this model.

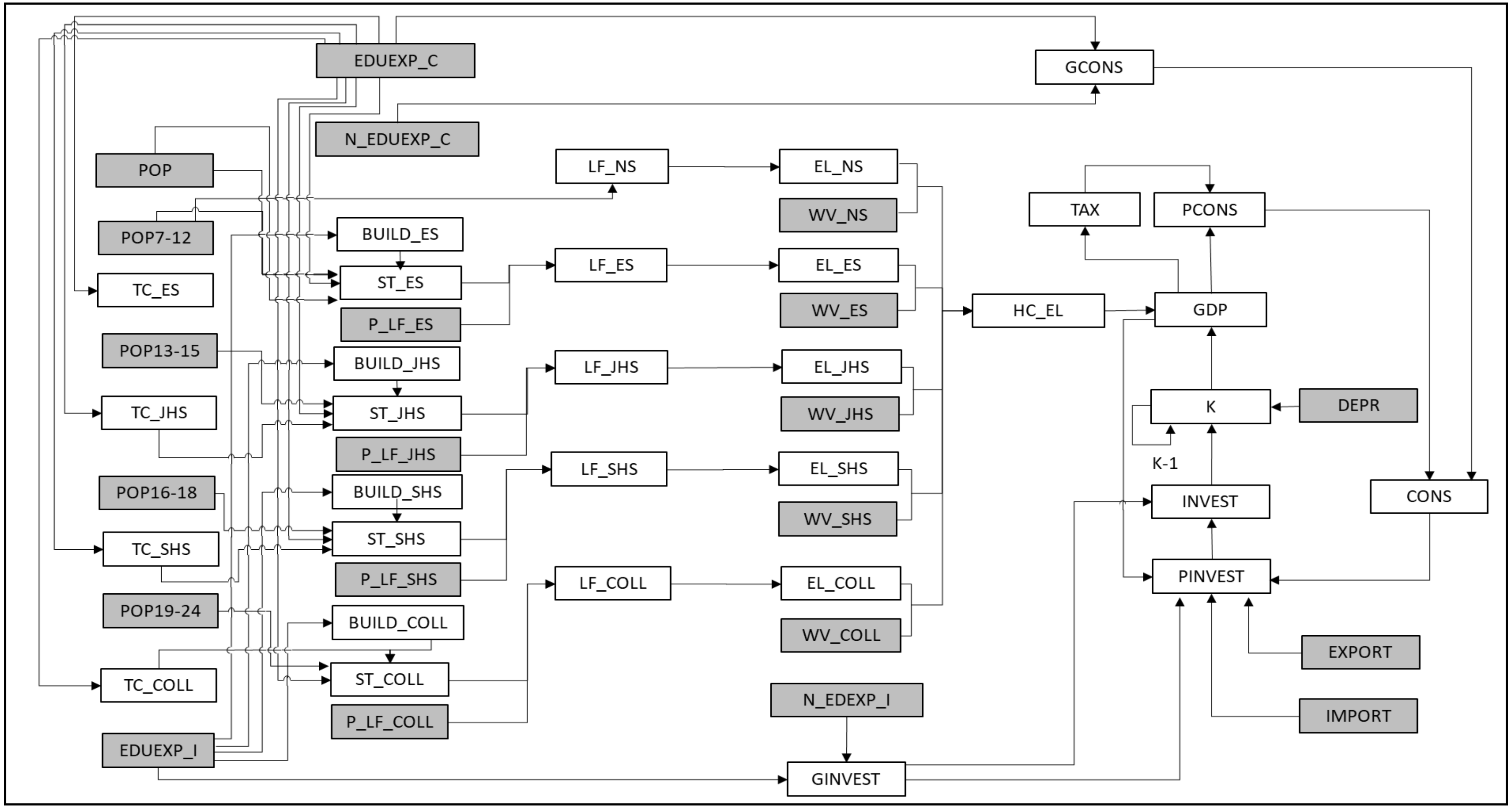
CHAPTER 6 MACROECONOMETRIC MODEL OF HUMAN CAPITAL IN INDONESIA

This chapter is dedicated to analyzing the impact of human capital investment in Indonesia through a macroeconometric model. Unlike Chapter 5, which examines human capital investment and its impact on the economy by using cross-country analysis, this chapter focuses on Indonesia. Presently, Chapter 5 has informed us of the positive impact of education on the economy to some extent. Within that framework, government expenditure on education is used as a proxy for human capital investment. However, as Chapter 5 relies on a reduced-form equation, it is not clear how education spending positively affects economic growth.

Based on those reasons, this chapter analyzes the impact of human capital on economic growth by developing a small yet robust macroeconometric model of the Indonesian economy. Chapter 6 is designed as complementary to the previous chapter. This chapter tries to explain the human capital investment related to economic growth through macroeconometric modeling based on a structural equation. Unlike the reduced form equation used in the previous chapter, applying the structural equation allows us to investigate more detailed information about the transmission mechanism from education spending to the economy.

Currently, Indonesia is targeting 20 percent of government expenditures to be allocated for education. Analyzing such a policy requires a tool that can be used for observing its impact and effectiveness. This study's constructed model is expected to be adequate to observe some essential elements from both the supply and demand side. Therefore, the government's policy in education can be thoroughly analyzed. This study will first design the macroeconometric model following basic economic theory. Based on the model, later, we run some scenarios for policy simulation analysis at the end of the analysis.

Figure 6.1 Macroeconometric Model of Indonesian Economy for Human Capital Analysis

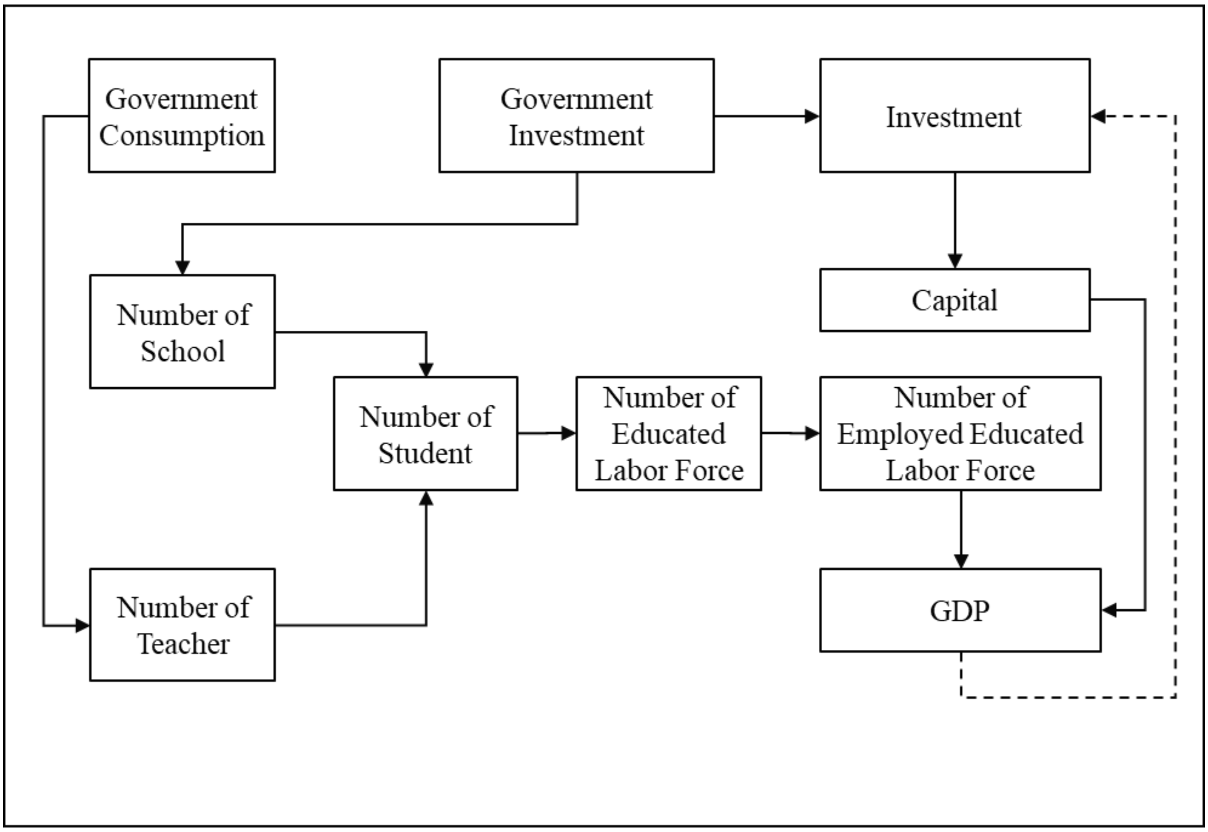


Source: Author’s conception

6.1 Model Specification

As mentioned earlier in the introduction, the model will be a small yet compact macroeconometric model consisting of 54 variables, including the dummy variable, where 32 are endogenous and 22 are exogenous. These variables are classified into 32 equations, of which 25 are behavioral, and 7 are identities. Figure 6.1 depicts the link of variables within the model in its complete form. The main idea of this model is to determine the impact of changes in budget allocation in government expenditures can be shown in a simplified chart in Figure 6.2 as follows.

Figure 6.2 Simplified Macroeconometric Model of Indonesian Economy for Human Capital Analysis



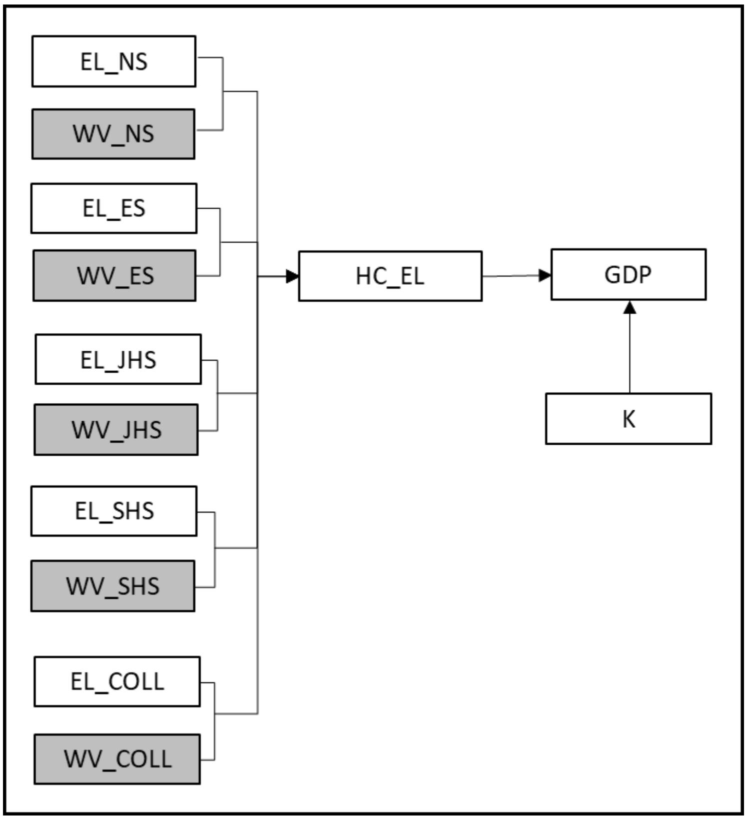
Source: Author's conception

As a part of government expenditure goes to consumption, the other part goes to investment. Therefore, this model tries to capture the flow of funds in human capital investment by the government and its impact on other factors. There are various factors in the model, such as capital stocks and the labor force, which lead to the economy's output. For instance, we can clearly track any changes in the composition between consumption and investment in government expenditures that will affect the number of capital stocks accumulation through changes in the total investment. On the other hand, any variables related to human capital accumulation factors, such as school building, also can be observed thoroughly. The full and detailed explanation of the equations within the model as follows:

6.1.1 Supply Side

6.1.1.1 Output

Figure 6.3 Diagram of Variables to Determine the Output in the Economy



Source: Author's conception

We start the explanation from the output by using the production function as the final target to examine the policy's impact on the economy, as shown in Figure 6.3. The production function follows the Solow model Cobb-Douglas production function, where the output of the economy, which refers to the gross domestic product (GDP), is modeled as a function of capital (K) and labor (EL).

Labor in this study refers to persons engaged in the economy. To capture the impact of human capital manifested in the persons engaged in the economy, we adjust those raw numbers of persons engaged in the economy into human capital adjusted labor (HC_EL). Principally, we assume that each person engaged in the economy has his/her own weight correspond to his/her specific level of education, which determines his/her true ability. Therefore, HC_EL represents a more realistic number of persons engaged in the economy rather than the raw numbers.

Furthermore, this study takes a logarithmic function for both dependent and independent variables. Thus, the output function is of the form:

$\log GDP = f(\log K, \log HC\_EL)$

HC_EL is derived from the identity equation to adjust the number of employed labor from each educational background by multiplying the weighted value of each level of education as follows:

HC_EL = (EL_NS * WV_NS) + (EL_ES * WV_ES) + (EL_JHS * WV_JHS) + (EL_SHS * WV_SHS) + (EL_COLL * WV_COLL)

where

HC_EL	:	Human capital adjusted employed labor
EL_NS	:	Employed labor with no educational background
WV_NS	:	Weighted value of employed labor with no educational background
EL_ES	:	Employed labor with primary educational background
WV_ES	:	Weighted value of employed labor with primary educational background
EL_JHS	:	Employed labor with lower-secondary educational background
WV_JHS	:	Weighted value of employed labor with lower-secondary educational background
EL_SHS	:	Employed labor with upper-secondary educational background

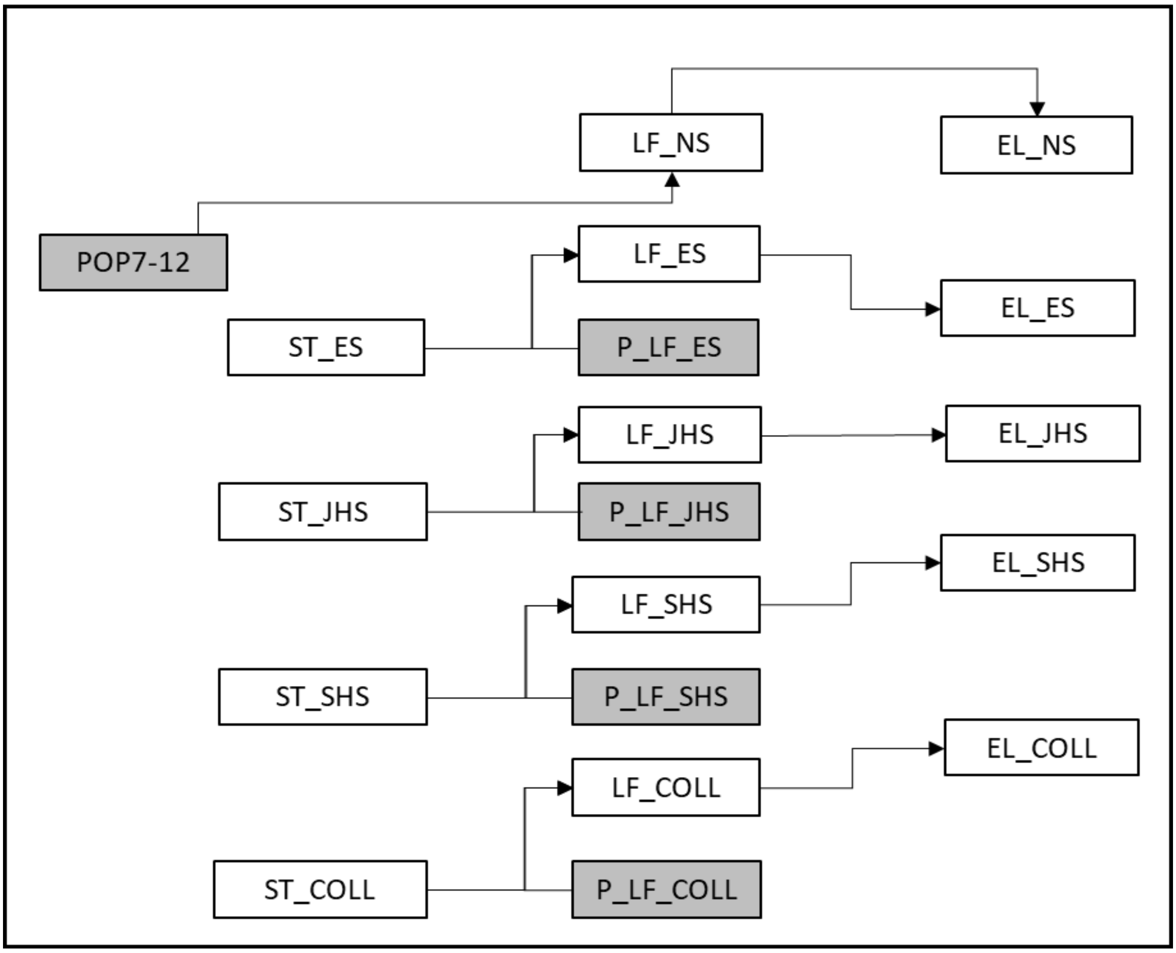
WV_SHS	:	Weighted value of employed labor with upper-secondary educational background
EL_COLL	:	Employed labor with tertiary educational background
WV_COLL	:	Weighted value of employed labor with tertiary educational background

In this formula, we assume that a person with higher education attainment has more weight to determine the actual number of employed labor. The value of education is based on finding in chapter 4, which refer to the difference in work-life earning among elementary school graduates, junior high school graduates, senior high school graduates, and college graduate workers. Meanwhile, the worker with no school is assumed to be worth 0.7 of the elementary school graduate workers. These numbers are multiplied by the quality of education for each level to reflect the variation of the value of education across time.

Based on the finding in chapter 4, assuming quartile 2 and full employment, college graduate workers earn Rp1,433 million. Meanwhile, elementary school graduate workers earn Rp539 million, junior high school graduate workers earn Rp662 million, and senior high school graduate workers earn Rp894 million. Using junior high school as a baseline, we can infer that the value of elementary school graduate worker is 0.81, junior high school graduate worker is 1.00, senior high school graduate worker is 1.35, and college graduate workers is 2.16. Since these values represent only one point of time, we further adjust these numbers by multiplying them with each year's quality of education. We use the comparison of the number of teachers available and the number of schools available as the proxy of the quality of education.

6.1.1.2 Labor (Engaged Person)

Figure 6.4 Diagram of Variables to Determine the Labor Force



Source: Author's conception

Labor in this model refers to persons engaged in Indonesia's economy. To draw the impact of education, we classify the labor supply based on their educational attainment. We also differentiate between the persons who have been employed and the total labor force as a potential labor market, as shown in Figure 6.4. There are five categories for each employed labor and total labor force: Not-schooling labor, elementary school graduate labor, junior high school graduate labor, senior high school graduate labor, and college graduate labor supply.

6.1.1.2.1 Employed Labor Force

Starting from the non-schooling labor force (EL_NS), this variable represents the number of workers working in the economy. This worker has no educational background. As the dependent variable, EL_NS mainly depends on the number of the total labor force with no educational background (LF_NS). Logically, EL_NS has a positive correlation with LF_NS. Therefore, as the number LF_NS increase, the number of EL_NS will also increase to some extent.

Similarly, the number of employed labor also depends on the labor force's availability with respective educational backgrounds. Employed labor with an elementary school background (EL_ES) depends on the total labor force with similar elementary school educational backgrounds (LF_ES). Junior high school graduate employed labor (EL_JHS) and senior high school graduate employed labor (EL_SHS) also depend solely on junior high school graduate labor force (LF_JHS) and senior high school graduate labor force (LF_SHS), respectively. Finally, college graduate workers (EL_COLL) also depend on the college graduate labor force (LF_COLL) as the main supply.

6.1.1.2.2 Labor Force

6.1.1.2.2.1 LF_NS

This variable represents the workers with the lowest human capital investment. Since there is no relationship between this labor and formal education, its supply to the economy is only determined last year labor force with no education (LF_NS $_{t-1}$) and by the population. As the labor force in this criteria has no primary education, we assume that the population age 7 to 12 (POP7-12), which represents the person who supposedly goes to elementary school, determines the supply of labor force in this model. In other words, these children go to work due to some circumstances rather than go to school.

6.1.1.2.2.2 LF_ES

This variable corresponds to the labor force with an elementary school educational background. It is only available once the workers have finished their primary education. Therefore, the supply depends on the number of graduated students in primary education who choose not to continue their study to a secondary-education and decide to work.

As an elementary school in Indonesia consists of six years of education, to approximate the number of current year graduates is by dividing last year's total number of elementary students (ST_ES) into six, which represents the current year's grade six students who graduate. The number of current year's elementary student graduates is multiplied by the portion of elementary school students that might graduate and look for a job for the current year (P_G_ES) to determine the number of students who enter the labor market. This portion is derived from the remaining graduates after considering the junior high school's enrollment rate (100%- junior high school enrolment rate).

Along with the current year number of graduated students from junior high school who choose to go to the labor market, we also include last year's labor force with this education level (LF_ES_{t-1}) in this equation.

6.1.1.2.2.3 LF_JHS

This variable determines the labor force of junior high school graduates. The labor force that falls under this classification should have graduated from junior high school. Therefore, the supply will depend on the current year number of graduated students from lower-secondary education who choose to go to the labor market instead of continuing to upper-secondary education.

In Indonesia, junior high school as lower-secondary education consists of three levels or three years of education. To approximate the number of current year's junior high school graduates, we divide last year's total junior high school students (ST_JHS_{t-1}) by three, representing the portion of last year's 3rd-grade students out of all students.

To represent the number of current year's junior high school graduates who choose to go to the labor market, we divide ST_JHS_{t-1} by 3 and multiply it with the portion of junior high school students that might graduate and look for a job for the current year ($P\_G\_ES_t$). This $P\_G\_ES_t$ is basically derived from the remaining portion of the enrollment rate for senior high school (100%- senior high school enrolment rate). We also include last year's labor force with this level of education (LF_JHS_{t-1}) to estimate LF_JHS.

6.1.1.2.2.4 LF_SHS

This variable determines the labor force with a higher-secondary education background. The labor force that falls under this classification should have graduated from senior high school. Consequently, the supply will depend on the current year number of graduated students from higher-secondary education who choose to go to the labor market instead of continuing to tertiary education.

In Indonesia, the senior high school consists of three levels or three years of education. Similar to junior high school, we divide last year's total senior high school students (ST_SHS_{t-1}) into 3 to represent the portion of 3rd-grade students. The result will be used to approximate the number of current year's senior high school graduates. To measure the number of current year's senior high school graduates who go to the labor market, we multiply the number of current year senior high school graduates by the portion of senior high school student graduates and look for a job for the current year ($P\_G\_SHS_t$). Since many senior high school graduates choose to go to work after finishing their secondary education, the portion is derived from the percentage of the labor force with senior high school graduate background to the total labor force with senior high school graduate background.

6.1.1.2.2.5 LF_COLL

This variable expresses the highest human capital investment in this model. It embodies the labor supply of higher education graduates. The labor force that falls under this classification should have graduated from college. The supply will depend on the current year number of graduated students from tertiary education.

College in Indonesia mainly consists of undergraduate students. Mainly, it takes around four years for a person to finish his or her study. Therefore, we divide last year's total college students (ST_COLL_{t-1}) by four to approximate the number of the current year's college graduates. The result is multiplied by the portion of college students who might graduate and look for a job for the current year (P_G_COLLt) to determine the college graduates willing to work. Since many colleges are the pinnacle of education level, one will eventually go to work after finishing their study. Thus, the portion of college students that might graduate and look for a job is derived from the percentage of the labor force with college graduate background to total labor force with college graduate background.

We take all of those 4 different levels in labor supplies into four equations in logarithmic form. Thus, all of the functions for not-schooling labor supply (LF_NS), elementary school graduate labor supply (LF_ES), junior high school graduate supply (LF_JHS), senior high school graduate supply (LF_SHS), and college graduate labor supply (LF_COLL) are of the forms:

- log *LF_NS* = *f* (log *POP7-12*, log *LF_NS*)
- log *LF_ES* = *f* (log *(ST_ES*P_G_ES*), log *LF_ES*)
- log *LF_JHS* = *f* (log *(ST_JHS*P_G_JHS*), log *LF_JHS*)
- log *LF_SHS* = *f* (log *(ST_SHS*P_G_SHS*), log *LF_SHS*)
- log *LF_COLL* = *f* (log *(ST_COLL*P_G_COLL*), log *LF_COLL*)

6.1.1.3 Student

In this model, the number of students plays a vital role in determining the total quality of labor in human capital investment. Refer to vast literature, investment of human capital is assumed to be determined mainly by formal education. Therefore, the number of students representing the labor force supply with specific educational attainment should be entered into functions in the model.

We classify the student based on four categories: elementary school students (ST_ES), junior high school students (ST_JHS), senior high school students (ST_SHS), and college students (ST_COLL).

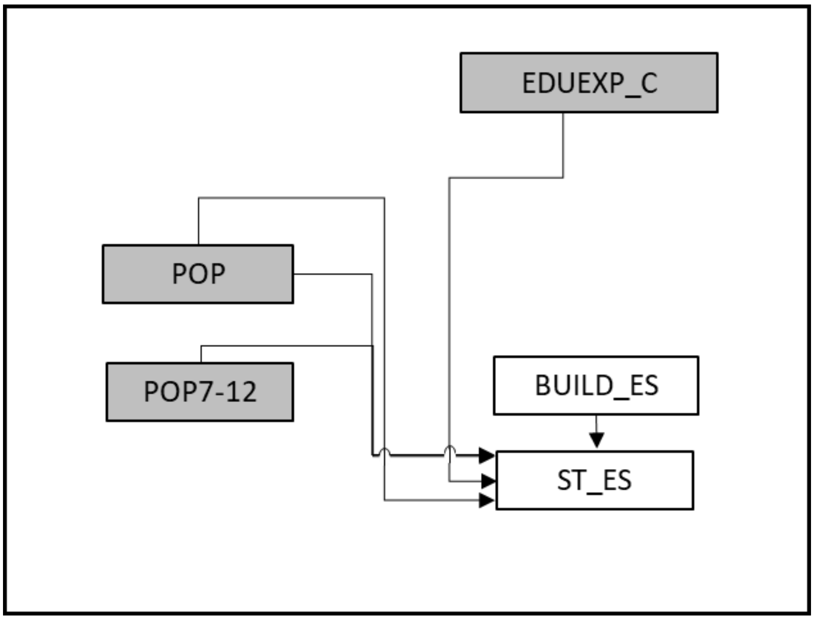
6.1.1.3.1 ST_ES

This variable represents the number of students in elementary school. In the model, as shown in Figure 6.5, we expect that the number of elementary school students, the most dominating part among all students, mainly depends on the number population (POP). Additionally, a student's typical age to go to elementary school is between 7 and 12 years old. Thus, the portion of the population age 7-12 years old (POP7-12), which represents the share of persons who go to primary education, also plays a role in the model.

Since the government also gives some financial assistance to all students (e.g., to buy books and school equipment), we include government education expenditure in this equation. As the government expenditures are mainly separated into investment and consumption, we specifically include government education expenditure for consumption (EDUEXP_C) in this equation. Since the budget has been decided one year ahead, we use last year's budget to determine the current year's estimation.

Other than that, education institutions in terms of the number of elementary school buildings also play a significant role. We expect that elementary school building (BUILD_ES) is important to deliver learning material. Moreover, since, in most cases, the total number of student does not fluctuate volatilely, we also include last year of the number of the student (ST_ES_{t-1}) in the equation.

Figure 6.5 Diagram of Variables to Determine the Elementary Student



Source: Author’s conception

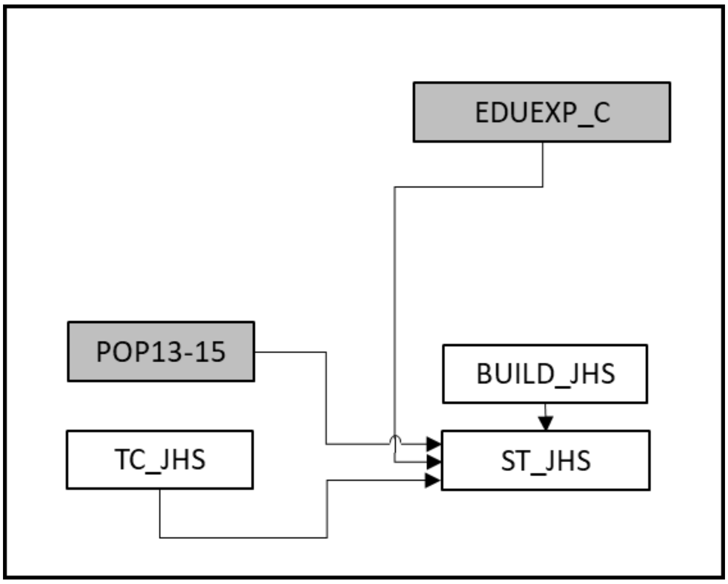
6.1.1.3.2 ST_JHS

In Indonesia, a person who goes to junior high school is usually around 13 to 15 years old. Therefore, we expect the number of populations with 13 to 15 years old (POP13-15) as a significant factor in determining students' number at this level. We expect that the last year's population with age 13 to 15 affects the current year’s number of junior high school students, as shown in Figure 6.6.

Like elementary school students, the government also allocates some of its budgets to assist junior high school students in buying books or necessary equipment. Since this budget is allocated to consumption purposes, we also include education expenditure for consumption (EDUEXP_C) in this equation. This equation expects that last year’s budget will be significant to determine the number of current year’s junior high school students.

Lastly, we also expect that the number of junior high school students depends on education institutions to some extent. These institutions primarily consist of the junior high school building (BUILD_JHS) as a place to learn and the junior high school teachers (TC_JHS) who supply the knowledge. For these variables, we expect that the last year's number of junior high school buildings and the last year's number of junior high school teachers as a variable to determine the number of current year's junior high school students.

Figure 6.6 Diagram of Variables to Determine the Junior High School Students



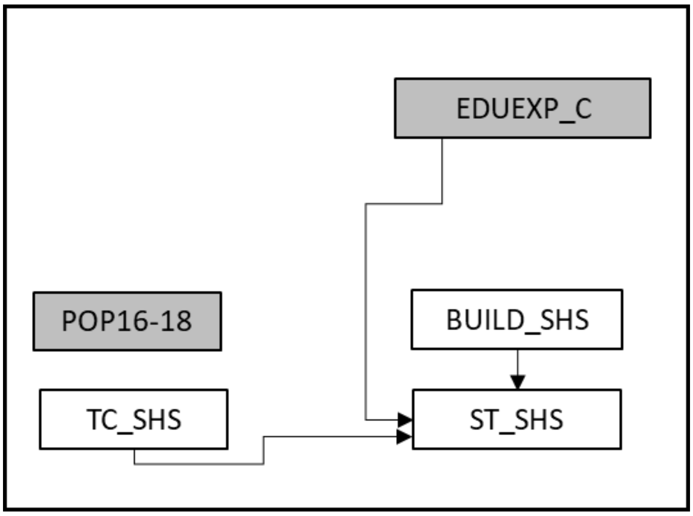
Source: Author's conception

6.1.1.3.3 ST_SHS

ST_SHS represents the number of students in senior high schools in Indonesia. The senior high school has three years of educational level with the students with age between 16 to18. In this equation, we include the population with age 16 to 18 (POP_16-18) as a variable that determines the number of senior high school students.

The students in senior high school still enjoy some benefits from the government to some extent. To accommodate it in the model, we include government education expenditure for consumption (EDUEXP_C) as a variable that decides the number of senior high school students. Like elementary and junior high schools, the number of senior high school students is influenced by the last year's government budget. Therefore, we use last year's education expenditure on consumption as a variable to estimate the number of current year's senior high school students.

Figure 6.7 Diagram of Variables to Determine the Senior High School Students



Source: Author's conception

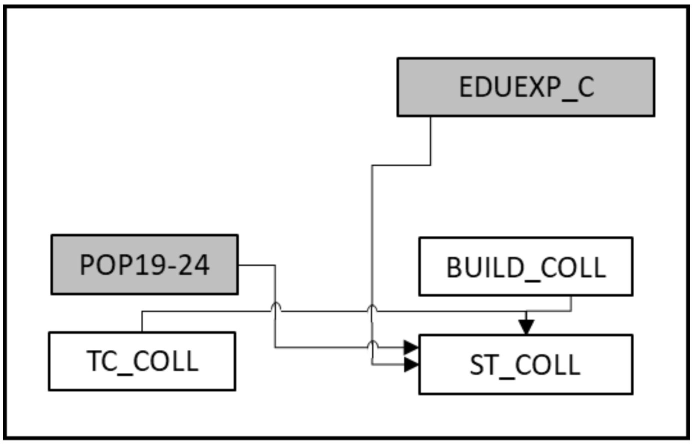
Other than the population age 16 to 18 and education expenditures, the number of senior high school students also depends on the number of educational institutions. In this case, the number of senior high school buildings (BUILD_SHS) as a place to deliver education material and senior high school teachers (TC_SHS) as persons to give the study material is necessary to determine the number of senior high school students. To some extent, these factors also determine the quality of education. Figure 6.7 shows the flow of the concept.

6.1.1.3.4 ST_COLL

ST_COLL refers to the number of students in college. Although people can continue to higher education without age-constrained, the common age to enroll in a college is between 19 and 24. This standard is also used by Indonesia Statistics to dealing with statistics in Indonesia. In the model, we count for the population age 19 to 24 (POP19-24) as one of the important factors to affect the number of students in college, as shown in Figure 6.8.

Although most universities do not depend heavily on government financial assistance, some of the students with a specific category still received special treatment such as tuition fee exemption. This fund is provided in the state budget as a part of education expenditures on consumption. Therefore, we include EDUEXP_C as an independent variable in this equation.

Figure 6.8 Diagram of the Variables to Determine College Students



Source: Author's estimation

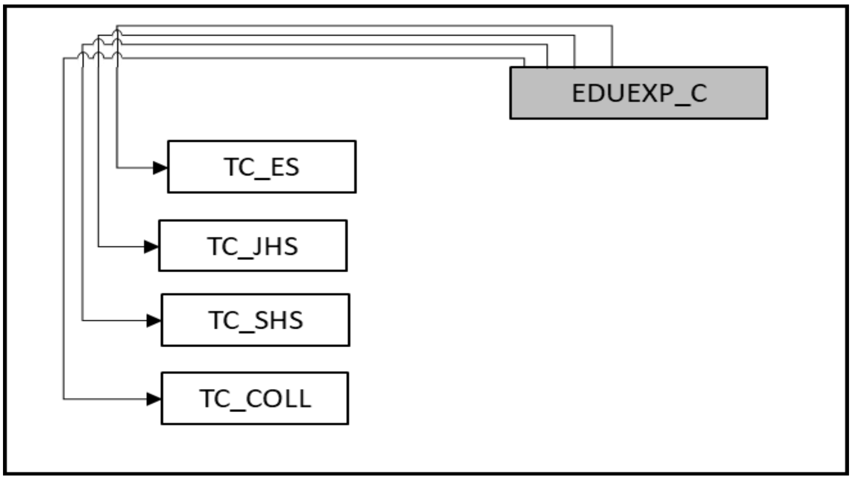
Since tertiary education is considered an expensive education investment, the quality of institutions becomes necessary. Therefore we include the quality of education for tertiary education as one factor to determine the number of students. We use the total number of lecturers in the college (TC_COLL) compared to the number of college institutions available (COLL) as a proxy to determine the quality of tertiary education in Indonesia.

By elaborating all of those factors, the equations for ST_ES, ST_JHS, ST_SHS, and ST_COLL will be written in the functions as follows:

- log *ST_ES = f* (log *POP*, log *(POP7-12/POP)*, log *EDUEXP_C*, log *BUILD_ES*)
- log *ST_JHS = f* (log *POP13-15*, log *EDUEXP_C*, log *BUILD_JHS*, log *TC_JHS*)
- log *ST_SHS = f* (log *POP16-18*, log *EDUEXP_C*, log *BUILD_SHS*, log *TC_SHS*)
- log *COLL = f* (log *POP19-24*, log *EDUEXP_C*, log (*TC_COLL/BUILD_COLL*)

6.1.1.4 Teacher

Figure 6.9 Diagram of Variables to Determine the Number of Teachers



Source: Author's estimation

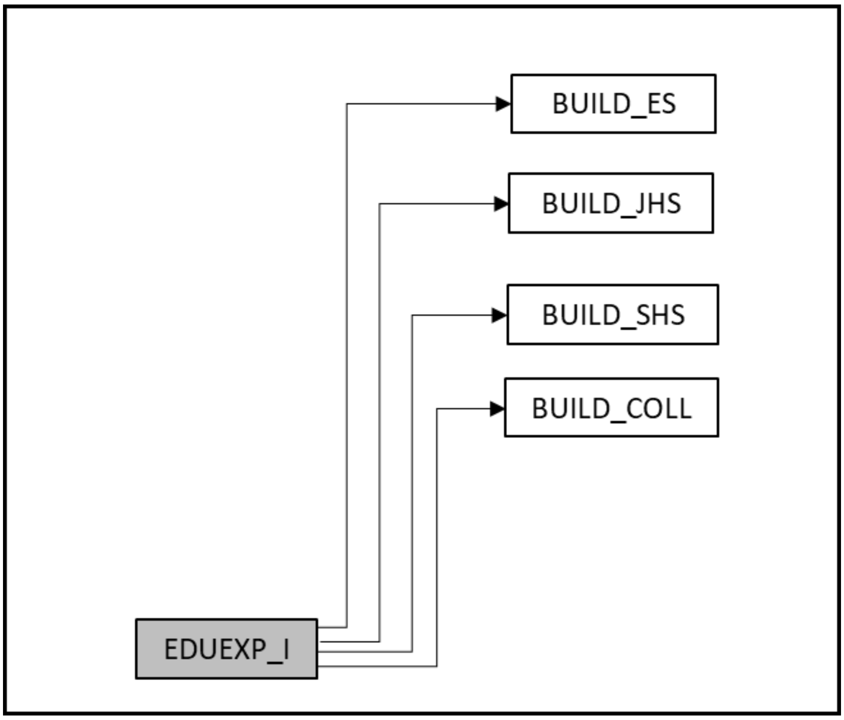
In this model, teachers determine the number of students as vital elements to deliver the learning material. With this assumption, the more teachers available, the more people can access formal education. As a consequence, the years of schooling can be higher, and human capital stocks can be elevated to some extent only by having more teachers. Moreover, the quality of education can also be improved as teachers' number goes up and lower the student to teacher ratio. However, the number of teachers each year does not fluctuate capriciously. Therefore, we expect that last year's number of teachers can predict the current year's teachers' supply.

One of the most fundamental factors to maintain teacher's numbers is the fund to pay their salary. In other words, the number of teachers depends on government budget limitations. In this model, the government budget on education will be classified into two independent variables: education expenditure for consumption (EDUEXP_C) and education expenditure for investment (EDUEXP_I). When discussing teacher supply, it mainly associated with wages that are funded through education expenditure for consumption. In short, these teacher variables will be divided into four more variables correspond to four levels of education, namely elementary school teachers (TC_ES), junior high school teachers (TC_JHS), senior high school teachers (TC_SHS), and the lecturer in the college (TC_COLL). Put all the dependent and independent variables in the logarithmic form, the functions are as follows:

- log *TC_ES = f (*log *EDUEXP_C,* log *TC_ES)*
- log *TC_JHS = f (*log *EDUEXP_C,* log *TC_JHS)*
- log *TC_SHS = f (*log *EDUEXP_C,* log *TC_SHS)*
- log *TC_COLL = f (*log *EDUEXP_C,* log *TC_COLL)*

6.1.1.5 School Building

Figure 6.10 Diagram of Variables to Determine the Number of Schools



Source: Author’s estimation

School building in this study refers to a place to held educational activities. In this model, the school building is an essential part of initiating the learning process, and thus predicting the number of school buildings becomes necessary. The number of school buildings for each year does not necessarily fluctuate each year. This model expects that last year's number of school buildings still determines the number of current year’s number of the school building.

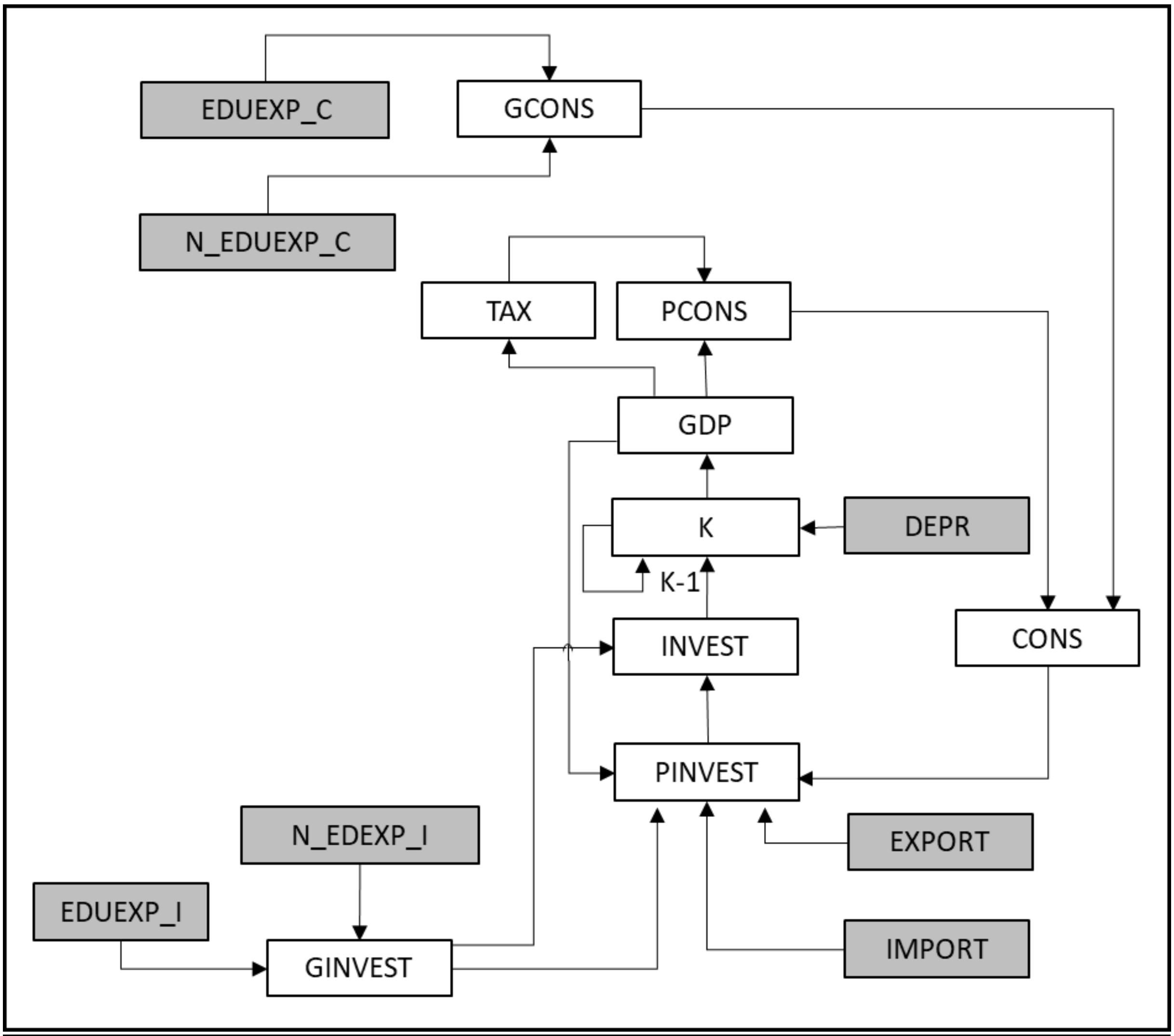
School buildings can be categorized as fixed assets with a life-span of more than one year. Usually, their construction process takes more than one year and is practically correlated with the budget from government education expenditures. In this case, the education expenditure for investment (EDUEXP_I) will be allocated as government investment to construct or renovate the school buildings. Since it takes more than one year to build the school, we expect that the last 2 years of government education expenditures on investment affect the current year's number of school buildings.

The variables of the school building are also classified into the school building for elementary school (BUILD_ES), junior high school (BUILD_JHS), senior high school (BUILD_SHS), and school building for tertiary education (BUILD_COLL), as shown in Figure 6.10. All the dependent and independent variables are taken in the logarithmic form; the estimation of the equation can be written as follows:

- log *BUILD_ES = f (*log *EDUEXP_I,* log *BUILD_ES)*
- log *BUILD_JHS = f (*log *EDUEXP_I,* log *BUILD_JHS)*
- log *BUILD_SHS = f (*log *EDUEXP_I,* log *BUILD_SHS)*
- log *BUILD_COLL = f (*log *EDUEXP_I,* log *BUILD_COLL)*

6.1.2 Demand Side

Figure 6.11 Diagram of Variables to Determine the Demand Side



Source: Author's estimation

6.1.2.1 Private Consumption

The first part of this chapter focuses on the supply side function. For the demand side, export and import are considered exogenous, as in Figure 6.11. Meanwhile, private consumption (PCONS) is estimated as a function of disposable income. Therefore, we elaborate output (GDP) minus taxes (TAX) as the proxy for disposable income. Moreover, last year's private consumption also included determining the current year's private consumption. By taking all the dependent and independent variables in the logarithmic form, the estimation of the equation can be written as follows:

log *PCONS* = *f* (log *(GDP-TAX),* log *PCONS(-1)*)

6.1.2.2 Tax

In this model, Tax (TAX) is a part of constructing disposable income determined as endogenous as a function of GDP. By taking all the dependent and independent variables in the logarithmic form, the estimation of the equation can be written as follows:

log *TAX* = *f* (log *GDP*)

In order to integrate the system into a model, some identity equations are utilized. Seven identities are used in this model. The identities are as follows:

- GCONS = EDUEXP_C + N_EDUEXP_C
- GINVEST = EDUEXP_I + N_EDUEXP_I
- PINVEST = GDP - TCONS - EXPORT + IMPORT - GINVEST
- INVEST = PINVEST + GINVEST
- K = K(-1) - DEPR + INVEST
- TCONS = PCONS + GCONS

6.2 Data and Estimation

6.2.1 Data

The equations were estimated using yearly data from 1986 to 2018. Data are mainly obtained from Badan Pusat Statistik Indonesia (Statistics Indonesia) and the World

Development Indicator from the World Bank. However, some data are extracted from the Ministry of Finance of the Republic of Indonesia. Details of each endogenous and exogenous variable's data sources and its abbreviation are shown in Table 6.1.

.

Table 6.1 Notation variables

Endogenous Variables

Variables	Explanation	Data Source
GDP	Total output	WDI
EL_NS	The engaged person with no formal education (no school)	Statistic Indonesia/WDI
EL_ES	The engaged person with primary education attainment (graduated from elementary school)	Statistic Indonesia/WDI
EL_JHS	The engaged person with lower secondary education attainment (graduated from junior high school)	Statistic Indonesia/WDI
EL_SHS	The engaged person with upper secondary education attainment (graduated from senior high school)	Statistic Indonesia/WDI
EL_COLL	The engaged person with tertiary education attainment (graduated from college)	Statistic Indonesia/WDI
GCONS	Government consumption	WDI
GINVEST	Government investments	WDI
HC_EL	The engaged person with human capital weighted value	Author
INVEST	Total investment	WDI
K	Capital Stock	WDI
LF_NS	The stock of non-schooling workers	Statistic Indonesia
LF_ES	The stock of elementary school graduate workers	Statistic Indonesia
LF_JHS	The stock of junior high school graduate workers	Statistic Indonesia
LF_SHS	The stock of senior high school graduate workers	Statistic Indonesia
LF_COLL	The stock of senior college graduate workers	Statistic Indonesia
PCONS	Private consumption	WDI
PINVEST	Private investment	WDI
BUILD_ES	Number of the elementary school building available for primary education	Statistic Indonesia/MOE
BUILD_JHS	Number of the junior high school building available for lower secondary education	Statistic Indonesia/MOE
BUILD_SHS	Number of the senior high school building available for upper secondary education	Statistic Indonesia/MOE

BUILD_COLL	Number of the college building available for tertiary education	Statistic Indonesia/MOE
ST_ES	Number of the student enroll in elementary school	Statistic Indonesia/WDI
ST_JHS	Number of the student enroll in junior high school	Statistic Indonesia/WDI
ST_SHS	Number of the student enroll in senior high school	Statistic Indonesia/WDI
ST_COLL	Number of the student enroll in college	Statistic Indonesia/WDI
TAX	Taxes	MOF
TC_ES	Number of teachers available in elementary school	Statistic Indonesia/WDI
TC_JHS	Number of teachers available in junior high school	Statistic Indonesia/WDI
TC_SHS	Number of teachers available in senior high school	Statistic Indonesia/WDI
TC_COLL	Number of lecturers available in college	Statistic Indonesia/WDI
TCONS	Total consumption	WDI

Exogenous variables

Variables	Explanation	Data Source
DEPR	Depreciation of Physical Asset	WDI
DUMMY	Dummy for 1998 Asian Financial Crisis	Author
EDUEXP_C	Government education expenditure for consumption	MOF/WDI
EDUEXP_I	Government education expenditure for investment	MOF/WDI
EXPORT	Number of export	WDI
IMPORT	Number of import	WDI
N_EDUEXP_C	Government expenditure for consumption other than education	MOF/WDI
N_EDUEXP_I	Government expenditure for investment other than education	MOF/WDI
POP	Total population	Statistic Indonesia
POP7-12	Population with age 7 to 12	Statistic Indonesia/WDI
POP13-15	Population with age 13 to 15	Statistic Indonesia/WDI
POP16-18	Population with age 16 to 18	Statistic Indonesia/WDI
POP19-24	Population with age 19 to 24	Statistic Indonesia/WDI

P_G_ES	Portion of elementary school students that might graduate and look for job for the current year	Statistic Indonesia/WDI
P_G_JHS	Portion of junior high school students that might graduate look for job for the current year	Statistic Indonesia/WDI
P_G_SHS	Portion of senior high school students that might graduate look for job for the current year	Statistic Indonesia/WDI
P_G_COLL	Portion of college students that might graduate for the current year	Statistic Indonesia/WDI
WV_NS	Weighted value of workers with no schooling	Author-Chapter 4
WV_ES	Weighted value of elementary school graduate workers	Author-Chapter 4
WV_JHS	Weighted value of junior high school graduate workers	Author-Chapter 4
WV_SHS	Weighted value of senior high school graduate workers	Author-Chapter 4
WV_COLL	Weighted value of college graduate workers	Author-Chapter 4

6.2.2 Estimation

This study implemented the OLS method to estimate all of the equations in this model. Although some scholars suggest using Two-Stage Least Square to reduce the tendency of bias estimation if implementing OLS to a simultaneous equations system, this study still utilizes OLS following Kuh and Schmalensee (1973) where:

1. OLS is both more straightforward and convenient to interpret than other alternatives;
2. The estimation results of OLS in macroeconometric stochastic equations rarely differ from the results of the alternatives; and
3. There is no consensus among scholars about the methodology that should be used to estimate the simultaneous equation. Moreover, using alternative methods such as 2SLS requires arbitrary decisions when selecting appropriate instrumental variables.

We estimate all behavioral equations individually and find the magnitude of the coefficient for each variable. For each equation, all correspond coefficients along with the standard error (SE), the adjusted value of the multiple coefficients of determination (adjusted R-squared), Durbin Watson statistic (D.W. Stat), and the t-statistic result will be discussed.

6.2.2.1 Supply Side

6.2.2.1.1 Output

Regression result

$$\log GDP = 11.8708 + 0.0953 * \log K(-1) + 1.1315 * \log HC\_EL - 0.0639 * dummy$$
$$SE: \quad (0.8710) \quad (0.0711) \quad (0.1141) \quad (0.0466)$$

Adj. R-squared : 0.9831 *D.W. Stat. : 0.5323*

Based on the regression result, we found that both last year's capital and employed labor positively impact the economy. We expect that each one percent increase in the capital stock will elevate around 0.1% of output in the economy. Similarly, each one percent increase in the (weight-adjusted) employed labor will increase the economy by around 1.1%. The result shows a slightly increasing return to scale with the sum of the coefficient is more than 1. Meanwhile, the dummy variable's coefficient explains the negative impact of the 1998 financial crisis in Asia.

We also found that these independent variables can explain more than 98% of the variation in the dependent variable. The coefficient for (weighted adjusted) employed labor is statistically significant at a 1% level. However, both capital stocks and the dummy variable are not statistically significant. A low score in Durbin Watson statistic indicates positive autocorrelation detected in this equation.

6.2.2.1.2 Labor

6.2.2.1.2.1 Employed Labor

Regression result

1. $$\log EL\_NS = -1.3790 + 1.0798 * \log LF\_NS$$
   $$SE: \quad (0.1551) \quad (0.0091)$$

   Adj. R-squared : 0.9977 *D.W. Stat. : 0.7959*

2. $$\log EL\_ES = 1.8959 + 0.8881 * \log LF\_ES$$
   $$SE: \quad (0.2005) \quad (0.0115)$$

   Adj. R-squared : 0.9945 *D.W. Stat. : 0.4868*

3. $\log EL\_JHS = 0.5836 + 0.9597 * \log LF\_JHS$
$SE : (0.1502) \quad (0.0091)$

Adj. R-squared : 0.9971 *D.W. Stat. : 0.1841*

4. $\log EL\_SHS = 0.1775 + 0.3554 * \log LF\_SHS + 0.6331 * \log EL\_SHS(-1)$
$SE : (0.2170) \quad (0.1468) \quad (0.1397)$

Adj. R-squared : 0.9971 *D.W. Stat. : 0.6898*

5. $\log EL\_COLL = -0.1230 + 0.828429 * \log LF\_COLL + 0.1750 * \log EL\_COLL(-1)$
$SE : (0.1038) \quad (0.0718) \quad (0.0699)$

Adj. R-squared : 0.9988 *D.W. Stat. : 0.7912*

All these equations represent the employed labor from a respective educational background. Mainly, the essential factor and the source of employed labor is the total labor force available. For employed labor with senior high school background and tertiary education background, besides total labor force stock, last year's number of employed labor also determines the number of current year’s employed labor.

Starting from the lowest on with no educational background, we can see that for one percent increase in labor force stock would lead to almost the same one percent increase in employed labor. Based on the adjusted R-squared result, we can imply that the number of labor force stocks alone can explain more than 99% of the variation. It also shows that the variable is statistically significant at a 1% level. Meanwhile, with less than 2 points of Durbin Watson statistic, it indicates positive autocorrelation.

For employed labor with elementary school background, the labor force's coefficient to employed labor is only 0.89. In this case, for a 1% increase in the number of the labor force with an elementary school graduate background, it is expected to bring about a 0.89% increase in the number of employed labor. Similarly, for the employed labor with junior high school graduate background, a 1% increase will affect a 0.96% increase in employed labor with corresponding educational backgrounds. For the coefficient of determination, we can say that the variables can explain almost all the variability for both groups. The result also shows that both variables are statistically significant at 1% level. However, the Durbin Watson statistic indicate the possibility of autocorrelation for both groups.

For workers with senior high school graduate and college graduate backgrounds, it seems that last year employed labor formation also determine the current number of employed labor. From the regression results, they indicate the correct logical order that all variables have positively correlated. From the result, we can infer that a 1% increase in the current year's senior high school graduates' labor force will increase its employed labor force by 0.36%. Meanwhile, the coefficient of last year's employed labor stock is 0.63.

On the other hand, a 1% increase in the current year's number of college graduate labor forces will give a 0.83% increase in the employed labor stock with a respective educational background. Additionally, the coefficient of last year's employed labor stock is 0.18.

The adjusted R-squared for both equations for senior high school graduate and college graduate workers is very high, which indicates that the data nicely fit the regression line. Like other previous groups, the Durbin Watson statistic for both equations are lower than 2, indicating positive autocorrelation.

6.2.2.1.2.2 Labor Force

Regression result

1. $\log LF\_NS = -2.7188 + 0.2563 * \log POP7\text{-}12 + 0.9010 * \log LF\_NS(-1)$
   SE : *(10.458) (0.5580) (0.0873)*
   Adj. R-squared : 0.8371 *D.W. Stat. : 2.3561*

2. $\log LF\_ES = 2.1164 + 0.0077 * \log (ST\_ES(-1)/6 * P\_LF\_ES)$
   SE : *(1.1616) (0.0194)*

   $+ 0.8721 * \log LF\_ES(-1)$
   (0.0572)

   Adj. R-squared : 0.9129 *D.W. Stat. : 2.1773*

3. $\log LF\_JHS = 0.3688 + 0.0424 * \log (ST\_JHS(-1)/3 * P\_LF\_JHS)$
   SE : *(0.7164) (0.0487)*

   $+ 0.9442 * \log LF\_JHS(-1)$
   (0.0169)

   Adj. R-squared : 0.9902 *D.W. Stat. : 2.1780*

4. $\log LF\_SHS = 0.4693 + 0.0363 * \log (ST\_SHS(-1)/3 * P\_LF\_SHS)$

SE : $(0.3485) \quad (0.0647)$

$+ 0.9442 * \log LF\_SHS(-1)$

(0.0382)

Adj. R-squared : 0.9967 *D.W. Stat. : 1.3885*

5. $\log LF\_COLL = -0.3386 + 0.1356 * \log (ST\_COLL(-1)/4 * P\_LF\_COLL)$

SE : $(0.8246) \quad (0.1303)$

$+ 0.9068 * \log LF\_COLL(-1)$

(0.0658)

Adj. R-squared : 0.9935 *D.W. Stat. : 2.2804*

In the model, we design that labor is classified into five levels based on their last education attainment. The lowest level is the labor force with no educational background, while the highest level is the labor force with tertiary education attainment.

Starting from the lowest class of the labor force, we presume that the population age 7 to 12 is the primary labor force source. Based on the regression result, we attain that the coefficient of population age 7 to 12 is 0.26. Since this equation takes logarithmic form, we can imply that each 1% increase in this population will raise the number of the labor force in this level around 0.26%. The result also implies that the population age 7 to 12 mainly chooses to go to school instead of working. On the other hand, since last year's labor force coefficient is high, the current year's number of the labor force is determined by the last year's labor force formation. Although standard error indicates that this variable is not statistically significant, the coefficient of determination shows a relatively high, and Durbin Watson statistic shows almost no problem with autocorrelation.

For the labor force with primary education to the tertiary education background, all of the current year's labor force stock is determined by the last year's labor force composition and newly graduated worker. Based on this scheme, all independent variables can explain more than 90% of the variation in the dependent variables. Moreover, Durbin Watson statistic are around 2 for almost all equations, indicating no autocorrelation problems.

The coefficients of labor supply from elementary school, junior high school, and senior high school newly graduate workers are 0.01, 0.04, and 0.03, respectively. These coefficients indicate that 1% increase in the number of new graduate workers from the respective level of education is merely 0.01%, 0.04%, and 0.03%. However, the labor force with tertiary education attainment shows a higher coefficient value. With the coefficient of a new graduate labor supply of 0.13, each 1% increase in new graduate workers will elevate 0.13% of the total number of the labor force with tertiary educational background.

6.2.2.1.3 Student

Regression result

1. $$\log ST\_ES = \underset{(2.0179)}{13.654} + \underset{(0.1333)}{0.1627}*\log POP + \underset{(0.1462)}{0.4712}*\log (POP7\text{-}12/POP) + \underset{(0.0092)}{0.0242}*\log EDUEXP\_C(-1) + \underset{(0.0594)}{0.0239}*\log BUILD\_ES(-1) + \underset{(4.9126)}{1.2405}*\log ST\_ES(-1)$$

   Adj. R-squared : 0.725203   D.W. Stat. : 1.910988

2. $$\log ST\_JHS = \underset{(2.2992)}{2.2338} + \underset{(0.2140)}{0.4542}*\log POP13\text{-}15(-1) + \underset{(0.0416)}{0.1140}*\log EDUEXP\_C(-1) + \underset{(0.1160)}{0.0502}*\log BUILD\_JHS(-1) + \underset{(0.1214)}{0.1752}*\log TC\_JHS(-1)$$

   Adj. R-squared : 0.9711   D.W. Stat. : 1.0433

3. $$\log ST\_SHS = \underset{(1.9972)}{1.9589} + \underset{(0.1406)}{0.4034}*\log POP16\text{-}18(-1) + \underset{(0.0345)}{0.1284}*\log EDUEXP\_C(-1) + \underset{(0.1098)}{0.2998}*\log BUILD\_SHS(-1) + \underset{(0.0921)}{0.0172}*\log TC\_SHS(-1)$$

   Adj. R-squared : 0.9744   D.W. Stat. : 0.8251

4. $$\log ST\_COLL = \underset{(6.4197)}{-5.1394} + \underset{(0.4206)}{0.4460}*\log POP19\text{-}24(-1) + \underset{(0.0658)}{0.3887}*\log EDUEXP\_C(-1) + \underset{(0.1251)}{0.1500}*\log (TC\_COLL(-1)/COLL(-1))$$

   Adj. R-squared : 0.9218   D.W. Stat. : 0.4591

The student in these equations refers to the number of student stock for the current year. In the model constructed, we expect that these numbers are mainly determined by the number of population for a specific level of education and the availability of government expenditure on education. To some extent, we also expect that educational institutions such as school building and teachers are also crucial in determining the number of students. In this case, the school buildings as the place to gather the students determine the space availability while the teachers specify the number of student-related to study materials delivery. For elementary school students, the current year's stock is determined by five different variables. They are the population, the portion population who should go to elementary school, last year's education expenditure for consumption, the number of the elementary school building, and last year's elementary school number of students.

From the result, we can observe that a 1% increase in population will approximately raise the number of students in the same year by 0.13%. Meanwhile, 1% increase in the population's composition with age 7 to 12, the student will be expected to increase the number of current year's students by 0.47%. Last year education expenditure on consumption to some extent also contribute to determining the number of students. It is approximately that 1% increase in the last year expenditure will positively affect the number of students by about 0.02%. Similarly, 1% increase in last year's stock of school buildings will increase the current year's number of the student by 0.02%.

For junior high school students, it is determined by the number of the population who population age 13 to15, last year's education expenditure on consumption, last year's stock of junior high school building, and last year's number of junior high school teachers.

Based on the regression, we can identify that a 1% increase in last year's population age 13 to 15 will escalate the number of current year's junior high school students to about 0.45%. Education expense for consumption, which usually goes to students, also impacts the growth of the number of students. In this case, the increase in the last year's education expenditure for consumption will increase the student's current year by 0.11%. Meanwhile, a 1% increase in the number of last year's stock of school building and junior high school teachers will raise junior high school students by 0.05% and 0.18%, respectively.

Senior high school is the last stage of secondary school. The students are usually around 16 to 18 years old. In the model, to determine the number of senior high school students, we include the population age 16 to 18. Similar to junior high school's case, we also include education expenditure on consumption, the number of stock of senior high school buildings, and the number of senior high school teachers to determine the number of senior high school students.

It is found that a 1% increase in last year's population age 16 to18 will increase the number of students by around 0.40%. In comparison, a 1% increase in the education expenditure for consumption will raise the number of students by about 0.13%. Similarly, changes in education institutions also affect the number of students to some extent. Based on the result, we can imply that a 1% increase in last year's senior high school buildings and teachers will raise the number of senior high school students by around 0.3% and 0.02%, respectively. Although there is a sign of autocorrelation, the adjusted R^2 is about 0.97, which shows that this model can explain 97% of the variation.

Lastly, we try to analyze the student in the college. In this model, we include the population age 19 to 24, representing the student who goes to tertiary education. As some of the students can obtain tuition fee waivers or discounts that the government covers, we include the government education expenditure on consumption as part of the independent variable. For tertiary education, we expect that the quality of education also determines the number of students. This time, we proxy the quality of education by comparing the number of lecturers in the college with the college buildings' number. We expect that the higher the number means the higher quality of education.

From the analysis, we can identify that a 1% increase in the population age 19 to 24 will increase the number of college students by 0.45%. Meanwhile, the education expenditure on consumption shows the highest impact among other level education when determining students' number. In this case, a 1% increase in the education expenditure on consumption will increase the number of students in the college by 0.39%. Additionally, we can notice that a 1% increase in education quality will escalate the number of college students by 0.15%.

6.2.2.1.4 School Building

Regression results

1. log *BUILD_ES* = 3.1285 +0.0240*log *EDUEXP_I(-2)*+0.6762*log *BUILD_ES(-1)*
   SE : *(1.2338) (0.0094) (0.1233)*

   Adj. R-squared : 0.8767 D.W. Stat. : 1.8188

2. log *BUILD_JHS* = -0.2293 + 0.0258*log *EDUEXP_I(-2)*
   SE : *(0.2364) (0.0110)*

   + 0.9471*log *BUILD_JHS(-1)*
   (0.0442)

   Adj. R-squared : 0.9870 D.W. Stat. 1.2239

3. log *BUILD_SHS* = -0.3462 + 0.0288*log *EDUEXP_I(-2)*
   SE : *(0.2093) (0.0164)*

   + 0.9470*log *BUILD_SHS(-1)*
   (0.0489)

   Adj. R-squared : 0.9888 D.W. Stat. : 1.5955

4. log *BUILD_COLL* = -3.6486 + 0.1878*log *EDUEXP_I(-2)*
   SE : *(1.5571) (0.0752)*

   + 0.7149 * log *BUILD_COLL(-1)*
   (0.1095)

   Adj. R-squared : 0.9787 D.W. Stat. : 1.7360

In this model, school buildings refer to learning places where the teachers and students gather to deliver education material. We classify the school building based on education level: elementary school, junior high school, senior high school, and college. We expect that the current year's number of school building is mainly depend on government education expenditures on investment beside last year's number of school building.

Except for tertiary education, we find that a 1% increase in the education expenditure for investment will increase the number of school building for both primary and secondary education by around 0.02%. Meanwhile, the increase in the education expenditure for investment by 1% for tertiary education will raise the number of college buildings by 0.19%. All the education expenditures for investment regression refer to 2 years before to accommodate the time to construct the buildings. This model can explain around 98% of the variation for all education levels except for the equation for elementary school building where adjusted R^2 is around 0.88.

6.2.2.1.5 Teachers

Regression results

1. log *TC_ES* = 5.6495 + 0.0732*log *EDUEXP_C* + 0.4420*log *TC_ES(-1)*
   SE : (1.4587) (0.0201) (0.1419)
   Adj. R-squared : 0.9023 D.W. Stat. : 2.0902
2. log TC_*JHS* = 3.1072 + 0.1734*log *EDUEXP_C* + 0.3621*log *TC_JHS(-1)*
   SE : (0.8141) (0.0512) (0.1753)
   Adj. R-squared : 0.9666 D.W. Stat. : 2.0290
3. log *TC_SHS* = 4.3215 + 0.0947*log *EDUEXP_C* + 0.4486*log *TC_SHS(-1)*
   SE : (1.1824) (0.0314) (0.1548)
   Adj. R-squared : 0.8874 D.W. Stat. : 1.8446
4. log *TC_COLL* = 4.1611 + 0.0246*log *EDUEXP_C* + 0.6055*log *TC_COLL(-1)*
   SE : (1.2235) (0.0210) (0.1205)
   Adj. R-squared : 0.6189 D.W. Stat. : 2.1711

In this model, teachers are also classified according to 4 four categories: teachers who teach in elementary school, teachers who teach in junior high school, teachers who teach in senior high school, and lecturers in the college. Mainly, their recruitment is based on budget availability. In other words, education expenditure on consumption, which is allocated for their salaries, becomes vital to determine the number of teachers in the given year. Other than that, last year's number of teachers still plays an important role in determining the current year's students' number.

We can see that except for the number of a college lecturer, the variation of all the number of teachers in primary and secondary education can be explained around 90% by these variables: the education expenditure on consumption and the last year's number of teachers. Moreover, Durbin Watson statistic clearly show almost no autocorrelation problem.

Starting from elementary school, we can see that a 1% increase in education expenditure on consumption can elevate teachers' number by 0.07%. For the secondary education level, a 1% increase in the education expenditure on consumption can increase teachers' number by 0.17% for junior high school and 0.09% for senior high school. Meanwhile, a 1% increase in the education expenditure on consumption can escalate the number of college lecturers to about 0.02%.

6.2.2.2 Demand Side

6.2.2.2.1 Private Consumption

$$\log PCONS = \underset{(0.6658)}{1.0486} + \underset{(0.1086)}{0.4303} * \log (GDP\text{-}TAX) + \underset{(0.1146)}{0.5362} * \log PCONS(-1)$$

SE : *(0.6658) (0.1086) (0.1146)*

Adj. R-squared : 0.9892 *D.W. Stat. : 2.2073*

6.2.2.2.2 Tax

$$\log TAX = \underset{(1.5206)}{-9.3011} + \underset{(0.0420)}{1.1920} * \log GDP - \underset{(0.0772)}{0.2397}\ dummy$$

SE : *(1.5206) (0.0420) (0.0772)*

Adj. R-squared : 0.9634 *D.W. Stat. : 1.1754*

6.3 Simulation

6.3.1 Final Test of the Model

After all behavior equations in this model are estimated, the next stage is to test the validity of the model to replicate the actual data through dynamic simulation for the period 1998 to 2017 (20 years of observation). In this case, the forecasted result of the model is matched with the original data to examine its fitness. The results are summarized in Figure 6.12 and Table 6.2. There will be 24 variables that will be examined.

Figure 6.12 shows the fitness of simulated and actual data plots by using dynamic simulation. Although some forecasting variables do not nicely fit the actual data, they still have similar trends to some extent. Meanwhile, Table 6.2 indicates some measurements to determine the model's validity by using three different methodologies. Those tools are the root mean square percentage error (RMSPE), mean absolute percent error (MAPE), and the Theil inequality coefficient (U).

Essentially, RMSPE is one of the methodologies to check the validity of the model to predict by comparing the *n* actual data (*A*) and the forecast data (*F*) by using the following equation. The result will be in percentage. The lower the result, the better the model can predict the actual data.

$$RMSPE = \sqrt{\frac{\sum_{i=1}^{n}\left(\frac{A_i - F_i}{A_i}\right)^2}{n}} \text{ x } 100$$

Similarly, assuming there are *n* data available, MAPE also investigates the validity of the model prediction by comparing the forecast data (F) with the actual data (A) by using the following equation:

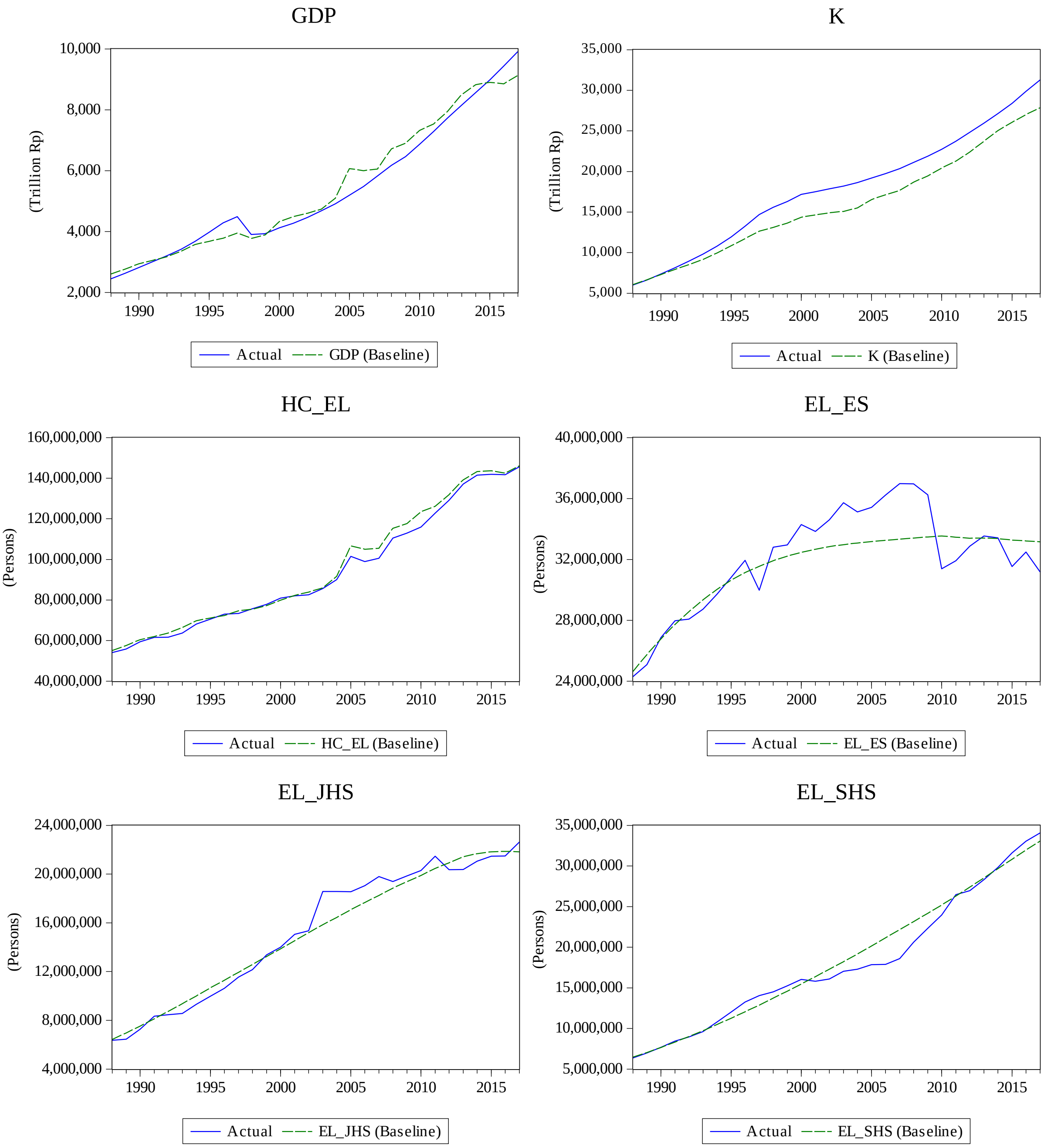
$$MAPE = \frac{\sum_{i=1}^{n}\left|\frac{A_i - F_i}{A_i}\right|}{n}$$

Therefore, this method is simply trying to calculate the deviation of the forecast value from the actual data. The result is between 0 and 1. While the number 0 indicates that the forecast value perfectly matches the actual data, the number 1 expresses otherwise.

On the other hand, U measures the model's validity by comparing the trend of forecasted value with the trend of actual value. In principle, the closer the result to 0, the more robust the forecast value prediction. Assuming similar *n* actual data (A) and forecast data (F), U can be calculated as follows:

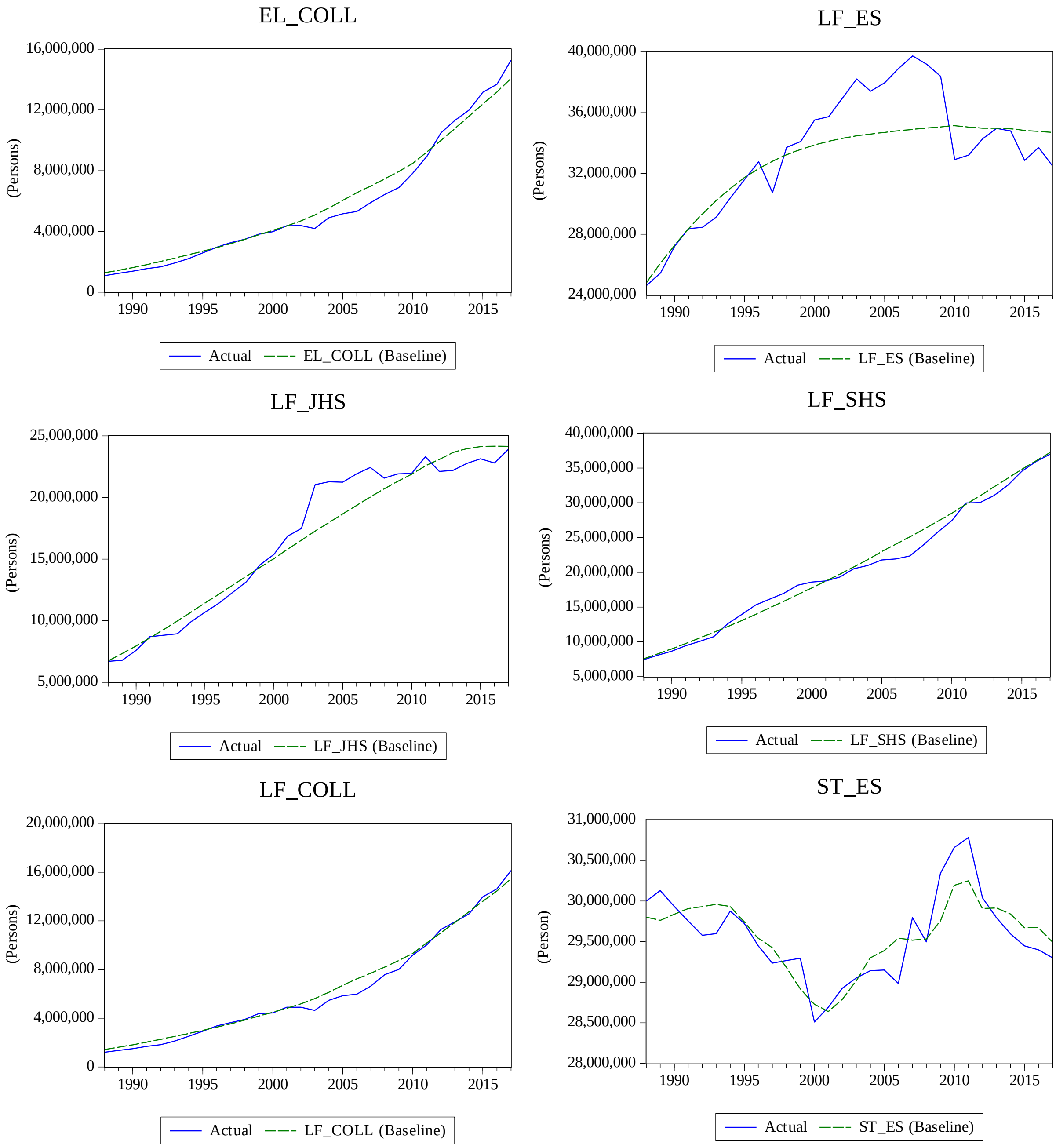
$$U = \frac{\sqrt{\frac{1}{n}\sum_{i}^{n}(F_i - A_i)^2}}{\sqrt{\frac{1}{n}\sum_{i}^{n}{F_i}^2} + \sqrt{\frac{1}{n}\sum_{i}^{n}{A_i}^2}}$$

Figure 6.12 Final Test of the Model



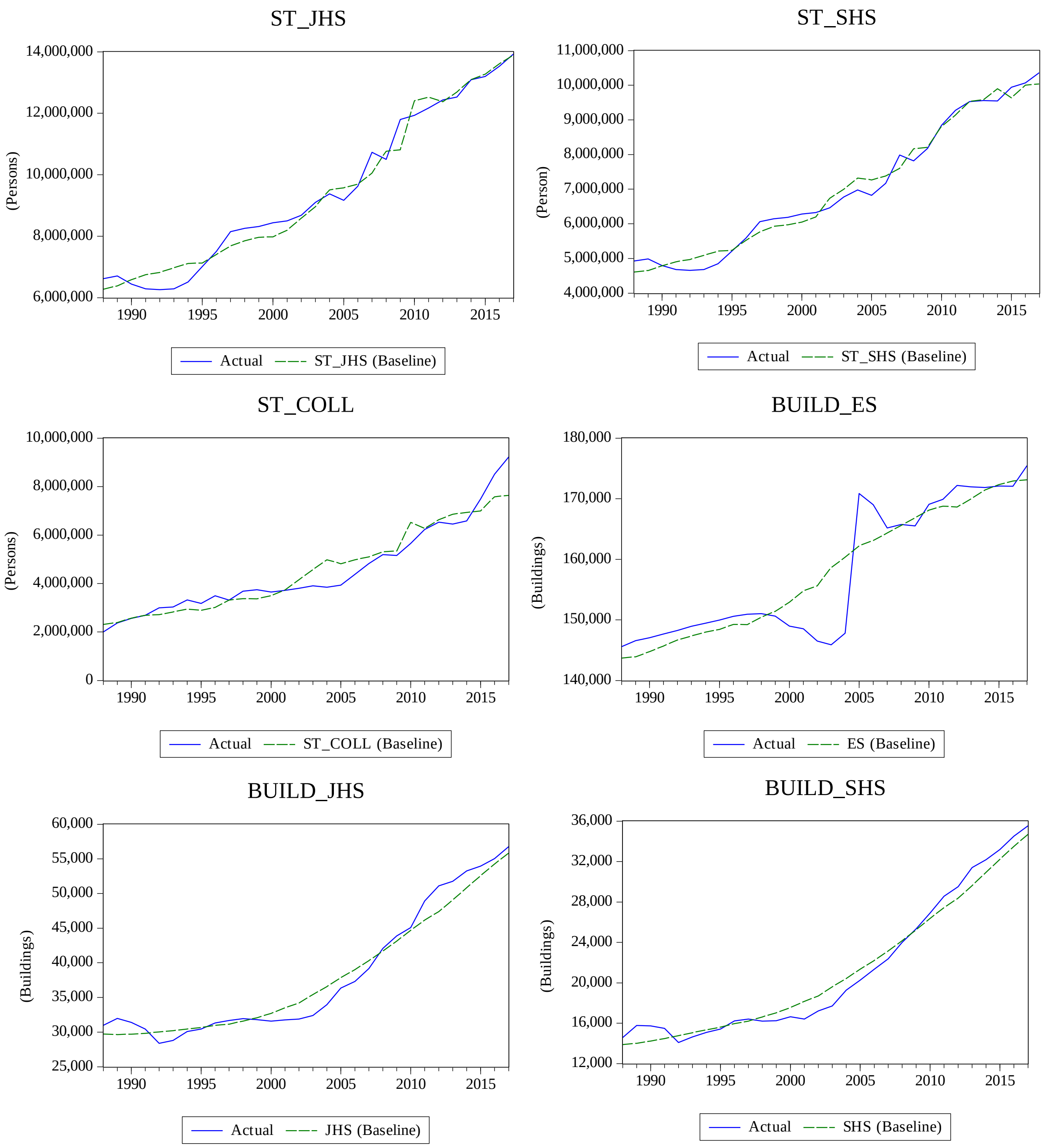
Source: Author’s estimation

Figure 6.12 Final Test of the Model (Continued)



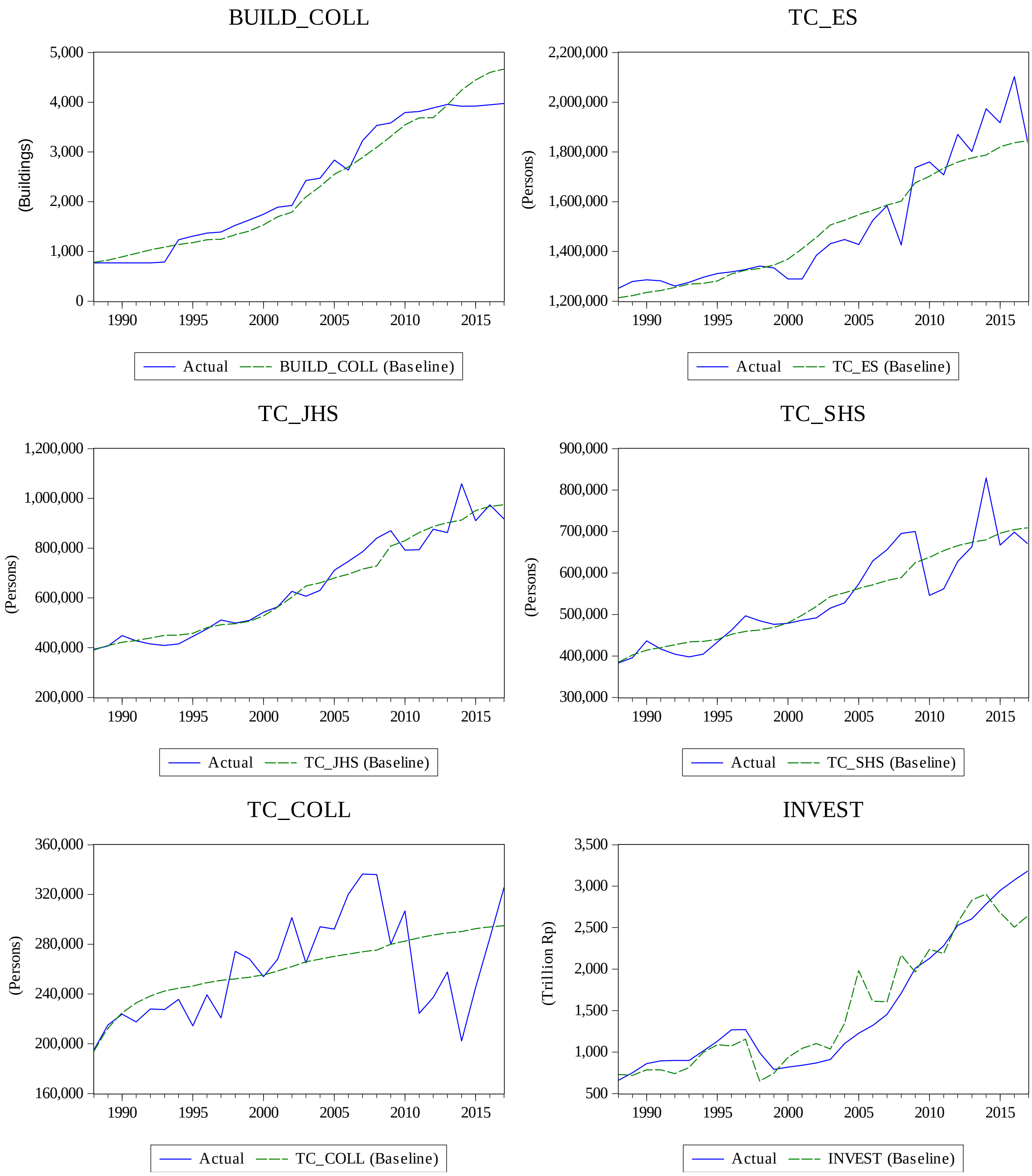
Source: Author’s estimation

Figure 6.12 Final Test of the Model (Continued)



Source: Author’s estimation

Figure 6.12 Final Test of the Model (Continued)



Source: Author's estimation

Based on RMSPE analysis, the values are mainly less than 10 percent. Some are greater than 10 percent, especially for every indicator for tertiary education, capital stocks, and investments, which shows a higher percentage. Similarly, the MAPE of major endogenous variables is mainly lower than 10 percent except for every variable connected with higher education, capital stocks, and investments, which reaches up to higher than 10 percent. Moreover, the U exhibits satisfactory forecasting ability with almost zero for all of the coefficients.

Table 6.2 Forecasting Accuracy of the Key Variables

Variables	RMSPE(%)	MAPE(%)	Theil Inequality Coefficient
GDP	6.3979	5.2437	1.0858
K	11.5232	10.4334	1.7573
HC_EL	2.8713	2.2615	0.6474
EL_ES	4.9389	4.0283	1.1207
EL_JHS	5.7234	4.6700	0.8758
EL_SHS	7.3842	5.4011	1.1085
EL_COLL	12.4060	10.0520	1.2323
LF_ES	5.8579	4.6324	1.2828
LF_JHS	7.4369	6.0732	1.0962
LF_SHS	5.3889	4.4289	0.8329
LF_COLL	11.8656	8.9121	1.1804
ST_ES	0.9303	0.7677	0.8237
ST_JHS	4.7683	3.7324	1.0513
ST_SHS	4.2404	3.4982	0.9645
ST_COLL	10.9433	8.5688	1.4245
BUILD_ES	3.0305	2.0049	1.0293
BUILD_JHS	4.4994	3.7618	1.2278
BUILD_SHS	5.4070	4.5157	1.1616
BUILD_COLL	14.1758	11.5909	1.1244
TC_ES	5.3087	4.0454	0.8502
TC_JHS	6.0346	4.7737	0.8219
TC_SHS	7.9682	6.1326	0.9460
TC_COLL	13.6793	0.0187	1.0558
INVEST	18.6250	14.1466	1.7911

Source: Author's calculation

6.3.2 Policy Simulation

This chapter's primary goal is to analyze policy implications related to human capital and economic growth by designing a macroeconometric model for Indonesia's economy. Subsequently, after the validity of the model to replicate the actual data has been obtained, we can proceed to run some policy simulations. To do so, we make the simulation by putting some shocks in the model from 2012 to 2017 to see the extent of the impact of the shock on the baseline.

In the model, to support our study on the impact of human capital investment on the economy, government expenditures are classified into two different categories: consumption and investment. Each of the categories is also organized into another two purposes: education spending and other than educational spending. As a result, there will be four different groups for government spending: education expenditure for consumption (EDUEXP_C), education expenditure for investment (EDUEXP_I), non-education expenditure for consumption (N_EDUEXP_C), and non-education for investment (N_EDUEXP_I).

Principally, the total amount of government budget has been predetermined where the allocation of the budget is to be settled on afterward. Within that framework, we will put shock by allocating an additional 10% of total education expenditure to either education expenditure for consumption or investment. In order to accommodate the variation of budgeting in government expenditure, four scenarios will be applied to test the model and also to analyze the policy implication as follows:

1. Allocating 10% additional education spending to education expenditure for consumption (EDUEXP_C) by decreasing non-education expenditure for consumption (N_EDUEXP_C) from the baseline;

2. Allocating 10% additional education spending to education expenditure for consumption (EDUEXP_C) by decreasing non-education expenditure for investment (N_EDUEXP_I) from the baseline;
3. Allocating 10% additional education spending to education expenditure for investment (EDUEXP_I) by decreasing non-education expenditure for consumption (N_EDUEXP_C) from the baseline; and
4. Allocating 10% additional education spending to education expenditure for investment (EDUEXP_I) by decreasing non-education expenditure for investment (N_EDUEXP_I) from the baseline.

In short, these four scenarios to measure the impact of allocating government expenditures related to education spending are explained in Table 6.3 to Table 6.6 below.

Table 6.3 Scenario 1 (10% Increase in Education Spending for Consumption and 10% Decrease in Non-Education Spending for Consumption)

Description	Government Consumption	Government Investment	Total Government Expenditures Changes
Education Expenditures	10% increase	-	10% increase
▪ *Education Expenditures for Consumption*	*10% increase*	-	*10% increase*
▪ *Education Expenditures for investment*	-	-	-
Non-Education Expenditures	10% decrease	-	10% decrease
▪ *Non-Education Expenditures for Consumption*	*10% decrease*	-	*10% decrease*
▪ *Non-Education Expenditures for Investment*	-	-	-
Total Government Expenditure changes	-	-	-

Source: Author’s estimation

Table 6.4 Scenario 2 (10% Increase in Education Spending for Consumption and 10% Decrease in Non-Education Spending for Investment)

Description	Government Consumption	Government Investment	Total Government Expenditures Changes
Education Expenditures	10% increase	-	10% increase
Education Expenditures for Consumption	*10% increase*	-	*10% increase*
▪ *Education Expenditures for investment*	-	-	-
Non-Education Expenditures	-	10% decrease	10% decrease
▪ *Non-Education Expenditures for Consumption*	-	-	-
▪ *Non-Education Expenditures for Investment*	-	*10% decrease*	*10% decrease*
Total Government Expenditure changes	10% increase	10% decrease	-

Source: Author's estimation

Table 6.5 Scenario 3 (10% Increase in Education Spending for Investment and 10% Decrease in Non-Education Spending for Consumption)

Description	Government Consumption	Government Investment	Total Government Expenditures Changes
Education Expenditures	-	10% increase	10% increase
▪ *Education Expenditures for Consumption*	-	-	-
▪ *Education Expenditures for Investment*	-	*10% increase*	*10% increase*
Non-Education Expenditures	10% decrease	-	10% decrease
▪ *Non-Education Expenditures for Consumption*	*10% decrease*	-	*10% decrease*
▪ *Non-Education Expenditures for Investment*	-	-	-
Total Government Expenditure changes	10% decrease	10% increase	-

Source: Author's estimation

Table 6.6 Scenario 4 (10% Increase in Education Spending for Investment and 10% Decrease in Non-Education Spending for Investment)

Description	Government Consumption	Government Investment	Total Government Expenditures Changes
Education Expenditures	-	10% increase	10% increase
▪ *Education Expenditures for Consumption*	-	-	-
▪ *Education Expenditures for Investment*	-	*10% increase*	*10% increase*
Non-Education Expenditures	-	10% decrease	10% decrease
▪ *Non-Education Expenditures for Consumption*	-	-	-
▪ *Non-Education Expenditures for Investment*	-	*10% decrease*	*10% decrease*
Total Government Expenditure changes	-	-	-

Source: Author's estimation

Note that except for budget allocation, there are no additional government expenditures allocated in this scenario. Therefore, these scenarios should represent the importance of the budget allocation policy to determine the optimal result in the economy. Moreover, the percentage refers to 10 percent of total government expenditures. Therefore, the amount will be fixed, whether there is an addition or deduction of a factor.

When analyzing the policy implication of human capital and economic growth, this discussion will focus only on 24 essential variables. Mainly, those variables in the production function (GDP, K, HC_EL) will be explained in detail. Some of the other important variables such as number of employed labor (EL_ES, EL_JHS, EL_SHS, EL_COLL), number of educated workers supply (LF_ES, LF_JHS, LF_SHS, LF_COLL), number of variables dealing with the education institution (BUILD_ES, BUILD_JHS, BUILD_SHS, BUILD_COLL, TC_ES, TC_JHS, TC_SHS, TC_COLL), the number of students (ST_ES, ST_JHS, ST_SHS, ST_COLL), and a variable form demand function (INVEST) will also be disclosed. The results of scenarios 1 to 4 are exhibited in Figure 6.14, Figure 6.16, Figure 6.18, and Figure 6.20, respectively. Below is the explanation for all scenarios that refer to the results in those figures.

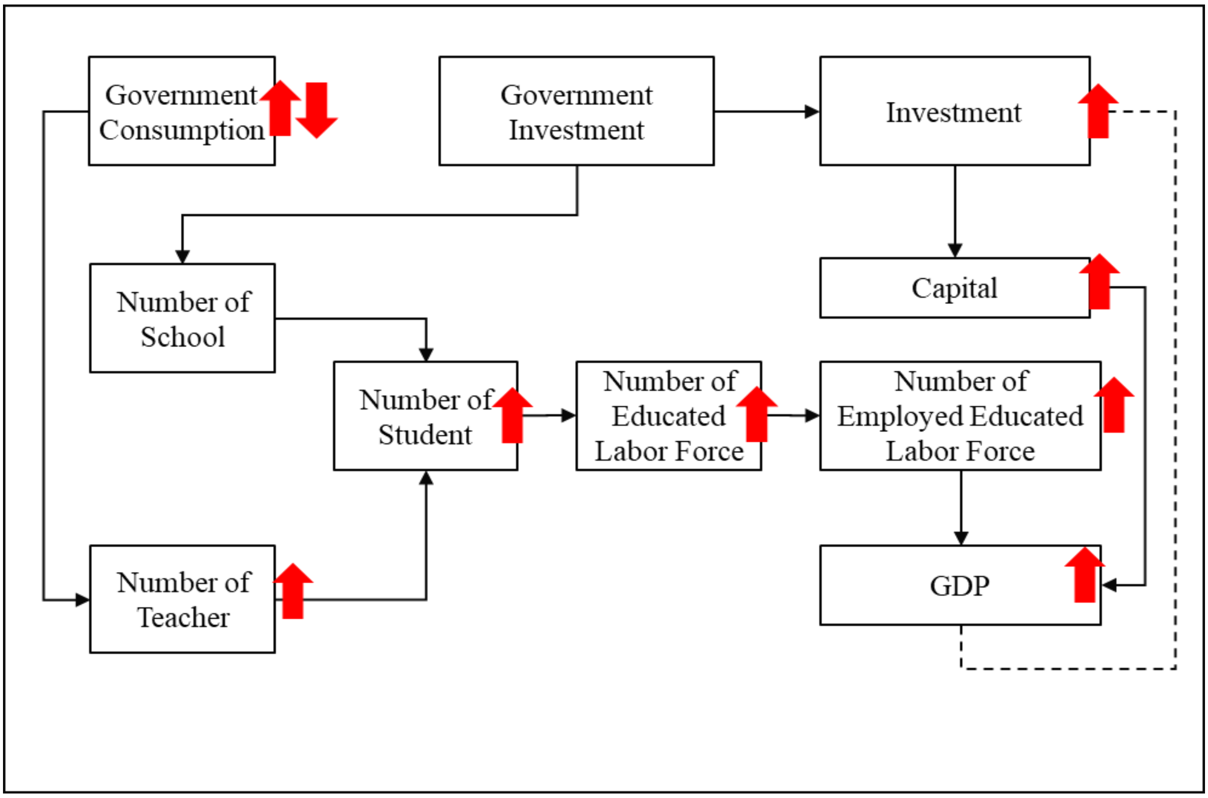
6.3.2.1 Scenario 1

Figure 6.14 exhibits all 24 key variables in light of the change in the allocation for education expenditure. In this scenario, education expenditure is increased by 10 percent and allocated for consumption purposes by reducing expenditures other than for education dedicated to consumption. This education expenditure for consumption usually goes for teachers' salaries, recruiting more teachers, and school administration.

If we refer to the flow of funds as depicted in Figure 6.2 and the scheme in Table 6.3, there are no changes in both total government consumption and government investment. Since both changes affect only government consumption, the increase in government education spending on consumption is nullified by the decrease in non-education government spending on consumption. However, the composition of allocation in consumption impacts other components to some extent, which can leverage the output in the economy. To illustrate the mechanism of how the policy works, we will use a simplified version of the macroeconometric model in Figure 6.13, referred to in Figure 6.2.

As a preliminary explanation based on this simplified chart, there are no total government consumption changes due to offsetting. We add the amount of budget allocated to education expenditure for consumption and subtract the budget to non-education expenditure for consumption. However, the impact of allocation gives leverage to the number of teachers hired to teach more students. As the number of the student increases, the number of the educated labor force also increases. This well-educated labor force will supply the labor market with workers. As the workers become more educated, the efficiency will increase, which boosts production. To some extent, the increase in the economy also gives a stimulant to capital stock investment. As a result, both from labor and capital side support the economy as a whole.

Figure 6.13 Mechanism of Human Capital Investment Based on Scenario 1



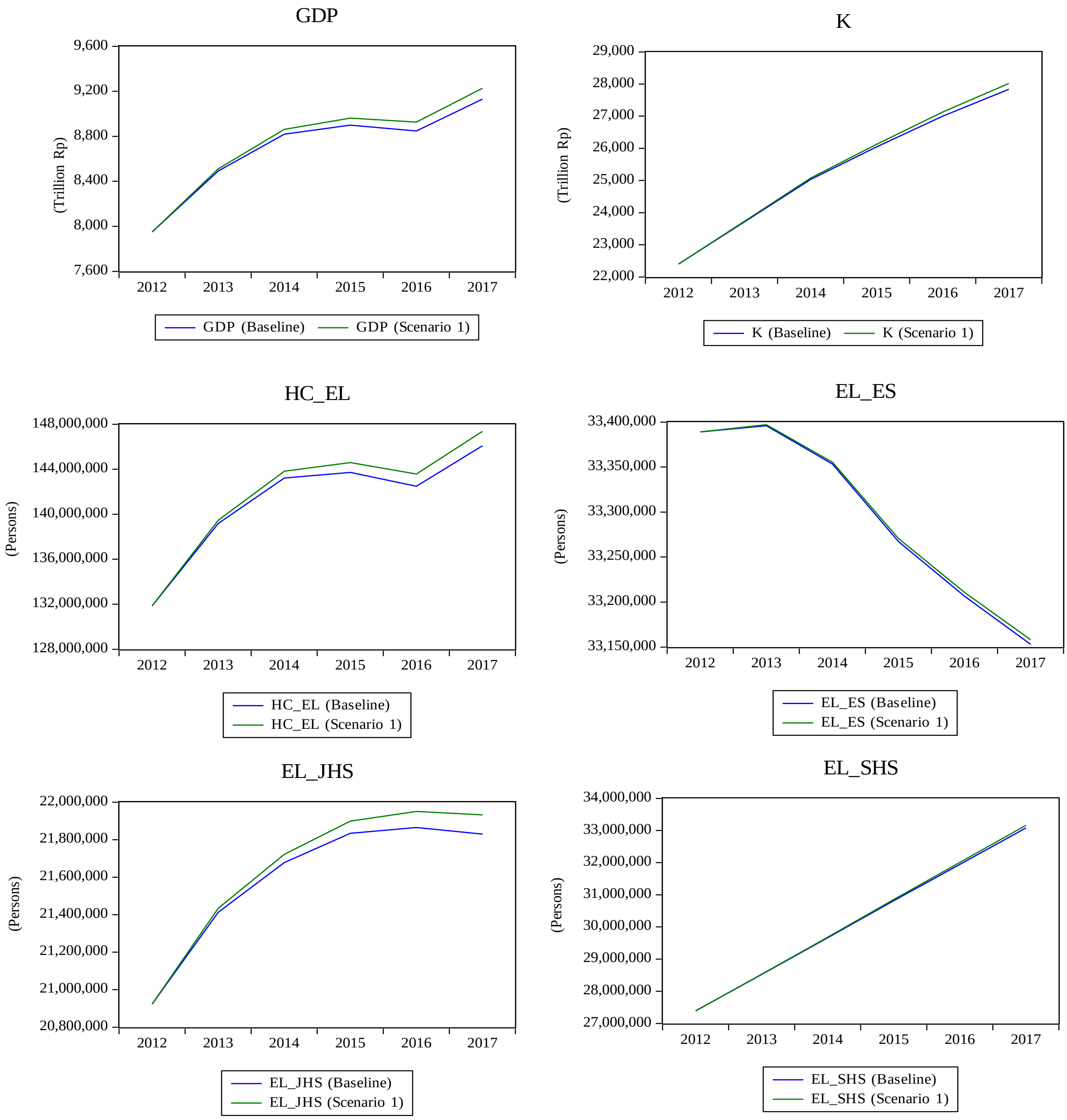
Source: Author's estimation

Based on the production function variables, the output indicates an increase of 0.22% starting from the year 2013 compared to the baseline. The number increased by more than twofold for the next period to 0.49% and slightly increased afterward. From 2012 to 2017, the economic benefit of applying this policy was about Rp50.0 trillion per year on average. This increase was supported by the gradual increase in capital stock from about 0.06% in 2013 to around 0.65% in 2017. In 2017, the capital stock accumulation was higher by around Rp181.4 trillion from the baseline.

Moreover, the human capital weighted workers in the production line indicated an improvement of about 0.4% on average compare to the baseline. In 2017, the accumulation of human capital weighted workers was around 147.4 million. This number is slightly higher than the baseline, which was only 146.1 million. If we reckon those numbers with the real number of persons engaged in the economy, the human capital index slightly increased from 1.18 points in the baseline to 1.19 points in 2017 based on this scenario.

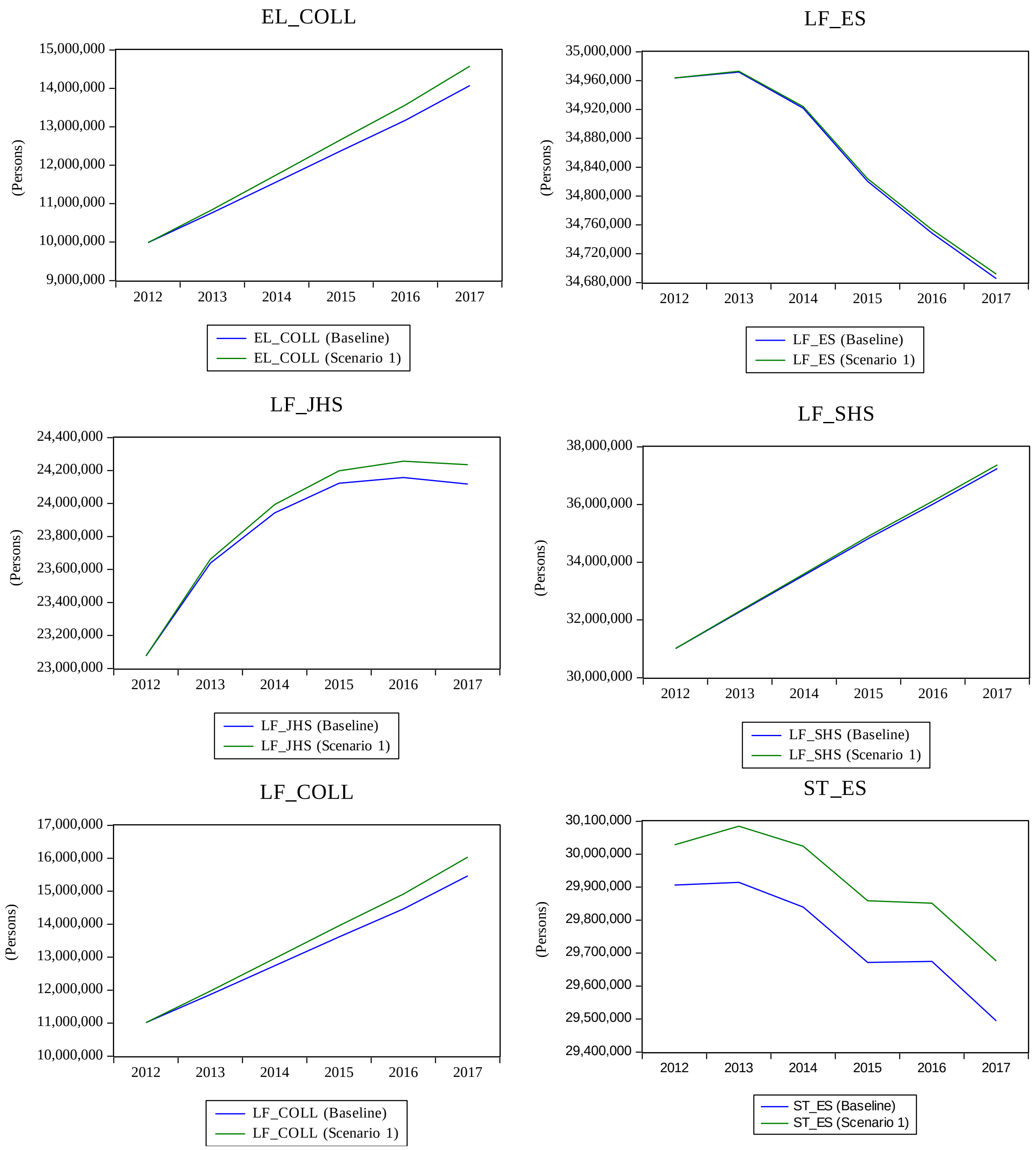
Meanwhile, the workers' composition from elementary school graduate, junior high school graduate, senior high school graduate, and college graduate in 2017 is around 33.2 million, 21.8 million, 33.1 million, and 14.1 million, respectively to the baseline. Based on the simulation, this number was improved by applying this policy by around 692.9 thousand workers in total, of which around 73% alone were tertiary education graduate workers. Meanwhile, elementary school graduate workers, junior high school graduate workers, and senior high school graduate workers increased by 5.1 thousand, 102.4 thousand, and 79.7 thousand workers from the baseline.

Figure 6.14 The Result of Scenario 1



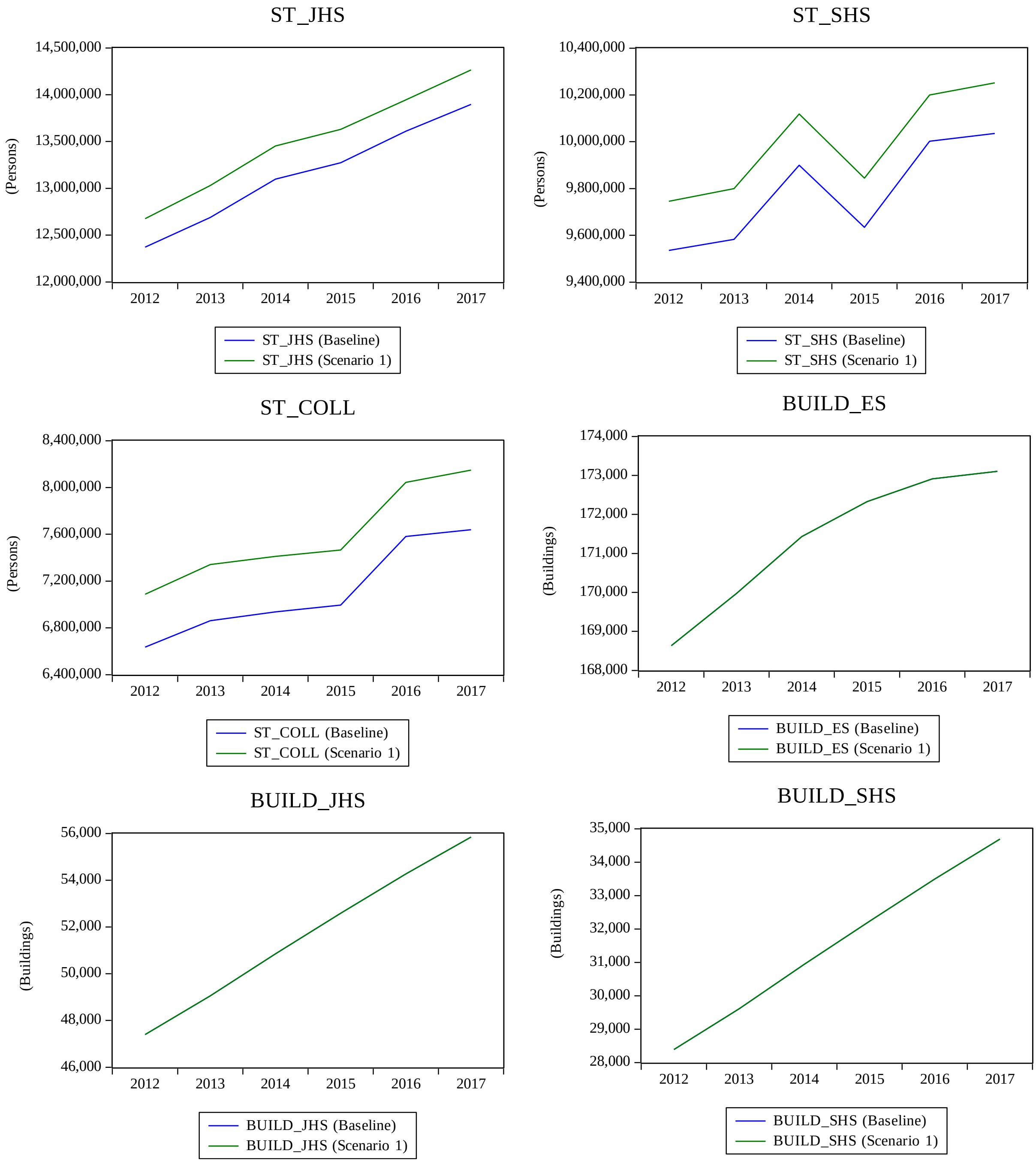
Source: Author’s estimation

Figure 6.14 The Result of Scenario 1 (Continued)



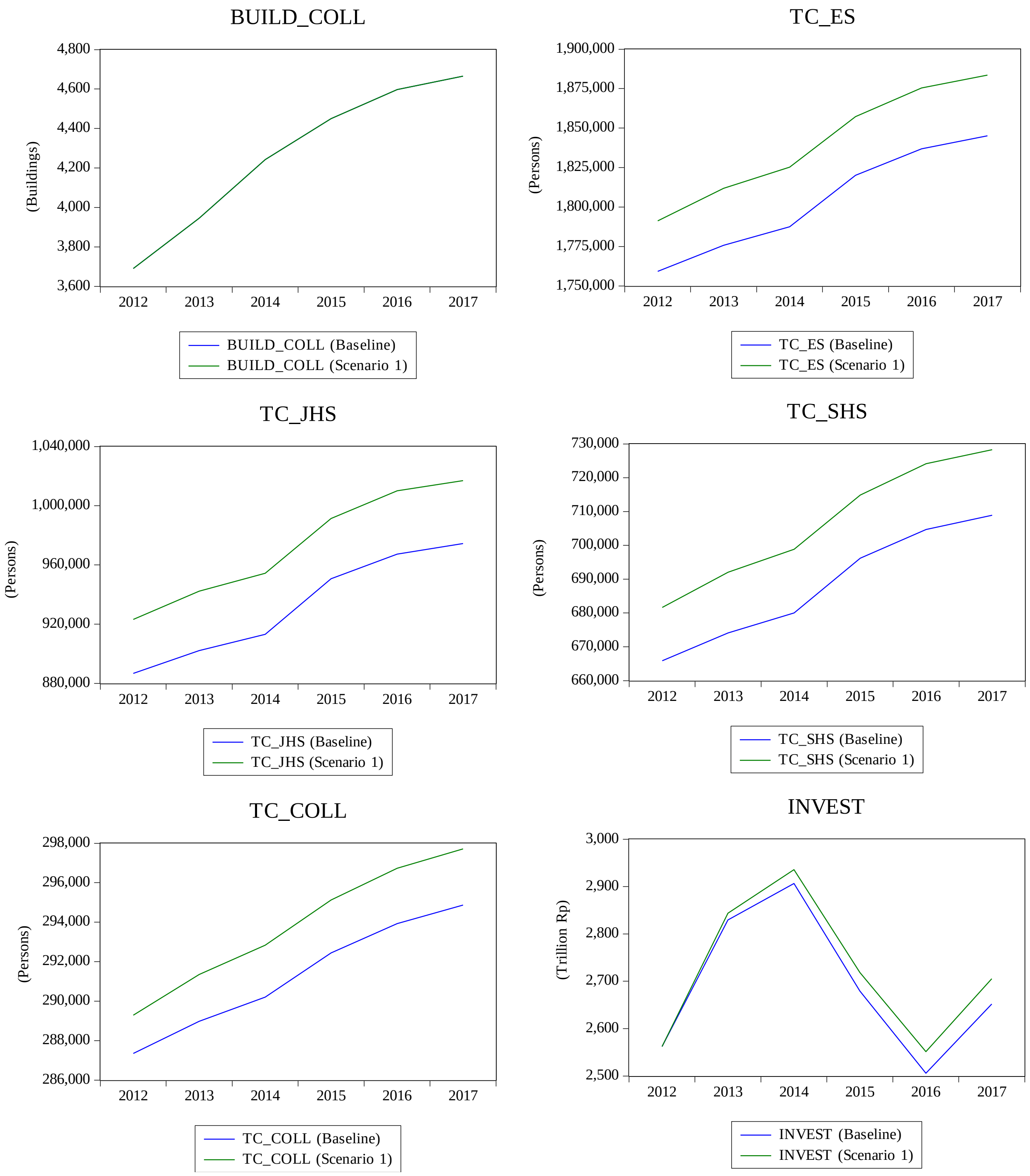
Source: Author’s estimation

Figure 6.14 The Result of Scenario 1 (Continued)



Source: Author’s estimation

Figure 6.14 The Result of Scenario 1(Continued)



Source: Author’s estimation

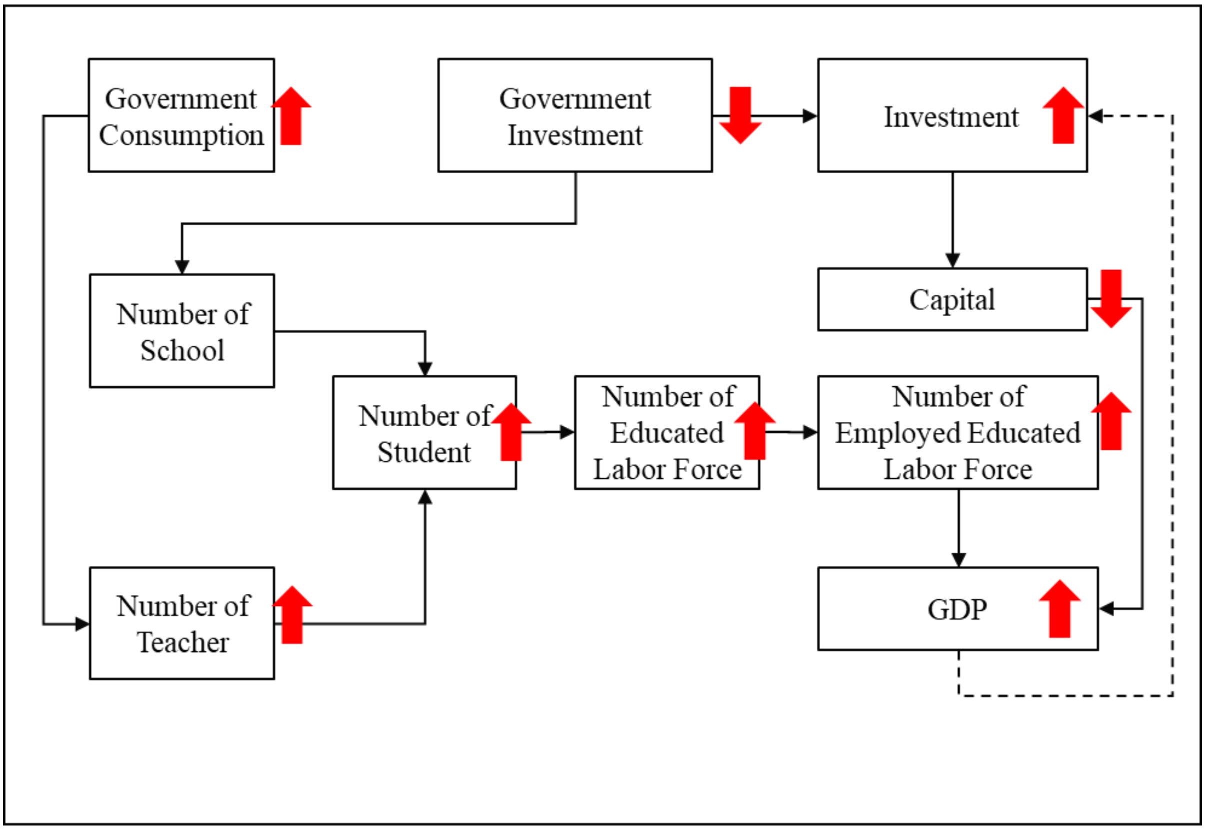
There is no additional establishment of the new building for either primary education, secondary education, or tertiary education under this scenario since the additional education expenditure is not allocated for investment. Based on the baseline, there were still 173.1 thousand buildings available for the elementary school in 2017. Similarly, the number of buildings available in 2017 for junior high school, senior high school, and college were 55.8 thousand, 34.7 thousand, and 4.7 thousand, respectively. On the other hand, there are more teachers than the baseline by 103.4 thousand persons in total. There are 38.4 thousand additional elementary school teachers, 42.5 thousand more teachers for junior high school, 19.4 thousand more teachers for senior high school, while tertiary education had only 2.9 thousand more lecturers in 2017.

The number of students from different educational levels also rises to some extent. Through this simulation, although there are no additional school buildings, the number of teachers increases. As a result, the number of elementary school students increases by 0.6% from the baseline, 2.6% in junior high school, 2.2% in senior high school, and 6.7% in higher education. To sum up, almost all of the key variables in this scenario increase except for school buildings.

6.3.2.2 Scenario 2

In this scenario, there are changes in the composition of government expenditures. Based on Table 6.4, this scenario will allocate 10 percent of total government spending as additional expenditures, which go to education expenditure for consumption. The same amount of budget will be deducted from non-education expenditures for investment. As a result, the total amount of government consumption will increase while government investment decreases with the same amount. In this scenario, the increase in government consumption for education by decreasing the amount of investment is still beneficial to the economy, as shown in Figure 6.16. However, before moving to the detailed explanation, we will try to observe the mechanism on how this policy works by using a simple model, as seen in Figure 6.15.

Figure 6.15 Mechanism of Human Capital Investment Based on Scenario 2



Source: Author’s estimation

This scenario will affect both government consumption and government investment. Although the total number stays the same due to the offsetting mechanism, the impact of a decrease in government investment appears to be lower than the increase in government consumption. As government consumption increases, the number of teachers hired escalates to some extent to teach more students. Like the previous scenario, as the number of students increases, there is a higher supply of educated workers in the labor market. As a part of the factor of production, the increase in the number of educated workers, in the end, will result in higher efficiency to support the economy.

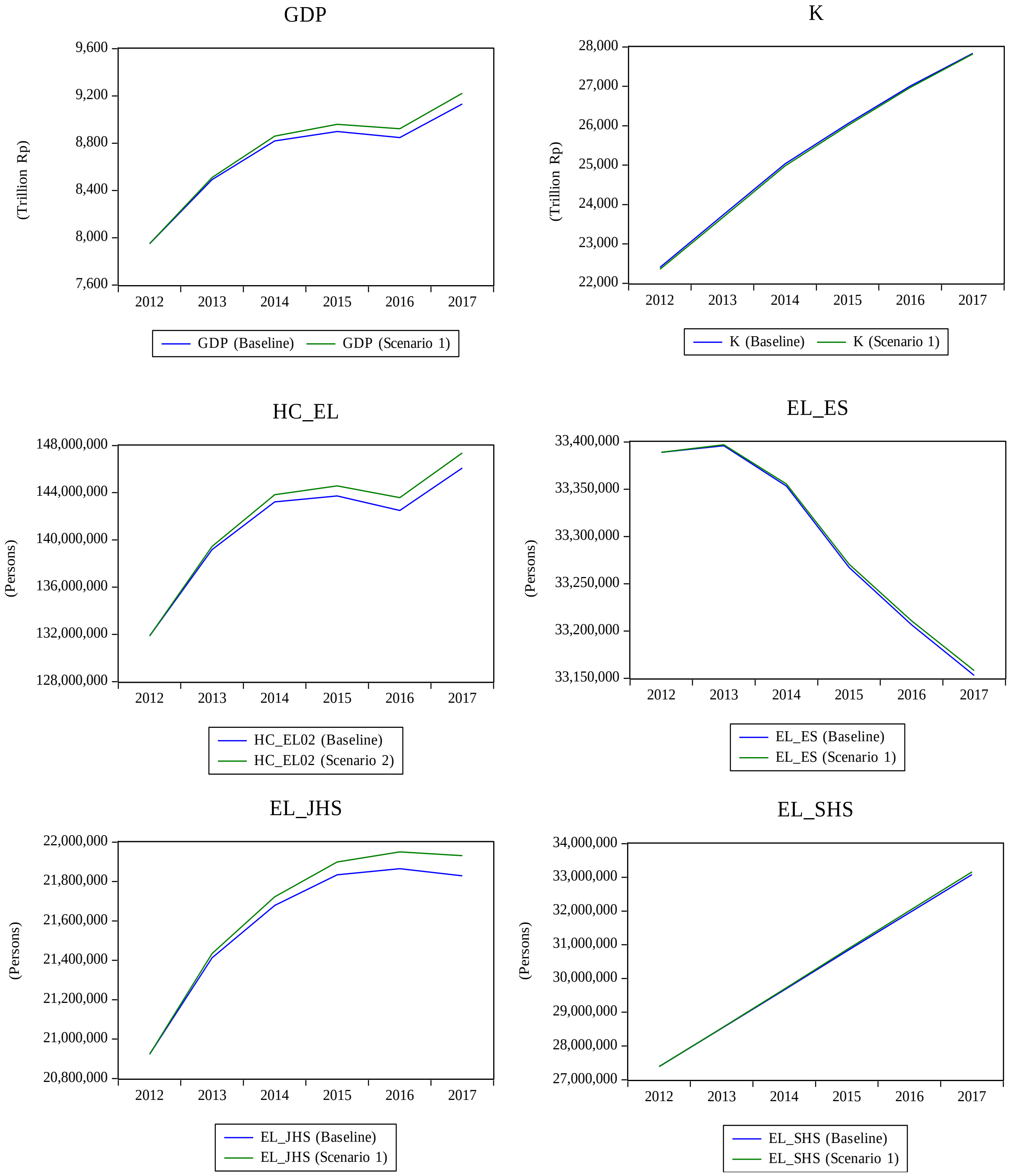
On the other hand, as government investment decreases, the total investment still slightly increase to some extent. However, due to the depreciation rate, the capital stocks in total still lower than the baseline. As a factor of production, the decrease in the capital will slow down the production. To some extent, the increase in educated employed labor still dominant to give a positive impact on the output.

In detail, based on the simulation, the output from the production function indicates an increasing pattern. At the beginning of the shock in 2012, the output exhibited a negative impact on the output. As a result, the economy contracted as the GDP slightly decrease by 0.01% from the baseline or almost Rp1 trillion. From 2013, the economy shows a positive trend to around 0.2% from the baseline. In 2014, the output increased by Rp40.2 trillion or around 0.46%, and continued to increase at a higher percentage. At the end of the simulation, in 2017, the economy appreciates by 0.99% from the baseline or equal to around Rp90.2 trillion. From the beginning of policy implementation to the end of the simulation, the economy increased by Rp280.2 trillion compared to that in the baseline.

Meanwhile, the total accumulation of capital stock based on the baseline is Rp27,835.0 trillion but decreased to Rp27,819.6 trillion. This decrease was due to the depreciation rate since there is still an increase in the total investment. Although there was a decrease in capital stock accumulation that reached 15.4 trillion in 2017 compared to that in the baseline, the impact of the increase in the number of educated employed labor is still dominant.

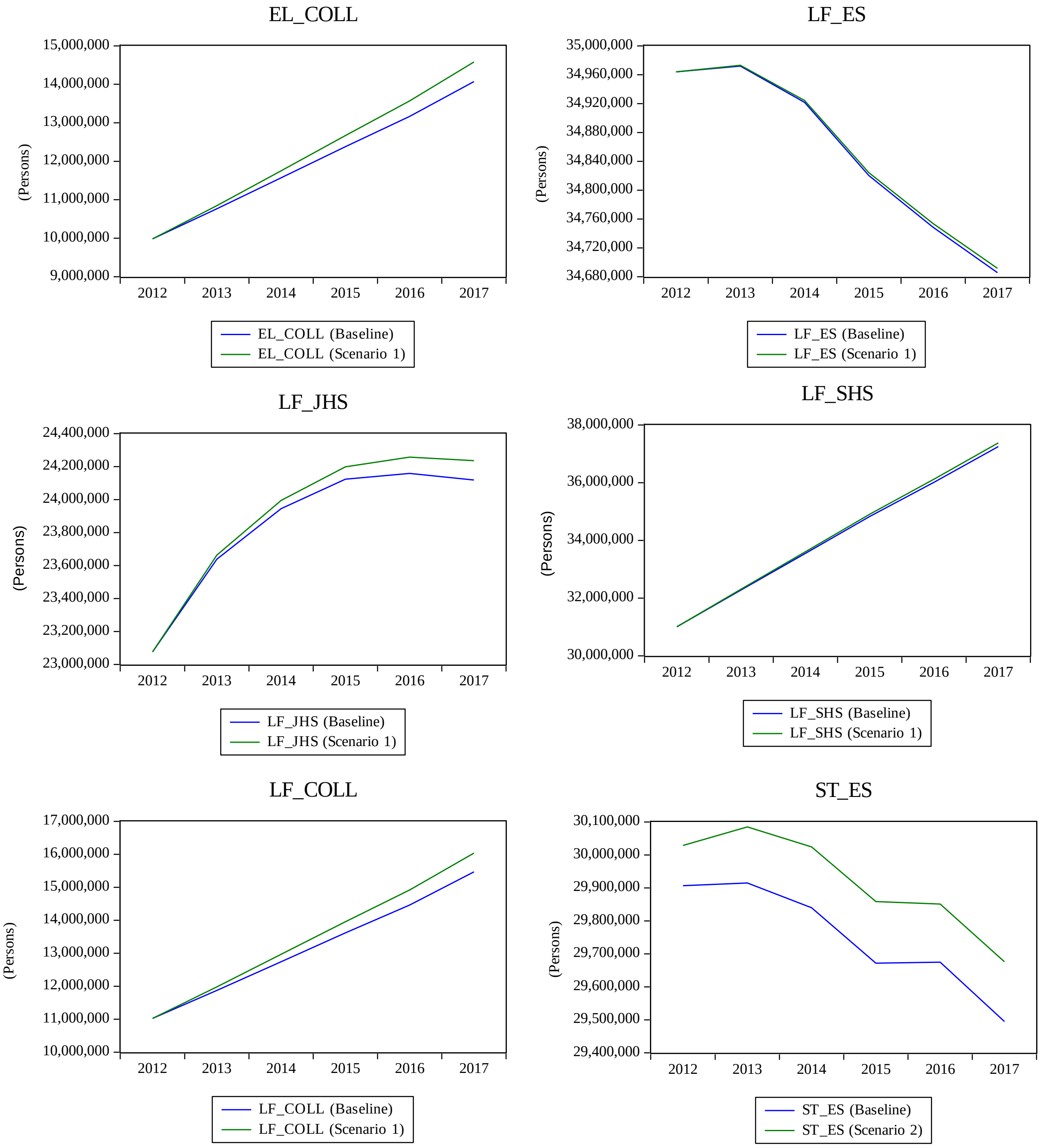
Similar to the first scenario, the second scenario generates more educated workers' supply by around 0.74% on average. For the elementary school graduate workers, the number increased by 0.02%, where the junior high school graduate workers increased by 0.49%, and senior high school graduate workers increased by 0.35% from the baseline. Meanwhile, college graduate workers are the highest with a 3.70% of increase from the baseline.

Figure 6.16 The Result of Scenario 2



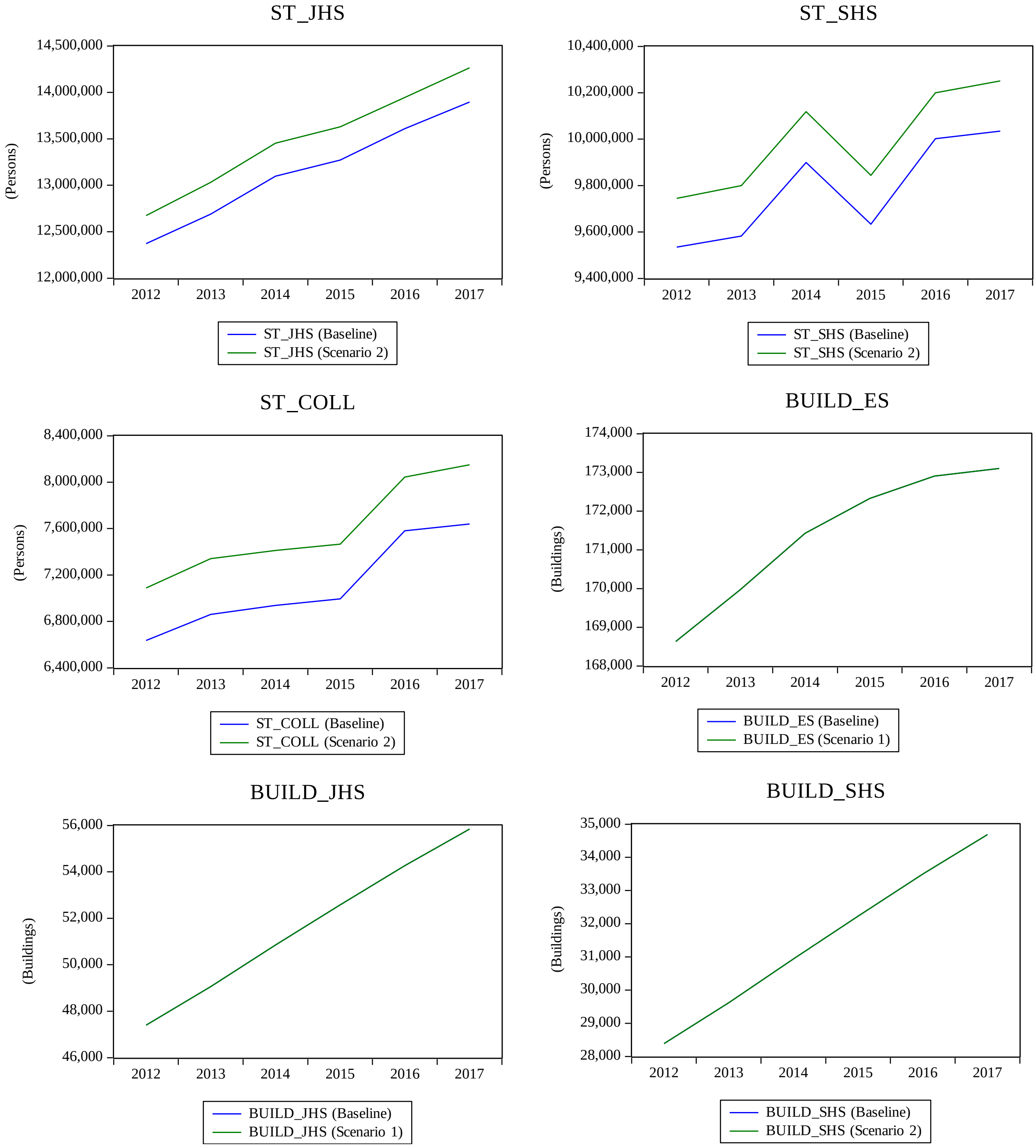
Source: Author’s estimation

Figure 6.16 The Result of Scenario 2 (continued)



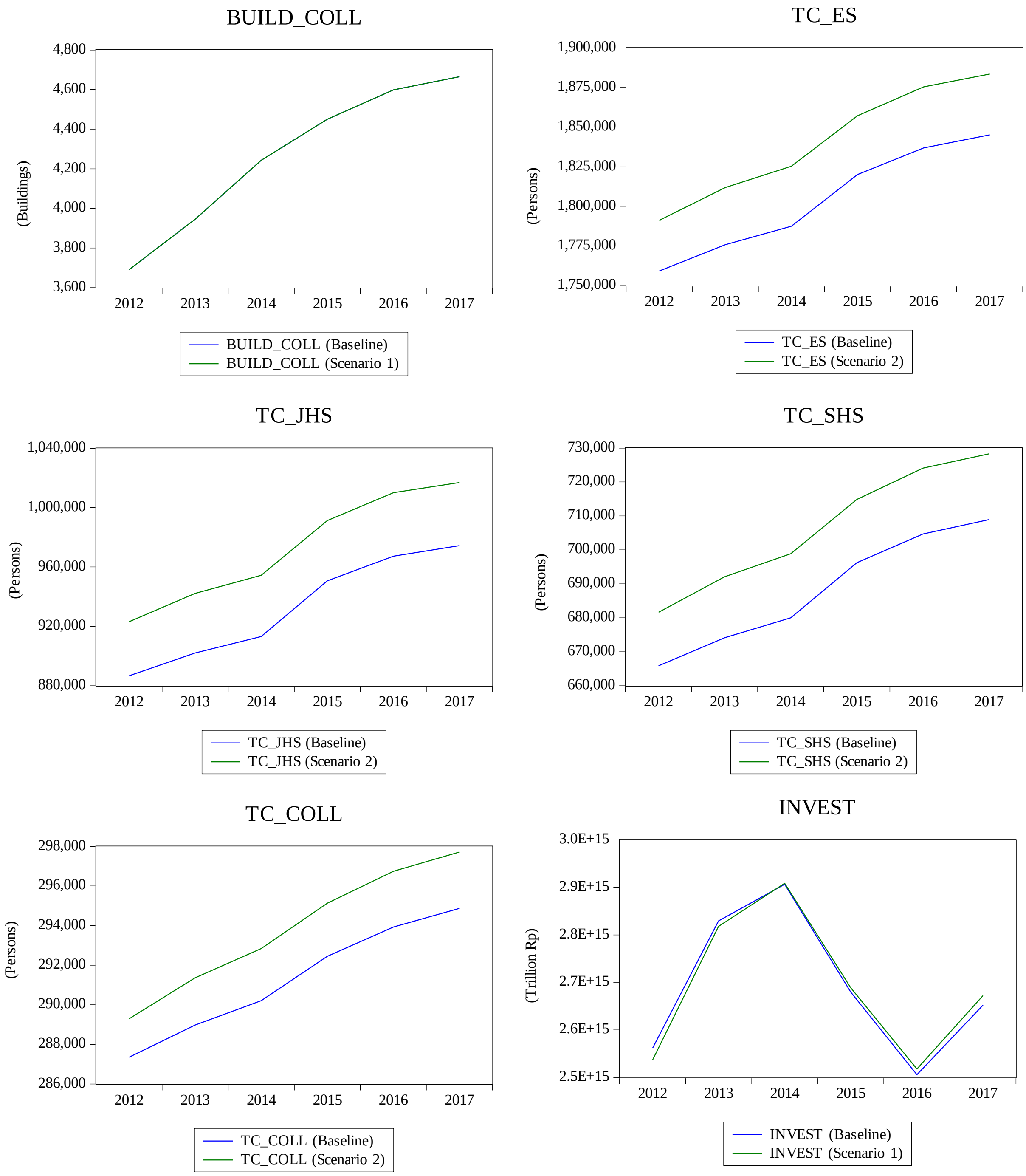
Source: Author’s estimation

Figure 6.16 The Result of Scenario 2 (continued)



Source: Author's estimation

Figure 6.16 The Result of Scenario 2 (continued)



Source: Author's estimation

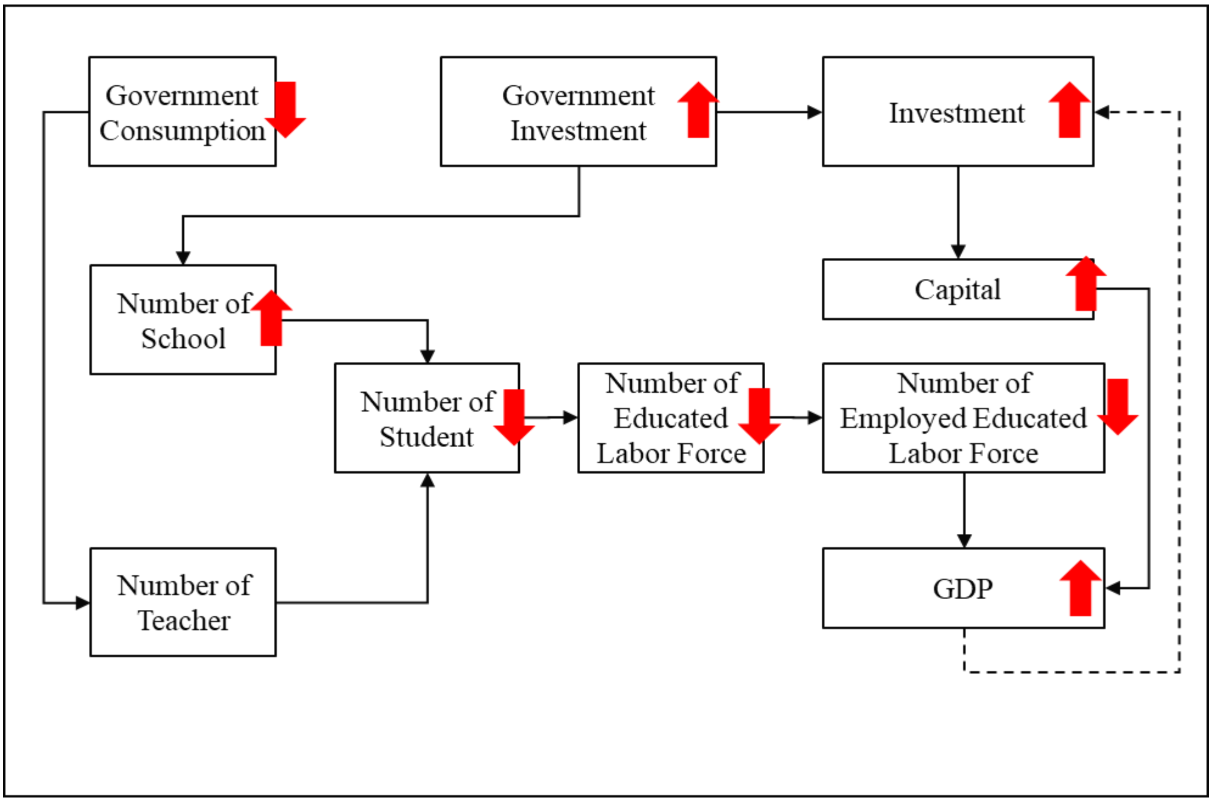
For the education institutions, both the number of school buildings and the number of teachers available based on the second scenario also resembled the number based on the first scenario. In general, there are no incremental for school buildings as there is no additional education spending for investment based on both first and second scenarios. On the other hand, the number of teachers available for elementary school, junior high school, senior high school, and tertiary education was higher by 38.4 thousand persons, 42.5 thousand persons, 19.4 thousand persons, and 2.8 thousand persons. As the number of teachers available increased in 2017, the number of students also increased to 181.4 thousand in elementary school. Meanwhile, the junior high school and senior high school obtained 367.7 thousand and 216.3 thousand more students. Moreover, tertiary education obtained 509.4 thousand more students based on this scenario.

6.3.2.3 Scenario 3

As explained in Table 6.5, the additional 10% education expenditure is allocated solely to education expenditure for investment in this scenario. At the same time, the same amount reduces the budget for expenditure for consumption other than education. As a result, there are government expenditure allocation changes compared to that of the initial plan. Although the total amount of government expenditures does not change, the allocation of government consumption decreases with the same amount of the increase in government investment.

As previously explained, we will observe the policy's mechanism by analyzing the flow of funds using the simplified version of the model from Figure 6.2. In this chart, government consumption is supposed to impact the economy as a whole. However, in this scenario, the decrease in government consumption is not related to education expenditure. Thus, there is no change in terms of the number of teachers hired.

Figure 6.17 Mechanism of Human Capital Investment Based on Scenario 3



Source: Author’s estimation

On the other hand, the increase in government investment positively impacts capital through increased investment. Moreover, this scenario assumes that the increase in government investment comes from increased education expenditure for investment. As a result, those additional funds support a greater number of schools to be built. Since the number of schools increases, it can provide more buildings for students to receive their education.

However, the number of students decreases in this scenario, especially for the number of college students. It might be due to a lack of lecturers in college to support the newly built college. Moreover, there is a decrease in total consumption, which affects the ability to continue to higher education. Hence, the number of prospective workers with better education also decreases to some extent.

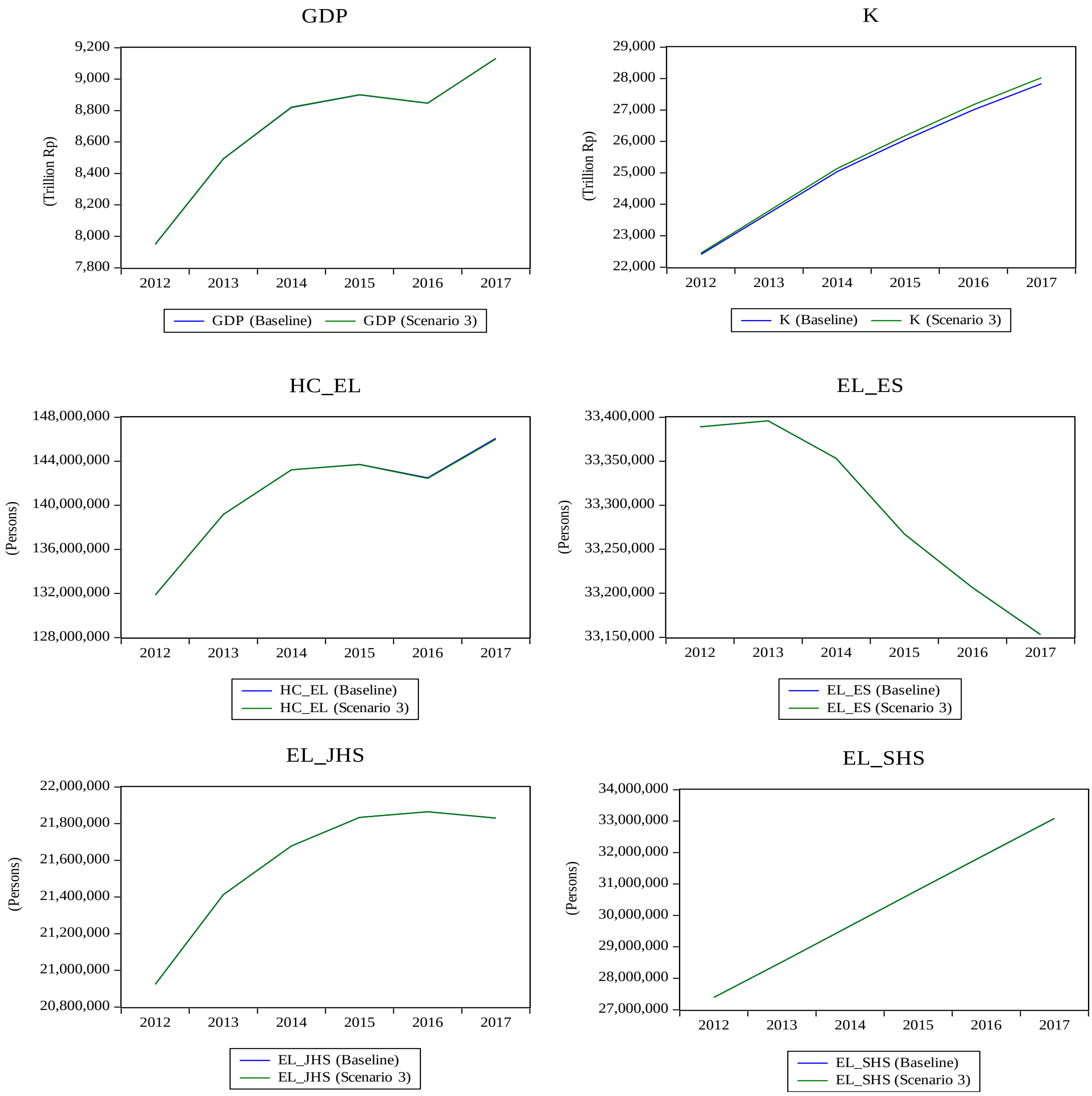
We will start our analysis by examining the impact on the economy through variables in the production function, as described in Figure 6.18. The number of output was gradually increased for the first four year by a substantial amount based on the production function. Initially, the economy expanded by 0.01% in 2012 compared to the baseline when this scenario was first applied. In 2013, the increased output was doubled to 0.2% and continued to increase gradually afterward. In 2014, the economy increased by around 0.03% compared to the baseline. However, starting from 2015, the economy started to slow down. In 2015, the economy only increased by around 0.2% from the baseline and decreased afterward. At the end of the scenario, the economy shows a negative result in 2017 by 0.01%. Although there was still an increase in the term of GDP in cumulative, this policy can worsen the economy in the long run.

There was a gradual increase in additional capital accumulation from the baseline. Initially, the incremental capital accumulation was around 0.10% from the baseline. In 2013, this percentage increased to 0.20% and continued to increase annually slightly. In 2017, the number of capital accumulation based on this simulation was around Rp28,024.2 trillion, where according to the baseline, the capital accumulation was only Rp27,835.0 trillion in the same year. It means the capital accumulation improved by 0.58% under this scenario.

Meanwhile, the number of human capital adjusted labor force decreased gradually under this scenario. When the policy was initially applied in 2012 until 2014, there were no differences compared to the baseline. In 2015, there was a decrease of 0.01% compared to the baseline. The number of human capital adjusted labor force continued to decrease gradually. In 2017, this number decreased to 0.06%. There was a decrease in the number of the educated employed labor equivalent to 86.6 thousand educated workers.

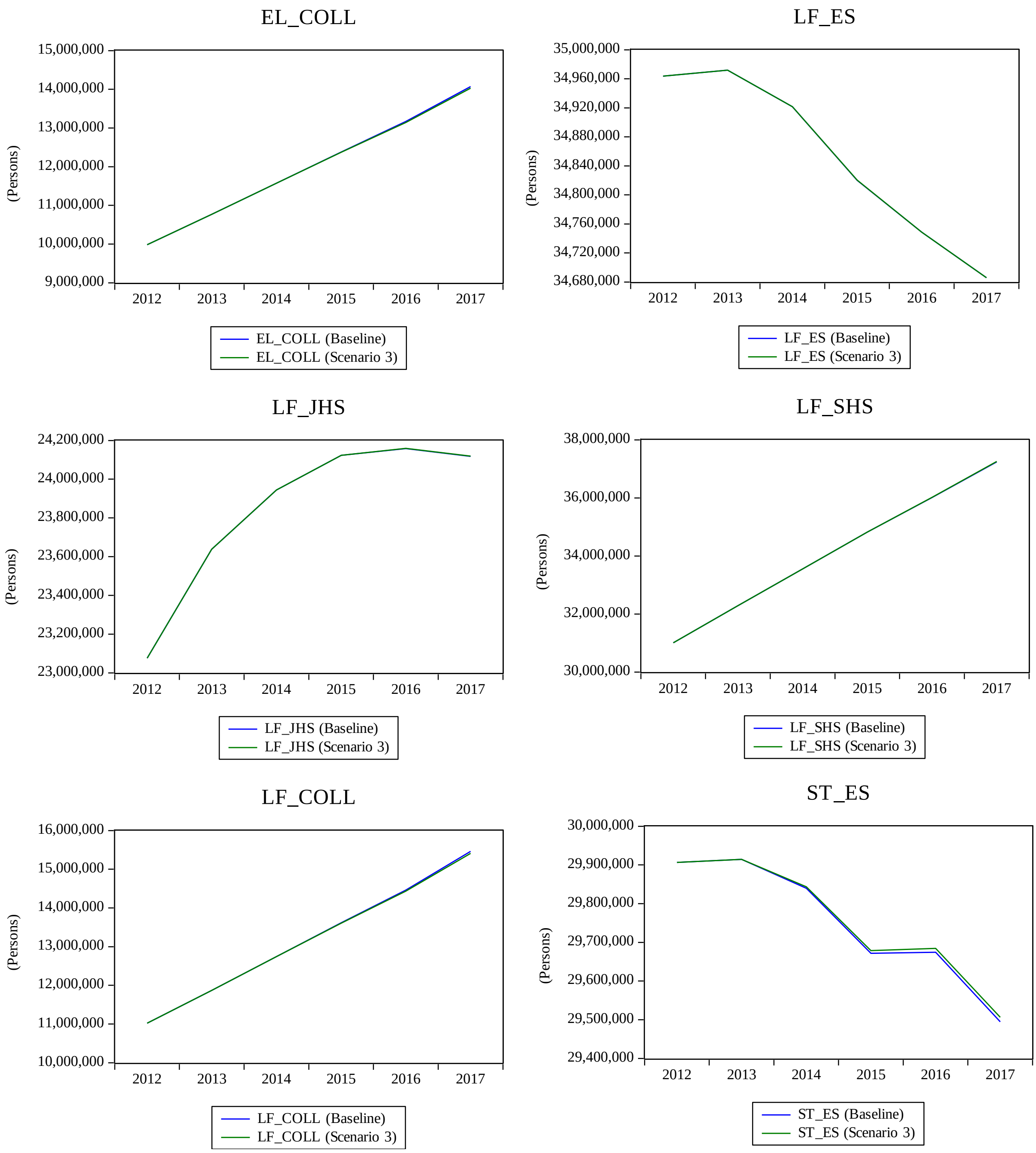
Apparently, this scenario does not provide better human capital investment and incentive to the economy. In 2017, the labor force with formal education to the baseline was around 111,511,240 persons. Meanwhile, the total labor force based on this scenario was only around 111,471,990 persons. It implied that there was a decrease in the labor force supply of 39,250 persons, which mainly from a college graduate.

Figure 6.18 The Result of Scenario 3



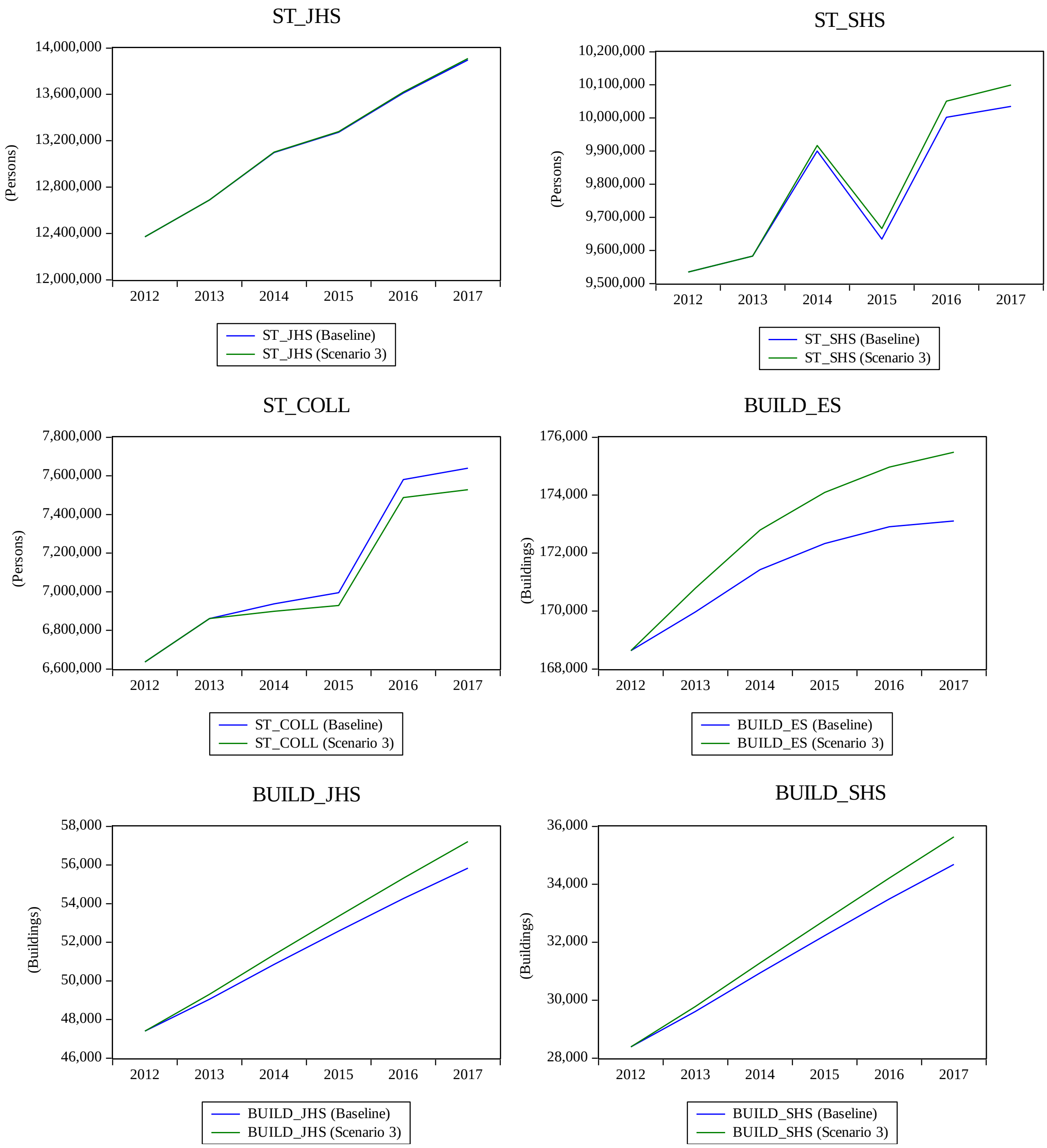
Source: Author’s estimation

Figure 6.18 The Result of Scenario 3 (continued)



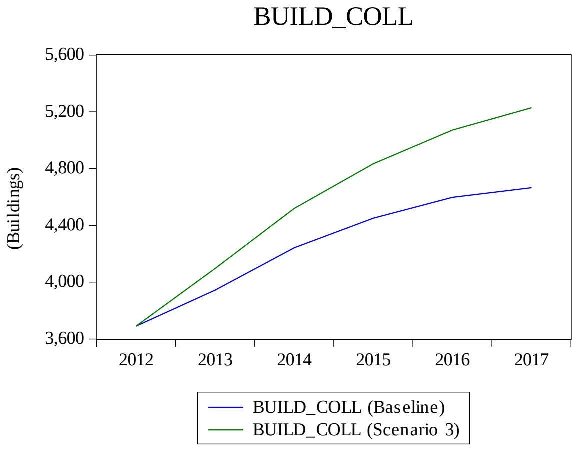
Source: Author’s estimation

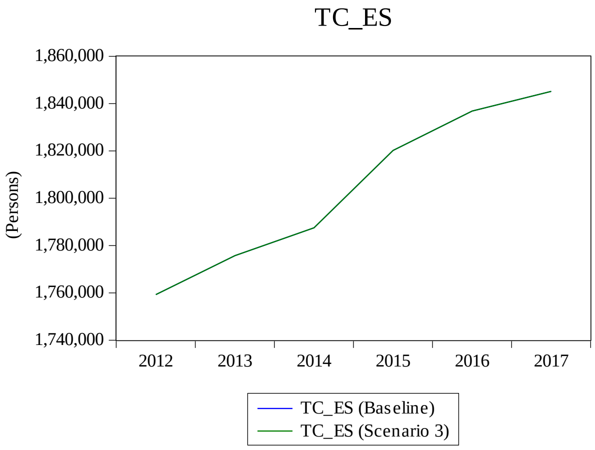
Figure 6.18 The Result of Scenario 3 (continued)

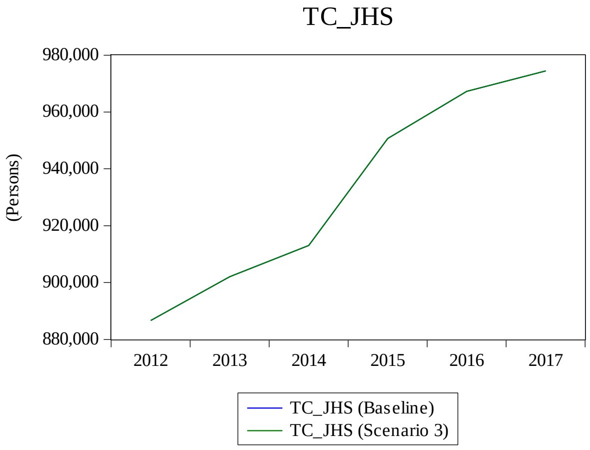


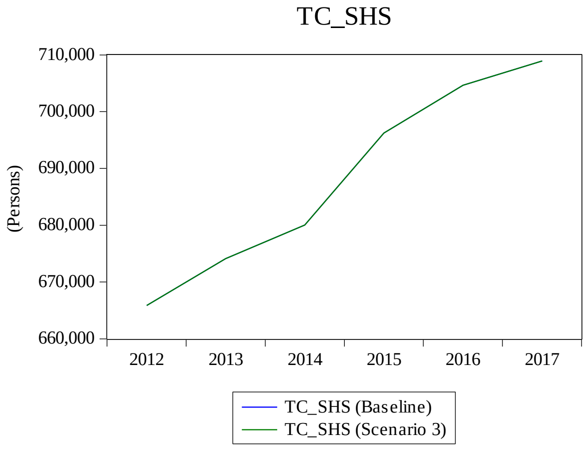
Source: Author’s estimation

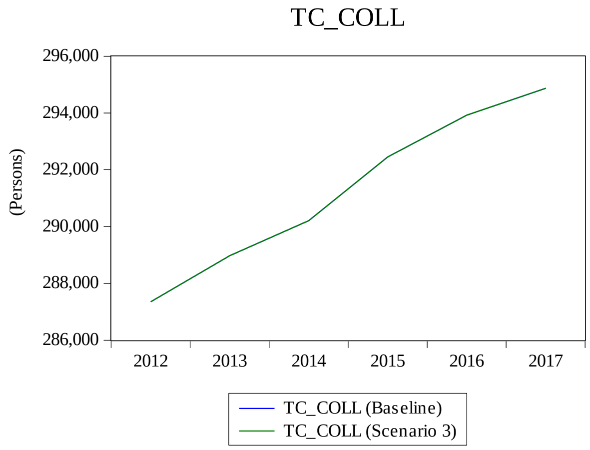
Figure 6.18 The Result of Scenario 3 (Continued)

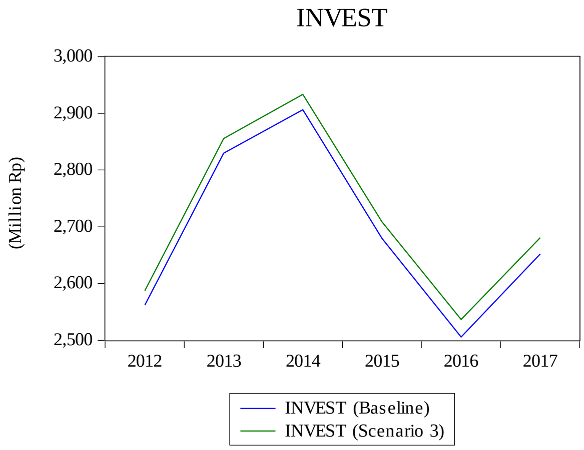












Source: Author’s estimation

Unlike the first and second scenarios where the additional education expenditure was allocated to consumption purposes, this scenario put more budget into investment. As a result, there was an additional establishment of school buildings under this scenario. There were 2,378 more school buildings for elementary school compared to the baseline. Furthermore, there were 1,366 additional school buildings for junior high school and 950 new school buildings for senior high school. Moreover, there will be 564 more college buildings.

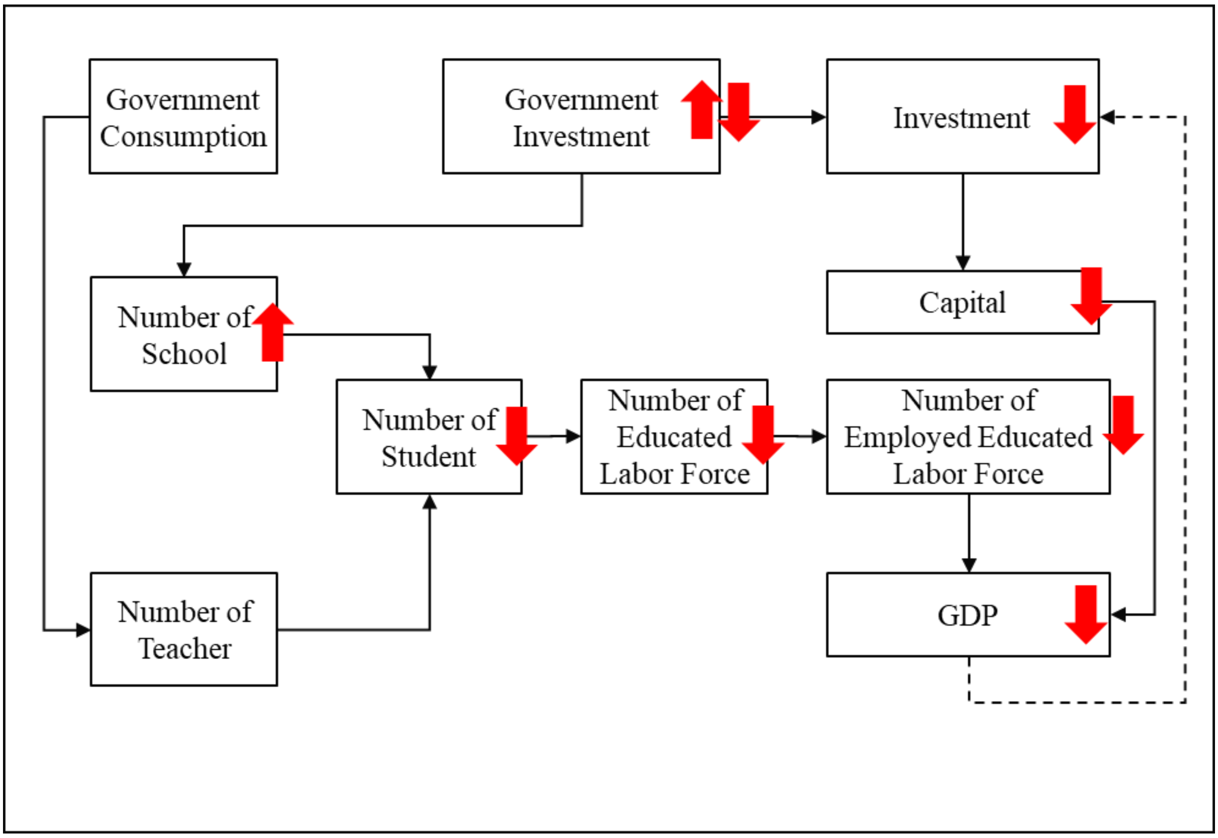
However, there are no additional teachers available for all levels of education under this scenario. By combining both additional school building and no incremental teachers, the number of students in primary education increased by 11,940. Furthermore, the number of junior high school and senior high school students slightly increased by 13,360 and 64,480 students, respectively. However, based on this scenario, the number of college students decrease by 111,409. It might be due to the lower supply of teachers to support the new college building. Moreover, lowering government consumption for non-education affects the economy negatively since Indonesia's economy is mainly driven by consumption. Therefore, many prospective students become reluctant to continue to higher education since it is costly and time-consuming.

6.3.2.4 Scenario 4

The last scenario under this study allocates 10% of additional education expenditure to investment by reducing education expenditure for investment other than education. Based on Figure 6.2, the policy's mechanism can be explained in the following Figure 6.19 below.

This chart shows that the changes only occur in government investment. There is an offset between the increase in education expenditure for investment and the decrease of non-education expenditure for investment. As for the government consumption side, there is no impact on the number of teachers than the baseline. However, the additional allocation to investment in education is not necessarily reflected in the investment increase. In fact, the investment decreased compare to the baseline. As the investment decreases, the capital stocks also decrease to some extent.

Figure 6.19 Mechanism of Human Capital Investment Based on Scenario 4



Source: Author's estimation

Meanwhile, the additional investment to build a new school apparently does not successfully attract new students, especially for tertiary education. By applying this scenario, the number of college students is slightly lower than the baseline. Consequently, both the number of the educated labor force and the number of the employed educated labor forces also decrease. Having both capital stocks decrease and the educated employed labor, this scenario result adversely affects the economy.

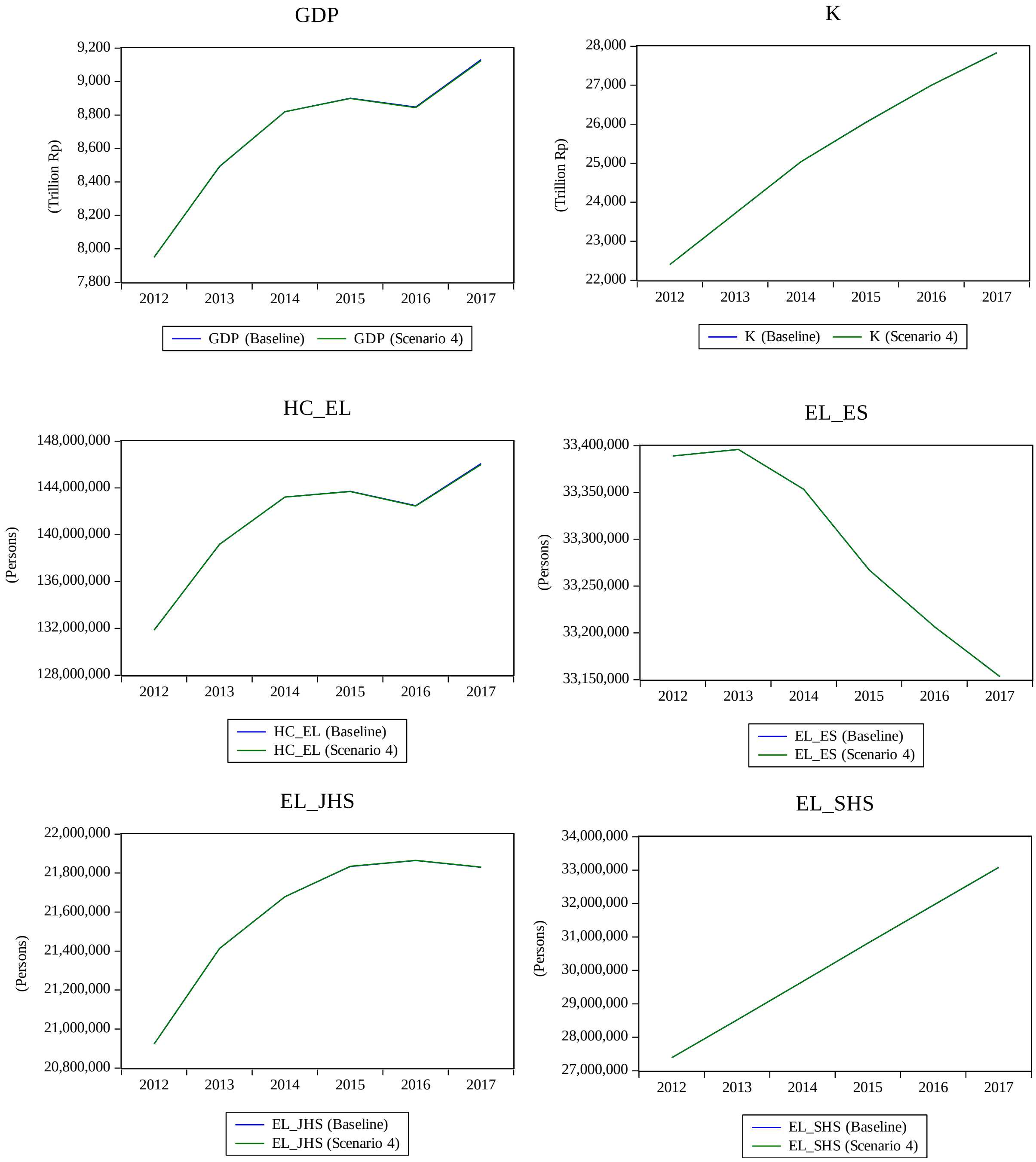
When the first scenario was applied in 2012, there are no differences between the baseline and this scenario. It means allocating more investment to education by decreasing the investment other than education does not affect the economy. From 2015, the economy slightly decreases compared to the baseline for about 0.02%. The GDP continues to decrease to -0.04 % in 2016 and -0.07 % in 2017. At the end of 2017, GDP is lower by Rp6,235 billion, or cumulatively around RP11,051 billion from 2015 to 2017.

Similarly, there are no differences between the number of capital stock based on this simulation and the baseline from 2012 to 2014. From 2015, there was a decrease by Rp1,000 billion and continue to decrease. In 2017, the capital stocks were around Rp7,410 billion lower than the baseline.

Meanwhile, the human capital adjusted workers also decrease by a similar amount as in the third scenario. There was no difference in these variables than the baseline in 2012 when the policy was initially applied. However, there was a decrease of 0.01% compared to the baseline starting from 2015. This number is equivalent to 19,200 persons. In 2017, the number of total educated employed labor was lower by 0.06% compared to the baseline, or equivalent to around 86,600 persons. Therefore, the total human capitalized workers engaged in the economy became 146,999,300 from 146.085.900 million in the baseline.

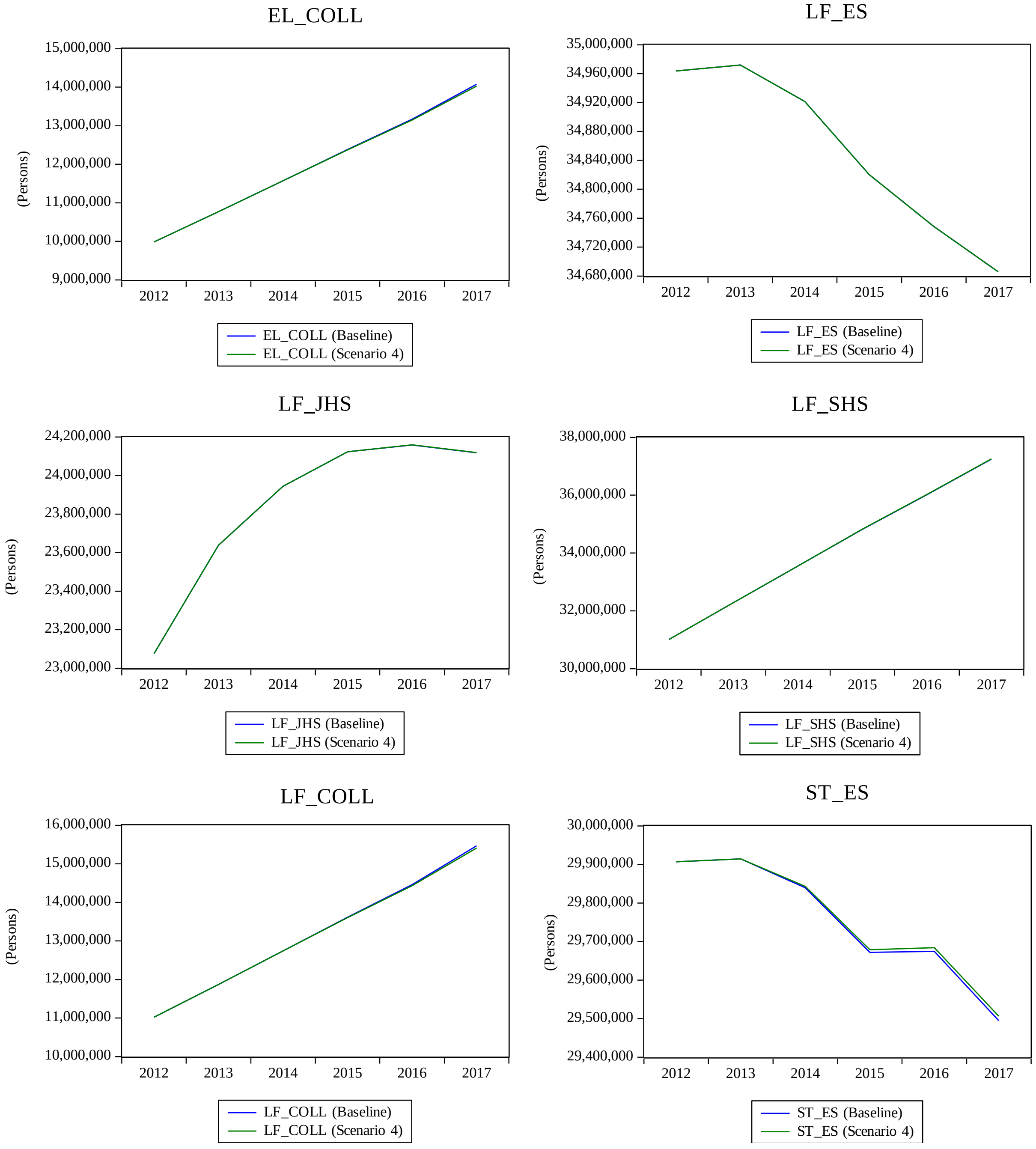
Principally, this fourth scenario was almost similar to the third scenario where additional education expenditure was solely reallocated to investment. In detail, there is no additional recruitment of teachers. For the school buildings, an additional 2,378 school buildings for elementary school, 1,366 additional school buildings for junior high school, 950 additional school buildings for senior high school, and 564 new school buildings for tertiary education are available compared with the baseline in 2017. As a result, there will be 11,940 additional students in elementary school, 13,360 students in junior high school, and 64,480 senior high school students compared to the baseline. However, the number of college students decrease by 111,409 compared to the baseline.

Figure 6.20 The Result of Scenario 4



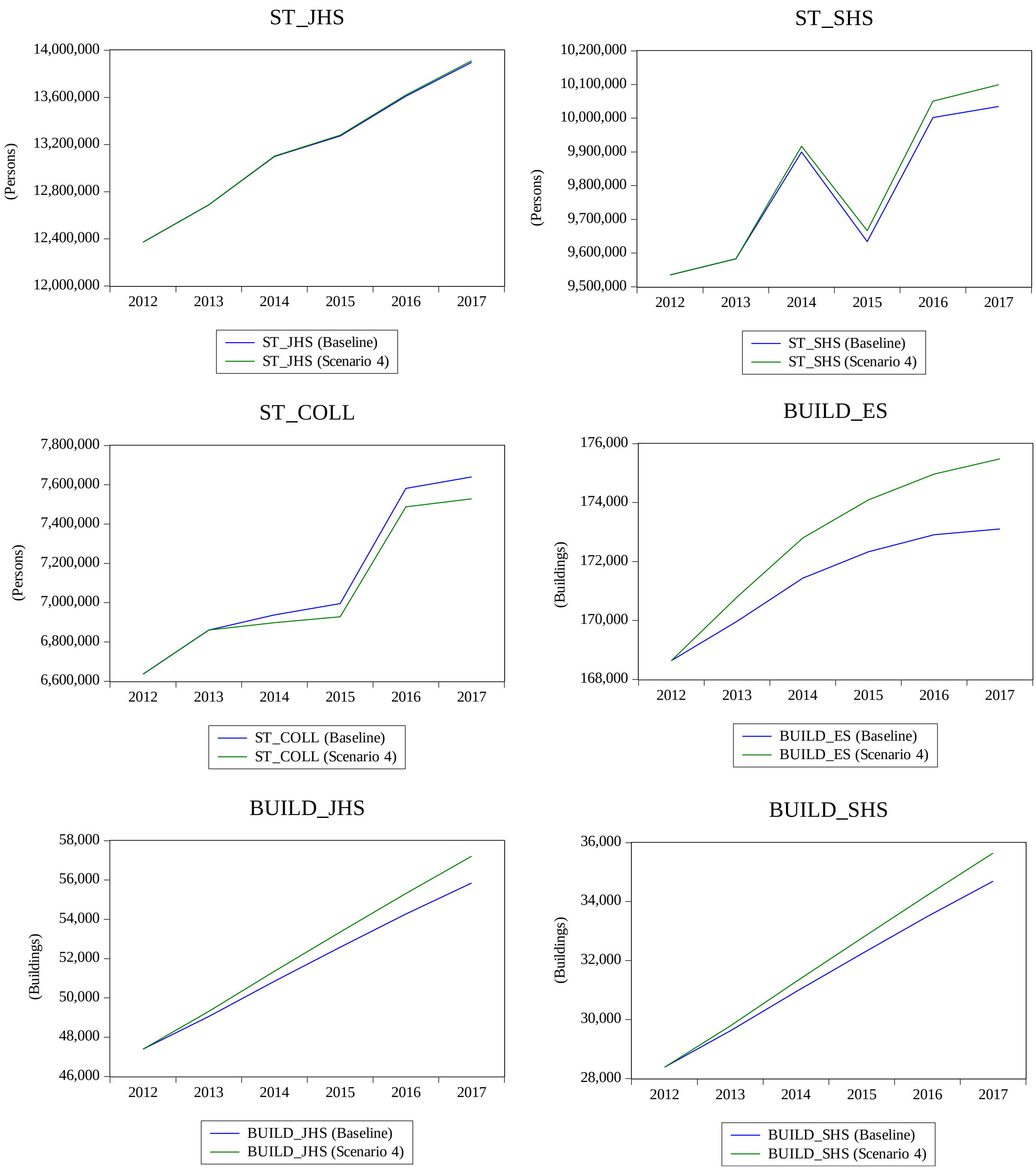
Source: Author’s estimation

Figure 6.20 The Result of Scenario 4 (Continued)



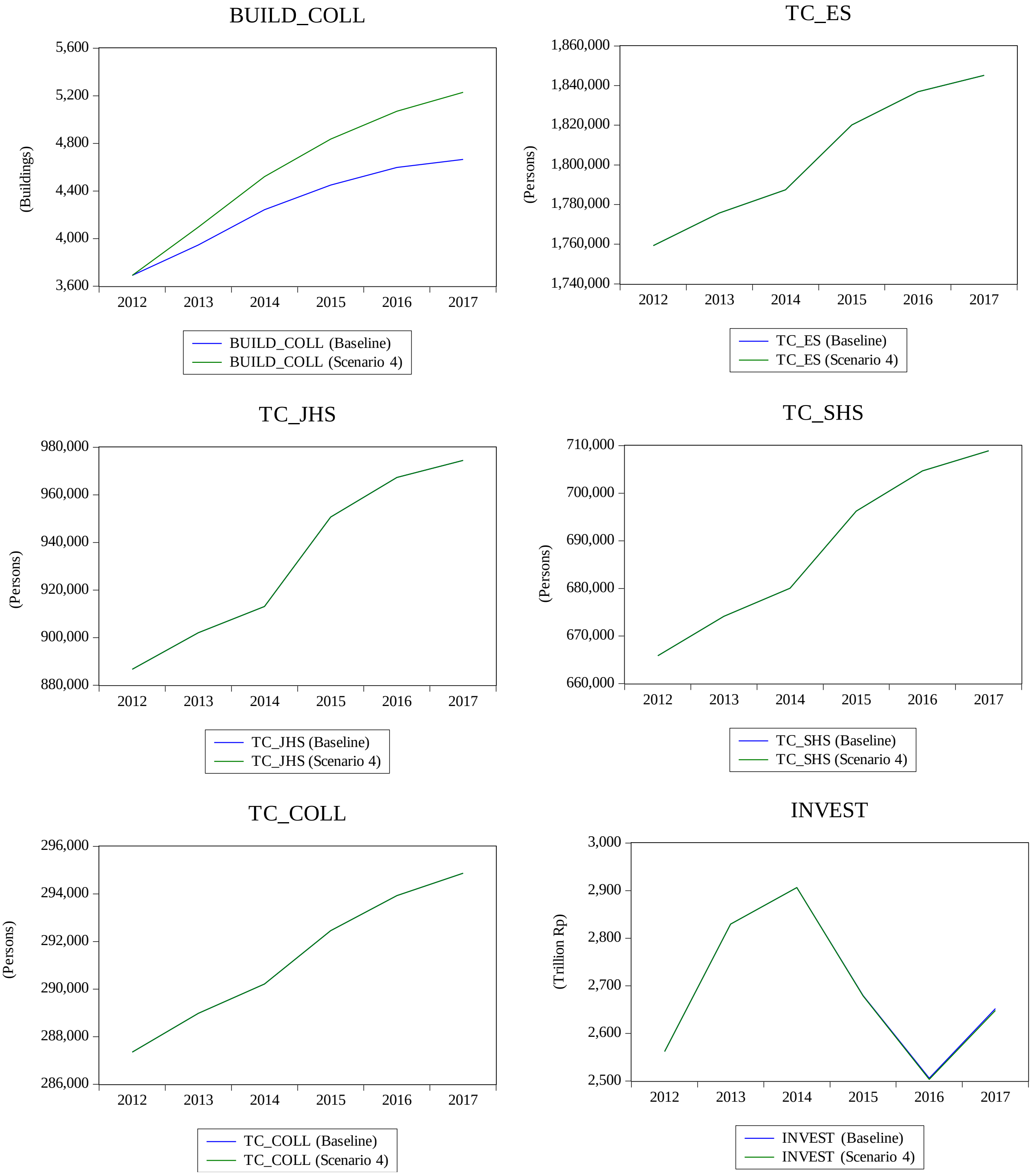
Source: Author’s estimation

Figure 6.20 The Result of Scenario 4 (Continued)



Source: Author’s estimation

Figure 6.20 The Result of Scenario 4 (Continued)



Source: Author's estimation

6.4 Summary

This chapter's main objective is to examine the impact of education expenditure as a form of human capital investment on the economy through macroeconometric modeling. Unlike the previous chapter that also tries to estimate the extent of human capital investment by using a reduced-form equation, this macroeconometric model is designed by accommodating structural equations, which is more robust to explain the interaction amongst variables to determine the impact on the economy.

In this study, government expenditure for education is classified into two parts based on its purposes. The first one goes for regular activities such as paying teacher’s wages and school administration. The rest is dedicated to building new schools. Moreover, this chapter combines the result in Chapter 4 to determine human capital for running the simulations. By combining two parts of education spending and all other essential variables, this study finds the following:

1. Education expenditures, to some extent, improve the economy gradually with increasing values for each year;
2. The magnitude of the impact of variation in education spending on the essential variables in the model differs amongst budget allocation;
3. Increasing education spending for investment by decreasing non-education expenditure for investment can deteriorate the economy in the long term;
4. Meanwhile, increasing education spending for consumption by reducing non-education expenditures for consumption can accelerate economic growth substantially.

CHAPTER 7 CONCLUSIONS AND POLICY RECOMMENDATIONS

7.1 Conclusions

Becoming a part of the production function, the role of human capital stock becomes essential to determine the extent of economic growth in a country. Thus, investment in human capital is unavoidable and becoming a vital part of nations' budget allocation. Unlike capital and labor, which is more straightforward to explain how human capital affects the economic output is still debatable amongst researchers. Not to mention, how to measure human capital stock is still evolving. Although many candidates might represent human capital, education is the most relevant factor. Therefore, the measurement of investment in education connected with the human capital accumulation process is key to determining economic growth.

This dissertation is designed to examine the role of investment in education as a form of human capital investment and its impact on economic activities. We try to examine from two perspectives. The first part focuses on investigating the impact of education investment by individuals on their earnings. Meanwhile, the second part emphasizes a broader perspective, the impact of government education expenditure on economic growth.

The first part discussed the return to education. By identifying the return to education, we can understand to what extent the investment in education can improve earning. Moreover, we can also acquire more information dealing with investment in having more education, such as the real benefit of having more spending to continue to higher education. This part is framed in Chapter 4 in this dissertation about investigating the return to education and higher education's financial value in Indonesia.

The second part mainly discussed education spending by the government and its impact on the economy. In explaining its impact, this study applied two approaches: reduced form and structural form. The reduced form is a simple yet reliable tool to determine the magnitude of this human capital investment, represented by government education spending, to the economy, as explained in detail in Chapter 5.

In essence, Chapter 5 discussed the impact of human capital investment on economic growth through cross-country analysis in South East Asia. However, examining human capital investment and its impact on the economy by using a reduced form model such as cross-country analysis does not demonstrate the process of how education spending positively affects economic growth.

On the other hand, applying the structural form model through designing a macroeconometric model can provide more detailed information about the transmission mechanism from education spending to the economy. Chapter 6 is based on that structural form to explore more human capital investment concerning economic growth through the macroeconometric model. The main findings and conclusions of those three analytical chapters will be discussed in Subsection 7.1.1 to 7.1.3.

7.1.1 Return to Education and Financial Value of Higher Education in Indonesia

Based on the analysis in Chapter 4 by using the IFLS-5 database with some assumptions, this study has identified some critical points dealing with return to education in Indonesia as follows:

1. This study constructed the age-earning pattern for different types of workers from a different level of education based on that database. To the best of the author's knowledge, this age-earning pattern in this study is the first one built by applying SWE estimates with different quartiles in Indonesia to enrich the analysis of both workers from a different level of education.
2. In short, the age-earning pattern exhibits the typical increasing level of income along with age and level of education. Overall, the highest-earnings were obtained by college graduate workers from quartile 3 and reached a peak at the age of 55-59 before gradually decreasing.

Meanwhile, elementary school graduate workers in quartile 1 earned the lowest income amongst all levels of education.

3. There is almost no career development for elementary and junior high school graduates as the age-earning pattern shows a relatively flat line across a lifetime in all quartiles.
4. College graduate workers earn around 60% to 70% more than senior high school graduate workers, while junior high school and elementary school earn 40-50% and 50-55% less, respectively.
5. Using the short-cut method, the return to education for having a tertiary education is around 15%, while senior high school and junior high school is around 11% and 8%, respectively.
6. Based on the Mincer earning equation using years of schooling as a proxy, the return to education in Indonesia is around 9%. This result is almost similar to other literature.
7. To some extent, the short-cut method provided an almost similar result with the Mincer equation in determining the return to education in Indonesia. It provides the opportunity for using the short-cut method, besides using the Mincer equation, in exploring the return to education for future research.
8. The cost of education varied across different types of universities and different types of facilities. In general, public universities offer a lower tuition fee, which is the most significant share of the cost. Besides tuition fees, the cost of lodging and food consumption also contributed to determining the total cost for higher education.
9. Continuing to higher education will be profitable for at least the workers in quartile 1 who graduated from a lower-cost public college. For all middle-class workers in quartile 2, having a bachelor's degree gave a positive return on investment, although it will take around 33 years to redeem the total investment cost.
10. For workers in quartile 3 who graduated from the lowest-cost of college, the break-even point of their investment in higher education is only 10 years with an IRR of 62.3% and NPV of almost Rp1 billion.

7.1.2 Panel Data Analysis of Human Capital and Economic Growth on Selected ASEAN Countries

This part explained the impact of human capital investment through government educational expenditure on promoting economic growth in the Southeast Asia region. In this part, this study applied the reduced-form equation by elaborating government expenditure in education as the proxy of human capital investment and capital stocks and labor as a factor of production. Based on the data from the WDI published by the World Bank for the education expenditure and capital stocks and labor employment from the PWT version 9.1, the important findings are:

1. Indonesia spent the highest education expenditure among five selected countries in Southeast Asia. However, compared to the number of employed labor available, Indonesia spent the least education expenditure per employed labor. On average, the Indonesian government only allocated education spending of US$101 per employed labor while Singapore allocated around US$2,021.
2. Government expenditure on education improves economic growth positively. It was found that this investment is statistically significant to explain the variation in the output of the economy.
3. By using the fixed-effect panel data method, it was found that a 1% increase in education expenditure will contribute to a 0.11% increase in the output of the economy.
4. Meanwhile, both capital stocks and labor are also statistically significant to predict economic activity in countries in the Southeast Asia region.
5. While expanding capital stocks by 1% will contribute positively to the next year's economic growth by 0.39%, adding 1% labor employment will improve the output by 0.88%.

7.1.3 Macroeconometric Model of Human Capital in Indonesia

Unlike reduced-form, which was used in Chapter 5, Chapter 6 uses the structural form model to analyze the human capital investment and Indonesia's economy. Chapter 5 try to explain the impact of spending on education as a proxy for human capital on economic growth through panel data analysis. In contrast, Chapter 6 focuses only on Indonesia by developing a macroeconometric model to examine the flow of human capital investment to the economy. Using this model, we can capture the interaction between significant variables within the system that can explain the mechanism and flow of the investment in education and its impact on economic growth.

By elaborating various data from the WDI from the World Bank, Statistics Indonesia, the Ministry of Finance, The Ministry of Education, and previous finding in Chapter 4, there are some essential assumptions and findings:

1. In general, government expenditure for education can be classified into two parts: consumption and investment.
2. In this model, the education expenditure for consumption is mainly allocated to pay teachers' salaries. Therefore, it determines the number of teachers supply to some extent.
3. Meanwhile, the education expenditure that goes to investments deals with establishing new school buildings or rehabilitating old or damaged school buildings. Thus, in this model, this type of expenditure specified the number of school building establishments.
4. Within the limitation of the budget in total government expenditure, the different budget allocation has different impacts on the economy as a whole. Therefore, prudent budget policy allocation is essential.
5. In this model, it was found that allocating more budget in the education expenditure for consumption by reducing government expenditure for consumption other than education purposes provides the highest impact on economic growth.

6. The worst budget allocation is when increasing the budget for education expenditure for investment by reducing government expenditure for investment other than educational purposes. In this scenario, it will adversely affect the output of the economy.

7.2 Policy Recommendations

Based on the detailed results in three analytical chapters in this dissertation and essential findings as previously explained in Section 7.1, this research suggests some policy recommendations for the Indonesian government in light of promoting economic growth as follows:

1. As higher education is essential to improve the workers' earnings, policy to promote higher education is necessary. There are several methods to encourage individuals to invest both their time and money in pursuing higher education:
   a. Providing more subsidies for higher education in the form of scholarships. Practically, the government can cooperate with private institutions to provide scholarships for a bachelor's degree as a part of corporate social responsibility.
   b. Giving a full or partial fee exemption for more students by re-classifying students' requirements to obtain the exemption. With the current condition, only those extremely poor with high potential can afford to be classified with "partially exemption" in terms of the very-low tuition fee in public universities.
   c. Promoting higher education through financing from financial institutions is another option. Currently, no policy is dedicated explicitly to promoting financing in higher education in Indonesia. Giving a zero or low-interest rate scheme exclusively for education is expected to increase the potential students' interest to pursue higher education.

2. Provide better career development for workers with a lower level of education by giving training or non-formal education to narrow the income gap with that of college graduate workers. In this regard, it will improve income distribution and also reduce poverty.
3. Although increasing investment in human capital improves the economy to some extent, the role of other components such as capital and labor are also important; thus, focusing only on human capital is not advisable. Providing more jobs to accommodate labor supply, on the one hand, gives more benefits to escalate the output of the economy. Thus, we can reduce the unemployment and increase average earning. On the other hand, investing in productive assets will undoubtedly have a significant impact on the economy.
4. Prudent budget allocation management also becomes an essential element to determine the extent of economic activities. Education spending is indeed unavoidable and potentially lucrative. However, since the government budget is limited, the failure to properly allocating the budget will adversely affect the economy. Based on the analysis, this study suggests:
    a. There must be balance between education spending for consumption and investment as well as education spending and non-education spending.
    b. Any additional spending on education from reducing other budgets should also be carefully considered.
    c. Allocating more education spending for consumption by reducing the non-education-consumption budget gives the optimal result of improving economic growth.
    d. Avoid increasing education spending budget for investment by reducing the non-education-investment budget since it will deteriorate the economy's output.

7.3 Limitation of the Study and Suggestion for Future Research

In Chapter 4, this study has constructed age-earning profiles by the level of education. To some extent, the results are normal and acceptable that having more education tends to correlate with having a higher income. Furthermore, there is a trend that the income increases as age increases (i.e., earning increases following experience). However, this study uses data from IFLS-5 with limited respondents. To construct a more realistic age-earning profile requires a more extensive data sample. Moreover, applying only data observation from a single time point, such as IFLS-5, cannot capture the dynamic of “quality of education.”

The short-cut method that has been applied in Chapter 4 to examine the return to education is supposedly designed to measure the benefit of having an additional one or more level of education concerning some sacrifices that should be made. These sacrifices can be in the form of time that should be spent, opportunity cost, and real money expensed. To some extent, this framework can be misleading, particularly if we want to make a comparison study. In a particular group of observations (e.g., quartile 1), where the marginal earning of having more education is high, it tends to have a high rate of return to education. However, it is not necessarily implied that to be at a different location in the sampling distribution (e.g., quartile 3) with lower marginal earnings is worse. By considering those flaws, future research is expected to accommodate a more extensive data set with different time-variants and combining more methods to improve the quality of the research.

Finally, both Chapter 5 and Chapter 6, which are dedicated to capturing the impact of human capital on a larger scale, are constructed with a simple design. To the best of the author's knowledge, no macroeconometric model is yet available to capture the flow of human capital investment in Indonesia. This model provides a small model as a stepping stone for further research by applying more sectors, such as the financial market. Moreover, the simulation in the Chapter 6 only based on in-sample forecast. Applying out-of-sample forecast in the future study will provide more comprehensive analysis in the policy making process.

REFERENCES

Akbar, Muhammad and Eatzas Ahmad. "A Review of Macroeconometric Modeling Practices." *Forman Journal of Economic Studies* 10 (2014): 17-51.

Badan Pusat Statistik. "Badan Pusat Statistik." n.d. *Badan Pusat Statistik website.* Spreadsheet Document. 9 2 2020. <https://www.bps.go.id/>.

Baltagi, Badi H. *Econometric Analysis of Panel Data*. 3rd. John Wiley & Sons Ltd., 2005.

Barro, Robert J and Jong Wha Lee. "A New Data Set of Educational Attainment in the World, 1950-2010." *Journal of Development Economics* 104 (2013): 184-198.

Barro, Robert J and Xavier I Sala-i-Martin. *Economic Growth*. 2nd. The MIT Press, 2003.

Barro, Robert J. "Economic Growth in a Cross Section of Countries." *The Quarterly Journal of Economics* 106.2 (1991): 407–443. <https://doi.org/10.2307/2937943>.

Becker, Gary S. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. New York: Columbia University Press, 1964.

—. "Investment in Human Capital: A Theoretical Analysis." *The Journal of Political Economy* LXX.5 (1962): 9-49. <https://www.jstor.org/stable/1829103>.

Benhabib, Jess and Mark M Spiegel. "The Role of Human Capital in Economic Development Evidence from Aggregate Cross-Country Data,." *Journal of Monetary Economics* 34.2 (1994): 143-173. <http://www.sciencedirect.com/science/article/pii/0304-3932(94)90047-7>.

Benhabid, Jess and Mark M Spiegel. "The role of human capital in economic development evidence from aggregate cross-country data." *Journal of Monetary Economics* 34.2 (1994): 143-173. <https://doi.org/10.1016/0304-3932(94)90047-7>.

Bloom, David, David Canning and Kevin Chan. *Higher Education and Economic Development in Africa*. Washington D.C.: World Bank, 2006.

Bodkin, Ronald, Lawrence Klein and Kanta Marwah. *A History of Macroeconometric Model-Building*. Edward Elgar Publishing, 1991.

Boediono. "Sebuah Model Makro Triwulanan untuk Indonesia." *Economics and Finance in Indonesia* (1979).

Card, D. "The Causal Effect of Education on Earnings." *Handbook of Labor Economics*. Ed. Orley Ashenfelter and David Card. Vol. 3. Elsevier Science B.V., 1999.

Chen, Stacey H. "Is Investing College Education Risky?" *Labor and Demography 0202001* (2001). <https://econwpa.ub.uni-muenchen.de/econ-wp/lab/papers/0202/0202001.pdf>.

Chimombo, Joseph Patrick Godson. "Quantity Versus Quality in Education: Case Studies in Malawi." *International Review of Education* 51 (2005): 155-172.

Cohen, Daniel and Marcelo Soto. "Growth and Human Capital: Good Data, Good Results." *Journal Economic Growth* 12 (2007): 51-76.

Deolalikar, Anil. "Gender Differences in the Returns to Schooling and in School Enrollment Rates in Indonesia." *Journal of Human Resources* 28.4 (1993): 899-932. <http://www.jstor.org/stable/pdfplus/146297>.

Duflo, Esther. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment." *American Economic Review* 91.4 (2001): 795-813.

Dumauli, Magdalena T. "Estimate of the Private Return on Education in Indonesia: Evidence from Sibling Data." *International Journal of Education Development* 42 (2015): 14-24. <https ://doi.org/10.1016/j.ijedu dev.2015.02.012>.

Fukuchi, Takao. "An Econometric Analysis of the Indonesia Economy." *The Developing Economies* 6.3 (1968): 324-369. < https://doi.org/10.1111/j.1746-1049.1968.tb00968.x>.

Goldin, Claudia. "Human Capital." *Handbook of Cliometrics*. Heidelberg: Springer Verlag, n.d. 55-86.

Hanushek, Eric A and Ludger Woessmann. "The Role of Cognitive Skills in Economic Development." *JOURNAL OF ECONOMIC LITERATURE* 46.3 (2008): 607-68.

Hornbeck, David W and Lester M Salamon. *Human Capital and America's Future: An Economic Strategy for the Nineties*. John Hopkins University Press, 1991.

Islam, Nazrul. "Growth Empirics: A Panel Data Approach." *The Quarterly Journal of Economics* 110.4 (1995): 1127-1170. <https://doi.org/10.2307/2946651>.

Jorgenson, Dale W and Barbara M. Fraumeni. "Investment in Education and U.S. Economic Growth." *Scandinavian Journal of Economics* 94 (1992): 51-70.

Julian, Tifanny and Robert Kominski. *Education and Synthetic Work-Life Earnings Estimates* . American Community Survey Reports. Washington, DC, 2011.

Kantrowitz, M. "The Financial Value of a Higher Education." *Journal of Study Financial Aid* 37.1 (2007): 19-27.

Kennedy, Peter. *A Guide to Econometrics*. 5th. The MIT Press, 2003.

Klein, Lawrence R. "The Use of Econometric Models as a Guide to Economic Policy." *Econometrica* (1947): 11-51.

Kobayashi, Kazumi, Hasudungan Tampubolon and Mitsuo Ezaki. "Indonesia Model." Ichimura, Shinichi and Mitsuo Ezaki. *Econometric Models of Asian Link*. Tokyo: Springer-Verlag, 1985. 141-160. Book.

Kol, J and P.D Wolff. "Tinbergen's Work: Change and Continuity." *De Economist* (1993): 1-28. Document.

Lucas, Robert E. "Econometric Policy Evaluation: A Critique." *Carnegie-Rochester Conference Series on Public Policy* 1.1 (1976): 19-46.

—. "On the Mechanics of Economics Development." *Journal of Monetary Economics* 22 (1988): 3-42. <https://doi.org/10.1016/0304-3932(88)90168-7>.

M, Aslam. "Education gender gaps in Pakistan:is the labor market to blame?" *Economic Development Cultural Change* (2009): 747-784.

Mankiw, Gregory N, David Romer and David N Weil. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107.2 (1992): 407–437. <https://doi.org/10.2307/2118477>.

—. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* (1992): 407-437.

Mari, Pangestu. "Adjustment Problems of A Small Oil-Exporting Country: Did Indonesia Suffer from the Dutch Disease?" *Economic Development in East and Southeast Asia: Essays in Honor of Professor Shinichi Ichimura*. Institute of Southeeast Asian Studies and East-West Center, n.d. 121-137.

Mello, Luiz de and M Comola. "Salaried Employment and Earnings in Indonesia: New Evidence on the Selection Bias." *Applied Economics* 45 (2013): 2808-16.

Mincer, Jacob A. *Schooling, Experience, and Earnings*. National Bureau of Economic Research, 1974.

Montenegro, Claudio E and Harry A Patrinos. *Comparable Estimates of Returns to Schooling Around the World*. Policy Research Working Paper WPS 7020. Washington D.C.: World Bank, 2014. <http://documents.worldbank.org/curated/en/830831468147839247/Comparable-estimates-of-returns-to-schooling-around-the-world>.

Muhdi and Komei Sasaki. "Roles of External and Domestic Debt in Economy: Analysis of a Macroeconometric Model for Indonesia." *Interdisciplinary Information Sciences* 15.2 (2009): 251-265. <https://doi.org/10.4036/iis.2009.251>.

Nelson, Richard R and Edmund S Phelps. "Investment in Humans, Technological Diffusion, and Economic Growth." *The American Economic Review* 56.1 (1966): 69-75. <https://www.jstor.org/stable/1821269>.

Pandit, V. "Macro-econometric Policy Modelling for India: A Review of Some Analytical Issues." Working Papers No.74. 2000.

Patrinos, Harry A. "Estimating the Return to Schooling Using the Mincer Equation." *IZA World of Labor* 2016.

Patrinos, Harry A, Ridao-Cano, C and C Sakellariou. "Estimating the Returns to Education: Accounting for Heterogeneity in Ability." Working Paper 4040. 2006.

Pritchett, Lant. "Where Has All the Education Gone?" *The World Bank Economic Review* 15.3 (2001): 367-391. <https://www.jstor.org/stable/3990107>.

Psacharopoulos, G and R Mattson. "Estimating the Returns to Education: a Sensitivity Analysis of Methods and Sample Size." *Journal of Education Development Administration* (1998): 271-287.

Psacharopoulos, George and Harry A Patrinos. "Human Capital and Rates of Return." *International Handbook on the Economics of Education*. Cheltenham: Edward Elgar Publishing Ltd, 2004. 1-57. Document.

Psacharopoulos, George and Harry Patrinos. *Returns to Investment in Education : A Decennial Review of the Global Literature (English)*. Policy Research Working Paper WPS 8402. Washington D.C.: World Bank Group, 2018. <http://documents.worldbank.org/curated/en/442521523465644318/Returns-to-investment-in-education-a-decennial-review-of-the-global-literature>.

—. "Returns to Investment in Education: A Further Update." *Education Economics* 12.2 (2004): 111-134.

Psacharopoulos, George. "Returns to Education: A Further International Update and Implications." *The Journal of Human Resources* 20.4 (1985): 583-604.

—. "Returns to Investment in Education: A Global Update." *World Development* 22.9 (1994): 1325-1343. <https ://doi.org/10.1016/0305-750X(94)90007 -8>.

—. "The profitability of investment in education: concepts and methods." Human Capital Development and Operations Policy Working Paper HCOWP 63. 1995.

—. "The Profitability of Investment in Education: Concepts and Methods." Human Capital Development and Operations Policy Working Paper. 1995.

Purnastuti, L, WM Paul and Salim R. "Declining Rates of Return to Education: Evidence for Indonesia." *Bulletin of Indonesia Economic Studies* 49.2 (2013): 213-236. <https ://doi.org/10.1080/00074 918.2013.80984 2>.

RAND. 2016. *RAND-Social and Economic Well-Being.* RAND. Stata Database. 4 April 2019. <https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html>.

Sakellariou, Chris. "Rates of Return to Investments in Formal and Technical/Vocational Education in Singapore." *Journal Education Economics* 11.1 (2003): 73-87. <https://doi.org/10.1080/09645290210127525>.

Schultz, Theodore W. "Investment in Human Capital." *The American Economic Review* 51.1 (1961): 1-17. < www.jstor.org/stable/1818907>.

Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations*. London: W. Strahan and T. Cadell, in the Strand, 1976.

Solow, Robert M. "A Contribution to the Theory of Economic Growth." *The Quarterly Journal of Economics* 70 (1956): 65-94. < http://www.jstor.org/stable/1884513>.

Swan, T W. "Economic Growth and Capital Accumulation." *The Economic Record* 32.2 (1956): 334-361. < https://doi.org/10.1111/j.1475-4932.1956.tb00434.x>.

The World Bank. *The Changing Wealth of Nations: Measuring sustainable development in the new*. Washington D.C.: World Bank, 2011.

Tingting, Li and Wang Yong. "Growth Channels of Human Capital: A Chinese Panel Data Study." *China Economic Review* (2016): 1-14. <http://dx.doi.org/10.1016/j.chieci.2016.11.002>.

United Nations Economic Comission for Europe. *Guide on Measuring Human Capital*. Geneva: United Nations, 2016.

Valadkhani, Abbas. "History Of Macroeconometric Modelling: Lessons From Past Experience." *Journal of Policy Modeling* 26.2 (2004): 265-281.

Wicaksono, Teguh Yudo and Deni Friawan. "Recent Developments of Higher Education in Indonesia : Issues and Challenges." *Financing Higher Education and Economic Development in East Asia*. 2011. 159-187.

World Bank. "World Bank." n.d. *DataBank World Development Indicators.* Metadata. 20 12 2019. <https://databank.worldbank.org/source/world-development-indicators>.

Yubilianto. "Return to Education and Financial Value of Investment in Higher Education in Indonesia." *Journal of Economic Structures* 9.17 (2020): 1-28. <https://doi.org/10.1186/s40008-020-00193-6>.

APPENDIX

SWE for Quartile 1 (Full Employment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	25,026,923	29,141,078	28,285,714	29,010,989	27,356,308	28,465,934	30,230,357	22,628,571	20,130,836	17,434,575	257,711,286
Junior High School	28,389,449	35,638,344	35,391,807	34,813,187	31,760,000	33,265,934	28,845,873	36,928,571	28,737,300	16,585,834	310,356,300
Senior High School	15,992,308	54,069,231	45,988,065	45,674,430	49,765,502	49,011,900	43,516,484	48,158,242	36,800,000	35,306,991	424,283,151
College	-	29,961,905	77,599,520	60,923,077	81,738,462	82,823,529	71,023,482	60,097,561	61,648,352	24,659,341	550,475,228

SWE for Quartile 2 (Full Employment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	50,034,286	54,450,000	56,571,429	62,700,000	56,571,429	56,654,317	64,819,921	53,776,134	45,705,000	37,309,004	538,591,520
Junior High School	51,826,057	62,549,020	67,692,308	70,714,286	65,229,955	74,057,143	71,753,846	72,930,403	61,460,317	63,918,193	662,131,527
Senior High School	30,171,429	92,745,098	93,471,795	99,000,000	101,498,643	94,769,231	95,135,040	105,600,000	92,033,333	89,188,000	893,612,568
College	-	62,503,846	149,516,981	130,730,769	178,646,617	162,624,000	187,462,185	232,320,000	209,352,770	120,000,000	1,433,157,168

SWE for Quartile 3 (Full Employment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	77,638,393	97,854,167	107,755,102	117,333,333	104,280,558	111,792,772	121,449,346	112,769,231	103,619,208	78,742,081	1,033,234,191
Junior High School	107,266,923	111,289,377	130,511,278	133,109,244	123,200,000	133,813,187	146,061,797	155,436,328	175,885,267	125,336,538	1,341,909,940
Senior High School	50,241,629	154,880,000	157,627,201	165,000,000	188,706,122	174,185,814	172,549,020	199,980,000	181,510,154	193,600,000	1,638,279,940
College	-	118,808,440	273,199,385	235,569,231	353,571,429	330,411,642	356,773,725	352,000,000	398,030,769	264,761,538	2,683,126,159

SWE for Quartile 1 (Including Unemployment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	-	7,872,746	7,310,769	10,552,747	14,474,632	14,505,495	14,518,534	11,649,374	10,093,407	6,034,286	97,011,989
Junior High School	-	7,496,992	13,682,143	11,053,140	22,184,874	22,564,103	11,815,934	26,199,483	19,340,659	3,093,144	137,430,472
Senior High School	8,066,667	37,230,769	28,465,934	26,346,122	35,812,500	36,985,507	31,059,520	26,015,873	16,605,769	27,651,099	274,239,761
College	-	12,864,286	61,520,362	39,147,912	62,264,497	57,674,451	51,494,505	48,351,648	47,324,176	3,535,714	384,177,552

SWE for Quartile 2 (Including Unemployment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	23,447,729	43,758,242	40,000,000	46,366,521	46,200,000	45,637,455	51,575,510	41,461,538	36,728,027	26,109,890	401,284,912
Junior High School	16,923,077	46,270,868	54,153,846	50,769,231	55,220,000	58,666,667	48,821,938	66,523,810	53,664,596	27,850,549	478,864,582
Senior High School	23,466,667	80,142,857	77,882,353	79,786,667	87,123,626	83,551,648	88,000,000	84,615,385	70,731,554	81,301,875	756,602,632
College	-	46,959,177	141,428,571	109,600,000	161,417,143	138,039,216	162,461,538	210,956,030	204,595,023	70,206,593	1,245,663,291

SWE for Quartile 3 (Including Unemployment) in Rupiah

	Age Cohorts										
	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	Total
Elementary School	62,254,762	82,421,026	83,185,882	100,386,555	94,285,714	102,771,429	103,162,088	98,951,471	87,274,725	69,019,608	883,713,259
Junior High School	62,408,824	94,285,714	114,782,609	112,020,408	117,585,165	124,970,057	129,250,000	135,502,041	157,683,258	103,888,889	1,152,376,964
Senior High School	45,129,495	144,941,176	145,026,503	147,840,000	175,516,484	162,461,538	162,047,096	185,952,381	153,970,588	191,351,648	1,514,236,909
College	-	104,729,670	264,000,000	217,582,418	333,730,435	293,505,882	330,000,000	342,917,083	383,090,110	177,852,632	2,447,408,229

IRR and NPV Calculation for Quartile 1 (Full Employment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(7,996,154)	(74,025,361)	(7,996,154)	(234,348,029)	(7,996,154)	(142,343,005)	(7,996,154)	(413,243,736)
In College	(7,996,154)	(82,021,515)	(7,996,154)	(242,344,183)	(7,996,154)	(150,339,159)	(7,996,154)	(421,239,890)
In College	(10,813,846)	(92,835,361)	(10,813,846)	(253,158,029)	(10,813,846)	(161,153,005)	(10,813,846)	(432,053,736)
In College	(10,813,846)	(103,649,207)	(10,813,846)	(263,971,875)	(10,813,846)	(171,966,851)	(10,813,846)	(442,867,583)
1	(826,545)	(104,475,752)	(826,545)	(264,798,419)	(826,545)	(172,793,396)	(826,545)	(443,694,127)
2	(826,545)	(105,302,297)	(826,545)	(265,624,964)	(826,545)	(173,619,940)	(826,545)	(444,520,672)
3	(826,545)	(106,128,841)	(826,545)	(266,451,509)	(826,545)	(174,446,485)	(826,545)	(445,347,216)
4	6,322,291	(99,806,550)	6,322,291	(260,129,218)	6,322,291	(168,124,194)	6,322,291	(439,024,925)
5	6,322,291	(93,484,259)	6,322,291	(253,806,927)	6,322,291	(161,801,903)	6,322,291	(432,702,634)
6	6,322,291	(87,161,968)	6,322,291	(247,484,636)	6,322,291	(155,479,612)	6,322,291	(426,380,343)
7	6,322,291	(80,839,677)	6,322,291	(241,162,344)	6,322,291	(149,157,321)	6,322,291	(420,058,052)
8	6,322,291	(74,517,386)	6,322,291	(234,840,053)	6,322,291	(142,835,030)	6,322,291	(413,735,761)
9	3,049,729	(71,467,657)	3,049,729	(231,790,324)	3,049,729	(139,785,300)	3,049,729	(410,686,032)
10	3,049,729	(68,417,927)	3,049,729	(228,740,595)	3,049,729	(136,735,571)	3,049,729	(407,636,302)

11	3,049,729	(65,368,198)	3,049,729	(225,690,865)	3,049,729	(133,685,841)	3,049,729	(404,586,573)
12	3,049,729	(62,318,468)	3,049,729	(222,641,136)	3,049,729	(130,636,112)	3,049,729	(401,536,844)
13	3,049,729	(59,268,739)	3,049,729	(219,591,406)	3,049,729	(127,586,383)	3,049,729	(398,487,114)
14	6,394,592	(52,874,147)	6,394,592	(213,196,815)	6,394,592	(121,191,791)	6,394,592	(392,092,522)
15	6,394,592	(46,479,555)	6,394,592	(206,802,223)	6,394,592	(114,797,199)	6,394,592	(385,697,931)
16	6,394,592	(40,084,963)	6,394,592	(200,407,631)	6,394,592	(108,402,607)	6,394,592	(379,303,339)
17	6,394,592	(33,690,372)	6,394,592	(194,013,039)	6,394,592	(102,008,015)	6,394,592	(372,908,747)
18	6,394,592	(27,295,780)	6,394,592	(187,618,447)	6,394,592	(95,613,423)	6,394,592	(366,514,155)
19	6,762,326	(20,533,454)	6,762,326	(180,856,121)	6,762,326	(88,851,097)	6,762,326	(359,751,829)
20	6,762,326	(13,771,128)	6,762,326	(174,093,795)	6,762,326	(82,088,772)	6,762,326	(352,989,503)
21	6,762,326	(7,008,802)	6,762,326	(167,331,469)	6,762,326	(75,326,446)	6,762,326	(346,227,177)
22	6,762,326	**(246,476)**	6,762,326	(160,569,143)	6,762,326	(68,564,120)	6,762,326	(339,464,851)
23	6,762,326	**6,515,850**	6,762,326	(153,806,817)	6,762,326	(61,801,794)	6,762,326	(332,702,525)
24	5,501,400	12,017,250	5,501,400	(148,305,418)	5,501,400	(56,300,394)	5,501,400	(327,201,126)
25	5,501,400	17,518,649	5,501,400	(142,804,018)	5,501,400	(50,798,994)	5,501,400	(321,699,726)
26	5,501,400	23,020,049	5,501,400	(137,302,618)	5,501,400	(45,297,595)	5,501,400	(316,198,326)
27	5,501,400	28,521,449	5,501,400	(131,801,219)	5,501,400	(39,796,195)	5,501,400	(310,696,927)
28	5,501,400	34,022,848	5,501,400	(126,299,819)	5,501,400	(34,294,795)	5,501,400	(305,195,527)

29	2,387,864	36,410,712	2,387,864	(123,911,955)	2,387,864	(31,906,932)	2,387,864	(302,807,663)
30	2,387,864	38,798,576	2,387,864	(121,524,091)	2,387,864	(29,519,068)	2,387,864	(300,419,799)
31	2,387,864	41,186,440	2,387,864	(119,136,228)	2,387,864	(27,131,204)	2,387,864	(298,031,935)
32	2,387,864	43,574,304	2,387,864	(116,748,364)	2,387,864	(24,743,340)	2,387,864	(295,644,072)
33	2,387,864	45,962,168	2,387,864	(114,360,500)	2,387,864	(22,355,476)	2,387,864	(293,256,208)
34	4,969,670	50,931,838	4,969,670	(109,390,830)	4,969,670	(17,385,806)	4,969,670	(288,286,537)
35	4,969,670	55,901,508	4,969,670	(104,421,159)	4,969,670	(12,416,136)	4,969,670	(283,316,867)
36	4,969,670	60,871,179	4,969,670	(99,451,489)	4,969,670	(7,446,465)	4,969,670	(278,347,197)
37	4,969,670	65,840,849	4,969,670	(94,481,819)	4,969,670	(2,476,795)	4,969,670	(273,377,526)
38	4,969,670	70,810,519	4,969,670	(89,512,148)	4,969,670	2,492,875	4,969,670	(268,407,856)
39	(2,129,530)	68,680,989	(2,129,530)	(91,641,678)	(2,129,530)	363,345	(2,129,530)	(270,537,386)
40	(2,129,530)	66,551,459	(2,129,530)	(93,771,208)	(2,129,530)	(1,766,185)	(2,129,530)	(272,666,916)
41	(2,129,530)	64,421,929	(2,129,530)	(95,900,738)	(2,129,530)	(3,895,715)	(2,129,530)	(274,796,446)
42	(2,129,530)	62,292,399	(2,129,530)	(98,030,268)	(2,129,530)	(6,025,245)	(2,129,530)	(276,925,976)
43	(2,129,530)	**60,162,869**	(2,129,530)	**(100,159,798)**	(2,129,530)	**(8,154,775)**	(2,129,530)	**(279,055,506)**
NPV	**60,162,869**		**(100,159,798)**		**(8,154,775)**		**(279,055,506)**	
IRR	11.7%		-9.9%		-1.1%		-19.1%	

IRR and NPV Calculation for Quartile 2 (Full Employment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(15,085,714)	(81,114,922)	(15,085,714)	(241,437,589)	(15,085,714)	(149,432,565)	(15,085,714)	(420,333,297)
In College	(15,085,714)	(96,200,636)	(15,085,714)	(256,523,303)	(15,085,714)	(164,518,280)	(15,085,714)	(435,419,011)
In College	(18,549,020)	(114,749,656)	(18,549,020)	(275,072,323)	(18,549,020)	(183,067,299)	(18,549,020)	(453,968,031)
In College	(18,549,020)	(133,298,675)	(18,549,020)	(293,621,343)	(18,549,020)	(201,616,319)	(18,549,020)	(472,517,050)
1	2,285,596	(131,013,079)	2,285,596	(291,335,747)	2,285,596	(199,330,723)	2,285,596	(470,231,455)
2	2,285,596	(128,727,484)	2,285,596	(289,050,151)	2,285,596	(197,045,127)	2,285,596	(467,945,859)
3	2,285,596	(126,441,888)	2,285,596	(286,764,555)	2,285,596	(194,759,532)	2,285,596	(465,660,263)
4	11,209,037	(115,232,851)	11,209,037	(275,555,518)	11,209,037	(183,550,494)	11,209,037	(454,451,226)
5	11,209,037	(104,023,813)	11,209,037	(264,346,481)	11,209,037	(172,341,457)	11,209,037	(443,242,189)
6	11,209,037	(92,814,776)	11,209,037	(253,137,444)	11,209,037	(161,132,420)	11,209,037	(432,033,151)
7	11,209,037	(81,605,739)	11,209,037	(241,928,406)	11,209,037	(149,923,383)	11,209,037	(420,824,114)
8	11,209,037	(70,396,702)	11,209,037	(230,719,369)	11,209,037	(138,714,345)	11,209,037	(409,615,077)
9	6,346,154	(64,050,548)	6,346,154	(224,373,215)	6,346,154	(132,368,191)	6,346,154	(403,268,923)
10	6,346,154	(57,704,394)	6,346,154	(218,027,061)	6,346,154	(126,022,038)	6,346,154	(396,922,769)

11	6,346,154	(51,358,240)	6,346,154	(211,680,907)	6,346,154	(119,675,884)	6,346,154	(390,576,615)
12	6,346,154	(45,012,086)	6,346,154	(205,334,754)	6,346,154	(113,329,730)	6,346,154	(384,230,461)
13	6,346,154	(38,665,932)	6,346,154	(198,988,600)	6,346,154	(106,983,576)	6,346,154	(377,884,308)
14	15,429,595	(23,236,338)	15,429,595	(183,559,005)	15,429,595	(91,553,981)	15,429,595	(362,454,713)
15	15,429,595	**(7,806,743)**	15,429,595	(168,129,410)	15,429,595	(76,124,386)	15,429,595	(347,025,118)
16	15,429,595	**7,622,852**	15,429,595	(152,699,815)	15,429,595	(60,694,792)	15,429,595	(331,595,523)
17	15,429,595	23,052,447	15,429,595	(137,270,221)	15,429,595	(45,265,197)	15,429,595	(316,165,928)
18	15,429,595	38,482,042	15,429,595	(121,840,626)	15,429,595	(29,835,602)	15,429,595	(300,736,334)
19	13,570,954	52,052,996	13,570,954	(108,269,672)	13,570,954	(16,264,648)	13,570,954	(287,165,380)
20	13,570,954	65,623,949	13,570,954	(94,698,718)	13,570,954	**(2,693,694)**	13,570,954	(273,594,426)
21	13,570,954	79,194,903	13,570,954	(81,127,764)	13,570,954	**10,877,260**	13,570,954	(260,023,472)
22	13,570,954	92,765,857	13,570,954	(67,556,810)	13,570,954	24,448,213	13,570,954	(246,452,518)
23	13,570,954	106,336,811	13,570,954	(53,985,857)	13,570,954	38,019,167	13,570,954	(232,881,564)
24	18,465,429	124,802,240	18,465,429	(35,520,428)	18,465,429	56,484,596	18,465,429	(214,416,135)
25	18,465,429	143,267,669	18,465,429	**(17,054,999)**	18,465,429	74,950,025	18,465,429	(195,950,706)
26	18,465,429	161,733,098	18,465,429	**1,410,430**	18,465,429	93,415,454	18,465,429	(177,485,277)
27	18,465,429	180,198,527	18,465,429	19,875,859	18,465,429	111,880,883	18,465,429	(159,019,848)
28	18,465,429	198,663,956	18,465,429	38,341,288	18,465,429	130,346,312	18,465,429	(140,554,420)

29	25,344,000	224,007,956	25,344,000	63,685,288	25,344,000	155,690,312	25,344,000	(115,210,420)
30	25,344,000	249,351,956	25,344,000	89,029,288	25,344,000	181,034,312	25,344,000	(89,866,420)
31	25,344,000	274,695,956	25,344,000	114,373,288	25,344,000	206,378,312	25,344,000	(64,522,420)
32	25,344,000	300,039,956	25,344,000	139,717,288	25,344,000	231,722,312	25,344,000	(39,178,420)
33	25,344,000	325,383,956	25,344,000	165,061,288	25,344,000	257,066,312	25,344,000	**(13,834,420)**
34	23,463,887	348,847,843	23,463,887	188,525,176	23,463,887	280,530,199	23,463,887	**9,629,468**
35	23,463,887	372,311,730	23,463,887	211,989,063	23,463,887	303,994,087	23,463,887	33,093,355
36	23,463,887	395,775,618	23,463,887	235,452,950	23,463,887	327,457,974	23,463,887	56,557,242
37	23,463,887	419,239,505	23,463,887	258,916,837	23,463,887	350,921,861	23,463,887	80,021,130
38	23,463,887	442,703,392	23,463,887	282,380,725	23,463,887	374,385,748	23,463,887	103,485,017
39	6,162,400	448,865,792	6,162,400	288,543,125	6,162,400	380,548,148	6,162,400	109,647,417
40	6,162,400	455,028,192	6,162,400	294,705,525	6,162,400	386,710,548	6,162,400	115,809,817
41	6,162,400	461,190,592	6,162,400	300,867,925	6,162,400	392,872,948	6,162,400	121,972,217
42	6,162,400	467,352,992	6,162,400	307,030,325	6,162,400	399,035,348	6,162,400	128,134,617
43	6,162,400	**473,515,392**	6,162,400	**313,192,725**	6,162,400	**405,197,748**	6,162,400	**134,297,017**
NPV	**473,515,392**		**313,192,725**		**405,197,748**		**134,297,017**	
IRR	45.3%		17.5%		28.9%		5.5%	

IRR and NPV Calculation for Quartile 3 (Full Employment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(25,120,814)	(91,150,022)	(25,120,814)	(251,472,689)	(25,120,814)	(159,467,666)	(25,120,814)	(430,368,397)
In College	(25,120,814)	(116,270,836)	(25,120,814)	(276,593,504)	(25,120,814)	(184,588,480)	(25,120,814)	(455,489,212)
In College	(30,976,000)	(147,246,836)	(30,976,000)	(307,569,504)	(30,976,000)	(215,564,480)	(30,976,000)	(486,465,212)
In College	(30,976,000)	(178,222,836)	(30,976,000)	(338,545,504)	(30,976,000)	(246,540,480)	(30,976,000)	(517,441,212)
1	8,626,813	(169,596,023)	8,626,813	(329,918,690)	8,626,813	(237,913,667)	8,626,813	(508,814,398)
2	8,626,813	(160,969,210)	8,626,813	(321,291,877)	8,626,813	(229,286,853)	8,626,813	(500,187,585)
3	8,626,813	(152,342,396)	8,626,813	(312,665,064)	8,626,813	(220,660,040)	8,626,813	(491,560,772)
4	23,114,437	(129,227,960)	23,114,437	(289,550,627)	23,114,437	(197,545,603)	23,114,437	(468,446,335)
5	23,114,437	(106,113,523)	23,114,437	(266,436,190)	23,114,437	(174,431,167)	23,114,437	(445,331,898)
6	23,114,437	(82,999,086)	23,114,437	(243,321,754)	23,114,437	(151,316,730)	23,114,437	(422,217,461)
7	23,114,437	(59,884,649)	23,114,437	(220,207,317)	23,114,437	(128,202,293)	23,114,437	(399,103,025)
8	23,114,437	(36,770,212)	23,114,437	(197,092,880)	23,114,437	(105,087,856)	23,114,437	(375,988,588)
9	14,113,846	(22,656,366)	14,113,846	(182,979,034)	14,113,846	(90,974,010)	14,113,846	(361,874,742)
10	14,113,846	**(8,542,520)**	14,113,846	(168,865,188)	14,113,846	(76,860,164)	14,113,846	(347,760,895)

11	14,113,846	**5,571,326**	14,113,846	(154,751,341)	14,113,846	(62,746,318)	14,113,846	(333,647,049)
12	14,113,846	19,685,172	14,113,846	(140,637,495)	14,113,846	(48,632,472)	14,113,846	(319,533,203)
13	14,113,846	33,799,018	14,113,846	(126,523,649)	14,113,846	(34,518,625)	14,113,846	(305,419,357)
14	32,973,061	66,772,080	32,973,061	(93,550,588)	32,973,061	**(1,545,564)**	32,973,061	(272,446,296)
15	32,973,061	99,745,141	32,973,061	(60,577,527)	32,973,061	**31,427,497**	32,973,061	(239,473,235)
16	32,973,061	132,718,202	32,973,061	**(27,604,465)**	32,973,061	64,400,558	32,973,061	(206,500,173)
17	32,973,061	165,691,263	32,973,061	**5,368,596**	32,973,061	97,373,619	32,973,061	(173,527,112)
18	32,973,061	198,664,324	32,973,061	38,341,657	32,973,061	130,346,681	32,973,061	(140,554,051)
19	31,245,166	229,909,490	31,245,166	69,586,823	31,245,166	161,591,846	31,245,166	(109,308,885)
20	31,245,166	261,154,656	31,245,166	100,831,988	31,245,166	192,837,012	31,245,166	(78,063,720)
21	31,245,166	292,399,821	31,245,166	132,077,154	31,245,166	224,082,178	31,245,166	(46,818,554)
22	31,245,166	323,644,987	31,245,166	163,322,320	31,245,166	255,327,343	31,245,166	**(15,573,388)**
23	31,245,166	354,890,153	31,245,166	194,567,485	31,245,166	286,572,509	31,245,166	**15,671,777**
24	36,844,941	391,735,094	36,844,941	231,412,426	36,844,941	323,417,450	36,844,941	52,516,718
25	36,844,941	428,580,035	36,844,941	268,257,367	36,844,941	360,262,391	36,844,941	89,361,659
26	36,844,941	465,424,976	36,844,941	305,102,308	36,844,941	397,107,332	36,844,941	126,206,600
27	36,844,941	502,269,917	36,844,941	341,947,249	36,844,941	433,952,273	36,844,941	163,051,541
28	36,844,941	539,114,858	36,844,941	378,792,190	36,844,941	470,797,214	36,844,941	199,896,482

29	30,404,000	569,518,858	30,404,000	409,196,190	30,404,000	501,201,214	30,404,000	230,300,482
30	30,404,000	599,922,858	30,404,000	439,600,190	30,404,000	531,605,214	30,404,000	260,704,482
31	30,404,000	630,326,858	30,404,000	470,004,190	30,404,000	562,009,214	30,404,000	291,108,482
32	30,404,000	660,730,858	30,404,000	500,408,190	30,404,000	592,413,214	30,404,000	321,512,482
33	30,404,000	691,134,858	30,404,000	530,812,190	30,404,000	622,817,214	30,404,000	351,916,482
34	43,304,123	734,438,981	43,304,123	574,116,313	43,304,123	666,121,337	43,304,123	395,220,605
35	43,304,123	777,743,104	43,304,123	617,420,436	43,304,123	709,425,460	43,304,123	438,524,728
36	43,304,123	821,047,227	43,304,123	660,724,559	43,304,123	752,729,583	43,304,123	481,828,852
37	43,304,123	864,351,350	43,304,123	704,028,682	43,304,123	796,033,706	43,304,123	525,132,975
38	43,304,123	907,655,473	43,304,123	747,332,806	43,304,123	839,337,829	43,304,123	568,437,098
39	14,232,308	921,887,781	14,232,308	761,565,113	14,232,308	853,570,137	14,232,308	582,669,405
40	14,232,308	936,120,088	14,232,308	775,797,421	14,232,308	867,802,445	14,232,308	596,901,713
41	14,232,308	950,352,396	14,232,308	790,029,729	14,232,308	882,034,752	14,232,308	611,134,021
42	14,232,308	964,584,704	14,232,308	804,262,036	14,232,308	896,267,060	14,232,308	625,366,328
43	14,232,308	**978,817,011**	14,232,308	**818,494,344**	14,232,308	**910,499,368**	14,232,308	**639,598,636**
NPV	**978,817,011**		**818,494,344**		**910,499,368**		**639,598,636**	
IRR	62.3%		32.5%		45.0%		19.4%	

IRR and NPV Calculation for Quartile 1 (Including Unemployment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(4,033,333)	(70,062,541)	(4,033,333)	(230,385,208)	(4,033,333)	(138,380,184)	(4,033,333)	(409,280,916)
In College	(4,033,333)	(74,095,874)	(4,033,333)	(234,418,541)	(4,033,333)	(142,413,518)	(4,033,333)	(413,314,249)
In College	(7,446,154)	(81,542,028)	(7,446,154)	(241,864,695)	(7,446,154)	(149,859,672)	(7,446,154)	(420,760,403)
In College	(7,446,154)	(88,988,182)	(7,446,154)	(249,310,849)	(7,446,154)	(157,305,825)	(7,446,154)	(428,206,557)
1	(3,158,059)	(92,146,240)	(3,158,059)	(252,468,908)	(3,158,059)	(160,463,884)	(3,158,059)	(431,364,616)
2	(3,158,059)	(95,304,299)	(3,158,059)	(255,626,966)	(3,158,059)	(163,621,943)	(3,158,059)	(434,522,674)
3	(3,158,059)	(98,462,358)	(3,158,059)	(258,785,025)	(3,158,059)	(166,780,001)	(3,158,059)	(437,680,733)
4	6,610,886	(91,851,472)	6,610,886	(252,174,139)	6,610,886	(160,169,116)	6,610,886	(431,069,847)
5	6,610,886	(85,240,586)	6,610,886	(245,563,254)	6,610,886	(153,558,230)	6,610,886	(424,458,962)
6	6,610,886	(78,629,701)	6,610,886	(238,952,368)	6,610,886	(146,947,345)	6,610,886	(417,848,076)
7	6,610,886	(72,018,815)	6,610,886	(232,341,483)	6,610,886	(140,336,459)	6,610,886	(411,237,190)
8	6,610,886	(65,407,930)	6,610,886	(225,730,597)	6,610,886	(133,725,573)	6,610,886	(404,626,305)
9	2,560,358	(62,847,572)	2,560,358	(223,170,239)	2,560,358	(131,165,215)	2,560,358	(402,065,947)
10	2,560,358	(60,287,214)	2,560,358	(220,609,881)	2,560,358	(128,604,857)	2,560,358	(399,505,589)

11	2,560,358	(57,726,856)	2,560,358	(218,049,523)	2,560,358	(126,044,500)	2,560,358	(396,945,231)
12	2,560,358	(55,166,498)	2,560,358	(215,489,165)	2,560,358	(123,484,142)	2,560,358	(394,384,873)
13	2,560,358	(52,606,140)	2,560,358	(212,928,807)	2,560,358	(120,923,784)	2,560,358	(391,824,515)
14	5,290,399	(47,315,741)	5,290,399	(207,638,408)	5,290,399	(115,633,384)	5,290,399	(386,534,116)
15	5,290,399	(42,025,341)	5,290,399	(202,348,009)	5,290,399	(110,342,985)	5,290,399	(381,243,716)
16	5,290,399	(36,734,942)	5,290,399	(197,057,609)	5,290,399	(105,052,585)	5,290,399	(375,953,317)
17	5,290,399	(31,444,542)	5,290,399	(191,767,210)	5,290,399	(99,762,186)	5,290,399	(370,662,917)
18	5,290,399	(26,154,143)	5,290,399	(186,476,810)	5,290,399	(94,471,786)	5,290,399	(365,372,518)
19	4,137,789	(22,016,354)	4,137,789	(182,339,021)	4,137,789	(90,333,998)	4,137,789	(361,234,729)
20	4,137,789	(17,878,565)	4,137,789	(178,201,233)	4,137,789	(86,196,209)	4,137,789	(357,096,941)
21	4,137,789	(13,740,777)	4,137,789	(174,063,444)	4,137,789	(82,058,420)	4,137,789	(352,959,152)
22	4,137,789	(9,602,988)	4,137,789	(169,925,655)	4,137,789	(77,920,632)	4,137,789	(348,821,363)
23	4,137,789	(5,465,199)	4,137,789	(165,787,867)	4,137,789	(73,782,843)	4,137,789	(344,683,575)
24	4,086,997	**(1,378,202)**	4,086,997	(161,700,870)	4,086,997	(69,695,846)	4,086,997	(340,596,578)
25	4,086,997	**2,708,795**	4,086,997	(157,613,873)	4,086,997	(65,608,849)	4,086,997	(336,509,581)
26	4,086,997	6,795,792	4,086,997	(153,526,876)	4,086,997	(61,521,852)	4,086,997	(332,422,583)
27	4,086,997	10,882,789	4,086,997	(149,439,879)	4,086,997	(57,434,855)	4,086,997	(328,335,586)
28	4,086,997	14,969,786	4,086,997	(145,352,881)	4,086,997	(53,347,858)	4,086,997	(324,248,589)

29	4,467,155	19,436,941	4,467,155	(140,885,726)	4,467,155	(48,880,703)	4,467,155	(319,781,434)
30	4,467,155	23,904,096	4,467,155	(136,418,571)	4,467,155	(44,413,548)	4,467,155	(315,314,279)
31	4,467,155	28,371,251	4,467,155	(131,951,416)	4,467,155	(39,946,392)	4,467,155	(310,847,124)
32	4,467,155	32,838,406	4,467,155	(127,484,261)	4,467,155	(35,479,237)	4,467,155	(306,379,969)
33	4,467,155	37,305,561	4,467,155	(123,017,106)	4,467,155	(31,012,082)	4,467,155	(301,912,814)
34	6,143,681	43,449,243	6,143,681	(116,873,425)	6,143,681	(24,868,401)	6,143,681	(295,769,133)
35	6,143,681	49,592,924	6,143,681	(110,729,743)	6,143,681	(18,724,720)	6,143,681	(289,625,451)
36	6,143,681	55,736,605	6,143,681	(104,586,062)	6,143,681	(12,581,038)	6,143,681	(283,481,770)
37	6,143,681	61,880,287	6,143,681	(98,442,381)	6,143,681	(6,437,357)	6,143,681	(277,338,089)
38	6,143,681	68,023,968	6,143,681	(92,298,699)	6,143,681	(293,676)	6,143,681	(271,194,407)
39	(4,823,077)	63,200,891	(4,823,077)	(97,121,776)	(4,823,077)	(5,116,753)	(4,823,077)	(276,017,484)
40	(4,823,077)	58,377,814	(4,823,077)	(101,944,853)	(4,823,077)	(9,939,830)	(4,823,077)	(280,840,561)
41	(4,823,077)	53,554,737	(4,823,077)	(106,767,930)	(4,823,077)	(14,762,907)	(4,823,077)	(285,663,638)
42	(4,823,077)	48,731,660	(4,823,077)	(111,591,007)	(4,823,077)	(19,585,983)	(4,823,077)	(290,486,715)
43	(4,823,077)	**43,908,583**	(4,823,077)	**(116,414,084)**	(4,823,077)	**(24,409,060)**	(4,823,077)	**(295,309,792)**
NPV	**43,908,583**		**(116,414,084)**		**(24,409,060)**		**(295,309,792)**	
IRR	9.6%		-12.6%		-3.6%		-21.7%	

IRR and NPV Calculation for Quartile 2 (Including Unemployment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(11,733,333)	(77,762,541)	(11,733,333)	(238,085,208)	(11,733,333)	(146,080,184)	(11,733,333)	(416,980,916)
In College	(11,733,333)	(89,495,874)	(11,733,333)	(249,818,541)	(11,733,333)	(157,813,518)	(11,733,333)	(428,714,249)
In College	(16,028,571)	(105,524,445)	(16,028,571)	(265,847,113)	(16,028,571)	(173,842,089)	(16,028,571)	(444,742,821)
In College	(16,028,571)	(121,553,017)	(16,028,571)	(281,875,684)	(16,028,571)	(189,870,661)	(16,028,571)	(460,771,392)
1	(375,512)	(121,928,529)	(375,512)	(282,251,197)	(375,512)	(190,246,173)	(375,512)	(461,146,905)
2	(375,512)	(122,304,042)	(375,512)	(282,626,709)	(375,512)	(190,621,685)	(375,512)	(461,522,417)
3	(375,512)	(122,679,554)	(375,512)	(283,002,222)	(375,512)	(190,997,198)	(375,512)	(461,897,929)
4	12,709,244	(109,970,310)	12,709,244	(270,292,978)	12,709,244	(178,287,954)	12,709,244	(449,188,686)
5	12,709,244	(97,261,067)	12,709,244	(257,583,734)	12,709,244	(165,578,710)	12,709,244	(436,479,442)
6	12,709,244	(84,551,823)	12,709,244	(244,874,490)	12,709,244	(152,869,467)	12,709,244	(423,770,198)
7	12,709,244	(71,842,579)	12,709,244	(232,165,247)	12,709,244	(140,160,223)	12,709,244	(411,060,955)
8	12,709,244	(59,133,336)	12,709,244	(219,456,003)	12,709,244	(127,450,979)	12,709,244	(398,351,711)
9	5,962,667	(53,170,669)	5,962,667	(213,493,336)	5,962,667	(121,488,313)	5,962,667	(392,389,044)
10	5,962,667	(47,208,002)	5,962,667	(207,530,670)	5,962,667	(115,525,646)	5,962,667	(386,426,378)

11	5,962,667	(41,245,336)	5,962,667	(201,568,003)	5,962,667	(109,562,979)	5,962,667	(380,463,711)
12	5,962,667	(35,282,669)	5,962,667	(195,605,336)	5,962,667	(103,600,313)	5,962,667	(374,501,044)
13	5,962,667	(29,320,002)	5,962,667	(189,642,670)	5,962,667	(97,637,646)	5,962,667	(368,538,378)
14	14,858,703	**(14,461,299)**	14,858,703	(174,783,966)	14,858,703	(82,778,943)	14,858,703	(353,679,674)
15	14,858,703	**397,404**	14,858,703	(159,925,263)	14,858,703	(67,920,239)	14,858,703	(338,820,971)
16	14,858,703	15,256,108	14,858,703	(145,066,560)	14,858,703	(53,061,536)	14,858,703	(323,962,268)
17	14,858,703	30,114,811	14,858,703	(130,207,857)	14,858,703	(38,202,833)	14,858,703	(309,103,564)
18	14,858,703	44,973,514	14,858,703	(115,349,153)	14,858,703	(23,344,129)	14,858,703	(294,244,861)
19	10,897,513	55,871,028	10,897,513	(104,451,640)	10,897,513	(12,446,616)	10,897,513	(283,347,348)
20	10,897,513	66,768,541	10,897,513	(93,554,126)	10,897,513	**(1,549,103)**	10,897,513	(272,449,834)
21	10,897,513	77,666,055	10,897,513	(82,656,613)	10,897,513	**9,348,411**	10,897,513	(261,552,321)
22	10,897,513	88,563,568	10,897,513	(71,759,099)	10,897,513	20,245,924	10,897,513	(250,654,807)
23	10,897,513	99,461,082	10,897,513	(60,861,586)	10,897,513	31,143,438	10,897,513	(239,757,294)
24	14,892,308	114,353,389	14,892,308	(45,969,278)	14,892,308	46,035,746	14,892,308	(224,864,986)
25	14,892,308	129,245,697	14,892,308	(31,076,970)	14,892,308	60,928,053	14,892,308	(209,972,678)
26	14,892,308	144,138,005	14,892,308	(16,184,663)	14,892,308	75,820,361	14,892,308	(195,080,371)
27	14,892,308	159,030,312	14,892,308	**(1,292,355)**	14,892,308	90,712,669	14,892,308	(180,188,063)
28	14,892,308	173,922,620	14,892,308	**13,599,953**	14,892,308	105,604,976	14,892,308	(165,295,755)

29	25,268,129	199,190,749	25,268,129	38,868,082	25,268,129	130,873,105	25,268,129	(140,027,626)
30	25,268,129	224,458,878	25,268,129	64,136,211	25,268,129	156,141,234	25,268,129	(114,759,497)
31	25,268,129	249,727,007	25,268,129	89,404,340	25,268,129	181,409,363	25,268,129	(89,491,368)
32	25,268,129	274,995,136	25,268,129	114,672,469	25,268,129	206,677,492	25,268,129	(64,223,239)
33	25,268,129	300,263,265	25,268,129	139,940,598	25,268,129	231,945,621	25,268,129	(38,955,110)
34	26,772,694	327,035,959	26,772,694	166,713,291	26,772,694	258,718,315	26,772,694	**(12,182,417)**
35	26,772,694	353,808,652	26,772,694	193,485,985	26,772,694	285,491,009	26,772,694	**14,590,277**
36	26,772,694	380,581,346	26,772,694	220,258,679	26,772,694	312,263,702	26,772,694	41,362,971
37	26,772,694	407,354,040	26,772,694	247,031,372	26,772,694	339,036,396	26,772,694	68,135,664
38	26,772,694	434,126,733	26,772,694	273,804,066	26,772,694	365,809,090	26,772,694	94,908,358
39	(2,219,056)	431,907,677	(2,219,056)	271,585,010	(2,219,056)	363,590,034	(2,219,056)	92,689,302
40	(2,219,056)	429,688,621	(2,219,056)	269,365,954	(2,219,056)	361,370,977	(2,219,056)	90,470,246
41	(2,219,056)	427,469,565	(2,219,056)	267,146,897	(2,219,056)	359,151,921	(2,219,056)	88,251,189
42	(2,219,056)	425,250,509	(2,219,056)	264,927,841	(2,219,056)	356,932,865	(2,219,056)	86,032,133
43	(2,219,056)	**423,031,452**	(2,219,056)	**262,708,785**	(2,219,056)	**354,713,809**	(2,219,056)	**83,813,077**
NPV	**423,031,452**		**262,708,785**		**354,713,809**		**83,813,077**	
IRR	43.6%		15.5%		27.0%		3.6%	

IRR and NPV Calculation for Quartile 3 (Including Unemployment) in Rupiah

Number of Working Year	Low-Cost Public College		High-Cost Public College		Low-Cost Private College		High-Cost Private College	
	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV	Current NPV	Accumulated NPV
In College	(66,029,207)	(66,029,207)	(226,351,875)	(226,351,875)	(134,346,851)	(134,346,851)	(405,247,583)	(405,247,583)
In College	(22,564,747)	(88,593,955)	(22,564,747)	(248,916,622)	(22,564,747)	(156,911,598)	(22,564,747)	(427,812,330)
In College	(22,564,747)	(111,158,702)	(22,564,747)	(271,481,369)	(22,564,747)	(179,476,346)	(22,564,747)	(450,377,077)
In College	(28,988,235)	(140,146,937)	(28,988,235)	(300,469,605)	(28,988,235)	(208,464,581)	(28,988,235)	(479,365,312)
In College	(28,988,235)	(169,135,172)	(28,988,235)	(329,457,840)	(28,988,235)	(237,452,816)	(28,988,235)	(508,353,548)
1	5,921,655	(163,213,518)	5,921,655	(323,536,185)	5,921,655	(231,531,161)	5,921,655	(502,431,893)
2	5,921,655	(157,291,863)	5,921,655	(317,614,530)	5,921,655	(225,609,507)	5,921,655	(496,510,238)
3	5,921,655	(151,370,208)	5,921,655	(311,692,875)	5,921,655	(219,687,852)	5,921,655	(490,588,583)
4	23,794,699	(127,575,509)	23,794,699	(287,898,176)	23,794,699	(195,893,152)	23,794,699	(466,793,884)
5	23,794,699	(103,780,809)	23,794,699	(264,103,477)	23,794,699	(172,098,453)	23,794,699	(442,999,184)
6	23,794,699	(79,986,110)	23,794,699	(240,308,777)	23,794,699	(148,303,753)	23,794,699	(419,204,485)
7	23,794,699	(56,191,410)	23,794,699	(216,514,078)	23,794,699	(124,509,054)	23,794,699	(395,409,786)
8	23,794,699	(32,396,711)	23,794,699	(192,719,378)	23,794,699	(100,714,355)	23,794,699	(371,615,086)
9	13,948,484	(18,448,227)	13,948,484	(178,770,895)	13,948,484	(86,765,871)	13,948,484	(357,666,603)
10	13,948,484	**(4,499,744)**	13,948,484	(164,822,411)	13,948,484	(72,817,388)	13,948,484	(343,718,119)

11	13,948,484	**9,448,740**	13,948,484	(150,873,928)	13,948,484	(58,868,904)	13,948,484	(329,769,636)
12	13,948,484	23,397,223	13,948,484	(136,925,444)	13,948,484	(44,920,421)	13,948,484	(315,821,152)
13	13,948,484	37,345,707	13,948,484	(122,976,961)	13,948,484	**(30,971,937)**	13,948,484	(301,872,669)
14	31,642,790	68,988,497	31,642,790	(91,334,171)	31,642,790	**670,853**	31,642,790	(270,229,878)
15	31,642,790	100,631,287	31,642,790	(59,691,380)	31,642,790	32,313,643	31,642,790	(238,587,088)
16	31,642,790	132,274,077	31,642,790	**(28,048,590)**	31,642,790	63,956,434	31,642,790	(206,944,298)
17	31,642,790	163,916,868	31,642,790	**3,594,200**	31,642,790	95,599,224	31,642,790	(175,301,508)
18	31,642,790	195,559,658	31,642,790	35,236,990	31,642,790	127,242,014	31,642,790	(143,658,717)
19	26,208,869	221,768,527	26,208,869	61,445,859	26,208,869	153,450,883	26,208,869	(117,449,849)
20	26,208,869	247,977,395	26,208,869	87,654,728	26,208,869	179,659,752	26,208,869	(91,240,980)
21	26,208,869	274,186,264	26,208,869	113,863,597	26,208,869	205,868,621	26,208,869	(65,032,111)
22	26,208,869	300,395,133	26,208,869	140,072,466	26,208,869	232,077,489	26,208,869	(38,823,242)
23	26,208,869	326,604,002	26,208,869	166,281,334	26,208,869	258,286,358	26,208,869	**(12,614,373)**
24	33,590,581	360,194,583	33,590,581	199,871,915	33,590,581	291,876,939	33,590,581	**20,976,207**
25	33,590,581	393,785,164	33,590,581	233,462,496	33,590,581	325,467,520	33,590,581	54,566,788
26	33,590,581	427,375,744	33,590,581	267,053,077	33,590,581	359,058,101	33,590,581	88,157,369
27	33,590,581	460,966,325	33,590,581	300,643,658	33,590,581	392,648,681	33,590,581	121,747,950
28	33,590,581	494,556,906	33,590,581	334,234,239	33,590,581	426,239,262	33,590,581	155,338,531

29	31,392,940	525,949,846	31,392,940	365,627,179	31,392,940	457,632,203	31,392,940	186,731,471
30	31,392,940	557,342,787	31,392,940	397,020,119	31,392,940	489,025,143	31,392,940	218,124,412
31	31,392,940	588,735,727	31,392,940	428,413,060	31,392,940	520,418,084	31,392,940	249,517,352
32	31,392,940	620,128,668	31,392,940	459,806,000	31,392,940	551,811,024	31,392,940	280,910,292
33	31,392,940	651,521,608	31,392,940	491,198,941	31,392,940	583,203,964	31,392,940	312,303,233
34	45,823,904	697,345,512	45,823,904	537,022,845	45,823,904	629,027,869	45,823,904	358,127,137
35	45,823,904	743,169,417	45,823,904	582,846,749	45,823,904	674,851,773	45,823,904	403,951,041
36	45,823,904	788,993,321	45,823,904	628,670,654	45,823,904	720,675,677	45,823,904	449,774,946
37	45,823,904	834,817,225	45,823,904	674,494,558	45,823,904	766,499,582	45,823,904	495,598,850
38	45,823,904	880,641,130	45,823,904	720,318,462	45,823,904	812,323,486	45,823,904	541,422,754
39	(2,699,803)	877,941,326	(2,699,803)	717,618,659	(2,699,803)	809,623,683	(2,699,803)	538,722,951
40	(2,699,803)	875,241,523	(2,699,803)	714,918,856	(2,699,803)	806,923,879	(2,699,803)	536,023,148
41	(2,699,803)	872,541,720	(2,699,803)	712,219,052	(2,699,803)	804,224,076	(2,699,803)	533,323,344
42	(2,699,803)	869,841,916	(2,699,803)	709,519,249	(2,699,803)	801,524,273	(2,699,803)	530,623,541
43	(2,699,803)	**867,142,113**	(2,699,803)	**706,819,445**	(2,699,803)	**798,824,469**	(2,699,803)	**527,923,738**
NPV	**867,142,113**		**706,819,445**		**798,824,469**		**527,923,738**	
IRR	59.4%		29.9%		42.1%		16.9%	

Capital Stocks Series for Indonesia at Constant 2010 US$

Year	GDP(Y)	Investment	Depreciation	K	K/Y
1969	82,409,484,955	7,829,125,635		112,001,766,276	1.36
1970	88,635,220,348	10,408,837,530	6,005,487,473	116,405,116,333	1.31
1971	94,860,955,741	12,598,592,976	6,185,683,277	122,818,026,032	1.29
1972	101,536,931,350	14,998,324,972	6,641,972,518	131,174,378,486	1.29
1973	109,765,459,426	17,548,040,217	7,148,902,964	141,573,515,739	1.29
1974	118,145,693,216	20,918,193,636	7,693,515,413	154,798,193,962	1.31
1975	124,026,159,829	23,971,668,846	8,068,877,629	170,700,985,179	1.38
1976	132,567,301,909	25,409,794,658	8,672,694,235	187,438,085,602	1.41
1977	144,181,954,870	29,452,526,109	9,421,734,962	207,468,876,749	1.44
1978	153,938,848,478	33,888,926,342	10,034,832,451	231,322,970,640	1.50
1979	165,213,806,159	35,386,610,901	10,802,052,665	255,907,528,876	1.55
1980	181,537,058,284	42,068,811,646	11,845,836,623	286,130,503,898	1.58
1981	195,927,785,589	46,753,615,429	11,854,761,220	321,029,358,106	1.64
1982	200,329,196,198	52,828,607,497	12,465,403,557	361,392,562,047	1.80
1983	208,728,934,024	56,961,403,392	10,458,558,235	407,895,407,204	1.95
1984	223,288,878,862	53,533,987,599	11,180,848,254	450,248,546,548	2.02
1985	228,786,571,622	57,394,146,090	11,467,308,227	496,175,384,411	2.17
1986	242,227,885,896	62,678,054,390	12,130,853,370	546,722,585,430	2.26
1987	254,159,855,613	66,116,296,066	12,736,951,610	600,101,929,885	2.36
1988	268,851,562,224	73,735,669,012	12,804,210,703	661,033,388,194	2.46
1989	288,898,712,661	83,587,807,018	14,481,267,836	730,139,927,376	2.53
1990	309,821,137,734	95,769,557,843	15,444,343,625	810,465,141,594	2.62
1991	331,235,921,597	102,018,432,618	16,657,597,666	895,825,976,546	2.70
1992	352,757,997,188	107,057,149,315	17,652,167,641	985,230,958,221	2.79
1993	375,674,596,363	113,148,609,910	18,841,052,138	1,079,538,515,993	2.87
1994	404,000,352,342	128,713,001,356	20,249,459,914	1,188,002,057,435	2.94
1995	437,209,211,197	146,726,215,456	21,874,282,637	1,312,853,990,254	3.00
1996	471,391,045,245	168,022,630,074	23,563,005,633	1,457,313,614,694	3.09
1997	493,545,853,300	182,418,814,178	24,777,671,578	1,614,954,757,295	3.27
1998	428,759,443,958	122,205,741,797	21,495,262,530	1,715,665,236,562	4.00
1999	432,151,471,748	99,969,852,433	21,659,546,571	1,793,975,542,423	4.15
2000	453,413,616,928	116,702,059,556	22,794,497,899	1,887,883,104,080	4.16
2001	469,933,589,928	124,278,904,008	86,504,653,079	1,925,657,355,010	4.10
2002	491,078,136,160	130,113,093,272	90,893,321,122	1,964,877,127,160	4.00
2003	514,553,483,744	130,894,170,481	95,265,410,854	2,000,505,886,787	3.89
2004	540,440,020,891	150,113,754,485	99,890,178,559	2,050,729,462,712	3.79
2005	571,204,954,435	166,456,861,816	105,661,129,864	2,111,525,194,665	3.70
2006	602,626,663,573	170,779,547,330	111,444,645,875	2,170,860,096,119	3.60
2007	640,863,459,320	186,702,827,275	118,398,099,734	2,239,164,823,660	3.49
2008	679,403,088,245	208,894,563,912	125,370,353,003	2,322,689,034,570	3.42
2009	710,851,782,010	215,774,320,908	131,342,973,034	2,407,120,382,444	3.39
2010	755,094,160,363	234,074,725,789	139,774,052,478	2,501,421,055,754	3.31
2011	801,681,840,622	254,812,837,590	146,416,946,581	2,609,816,946,764	3.26
2012	850,023,661,688	278,064,720,027	157,799,375,540	2,730,082,291,251	3.21
2013	897,261,717,987	291,996,536,260	166,385,490,191	2,855,693,337,319	3.18
2014	942,184,637,117	304,987,746,528	175,140,538,826	2,985,540,545,020	3.17
2015	988,128,596,686	320,265,919,871	183,049,590,744	3,122,756,874,147	3.16
2016	1,037,861,792,573	334,591,825,959	170,767,474,767	3,286,581,225,339	3.17
2017	1,090,454,467,115	355,182,519,989	200,194,117,528	3,441,569,627,800	3.16
2018	1,146,844,815,417	378,872,855,272	-	3,820,442,483,072	3.33

Capital Stocks Series for Malaysia at Constant 2010 US$

Year	GDP(Y)	Investment	Depreciation	K	K/Y
1969	19,530,147,389	2,458,298,407	-	20,819,921,700	1.07
1970	20,699,327,206	3,149,376,642	1,848,628,878	22,120,669,463	1.07
1971	22,776,434,434	3,741,841,607	2,038,499,621	23,824,011,450	1.05
1972	24,914,787,452	4,295,956,537	2,283,044,189	25,836,923,798	1.04
1973	27,830,087,065	5,004,253,361	2,514,939,359	28,326,237,799	1.02
1974	30,145,177,934	6,098,395,486	2,736,520,919	31,688,112,366	1.05
1975	30,386,661,336	5,645,242,464	3,216,982,188	34,116,372,641	1.12
1976	33,900,419,813	5,927,778,275	3,556,550,085	36,487,600,831	1.08
1977	36,528,739,153	6,792,604,638	3,793,470,625	39,486,734,845	1.08
1978	38,959,322,083	7,342,023,998	4,221,184,380	42,607,574,463	1.09
1979	42,601,668,038	8,742,181,398	4,648,619,504	46,701,136,357	1.10
1980	45,772,010,380	10,903,073,639	5,102,731,021	52,501,478,976	1.15
1981	48,949,551,035	12,874,565,180	6,002,843,838	59,373,200,318	1.21
1982	51,858,697,478	13,905,312,843	7,007,945,514	66,270,567,647	1.28
1983	55,101,022,942	15,021,368,508	7,833,555,495	73,458,380,660	1.33
1984	59,377,848,697	15,465,913,694	8,296,547,925	80,627,746,428	1.36
1985	58,769,077,154	14,000,012,604	9,513,381,690	85,114,377,343	1.45
1986	59,498,163,343	11,427,447,611	10,904,498,048	85,637,326,905	1.44
1987	62,587,267,591	10,921,075,192	11,001,105,471	85,557,296,626	1.37
1988	68,807,014,798	13,455,539,629	11,418,420,348	87,594,415,908	1.27
1989	75,040,655,707	17,225,822,980	11,935,042,010	92,885,196,877	1.24
1990	81,800,713,542	21,889,726,336	12,710,280,296	102,064,642,917	1.25
1991	89,608,973,984	26,785,423,396	14,582,817,554	114,267,248,758	1.28
1992	97,570,837,043	29,729,185,744	15,859,177,265	128,137,257,237	1.31
1993	107,225,416,100	35,020,758,871	17,733,572,389	145,424,443,719	1.36
1994	117,103,066,251	40,666,118,748	20,086,956,367	166,003,606,100	1.42
1995	128,613,226,382	49,954,277,203	22,630,925,463	193,326,957,840	1.50
1996	141,478,022,477	54,058,829,189	26,498,928,722	220,886,858,307	1.56
1997	151,838,092,825	59,011,863,773	29,739,294,398	250,159,427,682	1.65
1998	140,663,697,153	33,656,843,097	34,060,499,134	249,755,771,645	1.78
1999	149,297,089,131	31,455,428,053	34,163,371,053	247,047,828,644	1.65
2000	162,523,121,449	39,765,789,792	32,725,775,429	254,087,843,008	1.56
2001	163,364,463,537	38,945,690,137	34,352,612,490	258,680,920,655	1.58
2002	172,171,422,651	39,170,677,129	34,681,174,483	263,170,423,301	1.53
2003	182,137,564,217	40,284,583,341	34,876,780,287	268,578,226,355	1.47
2004	194,492,752,476	41,716,118,283	34,520,560,191	275,773,784,446	1.42
2005	204,863,376,673	43,791,653,628	33,780,656,865	285,784,781,209	1.40
2006	216,304,682,965	46,534,637,018	35,919,304,752	296,400,113,475	1.37
2007	229,929,251,902	51,557,578,808	37,511,412,152	310,446,280,132	1.35
2008	241,038,904,256	52,841,448,729	37,671,362,120	325,616,366,740	1.35
2009	237,390,711,217	51,527,103,039	40,844,104,582	336,299,365,197	1.42
2010	255,016,609,233	57,213,995,219	41,901,726,380	351,611,634,036	1.38
2011	268,516,966,254	60,847,536,556	41,295,255,310	371,163,915,282	1.38
2012	283,214,119,400	72,398,559,498	43,905,482,117	399,656,992,664	1.41
2013	296,507,404,303	78,284,436,994	45,781,148,521	432,160,281,137	1.46
2014	314,317,779,640	82,034,708,640	51,024,969,550	463,170,020,227	1.47
2015	330,321,318,804	84,998,292,509	53,790,961,977	494,377,350,759	1.50
2016	345,019,810,731	87,166,925,424	57,178,139,614	524,366,136,569	1.52
2017	364,830,260,268	92,441,782,258	61,599,313,179	555,208,605,648	1.52
2018	382,129,075,421	93,690,414,471	-	648,899,020,119	1.70

Capital Stocks Series for the Philippines at Constant 2010 US$

Year	GDP(Y)	Investment	Depreciation	K	K/Y
1969	43,373,585,465	7,840,780,438	-	68,792,733,915	1.59
1970	45,006,429,570	7,219,000,693	5,052,613,976	70,959,120,632	1.58
1971	47,449,662,724	7,805,428,839	4,995,697,093	73,768,852,378	1.55
1972	50,034,146,732	8,024,430,081	5,305,971,946	76,487,310,513	1.53
1973	54,497,516,253	8,417,126,360	5,134,965,972	79,769,470,902	1.46
1974	56,436,600,597	9,836,933,356	4,380,028,012	85,226,376,246	1.51
1975	59,577,169,661	12,983,225,657	4,532,043,734	93,677,558,169	1.57
1976	64,823,910,896	15,487,701,387	4,733,357,243	104,431,902,313	1.61
1977	68,455,382,412	15,958,375,382	4,944,901,880	115,445,375,814	1.69
1978	71,995,965,495	17,220,312,601	5,177,221,523	127,488,466,892	1.77
1979	76,056,304,499	17,836,732,179	5,811,327,366	139,513,871,704	1.83
1980	79,972,376,152	19,234,970,869	5,614,658,001	153,134,184,572	1.91
1981	82,710,045,855	21,568,559,266	5,873,495,316	168,829,248,522	2.04
1982	85,703,593,378	22,670,329,495	6,145,328,394	185,354,249,623	2.16
1983	87,310,207,053	24,584,931,251	6,879,271,320	203,059,909,554	2.33
1984	80,915,884,625	17,543,199,047	7,463,044,425	213,140,064,176	2.63
1985	75,003,677,449	12,018,012,148	7,432,916,201	217,725,160,123	2.90
1986	77,566,390,204	12,134,787,286	7,645,592,763	222,214,354,646	2.86
1987	80,910,769,692	12,969,952,856	7,580,274,142	227,604,033,359	2.81
1988	86,374,305,406	15,091,686,906	7,258,760,958	235,436,959,307	2.73
1989	91,734,099,781	18,352,712,376	7,175,022,020	246,614,649,663	2.69
1990	94,520,033,472	21,104,266,425	7,234,918,755	260,483,997,333	2.76
1991	93,973,391,366	18,110,100,860	7,409,230,506	271,184,867,687	2.89
1992	94,290,648,383	19,267,770,007	7,610,030,266	282,842,607,428	3.00
1993	96,286,128,144	20,946,141,404	8,592,194,641	295,196,554,190	3.07
1994	100,510,800,777	22,511,183,487	8,996,890,136	308,710,847,542	3.07
1995	105,213,391,792	23,567,775,140	9,494,074,032	322,784,548,650	3.07
1996	111,364,033,552	26,399,348,876	9,764,349,977	339,419,547,550	3.05
1997	117,138,662,136	29,428,483,172	10,047,442,109	358,800,588,613	3.06
1998	116,463,102,215	26,140,912,094	10,419,913,630	374,521,587,077	3.22
1999	120,052,397,730	24,599,139,542	10,250,004,273	388,870,722,345	3.24
2000	125,348,175,702	27,418,389,506	10,290,736,501	405,998,375,350	3.24
2001	128,975,735,689	26,658,312,663	11,213,256,945	421,443,431,068	3.27
2002	133,678,066,316	27,443,736,624	11,700,317,035	437,186,850,658	3.27
2003	140,322,359,078	29,269,801,663	12,483,989,139	453,972,663,182	3.24
2004	149,720,622,535	29,900,809,185	17,147,668,200	466,725,804,167	3.12
2005	156,873,776,537	30,606,188,370	18,198,178,154	479,133,814,383	3.05
2006	165,098,606,450	32,256,208,113	19,010,405,454	492,379,617,041	2.98
2007	176,022,623,675	33,946,454,704	20,169,199,705	506,156,872,040	2.88
2008	183,332,415,225	35,015,948,094	20,742,997,626	520,429,822,508	2.84
2009	185,437,680,419	34,403,733,048	20,360,472,205	534,473,083,351	2.88
2010	199,590,775,190	40,961,206,463	21,991,496,621	553,442,793,193	2.77
2011	206,895,301,780	40,186,855,076	21,510,482,300	572,119,165,969	2.77
2012	220,723,809,025	44,529,063,032	21,936,602,913	594,711,626,089	2.69
2013	236,315,792,451	49,796,135,591	23,772,063,385	620,735,698,295	2.63
2014	250,838,103,975	53,367,494,935	25,052,431,866	649,050,761,364	2.59
2015	266,055,320,224	62,385,137,961	23,783,975,404	687,651,923,921	2.58
2016	284,370,714,897	78,671,562,152	25,592,645,726	740,730,840,347	2.60
2017	303,359,721,709	86,074,393,764	27,520,321,184	799,284,912,927	2.63
2018	322,300,707,148	97,181,493,041	-	896,466,405,968	2.78

Capital Stocks Series for Singapore at Constant 2010 US$

Year	GDP(Y)	Investment	Depreciation	K	K/Y
1969	12,356,734,810	2,605,649,099	-	24,682,382,272	2.00
1970	14,079,541,349	3,471,795,148	875,526,052	27,278,651,368	1.94
1971	15,827,351,825	4,319,220,462	1,082,823,106	30,515,048,724	1.93
1972	17,934,796,405	4,956,349,508	1,326,743,307	34,144,654,926	1.90
1973	19,836,433,925	5,293,738,771	1,536,021,797	37,902,371,900	1.91
1974	21,049,864,466	5,862,849,144	1,877,340,055	41,887,880,989	1.99
1975	21,888,095,071	5,841,632,310	2,216,598,700	45,512,914,599	2.08
1976	23,516,027,513	6,144,284,208	2,650,108,261	49,007,090,545	2.08
1977	25,127,408,052	6,229,775,568	2,995,418,856	52,241,447,257	2.08
1978	27,081,659,491	7,033,865,845	3,351,738,057	55,923,575,046	2.06
1979	29,669,038,812	7,976,836,248	3,651,161,631	60,249,249,663	2.03
1980	32,669,581,794	9,625,301,052	4,132,507,882	65,742,042,832	2.01
1981	36,203,166,472	11,174,476,619	4,747,324,668	72,169,194,783	1.99
1982	38,774,275,624	13,524,691,676	5,329,816,932	80,364,069,527	2.07
1983	42,091,347,330	15,014,723,585	5,847,879,134	89,530,913,977	2.13
1984	45,792,071,007	16,485,826,749	6,374,177,627	99,642,563,099	2.18
1985	45,506,955,681	14,553,222,776	7,035,370,499	107,160,415,376	2.35
1986	46,117,967,403	12,762,827,059	7,683,734,041	112,239,508,395	2.43
1987	51,097,695,329	12,838,403,364	8,348,050,824	116,729,860,935	2.28
1988	56,853,249,666	13,570,730,819	8,714,176,431	121,586,415,323	2.14
1989	62,628,807,153	15,719,177,944	9,214,207,955	128,091,385,313	2.05
1990	68,779,564,576	17,489,327,532	9,682,920,023	135,897,792,822	1.98
1991	73,379,866,548	19,814,234,927	10,266,661,998	145,445,365,752	1.98
1992	78,252,042,324	22,183,309,393	11,294,337,209	156,334,337,935	2.00
1993	87,221,976,137	24,352,349,327	12,299,877,380	168,386,809,882	1.93
1994	96,901,528,751	26,763,926,797	12,910,595,889	182,240,140,790	1.88
1995	103,879,388,267	30,044,701,102	13,071,077,220	199,213,764,672	1.92
1996	111,640,540,158	37,289,764,583	13,694,408,664	222,809,120,591	2.00
1997	120,928,833,969	41,225,209,958	14,947,522,024	249,086,808,526	2.06
1998	118,274,049,667	39,154,904,571	16,984,192,648	271,257,520,449	2.29
1999	125,044,059,546	37,391,827,262	18,700,615,839	289,948,731,872	2.32
2000	136,347,036,849	41,660,016,384	19,028,345,739	312,580,402,518	2.29
2001	134,889,342,487	39,490,699,105	20,619,052,890	331,452,048,734	2.46
2002	140,169,822,003	35,875,724,995	21,874,512,283	345,453,261,446	2.46
2003	146,527,654,292	34,025,838,940	23,454,591,631	356,024,508,755	2.43
2004	160,915,976,666	37,528,488,635	24,008,282,959	369,544,714,431	2.30
2005	172,757,841,656	38,894,478,334	25,242,150,806	383,197,041,958	2.22
2006	188,315,010,084	42,565,406,643	26,304,827,079	399,457,621,523	2.12
2007	205,305,009,805	49,165,090,087	27,003,682,695	421,619,028,915	2.05
2008	209,140,543,445	54,453,212,637	29,826,894,156	446,245,347,397	2.13
2009	209,393,611,470	57,441,042,094	30,968,513,092	472,717,876,398	2.26
2010	239,809,387,605	61,318,591,859	31,424,741,827	502,611,726,431	2.10
2011	254,826,893,577	65,221,795,967	32,642,666,181	535,190,856,216	2.10
2012	266,164,946,827	70,850,219,895	34,482,637,908	571,558,438,203	2.15
2013	278,980,908,891	75,213,815,435	36,802,358,949	609,969,894,689	2.19
2014	289,862,763,533	78,388,020,217	39,348,517,571	649,009,397,335	2.24
2015	298,247,041,731	79,924,437,950	41,988,001,856	686,945,833,429	2.30
2016	307,082,095,146	80,803,064,490	43,683,603,259	724,065,294,659	2.36
2017	318,443,461,927	85,945,511,980	44,503,756,222	765,507,050,418	2.40
2018	328,440,881,504	82,524,124,147	-	848,031,174,565	2.58

Capital Stocks Series for Thailand at Constant 2010 US$

Year	GDP(Y)	Investment	Depreciation	K	K/Y
1969	30,760,009,015	10,317,563,778	-	114,598,405,213	3.73
1970	34,269,095,176	12,101,125,677	2,522,822,252	124,176,708,639	3.62
1971	35,946,695,469	12,164,663,926	2,875,384,929	133,465,987,636	3.71
1972	37,484,677,724	12,259,971,300	3,041,137,921	142,684,821,015	3.81
1973	41,321,771,650	13,498,634,497	2,937,977,858	153,245,477,654	3.71
1974	43,167,306,675	13,466,865,371	2,861,778,127	163,850,564,898	3.80
1975	45,312,896,743	13,371,557,997	3,233,491,872	173,988,631,023	3.84
1976	49,539,145,018	15,118,444,024	3,576,058,433	185,531,016,615	3.75
1977	54,415,512,545	18,739,292,571	3,899,073,938	200,371,235,248	3.68
1978	60,017,995,792	20,803,786,679	4,165,747,020	217,009,274,906	3.62
1979	63,242,022,392	21,629,534,421	4,500,127,427	234,138,681,900	3.70
1980	66,513,874,353	22,423,596,205	5,803,048,969	250,759,229,137	3.77
1981	70,442,760,955	23,882,564,142	6,241,406,464	268,400,386,814	3.81
1982	74,213,103,191	23,767,297,109	6,815,852,112	285,351,831,811	3.85
1983	78,357,313,132	27,229,050,539	7,480,917,419	305,099,964,931	3.89
1984	82,864,762,917	28,828,650,909	8,315,870,621	325,612,745,218	3.93
1985	86,715,687,620	27,747,585,857	9,087,964,267	344,272,366,808	3.97
1986	91,514,384,421	27,557,054,276	9,936,120,024	361,893,301,060	3.95
1987	100,225,589,276	32,634,708,467	10,706,230,743	383,821,778,784	3.83
1988	113,543,679,908	39,797,398,576	11,590,815,975	412,028,361,386	3.63
1989	127,385,229,005	48,761,281,618	12,911,774,934	447,877,868,069	3.52
1990	141,610,545,732	63,194,776,663	16,480,661,778	494,591,982,954	3.49
1991	153,729,944,878	71,208,330,425	18,057,616,246	547,742,697,132	3.56
1992	166,156,532,831	75,934,195,614	19,081,864,291	604,595,028,455	3.64
1993	179,866,180,005	82,977,793,093	21,325,593,401	666,247,228,147	3.70
1994	194,249,907,287	92,542,011,614	23,780,877,411	735,008,362,349	3.78
1995	210,023,508,390	103,526,693,807	26,485,204,099	812,049,852,058	3.87
1996	221,894,822,451	110,759,533,754	29,454,133,375	893,355,252,436	4.03
1997	215,784,747,526	86,625,414,096	33,544,653,089	946,436,013,443	4.39
1998	199,312,314,683	48,487,299,953	36,790,796,872	958,132,516,525	4.81
1999	208,425,468,396	46,310,538,003	36,180,010,662	968,263,043,866	4.65
2000	217,712,232,033	47,742,395,768	39,024,776,009	976,980,663,625	4.49
2001	225,210,772,012	48,618,434,127	41,561,469,928	984,037,627,824	4.37
2002	239,058,711,719	51,629,006,864	39,638,468,597	996,028,166,091	4.17
2003	256,245,431,314	58,154,187,835	39,547,826,766	1,014,634,527,160	3.96
2004	272,361,445,882	67,380,177,384	39,972,020,663	1,042,042,683,881	3.83
2005	283,767,493,632	77,001,652,247	42,041,052,438	1,077,003,283,690	3.80
2006	297,864,826,689	79,013,710,327	43,660,043,898	1,112,356,950,119	3.73
2007	314,054,055,752	80,400,277,591	44,645,735,958	1,148,111,491,752	3.66
2008	319,473,585,807	82,278,301,926	47,988,212,343	1,182,401,581,335	3.70
2009	317,266,875,218	73,334,060,950	48,993,765,396	1,206,741,876,889	3.80
2010	341,105,009,515	81,840,262,327	50,165,153,912	1,238,416,985,303	3.63
2011	343,970,153,354	85,825,377,200	52,958,866,866	1,271,283,495,637	3.70
2012	368,883,177,547	95,031,559,812	58,573,854,398	1,307,741,201,051	3.55
2013	378,796,469,985	94,070,331,204	60,956,999,400	1,340,854,532,855	3.54
2014	382,525,395,709	91,990,561,986	63,844,117,095	1,369,000,977,746	3.58
2015	394,513,347,464	96,007,082,086	67,104,122,237	1,397,903,937,595	3.54
2016	407,755,144,071	98,750,240,754	69,519,908,792	1,427,134,269,557	3.50
2017	424,163,560,844	100,533,110,113	77,633,373,016	1,450,034,006,654	3.42
2018	441,678,233,316	104,308,434,811	-	1,554,342,441,466	3.52

Macroeconometric Analysis Simulation Results

GDP (Rupiah)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	7,949,295,000,000,000	7,949,295,000,000,000	7,948,506,000,000,000	7,950,083,000,000,000	7,949,295,000,000,000
2013	8,492,052,000,000,000	8,510,918,000,000,000	8,509,204,000,000,000	8,493,759,000,000,000	8,492,052,000,000,000
2014	8,819,247,000,000,000	8,862,094,000,000,000	8,859,481,000,000,000	8,821,842,000,000,000	8,819,247,000,000,000
2015	8,899,419,000,000,000	8,961,749,000,000,000	8,958,328,000,000,000	8,901,461,000,000,000	8,898,072,000,000,000
2016	8,847,083,000,000,000	8,925,829,000,000,000	8,921,579,000,000,000	8,847,818,000,000,000	8,843,614,000,000,000
2017	9,131,404,000,000,000	9,226,907,000,000,000	9,221,581,000,000,000	9,130,430,000,000,000	9,125,169,000,000,000

K (Rupiah)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	22,402,700,000,000,000	22,402,700,000,000,000	22,355,420,000,000,000	22,449,970,000,000,000	22,402,700,000,000,000
2013	23,719,740,000,000,000	23,733,860,000,000,000	23,660,560,000,000,000	23,793,040,000,000,000	23,719,740,000,000,000
2014	25,033,920,000,000,000	25,077,450,000,000,000	24,977,240,000,000,000	25,134,110,000,000,000	25,033,920,000,000,000
2015	26,049,500,000,000,000	26,132,060,000,000,000	26,001,840,000,000,000	26,178,680,000,000,000	26,048,500,000,000,000
2016	27,002,760,000,000,000	27,131,050,000,000,000	26,967,250,000,000,000	27,163,110,000,000,000	26,999,390,000,000,000
2017	27,835,010,000,000,000	28,016,380,000,000,000	27,819,620,000,000,000	28,024,240,000,000,000	27,827,600,000,000,000

HC_EL (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	131,862,700	131,862,700	131,862,700	131,862,700	131,862,700
2013	139,181,600	139,454,800	139,454,800	139,181,600	139,181,600
2014	143,219,300	143,826,800	143,826,800	143,219,300	143,219,300
2015	143,714,900	144,582,900	144,582,900	143,695,700	143,695,700
2016	142,489,500	143,571,500	143,571,500	142,440,600	142,440,600
2017	146,085,900	147,376,500	147,376,500	145,999,300	145,999,300

EL_ES (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	33,389,050	33,389,050	33,389,050	33,389,050	33,389,050
2013	33,395,960	33,396,890	33,396,890	33,395,960	33,395,960
2014	33,353,280	33,355,400	33,355,400	33,353,280	33,353,280
2015	33,267,280	33,270,530	33,270,530	33,267,300	33,267,300
2016	33,206,460	33,210,720	33,210,720	33,206,540	33,206,540
2017	33,153,080	33,158,140	33,158,140	33,153,220	33,153,220

EL_JHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	20,923,330	20,923,330	20,923,330	20,923,330	20,923,330
2013	21,412,650	21,433,810	21,433,810	21,412,650	21,412,650
2014	21,678,270	21,722,060	21,722,060	21,678,270	21,678,270
2015	21,834,080	21,899,530	21,899,530	21,834,310	21,834,310
2016	21,864,570	21,950,130	21,950,130	21,865,240	21,865,240
2017	21,829,250	21,931,650	21,931,650	21,830,530	21,830,530

EL_SHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	27,389,930	27,389,930	27,389,930	27,389,930	27,389,930
2013	28,521,340	28,529,380	28,529,380	28,521,340	28,521,340
2014	29,663,830	29,685,630	29,685,630	29,663,830	29,663,830
2015	30,816,350	30,855,590	30,855,590	30,817,040	30,817,040
2016	31,949,070	32,008,140	32,008,140	31,951,570	31,951,570
2017	33,079,950	33,159,630	33,159,630	33,085,680	33,085,680

EL_COLL (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	9,985,493	9,985,493	9,985,493	9,985,493	9,985,493
2013	10,767,650	10,847,540	10,847,540	10,767,650	10,767,650
2014	11,571,090	11,753,050	11,753,050	11,571,090	11,571,090
2015	12,379,760	12,669,510	12,669,510	12,371,930	12,371,930
2016	13,167,830	13,567,130	13,567,130	13,144,770	13,144,770
2017	14,071,960	14,577,720	14,577,720	14,027,050	14,027,050

LF_ES (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	34,963,740	34,963,740	34,963,740	34,963,740	34,963,740
2013	34,971,890	34,972,990	34,972,990	34,971,890	34,971,890
2014	34,921,580	34,924,070	34,924,070	34,921,580	34,921,580
2015	34,820,210	34,824,040	34,824,040	34,820,240	34,820,240
2016	34,748,550	34,753,570	34,753,570	34,748,640	34,748,640
2017	34,685,660	34,691,620	34,691,620	34,685,830	34,685,830

LF_JHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	23,075,830	23,075,830	23,075,830	23,075,830	23,075,830
2013	23,638,360	23,662,700	23,662,700	23,638,360	23,638,360
2014	23,943,950	23,994,350	23,994,350	23,943,950	23,943,950
2015	24,123,280	24,198,620	24,198,620	24,123,550	24,123,550
2016	24,158,380	24,256,890	24,256,890	24,159,150	24,159,150
2017	24,117,720	24,235,610	24,235,610	24,119,190	24,119,190

LF_SHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	31,006,050	31,006,050	31,006,050	31,006,050	31,006,050
2013	32,284,150	32,309,750	32,309,750	32,284,150	32,284,150
2014	33,547,890	33,600,410	33,600,410	33,547,890	33,547,890
2015	34,822,020	34,901,250	34,901,250	34,824,210	34,824,210
2016	36,014,110	36,119,770	36,119,770	36,020,600	36,020,600
2017	37,243,300	37,373,080	37,373,080	37,256,260	37,256,260

LF_COLL (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	11,019,080	11,019,080	11,019,080	11,019,080	11,019,080
2013	11,868,940	11,975,320	11,975,320	11,868,940	11,868,940
2014	12,741,460	12,963,460	12,963,460	12,741,460	12,741,460
2015	13,615,410	13,954,930	13,954,930	13,605,020	13,605,020
2016	14,460,600	14,918,480	14,918,480	14,431,960	14,431,960
2017	15,464,560	16,036,440	16,036,440	15,410,710	15,410,710

ST_ES (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	29,906,710	30,028,670	30,028,670	29,906,710	29,906,710
2013	29,914,550	30,084,870	30,084,870	29,914,550	29,914,550
2014	29,839,720	30,024,230	30,024,230	29,843,150	29,843,150
2015	29,671,830	29,858,560	29,858,560	29,678,730	29,678,730
2016	29,674,520	29,851,160	29,851,160	29,684,310	29,684,310
2017	29,494,560	29,675,980	29,675,980	29,506,500	29,506,500

ST_JHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	12,371,010	12,674,320	12,674,320	12,371,010	12,371,010
2013	12,688,590	13,031,060	13,031,060	12,688,590	12,688,590
2014	13,098,010	13,452,070	13,452,070	13,101,410	13,101,410
2015	13,272,870	13,629,030	13,629,030	13,279,490	13,279,490
2016	13,610,420	13,945,830	13,945,830	13,620,400	13,620,400
2017	13,897,120	14,264,810	14,264,810	13,910,480	13,910,480

ST_SHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	9,534,951	9,745,162	9,745,162	9,534,951	9,534,951
2013	9,582,730	9,800,177	9,800,177	9,582,730	9,582,730
2014	9,899,752	10,118,870	10,118,870	9,916,902	9,916,902
2015	9,634,077	9,843,989	9,843,989	9,666,157	9,666,157
2016	10,001,960	10,199,940	10,199,940	10,050,970	10,050,970
2017	10,035,110	10,251,370	10,251,370	10,099,590	10,099,590

ST_COLL (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	6,636,284	7,087,630	7,087,630	6,636,284	6,636,284
2013	6,860,679	7,341,283	7,341,283	6,860,679	6,860,679
2014	6,937,376	7,411,590	7,411,590	6,898,409	6,898,409
2015	6,994,731	7,465,737	7,465,737	6,928,521	6,928,521
2016	7,580,967	8,044,293	8,044,293	7,487,077	7,487,077
2017	7,639,912	8,149,305	8,149,305	7,528,503	7,528,503

BUILD_ES (Buildings)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	168,634	168,634	168,634	168,634	168,634
2013	169,971	169,971	169,971	170,790	170,790
2014	171,431	171,431	171,431	172,795	172,795
2015	172,328	172,328	172,328	174,094	174,094
2016	172,909	172,909	172,909	174,966	174,966
2017	173,105	173,105	173,105	175,483	175,483

BUILD_JHS (Buildings)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	47,398	47,398	47,398	47,398	47,398
2013	49,054	49,054	49,054	49,308	49,308
2014	50,852	50,852	50,852	51,359	51,359
2015	52,583	52,583	52,583	53,356	53,356
2016	54,268	54,268	54,268	55,315	55,315
2017	55,844	55,844	55,844	57,210	57,210

BUILD_SHS (Buildings)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	28,389	28,389	28,389	28,389	28,389
2013	29,613	29,613	29,613	29,785	29,785
2014	30,940	30,940	30,940	31,285	31,285
2015	32,230	32,230	32,230	32,760	32,760
2016	33,495	33,495	33,495	34,218	34,218
2017	34,691	34,691	34,691	35,641	35,641

BUILD_COLL (Buildings)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	3,691	3,691	3,691	3,691	3,691
2013	3,945	3,945	3,945	4,096	4,096
2014	4,243	4,243	4,243	4,520	4,520
2015	4,450	4,450	4,450	4,835	4,835
2016	4,598	4,598	4,598	5,071	5,071
2017	4,665	4,665	4,665	5,229	5,229

TC_ES (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	1,759,245	1,791,187	1,791,187	1,759,245	1,759,245
2013	1,775,694	1,811,890	1,811,890	1,775,694	1,775,694
2014	1,787,447	1,825,275	1,825,275	1,787,447	1,787,447
2015	1,820,110	1,857,203	1,857,203	1,820,110	1,820,110
2016	1,836,828	1,875,451	1,875,451	1,836,828	1,836,828
2017	1,845,138	1,883,550	1,883,550	1,845,138	1,845,138

TC_JHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	886,643	923,094	923,094	886,643	886,643
2013	902,048	942,193	942,193	902,048	902,048
2014	913,048	954,348	954,348	913,048	913,048
2015	950,658	991,314	991,314	950,658	950,658
2016	967,264	1,010,092	1,010,092	967,264	967,264
2017	974,438	1,016,949	1,016,949	974,438	974,438

TC_SHS (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	665,861	681,611	681,611	665,861	665,861
2013	674,103	692,068	692,068	674,103	674,103
2014	680,014	698,870	698,870	680,014	680,014
2015	696,231	714,851	714,851	696,231	696,231
2016	704,669	724,115	724,115	704,669	704,669
2017	708,922	728,299	728,299	708,922	708,922

TC_COLL (Persons)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	287,350	289,290	289,290	287,350	287,350
2013	288,977	291,353	291,353	288,977	288,977
2014	290,209	292,834	292,834	290,209	290,209
2015	292,448	295,129	295,129	292,448	292,448
2016	293,926	296,739	296,739	293,926	293,926
2017	294,871	297,717	297,717	294,871	294,871

INVEST (Rupiah)

Year	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2012	2,562,033,000,000,000	2,562,033,000,000,000	2,536,888,000,000,000	2,587,177,000,000,000	2,562,033,000,000,000
2013	2,829,560,000,000,000	2,843,681,000,000,000	2,817,656,000,000,000	2,855,580,000,000,000	2,829,560,000,000,000
2014	2,906,284,000,000,000	2,935,693,000,000,000	2,908,790,000,000,000	2,933,173,000,000,000	2,906,284,000,000,000
2015	2,679,581,000,000,000	2,718,613,000,000,000	2,688,593,000,000,000	2,708,578,000,000,000	2,678,581,000,000,000
2016	2,505,609,000,000,000	2,551,338,000,000,000	2,517,762,000,000,000	2,536,778,000,000,000	2,503,234,000,000,000
2017	2,652,100,000,000,000	2,705,181,000,000,000	2,672,226,000,000,000	2,680,978,000,000,000	2,648,066,000,000,000