Ph.D. Dissertation of Yasir Niti Samudro

The Impact of Fuel Subsidy and Infrastructure Policies to Economic Growth and Income Distribution

– an Application of
Indonesian Financial CGE Model –

연료 보조금 및 도로 투자가 소득 성장과 불균형에 미치는 영향: 인도네시아 금융 CGE모형의 적용

February 2017

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Abstract

The purpose of this paper is to analyze whether government policy to reallocate subsidy funds into infrastructure projects is favorable for the Indonesian economy in terms of GDP and income distribution. A financial CGE model is employed to simulate the impact of fiscal policy regarding fuel subsidy funds and road investment, calibrating the Indonesian Financial SAM of 2008. Other policy options have also been simulated to identify a better policy for economic growth and income inequality. This research is the first Financial CGE model of Indonesia to use Financial SAM 2008 as its database. The model in this research is a dynamic Financial CGE model with attributes of ten sectors, four households and seven economic actors, twelve labor groups and three type of assets. It is found that the policy of using additional tax to build road infrastructure generates the highest GDP increase. The policy to reduce fuel subsidies is the best policy measure regarding the distribution of income. Furthermore, if the government also has the concern to release fiscal pressure, then the shifting of fuel subsidy to infrastructure provision is applicable.

Keyword: FCGE, FSAM, subsidy, infrastructure, growth, income distribution

Student Number: 2013-31311

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Chapter 1. Introduction

1.1. Research Background

After the 1998 Asian financial crisis, Indonesia's economic growth on average was slower than during the pre-crisis period. In the period from 1980 to shortly before the crisis of 1997, the average growth of the Indonesian economy reached 6.9% per year. While in the post-crisis period of 1999-2015 the growth was decelerated to 5.3% per year. In more detail, it was the share of agriculture sector and oil and gas sector which was shrinking during the 2000s. The Agricultural sector shrank from 15.6% in 2000 to 12.1% in 2014, while the oil and gas sector share dropped precipitously from 12.3% in 2000 to 4.5% in 2014.

In contrast, the sector that has strengthened its role in GDP is the transport and communications sector, which has growth on average reaching 12.1% per year during 2000-2014. This share of GDP increased from 4.7% in 2000 to 11.0% in 2014. The growth of this sector is mainly due to the fast growth in modern communications technology. Meanwhile, regarding income distribution, the Gini coefficient ratio continues to increase since the

Asian financial crisis. In 1997, when one-fourth of Indonesian household became poor, the Gini index was at its lowest point of 0.29. Afterward, the inequality index has been edging up as the Indonesian economy is recovering until it reached its highest point of 0.41 in 2011 and lasted until 2014. Then in 2015, the inequality index fell slightly to 0.40. It is uncertain as to why inequality increased during the period from 1997-2014. Some of the probable causes included a commodity boom, rigidity in the formal labor market, rice prices and cash transfer (Yusuf *et al.*: 2014).

The domination of oil and gas products in Indonesia's export ended in 1987, replaced by manufactured goods such as plywood, textiles, garments, footwear, electrical appliances, and palm oil. The role of oil and gas revenue in the state budget continues to experience a declining trend. In 2000, the proportion of oil and gas in total government revenues was 41.6%, however, in 2013 this was only 15.6%. The rest of central government revenue is derived from taxes, dominantly income tax and value added tax.

One of the problems that the government of Indonesia faced in 2000's era is the amount of energy subsidies. Each fiscal year the government has to allocate fuel subsidy expenditure which can take up a significant portion of the Indonesian state budget and at the

same time causes the government to suffer fiscal pressures due to a decrease in oil revenues in the form tax and non-tax revenues.

Energy subsidies in the form of cheap fuel and electricity prices in Indonesia began in the oil boom of the 1970s. The government had provided subsidies as an economic stimulus, which was not well-managed and in turn caused a moral hazard in the form of wasted fuel and smuggling. Due to high economic growth and rapid growth of the middle classes, Indonesia gradually faced higher fuel demand. Therefore the amount of fuel subsidy continued to increase. Alternatively, it became an oil-importing country in 2003.

Since the Asian crisis, the government allocated more funds to fuel subsidy than to capital expenditure. Economic agents have long enjoyed subsidies, cheap energy is taken for granted, and there is no intention to save energy. An increasing amount of the energy subsidies were not only the government's financial burden but also had adverse environmental impacts in the form of air pollution and CO2 emissions from motor vehicles. Luthfi and Kaneko (2016) suggested that if the fuel subsidy in Indonesia were abolished, then the CO2 would reduce by 70 million tons.

The existence and magnitude of fuel subsidies have always been a public debate, especially when the prices of international oil

fluctuate sharply. In 2004–2014, the average portion of fuel subsidy reached 16.6 percent of central government expenditure, with the highest point reaching 26.5 percent, in 2005 when the world crude oil price was US$51.8 per barrel. A high percentage of energy subsidies to government budget suppresses fiscal space; it means that there are limited resources available for the governments to promote economic growth through investment in infrastructure and human capital; and also to provide social protection for low-income groups through better-targeted subsidies and other social expenditures.

Removing fuel subsidy is problematic as fuel prices are embedded in households and firms' optimization problems, imposing negative impacts, particularly to the poor and medium income households (Widodo *et al.* 2012). Nevertheless, the new administration under President Joko Widodo took on a different policy compared to his predecessors to massively cut the fuel subsidy starting in 2015. This policy was a part of a structural reform and was intended to be beneficial for the improvement of economic conditions in the long term. It was designed to develop structural changes in the economy, both for the government and households. In 2015, the government no longer provided subsidies

on regular gasoline, while diesel oil received a fixed subsidy for Rp1000/liter (US$0.07). The proportion of fuel subsidy dropped to 5.1% of central government spending in 2015, which created a fiscal space for the government to run other policies such as the provision of infrastructure.

The partial reallocation of the fuel subsidy to infrastructure provision was shown by the increase of infrastructure funds, from 12.9% of the central government budget (average 2008−2014) to 16.0% in 2015. Nevertheless, the global economic slowdown and other factors have caused Indonesian economic growth to decelerate from 5.02% in 2014 to 4.74% in 2015. The outputs of the petroleum and chemical sectors, where the fuel subsidy was disbursed to the SOE Pertamina have been decreased by 1.76%. On the contrary, the construction sector, where government infrastructure investment is allocated, has increased in productivity by 6.6% in 2015. Other aspects show that income distribution was improved, indicated by the slight decrease of the Gini ratio. It would be of interest to identify; what is the impact of shifting the fuel subsidy to the development of infrastructure on Indonesian economy? Is there any improvement in income distribution?

The main objective of this research is to analyze the impact of fiscal policy in reallocating fuel subsidy into infrastructure development, whether the policy is favorable to the Indonesian economy in terms of Gross Domestic Product (GDP) and its effects on income distribution. The paper intends to explore these issues, a financial computable general equilibrium (FCGE) is used in this research.

1.2. Purpose of Research

In this research, the financial social accounting matrix (FSAM) 2005 is updated to FSAM 2008 as the database of the Indonesian economy. Based on the FSAM 2008, a financial CGE model is developed prior to conducting simulations of shifting the fuel subsidy to road infrastructure development on the distributional spectrum of macroeconomic and microeconomic variables, such as GDP and household income distribution. The FCGE model in this research is built upon two major background studies. These are, the financing model of Kim (1998) and the transportation network model of Kim *et al.* (2004). The parameters in the equation of the real and financial sector were estimated using actual Indonesian data, in most cases a time series data from various sources. Some

parameters that are already available from previous studies are adopted for the model. After completion of the model calibration and estimation, various fiscal policies concerning fuel subsidy and sources of fund of infrastructure development are simulated to identify the differences between its impact on GDP and income distribution.

1.3. Content of Dissertation

The paper is structured as follows. In the next chapter, the Indonesian economic policy relating to economic growth and income distribution is reviewed in the first part, along with economic performance following the Asian financial crisis, until its recent development. The second part describes the oil and petroleum industry in relation to the subsidies policy and government budget. The last part discusses infrastructure policy, specifically relating to road development.

Chapter 3 is intended to provide an extensive literature review of CGE modeling. It starts with fiscal policy literature, concerning fuel subsidy and infrastructure provision. Then, discussion on the structure of CGE modeling consisting of definition and type of CGE model. Subchapter 3.2 is dedicated to the previous work which uses

the financial CGE model, and then covers the development of CGE modeling in Indonesia.

Chapter 4 presents the Indonesian Financial CGE model used in this paper. Most of the relevant equations in the model are explained, then followed by descriptions of the parameters and coefficients appearing in the behavioral and technical equation of the model. The last section of this chapter describes the updating process of FSAM 2008 from FSAM 2005.

Chapter 5 describes the policy options and policy simulation used in this research. The results of various counterfactual policy simulation are reported. Given these results, the impact of various fiscal policies and its funding options are analyzed. Finally, Chapter 6 is devoted to conclusions, consisting of a summary of current research and a further research agenda.

Chapter 2. Indonesian Economic Policy

2.1. Economic Development Policies of Indonesia

At the beginning of Soeharto's era in 1967, the government's economic policies focused on how to rescue the national economy; especially to control 650% hyper-inflation, to rescue government financial reserve and safeguard people's basic needs. The policy to restore the economic structure and development is as follows. Firstly, economic stabilization to control the inflation. Secondly, economic rehabilitation by improving physical facilities and economic infrastructure. The implementation of this national development in Soeharto's era was based on the development trilogy that is; an equitable distribution of development and its results towards the creation of social justice for all the people, high economic growth, and national stability.

The development plan is divided into five yearly priority programs. Pelita I (five-year development) during the period 1969-1974, which focused on the agricultural and industrial sectors that support agriculture. The aim was to improve the lives of the people and at the same time lay the groundwork for development to the next stage with a goal of food, clothing,

improvement of infrastructure, housing, employment expansion, and spiritual well-being.

Pelita II (1974-1979) focusing on the agricultural sector by increasing the raw materials industry processing into intermediate goods. The main target was the availability of food, clothing, housing, infrastructure, the welfare of the people and expanding employment opportunities. Economic growth reached 7%, on average. At the beginning of the Soeharto's era inflation reached 60%, and by the end of Pelita I the inflation rate dropped to 47%. In the fourth year of Pelita II, inflation fell to 9.5%. Pelita III (1979-1984) focused on the agricultural sector regarding food self-sufficiency and improvements to industrial processing of intermediate goods into finished goods.

The agriculture sector that supports the realization of food self-sufficiency was still continued in the Pelita IV (1984-1989), plus an increase in the manufacture and machinery industry. In the early 1980s, economic recession affected the economy of Indonesia. The government introduced significant monetary and fiscal policies such as budget retrenchment, tax reform, rupiah devaluation and financial liberalization (Kim, 1990) to sustain economic development. Pelita V (1989-1994) was still reliant on agriculture

and industry but was able to create favorable economic conditions indicated by an average economic growth of 6.8% per year. Pelita VI (1994– 1999) focused on the development of the economic sectors related to industry and agriculture, and the development and improvement of the quality of human resources. In this period, the Asian financial crisis hit Indonesia, which led to the political turmoil and the fall of the Soeharto regime.

In the 1980s until shortly before the Asian financial crisis of 1997, the Indonesian economy growth averaged 6.9% per year. Following the crisis, Indonesia's economic growth was slower than that of the pre–crisis period. In the post–crisis period of 1999–2015, the economic growth was decelerated to 5.3% per year, on average. The Indonesian economy is among the most resilient economies in the world. When the global financial crisis occurred in 2009, Indonesia still grew by 4.6% while almost all other countries in the world experienced negative growth. The strength of Indonesia's economy is mainly supported by strong private consumption, which is 56.5% (average 2010–2015) of the total GDP. Besides private consumption, investment is the second–largest share of GDP, amounting to 33.7%, followed by government consumption of 9.3% and the remainder is from net exports. The

resilience of the Indonesian economy is inseparable from the role of government economic policies. For instance, in 2009 during a global economic slowdown, the government launched a counter-cyclical policy that contained programs to maintain the level of consumption, investment, and exports. The policy to reduce tax rates and increase non-taxable income are issued to maintain consumption levels. The government also provided tax-free incentives to attract investors in strategic industry sectors such as geothermal and biofuels. Furthermore, to support export volume, the government launched the export credit program, which meant that exporters had their working capital immediately ready before receiving the payment results from abroad.

The Government committed to promoting strong economic growth, as stated in RPJMN (*Rencana Pembangunan Jangka Menengah*/ Medium Term Development Plan) 2015 – 2019 to reach an average of 7% in five years. However, in the short term, in relation to the development of the global and domestic economy, the Government are also focusing on maintaining the stability of the Indonesian economy. The Government is aware that in the current situation relating to the national economy, especially the limitedness of supply in infrastructure, productivity, and other handicaps, the

measures to boost economic growth may influence the stability of the economy, internally or externally. External balance is shown by the pressures on current account (deficit), while internally, there will be overheating due to the significant amount of demand indicated by the pressure of inflation.

The government's policies in managing the economy, in general, are divided into two, namely: State Budget (APBN) and incentive. State Budget is executed via spending allocation and financing in an expansive manner to boost robust and sustainable economic growth. Meanwhile, the stabilization is done by issuing regulative and incentive policies. Therefore, to maintain economic stabilization and boost strong and sustainable economic growth policies assimilation is required, whether this is the regulative and incentive or direct allocation of spending/budget financing.

The stabilization is necessary to provide a sound foundation for the acceleration of Indonesia's economic growth. The policies issued via regulative and incentive aimed at improving the current account deficit and maintaining the stabilization of exchange rate, are as follows. First of all, within the framework of encouraging reinvestment on the profit made by companies as well as supporting export rate; the government is issuing an amendment to the

regulation of tax allowance with simpler procedures and criteria. Tax allowance will be given to companies that are providing employment, using local materials, export-oriented, and with high investment. Additional incentives are provided for businesses reinvesting the profits gained from dividends and/or implementing research and development.

In addition, the government is issuing exemption on value added tax to encourage logistic sectors, among others for dockyards, equipment used in the rail industry, air transportation industry, and similar. Moreover, to improve the competitiveness of domestic products, the government is issuing regulation for the flexibility of import duties on temporary anti-dumping and import duties on temporary security measures. The policies above are in response to the possibility of a spike in the import of certain goods, and the simplification of procedures and returns mechanisms. Furthermore, the tourism sector is encouraged to support the improvement in current account deficit by adding the 45 countries listed as visa-free. Lastly, the energy sector is invited to support the policies in improving the use of biofuel from 10% to 15% by keeping an eye on supply availability and competitive pricing policy.

In the budget revision of 2015, the government starting to

reallocate the non-productive spending to the productive spending significantly as shown in the allocation of infrastructure spending that reached Rp290 trillion (US$21.7 billion). It was the first time that the infrastructure allocation exceeds energy subsidy. In addition, the government also allocated state investment for Rp70.4 trillion (US$5.3 billion) particularly to improve the State Owned Enterprises (SOEs), and to support national infrastructure development and economy. In the short term, it will directly and significantly add up gross fixed capital formation (investment), and in the long term, it is expected to create a multiplier effect for investment and other productive activities, essential to the acceleration of economic growth.

In the medium-long term, the government continues to encourage strong and inclusive economic growth. Several policies to be taken are, first of all, the improvement in budget structure. It is aimed at improving budget by creating a larger fiscal space to allocate sufficient budget to support high economic growth, with several common principles. These principles are as follows: sustainable revenue source; quality of spending – more productive spending; and manageable fiscal deficit. In addition, government to support real sector and investment particularly in FDI. The policies

taken are:

1. Better and measurable incentives for investment;
2. Tax incentives for downstream industries with high added value and export-oriented;
3. Incentives for infrastructure investment for Public Private Partnership (PPP) and optimization of SOEs role as an agent of development;
4. One Stop Service Center in Investment Coordination Board for better, simpler, transparent, and integrated service on investment.

After recovering from the Asian financial crisis, Indonesia's real GDP per capita grew at an annual rate of 5.4%, average 2000-2014. This growth helped to pull the poor out of poverty, which more than halved from 24% during the crisis to 11% by 2014. Economic growth has also facilitated the building of a stronger middle class. There are now 45 million people, the richest 18% of all Indonesians, who are economically secure and enjoy a higher quality of life. They are the fastest growing group of the population, increasing at 10 percent per year since 2002.

Nevertheless, those wealthy Indonesians who are now

economically secure are starting to leave the other 205 million behind. The benefits of economic growth have been enjoyed mostly by the growing consumer class. From 2003 to 2010, consumption per person of the richest 10% of Indonesians grew at over 6% per year. On the contrary, the poorest 40% only grew at less than 2% per year; this condition contributed to a slow pace of poverty reduction. Since 2002, the number of poor people has declined by only 2% per year, and the numbers of those vulnerable to poverty have barely fallen at all.

Income inequality in Indonesia has reached the highest levels in history. In 2002, the richest 10% of Indonesians consumed as much as the poorest 42%. The condition worsened in 2014 when they consumed as much as the poorest 54%. During the Asian financial crisis, while poverty increased sharply, the Gini ratio fell. Everyone was affected, but the richest group were hit the hardest by the crisis. Since then, the Gini ratio has increased from 0.30 in 2000 to 0.41 points in 2014, which is the highest recorded level.

The government's policy to eliminate the income gap is to raise the living standard of the bottom 40% of the population and to ensure that poor people obtain social protection measures. These are carried out are as follows. First of all, the governments commit

to creating inclusive economic growth that maximizes the economic potential to include as much of the labor force in decent work and poor family friendly. Therefore able to encourage the improvement of equality and reduce the income gap. The inclusive economy is intended to drive growth in the various sectors, such as agriculture, industry, and services which are labor intensive.

Moreover, the government aims to enlarge labor-intensive investments. The opening of new jobs is one means of increasing the incomes of the population. The new investment is required for the creation of jobs and new employment opportunities to absorb the labor force with a primary and secondary school background. In addition, the government support microenterprises. Micro-businesses need support in technology strengthening, marketing, capital, and market access. Such support should be given as most microenterprises do not have a permanent location and no legal status, making them vulnerable to a variety of obstacles that may hinder the potential for growth and development.

Furthermore, the government needs to ensure social protection for informal workers. The expansion of employment opportunities and businesses are necessary to enable disadvantaged residents and vulnerable workers, including people with disabilities and the

elderly. This population group have limited opportunities in the formal sector and do not have alternative sources of income to support their family. Fewer job opportunities are accessible to this group of the population who are therefore less able to meet the standards of a decent life, thus becoming unsustainable. The integration of a variety of social assistance measures to support this underprivileged population is necessary for them to manage the risks, opportunities and create an inclusive environment, providing them with a decent living and sufficient social security.

Likewise, the government urges to improve and expand basic services for the poor. It is necessary to improve the quality of life, especially for disadvantaged households. These basic rights include the right to obtain identity/ legal status, health care, sufficient nutrition, access to education, decent housing, adequate lighting, sanitation facilities and access to drinking water. Additionally, the government requires to expand the rural economy and to develop the agriculture sector in a way that increases the agricultural productivity of poor farmers, fisheries and aquacultures, and other micro-scale enterprises that support the production chain of small businesses; which provide potential in the region. Therefore, the government require to improve access to land and productive assets;

these are necessary to increase the output and business scale of disadvantaged communities. The availability of facilities and economic infrastructure in rural areas, access to financial services, credit, and other capital sources, as well as the utilization of agricultural research and technology, dissemination and provision of agricultural technology information is also an important factor in stimulating the rural economy.

Lastly, the government effort to maintain price stability and curb inflation. The poor household groups are more vulnerable to economic shocks than the high-income group. Therefore, inflation needs to be maintained at a low and stable rate to sustain the purchasing power of low-income households which are vulnerable to price shock. In addition, there is a need to monitor food pricing developments and to maintain the availability of basic commodities through market operations.

2.2. The Role of Oil Sector and Fuel Subsidy

Based on the constitution, Indonesia's natural resources belong to the government and are used in the best possible way for the welfare of the people. The government through its state-owned enterprise (SOE), such as Pertamina, is entrusted with the

authority to manage natural resources, especially the oil and gas sector. The government, as represented by Pertamina, does not have sufficient funds to maintain all areas of oil and gas as well as being unwilling to take the risk to fail in the exploration. Therefore, investors are invited under the Production Sharing Contract (PSC). Indonesia currently has 293 working areas, which consist of 74 areas of production and 219 areas of exploration.

Prior to PSC, Indonesia had embraced two contract regimes, namely concessions and work of contract (WOC). The concession regime was adopted in the Dutch colonial era until the beginning of Indonesian independence. In this scheme, all of the production within the concession is held by the company. The government only receives royalties that are generally in the form of a percentage of gross revenue and tax. Therefore, the government involvement is very limited.

WOC regime prevailed around the first half of the 1960s. This regime provided oil and gas resources that belonged to the government. The status of the oil company was derived from the concession holder to become a government contractor. In this system, the government and the companies share the proceeds of oil and gas. The oil company still holds control of management,

while the role of government is limited to a supervisory capacity.

PSC scheme first came into force in 1966. The implementation of the PSC was motivated by the government desire to play a bigger role in the management of oil and gas upstream activities. In the PSC scheme, the government was the owner of the resources, which mandated the management of the resources to oil and gas companies. In the upstream oil and gas business, oil and gas companies both domestic and foreign had to provide funds and equipment. However, all of the expenses had to be approved by the government, because the capital would be restored later when the production ran. This replacement, in the world of oil and gas business, is known as cost recovery and is only done if there is a finding of commercial reserves to be developed. Otherwise, all costs are borne entirely by oil and gas companies. When production starts, the production output will be deducted in advance with the capital to be returned to the oil company, and the rest of the output is then split between the government and oil companies by the agreements in the contract. With this PSC scheme, the government utilized oil and gas resources with capital and technology provided by the investor. On the other hand, the government is not exposed to the risk of failure of exploration, because the cost of capital in

the explorations is not replaced in the scheme of cost recovery. In this sense, the government has a control both on the operational management and the ownership of oil and gas resources.

The oil and gas sector, in this case, are the oil and gas mining subsector and the oil manufacturing subsector which was consistently shrinking from 2000 to 2014. In 2000, the share of the oil and gas sector was 12.3% of GDP, in 2014 it was only 4.5% (see Figure 1). The decline in oil and gas industry performance directly translates to the government budget as a decrease in the realization of Indonesian crude oil production throughout the decade of the 2000s. In 2000, the oil production was still above 1 million barrels per day (mbpd), but each year the crude oil production shrunk by an average of 3.6 per year. Up to 2014, the oil production only reached 0.818 mbpd.

The decline in oil production came from the fact that most of the oil field in operation is matured. The government proposed the use of new technology to encourage the production of oil and gas, but this strategy only seemed to slow the decline of oil production. An incentive policy was given to encourage the discovery of new oil field, such as the rules simplification and deregulations to support the acceleration of ready-to-produce oil fields. The discovery of

new oil fields requires serious effort in terms of capital, accompanied by high uncertainty. As an alternative, the government expects that the production of natural gas will be able to replace the role of crude oil.

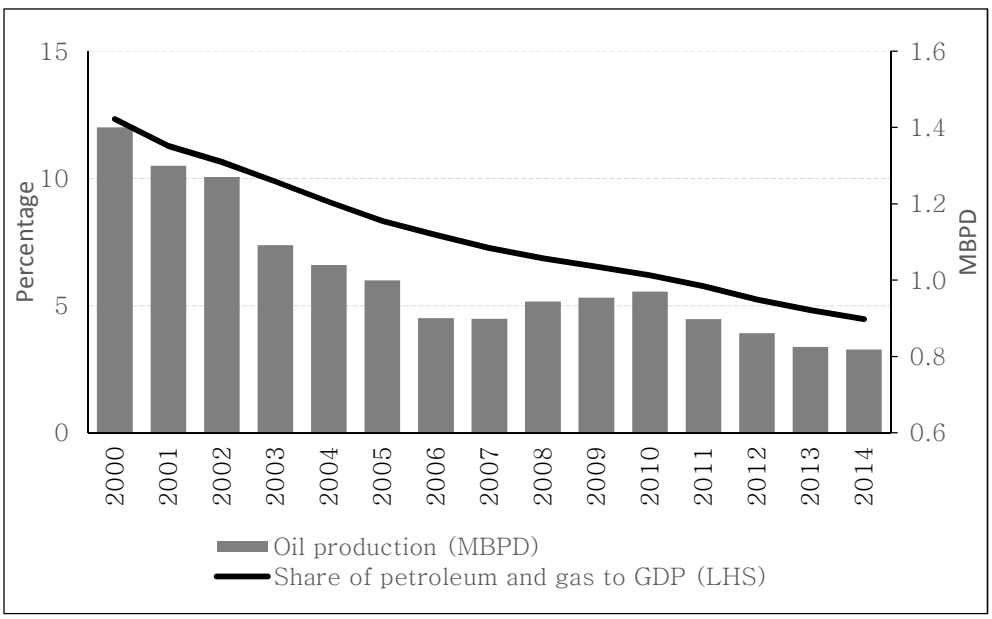


Figure 1 Oil and Gas Sector Performance

Due to a decrease in crude oil production, Indonesia left OPEC in 2008. The ratio between crude oil production and fuel consumption also continued to decline. In 1990, the ratio reached 205%, then in 2000 came down to 128% and then dropped to 58% in 2011. Along with an increase in energy consumption in the oil and gas sector, as a result of population growth, Indonesia became a

net oil importer with the amount of oil imported reaching 850 thousand barrels per day in 2014.

The provision of fuel in Indonesia is the monopoly of Pertamina to manage the oil industry. Pertamina receives a Public Service Obligation (PSO) task from the government to provide fuel at a price controlled by the government. In carrying out its PSO, Pertamina receives a subsidy from the government when its revenue from selling fuel is lower than the provision cost. Other private oil companies are allowed to produce and sell unsubsidized fuel domestically.

There are two major groups of subsidies; these are energy subsidies and non-energy subsidies. Energy subsidies are divided into two, namely fuel subsidy and electricity subsidy. The fuel subsidy seized the largest share, 49.0% of the total subsidy (average 2007-2015), while the share of electricity subsidy was 28.3%. Non-energy subsidy consisted of the fertilizer subsidy (8.3%), food subsidy (6.7%), tax subsidies (5.3%), credit program subsidy (1.1%), public service obligation subsidy (0.8%) and seeds subsidy (0.5%).

The amount of allocated subsidy has a tendency to increase from year to year. In 2003, total subsidy was only Rp55.6 trillion

(US$4.1 billion), in the following years, the number was continuously increased, reaching a peak in 2014 of Rp246.5 trillion (US$34.0 billion) (see Figure 2). In 2015 the value dropped to US$15.9 billion when the government diverted the fuel subsidy for various welfare programs and infrastructures development.

Increased volatility in oil prices, especially during 2004–05 and 2008, has made spending on fuel subsidies difficult to predict, resulting in spending realization exceeding the original budget in 6 out of the last seven years. In 2008, fuel subsidies were three times more than that which was originally budgeted.

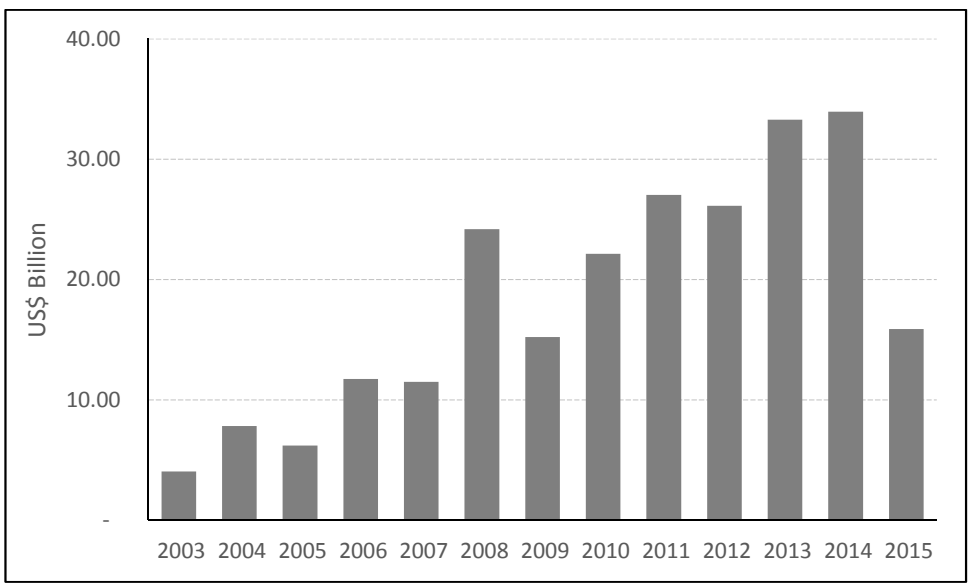


Figure 2 Subsidy 2003–2015 (in US$ Billion)

Uncertainty about the ultimate size of fuel subsidies created risks for public finances in the past. It led to uncertainty about the government's ultimate financing needs and bonds issuance plans for the year as well as in relation to the outlook for inflation, thus raising the cost of borrowing. The cost of the Indonesian Government's debt is correlated to the gap between regulated and market prices for fuel. Debt markets charge a premium when subsidies are expanding. Government bonds yield that move in tandem with oil prices that are not unique to Indonesia. However, the movements in Indonesia's yields appear to be particularly pronounced, and can take longer than average to return to normal levels after an oil price rally.

Furthermore, the government bonds deals are also highly sensitive to how the Indonesian Government manages domestic regulated fuel prices. As the gap between Indonesian fuel prices and international fuel prices widens, speculation over whether the Government will raise fuel prices – which temporarily increases inflation – can contribute to a marked rise in Indonesia's bond yields. For example, in 2005 and 2008, the 5-year bond yield rose by over five percentage points to almost 16 percent in a matter of months.

The policy to maintain fuel subsidies within the budget makes government finances uncertain. During the previous administration, revenue and expenditure were always increased in the revised budget, one of the reasons being the revision of the amount of subsidy, but in the 2015 budget revision, revenue and expenditure were lowered because subsidy was cut and tax revenue was below the targets. In the 2015 original budget, state revenue is set at Rp1793.6 trillion (US$134.23 billion) and expenditure of Rp2039.5 trillion (US$152.63 billion). Then in budget revision, the revenues lowered to Rp1761.6 trillion (US$131.84 billion), while spending is trimmed to Rp1984.1 trillion (US$148.49 billion). Nevertheless, the revenues realization remain far below the target, which is only Rp1504.5 trillion (US$112.60 billion), or 85.4 percent of the target. As for the expenditure, government disbursed Rp1810.0 trillion (US$135.55 billion) or 91.2 percent of the target.

One of the causes of non-fulfillment of government revenue is the low production of Indonesian crude oil. If the oil production is below the target, it affects the amount of revenue derived from the sales of crude oil, namely oil and gas income tax revenue, non-tax revenues from natural resources, and regional oil and gas revenue sharing. Such factors and the increase in world crude oil prices, also

the exchange rate depreciation, forced the government to adjust fuel price irregularly in the period during 2000–2011 to reduce fiscal pressure. The pressure on the 2015 state budget can be derived from the possibility of a shortfall of tax revenue due to slowing economic performance; the possibility of expanding fuel subsidies mainly due to the depreciation of the exchange rate; and high oil prices up to the first three–quarters of 2014. These pressures have encouraged the Government to pursue budget cuts.

Historically, to reduce fiscal pressure, for the first time in 2001, the government deregulated fuel prices. The deregulation is intended to improve industrial competitiveness and also aims to improve the budget allocation targeted at the poor. In principle, this policy stated fuel price discrimination based on the type of consumers. The retail fuel price to household, land and sea transportation and small businesses is regulated by the government. On the other hand, the retail price of fuel for industry and fishing vessels is set at 50% of the international price. In 2003 the government fully deregulated fuel prices for the industries, fisheries, mining, foreign–flagged vessels and ships with overseas destinations. The price of fuel for previously mentioned consumers is similar to international prices. Household, land and water transportation and small businesses are entitled to a subsidized price.

In addition to the fiscal burden and the risks of the fuel subsidy system, there is also a concern that the subsidies are not meeting the objective of assisting the poorer segments of the population who most need such support. The World Bank (2011) estimates based on the data of Indonesia's National Household Socioeconomic Survey (SUSENAS, *Survei Sosial Ekonomi Nasional*) indicate that households or private users may consume as little as one-third of all subsidized fuel. The rest of it potentially attributable to commercial users such as transport operators, businesses, and other users. With respect to individual fuels, estimates indicate that households consumed almost half of subsidized gasoline in 2008, implying that commercial and other users consumed the remaining half.

Furthermore, a breakdown of the household component of gasoline consumption by socio-economic group indicates that the top half of households by consumption accounted for 84 percent, with the highest consumption decile alone accounts for almost 40 percent. In contrast, the poor and near-poor (defined as the bottom five deciles) accounted for just 16 percent, with the poorest decile account for less than 1 percent. Moreover, a detailed examination of reported fuel consumption in the household survey indicates that

around two-thirds of poor and near-poor households do not consume any gasoline whatsoever, although the likelihood of consuming gasoline and the actual quantity consumed rises with wealth status. With respect to diesel, very few households report any consumption. Therefore, commercial and other users are estimated to account for virtually all (98 percent) consumption of subsidized diesel. The gasoline subsidy is the most regressive, meaning it benefits the rich disproportionately more than the poorest households, as expected given limited ownership of motorcycles and virtually no car ownership amongst poor and near-poor households.

Subsidy reform is a sensitive policy issue. However, the experience of other countries and Indonesia's experience demonstrates that ambitious change is possible even during times of crisis. Where it has been successful, subsidy reform has often been accompanied by, first of all, a compensation package to assist the poorest and most vulnerable. Furthermore, increased spending on priorities which attract broad public support, such as education, health, public transport, and infrastructure. Lastly, a public information campaign to raise public awareness of the costs and implications of the current system and the benefits of reform, as well as to alleviate public and investor concerns about the proposed

changes.

The government irregularly adjusted the retail fuel price by reducing the amount of subsidy. The most substantial subsidy reduction occurred in 2005 which had a widespread impact upon Indonesian households, especially the poor (see Azis, 2006), because, in addition to the rising price of energy, a spillover was created due to the increasing cost of necessities. Reduction of fuel subsidies impacted on household welfare due to their dependence on energy and transportation costs, which is reflected in their consumption patterns. Poor households that do not have enough savings face difficulty in adjusting their consumption as a reaction to rising prices. According to data released by BPS, the number of poor people has increased from 16.0% to 17.8% in the 2005-2006 period. At that time the government initiated mitigation measures with a compensation policy of fuel subsidy reductions, which included cash transfers, health insurance, subsidized education and infrastructure development in rural areas.

In June 2013 and November 2014, in response to high international oil prices and a weak Rupiah, Indonesia raised subsidized fuel prices by 30 percent or more. As in the previous years (e.g., 2005 and 2008), in 2013 a temporary unconditional

cash transfer (*Bantuan Langsung Sementara Masyarakat*, BLSM) was implemented to compensate the poor and vulnerable. In 2014, President Joko Widodo increased fuel prices immediately after taking office. The policy also accompanied by six monthly BLSM payments as compensation to the poor. In 2015, the government took a bold step in fiscal policy to support a sounder state budget. In order to improve the efficiency of government spending, the government cut the fuel subsidy through fuel price adjustment. The applications of fixed subsidy for diesel fuel, as well as the elimination of subsidies for regular gasoline, started in early 2015. The Policy aimed to increase fiscal space for more productive programs and also to minimize the fiscal vulnerability caused by fluctuating crude oil prices and Rupiah exchange rates.

Fuel price adjustments are part of the measures put in place to improve the mechanism of for a better-targeted subsidy and part of the structural reform of the Indonesian economy. Subsidized fuel price adjustment will push inflation and in turn, depress purchasing power. The government needs to mitigate the impact of fuel price adjustment policy in the form of compensation programs and other social programs, especially with regard to education and health.

2.3. Infrastructure Policy

The lack of infrastructure has created a bottleneck issue in relation to supply which has shackled the Indonesian economy to grow high. Improvements to infrastructure focused on the efforts to improve national connectivity, therefore, increasing domestic integration to improve economic efficiency and flow of goods and services between regions in Indonesia.

A recent World Bank (2016) survey of manufacturers across Indonesia's major agglomerations shows a breakdown of logistical costs. Average total logistical costs reflect transport and container-handling costs (45% of the total), inventory costs (26%), warehousing (17%) and logistics administration (17%). Inventory costs are clearly much higher than those for some of Indonesia's competitors: these are only 13% of total costs in Malaysia and 16% in Thailand.

In addition, surveys show that Indonesian firms incur substantial indirect costs due to poor logistics, gaps in infrastructure and restrictive licensing and permitting procedures. Those condition put firms located in Indonesia at a disadvantage to their peers operating in other countries where these costs are lower. Measures to reduce these costs, as well as improved trade

facilitation and a reduction of non-tariff measures, are especially important in a context of growing global value chain integration where efficient importing is critical to export success. Good logistics are a vital prerequisite for supplying domestic markets efficiently and competing internationally. High inventory costs reflect uncertainties in the supply chain. A key source of uncertainty lies in hinterland connections. The costs of bringing containers to Jakarta's main port, Tanjung Priok, are double those in Malaysia, although distances are similar. A survey of 83 trucking firms operating in Greater Jakarta highlights why: prolonged idle and waiting times due to congestion; long queuing at the port, and low efficiency in synchronizing cargo deliveries and pick-ups.

In the period from 1990-2013, additional road lengths for all types of surface (excluding highways) averaged only 2.5% per year, while the growth of asphalted roads was relatively higher, on average 3.7% per year. The growth of highway roads also did not differ, which averaged only 3.5% per year, even at the end of 2013 the length of toll roads in Indonesia did not reach 1000 kilometers (see Table 1).

In the period from 2010-2014, the government constructed 1268 kilometers of national roads and 45.59 kilometers of highways.

Thus the total length of national roads which has been built up in 2014 was 39838 kilometers. The following is the list of ongoing road infrastructure projects on the country border region. The Kalimantan Border Parallel Roads have connected along 42.07 kilometers from the planned 1755 kilometers. The East Nusa Tenggara – Republic of Timor–Leste Border Roads have been constructed for 54.2 kilometers out of the planned 877 kilometers. The accelerated development in Papua and West Papua, including the Papua Border Road, has resulted in 102 kilometers.

Table 1 Road Stock (unit: kilometers)

Period	All type	Asphalted	Highway
1990–1994	356,878	164,866	519
1995–1999	355,951	203,374	564
2000–2004	372,929	206,444	564
2005–2009	476,337	271,230	698
2010–2013	502,724	287,925	763

Sources: Bureau of Indonesian Statistics (BPS) and Toll Road Regulatory Agency (BPJT)

In order to support national connectivity, during the period 2010–2014, the main corridor on the islands of Sumatra, Java, Kalimantan, Sulawesi, Bali, Nusa Tenggara, Maluku, and Papua,

among others, have been subject to the completion of an assessment of the East Sumatera Line, North Java Line, Southern Kalimantan Line, and West Sulawesi Line. Meanwhile, to encourage national industries and services, the handling of the road network is applied for Java Island. In addition, to support the center for production and processing of mines and national energy sources, handling road network continued on Kalimantan Island. Furthermore, to support the center for production and processing of mines and national energy sources, handling road network continued on Kalimantan Island. Moreover, to support the center for production and processing of agriculture, horticulture, fisheries and mining, road network handling has taken place on the island of Sulawesi. Also, to support the region of tourism gateway, handling the road network is carried out on the island of Bali and Nusa Tenggara. Lastly, to support the food development center, fisheries, energy and mining, road network handling has been carried out in the Maluku Islands and Papua.

Infrastructure provisions are directed to reduce inequalities between income groups and regions, through the development of productive economic infrastructure and development of roads in the border region. To reduce regional disparities, in 2015 the

government reallocated fuel subsidy to the construction of road infrastructure and road construction in the border region of Kalimantan and East Nusa Tenggara. There is also the construction of infrastructure connectivity in the form of the highway (government portion liabilities, usually for land acquisition) and the construction of access roads to the ports of Sorong, Kuala Tanjung, and Maloy. In addition, the central government also allocated an additional transfer fund of DAK (*Dana Alokasi Khusus*/ Special Allocation Fund) for road transportation. The road provision intend to increase connectivity and accessibility in the border areas and underdeveloped regions as well as to reduce disparities between the western and eastern areas of Indonesia, which included the construction, improvement, rehabilitation or maintenance of roads and bridges under the authority of the regional government. In the 2015–2019 National Medium Term Development Plan (*Rancangan Pembangunan Jangka Menengah Nasional*/ RPJMN), the government plan to allocate Rp805 trillion (US$60.25 billion) for roads infrastructure provision.

The government has an ambitious plan to close the infrastructure gap in the years to come. It started in September 2015, to address regulatory restrictions through a series of policy

packages. Provision of infrastructure in Indonesia is sluggish because of obstacles encountered at various project stages from preparation to execution. As a whole, poor coordination among stakeholders often delays the decision-making process. At the preparation stage, problems usually arise as a result of low quality in project preparation and constraints associated with the allocation of funds. Similarly, projects are often hindered by problems in land acquisition, resulting in delays in achieving financial closure of PPP (Public Private Partnership) projects. Furthermore, from a financial perspective, the unavailability of fiscal support caused by inconsistency or disagreement on equal risk sharing mechanisms between the government and business entities is another constraint that often emerges. In addition to financial support, limitations on guarantees provided by the government for infrastructure projects also reduces interest in investment in Indonesia.

The government has taken corrective measures to overcome the obstacles with regard to regulatory, fiscal, and institutional aspects. In 2014 the Government formed the Committee for Acceleration of Priority Infrastructure Delivery (KPPIP) charged with leading coordination to accelerate priority infrastructure and promoting improvement in the quality of project preparation. These

corrective measures are further supported by the increasing capacity of the Ministry of National Development Planning (Bappenas) in providing facilities for project preparation. It then continued by the PPP Unit at the Ministry of Finance that provides Project Development Facility (PDF) and Transaction Advisory for PPP projects to increase investors' interests in funding the projects. In addition, to surmount obstacles to land procurement, regulation has also been issued for the purpose of accelerating the land acquisition process for the public interest. This particular regulation is equipped with derivative regulations that have been revised as needed.

Considering that government support is pivotal to attract investment of business entities, the government also issued regulations to provide Viability Gap Funding (VGF) and availability payment. In order to bolster this government support, guarantees provided by the government have been expanded to allow State Owned Enterprises (SOE) that are assigned within the structural development, to receive such a guarantee.

In 2015, the government actively drew up and issued Economic Policy Packages encompassing improvements to policies and regulations to boost Indonesia's economy. From a fiscal policy point

of view, the government has provided a direct lending facility for State Owned Enterprises (SOE) and an availability payment facility taken from APBN (the State Budget). These measures are expected to improve the feasibility of projects.

On November 23rd, 2016, Finance Minister Sri Mulyani Indrawati presented a tax amnesty for the profession of legal services in Jakarta and stated that Rp1 trillion of government expenditure could build roads of 155 kilometer length; this information is used in conducting the policy simulation in this research. Meanwhile, according to the Toll Road Regulatory Agency (Badan Pengatur Jalan Tol/BPJT), toll road provision costs in Indonesia ranged between Rp80−100 billion (US$5.99−7.48 million) per kilometer, except the toll road over the sea in Bali, cost more to reach Rp200 billion (US$14.97 million) per kilometer.

Chapter 3. Literature Review

3.1. Impact of Fiscal Policy to Economic Growth and Income Distribution

In the discussion on economic policy, fiscal policy is mainly regarded as an instrument to mitigate short-run shocks of output and employment. By changing the composition of government spending or revenue, fiscal policy aims to alter aggregate demand to redirect the economy closer to its potential output. However, the capabilities of each fiscal policy in reducing output fluctuations are different. Lucas (1988) in his paper on endogenous growth argued that government investment in education is improving human capital. Education enhances the capability of labor as one factor of production and in turn, output also increased. Another example of government spending that could affect economic growth is infrastructure investment (Barro, 1990), research and development expenditures (Romer, 1990), and health expenditures (Bloom *et al.*, 2001).

On the revenue side, taxes are known to distort the behavior of economic actors. Economic actors will consider the effect of taxes on their decision about the accumulation of capital and product

supply. Accumulation of capital affect investment, while turnover product affects consumption, both of them directly affect the GDP.

A number of studies were attempted to examine the relationship between subsidy and economics performance. Ikhsan *et al.* (2005) studied cutting Indonesian fuel subsidy in 2005 and found that if fuel subsidies were decreased without compensation to the poor, the poverty index would increase from 16.3% to 16.7%. Zhang (1998) studied the impact of subsidy using CGE on the environmental aspect such a carbon emission. He analyzed the macroeconomic effects of limiting China's CO2 emissions by using a time-recursive dynamic CGE model of the Chinese economy. He found that large reductions in carbon emissions can only be achieved by higher increases in carbon taxes and thus, prices of fossil fuels. Furthermore, carbon emission limitations tend to decrease aggregate gross production, where the coal sector is severely affected.

In the case of another country, such as Yemen, Breisinger *et al.* (2012) showed that overall growth effects of fuel subsidy reduction are positive in general, but poverty can increase or decrease depending on reform design. Reform without compensation raises poverty rates up to 2.6 percentage points while reforming with

compensation of direct cash transfers to the poorest one-third of households will reduce the poverty rate up to 4 percentage points.

Studies about infrastructure provision also one of the major topics using CGE analysis (Lee and Kim, 2015). Applied his previous work of Kim and Bae (2015), Kim *et al.* (2016) developed Financial CGE model that analyzes the economic impacts of infrastructure investment projects and their financing options on growth and income distribution in the Indonesian economy. The model analyzed the economic effects of fiscal policies such as the transportation investment expenditures and alternative procurement approaches, linking the investment expenditures with specific financial resources. The construction location and the changes in the accessibility generated by the project are injected into the model. The simulations on the Indonesian transportation projects revealed that using tax revenues as the source of project financing generated higher effects on GDP than other financing sources.

Previously, Kim et al. (2011) examined the impacts of highway development regarding how they were financed. The results indicated that imposing regional earmarked taxes had larger effects on income growth and the reduction of regional income inequality than the existing tax system. Most papers showed positive impacts

of the investments on productivities and cost reductions, for instance, Kim and Shin (2002) found that an increase of the road capital stock by 1 per cent in Korea could lead to a reduction of production cost of the manufacturing sector by 0.012%. Duffy-Deno and Eberts (1991) using data for US metropolitan showed that both public investment and the public capital stock had positive effects on per capita income through two channels that are the actual construction of public capital in the demand side, and of an unpaid factor (for using public capital) in the production process.

On the contrary, there are also some papers against the economic contribution of the infrastructure to growth. Berechman (1994) revealed its negative effect on economic growth, and Kim (1998) examined that the infrastructure investment policy beneficial to economic growth, but also boosting the price inflation. Moreover, Pereira (2001) found that the public investment might crowd out the private investments in the sector of information equipment, while the crowding-in effects of public investment might be significant in the industrial sector and transportation equipment sector.

The conclusion that can be drawn from this subsection are, the fiscal policy usually used to dampen the impact of short-term

economic fluctuations or change the behavior of economic agents in the long term. Policies related to subsidy cuts or carbon limitation has a tendency to lower aggregate output, which, if it is not mitigated would increase poverty rate. Lastly, investment in infrastructure development, in general, will increase output, however, the magnitude of the output increase depends on the source of the financing, since it can potentially cause a crowding out of private investment.

3.2. Structure of CGE Model

The CGE model can be defined as an economic model which consists of linkages between income groups, patterns of demand, the balance of payments and multi-sector production structure. The model includes a set of behavioral equations describing the behavior of economic agents and their technological and institutional constraints. The model is in general equilibrium, meaning that the set of prices and quantities exists and all excess demands for commodities and services in nominal and real value are zero.

The most innovative technique of CGE is that the model is free from the linearity constraints unlike other predecessor models (Iqbal and Siddiqui: 2001). According to Adelman and Robinson

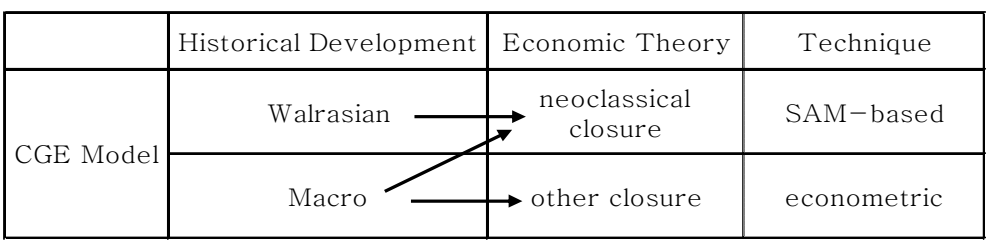
(1978), it is not the objective of CGE model to forecast the exact outcome of policy measures but to provide only an indication of the direction and size of the effects.

The CGE models consist of three information structures, namely analytical, functional and numerical (Iqbal and Siddiqui: 2001). The analytical structure is the underlying theory of variable interest and hypothesizes their causal relationship. The functional structure is a mathematical representation of the analytical material consisting of an algebraic equation. The numerical structure consists of the signs and magnitudes of the coefficients in the functional structure equation.

In the literature, there are three layers of classifications of CGE models based on their historical development and the intended use of the model. The first classification is based on the historical development; these are Macro model versus Walrasian model. The macro model develops from the multi-sector analysis carried out in the 1970s; it is often used in policy analysis in developing countries. The Walrasian CGE model developed from the general equilibrium framework of Walras, popularized by the work of Scarf (1967) on the Walrasian computation of equilibrium price. The second classification is based on the theoretical economy uses in the model,

of which there are two groups, the neoclassical closure versus the other closure. Economists classified the Walrasian model as belonging to neoclassical closure. The third classification is based on techniques used in the determination of the parameters; these are calibration techniques versus econometric estimation.

However, CGE models are usually distinguished based on closure rule. The use of closure also distinguishes between neoclassical models and structuralist models. The neoclassical models use savings driven closures, meaning that the amount of investment is determined by the amount of savings, while in the structuralist models, investment has its own function. In addition, in neoclassical models, it is assumed that there is a full employment condition, while in the structuralist model there is a possible existence of unemployment.



adapted from Thissen (1998)

Figure 3 Classification of CGE Modeling

In order to understand the differences between the uses of closure in building a CGE model, the following are illustrations taken

from a simple closed economy by Dewatripont and Michel (1987). It supposes that the economy has only three goods, these are "consumption good," "labor," and "money." There are four agents "government," "capitalist household," "labor household" and "firm." As a simplification, the government is supplying the money to finance its exogenous consumption.

Production	$Y = f(\bar{K}, L_{d})$	(1)
Labor demand	$f_{L}(\bar{K}, L_{d}) = w/p$	(2)
Exogenous investment	$I = \bar{I}$	(3)
Consumption	$C = c_{l}(w/p)w \ + c_{\pi}(\pi/p)\Pi$	(4)
Labor supply	$L_{s} = \bar{L}$	(5)
Goods market equilibrium	$Y = C + \bar{I} + \bar{G}$	(6)
Labor market equilibrium	$L_{s} = L_{d}$	(7)

Where Y is production, f is production function, $\overline{K}$ is fixed capital stock, L_{d} is labor demand, L_{s} is labor supply, p is goods price, w is wage rate, c_{l} is marginal propensity to consume (MPC) out of wages wL, c_{π} is marginal propensity to consume (MPC) out of profit π.

This simple model has two market equilibrium conditions which are the equilibrium in the goods market and the equilibrium in the

labor market; the money market equilibrium is neglected by Walras' law. By combining and substituting equations (1) to (7), the reduced equilibrium condition is derived as follows.

$$\bar{L} = L(w/p) \tag{8}$$

$$f(L, \bar{K}) = C(w/p) + \bar{I} + \bar{G} \tag{9}$$

Equation (8) and (9) which are a summary of this simple model clearly show the closure problem. There are two equilibrium conditions, but there is only one independent variable that is *w/p*, in other words, this system of equations is over-determined. Therefore, one equation must be relaxed to find a solution. In summary, choosing a particular closure means to determine which conditions must be dropped.

The Keynesian closure allows for unemployment. Therefore equation (5) is dropped and replaces $\bar{L}$ with L which later became endogenous in systems (8) and (9). Kaldorian closure breaks the equality between wage and marginal labor productivity, for that, equation (8) is replaced by $f_L(K, L) \geq w/p$ and $L \leq \bar{L}$, then the system is solved *w/p* and L endogenously. Johansen closure wipes away equation (4), and assumes that full employment equilibrium is realized by means of residual adjustment for consumption C in the

system (8)—(9). Finally, the Classical closure can be seen as a system with endogenous investment, equation (8)—(9) then solved for w/p and I. The other way is to add a new variable that is the interest rate r on consumption and investment scheme, thus the system (8)—(9) would solve for w/p and r.

Neoclassical economists usually select Classical closure, while structuralists tend to use Keynesian closure. The choice of closure is very influential on the model structure and policy conclusions. The most important point of the selection algorithm solution is that the choosing of closure can lead to different implications in the evaluation of the impact of alternatives policy in the CGE model simulations. For example, the level of output in the neoclassical approach is nearly constant even though the simulation is presented in the form of a severe external shock. Therefore, this neoclassical specification does not fit for simulating the effect of external shocks in short-term or medium-term, but it might be suitable for exploring government policies for a dynamic long-term model.

3.3. Application of Financial CGE Model

Financial Computable General Equilibrium (FCGE) can be defined as an extension of traditional (real) CGE models with the interaction linkages between financial side and real side of the economy. The inclusion of the financial sector into the standard CGE real side is necessary to allow experimentation using instrumental policies that affect the financial variable.

In the standard CGE models that do not include the financial sector, or more precisely the financial instrument, the only wealth in that real closed system is just capital stock. Saving is directly linked to the purchase of investment goods through the implicit process or, in another word, the decision to save is directly translated into capital investment because there is no other medium to store wealth. The standard CGE model cannot capture the effect of the decision to allocate portfolios in the real variable because the behavioral rules in the wealth allocation process of the private sector are not specified in the models.

The models of Adelman and Robinson (1978) for South Korea can be considered as an early FCGE model because it includes the market for loanable funds and currency that clears the equilibrium interest rate and the price level. However, in their model

specifications, the price level has no effect on output and employment and therefore did not affect real balance. Inflation is merely a monetary symptom and has no effect on the real economy.

The milestone of the modern financial CGE model was disseminated by the double work of Robinson (1991) and Thorbecke (1991) in World Development, Vol. 19, No. 11. Robinson (1991) incorporated the loanable funds market consisting of currency, demand deposits, time deposits, government debt, domestic bonds, foreign bonds, equity, real capital and working capital into the Financial SAM. Previously, scholars such as Lewis (1985), Rosenweig and Taylor (1990), Feltenstein (1984), Feltenstein (1986), and Feltenstein and Morris (l988) had already introduced assets and asset markets into CGE models, where an interest rate acts as an equilibrating variable. However, these models' dynamic behavior is very limited; there is no uncertainties and specification of portfolio behavior on the part of asset holders is very simple. Subsequently, the financial CGE is widely used by researchers in analyzing government policy.

Taylor and Rosensweig (1984) models for Thailand focused on the exchange rate, fiscal and monetary policy, the inclusion of a more diverse financial side with a portfolio decision of banks, firms,

and households. The model is Keynesian, indicated by the inclusion of unemployment and fixed nominal wages. The expansionist fiscal policy, although financed by domestic borrowing, generates high growth. The income effect of saving is huge and dominates the effect of government borrowing, inducing a crowding-in effect for investment. In contrast, fiscal restraints have a huge recessive impact, while monetary contraction raises interest rates, reduces investment and national income. Furthermore, inflation has no adverse effect on the real economy side. Thus it reduces the role of monetary policy as a stabilization instrument.

The paper from Thorbecke (1991) can be considered as an earlier study using an FCGE method with Indonesian cases. The paper discussed the impact of the stabilization and structural adjustment of a policy package implemented in Indonesia during 1982 to 1988 following the drop in oil prices, and its effects on income distribution, internal and external equilibrium.

In his research, Thorbecke (1991) used real side SAM with the dimension of a 51x51 matrix, consisting of factors of production (four labor categories and five kinds of capital); institutions (eight socioeconomic household groups and companies); 14 production activities; government expenditures (four types of government

current expenditure); government investment (eight types of government capital expenditures by sector of destination); total government current accounts; total government capital accounts; private capital; rest of the world; trade and transport margins; indirect taxes; and subsidies. There is also a separate financial side SAM that consist of eight households and companies, 5 other institutions (firms, commercial banks, the central bank, government, and the rest of the world) and financial assets portfolio (currency, demand deposits, time deposits, foreign deposits, equity, and foreign bonds). Nevertheless, the financial side SAM was not disclosed in the paper.

Thorbecke (1991) runs through six alternative policy scenarios which are: budget cuts; increased public investment and reduced current expenditure; reduced public investment and increased current expenditure; accelerated devaluation; and monetary contraction or expansion. He revealed that budget cuts are deflationary and GDP growth is lower than base case, real incomes for all socioeconomic groups are also lower. Moreover, allocating more to public investment entails a lower stream of aggregate consumption in the short term for larger streams of incomes and consumption in the long run. On the contrary, maintaining high

levels of government current expenditure shelters household incomes in the short term but results in lower growth rates and a contraction of incomes and consumption in the long run.

Furthermore, accelerated devaluation encourages exports and discourages imports in the long run; the improved balance of payments, thus reduces the government' s foreign borrowing; inflationary which in turn encourage capital flight; higher GDP growth as a result of the favorable balance of payments. Farmers who produce much of the exported crops benefit from the increase in the prices of tradable goods. However, all other household groups are unfavorably affected.

Additionally, monetary contraction is deflationary, though GDP growth is unaffected in the short term but falls in the long run. The current account of the balance of payments improves mainly because of the slowdown in import demand. Moreover, the distributional consequences are generally neutral. On the contrary, a monetary expansion is inflationary, boosts GDP growth slightly in the short term and marginally in the long run; where the distributional impact is neutral, the current account is worsening and a switch from the traditional flow of net private lending abroad to net private borrowing abroad.

The Turkey FCGE model from Lewis (1992) is a structuralist model highlighting premium rationing of imports, working capital financing by firms, segmented credit markets, interest rate controls, and monetization of fiscal and balance-of-payments deficits. It is focused on labor rigidities, product and credit markets in analyzing the economic performance from the impact of external shock. However, the model uses several policy instruments that cannot be distinguished from the fiscal and monetary policy. Li (2010) model of China can be classified as a "Classical" FCGE model. The system determines the exchange rate, covering fixed, partially flexible and completely flexible exchange rate systems to consider the effect of international oil price changes. OECD model of Bourguignon *et al.* (1992) have more qualified specifications of a financial CGE with the inclusion of imperfect adjustment of wages to inflation, and the expectations formation related to inflation and devaluation.

Yeldan (1997) conducted a simulation to determine the impact on the real economy of the Turkish financial liberalization reforms in the 1980s. He found that the government's mode of financing its fiscal deficit through debt instrument or monetization has significant diverse effects on real output, employment, and the movement of

the interest and the foreign exchange rates. In the case of credit market failure, the government can take fiscal policy measures such as the provision of credit directed to certain sectors. Naastepad (2001), conducted a study on a similar subject, for the case of India, she found that in the short and medium-term simulations, macro-economic effects of directed credit to the agriculture sector and small industries are likely to be significant and positive for the Indian economy.

Liu *et al.* (2015) studied monetary policy responses to oil price shocks. The idea was to identify the optimal monetary policies aiming at an inflation target. They found that when tolerance for inflation is high, then interest rate policy alone is sufficient, but, while tolerance for inflation is low; and the government prefers on social stability and household welfare, then reserve ratio policy should also be implemented in addition to interest rate policy. Furthermore, they stated that if the world oil price increases by 100% and the inflation target are below 2%, then monetary authorities should raise the interest rate and reserve ratios by 2.5 and 3.0 percentage points, respectively.

From the review above, it can be concluded the following matters. Firstly, there was an interval of 18 years since CGE model

first introduced by Johansen (1960) to Adelman and Robinson (1978) model, which managed to combine the financial side with the real side in general equilibrium model. Those initial FCGE model, although it has included financial instruments where the interest rate acts an equilibrating variable in the model specification, the price level has no effect on output and employment. Secondly, papers of Robinson (1991) and Thorbecke (1991) can be considered as the foundation of modern FCGE models, since it contains information that is sufficiently detailed to build this complex model. Thirdly, Table 2 showed that besides serving as a simulation tool for structural adjustment and stabilization policies, FCGE models widely used for the analysis of the impact of external shock such as rising international commodity prices, oil for instance. Another external impact is the rising of lender countries' interest rates. Kim *et al.* (2016) innovated the uses of FCGE models in assessing the feasibility of infrastructure projects based on sources of financing and transportation accessibility, already discussed in Subchapter 3.1.

Table 2 Application of the FCGE Model

Author (year)	Financial assets	Model type	Policy issues
Adelman and Robinson (1978)	Loanable funds and money	Static, neoclassical	Structural adjustment
Robinson (1991)	Currency, demand deposits, time deposits, government bonds, domestic bonds, foreign bonds and equity	Dynamic 5−10 years, neoclassical	Structural adjustment and stabilization programs
Thorbecke (1991)	currency, demand deposits, time deposits, foreign deposits, equity, and foreign bonds	Short−run (static) and medium to long−run, neoclassical	Government expenditure and investment adjustment, devaluation, and monetary adjustment
Bourguignon, *et al.* (1992)	Money, equity, government bonds, foreign exchange	Short−run (static) and dynamics, structuralist	External shock: interest rate, terms of trade, and foreign borrowing
Lewis (1992)	Currency and deposits/loans	Static, structuralist	Financial liberalization
Yeldan (1997)	Money, foreign currency, bonds, credit loans	Static, neoclassical	Deficit financing, government credit loans
Naastepad (2001)	currency, deposits, bank deposits, deposits of non−bank financial institutions, claims on the government, claims on the private sectors	Dynamic, structuralist	Government credit loans

3.4. Development of CGE Model in Indonesia

The paper from Gelb (1985), which assessed the impact of oil windfall profits is one of the earliest empirical studies of Indonesia using a CGE model. The model is 20 years dynamic, has six industrial sectors, dualistic economy, and has three institutions (firms, single representative household, and the government). It then followed by a study from Devarajan and Lewis (1989), which discussed the structural adjustment and economic reform in Indonesia using a 13-sector CGE model. Behrman et al. (1989) analyzed the impact of price fluctuations in international markets for primary products on the Indonesian economy using a static CGE model. They found that there is no case for price instability impact, only good or only bad. Usually, GDP and investment are decreased, and usually, real consumption and foreign reserves (in a fixed exchange rate) are increased.

Entering the 1990s, Devarajan et al. (1993) again took the case of Indonesia in the application of a simple CGE model which they called 1-2-3 models or one country, two-activity, and three-commodity. They applied the model in discussing the approaches to determining the equilibrium of real exchange rate in a country after external shocks. They claimed that a simple 1-2-3 model is a

generalization of the Salter-Swan models, which incorporates imperfect substitutes for both imports and exports and provides a practical way to estimate the changes in the equilibrium of a real exchange rate. Moreover, the 1-2-3 model requires less information than is required to produce PPP (Purchasing Power Parity) calculations.

Resosudarmo and Thorbecke (1996) performed a study with an environmental aspect regarding the policy of air pollution restrictions on output and income distribution. In their study, they expand a social accounting matrix to include the link from the economy to the environment, and vice versa, exploring the relationship between production activities, pollution, and human health problems. They found that if the policies designed to reduce the amount of pollutants in the air did not decrease the output of production sectors, then the policies also improve income distribution.

In the study of finding Dalton - improving tax and expenditure reform, Yitzhaki and Lewis (1996) also applied CGE models in the case of Indonesia. They applied the method to the energy sector of Indonesia, which is characterized by high gasoline taxes and high kerosene subsidies, and they found that if the concerns are

efficiency, then it suggest the distortionary tax of gasoline and kerosene subsidy should both be lowered. When the concern is a distributional aspect, then the given structure of energy taxes is more reasonable. Furthermore, they concluded that given the structure of demand for different energy products, equity could be improved further by reducing the gasoline tax, increasing the subsidy to kerosene, and imposing a tax on electricity.

A study from Rodrigo and Thorbecke (1997) is quite different in modeling productivity gains in Indonesia. The idea is to use externalities of promoting exports and encouraging faster deployment of imported production technology. These externalities, in turn, induce faster accumulation of human and social capital. Since such accumulation cannot be quantified or measured satisfactorily, then it can be "proxied" by tracked measures of export growth, export orientation and the growth of imported machinery. From the results of the simulation they concluded that under maximum conditions, the share of TFPG (Total Factor of Productivity Growth) in total GDP growth could rise to around 40%, a ratio that would lift Indonesia parallel to the ranks of productivity-driven countries such as Korea and Taiwan.

Four major topics in the study of Indonesia using CGE during the decade 2000–2009 are the international trade (Abimanyu: 2000, Sugiyarto *et al.* 2003), environment (Resosudarmo: 2003), external shock (Robilliard *et al.* 2001), and fiscal policy (Azis, 2006). Abimanyu (2000) in his study tried to connect between trade liberalization and the environmental aspect; in this case, the level of pollution. In his framework, massive trade flows could result in a flood of cheap but dirty products from other countries to the domestic market. The condition also worsened by the relocation of industries from countries which have relatively strict environmental standards to those which are of relatively low standard. If the condition occurs, Indonesia would be flooded with environment–polluting industries. The study intended to simulate the effects of trade liberalization of agricultural inputs and government subsidies on the economic, social and environmental aspects. It is found that trade liberalization policy, such as import tariff reduction, exerts a beneficial effect on the industry and may strengthen the industrial structure in the long term. Thus, the industry also benefits from competition, as it become more efficient.

Additionally, from the environmental perspective, imported agricultural inputs are relatively less harmful to the environment

than domestically produced agricultural inputs. Furthermore, trade liberalization stimulates the inflow of fewer dirty products to the agricultural sector. Increasing subsidies for fertilizer should be avoided because it seems to be more beneficial to the large manufacturer and middle-income farmers. He concluded that promoting trade openness along with providing targeted subsidies to landless and poor farmers enables to the expansion of the economy and achieves social and environmental objectives.

The answer to the question of whether globalization is beneficial to Indonesia is attempted by Sugiyarto *et al.* (2003). They argued that globalization policies are often examined without consideration being given to their interactions with key sectors of the economy, such as tourism. Using a CGE model for Indonesia they simulate a globalization policy by tariff reductions, as a stand-alone policy and in conjunction with tourism growth. The results of their simulations show that tourism growth amplifies the positive effects of globalization, which increases production and improves welfare, while the adverse effects on government deficits and the trade balance deficit are reduced.

Resosudarmo (2003) returned to the study of the environmental impact on the economy or vice versa. He developed

CGE models to analyze the impact of air pollution policies on national economic performance and household incomes. The model includes the impact of economic activities on air quality in urban areas as well as the impact of urban air quality on the economy. The links between air pollutants and the economy focus on the relationships between urban production activities, urban air quality, and human health problems in urban areas. His model assumes that the government and the private sector invest in technology that can reduce pollutants. He found that the implementation of policies to improve urban air quality induce a higher GDP and increase the income of poor households.

A study from Robilliard *et al.* (2001) is widely cited for its contribution to the micro-simulation model for income generation by household. The model quantifies the effects on poverty and inequality of the financial crisis that hit Indonesia in 1997. The micro-simulation models are based on a detailed representation of the real income generation mechanism, capturing household heterogeneity in terms of income sources, the area of residence, demographic composition, an endowment in human capital, and consumption preferences. Furthermore, it introduced alternative social policy packages during the crisis such as food subsidies, household transfers or public work programs.

Azis (2006) showed that the drastic reduction in fuel subsidies in 2005 was not unnecessary, especially considering the adverse socio-economic climate, poverty and the political repercussions of that unpopular policy. Instead, the reduction in fuel subsidies could have been substituted by reducing subsidies for the banking sector, providing that the money saves be spent on agricultural-related infrastructures, it could have produced a favorable outcome regarding income distribution and poverty alleviations without deteriorating macroeconomic stability or injuring investors' confidence.

Using 1995 data, Clements *et al.* (2007) conducted a simulation of policies to reduce fuel subsidies in Indonesia in 2003. The study analyzed the impact of higher petroleum prices on the aggregate price level, real growth, and income distribution. A reduction in the government subsidy raises petroleum prices and production costs so that consumer demand, production, and income declines as output prices increase and consumer purchasing power decreases. By using a multi-sector CGE model, their analysis results showed that the price level only slightly increases, output slightly decreases and an urban household is a group that is significantly affected by the subsidy reduction.

Still discussing the Indonesian fuel price hike in 2005, Yusuf and Resosudarmo (2008) examined that the fuel price reform could have been progressive in reducing inequality if it had only increased fuel prices for a motor vehicle. However, in practice, it tended to increase income inequality, especially in urban areas where the price of kerosene was also increased. Government mitigation in the form of a uniform cash transfer to poor households neglecting its heterogeneity tends to over-compensate the rural poor but under-compensate the urban poor. It is due to the consumption pattern of households in the urban area that are highly dependent on industrial products and transportation, which is why the increase in fuel price directly affects the price of both products. The result is a significant reduction in the household welfare in an urban area rather than a rural household.

In the period 2010 to 2016 several notable studies that use CGE methods to Indonesia cases are Dartanto (2011) of the impact of commodity prices; Resosudarmo *et al.* (2011) and Sakamoto (2013) which uses a multiregional CGE; Dartanto (2013) which discusses the fuel subsidy; Amir *et al.* (2013), and Yusuf and Resosudarmo (2015) on income tax and carbon tax; and Kim *et al.* (2016) which discusses infrastructure provision policy. A

significant contribution of Yusuf and Resosudarmo (2015) is their effort in disaggregating 200 classes of households (100 urban and 100 rural households grouped by expenditure per capita centiles), which requires a large-scale household survey of data and reconciliation of various data sources. The model also disaggregates labor into 16 classifications, four types of skills (agricultural, non-agricultural unskilled, clerical and services, and professional workers), and distinguishes between urban and rural, and formal and informal (unpaid) workers.

Dartanto (2013) when applying a CGE model found that complete removal of fuel subsidies and the reallocation of 50% of them to government spending, transfers, and other subsidies could decrease poverty incidence by 0.28% in Indonesia. Irawan *et al.* (2012) discussed the impact of infrastructure on the Indonesian economy. They found that an improvement on any types of infrastructure is expected to result in higher economic growth, higher government revenue, higher factors' income, and lower the poverty level. Moreover, they stated that if higher productivity is used as an indicator for a better infrastructure, the improvement on agriculture public work is economically preferable. If better infrastructure means lower transport costs, then the improvement

of transportation infrastructure on land gave a higher positive result rather than water and air transportation. Lastly, if improvement of infrastructure means an increase of capital stock, then investment in the telecommunication sector is expected to result in higher economic impacts rather than allocating more budgets to the electricity sector.

Table 3 shows the development of CGE models in Indonesia. The majority of the methods commonly used is the comparative statics CGE. While the topic of research usually updated with the problems that the Indonesian economy faced at the time. For example, the paper of Gelb (1985) about the use of petroleum windfall profit. Then about oil price shock and economic crisis (Behrman *et al.*, 1989; Robilliard *et al.*, 2001), fuel subsidy (Azis, 2006; Clements *et al.*, 2007; Yusuf and Resosudarmo 2008; Dartanto, 2013), about the implication of regional autonomy (Resosudarmo *et al.*, 2011; Sakamoto, 2013), and the provision of infrastructure (Irawan *et al.*, 2012; Kim *et al.*, 2016).

Table 3 Development of the CGE Model in Indonesia

Author (year)	Model type	Policy issues
Gelb (1985)	Dynamic CGE	Allotment of oil windfalls profit
Behrman *et al.*, (1989)	Static CGE	International price shock
Resosudarmo and Thorbecke (1996)	Static CGE	Air pollution restriction
Yitzhaki and Lewis (1996)	Static CGE	Taxes reform
Abimanyu (2000)	Static CGE	Trade liberalization and subsidies
Robilliard *et al.* (2001)	Static CGE	Economic crisis
Sugiyarto *et al.* (2003)	Static CGE	Tariff reduction
Resosudarmo (2003)	Dynamic CGE	Clean air policies
Azis (2006)	Dynamic Financial CGE	Fuel subsidy
Clements *et al.* (2007)	Static CGE	Fuel subsidy
Yusuf and Resosudarmo (2008)	Static CGE	Fuel subsidy
Resosudarmo *et al.* (2011)	Inter-regional CGE	Development gap, energy subsidies, carbon tax, and deforestation
Irawan *et al.* (2012)	Static CGE	Infrastructure provision
Dartanto (2013)	Static CGE	Fuel subsidy
Amir *et al.* (2013)	Static CGE	Income tax
Sakamoto (2013)	Inter-regional CGE	Regional disparity
Yusuf and Resosudarmo (2015)	Static CGE	Carbon tax
Kim *et al.* (2016)	Dynamic Financial CGE	Infrastructure financing

Chapter 4. Development of Financial CGE Model

4.1. Structure of Financial CGE Model

For the purposes of analysis, this research uses a Financial CGE model. It is an integrated model of the real side of the economy and financial asset choices to address the impacts of shifting fuel subsidies to investment in transportation infrastructure. This FCGE model is built on two major background studies that are the financing model of Kim (1998) and the transportation network model of Kim *et al.* (2004). To estimate the economic impact of the transportation sector's infrastructure investment on GDP and inflation within a global network, Kim (1998) developed a recursive dynamic CGE model. Using the model, he examined the alternatives of financing source for the transportation sector, such as tax revenues and foreign borrowings. The study found that the growth effect of transportation investment would be maximized if the private sector can freely use foreign capital. Additionally, the impact of transportation investment on inflation could be minimized if the project is funded from the tax revenues. As for estimating the economic impacts of transport investments, such a calibration of the economic effects of road infrastructure on GDP and household

income, taking the reference from Kim *et al.* (2004) who measured the dynamic economic effects of highway projects on the economic growth and the regional disparity in Korea using the transport network–multiregional CGE models. They defined that the change in GDP is due to the indirect economic impacts associated with the construction which was treated as benefits, while the construction and operation costs of the highway are considered as costs.

In this paper, the Indonesian FCGE model consists of interactions between the real–side and financial–side blocks. Industrial activities are disaggregated into ten sectors: Agriculture (AGRI), mining (MINE), other manufacturing (MANU), petroleum and chemical (MOIL), utility (ELGW), construction (BLDG), trade, hotel, and restaurant (TRAD), transportation and communication (TRAN), banking and finance (FINA), and other service sectors (OTHR). The portfolio choice for financial instruments (assets) is disaggregated into real wealth, government bonds, and composite financial instruments including currencies, credits, savings, time and demand deposits, equity, insurance and pension funds. The economic institutions are represented by four household classes which are Rural Poor (RP), Rural High (RH), Urban Poor (UP) and Urban High (UH), corporations (CO), the central bank (CB),

government (GO), and the rest of the world (ROW).

Figure 4 shows the relationship between the real sector, trade block, and financial sector. Firstly, export and import activities are influenced by exchange rate and are the main component of the current account in the balance of payment. In addition, export and import activities also affect the domestic production activities. For most of the countries, including Indonesia, import is one of input component for production activities, while from the amount of output generated by production activities some proportion is for export.

For the sake of simplification, the non-financial firms (corporations) and commercial banks are merged into one account, corporation. In order to avoid misunderstanding, an intermediary relationship between the central bank, banks and the non-financial firm is shown in figure 5. Non-financial firms save money in banks in the form of composite financial instruments, for instance, time deposits (TD) or demand deposits (DD). Banks gave credit (CR) to non-financial firms. Central banks control the circulation of money by using central bank certificates (CBC) purchased by the commercial bank to gain interest in return. Legally, the central bank also requires commercial banks to withhold cash out of aggregate

deposits as required reserves (RR).

Goods and services produced by each sector consist of domestic commodities, import, and export, which are imperfectly substituted. Domestically produced goods (XD) are made through two stages of the production function, which are value-added and composite intermediate inputs. At first stage, the value added (VA) is determined by labor (L), capital (K) input and road capital stock (RCS) and productivity by Cobb-Douglas production function. L is determined according to profit maximization condition. K is defined as the sum of lagged capital stock (LK) and current investment by destination (INVD).

At the second stage, XD is produced through the composition of VA and intermediate inputs by Leontief production technology. The intermediate inputs are derived from input-output coefficients.

$$V_i = A_i \cdot L_{m,i}^{\alpha_{m,i}} \cdot K_i^{1-\alpha_{m,i}} \cdot R^{\beta_i} \quad (10)$$

$$L_{m,i} \cdot W_m \cdot w_{m,i} = \alpha_{m,i} \cdot P_i \cdot V_i, \quad K_i = L_i + I_i$$

$$X_i = \min\left(\frac{V_i}{a_i}, \frac{I_{1i}}{it_{1i}} \ldots, \frac{I_j}{it_{ij}}\right) \quad (11)$$

VA_i: Value-added

$L_{m,i}$: Labor input

K_i: Capital input

RCS: Road capital stock

LK_i: Lagged capital

$INVD_i$: Investment by destination

WA_m: Average wage rate

$wdist_{mi}$: wage distribution parameter

PVA_i: Price of value-added

XD_i: Domestically produced goods

$INTER_{ji}$: Intermediate inputs

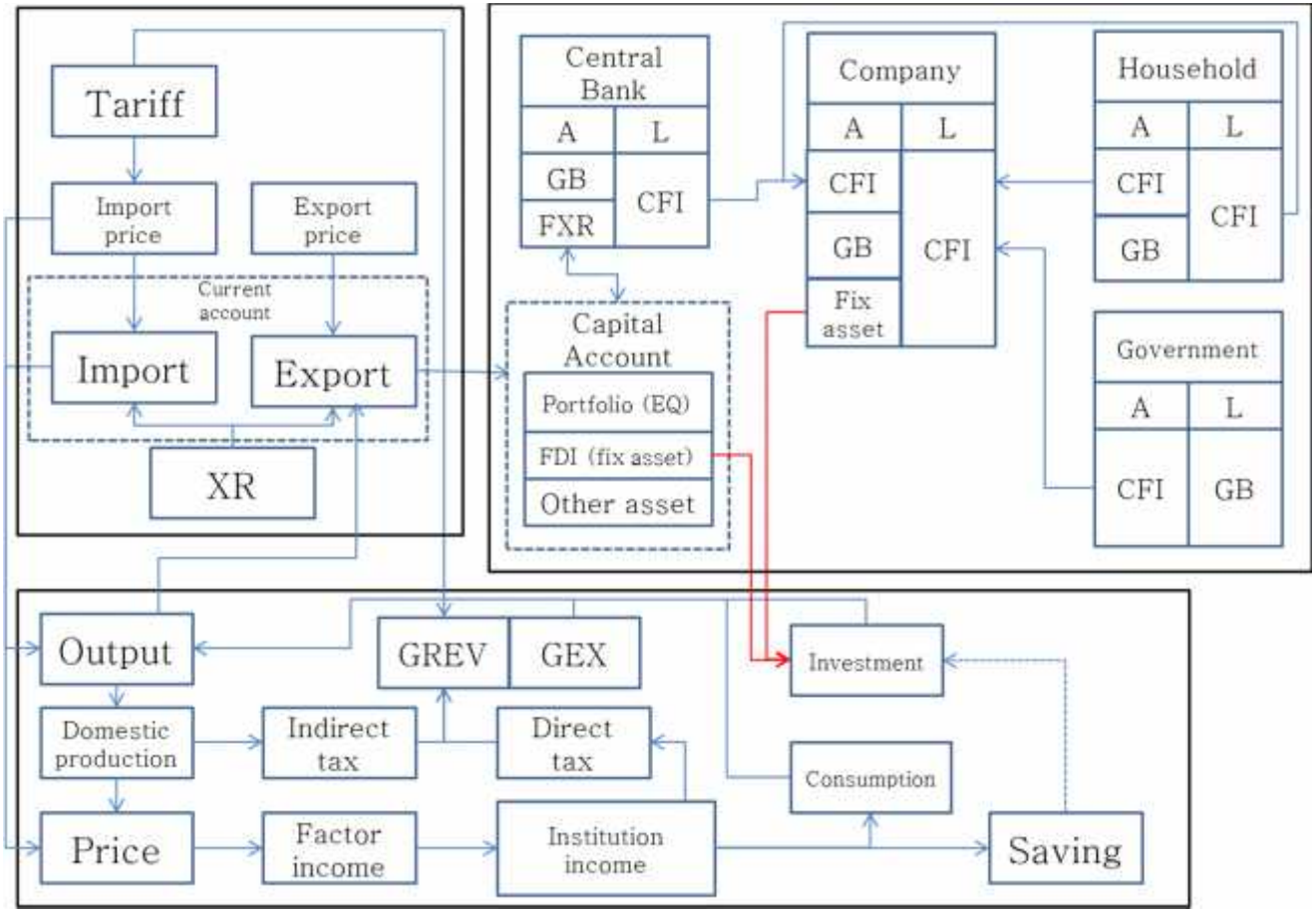


Figure 4 Methodological Framework

Where

A: Assets;
EQ: Equity;
XR: Exchange rate;
GB: Government bonds;
L: Liabilities.

CFI: Composite financial instruments;
FDI: Foreign direct investment;
FXR: Foreign exchange reserves;
GEX: Government expenditure;
GREV: Government revenue;

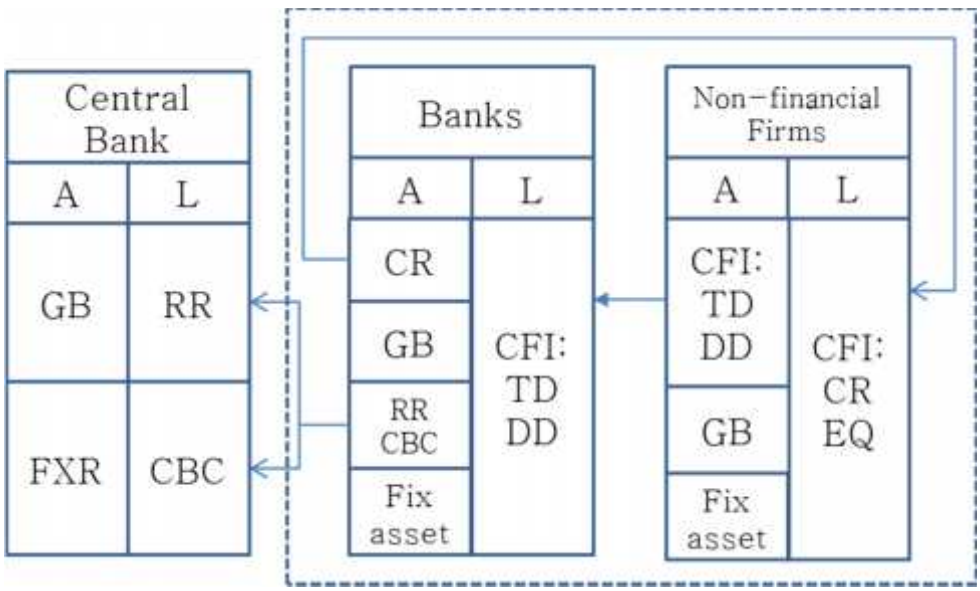


Figure 5 Bank Intermediaries

The RCS represent infrastructure availability that reflects the importance of both the scale and proximity of economic activity and is a proxy for the quality of transportation services and development potential. The RCS is defined as a road length. The value of road length is used for the estimation of the value-added production function with two other factor inputs. Due to limitations

on data availability of the capital stock by sector, the function is estimated for the transportation sector only. The elasticity of the road length with respect to the value added of the transportation sector is estimated using the 1993−2013 data of industries and road length and is presented below. Where *TRAN* is Transportation & communication sector[①]

$$\ln V_t^T = -1.794 + 0.337 \ln L_t^T + 0.663 \ln K_t^T + 0.565 \ln R_t \quad (12)$$

$$(-3.96)\ (9.62)\qquad (18.97)\qquad (5.54)$$

$$Adjusted\ R^2 = 0.9864$$

SAM 2008 disaggregated labor into 16 job types, this model disaggregated labor into 12 types of jobs (see Table 4 and 5). Capital stock is assumed to be fixed in the short term. The demand for labor by industry is derived from the producers' value−added maximization of the first order conditions. Each producer requires a set of factor inputs in which the marginal revenue of each factor input is equal to its factor input price.

① For quasi production functions please see Oosterhaven and Elhorst (2003)

Table 4 Type of Labor Definition

Labor	Type of Jobs	Residence	Payment
L1	Agriculture, production, transportation operator, manual and low-skilled labor	Rural	Wage
L2	Agriculture, production, transportation operator, manual and low-skilled labor	Urban	Wage
L3	Agriculture, production, transportation operator, manual and low-skilled labor	Rural	Non-wage
L4	Agriculture, production, transportation operator, manual and low-skilled labor	Urban	Non-wage
L5	Administration, sales, services	Rural	Wage
L6	Administration, sales, services	Urban	Wage
L7	Administration, sales, services	Rural	Non-wage
L8	Administration, sales, services	Urban	Non-wage
L9	leadership, management, professionals, military and technicians	Rural	Wage
L10	leadership, management, professionals, military and technicians	Urban	Wage
L11	leadership, management, professionals and technicians	Rural	Non-wage
L12	leadership, management, professionals and technicians	Urban	Non-wage

Table 5 Labor by Type of Jobs by Sector (in million workers)

Labor	Agricultu−re	Mining	Other Manufac−turing	Petroleum & Chemical	Utility	Building	Trade, Hotel & Restaurant	Transpor−tation & Communi−cation	Finance	Other Services
L1	11.009005	0.411171	1.423423	0.811990	0.035183	2.376172	0.368112	0.828537	0.037124	0.541700
L2	1.633814	0.170174	3.299853	1.392468	0.050375	1.892278	0.757354	1.214234	0.117381	1.255971
L3	25.518590	0.212788	1.656798	0.627003	0.003059	0.336481	0.294210	1.015402	0.004115	0.239074
L4	2.664101	0.037729	0.921475	0.151542	0.005373	0.247130	0.466416	1.091314	0.007332	0.335750
L5	0.216795	0.050708	0.357273	0.073273	0.011263	0.029106	0.973311	0.329610	0.159847	1.268586
L6	0.057492	0.087366	0.601260	0.454478	0.053780	0.219520	5.086405	1.154322	0.729631	3.456888
L7	0.064406	0.012944	0.086280	0.034317	0.002628	0.012287	6.155279	0.149258	0.015778	0.167956
L8	0.008576	0.002529	0.038405	0.004414	0.002089	0.055054	6.619108	0.154957	0.102937	0.348060
L9	0.062865	0.020956	0.065893	0.024712	0.005513	0.020372	0.065695	0.019056	0.019422	1.759913
L10	0.021750	0.042860	0.146716	0.170893	0.028010	0.133226	0.319363	0.186660	0.219087	3.379345
L11	0.067809	0.021063	0.064872	0.026097	0.000728	0.029852	0.056526	0.008869	0.004308	0.036040
L12	0.006503	0.000252	0.070194	0.045747	0.003113	0.087487	0.059965	0.027284	0.043023	0.310534
Total	41.331706	1.070540	8.732442	3.816934	0.201114	5.438965	21.221744	6.179503	1.459985	13.099817

In international trade, Indonesia is assumed as a small and open country that cannot affect prices on the international market. The domestic market is assumed to be a price taker at the given world price, that adopts the Armington approach. Composite goods (X) include both domestically produced and demanded (XD) and imported (IM). Consumers determine their IM consumption to minimize the total cost at the given price and quantity. X can also be sold in domestic (XD) or a foreign country (EX). The producer allocates products to maximize their revenue at the given relative price and quantity. Any positive difference between total exports and total imports is regarded as foreign savings or the current account deficit if it is negative.

$$M \quad P \;_i \cdot I \;_i + P \;_i \cdot X \;_i \tag{13}$$

$$\text{s.t. } Q_i = a \;_i \cdot (\delta \;_i \cdot I \;_i^{-a_i} + (1-\delta_i) \cdot X \;_i^{-a_i})^{-\frac{1}{a_i}} \tag{14}$$

$$\Rightarrow \frac{I \;_i}{X \;_i} = (\frac{\delta_i}{1-\delta_i} \cdot \frac{P \;_i}{P \;_i})^{\frac{1}{1+a_i}} \tag{15}$$

$$M \quad P \;_i \cdot E_i + P \;_i \cdot X \quad _i \tag{16}$$

$$\text{s.t. } X_i = a \;_i \cdot (\gamma \;_i \cdot E \;_i^{\mu_i} + (1-\gamma_i) \cdot X \;_i^{\mu_i})^{\frac{1}{\mu_i}} \tag{17}$$

$$\Rightarrow \frac{E \;_i}{X \;_i} = (\frac{1-\gamma_i}{\gamma_i} \cdot \frac{P \;_i}{P \;_i})^{\frac{1}{\mu_i - 1}} \tag{18}$$

PM_i: Price or imported goods PD_i: Price of domestic goods

IM_i: Import EX_i: Export

X_i: Composite goods PE_i: Price of exported goods

XD_i: Domestically produced and demanded goods

The total demand for goods and services is a summation of intermediate demands, total consumption expenditures for households, government consumption expenditures, and investment. Each institution gains production income as compensation for their labor and capital inputs.

Households receive labor income (YLC) by type of labor is a summation of average wage rate by type of labor in the sector (i) and fixed labor income from rest of the world (YLCRW).

$$Y_m = \sum_i W_m \cdot L_{m,i} W_{m,i} + YL_m \cdot E \quad (19)$$

$wdist_{m,i}$: Wage adjustment share by type of labor (m) by sector (i)

Capital income (YKC) is residual of value-added (VA) after indirect taxes (itax) to government, and labor wage (WA) plus sectoral subsidies to household, and fixed capital income from abroad (YKCRW).

$$Y \quad = \sum_{i} (P \quad {}_{i} V \quad {}_{i} (1 - it \quad) - \sum_{m} (W \quad {}_{m} \cdot L_{m,i} \cdot w \quad \quad {}_{m,i} + I \quad {}_{i}) \qquad (20)$$

$$+ YI \quad \cdot E$$

PVA_i: Price of value-added by sector (i)

Therefore, the total income (Y) of each economic actors (e) is labor income (YLC), capital income (YKC), summation of transfer from other institution (TREA), net transfer to institutions from abroad (TREARW), cumulative demand of financial assets (CDFA) minus cumulative supply of financial assets (CSFA). Saving rates (savep) are applied to total income (Y) after transfer among economic actors (TREA).

$$\begin{aligned} Y_e = {} & Y \quad {}_{m} \cdot y \quad {}_{m,e} + Y \quad \cdot y \quad {}_{e} + \sum_{e} T \quad {}_{e,e} \, Y_e \\ & + D \quad {}_{e} \sum_{i} P \quad {}_{i} V \quad {}_{i} it \quad {}_{i} + T \quad {}_{e} E \\ & + \sum_{b} \left(P \quad {}_{b} \left(C \quad {}_{b,e} - B \quad {}_{b,e} \right) \right) - \sum_{a} (P \quad {}_{a} (C \quad {}_{e,a} - B \quad {}_{e,a})) \end{aligned} \qquad (21)$$

$$S \quad {}_{e} = s_{i} \quad {}_{e} Y_e (1 - \sum_{e} T \quad {}_{e,e}) \qquad (22)$$

$ylcp_{m,e}$: Allocation of labor income by type of labor by economic actor (e)

$ykcp_e$: Allocation of capital income by economic actor (e)

$DTAX_e$: Dummy variable for government

$itax_i$: Indirect tax rate by sector (i)

PA: rate of return

$BCDFA_{b,e}$: Policy variable for cumulative demand of financial asset (b) of economic actor (a)

$BCSFA_{e,a}$: Policy variable for cumulative supply of financial asset (a) of economic actor (e)

Total consumption (PCT) is total income after transfer (TREA) and savings (SAVE). For the government, subsidy and investment must also be excluded from consumption.

$$P_{e} = Y_{e}(1 - \sum_{e'} T_{e',e}) - S_{e} - D_{e} \sum_{i} IS_{i} - D_{e} R_{e} \quad (23)$$

$RINVD_e$: dummy variable for investment economic actor (e)

Bridging the gap between the real sector and the financial sector is investment and savings balance. Assets and liabilities are placements made by institutions on financial instruments in the financial block. Meanwhile, fixed asset is an investment in the real sector. Total savings (SAVINGS) is a summation of real asset investment (DFARIV) by economic actor (e), summation of government financial sources (RINVD), and summation of injection (SHOCK) of financial asset (a) by economic actor (e), minus summation of capital injection (KINVD) by sector (i)

$$S_{i} = \sum_{e} D_{e} + \sum_{e} D_{e} R_{e} + \sum_{e} \sum_{a} S_{e,a} - \sum_{i} KI_{i} \quad (24)$$

The macroeconomic closure rule is used to account for the way in which equilibrium is achieved in the macroeconomic balances for

the government, the rest of the world, and the capital account of savings and investments (Iqbal & Siddiqui, 2001). Final demand for productive investment (INVD) by sector (j) is total domestic investment (INVEST) capital injection (KINVD) by sector (i)

$$I \quad _j \sum_{i} (P_i IV \quad _{i,j}) = in \quad _j I \qquad + K \qquad _j \tag{25}$$

$invdp_j$: Allocation of investment by destination sector (j)

In this research, the government saving (difference between the government revenues and the government consumption expenditures) is endogenous while all tax rates are exogenous. The real exchange rate is flexible while the foreign savings are fixed in the model.

The closure rule for the capital account is savings-driven, it means that the investment expenditures increase or decrease so as to meet the required savings. The flows into the capital account are depreciation, savings, and financial liability. Depreciation is considered as retained saving to compensate future investment. Financial liability occurs when institutions borrow money from the deposit, bonds or loans. Meanwhile, the outflow of capital is the purchase of capital goods for investment or financial assets for

wealth. Capital goods can be in the form of machinery, land, buildings, and including products from the services sector. Institutions are also buying financial assets to increase their wealth, preparing the fund's shortage in the future. Capital goods purchased by the institution are goods and services from production sectors or imports. This original investment is distributed into production activities as investment demand. Investments in each period enlarge the capital stock recursively. After the development of infrastructure, the road length is increased, meaning increased road capital stock and consequently, the value added also increases.

The loanable fund markets such as money (deposits), domestic bonds, equity and real capital are specified in the model. Total wealth (WE) consists of real wealth and financial wealth. Real wealth includes machinery and buildings; financial wealth is classified into government bonds, and a composite of financial instruments such as equity, deposits (money) and private bonds.

$$W_{e} = S_{e} + \sum_{a} S_{e,a} + SF_{e} E \qquad (26)$$

$SFA_{e,a}$: Supply of financial assets (a) by economic actor (e)

SFARWe: Supply of financial assets from abroad by economic actor (e)

The specification of the portfolio behavior of asset holders (institutions) is based on Kim (1990) as shown in Figure 6. If the return on investment increases compared to the interest rate, an institution shift to buying more real assets for investment, such as buildings and machinery. In the same way, if a bond's rate exceeds the interest rate on the competing financial assets, institutions would be willing to buy more bonds to increase their property income from the bond's coupon.

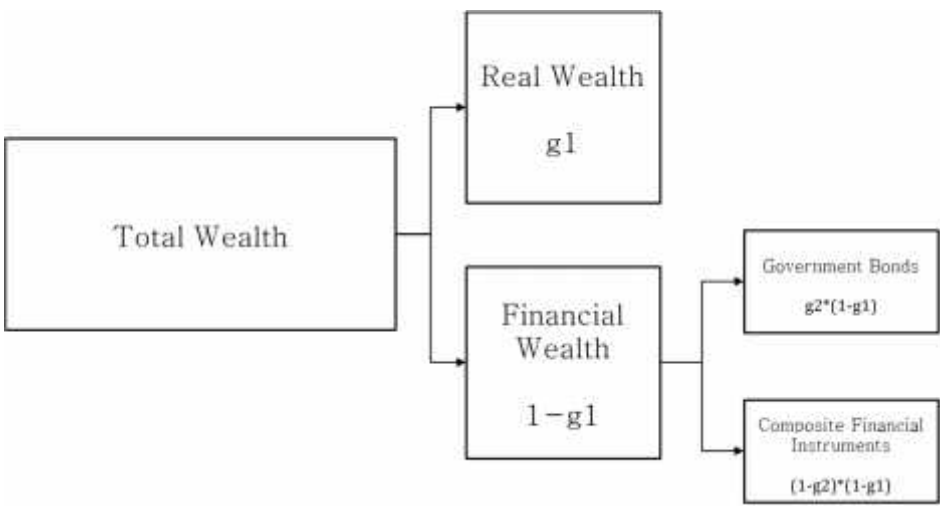


Figure 6 Total Wealth Demand Structure

Each asset holder is required to make a decision regarding how much they are willing to buy of two competing financial assets in the portfolios in every successive stage. In the first stage, the total wealth is divided into real wealth acquisition and the financial assets

purchased in the ratio of g1:(1−g1). The ratio, g1, of real wealth to total wealth is endogenously determined by the rate of return on the investments and the average rate of return on the financial wealth. The latter is again distributed to government bonds and composite financial instruments in the ratio of g2:(1−g2).

$$D_{e} = D\ A_{e} W_{e} \quad (27)$$

$DFARIV_e$: Demand for real investment by economic actor (e)
$DFAPRIV_e$: Share of real investment by economic actors (e)

$$D_{e} = D_{e}(1 - D_{e}) W_{e} \quad (28)$$

$DFAGB_e$: Demand for financial assets (government bonds) by economic actors (e)
$DFAPGB_e$: Share of investment in financial instrument (government bonds) by economic actors (e)

$$D_{e} = (1 - D_{e})(1 - D_{e}) W_{e} \quad (29)$$

DFACFIe: Demand for financial assets (composite financial instruments) by economic actors (e)

Financial decisions are also dependent on their net returns. In order to reflect this asset demand relationship with its rate of return in the model, the elasticity of demand parameter in respect to its relative rate of return is derived from the regression model (see Table 6).

$$\frac{D}{(1-D)} = d \quad 0g \left(\frac{1+P}{1+P}\right)^{d} \quad (30)$$

dfap0gb$_e$: Shift parameters of asset (government bonds) demand function by economic actor (e)

PAGB: Price of government bonds

PACFI: Price of composite financial instruments

dfap2gb$_e$: Elasticity parameters of asset (government bonds) demand function by economic actor (e)

$$\frac{D}{(1-D)} = d \quad 0i \left(\frac{1+P}{1+P}\right)^{d} \quad (31)$$

dfap0iv$_e$: Shift parameters of real asset demand function by economic actor (e)

PARIV: Price of real investment

PAGBCFI: Rate of return of composite assets

dfap2riv$_e$: Elasticity parameters of real asset demand function by economic actor (e)

Table 6 Elasticity Value of Assets Demand

Assets	Household	Corporation	Central Bank	Government
Physical Assets	1.230	1.777	1.777	4.623
Government Bonds	3.663	6.573	7.138	6.949

The total supply of each financial asset is fixed, but the total demand is the summation of an individual institution's demand that

is derived from the maximization of revenue subject to imperfect substitutability in the CET aggregation function shown in Figure 6. Hence, the price of financial assets, namely the interest rate, varies flexibly enough to generate a balance between the total demands from all economic institutions and total supply.

The FCGE model consists of a two-step dynamic process including a within-period model and a between-period model. An adaptive and recursive pattern was selected, which was commonly used in CGE applications for the dynamics of the model due to the computation problems created by multi-sectoral classifications of the institutions, the industrial sectors, and the financial assets. The within-period model determines equilibrium quantities and prices under objectives and constraints for each economic agent in the context of a static model. The between-period model finds a sequential equilibrium path for the within-period model over multiple periods by updating the values of all exogenous variables using the growth rate and adaptive expectation methods of Devarajan and Robinson (2013). On the real side economy, the current capital stock is expanded with new investment but also reduced by a constant depreciation rate. The within-period model is a square system of equations with 456 equations and 205

exogenous variables including world market prices and labor supply. The *numeraire* of the model is set as the consumer price index.

4.2. Calibration of Financial SAM

After the economic crisis in 1997/1998, one of the problems that arose in Indonesian economy was the disconnection between the financial sector and the real sector. The financial sector indicators might have shown positive growth in terms of the stock market and the money market activities, which was not a driving factor for the real sector' s growth. In order to understand the connection between the financial sector and the real sector, it is necessary to develop a comprehensive and integrated data system of those two markets.

Keuning and Ruuter (1988) defined the SAM as a numerical representation of the economic cycle with emphasis on distributive aspects. They identified how sectoral value, added accruals to production factors and their institutional owners; how these incomes, corrected for net current transfers are spent; and how expenditure on commodities leads to sectoral production and value added in the SAM framework.

The SAM cycle also contained leakages, for instance, payments to abroad or savings. In the late 1980s, capital finance has been linked to savings that are the property of the FSAM. This linkage connects between multi–industrial relationships in production to the multi–sectoral distribution of income, consumption, investment in fixed assets, and financial instruments in the economy as well as its interaction with the rest of the world (Dakila *et al.*, 2013).

The FSAM is a combination of the flow of funds (FOF) matrix and the Social Accounting Matrix (SAM) to macroeconomics that provides details of the real financial transactions and flows between economic agents (Emini and Fofack, 2004). Other definitions came from Wong et al., 2009, referring to the FSAM as the flow of funds between institutions in national economy activities, which construct a complete SAM to be linked with a detailed capital account in the matrices. In simple, the FSAM can be regarded as the SAM with a detailed capital account of each economic agent regarding physical and financial investments, which can be used as an analytical tool to account for the transmission between real and financial sectors and to measure the impact between both sectors.

The author calibrated FSAM 2008 using SAM 2008 from Statistics Indonesia (BPS) and Bank Indonesia (BI/central bank).

Through the integration of the financial sector FOF matrix into Indonesia SAM, the FSAM was able to trace out financial transmission channels, which eventually affected monetary policy formulation. There are nine components in Indonesia FSAM; namely Factor of Productions, Institutions, Production Sector, Trading and Transportation Margin, Commodities, Capital, Indirect Taxes and Subsidies, Financial Instruments, and Foreign sector. In detail, the Indonesian FSAM disaggregates to 79 dimensions of components. The main data sources used in constructing FSAM are Input Output (IO) data, Social Accounting Matrix and flow of funds data that are supported by the results of special surveys, such as the Special Survey of Input and Output, Special Survey of Household Savings and Investment and Special Survey of Private Company.

In concept, the SAM captures all the economic activities that run in a country, but it is limited in grasping financial sector activities. The links between the real sector and the financial sector are described in the capital account that records information about gross savings by the institutions (households, government, and enterprise). The gross saving is the excess of revenue over expenditure, which is then used to finance physical investment. In practice, the gross saving by the economic agent is not only used to

finance physical investments but also used to finance investments in non-physical or investment portfolios, such as for the purchase of securities, deposits, foreign exchange, and others. Alternatively, the sources of funds for real and financial investments are not exclusively coming from gross savings, but can also be derived from other sources of funding, such as loans and bonds issuance, or withdrawal from another source. Such interactions produce the change of assets and liabilities in the financial balance of economic actors. The links between gross savings and real investment as well as between the source and the use of financial instruments are included in the FSAM, which can provide a more detailed framework in which to understand the movement of the financial sector in relation to the real sector activities or vice versa. The FSAM is expected to examine various transmission paths traversed by economic actors, and to monitor the impact of various monetary policies on real sector performance.

In calibrating the FSAM of Indonesia for this dissertation, the capital account in the SAM needs to be extended to be able to provide information on savings and investment, as well as the movement of the assets and liabilities of the economic actors. Calibration is done by inserting a flows of funds matrix into the

SAM's capital account. Institutions in the Indonesian flow of funds matrix are divided into four groups: the Central Bank, Commercial Banks, Other Domestic Institutions, Government, and Foreign. We disaggregate Other Domestic Institutions into six agents which are Non-bank Financial Institutions, Non-financial Enterprises and four Households (Rural Poor, Rural High, Urban Poor, and Urban High). Disaggregation of the Other Domestic Institutions was done by replicating the share of six respective agents in the FSAM 2005. In order to simplify the analysis, an aggregation is required to some of the accounts. The aggregation of FSAM 2008 accounts is as follows:

1. Commercial Banks, Non-Bank Financial Institutions, and Non-Financial Enterprise merge into "Corporation" account;
2. Commodities and Activities merged into "Industries" by sector accounts;
3. There are only two financial instruments, which are "Government Bonds" and "Composite Financial Instrument." The Composite Financial Instrument is an aggregation of 16 financial instruments.

A block of cells of physical investment by sector of industry was added to the matrix, replicating the pattern of investment by

destination matrix from Kim *et al.,* (2016). The calibrated Indonesian FSAM 2008, is presented in the appendix.

Table 5 shows the aggregated Indonesian FSAM 2008. The rows of the FSAM account are for the income (receipts), and the columns accounts are for the use (expenditures) by economic agents. Its upper left corner (accounts 1 to 8) concerns real variables, while its lower left and right corner (accounts 9−11) concerns the financial variables and flows between agents. Account 12 is concerned with the rest of the world, where the real sectors account such as export, import, income, and transfers from and to foreign countries is located, including financial assets and liabilities held by foreign countries. The linkages between the real and financial aspects of the economy are provided by institution' s savings in row 10 of the FSAM. The savings are presented in the form of flows in the capital accounts and changes in the assets and liabilities accounts of economic agents. Savings may be viewed as equivalent to changes in net worth, where net worth includes both physical capital and net financial assets.

Table 7 Financial Social Accounting Matrix of Indonesia 2008②

Indonesia FSAM 2008 (in trillion Rupiah)				Expenditures												
				Factors		Institutions				Industry	Subsidy	Invest-ment	Capital account	Financial instrument	Rest of the World	Total
				L	K	CB	CO	GO	HH							
				1	2	3	4	5	6	7	8	9	10	11	12	13
Receipts	Factors	L	1							2692.613					−3.712	2688.901
		K	2							2464.314					−84.569	2379.745
	Institutions	CB	3		33.117		0.674	8.268	0.009						−10.331	31.737
		CO	4		1558.080	12.59	82.006	81.424	35.152						−25.819	1743.433
		GO	5			0.497	649.554	181.676	85.071	344.937					−26.408	1235.327
		HH	6	2688.901	788.548	0.026	43.055	199.032	43.357						48.031	3810.950
	Industry		7					294.563	3318.089	6389.106	240.891	1530.237			1465.839	13238.725
	Subsidy		8					240.891								240.891
	Investments		9										1530.237			1530.237
	Capital account		10			18.624	968.144	229.473	329.272					583.120	37.343	2165.976
	Financial instrument		11										635.739		−52.619	583.120
	Rest of the World		12							1347.755						1347.755
	Total		13	2688.901	2379.745	31.737	1743.433	1235.327	3810.950	13238.725	240.891	1530.237	2165.976	583.120	1347.755	

② L: Labor; K: Capital; CB: Central Bank; CO: Company; GO: Government; HH: Household;

Chapter 5. Policy Simulations

5.1. Shifting Fuel Subsidy Policy

An essential policy pursued by the government in the 2015 budget revision was the diversion of unproductive to productive spending to accelerate the achievement of objectives and development priorities. The policy is pursued through an efficiency in subsidy expenditure by abolished subsidies for regular fuel, fixed subsidy for diesel oil, but still providing subsidies for kerosene. The policy aims to improve government capability to fund the programs or activities that are more productive; it is also intended to minimize the fiscal vulnerability from the impact of external factors such as fluctuations international crude oil prices and the exchange rate.

Government diverts subsidy funds amounting to Rp186 trillion (US$13.92 billion) to various productive programs, in outline allocated to:

1. Additional social protection fund amounting to Rp14.3 trillion (US$1070.20 million);
2. Additional health protection fund of Rp422 billion (US$31.58 million) or equal to additional 1.8 million people beneficiaries. Additional amenities, facilities, and infrastructure for the

national referral hospital Rp2.2 trillion (US$164.65 million);

3. The Village Fund of Rp11.7 trillion (US$875.62 million);
4. The development of country border fleet, marine logistics and information systems Rp3.3 trillion (US$246.97 million);
5. The education sector amounted to Rp6.4 trillion (US$478.97 million), among others, to give education vouchers to an additional 10 million students. Therefore the total education voucher recipients become 19.2 million students;
6. The agricultural sector amounted to Rp16.9 trillion (US$1264.78 million), among others, to increase food production through irrigation development, provision of tools and agricultural machinery, fertilizer, and seeds;
7. The housing sector and public works. For irrigation, dams, and flood control amounted to Rp8.4 trillion (US$628.65 million). The development of drinking water, environmental sanitation, housing development amounted to Rp9.1 trillion (US$681.04 million). The construction of road infrastructure and road on the country borders amounted to Rp10.0 trillion (US$748.39 million). The land acquisition for highway amounted to Rp5.75 trillion (US$430.32 million);
8. The transportation sector amounted to Rp11.9 trillion

(US$890.59 million) for the construction of various types of ships, seaport facilities, and information systems;

9. The increase in regional transfer in the form of special allocation funds, for irrigation infrastructure, amounted to Rp9.3 trillion (US$696.00 million), for agriculture amounted to Rp4.0 trillion (US$299.36 million), for roads construction amounted to Rp5.0 trillion (US$374.20), and for the improvement of health referral services amounted to Rp1.4 trillion (US$104.77 million).

5.2. Policy Simulation of Subsidies and Infrastructure

The crude oil price hike provided the government with additional revenues with which to bear the fuel subsidy that has been enjoyed by the middle and upper-classes (Dartanto, 2013). However, the reduction of the fuel subsidy results in an increase in the fuel price, in turn, the price of other goods also increases. In 2014, fuel subsidies reached Rp240.0 trillion (US$20.22 billion), or 20.3 percent of central government spending, while government capital expenditures were only Rp177.9 trillion (US$ 14.12 billion) or 14.2 percent of central government spending (see Figure 7). Evidently, the government allocated more in non-productive

expenditure in the form of fuel subsidies. Then, fuel subsidies as a percentage of central government expenditure dropped to 5.1 percent in 2015, as it partially transferred to capital expenditures, where the percentage rose to 18.0 percent of central government spending or Rp189.7 trillion (US$15.96 billion). Economic growth and inflation in 2014 reached 5.02 and 8.36 percent, respectively. In 2015, the economic growth rate was decelerated to 4.79% and the inflation rate also decreased to 3.35 percent.

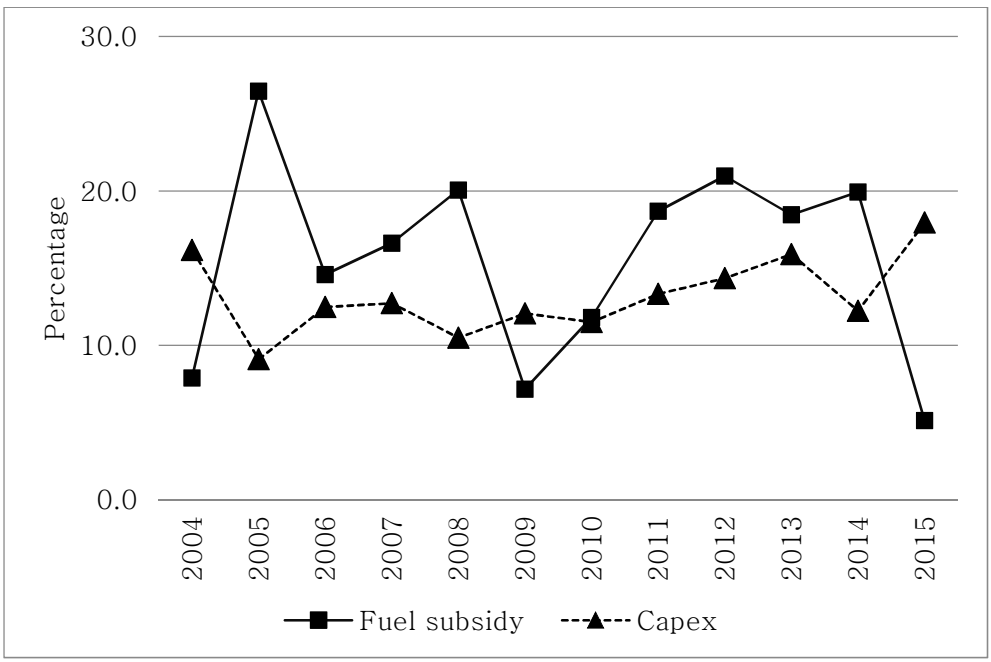


Figure 7 the Portion of Fuel Subsidy and Capital Expenditure

Recall the government fiscal policy previously mentioned to divert the fuel subsidy into a variety of programs, such as the construction of road infrastructure and road on country borders amounted to Rp10 trillion (US$0.748 billion) and the regional transfer in the form of special allocation funds for roads construction amounted to Rp5 trillion (US$0.374 billion). Thus the central government reallocated funds amounted to Rp15 trillion (US$1.123 billion) fuel subsidies for the construction of road infrastructure.

In order to get an appropriate estimation on how much additional road can be built with the diverted subsidy fund; in the model, the nominal value of 2015 had to be converted into constant prices 2008 using the GDP deflator. The GDP deflator index for 2008 and 2015 respectively was 85.31 and 135.36. Thus the 2008 constant value of Rp15 trillion was Rp9.45 trillion (US$0.975 billion in 2008 exchange rate). Thus the length of additional road that can be constructed with the diverted fuel subsidy money is equal to 1465.38 kilometers.

There are six simulations to determine the impact of fuel subsidy and transportation investment to GDP and income distribution in Indonesia, whether it is financed by a tax, budget reallocation, government bonds or bank loan, as follows.

1. Option 1: To cut fuel subsidy by Rp15 trillion (US$1122.59 million) in period 1;
2. Option 2: To cut fuel subsidy by Rp15 trillion and to use it for road investment in period 1, assume that in period 2 road length is expanded by 1465.38 kilometers and fully functional;
3. Option 3: To cut fuel subsidy by Rp15 trillion, and then government also to increase tax by Rp15 trillion and to use it for road investment in period 1, assume that in period 2 road length is expanded by 1465.38 kilometers and fully functional;
4. Option 4: To cut fuel subsidy by Rp15 trillion, and then government also to issue government bonds by Rp15 trillion and to use it for road investment in period 1, assume that in period 2 road length is expanded by 1465.38 kilometers and fully functional;
5. Option 5: to increase tax by Rp15 trillion and to use it for road investment in period 1, assume that in period 2 road length is expanded by 1465.38 kilometers and fully functional;
6. Option 6: to borrow money from the bank by Rp15 trillion and to use it for road investment in period 1, assume that in period 2 road length is expanded by 1465.38 kilometers and fully functional.

Table 8 is a summary of policy options to reduce fuel subsidy and road investment with various financing sources. Minus sign (−) indicates fuel subsidy reduction, while positive sign (+) indicates an injection of the corresponding columns.

Table 8 Policy Options

Options	Fuel subsidy	Tax increase	Govern-ment bonds	Bank credit	Road investment
Option 1	(−)				
Option 2	(−)				(+)
Option 3	(−)	(+)			(+)
Option 4	(−)		(+)		(+)
Option 5		(+)			(+)
Option 6				(+)	(+)

Table 9 presents the simulation results of the impact on GDP. The unpopular policy to cut fuel subsidy is exercised in option 1. The policy to reduce fuel subsidy by Rp15 trillion ((US$1122.59 million), produces the lowest average GDP compared to other options, lower than the baseline by -0.0037%. When it firstly introduced in period 1, GDP is lower by 0.0224%, but then the

effect fades away over the time. Therefore, on average, the value is quite small. The fuel subsidy reduction allows the economy to adjust for a lesser fuel consumption. Sectors of industry reduce their dependence on subsidized fuel and make the switch to another kind of energy. Similarly, the end consumer, such as households, rationalizes their consumption of subsidized fuel and replaces it with another energy. Industry and household behaviors are changing due to the reduced fuel subsidy with the level of economic activity eventually returning to the baseline with new consumption patterns.

Table 9 Impacts on GDP Growth (in percentage)

Baserun= 0

Options	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8
Option 1	−0.0224	−0.0054	−0.0047	−0.0039	−0.0034	−0.0030	−0.0027	−0.0023
Option 2	−0.0224	0.0157	0.0165	0.0173	0.0179	0.0184	0.0189	0.0193
Option 3	−0.0103	0.0282	0.0208	0.0212	0.0216	0.0219	0.0222	0.0224
Option 4	−0.0237	0.0133	0.0149	0.0162	0.0174	0.0183	0.0192	0.0200
Option 5	0.0119	0.0335	0.0254	0.0252	0.0250	0.0249	0.0248	0.0247
Option 6	−0.0013	0.0187	0.0195	0.0202	0.0208	0.0214	0.0219	0.0224

Options	Period 9	Period 10	Period 11	Period 12	Period 13	Period 14	Period 15	*Average*
Option 1	−0.0020	−0.0017	−0.0014	−0.0012	−0.0009	−0.0006	−0.0003	*−0.00373*
Option 2	0.0197	0.0201	0.0204	0.0207	0.0210	0.0212	0.0214	*0.01641*
Option 3	0.0226	0.0229	0.0231	0.0232	0.0234	0.0236	0.0237	*0.02069*
Option 4	0.0208	0.0215	0.0221	0.0228	0.0234	0.0239	0.0245	*0.01698*
Option 5	0.0246	0.0246	0.0245	0.0244	0.0243	0.0242	0.0240	*0.02441*
Option 6	0.0228	0.0232	0.0236	0.0239	0.0242	0.0245	0.0248	*0.02070*

Except for the OTHR sector, all the sectors are affected by the negative impact of subsidy cuts (see Table 10). The big three of the sectors most affected by subsidy cut are the utility (ELGW) sector, mining (MINE) sector, and transport and communications (TRAN) sector. This three sector effect directly related to subsidized fuel. The mining sector is associated with crude oil production, the transport sector is one of the largest consumers of fuel subsidies, while the utility sector also has to provide subsidized electricity with subsidized diesel. The OTHR sector survived the negative impact of subsidy cut because this policy creates a broader fiscal space for the government budget. Government spending is mainly disbursed in this very sector. The decline in the value-added to other industries sector shows that the subsidized fuel are complementary goods for their industry. Regarding household income, all household income decreased compared to the baseline (see Table 11). The most severe decline is the poor households in urban areas, because they require the use of kerosene for daily cooking activities, as previously revealed by Yusuf and Resosudarmo (2008) that kerosene subsidies could progressively have an effect in reduction of poverty in urban areas.

Table 10 Impact on Value Added (average)

Baserun= 0

Sectors	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Agriculture	−0.0040	0.0007	0.0011	−0.0012	0.0051	0.0028
Mining	−0.0063	−0.0086	−0.0079	−0.0142	−0.0016	−0.0079
Other Manufacturing	−0.0055	−0.0050	−0.0040	−0.0084	0.0016	−0.0029
Utility	−0.0069	0.0097	0.0091	0.0021	0.0161	0.0091
Building	−0.0025	−0.0006	0.0208	0.0205	0.0233	0.0229
Trade, Hotel & Restaurant	−0.0046	0.0000	0.0018	−0.0011	0.0064	0.0035
Transport & Communication	−0.0056	0.2223	0.2650	0.2605	0.2705	0.2661
Finance	−0.0054	−0.0008	0.0010	−0.0025	0.0064	0.0029
Other Services	0.0091	0.0249	0.0097	0.0082	0.0005	−0.0009
Petroleum & Chem.	−0.0034	0.0086	0.0136	0.0115	0.0170	0.0149

Table 11 Impact on Household Income (average)

Baserun= 0

Options	Rural Poor	Rural High	Urban Poor	Urban High
Option 1	−0.0192	−0.0119	−0.0235	−0.0099
Option 2	−0.0005	0.0066	−0.0033	0.0134
Option 3	0.0106	0.0125	0.0054	0.0158
Option 4	0.0003	0.0094	−0.0099	0.0102
Option 5	0.0298	0.0244	0.0290	0.0258
Option 6	0.0195	0.0213	0.0136	0.0201

In terms of labor income, the most affected labor are those with low income who do not have a steady source of income (see Table 12). Low−income groups are labor L1, L2, L3, and L4, working in the agricultural field or manual labor. Labor who do not have a steady income (non−wage) that is labor L7, L8, and L11. Labor L7 and L8 are administration personnel, sales, and services that do not have a regular income and live in rural or urban areas. While labor L11 are professionals living in rural areas, who do not have a steady income. They experienced a drop in real income due to rising fuel prices. Labor who have a regular income can anticipate fuel price hike by rationing the consumption of other goods and services. While for those who do not have a regular income it is certainly not easy to do rationing before they have the assurance of income.

Table 12 Impact on Labor Wage (average)

Baserun= 0

Labor	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
L1	−0.0100	0.0079	0.0190	0.0132	0.0290	0.0232
L2	−0.0028	0.0122	0.0205	0.0181	0.0233	0.0208
L3	−0.0121	0.0060	0.0127	0.0061	0.0249	0.0182
L4	−0.0069	−0.0053	−0.0039	−0.0085	0.0030	−0.0016
L5	0.0066	0.0336	0.0230	0.0208	0.0165	0.0143
L6	0.0046	0.0323	0.0239	0.0208	0.0193	0.0162
L7	−0.0042	0.0291	0.0278	0.0213	0.0319	0.0255
L8	−0.0034	0.0308	0.0291	0.0228	0.0325	0.0262
L9	0.0225	0.0721	0.0486	0.0505	0.0260	0.0279
L10	0.0187	0.0628	0.0435	0.0445	0.0249	0.0258
L11	−0.0033	0.0218	0.0277	0.0240	0.0310	0.0273
L12	0.0102	0.0476	0.0425	0.0420	0.0324	0.0318

The policy to divert fuel subsidy into infrastructure provision is reflected in option 2. The policy simulation results show that GDP at period 1 drops by 0.0224% from the baseline. However, after the road construction is completed at the end of period 1, GDP jumps to 0.0157% and continue to grow gradually in the subsequent year, on average GDP grows by 0.0164%. It can be interpreted as follows; at the time when the subsidy is reduced, the economic institutions rationalize their consumption of subsidized fuel and other goods that

are closely associated with fuel. At period 2, expanded road capital stock helps to increase production activity, and at this time with altered consumption patterns, which is less dependent on subsidized fuel. As a result, higher value added was gained.

The transportation and communication (TRAN) sector gave the highest increase in value added, while the mining sector is the most hit by this policy. The TRAN sector is the sector that directly gains additional road stock. Therefore its value added gave the highest increase in option 1. Related to household income, the groups of a poor household in urban and rural areas experience a negative impact on the transfer of the fuel subsidy into infrastructure development fund. This indicates that the poor household groups are in relatively more need for subsidized fuel that the rich group. Additionally, this poor household group did not enjoy the increasing value added from the new road capital stock. This is because the sectors in which they usually work, such as BLDG sectors experience a lessened value added as a result of diverting fuel subsidy policy. It was confirmed by a reduction in labor wage of labor L4 (low-skilled, urban, non-wage) which are usually working in the BLDG sector. The labor groups that most benefit from the option 1 is labor L9, those who earn fixed salaries and live in the

rural area, for example, the civil servants. This group of labor does not need much of a fuel subsidy since they are only traveling a short distance and experience fewer traffic jams.

Option 3 simulates that government insists on cutting subsidies to loosen fiscal space but at the same time urges to build infrastructure which is financed by additional tax revenue. The simulation results showed that on average GDP grows by 0.0207%. All sectors of industry gain an increase in value added, except the mining (MINE) sector and other manufacturing (MANU). All groups experienced an increase in income, where the increase in the rich group is larger than in the poor households. Only labor L4 experience a decreasing income.

Option 4 illustrates the condition when the government removes fuel subsidy but at the same time increases the amount of debt by issuing government bonds to finance infrastructure provision. The simulation results showed that on average GDP increased slightly above the result of option 2. Five out of ten sectors, including agriculture, mining, other manufacturing, hotel trade and restaurant, and finance has decreased in value added. The mining sector is the sector most affected by the negative impact of this policy option; it is related to the elimination of fuel subsidies. The finance sector is

also exposed to a negative impact due to the policy options, in relation to a crowding out effect. The sector showing the most growth in policy option 4 is the transport and communications sector. Only the urban poor households which experience an income decrease from this policy option and this is associated with the increase in the price of subsidized fuel, kerosene to be precise. This is confirmed by a decline in labor L4 income, the group that does not have a fixed income.

Option 5 illustrates the use of tax money for productive government spending, for example by building infrastructure. This policy resulted in the largest average GDP. Almost all sectors experienced an increase in value-added sectors except the mining sector (see Table 8). The sector which highest increase in value-added in option 5 are transport and communications (TRAN) sector, these are the consequences because road construction investment is injected into this sector.

With regard to the income of households, all households experience an income increase as a result of option 5 (see Table 11). The highest income increases happen to the poor households in rural and urban areas, because when the government levy additional tax to build infrastructure, poor households do not bear a great tax

burden as wealthy households. All groups experienced an increase in labor income in option 5. The highest income increase occurrence is for the labor group L8, which consists of labor in administrative, sales and service which do not have a regular income. Therefore they might be excused from the impact of tax increase.

Option 6 illustrates what happens the government wants to borrow money from financial markets through a banking system. Option 6 and 4 involving the use of a financial instrument, which is not possible to perform when using a conventional real-side CGE. On average during the 15 years of simulation GDP grows by 0.0207%, higher than the result of option 4. Only mining, other manufacturing, and the other services sector experience a decrease in value added. Apparently, the transport and communication sector, and construction sector gives the highest value-added increase. The finance sector is surviving from negative impact, whether this is an indication of a no crowding out effect its needs further examination.

In planning a public policy, besides the impact on economy and income distribution, another aspect that is also being questioned is the public welfare. In this case, the technique used is to compare the state of existing equilibrium where there are no changes to

policies with the counterfactual equilibrium state modified by the policy options. The general procedure is to construct numerical welfare measures of gain and loss.

Hicksian compensating and equivalent variations are widely used measures of utility associated with the equilibrium comparison. The compensating variation (CV) took a new benchmark of equilibrium income and prices and then asked how much income that must be taken or added to the household in order to return to the previous utility level before the policy change. While the equivalent variation (EV) using a benchmark of income and prices of old equilibrium, and then calculating how much changes is necessary to reach the new equilibrium level of utility. The impact to the whole economy, the welfare gain and loss of the subsidy cut, road investment and its funding sources is the sum of the CVs or EVs of every household. By using the utility and income of households, CV and EV can be calculated easily by using the following formula (Shoven and Whalley, 1984).

$$C = \frac{(U_N - U_O)}{U_N} I_N \tag{24}$$

$$E = \frac{(U_N - U_O)}{U_O} I_O \tag{25}$$

Where U_N, U_O, I_N and I_O denote the new levels of utility, old level of utility, new levels of income and old level of income, respectively.

Table 13 Welfare Measures of the Policy Impact (average)

Welfare Measures	Households	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Hicksian Compensating Variation	Rural Poor	−0.01770	0.00754	0.02000	0.01129	0.03769	0.02899
	Rural High	−0.17407	0.30830	0.44638	0.41936	0.62049	0.59321
	Urban Poor	−0.01256	0.00449	0.01071	0.00214	0.02354	0.01464
	Urban High	−0.31179	0.71371	0.87282	0.67576	1.18480	0.98732
	Total	−0.51612	1.03404	1.34992	1.10855	1.86652	1.62417
	Welfare Gain (Loss) as a Percent of Total Household Income	−0.01138	0.01255	0.01854	0.01365	0.02993	0.02502
Hicksian Equivalent Variation	Rural Poor	−0.01770	0.00754	0.02000	0.01129	0.03769	0.02899
	Rural High	−0.17404	0.30834	0.44641	0.41942	0.62052	0.59324
	Urban Poor	−0.01256	0.00449	0.01071	0.00214	0.02354	0.01464
	Urban High	−0.31176	0.71377	0.87288	0.67584	1.18485	0.98737
	Total	−0.51606	1.03415	1.35001	1.10869	1.86660	1.62425
	Welfare Gain (Loss) as a Percent of Total Household Income	−0.01138	0.01254	0.01853	0.01364	0.02992	0.02502

Table 11 presents the calculation results of Hicksian compensating and equivalent variations, and there are no significant differences between the CV and EV calculation results. Option 1,

cutting fuel subsidies led to a loss in total welfare amounting to 0.011% of total household income. The wealthy households in urban areas experienced the biggest welfare loss, followed by the rural rich households. This is a confirmation that they are benefited from fuel subsidy the most. Therefore when fuel subsidy is reduced, they become the most disadvantaged groups experiencing a decrease in welfare. Other policy options result in increasing welfare for all household groups.

The highest increase in welfare occurs when governments implement policy option 5 which is to increase tax revenue and then use it for investment to build roads. The total household welfare increased by 1.87 units or 0.030% of total household income, this welfare increase is outpacing the economic growth which is only 0.024%.

In options 6 welfare increase by 0.004 percentage point higher than the increase in output. While in option 2, 3 and 4, GDP increase is higher than welfare improvement. It also happens to option 1 where the reduction of fuel subsidy which is not accompanied by mitigation or other counter-policy resulted in a decrease in welfare deeper than the decline in output. It is a confirmation of Widodo et al. (2012) findings that fuel prices are embedded in households and

firms' optimization problem. In regard to a lower increase in welfare than the increase in output will be outlined in the final chapter of this paper as the topic of further research.

The policy simulation results on the income distribution are shown in Figure 8. When the government cut fuel subsidy without compensation policies, such as in option 1, the result is an improvement of income distribution, 0.027% lower than the baseline, the best compared to the other simulation results. This occurs because the rich households experienced a deeper decrease in real income than the poor households resulting in more equitable income distribution (This is less visible in Table 11 because it was the value of 15-year average change of household income). Theil index comparison between the baseline and option 1 is presented in Table 14, which shows that income distribution has improved from period 1 to period 15.

Option 2, the policy to divert fuel subsidy into government capital expenditure for the construction of roads also came up with a worse income distribution, Theil index increase by 0.032% compared to the baseline. Option 2, generated economic growth but on the other hand, worsens income distribution. This can be understood as follows, that the construction of the road and its

function as the capital stock causes the rich household to benefit the most from additional value added created by additional road capital stock, although previously their real income had dropped due to subsidy cuts.

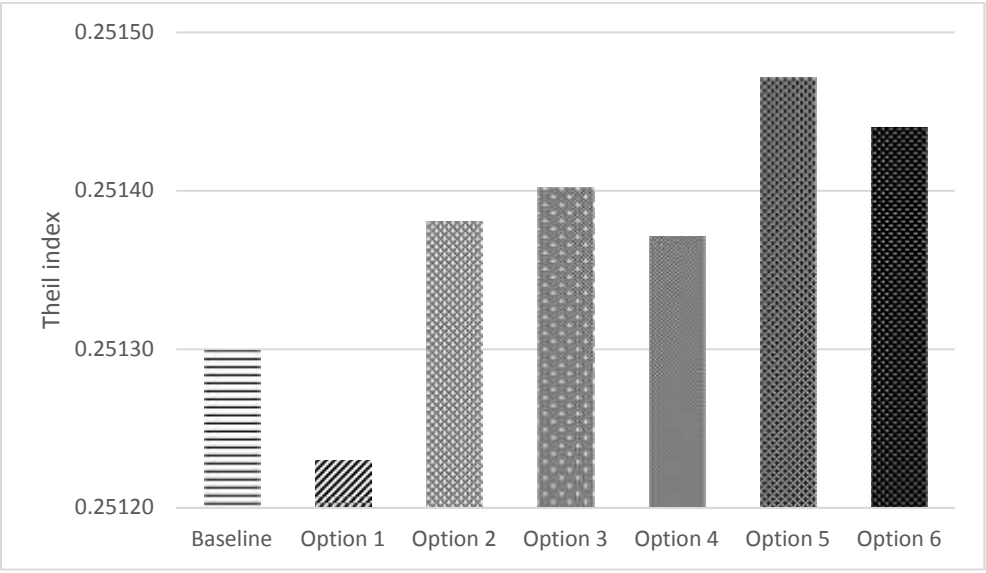


Figure 8 Impacts on Income Distribution (unit: Theil index)

In option 3, the government cut the fuel subsidy then collected additional taxes to invest in roads. The result is an increase in every household income (see Table 11). However, the increase in the rich household income is higher than the poor household income, at the end, the result is deterioration in the income distribution, inequality increased by 0.041% compared to the baseline.

Option 4 illustrates the circumstances in which the government deems it is necessary to cut subsidies while the investment needs of road construction were taken from financial markets by issuing government bonds. The policy options generate an income distribution that is worse by 0.029% than the baseline because all household groups experienced an increase in income except for the urban poor households. However, the distribution of income of policy option 4 is better than option 2. It is necessary to compare these two options since both reduce subsidies and build road infrastructure; the difference is option 4 used borrowed funds from the public through the issuance of government bonds.

Table 14 Theil Index of Baserun and Option 1

Scenario	Period 1	Period 2	Period 3	Period 4	Period 5
Baserun	0.25187	0.25180	0.25162	0.25136	0.25118
Option 1	0.25127	0.25174	0.25157	0.25132	0.25114

Scenario	Period 6	Period 7	Period 8	Period 9	Period 10
Baserun	0.25110	0.25107	0.25106	0.25107	0.25109
Option 1	0.25106	0.25104	0.25103	0.25104	0.25107

Scenario	Period 11	Period 12	Period 13	Period 14	Period 15
Baserun	0.25113	0.25118	0.25124	0.25132	0.25141
Option 1	0.25110	0.25115	0.25122	0.25130	0.25140

Option 5, which is to build road infrastructure using additional tax while maintaining the fuel subsidy provides the worst income distribution, Theil index increased by 0.069% compared to the baseline. It is a structural problem that can be explained as follows. At one side, the rich household group continues to enjoy additional real income by consuming subsidized fuel. At the other side, the investment in road infrastructure means an addition to capital stock. In the production process, more capital stocks mean more value added. The value added is distributed to those who have more factors of production. The wealthy household groups, rural high and urban high have more possession of the production factor than the poor households, rural poor and urban poor. Thus road investment is more favorable in terms of income distribution to wealthy households.

In the options 6 the government is using funds from the banking system to create road provision, this is just like the government assign SOE in the construction sector to build roads using loan funds from commercial banks. Aside from generating the second largest increase in GDP, this policy option also produces the second worst income distribution where inequality raised by 0.056% above the baseline, only defeated by option 5.

Based on the simulation results, there is no superior policy option for both GDP and income distribution. In order to find the best policy option for a combination of GDP growth and income distribution, a quadrant matrix is used. The value of simulation results from table 7 and figure 8 are standardized and then plotted on a quadrant diagram (see Figure 9). The midpoint (0, 0) is the average of each options results. On the upright axis is the scale of GDP growth, where the area in quadrants I and II are favorable because they indicate an increase in GDP. While the income distribution represented by the Theil index is set on the horizontal axis, where the quadrants II and III are a favorable area for improving the distribution of income since the Theil index is decreased.

Option 1, the subsidy cut, is the most extreme point where the best improvement of income distribution is accompanied by the worst decline in GDP. The next extreme point is option 5, to increase tax revenues in order to finance investment in road infrastructure, generates the highest GDP increase that accompanies the worst income distribution compared to the baseline. Option 3 and option 6 resulted in almost the same GDP growth, but the distribution of income from option 3 is better than the option 6.

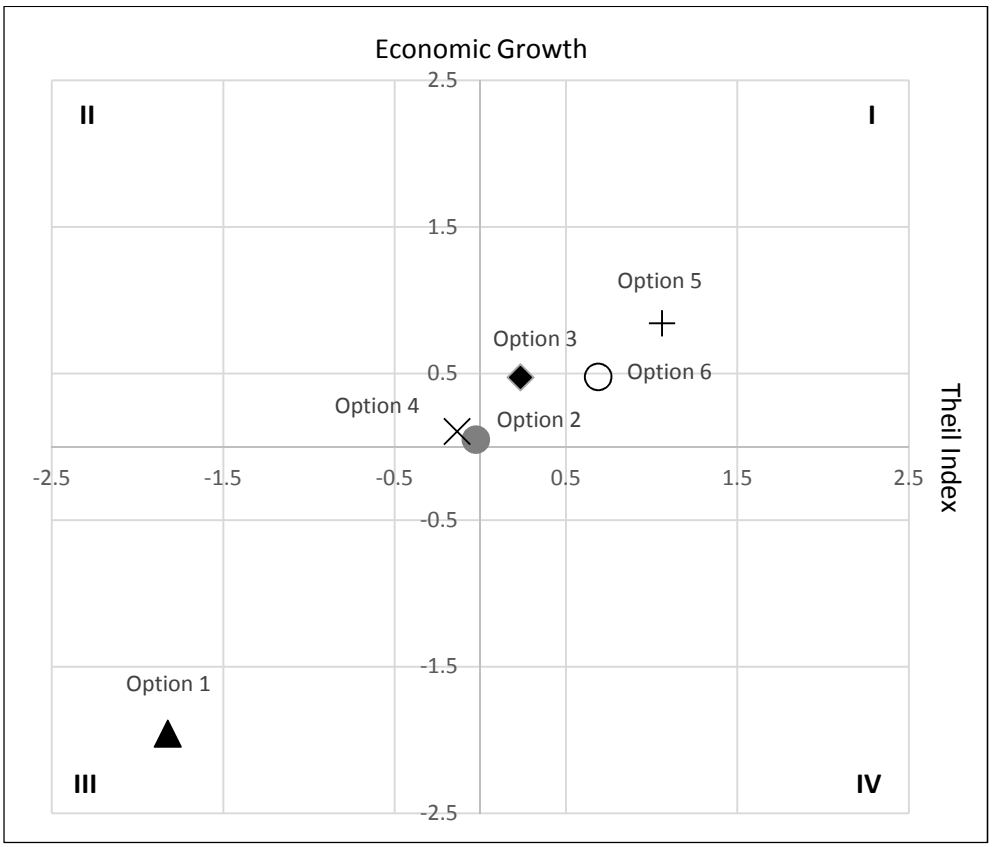


Figure 9 Policy Options Result

The impact of option 2 and option 4 are relatively more favorable than the other policy options, since GDP growth and income distribution improvements are better than average. Also in relative terms, option 4 is better than option 2, since it produces a higher GDP growth and better income distribution than average. The problem is, option 4 is using government bonds as a source of financing for road infrastructure investment, which means it places additional pressure on the state budget by mounting fiscal deficit,

which is the less favorable option for the Finance Minister as Chief Financial Officer (CFO).

If the government concern is only to increase GDP, then the best policy option is to build infrastructure using money from tax. Meanwhile, when the government's concern is to improve income distribution, then the best policy is to cut fuel subsidy. When the fuel subsidy is cut, and infrastructure development must be applied simultaneously, then the best policy option for the sake of increasing GDP is to combine it with raising tax revenues. However, if the government concern is income distribution, then the best policy is to combine the subsidy cut and the development of infrastructure with the issuance of government bonds, even though the income distribution is worse than the baseline, however, the Theil index is lower than average, but unfortunately, this policy option narrows fiscal space since the government debt is increasing.

Policy implication of the result is, that the infrastructure development policies coupled with a policy of cutting subsidy alone are not enough to improve the distribution of income, it should be combined with other fiscal policy such as social assistance in the form of health insurance, scholarship, food aid, business loan or job creation, intended for the poor household group.

Chapter 6. Conclusions

The government of Indonesia executed a dramatic policy to shift fuel subsidies to various pro-people programs including transportation construction projects. The purpose of this paper is to analyze whether government policy to reallocate fuel subsidy into infrastructure development is favorable for Indonesian economy in terms of GDP and income distribution. The financial CGE model is employed to simulate the impact of fiscal policy regarding fuel subsidy and road investment, calibrating a 2008 Financial Social Accounting Matrix of Indonesia. Other policy options have also been simulated to identify a better policy for economic growth and income inequality.

This model is the first Financial CGE model of Indonesia to use Financial SAM 2008 as its database. It is also the first paper using the Financial CGE models in analyzing the impact of fiscal policy related to fuel subsidies in Indonesia. Finally, the model in this research is a dynamic Financial CGE model with an attribute of a multi-sector, multi-household and multi economic-actor, multi-labor and multi-assets.

It is found that with regard to GDP growth the policy of using additional tax money to build roads infrastructure generates the highest GDP and welfare increase. Regarding the distribution of income, the policy to reduce fuel subsidies is the best policy measure since the fuel subsidy policy has been mistargeted to wealthy households. Other policies did not produce a better income distribution compared to the baseline condition. If the government insists on making fiscal space for supporting other productive activities, then the shifting of fuel subsidy into infrastructure provision is applicable.

This research was conducted for Indonesian case studies. Generalizations that can be drawn from this paper relates to fiscal policy on subsidies wide or energy subsidies, in particular, government capital expenditure, infrastructure development, the economic impact of road procurement. All of these subject areas would certainly have things in common with other countries who have problems which are similar to those faced by Indonesia, for instance on how the government is to deal with fiscal pressure on unproductive spending or the impact on new debt issuance or the impacts of infrastructure development in the long term, or which households and labor are affected by the government's certain fiscal

policy. This paper assumes that all roads have the same impact on the value-added creation. Most of the roads build by the reallocating fund are in the country borders or remote areas that might have a different impact if the road if were built in high-density population area.

As mentioned in the previous section, that in terms of fuel subsidy reduction and its counter-policy by transferring the funds into transportation infrastructure investment give result welfare increase less than output increase. It is interesting to be explored those result as a further research topic for the following reasons. First, whether the mitigation of fuel subsidy reduction by building road infrastructure requires a larger project value in terms of rupiah in order to obtain a higher increase in household welfare than the increase in output. Second, to find alternatives infrastructure projects rather than transportation infrastructure which bring higher welfare increase than the increase in GDP. To satisfy research purpose, the FCGE model used in this paper can be reuse with modification, if necessary, such as a change in industrial disaggregation. The change is needed to determine production function of investment target sector. Additionally, identification of target sector for government capital expenditures also needed to

run policy simulation.

Another subsidy that is still weighing on government finances is the electricity subsidy. In 2016, electricity subsidy reach Rp60 trillion (US$4.49 billion). According to the National Poverty Reduction Team, only 17.8% of 23.04 million electric customers of 900 VA (Volt Ampere) entitled to receive electricity subsidy. Since it is considered wrongly targeted, the government revoke the electricity subsidy in three month stages namely January, March and May 2017. At each stage of the electricity bill will rise by 32%. On the government side, this subsidy removal can certainly ease the government fiscal pressure. On the other hand, the hike of electricity prices is certainly changing the household consumption patterns. As one of the component of household expenditure that goes in CPI (consumer price index) basket, the rise in electricity tariffs will trigger a rise in inflation. It is interesting to research the impact of government policy to reduce electricity subsidy on poverty rate and income distribution. This policy should not be counterproductive to the government efforts in reducing poverty and income inequality. Reflecting on the inappropriateness of fuel subsidy which favors the high and middle-income classes, is the reduction of electricity subsidies brings improvement in the income

distribution by reducing the real income of wealthier households? A CGE model is needed to perform this research. The model must specify representative households divided by their electricity subscription of 450 VA, 900 VA and above of 900 VA. The data of electricity subscription can be obtained from the electricity consumption in national socio-economic survey (Susenas).

Another interesting topic is to find a combination of fiscal and monetary policy that can increase the income of poor households, therefore not only improving income distribution, but that might also contribute to the solutions for structural problems in the Indonesian economy using the FCGE method. The method allows for selecting policy options and monetary instruments that can be used to improve income distribution.

The next research issue is to develop a fiscal social accounting matrix, which captures detailed government budget information such as tax revenues, various types of government capital expenditures and various types of subsidies. To develop this extended SAM, the consolidation and reconciliation of government revenues and expenditure data between the Ministry of Finance and Statistics Indonesia (BPS) are the core of the effort.

The final one still uses the FCGE framework, but with different topics, it is about the impact of tax amnesty on the Indonesian economy. The tax amnesty program in 2016 has succeeded in collecting a redemption fee of US$7.5 billion and assets declaration amounting to US$279 billion. This significant amount of funds will be invested in certain businesses such as property, construction or capital markets. The government needs to be alert to the possibility of the negative impact that might arise from this massive capital return.

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Indonesian FSAM 2008

Trillion Rupiah				EXPENDITURES								
				FACTORS								
				1	2	3	4	5	6	7	8	9
RECEIPTS	FACTORS	AGRI-TECH-W-R	1									
		AGRI-TECH-W-U	2									
		AGRI-TECH-NW-R	3									
		AGRI-TECH-NW-U	4									
		CLERC-W-R	5									
		CLERC-W-U	6									
		CLERC-NW-R	7									
		CLERC-NW-U	8									
		MNGR-W-R	9									
		MNGR-W-U	10									
		MNGR-NW-R	11									
		MNGR-NW-U	12									
		K	13									
	INSTITUTIONS	CB	14									
		CO	15									
		GO	16									
		RP	17	33.733		8.861						
		RH	18	263.778		418.636		76.789		125.182		58.395
		UP	19		12.250		7.640					
		UH	20		491.971		242.984		448.981		251.792	
	INDUSTRIES	AGRI	21									
		MINE	22									
		MANU	23									
		MOIL	24									
		ELGW	25									
		BLDG	26									
		TRAD	27									
		TRAN	28									
		FINA	29									
		OTHR	30									
	SUBSIDY		31									
	INVESTMENTS	INV_AGRI	32									
		INV_MINE	33									
		INV_MANU	34									
		INV_MOIL	35									
		INV_ELGW	36									
		INV_BLDG	37									
		INV_TRAD	38									
		INV_TRAN	39									
		INV_FINA	40									
		INV_OTHR	41									
		CAP ACC	42									
	CAPITAL ACCOUNT	Cap_CB	43									
		Cap_CO	44									
		Cap_GO	45									
		Cap_RP	46									
		Cap_RH	47									
		Cap_UP	48									
		Cap_UH	49									
	FIN. INSTR	CFI	50									
		GOB	51									
		ROW	52									
		TOTAL	53	297.511	504.221	427.497	250.624	76.789	448.981	125.182	251.792	58.395

Indonesian FSAM 2008 (continued, part 2)

Trillion Rupiah				EXPENDITURES							
				FACTORS				INSTITUTIONS			
				10	11	12	13	14	15	16	17
RECEIPTS	FACTORS	AGRI-TECH-W-R	1								
		AGRI-TECH-W-U	2								
		AGRI-TECH-NW-R	3								
		AGRI-TECH-NW-U	4								
		CLERC-W-R	5								
		CLERC-W-U	6								
		CLERC-NW-R	7								
		CLERC-NW-U	8								
		MNGR-W-R	9								
		MNGR-W-U	10								
		MNGR-NW-R	11								
		MNGR-NW-U	12								
		K	13								
	INSTITUTIONS	CB	14				33.117		0.674	8.268	
		CO	15				1558.080	12.590	82.006	81.424	0.081
		GO	16					0.497	649.554	181.676	1.097
		RP	17				26.742		0.012	6.905	0.326
		RH	18		10.827		314.049	0.001	8.928	29.295	0.013
		UP	19				16.857	0.006	0.334	6.559	0.165
		UH	20	201.446		35.636	430.900	0.019	33.781	156.273	0.014
	INDUSTRIES	AGRI	21							0.049	27.305
		MINE	22								0.029
		MANU	23							19.774	28.086
		MOIL	24							14.221	6.745
		ELGW	25							2.845	0.656
		BLDG	26							17.135	
		TRAD	27							16.897	5.402
		TRAN	28							19.443	4.238
		FINA	29							10.708	3.401
		OTHR	30							193.491	8.818
	SUBSIDY		31							240.891	
	INVESTMENTS	INV_AGRI	32								
		INV_MINE	33								
		INV_MANU	34								
		INV_MOIL	35								
		INV_ELGW	36								
		INV_BLDG	37								
		INV_TRAD	38								
		INV_TRAN	39								
		INV_FINA	40								
		INV_OTHR	41								
		CAP ACC	42								
	CAPITAL ACCOUNT	Cap_CB	43					18.624			
		Cap_CO	44						968.144		
		Cap_GO	45							229.473	
		Cap_RP	46								0.340
		Cap_RH	47								
		Cap_UP	48								
		Cap_UH	49								
	FIN. INSTR	CFI	50								
		GOB	51								
		ROW	52								
		TOTAL	53	201.446	10.827	35.636	2379.745	31.737	1743.433	1235.327	86.716

Indonesian FSAM 2008 (continued, part 3)

Trillion Rupiah				EXPENDITURES							
				INSTITUTIONS			INDUSTRIES				
				18	19	20	21	22	23	24	25
RECEIPTS	FACTORS	AGRI-TECH-W-R	1				119.199	22.224	21.645	26.002	2.259
		AGRI-TECH-W-U	2				57.895	27.803	192.527	62.638	3.525
		AGRI-TECH-NW-R	3				319.335	12.939	28.343	22.588	0.221
		AGRI-TECH-NW-U	4				108.633	6.935	60.483	7.669	0.423
		CLERC-W-R	5				3.871	3.426	6.791	2.933	0.904
		CLERC-W-U	6				3.346	17.843	43.850	25.555	4.704
		CLERC-NW-R	7				1.265	0.962	1.804	1.511	0.232
		CLERC-NW-U	8				0.549	0.568	3.081	0.273	0.201
		MNGR-W-R	9				1.347	1.699	1.503	1.187	0.531
		MNGR-W-U	10				1.519	10.504	12.840	11.531	2.940
		MNGR-NW-R	11				1.574	1.850	1.603	1.358	0.076
		MNGR-NW-U	12				0.492	0.067	6.655	3.344	0.354
		K	13				191.185	442.310	517.390	374.785	111.220
	INSTITUTIONS	CB	14			0.009					
		CO	15	9.838	0.301	24.932					
		GO	16	14.062	1.454	68.458	18.832	26.722	146.464	38.018	2.350
		RP	17	3.155	0.017	0.866					
		RH	18	1.941	0.212	10.252					
		UP	19	0.270	0.419	0.878					
		UH	20	4.558	0.018	20.253					
	INDUSTRIES	AGRI	21	257.781	14.318	345.074	155.790	0.151	486.577	47.102	
		MINE	22	0.476	0.017	0.789	0.002	84.101	63.339	298.957	21.902
		MANU	23	456.558	12.250	794.741	85.187	15.037	836.731	21.463	3.107
		MOIL	24	109.645	2.942	190.861	88.216	15.896	213.805	210.041	35.968
		ELGW	25	13.766	0.432	24.194	0.763	0.366	23.219	6.755	12.811
		BLDG	26				8.234	7.908	2.865	1.069	1.003
		TRAD	27	90.002	3.227	151.510	258.010	15.484	563.472	175.095	0.082
		TRAN	28	84.252	3.204	138.304	34.154	14.769	131.151	65.437	0.374
		FINA	29	57.716	1.999	94.031	11.989	6.906	58.225	12.806	3.007
		OTHR	30	149.189	5.205	230.926	4.922	5.669	22.726	7.324	0.198
	SUBSIDY		31								
	INVESTMENTS	INV_AGRI	32								
		INV_MINE	33								
		INV_MANU	34								
		INV_MOIL	35								
		INV_ELGW	36								
		INV_BLDG	37								
		INV_TRAD	38								
		INV_TRAN	39								
		INV_FINA	40								
		INV_OTHR	41								
		CAP ACC	42								
	CAPITAL ACCOUNT	Cap_CB	43								
		Cap_CO	44								
		Cap_GO	45								
		Cap_RP	46								
		Cap_RH	47	82.341							
		Cap_UP	48		0.398						
		Cap_UH	49			246.193					
	FIN. INSTR	CFI	50								
		GOB	51								
		ROW	52				54.385	140.667	574.595	389.625	0.001
		TOTAL	53	1335.550	46.413	2342.271	1530.694	882.806	4021.684	1815.066	208.393

Indonesian FSAM 2008 (continued, part 4)

Trillion Rupiah				EXPENDITURES							
				INDUSTRIES					Subsidy	INVESTMENTS	
				26	27	28	29	30	31	32	33
RECEIPTS	FACTORS	AGRI-TECH-W-R	1	74.259	4.789	17.073	1.612	8.449			
		AGRI-TECH-W-U	2	73.167	18.257	33.384	6.375	29.524			
		AGRI-TECH-NW-R	3	11.830	4.306	23.539	0.201	4.195			
		AGRI-TECH-NW-U	4	10.750	12.649	33.755	0.448	8.879			
		CLERC-W-R	5	1.137	15.828	8.490	8.676	24.733			
		CLERC-W-U	6	10.610	153.268	39.671	49.533	101.576			
		CLERC-NW-R	7	0.528	110.107	4.229	0.942	3.602			
		CLERC-NW-U	8	2.927	219.398	5.858	7.687	11.250			
		MNGR-W-R	9	0.955	1.282	0.589	1.265	48.037			
		MNGR-W-U	10	7.727	11.548	7.698	17.848	119.154			
		MNGR-NW-R	11	1.516	1.195	0.297	0.304	1.054			
		MNGR-NW-U	12	5.497	2.349	1.219	3.797	11.862			
		K	13	226.751	84.505	141.520	274.350	100.298			
	INSTITUTIONS	CB	14								
		CO	15								
		GO	16	23.986	46.128	20.296	11.948	10.193			
		RP	17								
		RH	18								
		UP	19								
		UH	20								
	INDUSTRIES	AGRI	21	24.478	111.070	0.381	0.331	47.171	0.985	4.306	
		MINE	22	90.404	0.059	0.071		1.162			72.330
		MANU	23	385.909	117.242	33.401	25.411	132.982		13.232	7.627
		MOIL	24	215.172	63.207	123.065	7.861	58.372	154.270	13.703	8.063
		ELGW	25	0.405	24.809	5.377	3.111	4.975	83.908		
		BLDG	26	1.203	28.300	10.499	17.327	4.329		54.168	20.890
		TRAD	27	8.684	22.098	4.891	3.696	3.132			
		TRAN	28	11.120	93.358	53.852	16.025	8.797	1.688		
		FINA	29	48.480	162.432	33.442	81.431	20.564			
		OTHR	30	6.476	28.041	59.187	26.448	18.703	0.040	1.600	1.058
	SUBSIDY		31								
	INVESTMENTS	INV_AGRI	32								
		INV_MINE	33								
		INV_MANU	34								
		INV_MOIL	35								
		INV_ELGW	36								
		INV_BLDG	37								
		INV_TRAD	38								
		INV_TRAN	39								
		INV_FINA	40								
		INV_OTHR	41								
		CAP ACC	42								
	CAPITAL ACCOUNT	Cap_CB	43								
		Cap_CO	44								
		Cap_GO	45								
		Cap_RP	46								
		Cap_RH	47								
		Cap_UP	48								
		Cap_UH	49								
	FIN. INSTR	CFI	50								
		GOB	51								
		ROW	52	0.001	24.797	78.349	60.691	24.644			
		TOTAL	53	1243.972	1361.022	740.133	627.318	807.637	240.891	87.009	109.968

Indonesian FSAM 2008 (continued, part 5)

Trillion Rupiah				EXPENDITURES							
				INVESTMENTS							
				33	34	35	36	37	38	39	40
RECEIPTS	FACTORS	AGRI-TECH-W-R	1								
		AGRI-TECH-W-U	2								
		AGRI-TECH-NW-R	3								
		AGRI-TECH-NW-U	4								
		CLERC-W-R	5								
		CLERC-W-U	6								
		CLERC-NW-R	7								
		CLERC-NW-U	8								
		MNGR-W-R	9								
		MNGR-W-U	10								
		MNGR-NW-R	11								
		MNGR-NW-U	12								
		K	13								
	INSTITUTIONS	CB	14								
		CO	15								
		GO	16								
		RP	17								
		RH	18								
		UP	19								
		UH	20								
	INDUSTRIES	AGRI	21						0.090		0.288
		MINE	22								
		MANU	23	61.445	1.579	1.576	5.376	7.607	10.189	4.243	40.980
		MOIL	24	15.702	15.425	18.254	2.998	4.101	37.540	1.312	17.989
		ELGW	25								
		BLDG	26	60.989	22.756	140.204	2.136	151.453	248.221	224.328	218.954
		TRAD	27								
		TRAN	28								
		FINA	29							2.445	
		OTHR	30	5.320	1.714	1.505	0.442	0.615	1.059	0.380	4.045
	SUBSIDY		31								
	INVESTMENTS	INV_AGRI	32								
		INV_MINE	33								
		INV_MANU	34								
		INV_MOIL	35								
		INV_ELGW	36								
		INV_BLDG	37								
		INV_TRAD	38								
		INV_TRAN	39								
		INV_FINA	40								
		INV_OTHR	41								
		CAP ACC	42								
	CAPITAL ACCOUNT	Cap_CB	43								
		Cap_CO	44								
		Cap_GO	45								
		Cap_RP	46								
		Cap_RH	47								
		Cap_UP	48								
		Cap_UH	49								
	FIN. INSTR	CFI	50								
		GOB	51								
		ROW	52								
		TOTAL	53	143.456	41.474	161.539	10.952	163.776	297.099	232.708	282.256

Indonesian FSAM 2008 (continued, part 6)

Trillion Rupiah				EXPENDITURES							
				INVESTMENTS	CAPITAL ACCOUNT						
				41	42	43	44	45	46	47	48
RECEIPTS	FACTORS	AGRI-TECH-W-R	1								
		AGRI-TECH-W-U	2								
		AGRI-TECH-NW-R	3								
		AGRI-TECH-NW-U	4								
		CLERC-W-R	5								
		CLERC-W-U	6								
		CLERC-NW-R	7								
		CLERC-NW-U	8								
		MNGR-W-R	9								
		MNGR-W-U	10								
		MNGR-NW-R	11								
		MNGR-NW-U	12								
		K	13								
	INSTITUTIONS	CB	14								
		CO	15								
		GO	16								
		RP	17								
		RH	18								
		UP	19								
		UH	20								
	INDUSTRIES	AGRI	21								
		MINE	22								
		MANU	23								
		MOIL	24								
		ELGW	25								
		BLDG	26								
		TRAD	27								
		TRAN	28								
		FINA	29								
		OTHR	30								
	SUBSIDY		31								
	INVESTMENTS	INV_AGRI	32	87.009							
		INV_MINE	33	109.968							
		INV_MANU	34	143.456							
		INV_MOIL	35	41.474							
		INV_ELGW	36	161.539							
		INV_BLDG	37	10.952							
		INV_TRAD	38	163.776							
		INV_TRAN	39	297.099							
		INV_FINA	40	232.708							
		INV_OTHR	41	282.256							
		CAP ACC	42		0.176	1226.490	178.635	1.483	20.867	1.671	100.915
	CAPITAL ACCOUNT	Cap_CB	43								
		Cap_CO	44								
		Cap_GO	45								
		Cap_RP	46								
		Cap_RH	47								
		Cap_UP	48								
		Cap_UH	49								
	FIN. INSTR	CFI	50		15.977	270.584	130.306	0.859	61.475	1.017	153.047
		GOB	51		2.472	0.001					0.001
	ROW		52								
	TOTAL		53	1530.237	18.625	1497.075	308.941	2.342	82.342	2.688	253.963

Indonesian FSAM 2008 (continued, part 7, end)

Trillion Rupiah				FIN. INSTR		ROW	TOTAL
				50	51	52	53
RECEIPTS	FACTORS	AGRI-TECH-W-R	1				297.511
		AGRI-TECH-W-U	2			-0.874	504.221
		AGRI-TECH-NW-R	3				427.497
		AGRI-TECH-NW-U	4				250.624
		CLERC-W-R	5				76.789
		CLERC-W-U	6			-0.975	448.981
		CLERC-NW-R	7				125.182
		CLERC-NW-U	8				251.792
		MNGR-W-R	9				58.395
		MNGR-W-U	10			-1.863	201.446
		MNGR-NW-R	11				10.827
		MNGR-NW-U	12				35.636
		K	13			-84.569	2379.745
	INSTITUTIONS	CB	14			-10.331	31.737
		CO	15			-25.819	1743.433
		GO	16			-26.408	1235.327
		RP	17			6.099	86.716
		RH	18			17.252	1335.550
		UP	19			1.035	46.413
		UH	20			23.645	2342.271
	INDUSTRIES	AGRI	21			7.447	1530.694
		MINE	22			249.168	882.806
		MANU	23			899.951	4021.684
		MOIL	24			169.692	1815.066
		ELGW	25			0.001	208.393
		BLDG	26			0.001	1243.972
		TRAD	27			39.340	1361.022
		TRAN	28			59.967	740.133
		FINA	29			17.736	627.318
		OTHR	30			22.536	807.637
	SUBSIDY		31				240.891
	INVESTMENTS	INV_AGRI	32				87.009
		INV_MINE	33				109.968
		INV_MANU	34				143.456
		INV_MOIL	35				41.474
		INV_ELGW	36				161.539
		INV_BLDG	37				10.952
		INV_TRAD	38				163.776
		INV_TRAN	39				297.099
		INV_FINA	40				232.708
		INV_OTHR	41				282.256
		CAP ACC	42				1530.237
	CAPITAL ACCOUNT	Cap_CB	43	0.001			18.625
		Cap_CO	44	491.832		37.099	1497.075
		Cap_GO	45	29.243	50.225		308.941
		Cap_RP	46	2.002			2.342
		Cap_RH	47	0.001			82.342
		Cap_UP	48	2.290			2.688
		Cap_UH	49	7.526		0.244	253.963
	FIN. INSTR	CFI	50			-100.370	532.895
		GOB	51			47.751	50.225
		ROW	52				1347.755
		TOTAL	53	532.895	50.225	1347.755	

Major Equations in FCGE Model

Output	Output = Leontief (Value added, Intermediate demand)
Value added	Value added = Road Length*CD (Capital Stock, Labor)
Supply	Output = CET (Foreign exports, Domestic supply)
Demand	Demand = Armington (Foreign imports, Domestic demand)
Labor demand	Labor demand = LD (Wage, Value added, Net price)
Incomes	Incomes = Wage + Capital returns + Transfer
Consumption	Consumption by commodity = CC (Price, Incomes)
Government revenues	Government revenues = Indirect tax + Direct tax + Tariff + Property Income
Government expenditures	Government expenditures = Government current expenditure + Government transfer + Government investment expenditure + Property cost
Labor market equilibrium	Labor demand = Labor supply
Capital market equilibrium	Savings = Total investments
Government budget equilibrium	Government expenditures = Government revenues
Financial market equilibrium	Wealth = Real wealth + Bonds + Composite financial asset

List of key behavior equations and identities

(1) Domestic import price	$P_{i} = P^{*}_{i} E (1 + t^{m}_{i})$
(2) Domestic export price	$P^{e}_{i} = P_{i} E$
(3) Composite goods price	$P_i Q_i = P^{d}_{i} X_i + P^{m}_{i} IM_i$
(4) Production price	$P_i X_i = P^{d}_{i} X_i + P^{e}_{i} E_i$
(5) Value-added prices	$P^{v}_{i} V_i = P_i X_i + \sum_j io_{j,i} P_j X_i$
(6) Value added	$\ln(V_i) = v_i + \sum_m v_{m,i} \ln(L_{m,i}) + v_i \ln(K_i) + v_i \ln(\bar{R})$
(7) Output	$X_i = V_i + \sum_j io_{j,i} X_i$
(8) Labor demand	$W_m \cdot w_{m,i} L_{m,i} = V_i P^{v}_{i} V_{m,i}$
(9) Total labor demand	$L_m = \sum_i L_{m,i}$
(10) Total supply	$X_i = a_i \left[\gamma_i E_i^{\rho_i} + (1-\gamma_i) X_i^{\rho_i}\right]^{\frac{1}{\rho_i}}$
(11) Export	$\frac{E_i}{X_i} = \left[\frac{P E_i}{P_i} \frac{(1-\gamma_i)}{\gamma_i}\right]^{\frac{1}{\rho_i - 1}}$
(12) Total demand	$Q_i = a_i \left[\delta_i IM_i^{-a_i} + (1-\delta_i) X_i^{-a_i}\right]^{-\frac{1}{a_i}}$
(13) Import	$\frac{IM_i}{X_i} = \left[\frac{P D_i}{P_i} \frac{\delta_i}{(1-\delta_i)}\right]^{\frac{1}{a_i + 1}}$
(14) Commodity market	$Q_i = \sum_j io_{i,j} X_j + \sum_e P_{i,e} + \sum_j IM_{i,j}$
(15) Wealth	$W_e = S_e + \sum_a S_{e,a} + SH_e E$
(16) Demand for real investment	$D_e = D_e W_e$
(17) Demand for government bonds	$D_e = D_e (1 - D_e) W_e$
(18) Demand for composite financial instrument	$D_e = (1 - D_e)(1 - D_e) W_e$
(19) Share of demand for government bonds	$\frac{D_e}{(1 - D_e)} = d_e 0g_e \left(\frac{1+P}{1+P}\right)^{d_e 2g_e}$

(20) Share of demand for real investment	$\frac{D}{(1-D)} = d \quad 0i_1 \left(\frac{1+P}{1+P}\right)^{d}$
(21) Average price of composite financial instrument	$\sum D + Cl \cdot E = \sum (S + S)$
(22) Average price of government bonds	$\sum D + G \cdot E = \sum (S + S)$
(23) Average price of government bonds and composite financial instrument	$P \sum D + \sum D = P \sum D + P \sum D$
(24) Average price of real investment	$P = \frac{Y}{\sum_i K_i}$
(25) Labor income	$Y_m = \sum_i W_m \cdot L_{m,i} w_{m,i} + Yl_m \cdot E$
(26) Capital income	$Y = \sum_i (P_i V_i (1-tt) - \sum_m (W_m \cdot L_{m,i} \cdot w_{m,i} + IS_i) + Yl \cdot E$
(27) Total income	$Y_e = Y_m \cdot y_{m,e} + Y \cdot y_e + \sum_e T_{e,e} Y_e + D_e \sum_i P_i V_i tt_i + T_e E + \sum_k \left(P_k (C_{k,e} - B_{k,e})\right) - \sum_u (P_u (C_{e,u} - B_{e,u}))$
(28) Savings	$S_e = s_e Y_e (1 - \sum_e T_{e,e})$
(29) Total consumption	$P_e = Y_e (1 - \sum_e T_{e,e}) - S_e - D_e \sum_i IS_i - D_e R_e$
(30) Sectoral consumption	$P_{i,e} P_i = p_{i,e} P_e$
(31) Total savings	$S = \sum D_e + \sum D_e R_e + \sum \sum S_{e,u} - \sum K_i$

(32) Investments	$I_{\quad j} \sum_{i} (P_i IV_{\quad i,j}) = \eta_{\quad j} I_{\quad} + K_{\quad j}$
(33) Capital stock	$K_i = L_{\quad i} + I_{\quad i} + E_{\quad i} K_{\quad i}$
(34) Trade balance	$\sum_{i} P_{\quad i} I_{\quad i} = \sum_{e} P_{\quad i} E_{\quad i} + \sum_{m} YI_{\quad m} + YI_{\quad} + \sum_{e} T_{\quad} R_{\quad e} + \sum_{e} SI_{\quad e} + CI_{\quad} + G$
(35) Accumulation demand of financial asset	$C_{\quad b,e} = L_{\quad b,e} + D_{\quad b,e}$
(36) Accumulation supply of financial asset	$C_{\quad e,a} = L_{\quad e,a} + S_{\quad e,a} + S_{\quad e,a}$

Variables list

R	Road capital stock
$B_{\quad b,e}$	Policy variable for cumulative demand of financial asset *b* by economic actor *e*
$B_{\quad e,a}$	Policy variable for cumulative supply of financial asset *a* by economic actor *e*
$C_{\quad b,e}$	Cumulative demand of financial asset *b* by economic actor *e* (real investment, government bonds, and composite financial instruments)
$C_{\quad e,a}$	Cumulative supply of financial asset *a* by economic actor *e* (real investment, government bonds, and composite financial instruments)
$T_{\quad e}$	Net foreign transfer to domestic economic actor (e)
CI	Demand for financial assets *a* by the rest of the world (composite financial instruments)
$D_{\quad b,e}$	Demand for financial assets *b* by economic actor *e*
$D_{\quad e}$	Demand for financial assets by economic *e* (composite financial instruments)
$D_{\quad e}$	Demand for financial assets by economic *e* (real investment)

D_{e}	Demand for financial assets by economic e (government bonds)
D_{e}	Share of $DFAIV_e$
D_{e}	Share of $DFAGB_e$
D_{e}	Dummy variable for government sector (economic actor e)
E	Real exchange rate (rupiah per dollar]
E_{i}	Exports by sector i
I_{i}	Imports by sector i
I_{j}	Final demand for productive investment by sector j
I	Total domestic investment
IS_{i}	Subsidy by sector i
K_{i}	Private capital stock by sector i
$L_{m,i}$	Employment by type of job m, by sector i
L	Total labor demand
$L_{b,e}$	Lagged demand of financial asset b (real investment, government bonds, and composite financial instruments)
LK_{i}	Lag−private capital stock by sector i
$L_{e,a}$	Lagged supply of financial asset a (real investment, government bonds, and composite financial instruments)
G	Demand for financial assets a by the rest of world (government bonds)
P_{i}	Price of composite goods by sector i
P_{b}	Rate of return on assets b
P	Price of composite financial instruments
P	Price of real investment
P	Price of government bonds
P	Rate of return of composite assets
$P_{i,e}$	Final demand for private consumption of economic actor e by sector i
P_{e}	Disposable income of household by economic actor e

P_i	Domestic price by sector *i*
P_i	Domestic price of exports by sector *i*
P_i	Domestic price of imports by sector *i*
P_i	Vale added price by sector *i*
P_i	World market price of exports by sector *i*
P_i	World market price of imports by sector *i*
P_i	Average output price by sector *i*
Q_i	Composite goods supply by sector *i*
R_e	Dummy variable for investment (economic actor *e*)
S_e	Savings by economic actor *e*
S	Total savings
$S_{e,a}$	Supply of financial assets *a* by economic actor *e* (government bonds and composite financial instruments)
S_e	Supply of financial assets *a* by economic actor *e* (composite financial instruments)
S_e	Supply of financial assets *a* by economic actor *e* (government bonds)
SF_e	Supply of financial assets of the rest of world by economic actor *e*
$S_{e,a}$	Policy tool for financial asset *a* by economic actor *e*
S_e	Policy tool for financial asset *a* by economic actor *e* (composite financial instruments)
S_e	Policy tool for financial asset *a* by economic actor *e* (government bonds)
V_i	Value-added by sector *i*
W_m	Average wage rate by type of job
W_e	Wealth by economic actor *e*
X_i	Domestic output by sector *i*
X_i	Domestic sales by sector *i*

Y_e	Economic agents income
Y	Household income by capital
Yl	Capital factor incomes from the rest of world
Y	Household income by labor
Yl	Labor factor incomes from the rest of world

Parameters list

a_i	Armington function shift parameter by sector *i*
δ_i	Armington function share parameter by sector *i*
a_i	Armington function exponent by sector *i*
a_i	CET function shift parameter by sector *i*
γ_i	CET function shift parameter by sector *i*
ρ_i	CET function exponent by sector *i*
$v_{m,i}$	Value-added function shift parameter by sector *i*
$v_{m,i}$	Labor share of value-added function by sector *i*
v_i	Capital share of value-added function by sector *i*
v_i	Accessibility share of value-added function by sector *i*
tt_i	Indirect tax rate by sector *i*
t_i	Tariff rates on import by sector *i*
$ic_{i,j}$	Leontief input-output coefficients
$w_{m,i}$	Wage adjustment share by sector *i*
d_{0g_e}	Shift parameters of asset demand function by economic actor *e* (government bonds)
d_{0r_e}	Shift parameters of asset demand function by economic actor *e* (real investment)
d_{2g_e}	Elasticity parameters of asset demand function by economic actor *e* (government bonds)
d_{2r_e}	Elasticity parameters of asset demand function by economic actor *e* (real investment)

$y_{m,e}$	Allocation of labor income by economic actor e
$y_{k,e}$	Allocation of capital income by economic actor e
$p_{i,e}$	Allocation of sectoral consumption of economic actor e by sector i
in_{j}	Allocation of investment by destination sector j
s_{e}	Saving rate
$IV_{i,j}$	Investment matrix
$T_{e,e'}$	Current expenditure matrix, transfer among economic agents

국문초록

연료 보조금 및 도로 투자가 소득 성장과 불균형에 미치는 영향: 인도네시아 금융 CGE모형의 적용

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본 논문의 목적은 인도네시아 정부의 연료 보조금과 도로 투자 정책이 경제 성장과 소득 격차에 미치는 영향을 분석하는 것이다. 인도네시아의 2008년 기준 동태적 금융 연산일반균형모형을 개발하여 정부 예산의 연료 보조금 지원과 도로 건설 배분에 따라 소득 불평등과 경제 성장이 어떻게 변하는 지를 동태적으로 분석하였다. 동태적 금융 연산일반균형모형은 10개의 산업 부문, 4개의 가계 및 12개의 노동으로 구성하였으며, 자본은 2개의 금융자산 및 단일의 실물자산으로 구분하였다. 정부 재원을 도로 건설에 배분하는 것이 경제 성장을 효율적으로 유도할 수 있으며, 소득 분배의 측면에서 보면 연료 보조금을 삭감하는 정책이 가장 효과적인 것으로 나타났다. 또한 연료 보조금 예산을 도로 투자 부문에 이전하는 대안이 정부 예산을 가장 효과적으로 관리하는 것으로 나타났다.

주요어: 금융연산일반균형모형, 정부보조금, 사회기반시설, 경제성장, 소득 배분

학번: 2013-31311