

# Should Indonesia Suffer from More Reduction of the Subsidy to the Petroleum Sector?

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# Should Indonesia Suffer from More Reduction of the Subsidy to the Petroleum Sector?

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## Abstract

We numerically examine the impact of the actually implemented reduction policy of the subsidy to the petroleum sector by using a static CGE model with the latest input-output table of Indonesia of year 2008. Our simulation results indicate that the Indonesian economy suffered from the actually implemented policy with a welfare loss of 28,417.78 billion rupiah even with the conversion policy. Furthermore, the proposed future reduction policy by the Ministry of Finance would unavoidably result in a welfare loss even when the government continues the current conversion policy. However, our simulation results also suggest that a new future conversion policy with a slightly additional subsidy to the LPG sector would eventuate in completely offsetting the negative effect of the proposed plan on the future welfare with an expanding government expenditure.

**Keywords:** Indonesia, Computable General Equilibrium (CGE) Model, Petroleum, Subsidy, Welfare, Simulation

**JEL Classification:** C68, D57, D58, D60, E17, and H53

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# 1 Introduction

We numerically examine the impact of the reduced subsidy to the petroleum refinery sector on the Indonesian economy by using a static CGE model with the latest Input-Output table of Indonesia of year 2008.

While the Indonesian government had substantially been subsidizing the petroleum refinery sector in order to fulfil the price gap between the world and domestic ones, it recently reduced the subsidy drastically. The total amount of the subsidy to the petroleum refinery sector was 139,106.7 billion rupiah in year 2008, but it was reduced down to 88,890.8 billion rupiah in year 2010. Its reduction rate reaches 36.1% based on our calculation. However, the Indonesian government has still subsidized the petroleum refinery sector substantially, and the petroleum refinery sector is only the sector of which imports the Indonesian government subsidizes. In fact, the Ministry of Finance of Indonesia is further going to substantially reduce the subsidy to the petroleum refinery sector based on its future plan, and it tries to reduce the amount of the subsidy to 44,300 billion rupiah in year 2014, which corresponds to the 68.154% reduction from the level of year 2008. Since the Indonesian economy has been relying on the large amount of the subsidy to the petroleum refinery sector, the impact of the reduction policy seems substantial. Furthermore, there is another fact that the Indonesian government also introduced a conversion policy to shift demand for petroleum to for LPG when it implemented the reduction policy, and it has indeed been providing the LPG sector (the electricity, gas and water supplies sector) with additional 14,100 billion rupiah since 2007 until 2011. While the impact of the reduction of the subsidy to the petroleum refinery sector seems negative, an expansion of the subsidy to the LPG sector is expected to have a positive effect on the Indonesian economy.

Our main purpose is to numerically explore the impact of such actual subsidy policies on the welfare of Indonesia within a CGE framework<sup>1</sup>. We try to numerically measure the impact of the actual reduction of the subsidy to the petroleum refinery sector (the reduction policy) as well as of the actual increase in the subsidy to the LPG sector (the

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<sup>1</sup>Our simulation results have been obtained by executing our own FORTRAN programmes.

conversion policy). Then, we further investigate the effect of further reduction of the subsidy to the petroleum refinery sector on economic efficiency of Indonesia. Based on the actual future plan proposed by the Ministry of Finance of Indonesia, we conduct realistic simulations in order to explore the numerical effect of the future reduction policy. Since we employ a CGE model, all possible channels of the reduction policy can be taken into account, and the overall effect on the Indonesian economy can be captured numerically.

By using the estimated parameter values, we have successfully re-produced the actual Indonesian economy within our CGE model. In comparison with our successful benchmark model, we have simulated the impact of the actual reduction of the subsidy to the petroleum refinery sector from 139,106.7 billion rupiah to 88,890.8 billion rupiah, and we have obtained the following results: First, we have estimated the pure effect of the reduction policy to be a welfare loss of 295,631.95 billion rupiah to the Indonesian economy in two years between 2008 and 2010. Second, when we also take into account more realistic aspects such as an actual expansion of government expenditure in the two years, then the magnitude of a welfare loss shrinks to 68,064.43 billion rupiah. Third, when we further consider the effect of the actual ongoing conversion policy as well, then our simulation result suggests that the actually implemented reduction policy still has a negative effect on welfare with a welfare loss of 28,417.78 billion rupiah. Fourth, we have also explored the effect of the proposed future reduction plan by the Ministry of Finance of Indonesia, and we have estimated a welfare loss of the plan in different years. While we have estimated the welfare loss to decrease over time, the range of the welfare loss in the next 3 years is between approximately 40,000 billion and 79,000 billion rupiah based on our different assumption on the future conversion policy to the LPG sector. Finally we have also estimated the additional amount of the subsidy to the LPG sector in the future conversion policy to neutralize the negative effect of the proposed future reduction plan on the Indonesian economy. Our estimated additional amount of the subsidy to the LPG sector are between approximately 114 billion and 149 billion rupiah in different years. In our effect-neutral future conversion policy, we have further obtained the result that such a further increase in the subsidy to the LPG sector stimulates the economy, thus

resulting in an expansion of government expenditure with no negative effect on welfare.

We organize our paper as follows. We briefly present the background and review the literature in the next two sections. Then we explain our numerical model, where we also present our social accounting matrix (SAM) and our calibration method. In section 5, we explore the impact of the actually implemented reduction policy by using our CGE model. In section 6, we also simulate the effect of the proposed future reduction plan by the Ministry of Finance of Indonesia. We conclude our paper in section 7.

## 2 The Background

Figure 1 shows the increasing trend of fuel consumption in Indonesia. While fuel consumption in year 2000 was only 980 bb/day, it increased up to 1,200 bb/day in year 2010. The increasing trend of fuel consumption can mainly attribute to the expanding Indonesian economy, and the Ministry of Finance of Indonesia forecasts a further increase in fuel consumption in the future in accordance with its expectation of future economic growth. The Indonesian government has tried to keep the domestic fuel price lower than the world level in order to maintain its stable economic growth. The subsidy has been used to pay the price gap between domestic and world levels. The increasing trend of fuel consumption associated with high economic growth as well as an increase in the world oil price resulted in the expanding subsidy to fuel consumption (the petroleum refinery sector). While the ratio of the subsidy given to the petroleum refinery sector to the total government expenditure was only 10.065% in year 2006, it increased to 14.17% in year 2008. The expanding subsidy to the petroleum refinery sector obviously induced further financial burdens on the Indonesian government, and its deficits increased. While the Indonesian government recognizes an important role of the subsidy to the petroleum refinery sector to maintain stable economic growth, it started to decrease the subsidy to the petroleum refinery sector in order to reduce government deficits. The Indonesian government also implemented a policy called the conversion policy, in which the government has subsidized the LPG sector in order to reduce high dependency of the Indonesian economy

on petroleum consumption. In the conversion policy the government has subsidized LPG consumption to shift demand for petroleum to for LPG. While the government plans to end the conversion policy in year 2011, it also tries to further reduce the subsidy to the petroleum refinery sector down to 44,300 billion rupiah in year 2014, which is nearly 1/7 of the amount of year 2008.

### 3 Literature Review

We employ the conventional static CGE model developed by Ballard, Fullerton, Shoven, and Whalley (1985), and Shoven and Whalley (1992). We basically use the framework of Kato (2011) and Kato (forthcoming) in order to explore the effect of subsidy reduction in Indonesia. While there has been many studies on the effect of energy policies in Indonesia, the following studies are in particular related to us: Hartono and Resosudarmo (2006) investigated the effect of pricing and subsidy policies for fuel oil, gas and electricity in Indonesia. Hartono and Resosudarmo (2008) evaluated a subsidy cut in fuel oil consumption in Indonesia as an energy policy within a social accounting matrix framework, and investigated the effect on income of different income groups. Clements, Jung, and Gupta (2007) explored the effect of higher petroleum prices on the Indonesian economy within a multi-sector CGE model, and concluded that subsidy reduction would result in the increasing price and the decreasing output. Clements, Jung, and Gupta (2007) also predicted that the urban household group would mostly be affected by subsidy reduction<sup>2</sup>.

While these studies used a multi-sector CGE model or a social accounting matrix framework, we explicitly specify utility and production functions in our model, in order to take into account the optimal behavior of each agent with our own SAM constructed by using the latest input-output table of Indonesia of year 2008. We also consider the budget constraint of the government explicitly in our framework, and evaluate the effect of the currently ongoing reduction policy on welfare rather than on prices and quantity.

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<sup>2</sup>Saad (2009) estimated demand for petroleum in Indonesia based on a cointegration approach, while its main concern was not directly related to the effect of the subsidy policy.

This is because our main concern is to numerically evaluate the effect of the actually implemented reduction policy on economic efficiency of the whole Indonesian economy. While the above mentioned studies tried to evaluate the effect of subsidy reduction as an energy policy, our main concern is also to provide alternatives based on the welfare concern.

## 4 Numerical Analysis

We use the conventional static CGE model in which there are following agents; a representative consumer, 66 different production sectors, the government, and an investment industry<sup>3</sup>. The 66 production sectors are the same as those in the Indonesian Input-Output Table of year 2008. A representative consumer maximizes his/her utility defined over 66 different consumption goods, which are produced by 66 different production sectors respectively. Each of 66 different production sectors maximizes its own profits. Each production sector uses its own good and other goods produced by other production sectors in its intermediate production processes. Each production sector uses imported goods to produce its final domestic consumption good, and it also determines its optimal amount of exports. The government imposes an individual income tax on the representative consumer, and a production tax as well as an import tariff on 66 different production sectors. The government also subsidizes 66 different production sectors, and subsidies are divided into two types; a general subsidy and an import subsidy. All markets are assumed to be fully competitive, so that all prices are determined in equilibrium in the corresponding fully competitive market. The detailed explanation about the model is given in Appendix.

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<sup>3</sup>It is conventional in a static CGE model to introduce an investment industry to the model. The investment industry is introduced only for making a CGE model consistent with the actual SAM. See, for instance, Hosoe, Ogawa, and Hashimoto (2004).



## 4.1 Social Accounting Matrix (SAM)

We have used the latest Input-Output table of Indonesia of year 2008 in order to construct our social accounting matrix (SAM). Table 8 shows our SAM<sup>4</sup>. The 41st sector ( $i = 41$ ) among the 66 different production sectors corresponds to the petroleum refinery sector, which we explore in our analysis. We also consider the LPG sector, which is categorized in the 51st sector ( $i = 51$ ) called the "electricity, gas and water supplies" sector in our SAM. Note that the only petroleum refinery sector ( $i = 41$ ) obtains the import subsidy among all 66 different production sectors, and also that the total amount of the subsidy to the petroleum sector ( $i = 41$ ) reaches 16.445% of the total amount of the subsidy in year 2008. By utilizing our SAM, we calibrated our model in order to produce a benchmark model as follows.

## 4.2 Calibration

Table 1-1 to 1-4 show the calculated values of relevant endogenous variables obtained within our benchmark model. Table 6 and 7 also show the parameter values which resulted in the benchmark values of endogenous variables. Table 6 shows the general subsidy rates and the import subsidy rates of sector  $i = 41$  (the petroleum refinery sector) and  $i = 51$  (the LPG sector), which have been calculated from our SAM. These rates are proportional, since they have been obtained by dividing the total amount of the subsidy by the total amount of production and imports. As Table 1-1 to 1-4 show, our benchmark model has successfully reproduced the actual Indonesian economy within our CGE model. We can now use our benchmark model to simulate the impact of the actually implemented policies related to the petroleum as well as the LPG sectors.

# 5 The Impact of the Actually Implemented Policies

In practice, the government usually implements several mixed policies at the same time. When the government reduces the subsidy, the government expects to have a surplus if

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<sup>4</sup>The figures in our SAM are measured in million rupiah.

expenditure remains unchanged. This implies that it is relatively easy for the government to increase its expenditure when it reduces the subsidy. In fact, while the Indonesian government reduced the amount of the subsidy to the petroleum refinery sector, it increased its expenditure. As Budget Statistics 2006-2012 of the Ministry of Finance shows, the Indonesian government substantially expanded expenditure of some items in its general government expenditure such as defense, communities amenities, and education. Furthermore, the Indonesian government also implemented the so-called conversion policy in which the government increased the subsidy to the LPG sector in order to shift demand for petroleum to for LPG. This implies that in practice the reduction of the subsidy to the petroleum refinery sector was followed by other two policies; an expanding expenditure policy and the conversion policy. While the effect of the reduction of the subsidy to the petroleum refinery sector on the Indonesian economy seems negative, other two policies can be expected to stimulate the economy. Thus, when we examine the impact of the actually implemented policies, we first separate the pure effect of the reduction of the subsidy to the petroleum refinery sector from other two policies, and then add other effects of two policies in order to comprehensively explore the overall effect of the actually implemented policies.

## **5.1 The Pure Effect of the Reduction of the subsidy to the Petroleum Refinery Sector**

The Indonesian government reduced the subsidy to the petroleum refinery sector by 50,215.9 billion rupiah from 139,106.7 billion rupiah in year 2008 to 88,890.8 billion rupiah in year 2010. The reduction corresponds to 36.1% in the rate from the year 2008 level. In this section, we only reduce the amount of the subsidy to the petroleum refinery sector by 36.1% in our simulation so that we try to capture the pure effect of the reduction. Since the amount of the subsidy to the petroleum sector is only changed and all other government instruments remain unchanged, the government surplus is expected in this simulation. It is obviously unrealistic, but this simulation can numerically present the pure effect of the reduction of the subsidy. Table 2 shows the result, where we use the

equivalent variation to measure the welfare effect. The table also includes the effect on income of several sectors which are affected by the reduction policy. The reduction itself resulted in a welfare loss of 295,631.946 billion rupiah to the Indonesian economy, and it also generated a new government surplus by 4936.285 billion rupiah. The petroleum refinery sector has been most damaged, and its damage by the pure effect is measured to be the 21.6085% reduction in its income from the year 2008 level. The table also shows that other transportation sectors have also been damaged by the pure effect.

However, note that in this simulation the temporary budget constraint of the government is not satisfied, since the amount of the subsidy to the petroleum sector is only changed. In fact, while the government reduced the subsidy to the petroleum refinery sector, it also expanded its expenditure. In the next section, we also incorporate an expansion of government expenditure where we explicitly consider the budget constraint, so that the government surplus generated by the subsidy reduction is used to expand government expenditure in the next simulation. An expansion of government expenditure is expected to have stimulated the Indonesian economy.

## 5.2 The Reduction with expanding expenditure

As Budget Statistics 2006-2012 of the Ministry of Finance shows, the Indonesian government substantially expanded expenditure of some items in its general government expenditure such as defense, communities amenities, and education, when it drastically reduced the subsidy to the petroleum refinery sector between 2008 and 2010. The expanded items in the general government expenditure appear in the Input-Output table as  $i = 63$  (public administration and defense) and  $i = 64$  (social and community services). For instance, expenditure on defense appears in  $i = 63$  (public administration and defense), and communities amenities as well as education appear in  $i = 64$  (social and community services). Thus, in this section, we simulate the case where all the government surplus generated by the reduction of the subsidy to the petroleum refinery sector is used to expand the government consumption of  $i = 63$  (public administration and defense) and  $i = 64$  (social and community services). Note that in this simulation the

budget constraint is satisfied, and also that we assume the ratio of expenditure between  $i = 63$  and  $i = 64$  remains unchanged in the simulation. The second row in Table 2 shows the result. As expected, expanding government expenditure results in stimulating the Indonesian economy, and thus the negative pure effect of the reduction of the subsidy to the petroleum refinery sector is substantially reduced. However, as the table shows, the effect on welfare is still negative, and an estimated welfare loss is still 68064.432 billion rupiah.

### 5.3 The Overall Effect with the Conversion Policy

The government also implemented the so-called conversion policy in order to shift demand for petroleum to for LPG, when it reduced the subsidy to the petroleum refinery sector between 2008 and 2010. Indeed, the Indonesian government has been subsidizing the LPG sector ( $i = 51$ ) with additional 14,100 billion (14.1 trillion) rupiah in the conversion policy for 5 years since 2007 until 2011. This implies that on average the Indonesian government has provided the LPG sector with 2,820,000 million (2,820 billion) rupiah annually through the conversion policy. We now explicitly consider the effect of an expansion of the subsidy to the LPG sector as well, and we add the conversion policy to our simulation. This simulation corresponds to the most realistic case where all actually implemented policy changes are taken into account. In the simulation here, we assume that the government not only reduces the subsidy to the petroleum refinery sector by 36.1%, but also increases the subsidy to the LPG sector by 3.36088%<sup>5</sup> in two years from the year 2008 level. Furthermore, the government surplus is used to expand government

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<sup>5</sup>Note that the conversion policy started in year 2007, and the total amount of the subsidy to the LPG sector in year 2008, which is 83,906,513 million rupiah, already includes the subsidy through the conversion policy. Since the annually additional amount through the conversion policy is 2,820,000 million rupiah on average, we assume that the government subsidized the LPG sector with 5,640,000 million rupiah in two years. This implies that the total amount of the subsidy to the LPG sector increased from 83,906,513 million to 86,726,513 (= 83,906,513 + 2,820,000) million rupiah in two years. We can only obtain each value of the total amount of the subsidy to the petroleum refinery sector in year 2008 and 2010, and we have calculated the reduction rate from the year 2008 level to that of year 2010 to be 36.1%. Thus, we also calculate the increasing rate of the subsidy to the LPG sector, as if it increased from the year 2008 level to that of 2010. This consistent assumption gives us the increasing rate to be 3.36088%. Since the total amount of the subsidy to the LPG sector of year 2008 already includes the subsidy through the conversion policy, we assume that the figure of 83,906,513 million rupiah remains unchanged every year from 2007 to 2011.

expenditure in this simulation. Note that the budget constraint of the government is satisfied so that government deficits are not generated by such a mixed policy. The last row in Table 2 shows the overall effect of the actually implemented policies between 2008 and 2010. As Table 2 shows, the overall effect on the Indonesian economy is still negative, and a welfare loss is measured to be 28,417.78 billion rupiah<sup>6</sup>. Note that a 3.36088% increase in the subsidy to the LPG sector strongly induces a welfare gain by stimulating the Indonesian economy. However, the conversion policy by the 3.36088% increase in the subsidy to the LPG sector cannot offset the negative effect of the 36.1% reduction of the subsidy to the petroleum refinery sector. While the reduction itself decreased welfare by 295,631.946 billion rupiah, we estimate the actual effect followed by an expansion of government expenditure *and* the conversion policy to have reduced welfare by 28,417.78 billion rupiah. Note that these results of the effect on welfare are measured in two years from 2008 to 2010, so that we roughly interpret a half of the effect per year to obtain an annual welfare loss of 14,208.89 billion rupiah provided that the reduction of the subsidy to the petroleum refinery sector was proportional in two years.

## **6 The Impact of the Proposed Further Reduction Plan**

The Ministry of Finance of Indonesia has already announced its future plan to further reduce the subsidy to the petroleum refinery sector. Figure 2 shows the future plan proposed by the Ministry of Finance of Indonesia. In this last section, we simulate the effect of the future reduction plan on the Indonesian economy. As the previous section

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<sup>6</sup>In our separate simulation, we have estimated the magnitude of the "pure" positive effect of an increase in the subsidy to the LPG sector by 3.36088% to be 32,309.91 billion rupiah in a welfare gain. Furthermore, since such a policy strongly stimulates the economy, it ends up reducing the government deficits, and the estimated government "surplus" is 378.04 billion rupiah, although the subsidy to the LPG sector increases. Since the generated government surplus can be used to expand government expenditure, it further results in a more welfare gain. If the government only increases the subsidy to the LPG sector by 3.36088% and it uses all the surplus for expanding government expenditure, then we estimate a welfare gain of 60,445.52 billion rupiah. Since the actually implemented policy is a mixed policy of such a policy with expanding government expenditure as well as the reduction of the subsidy to the petroleum refinery sector, the overall effect on welfare is reduced to eventuate in a welfare loss of 28,417.78 billion rupiah.

suggests, the overall effect substantially depends on the assumption of the future amount of the subsidy to the LPG sector. This implies that the overall effect of the proposed reduction policy depends on the future conversion policy. Then as shown in Table 3, we simulate two cases depending on different scenarios on the future conversion policies. In Scenario I, we assume that the conversion policy ends in year 2011 as actually planned. On the other hand, in Scenario II we assume that the government continues to subsidize the LPG sector through the conversion policy even after year 2011. In Scenario II, we assume that the government keeps providing the LPG sector with additional 2,820,000 million rupiah every year until 2014. In both scenarios, we keep our assumption that the budget constraint of the government is satisfied, so that the government surplus is fully used to expand government expenditure. Note also that both scenarios are the same until 2011. Table 4 shows the effect of the proposed future reduction plan on the Indonesian economy. Due to the successive provision of the subsidy to the LPG sector even after year 2011, a welfare loss is smaller in Scenario II<sup>7</sup>. However, the table indicates that a welfare loss cannot be avoidable even though the government continues to provide the LPG sector with the same amount of the subsidy through the conversion policy. Note also that the magnitude of the negative effect on welfare keeps decreasing in both scenarios over time, since the reduction of the subsidy to the petroleum sector enables the government to expand its expenditure, thus resulting in the economy being more stimulated by expanded government expenditure.

Table 4 shows that the Indonesian economy will suffer from the proposed future reduction plan. Even when the government continues to provide the LPG sector with the same amount of the subsidy through the conversion policy, we estimate a welfare loss of 46,547.69605 billion rupiah in year 2013 and 39,707.50901 billion rupiah in year 2014, respectively. Then, we guess to the extent how much the government should provide the LPG sector with an additional subsidy, in order to completely offset the negative effect of the reduction policy on the future welfare. Table 5 shows our simulation result of the effect-neutral conversion policy, where we have assumed that the government can increase

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<sup>7</sup>Note that all welfare gains are measured in comparison with the welfare level of year 2008.

the subsidy to the LPG sector up to the level at which the proposed future reduction of the subsidy to the petroleum refinery sector has no effect on welfare. Note that the rate shown in Table 5 has endogenously been calculated, and it is the increasing rate of the subsidy to the LPG sector from the year 2008 level. The budget constraint is satisfied so that the government expands its expenditure if a further increase in the subsidy to the LPG sector generates the government surplus. In comparison with Scenario II in Table 4, we suggest that the government could further expand its expenditure with the effect-neutral conversion policy. While the government has to increase the subsidy to the LPG sector through the effect-neutral conversion policy by approximately 4 to 5% from the year 2008 level, the effect-neutral policy induces the more government surplus by stimulating the economy, thus resulting in more government expenditure with no effect on welfare. If we assume the average annual amount of the subsidy to the LPG sector through the current conversion policy to be 2,820 billion rupiah, then we estimate the additional amount of the subsidy to the LPG sector to be 148.89 billion in year 2011, 137.07 billion in year 2012, 128.535 billion in year 2013, and 113.966 billion in year 2014, respectively, under the proposed future reduction plan.

## 7 Concluding Remarks

We have numerically examined the impact of the reduced subsidy to the petroleum refinery sector on the Indonesian economy by using a static CGE model with the latest Input-Output table of Indonesia of year 2008.

We have also explored the effect of the proposed future reduction policy by the Ministry of Finance of Indonesia by taking into account several possibilities over the conversion policy with the subsidy to the LPG sector.

By comparing several simulation results with our successful benchmark model, we have obtained the following results. First, we have estimated the pure effect of the reduction policy to be a welfare loss of 295,631.95 billion rupiah to the Indonesian economy in two years between 2008 and 2010. Second, when we also take into account more realistic

aspects such as an actual expansion of government expenditure in the two years, then the magnitude of a welfare loss shrinks to 68,064.43 billion rupiah. Third, when we further consider the effect of the actual ongoing conversion policy as well, then our simulation result suggests that the actually implemented reduction policy still has a negative effect on welfare with a welfare loss of 28,417.78 billion rupiah. Fourth, we have also explored the effect of the proposed future reduction plan by the Ministry of Finance of Indonesia, and we have estimated a welfare loss of the plan in different years. While we have estimated the welfare loss to decrease over time, the range of the welfare loss in the next 3 years is between approximately 40,000 billion and 79,000 billion rupiah based on our different assumption on the future conversion policy to the LPG sector. Finally we have also estimated the additional amount of the subsidy to the LPG sector in the future conversion policy to neutralize the negative effect of the proposed future reduction plan on the Indonesian economy. Our estimated additional amount of the subsidy to the LPG sector are between approximately 114 billion and 149 billion rupiah in different years. In our effect-neutral future conversion policy, we have further obtained the result that such a further increase in the subsidy to the LPG sector stimulates the economy, thus resulting in an expansion of government expenditure with no negative effect on welfare. Our simulation results suggest that the Indonesian government could offset the negative effect of the proposed future reduction policy for the petroleum refinery sector on the Indonesian economy, by providing the LPG sector with a slightly more subsidy in the future conversion policy. This also implies that a huge amount of welfare loss cannot be avoidable if the proposed future reduction policy is only implemented. Since a further increase in the subsidy to the LPG sector can be expected to stimulate the economy, the increase in the subsidy to the LPG sector eventuates in an increase in tax revenue, thus resulting in more government expenditure.



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## Appendix: Model

We employ the conventional static CGE model<sup>8</sup>. We assume that the Indonesian economy consists of 66 different production sectors, a representative consumer, the government, and the investment firm sector. We allow all 66 production sectors to have intermediate production processes, and we assume that they maximize their profit. We assume that households maximize their utility over 66 different consumption goods. We assume that the government determines its tax revenue, the amount of the subsidy, and its consumption in order to satisfy its budget constraint. We also assume that the economy is fully competitive, so that all prices are determined in the relevant markets in order to equate the amount of demand to the amount of supply at its fully competitive price level in equilibrium. Note that the model is static and thus we only investigate the short-run effect. For simplicity we then assume that factor inputs are not mobile among different sectors in the short-run. All parameter values are presented in Table 6 and 7.

### <Consumer>

Utility of a representative consumer is given by:

$$U(X_1, X_2, \dots, X_{66}) = \prod_{i=1}^{66} X_i^{\alpha_i}, \quad (1)$$

where  $X_i$  denotes consumption of good  $i$ .  $\sum_{i=1}^{66} \alpha_i = 1$  is assumed.  $i$  denotes each sector. We determine the parameter value of each  $\alpha_i$  by using the actual social accounting matrix.

We assume that a representative consumer maximizes (1) with respect to her/his consumption goods subject to her/his budget constraint such that:

$$\sum_{i=1}^{66} p_i X_i = I(1 - \tau^I) - S^I,$$

where  $p_i$  and  $I$  denote the price of good  $i$  and income, respectively.  $\tau^I$  is the propor-

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<sup>8</sup>In terms of the conventional static model, see Ballard, Fullerton, Shoven, and Whalley (1985), Shoven and Whalley (1992), and Scarf and Shoven (2008). In particular, the model used in this paper is similar to Hosoe, Ogawa, and Hashimoto (2004). Regarding the dynamic model, it is conventional to employ an overlapping generations model. In terms of computable overlapping generations model within a general equilibrium framework, see Auerbach and Kotlikoff (1987), Kato (2002) and Ihori, Kato, Kawade, and Bessho (2011).

tional income tax rate, and it is calculated by using the actual social accounting matrix.  $S^I$  denotes savings, and we assume that a representative consumer saves the constant amount relative to her/his disposal income. Savings are assumed to be given by

$$S^I = s^I (1 - \tau^I) I,$$

where the constant ratio,  $s^I$ , is given exogenously<sup>9</sup>. The value of  $s^I$  has been calculated by using the actual SAM. Then income is given by

$$I = \sum_{i=1}^{66} r_i \bar{K}_i + \sum_{i=1}^{66} w_i \bar{L}_i,$$

where  $r$  and  $w$  denote the rental cost and the wage rate, respectively.  $\bar{K}$  and  $\bar{L}$  are endowments of capital and labor, respectively. The factor payments change as  $r$  or  $w$  changes. Note that the amounts of  $r_i \bar{K}_i$  and  $w_i \bar{L}_i$  are both obtained from the actual social accounting matrix.

The first order conditions yield the demand functions such that:

$$X_i = X_i(p_i, Y; \alpha_i) = \frac{\alpha_i I (1 - \tau^I) (1 - s^I)}{p_i}, \quad i = 1, 2, \dots, 66. \quad (2)$$

Note that  $\alpha_i$  can be calculated by using (2) and the actual social accounting matrix so that:

$$\alpha_i = \frac{p_i X_i}{I (1 - \tau^I) (1 - s^I)} = \frac{p_i X_i}{(1 - s^I) (1 - \tau^I) \left( \sum_{j=1}^{66} r_j \bar{K}_j + \sum_{j=1}^{66} w_j \bar{L}_j \right)}, \quad i = 1, 2, \dots, 66,$$

where both the values of the denominator and the numerator can be obtained from the actual social accounting matrix.

### <Production Sector>

Following the conventional assumption, we describe the multiple decisions by each

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<sup>9</sup>The assumption that the ratio is exogenously given is made only for the model to be consistent to the actual social accounting matrix, and this assumption is very common in the literature.

firm by the tree structure, where each firm is assumed to make a decision over several different items. In the tree structure, the optimal behavior of each firm which makes a decision over different items is described as if the firm always makes a decision over two different items at different steps. Each firm makes a decision over different items; exports of its own product, the amount of imported goods and intermediate goods used for its production, and labor and capital. This assumption simplifies a complicated decision over several items by each firm. The detailed tree structure is given by Figure 3.

At step 1, a firm,  $i$ , is assumed to use labor and capital to produce its composite goods,  $Y_i$ . Then, the firm is assumed to produce its domestic goods,  $Z_i$ , by using its own  $Y_i$  and  $X_{i,j}$  at the second step.  $X_{i,j}$  denotes the final consumption goods produced by firm  $j$  used by firm  $i$  for its production. Thus,  $X_{i,j}$  is the amount of the final consumption goods produced by firm  $j$  for the intermediate production process of firm  $i$ . At the third step, the firm is assumed to decompose its domestic goods,  $Z_i$ , into exported goods,  $E_i$ , and final domestic goods,  $D_i$ . This step is concerned about its optimal decision over the amount of its product to be exported. At the final step (the fourth step), the firm is assumed to produce its final consumption goods,  $Q_i$ , by using its final domestic goods,  $D_i$ , and imported goods,  $M_i$ . This step corresponds to its optimal decision over how much it uses imported goods,  $M_i$ , and its own goods,  $D_i$ , to produce its final consumption goods,  $Q_i$ , which are consumed by domestic households. The assumption of this tree structure in terms of different decisions can incorporate firm's complicated decisions over exports of its own product, the amount of imported goods and intermediate goods which the firm uses in its production process, and the amount of factor inputs into the model in a tractable way.

Note that all market clearing conditions are used to determine all prices endogenously in their corresponding markets, and also that at each step the firm is assumed to determine the amount of relevant variables in order to maximize its profit.

By the assumption of the above tree structure, all decision making processes can be simplified, and the optimal behavior about all different decisions can be incorporated as follows:

### Step 1: The production of composite goods

Each firm is assumed to produce its composite goods by using capital and labor. Each firm is assumed to maximize its profit given by:

$$\pi_i = p_i^Y Y_i(K_i, L_i) - r_i K_i - w_i L_i, \quad (3)$$

where  $Y_i$  and  $p_i^Y$  denote the composite goods produced by firm  $i$  and its price, respectively.  $K_i$  and  $L_i$  denote capital and labor used by firm  $i$  in order to produce its composite goods, respectively. The production technology is given by:

$$Y_i(K_i, L_i) = K_i^{\beta_{K,i}} L_i^{\beta_{L,i}}, \quad i = 1, 2, \dots, 66, \quad (4)$$

where  $\beta_{K,i} + \beta_{L,i} = 1$  is assumed for all  $i = 1, 2, \dots, 66$ . Each firm is assumed to maximize (3) with respect to labor and capital subject to (4), and the first order conditions yield the demand functions such that:

$$K_i = K_i(p_i^Y, r_i, w_i; \beta_{K,i}, \beta_{L,i}) = \frac{\beta_{K,i}}{r_i} p_i^Y Y_i, \quad (5a)$$

$$L_i = L_i(p_i^Y, r_i, w_i; \beta_{K,i}, \beta_{L,i}) = \frac{\beta_{L,i}}{w_i} p_i^Y Y_i, \quad i = 1, 2, \dots, 66. \quad (5b)$$

Note that  $\beta_{K,i}$  and  $\beta_{L,i}$  can be calculated by using (5a), (5b), and the actual social accounting matrix so that:

$$\beta_{K,i} = \frac{r_i K_i}{p_i^Y Y_i},$$

$$\beta_{L,i} = \frac{w_i L_i}{p_i^Y Y_i}, \quad i = 1, 2, \dots, 66,$$

where  $r_i K_i$ ,  $w_i L_i$ , and  $p_i^Y Y_i$  can be obtained from the actual social accounting matrix. The estimated values of  $\beta_{K,i}$  and  $\beta_{L,i}$  are given in Table 7.

### Step 2: The production of domestic goods

Each firm is assumed to produce domestic goods,  $Z_i$ , by using intermediate goods and its own composite goods, which production has been described at step 1. The optimal behavior of each firm in terms of the production of domestic goods can be described such that:

$$\begin{aligned} \underset{Y_i, X_{i,j}}{Max} \quad \pi_i &= p_i^Z Z_i - \left( p_i^Y Y_i - \sum_j^{66} p_j^X X_{i,j} \right), \\ \text{st} \quad Z_i &= \min \left( \frac{X_{i,j}}{ax_{i,j}}, \frac{Y_i}{ay_i} \right), \quad i = 1, 2, \dots, 66, \end{aligned}$$

where  $X_{i,j}$  and  $p_j^X$  denote intermediate good  $j$  used by firm  $i$  and its price, respectively.  $p_i^Z$  is the price of  $Z_i$ .  $ax_{i,j}$  denotes the amount of intermediate good  $j$  used for producing one unit of a domestic good of firm  $i$ , and  $ay_i$  denotes the amount of its own composite good for producing one unit of its domestic good. The estimated values of  $ay_i$  are given in Table 7<sup>10</sup>. Note that the production function at this step is assumed to be the Leontief type. Using  $ax_{i,j}$  and  $ay_i$ , and assuming that the market is fully competitive, the zero-profit condition can be written by:

$$p_i^Z = p_i^Y ay_i + \sum_j^{66} p_j^X ax_{i,j}, \quad i = 1, 2, \dots, 66.$$

### Step 3: Decomposition of Domestic Goods into Exported Goods and Final Domestic Goods

The optimal decision made by firm  $i$  in terms of the amount of exports of its own goods is described as the decomposition of  $Z_i$  ( $i = 1, 2, \dots, 66$ ) into exported goods,  $E_i$ , and final domestic goods,  $D_i$ . Each firm is assumed to maximize its profit such that:

$$\pi_i = p_i^e E_i + p_i^d D_i - (1 + \tau_i^p - \tau_i^s) p_i^Z Z_i, \quad (6)$$

where  $p_i^e$  and  $p_i^d$  denote the price when the domestic goods are sold abroad, and the price when the domestic goods are sold domestically, respectively. Note that  $p_i^e$  is

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<sup>10</sup>The estimated values of  $ax_{i,j}$  are not presented in Table 7, since the number of the estimated values reach 4,356. The estimated values are given upon request.

measured in the domestic currency.  $\tau_i^p$  and  $\tau_i^s$  are the tax rates of a production tax imposed on the production of  $Z_i$  and the subsidy rate, respectively. The values of  $\tau_i^p$  and  $\tau_i^s$  are calculated by using the actual social accounting matrix, and the calculated values are given in Table 6. The decomposition is assumed to follow the Cobb-Douglas technology such that:

$$Z_i = E_i^{\kappa_i^e} D_i^{\kappa_i^d}, \quad i = 1, 2, \dots, 66, \quad (7)$$

where  $\kappa_i^d + \kappa_i^e = 1$  ( $i = 1, 2, \dots, 66$ ) is assumed. Each firm is assumed to maximize (6) with respect to  $E_i$  and  $D_i$  subject to (7), and the first order conditions yield

$$E_i = E_i(p_i^e, p_i^d, p_i^Z; \tau_i^p, \tau_i^s, \kappa_i^d, \kappa_i^e) = \frac{\kappa_i^e (1 + \tau_i^p - \tau_i^s) p_i^Z Z_i}{p_i^e}, \quad (8a)$$

$$D_i = D_i(p_i^e, p_i^d, p_i^Z; \tau_i^p, \tau_i^s, \kappa_i^d, \kappa_i^e) = \frac{\kappa_i^d (1 + \tau_i^p - \tau_i^s) p_i^Z Z_i}{p_i^d}, \quad i = 1, 2, \dots, 66. \quad (8b)$$

Note that  $\kappa_i^e$  and  $\kappa_i^d$  can be calculated by using (8a), (8b), and the actual social accounting matrix so that:

$$\begin{aligned} \kappa_i^e &= \frac{p_i^e E_i}{(1 + \tau_i^p - \tau_i^s) p_i^Z Z_i}, \\ \kappa_i^d &= \frac{p_i^d D_i}{(1 + \tau_i^p - \tau_i^s) p_i^Z Z_i}, \quad i = 1, 2, \dots, 66, \end{aligned}$$

where  $p_i^e E_i$ ,  $p_i^d D_i$ ,  $p_i^Z Z_i$ ,  $\tau_i^s p_i^Z Z_i$ , and  $\tau_i^p p_i^Z Z_i$  can be obtained from the actual social accounting matrix. The estimated values of  $\kappa_i^e$  and  $\kappa_i^d$  are given in Table 7.

#### Step 4: The Production of the final goods

Denote the final consumption goods by  $Q_i$  ( $i = 1, 2, \dots, 66$ ). The final consumption goods are assumed to be produced by using the final domestic goods,  $D_i$ , and the imported goods,  $M_i$ . This step corresponds to the optimal decision making behavior of each firm in terms of the amount of imported goods which are used in its production process. The production technology at this final step is given by the following Cobb-Douglas function:



$$Q_i = M_i^{\gamma_i^m} D_i^{\gamma_i^d}, \quad i = 1, 2, \dots, 66, \quad (9)$$

where  $\gamma_i^m + \gamma_i^d = 1$  ( $i = 1, 2, \dots, 66$ ) is assumed. Each firm is assumed to maximize its profit with respect to  $M_i$  and  $D_i$  subject to (9). Its profit is given by:

$$\pi_i = p_i^Q Q_i - (1 + \tau_i^m - \tau_i^{ms}) p_i^m M_i - p_i^d D_i, \quad i = 1, 2, \dots, 66,$$

where  $p_i^Q$ ,  $\tau_i^m$  and  $\tau_i^{ms}$  denote the price of its final consumption goods,  $Q_i$ , the import tariff rate, and import subsidy rate, respectively. The import tariff rate and the import subsidy rate are both calculated by using the actual social accounting matrix, and they are given in Table 6. Then, the first order conditions yield

$$M_i = M_i \left( p_i^m, p_i^d, p_i^Q; \tau_i^m, \tau_i^{ms}, \gamma_i^m, \gamma_i^d \right) = \frac{\gamma_i^m p_i^Q Q_i}{(1 + \tau_i^m - \tau_i^{ms}) p_i^m}, \quad (10a)$$

$$D_i = D_i \left( p_i^m, p_i^d, p_i^Q; \tau_i^m, \tau_i^{ms}, \gamma_i^m, \gamma_i^d \right) = \frac{\gamma_i^d p_i^Q Q_i}{p_i^d}, \quad i = 1, 2, \dots, 66. \quad (10b)$$

Note that  $\gamma_i^m$  and  $\gamma_i^d$  can be calculated by using (10a), (10b), and the actual social accounting matrix so that:

$$\begin{aligned} \gamma_i^m &= \frac{(1 + \tau_i^m - \tau_i^{ms}) p_i^m M_i}{p_i^Q Q_i}, \\ \gamma_i^d &= \frac{p_i^d D_i}{p_i^Q Q_i}, \quad i = 1, 2, \dots, 66, \end{aligned}$$

where  $p_i^m M_i$ ,  $p_i^d D_i$ ,  $p_i^Q Q_i$ ,  $\tau_i^m p_i^m M_i$  and  $\tau_i^{ms} p_i^m M_i$  can be obtained from the actual social accounting matrix. The estimated values of  $\gamma_i^m$  and  $\gamma_i^d$  are given in Table 7.

### <The Government>

The government is assumed to impose several taxes to satisfy its budget constraint. Its budget constraint is given by:

$$\sum_{i=1}^{66} p_i^Q X_i^g + S^g + Sub = T^I + T^p + T^m,$$

where the left hand side is the total government expenditure, and the right hand side is the total government revenue.  $X_i^g$  and  $S^g$  denote government consumption of final consumption good  $i$ , and government savings, respectively.  $Sub$  denotes the total amount of the subsidy such that:

$$Sub = \sum_{i=1}^{66} (\tau_i^s (p_i^Z Z_i) + \tau_i^{ms} (p_i^m M_i)).$$

The total tax revenue is given by:

$$\begin{aligned} T^I &= \tau^I I = \tau^I \left( \sum_{i=1}^{66} r_i \bar{K}_i + \sum_{i=1}^{66} w_i \bar{L}_i \right), \\ T^p &= \sum_{i=1}^{66} \tau_i^p (p_i^Z Z_i), \\ T^m &= \sum_{i=1}^{66} \tau_i^m (p_i^m M_i), \end{aligned}$$

where  $T^I$ ,  $T^p$ , and  $T^m$  denote the total income tax revenue, the total production tax revenue, and the total import tariff revenue, respectively. The government is assumed to save the constant amount relative to the total amount of tax revenue, and the government savings are assumed to be given by

$$S^g = s^g (T^I + T^p + T^m),$$

where the constant ratio,  $s^g$ , is given exogenously, and its value has been calculated by using the actual SAM.

### <Equilibrium Conditions>

There are two factor inputs, labor and capital. Since the model is static and thus the short-run effect is explored, it is assumed that each factor cannot move among different sectors (industries) in the short-run. This implies the equilibrium conditions of factor

markets such that

$$\bar{K}_i = K_i, \quad (11a)$$

$$\bar{L}_i = L_i, \quad i = 1, 2, \dots, 66, \quad (11b)$$

where the total amount of endowments is given by:

$$\begin{aligned} \bar{K} &= \sum_{i=1}^{66} \bar{K}_i, \\ \bar{L} &= \sum_{i=1}^{66} \bar{L}_i. \end{aligned}$$

Note that  $r_i$  and  $w_i$  ( $i = 1, 2, \dots, 66$ ) are determined in order to satisfy (11a) and (11b), respectively.

In terms of the market clearing condition of good  $i$  ( $i = 1, 2, \dots, 66$ ), a private investment sector is introduced in order to close the economy in this paper<sup>11</sup>. Denoting the amount of good  $i$  consumed by the private investment sector by  $X_i^s$ , the market clearing condition of good  $i$  is given by:

$$Q_i = X_i + X_i^g + X_i^s + \sum_j X_{i,j}, \quad i = 1, 2, \dots, 66, \quad (12)$$

where the left hand side is the total supply, and the right hand side is the total demand for good  $i$ .  $p_i^Q$  ( $i = 1, 2, \dots, 66$ ) is determined in order to satisfy (12). Note that the budget constraint of the private investment sector is given by:

$$\sum_{i=1}^{66} p_i^Q X_i^s = S^g + S^I + S^f,$$

where the left hand side is the total amount of its consumption, and the right hand side is the total amount of its income.  $S^f$  denotes the total amount of savings by the

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<sup>11</sup>This is also a conventional assumption in the literature.

foreign sector, or the deficits in the current account, and it is given by subtracting exports from imports<sup>12</sup>. Since both the amount of exports and the amount of imports can be obtained from the actual social accounting matrix,  $S^f$  can be calculated from the actual social accounting matrix, and thus it is exogenously given in the model. Furthermore, the foreign trade balance is given by

$$\sum_{i=1}^{66} p_i^{w,e} E_i + S^f = \sum_{i=1}^{66} p_i^{w,m} M_i,$$

where  $p_i^{w,e}$  and  $p_i^{w,m}$  denote the world price of export goods, and import goods of good  $i$ , respectively, and both of them are assumed to be given exogenously. Since  $p_i^e$  and  $p_i^m$  are both measured in the domestic currency, they are also expressed such that:

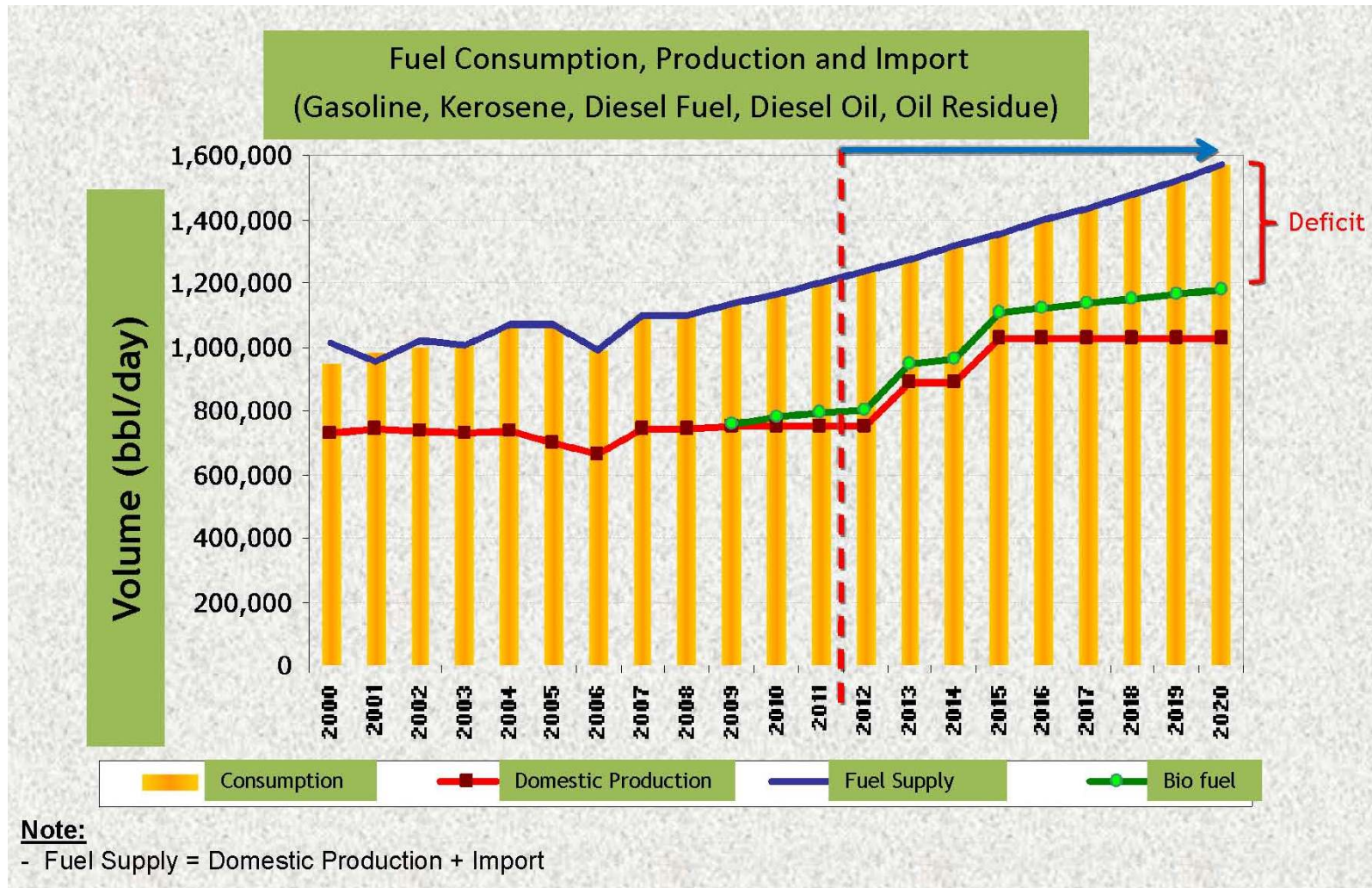
$$\begin{aligned} p_i^e &= \varepsilon p_i^{w,e}, \\ p_i^m &= \varepsilon p_i^{w,m}, \quad i = 1, 2, \dots, 66, \end{aligned}$$

where  $\varepsilon$  denotes the exchange rate. Note that the exogeneity assumption on the world prices implies that the exchange rate is endogenously determined within the model.

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<sup>12</sup>The FDI is assumed to be negligible in this paper.

Figure 1:



✓ Source: Ministry of Finance of Indonesia

**Table 1-1: Economic Values in the Benchmark Model  
Final Domestic Consumption Goods,  $i = 1, 2, \dots, 66$**

Unit: One billion Rupiah

$i$	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MODEL	169856.9	23181.81	75495.27	29301.85	189820.6	25279.42	36070.84	10443.7	18600.61	77515.99	3955.219	4243.885	1006.108	2715.314	13050.98
ACTUAL	169856.9	23181.81	75495.27	29301.85	189820.6	25279.42	36070.84	10443.7	18600.61	77515.99	3955.219	4243.885	1006.108	2715.314	13050.98
$i$	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MODEL	9771.237	22001.78	79725.82	83587.52	108594.5	44390.47	9871.421	181119	160574	364236.1	90318.76	133900.3	78531.7	239444.1	107780.1
ACTUAL	9771.237	22001.78	79725.82	83587.52	108594.5	44390.47	9871.421	181119	160574	364236.1	90318.76	133900.3	78531.7	239444.1	107780.1
$i$	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
MODEL	30401.32	178185.2	18814.84	118232	28943.11	186671.7	140991	131360.6	76517.59	384244.5	395612.8	174784.4	54077.64	36649.28	126795.8
ACTUAL	30401.32	178185.2	18814.84	118232	28943.11	186671.7	140991	131360.6	76517.59	384244.5	395612.8	174784.4	54077.64	36649.28	126795.8
$i$	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
MODEL	33293.46	252853.9	626266.3	338365.1	30740.02	124490.7	1243976	848385.8	322565	5991.71	248607.6	78203.15	79225.28	53862.56	181714.1
ACTUAL	33293.46	252853.9	626266.3	338365.1	30740.02	124490.7	1243976	848385.8	322565	5991.71	248607.6	78203.15	79225.28	53862.56	181714.1
$i$	61	62	63	64	65	66									
MODEL	276761.1	332828.7	272982.4	329246.5	296310.3	3874.718									
ACTUAL	276761.1	332828.7	272982.4	329246.5	296310.3	3874.718									

$i=41$ : Petroleum Refinery Sector

$i=51$ : LPG Sector

**Table 1-2: Economic Values in the Benchmark Model (Continued)**  
**Capital Income,  $rK_i$ ;  $i = 1, 2, \dots, 66$**

Unit: One billion Rupiah

<i>i</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MODEL	103400.3	9819.214	48916.11	22196.86	126930.6	1305.485	11298.29	4634.259	10980.19	29072.6	1062.658	4911.48	542.414	1884.862	511.516
ACTUAL	103400.3	9819.214	48916.11	22196.86	126930.6	1305.485	11298.29	4634.259	10980.19	29072.6	1062.658	4911.48	542.414	1884.862	511.516
<i>i</i>	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MODEL	11165.67	11255.03	35889.1	23481.75	26496.16	25336.67	5940.84	107352.8	156097.8	271783.3	39359.71	28595.5	43943.57	42033.31	19991.9
ACTUAL	11165.67	11255.03	35889.1	23481.75	26496.16	25336.67	5940.84	107352.8	156097.8	271783.3	39359.71	28595.5	43943.57	42033.31	19991.91
<i>i</i>	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
MODEL	3710.997	37197.21	2843.623	20231.15	8992.068	64396.24	51210.22	36322.03	22650.06	50778.16	272167.6	37799.26	15200.47	9719.815	10785.44
ACTUAL	3710.997	37197.21	2843.623	20231.15	8992.068	64396.25	51210.22	36322.03	22650.06	50778.16	272167.6	37799.26	15200.47	9719.815	10785.44
<i>i</i>	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
MODEL	10461.97	68074	92411.76	66354.29	5328.204	112506.8	267444.9	362486.6	91603.03	911.209	63488.62	15088.45	10682.73	16938.73	117766.9
ACTUAL	10461.97	68074	92411.76	66354.29	5328.204	112506.8	267444.9	362486.6	91603.03	911.209	63488.62	15088.45	10682.73	16938.73	117766.9
<i>i</i>	61	62	63	64	65	66									
MODEL	124091.1	167405.5	18744.51	43665.88	83937.39	1527.993									
ACTUAL	124091.1	167405.5	18744.51	43665.88	83937.39	1527.993									

i=41: Petroleum Refinery Sector

i=51: LPG Sector

**Table 1-3: Economic Values in the Benchmark Model (Continued)**  
**Labor Income,  $wL_i$ ;  $i = 1, 2, \dots, 66$**

Unit: One billion Rupiah

<i>i</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MODEL	21865.56	1810.716	7731.414	2928.34	30037.99	176.585	12173.4	2441.192	2683.275	13456.63	744.498	1679.83	304.662	518.754	88.568
ACTUAL	21865.56	1810.716	7731.414	2928.34	30037.99	176.585	12173.4	2441.192	2683.275	13456.63	744.498	1679.83	304.662	518.754	88.568
<i>i</i>	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
MODEL	2158.134	5214.59	12432.01	9840.712	21128.79	7110.591	1745.677	26451.27	32741.56	27333.3	23424.21	10541.11	23538.74	10564.29	9417.451
ACTUAL	2158.134	5214.59	12432.01	9840.712	21128.79	7110.591	1745.677	26451.27	32741.56	27333.3	23424.21	10541.11	23538.74	10564.29	9417.451
<i>i</i>	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
MODEL	1957.179	17141.02	2024.185	8758.06	2526.806	33403.95	20355.39	15752.33	8684.796	26487.03	61257.55	21394.87	8692.499	4127.232	2225.738
ACTUAL	1957.179	17141.02	2024.185	8758.06	2526.806	33403.95	20355.39	15752.33	8684.796	26487.03	61257.55	21394.87	8692.499	4127.232	2225.738
<i>i</i>	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
MODEL	5089.327	39618.42	38499.42	33995.72	3746.667	14863.2	167855.9	151338.6	53632.13	1582.698	45471.62	8620.54	10036.11	11542.38	29923.87
ACTUAL	5089.327	39618.42	38499.42	33995.72	3746.667	14863.2	167855.9	151338.6	53632.13	1582.698	45471.62	8620.54	10036.11	11542.38	29923.87
<i>i</i>	61	62	63	64	65	66									
MODEL	51739.65	33569.51	138982.3	133851.3	54672.48	528.986									
ACTUAL	51739.65	33569.51	138982.3	133851.3	54672.48	528.986									

i=41: Petroleum Refinery Sector

i=51: LPG Sector



**Table 1-4: Economic Values in the Benchmark Model (Continued)**

Unit: One billion Rupiah

savings					
private sector		government sector		foreign sector	
model	actual	Model	actual	model	actual
1,751,059.00000000	1,751,059.00000000	-102,746.43746847	-102,746.43750000	-139,481.93200000	-139,481.93750000

tax and subsidy									
individual wage income tax		production tax		import tariff		(general) subsidy		import subsidy	
model	actual	model	actual	model	actual	model	actual	model	actual
250,484.9999036100	250,485.0000000000	196,685.3799999999	196,685.3800000000	107,841.3260000000	107,841.3260000000	199,701.9749999999	199,701.9750000000	41,189.4959999998	41,189.4960000000

✓ The above figures indicate the total amount.

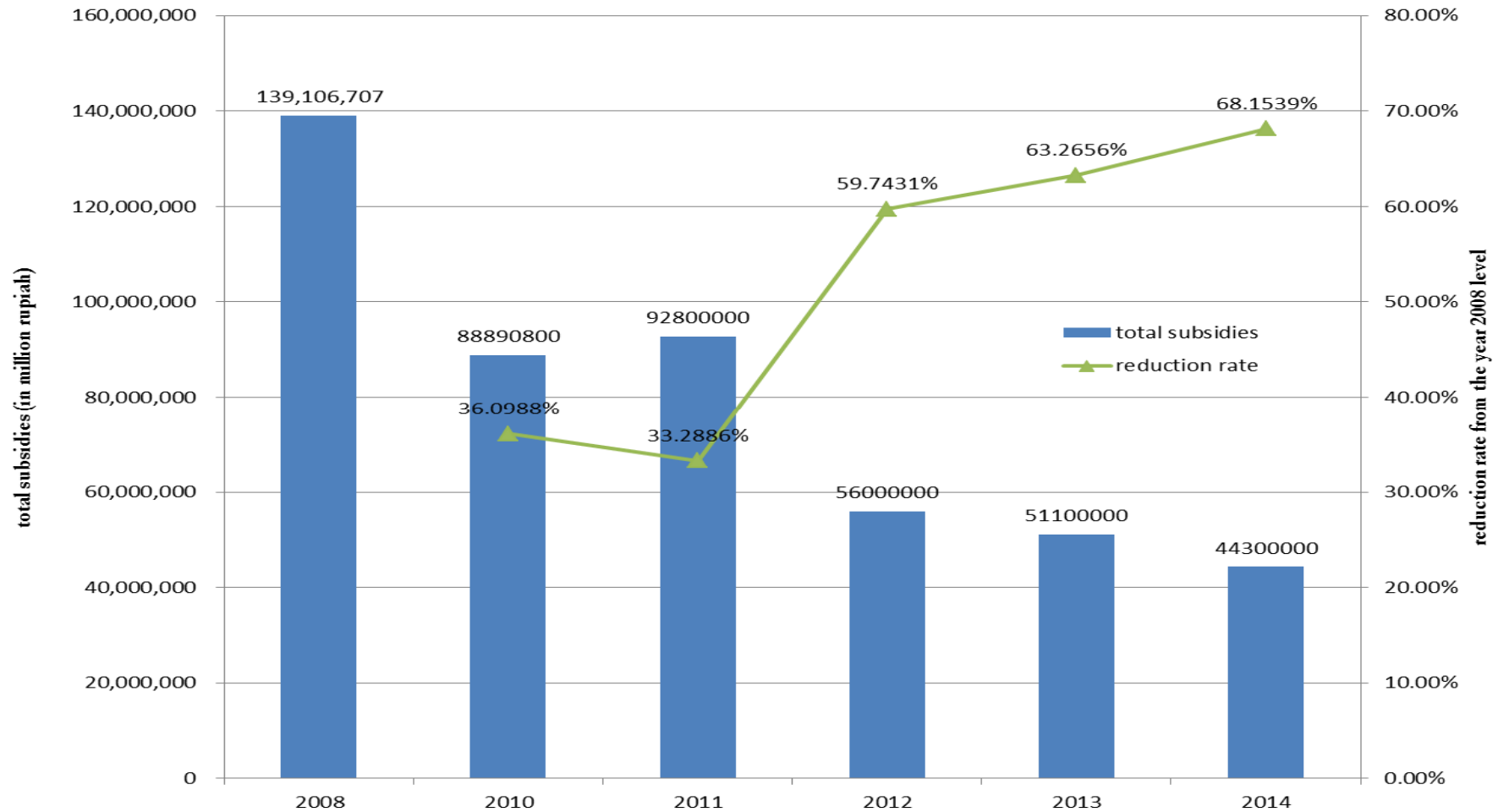
**Table 2: The Effect of the Actual Reduction of the Subsidy to the Petroleum Refinery Sector by 36.1%**

Unit: One billion Rupiah

	welfare gain	government deficits	Income							
			i=41 (petroleum refinery)	i=55 (railways)	i=56 (road transport)	i=57 (water transport)	i=58 (air transport)	i=51 (LPG)	i=63 (Defense)	i=64 (gov. services)
Pure Effect:	-295631.946	-4936.2846	261,376.7804 (-21.6085%)	2,133.2563 (-14.4613%)	92,907.0165 (-14.7331%)	20,247.2900 (-14.6008%)	17,902.1377 (-13.5949%)	108,832.4997 (-14.554%)	155,553.0351 (-1.378%)	164,936.8792 (-0.7087%)
with expanding expenditure:	-68064.4315	0	297,060.9650 (-10.9062%)	2,420.5381 (-2.9419%)	105,567.8876 (-3.1133%)	23,006.7408 (-2.9620%)	20,279.0224 (-2.1228%)	123,606.2550 (-2.9549%)	172,100.5031 (9.1130%)	184,354.7350 (3.8518%)
overall effect:	-28417.78	0	303,677.0476 (-8.922%)	2,469.4332 (-0.9813%)	107,730.8944 (-1.128%)	23,473.8239 (-0.9919%)	20,668.5565 (-0.2427%)	129,369.9807 (1.570%)	173,236.0623 (9.833%)	186,592.3226 (5.112%)

✓ The figures in the parentheses indicate the relative change from the benchmark (year 2008) level.

Figure 2: The Proposed Future Reduction Plan of the Subsidy to the Petroleum Refinery Sector



✓ Based on the data from the Ministry of Finance of Indonesia, we have calculated above figures.

**Table 3: Scenarios on the Future Subsidies to the Petroleum Refinery ( $i = 41$ ) and LPG ( $i = 51$ ) Sectors**

Unit: One million rupiah

	unit: million	year 2008		year 2011		year 2012		year 2013		year 2014	
		i=41	i=51	i=41	i=51	i=41	i=51	i=41	i=51	i=41	i=51
Scenario I:	total subsidies	139,106,707	83,906,513	92,800,000	83,906,513	56,000,000	81,086,513	51,100,000	81,086,513	44,300,000	81,086,513
	reduction rate (from the 2008 level)			33.2886%	0.0000%	59.7431%	3.3609%	63.2656%	3.3609%	68.1539%	3.3609%
Scenario II:	total subsidies	139106707	83906513	92800000	83906513	56000000	83906513	51100000	83906513	44300000	83906513
	reduction rate (from the 2008 level)			33.2886%	0.0000%	59.7431%	0.0000%	63.2656%	0.0000%	68.1539%	0.0000%

- ✓ The figures of future subsidies to the petroleum refinery sectors are all given based on the proposed plan by the Ministry of Finance of Indonesia.
- ✓ The figures of future subsidies to the LPG sector depend on a different assumption in each scenario. In Scenario I, the conversion policy is assumed to end in year 2011, but in Scenario II it is assumed to continue until year 2014. Note that the figure of the subsidies to the LPG sector ( $i = 51$ ) in year 2008 already includes the subsidies through the conversion policy. The annual amount of additional subsidies to the LPG sector through the conversion policy is assumed to be 2,820,000 billion rupiah in both scenarios.

**Table 4: The Effect of the Proposed Future Reduction Plan of the Subsidy to the Petroleum Refinery Sector (i=41)**

Unit: One billion Rupiah

		year 2011	year 2012	year 2013	year 2014
Scenario I:	welfare gain		-78761.7063	-73844.41233	-66457.64969
	government expenditure		493702.4169 (18.432%)	499085.6219 (19.723%)	506610.4479 (21.528%)
Scenario II:	welfare gain	-68100.96806	-51026.1681	-46547.69605	-39707.50901
	government expenditure	456224.2628 (9.441%)	494750.122 (18.683%)	500097.372 (19.966%)	507579.2459 (21.761%)

✓ The figures in the parentheses indicate the relative change from the benchmark (year 2008) level.

Table 5: The Effect-Neutral Conversion Policy for the Proposed Future Reduction Plan

Unit: One billion Rupiah

	year 2011	year 2012	year 2013	year 2014
welfare gain	0	0	0	0
increasing rate of subsidies to LPG	5.2798%	4.8607%	4.5580%	4.0413%
corresponding additional amount of subsidies to LPG	148.8901	137.0704	128.5353	113.9658
government expenditure	460807.7875 (10.541%)	497793.3672 (19.413%)	502811.9318 (20.617%)	509815.8312 (22.297%)

- ✓ Increasing rate indicates the endogenously calculated increasing rate of subsidies to the LPG sector from the year 2008 level, in order to neutralize the negative effect of the proposed future reduction plan on welfare.
- ✓ The figures in the parentheses indicate the relative change from the benchmark (year 2008) level.

**Table 6: Calculated Rates**

$$TAUP(i) = \tau_i^p; i = 1, 2, \dots, 66 \text{ (Production Tax Rate)}$$

TAUP( 1)	TAUP( 2)	TAUP( 3)	TAUP( 4)	TAUP( 5)	TAUP( 6)	TAUP( 7)	TAUP( 8)	TAUP( 9)	TAUP(10)	TAUP(11)	TAUP(12)	TAUP(13)	TAUP(14)	TAUP(15)
0.011021	0.010784	0.008108	0.008323	0.011684	0.011577	0.007399	0.014230	0.012070	0.009332	0.006918	0.020258	0.015348	0.006912	0.129031
TAUP(16)	TAUP(17)	TAUP(18)	TAUP(19)	TAUP(20)	TAUP(21)	TAUP(22)	TAUP(23)	TAUP(24)	TAUP(25)	TAUP(26)	TAUP(27)	TAUP(28)	TAUP(29)	TAUP(30)
0.008315	0.016682	0.010863	0.012855	0.008818	0.036395	0.022894	0.009006	0.032097	0.036702	0.029738	0.024430	0.009768	0.004160	0.012806
TAUP(31)	TAUP(32)	TAUP(33)	TAUP(34)	TAUP(35)	TAUP(36)	TAUP(37)	TAUP(38)	TAUP(39)	TAUP(40)	TAUP(41)	TAUP(42)	TAUP(43)	TAUP(44)	TAUP(45)
0.022411	0.013819	0.117723	0.600629	0.013845	0.010144	0.012600	0.009781	0.002809	0.020054	0.004323	0.015524	0.031658	0.030596	0.014832
TAUP(46)	TAUP(47)	TAUP(48)	TAUP(49)	TAUP(50)	TAUP(51)	TAUP(52)	TAUP(53)	TAUP(54)	TAUP(55)	TAUP(56)	TAUP(57)	TAUP(58)	TAUP(59)	TAUP(60)
0.013741	0.017939	0.013836	0.012393	0.024859	0.012493	0.013311	0.020136	0.020672	0.009257	0.008237	0.008882	0.011283	0.011286	0.006861
TAUP(61)	TAUP(62)	TAUP(63)	TAUP(64)	TAUP(65)	TAUP(66)									
0.006072	0.022627	0.000000	0.005360	0.017774	0.015636									

$$SUBR(i) = \tau_i^s; i = 1, 2, \dots, 66 \text{ ((General) Subsidy Rate)}$$

SUBR( 1)	SUBR( 2)	SUBR( 3)	SUBR( 4)	SUBR( 5)	SUBR( 6)	SUBR( 7)	SUBR( 8)	SUBR( 9)	SUBR(10)	SUBR(11)	SUBR(12)	SUBR(13)	SUBR(14)	SUBR(15)
0.00361474	0.00384571	0.00298029	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
SUBR(16)	SUBR(17)	SUBR(18)	SUBR(19)	SUBR(20)	SUBR(21)	SUBR(22)	SUBR(23)	SUBR(24)	SUBR(25)	SUBR(26)	SUBR(27)	SUBR(28)	SUBR(29)	SUBR(30)
0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00053629	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
SUBR(31)	SUBR(32)	SUBR(33)	SUBR(34)	SUBR(35)	SUBR(36)	SUBR(37)	SUBR(38)	SUBR(39)	SUBR(40)	SUBR(41)	SUBR(42)	SUBR(43)	SUBR(44)	SUBR(45)
0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.23614366	0.00000000	0.19434097	0.00000000	0.00000000	0.00000000	0.00000000
SUBR(46)	SUBR(47)	SUBR(48)	SUBR(49)	SUBR(50)	SUBR(51)	SUBR(52)	SUBR(53)	SUBR(54)	SUBR(55)	SUBR(56)	SUBR(57)	SUBR(58)	SUBR(59)	SUBR(60)
0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.40765791	0.00000000	0.00000000	0.00000000	0.10056601	0.00000000	0.01136293	0.00000000	0.00000000	0.00079159
SUBR(61)	SUBR(62)	SUBR(63)	SUBR(64)	SUBR(65)	SUBR(66)									
0.00000000	0.00000000	0.00000000	0.00000000	0.00014256	0.00000000									

i=41: Petroleum Refinery Sector

i=51: LPG Sector

$$SUBIMP(i) = \tau_i^{ms}; i = 1, 2, \dots, 66 \text{ (Import Subsidy Rate)}$$

SUBIMP( 1)	SUBIMP( 2)	SUBIMP( 3)	SUBIMP( 4)	SUBIMP( 5)	SUBIMP( 6)	SUBIMP( 7)	SUBIMP( 8)	SUBIMP( 9)	SUBIMP( 10)	SUBIMP( 11)	SUBIMP( 12)	SUBIMP( 13)	SUBIMP( 14)	SUBIMP( 15)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUBIMP( 16)	SUBIMP( 17)	SUBIMP( 18)	SUBIMP( 19)	SUBIMP( 20)	SUBIMP( 21)	SUBIMP( 22)	SUBIMP( 23)	SUBIMP( 24)	SUBIMP( 25)	SUBIMP( 26)	SUBIMP( 27)	SUBIMP( 28)	SUBIMP( 29)	SUBIMP( 30)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUBIMP( 31)	SUBIMP( 32)	SUBIMP( 33)	SUBIMP( 34)	SUBIMP( 35)	SUBIMP( 36)	SUBIMP( 37)	SUBIMP( 38)	SUBIMP( 39)	SUBIMP( 40)	SUBIMP( 41)	SUBIMP( 42)	SUBIMP( 43)	SUBIMP( 44)	SUBIMP( 45)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.205184	0.000000	0.000000	0.000000	0.000000
SUBIMP( 46)	SUBIMP( 47)	SUBIMP( 48)	SUBIMP( 49)	SUBIMP( 50)	SUBIMP( 51)	SUBIMP( 52)	SUBIMP( 53)	SUBIMP( 54)	SUBIMP( 55)	SUBIMP( 56)	SUBIMP( 57)	SUBIMP( 58)	SUBIMP( 59)	SUBIMP( 60)
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
SUBIMP( 61)	SUBIMP( 62)	SUBIMP( 63)	SUBIMP( 64)	SUBIMP( 65)	SUBIMP( 66)									
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000									

$$TAUM(i) = \tau_i^m; i = 1, 2, \dots, 66 \text{ (Import Tariff Rate)}$$

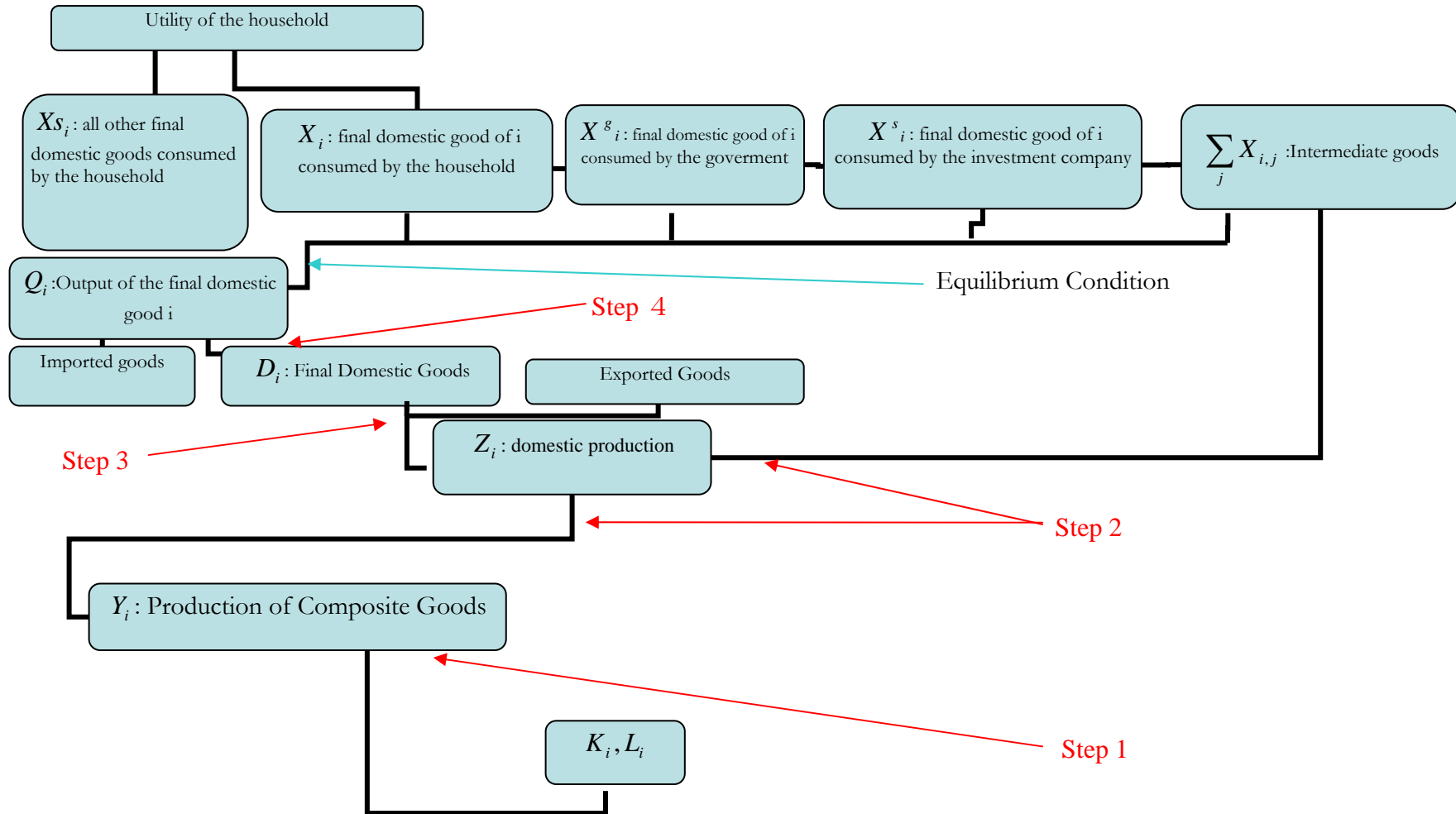
TAUM( 1)	TAUM( 2)	TAUM( 3)	TAUM( 4)	TAUM( 5)	TAUM( 6)	TAUM( 7)	TAUM( 8)	TAUM( 9)	TAUM( 10)	TAUM( 11)	TAUM( 12)	TAUM( 13)	TAUM( 14)	TAUM( 15)
0.001001502	0.064806604	0.022767977	0.136129097	0.188315989	0.077949645	0.004024959	0.038780589	0.105289421	0.084536739	0.00000000	0.014066679	0.000238152	202.2352941	0.23779266
TAUM( 16)	TAUM( 17)	TAUM( 18)	TAUM( 19)	TAUM( 20)	TAUM( 21)	TAUM( 22)	TAUM( 23)	TAUM( 24)	TAUM( 25)	TAUM( 26)	TAUM( 27)	TAUM( 28)	TAUM( 29)	TAUM( 30)
0.031335942	1.237528604	0.066217692	0.050406143	0.400227491	0.040853659	0.15507155	0.071879262	0.100831514	1.76181E-06	0.133977544	0.140881474	0.034979082	0.0947284	0.083094075
TAUM( 31)	TAUM( 32)	TAUM( 33)	TAUM( 34)	TAUM( 35)	TAUM( 36)	TAUM( 37)	TAUM( 38)	TAUM( 39)	TAUM( 40)	TAUM( 41)	TAUM( 42)	TAUM( 43)	TAUM( 44)	TAUM( 45)
0.693249241	0.095420655	0.093905594	0.125198695	0.52234314	0.248673096	0.068734239	0.136514661	0.048403154	0.142778424	0.007848744	0.166511185	0.157586974	0.094824076	0.098742183
TAUM( 46)	TAUM( 47)	TAUM( 48)	TAUM( 49)	TAUM( 50)	TAUM( 51)	TAUM( 52)	TAUM( 53)	TAUM( 54)	TAUM( 55)	TAUM( 56)	TAUM( 57)	TAUM( 58)	TAUM( 59)	TAUM( 60)
0.096590866	0.095403675	0.122658645	0.140203097	0.145207066	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
TAUM( 61)	TAUM( 62)	TAUM( 63)	TAUM( 64)	TAUM( 65)	TAUM( 66)									
0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.0004418									

i=41: Petroleum Refinery Sector

i=51: LPG Sector



Figure 3:



**Table 7: Parameter Values**

$$ALPHA(i) = \alpha_i; i = 1, 2, \dots, 66$$

ALPHA( 1)	ALPHA( 2)	ALPHA( 3)	ALPHA( 4)	ALPHA( 5)	ALPHA( 6)	ALPHA( 7)	ALPHA( 8)	ALPHA( 9)	ALPHA(10)	ALPHA(11)	ALPHA(12)	ALPHA(13)	ALPHA(14)	ALPHA(15)
0.000000	0.002684	0.012634	0.006316	0.044487	0.000231	0.000000	0.000020	0.002460	0.000000	0.000226	0.000206	0.000042	0.000001	0.000000
ALPHA(16)	ALPHA(17)	ALPHA(18)	ALPHA(19)	ALPHA(20)	ALPHA(21)	ALPHA(22)	ALPHA(23)	ALPHA(24)	ALPHA(25)	ALPHA(26)	ALPHA(27)	ALPHA(28)	ALPHA(29)	ALPHA(30)
0.000382	0.000734	0.007215	0.016520	0.019510	0.000639	0.001025	0.035299	0.000000	0.000000	0.000336	0.030979	0.009601	0.062265	0.020709
ALPHA(31)	ALPHA(32)	ALPHA(33)	ALPHA(34)	ALPHA(35)	ALPHA(36)	ALPHA(37)	ALPHA(38)	ALPHA(39)	ALPHA(40)	ALPHA(41)	ALPHA(42)	ALPHA(43)	ALPHA(44)	ALPHA(45)
0.004995	0.029126	0.004754	0.032312	0.000137	0.030998	0.010541	0.006598	0.002021	0.025885	0.030358	0.020897	0.002181	0.000000	0.000000
ALPHA(46)	ALPHA(47)	ALPHA(48)	ALPHA(49)	ALPHA(50)	ALPHA(51)	ALPHA(52)	ALPHA(53)	ALPHA(54)	ALPHA(55)	ALPHA(56)	ALPHA(57)	ALPHA(58)	ALPHA(59)	ALPHA(60)
0.000000	0.007012	0.043892	0.036600	0.004833	0.012219	0.000000	0.119309	0.078272	0.001213	0.032286	0.006576	0.014732	0.002981	0.030487
ALPHA(61)	ALPHA(62)	ALPHA(63)	ALPHA(64)	ALPHA(65)	ALPHA(66)									
0.017364	0.031809	0.004424	0.042217	0.037552	0.000896									

$$AY(i) = ay_i; i = 1, 2, \dots, 66$$

AY( 1)	AY( 2)	AY( 3)	AY( 4)	AY( 5)	AY( 6)	AY( 7)	AY( 8)	AY( 9)	AY(10)	AY(11)	AY(12)	AY(13)	AY(14)	AY(15)
0.743010702	0.794876264	0.761029755	0.867329998	0.874580965	0.844749067	0.655499284	0.687409701	0.732796118	0.55233487	0.460064994	0.615867825	0.842519654	0.822158031	0.842570829
AY(16)	AY(17)	AY(18)	AY(19)	AY(20)	AY(21)	AY(22)	AY(23)	AY(24)	AY(25)	AY(26)	AY(27)	AY(28)	AY(29)	AY(30)
0.685909037	0.756009981	0.64343273	0.404948605	0.444150728	0.762980597	0.787956557	0.734283986	0.73715708	0.840467413	0.768439218	0.297168189	0.346553563	0.221810728	0.287264165
AY(31)	AY(32)	AY(33)	AY(34)	AY(35)	AY(36)	AY(37)	AY(38)	AY(39)	AY(40)	AY(41)	AY(42)	AY(43)	AY(44)	AY(45)
0.251488062	0.31923395	0.304375559	0.393760879	0.297759687	0.384596887	0.41461869	0.358227603	0.487970358	0.276553982	0.661764872	0.260768515	0.47318076	0.391707058	0.248509247
AY(46)	AY(47)	AY(48)	AY(49)	AY(50)	AY(51)	AY(52)	AY(53)	AY(54)	AY(55)	AY(56)	AY(57)	AY(58)	AY(59)	AY(60)
0.235796061	0.472349803	0.277727591	0.398045478	0.307343355	0.618824462	0.354584965	0.524631684	0.439744138	0.364318454	0.411079537	0.316945392	0.297586583	0.565092001	0.779403968
AY(61)	AY(62)	AY(63)	AY(64)	AY(65)	AY(66)									
0.653494634	0.694488569	0.57295418	0.539818641	0.485499558	0.539926772									

$$GAMMAM(i) = \gamma_i^M; i = 1, 2, \dots, 66$$

GAMMAM( 1)	GAMMAM( 2)	GAMMAM( 3)	GAMMAM( 4)	GAMMAM( 5)	GAMMAM( 6)	GAMMAM( 7)	GAMMAM( 8)	GAMMAM( 9)	GAMMAM(10)	GAMMAM(11)	GAMMAM(12)	GAMMAM(13)	GAMMAM(14)	GAMMAM(15)
9.41499E-05	0.366335976	0.011391693	0.005838675	0.045001098	0.932300498	0.002614078	0.000479619	0.000119082	0.001274047	0	0.011703899	0.008349004	0.001272413	0.942348165
GAMMAM(16)	GAMMAM(17)	GAMMAM(18)	GAMMAM(19)	GAMMAM(20)	GAMMAM(21)	GAMMAM(22)	GAMMAM(23)	GAMMAM(24)	GAMMAM(25)	GAMMAM(26)	GAMMAM(27)	GAMMAM(28)	GAMMAM(29)	GAMMAM(30)
0.093068871	0.000444419	0.053082264	0.002996656	0.003888226	0.009767367	0.018921491	0.001136783	0.038131822	0.353739639	0.078602117	0.133551221	0.167014197	0.006333667	0.066484269
GAMMAM(31)	GAMMAM(32)	GAMMAM(33)	GAMMAM(34)	GAMMAM(35)	GAMMAM(36)	GAMMAM(37)	GAMMAM(38)	GAMMAM(39)	GAMMAM(40)	GAMMAM(41)	GAMMAM(42)	GAMMAM(43)	GAMMAM(44)	GAMMAM(45)
0.250563528	0.082690497	0.064457899	0.036766809	0.232873672	0.083917707	0.029356328	0.191479735	0.394808057	0.405746452	0.407292958	0.109886965	0.13521219	0.025600779	0.684370932
GAMMAM(46)	GAMMAM(47)	GAMMAM(48)	GAMMAM(49)	GAMMAM(50)	GAMMAM(51)	GAMMAM(52)	GAMMAM(53)	GAMMAM(54)	GAMMAM(55)	GAMMAM(56)	GAMMAM(57)	GAMMAM(58)	GAMMAM(59)	GAMMAM(60)
0.647787515	0.166772728	0.385482508	0.363028045	0.463380781	0	0	0	0.076876258	0.011557469	0.00540763	0.485548326	0.213365034	0.218629459	0.056596627
GAMMAM(61)	GAMMAM(62)	GAMMAM(63)	GAMMAM(64)	GAMMAM(65)	GAMMAM(66)									
0.035561073	0.15277899	0.006754489	0.036613488	0.036111329	0.011684463									

$$GAMMAD(i) = \gamma_i^D; i = 1, 2, \dots, 66$$

GAMMAD( 1)	GAMMAD( 2)	GAMMAD( 3)	GAMMAD( 4)	GAMMAD( 5)	GAMMAD( 6)	GAMMAD( 7)	GAMMAD( 8)	GAMMAD( 9)	GAMMAD(10)	GAMMAD(11)	GAMMAD(12)	GAMMAD(13)	GAMMAD(14)	GAMMAD(15)
0.9999059	0.633664	0.9886083	0.9941613	0.9549989	0.0676995	0.9973859	0.9995204	0.9998809	0.998726	1	0.9882961	0.991651	0.9987276	0.0576518
GAMMAD(16)	GAMMAD(17)	GAMMAD(18)	GAMMAD(19)	GAMMAD(20)	GAMMAD(21)	GAMMAD(22)	GAMMAD(23)	GAMMAD(24)	GAMMAD(25)	GAMMAD(26)	GAMMAD(27)	GAMMAD(28)	GAMMAD(29)	GAMMAD(30)
0.9069311	0.9995556	0.9469177	0.9970033	0.9961118	0.9902326	0.9810785	0.9988632	0.9618682	0.6462604	0.9213979	0.8664488	0.8329858	0.9936663	0.9335157
GAMMAD(31)	GAMMAD(32)	GAMMAD(33)	GAMMAD(34)	GAMMAD(35)	GAMMAD(36)	GAMMAD(37)	GAMMAD(38)	GAMMAD(39)	GAMMAD(40)	GAMMAD(41)	GAMMAD(42)	GAMMAD(43)	GAMMAD(44)	GAMMAD(45)
0.7494365	0.9173095	0.9355421	0.9632332	0.7671263	0.9160823	0.9706437	0.8085203	0.6051919	0.5942535	0.592707	0.890113	0.8647878	0.9743992	0.3156291
GAMMAD(46)	GAMMAD(47)	GAMMAD(48)	GAMMAD(49)	GAMMAD(50)	GAMMAD(51)	GAMMAD(52)	GAMMAD(53)	GAMMAD(54)	GAMMAD(55)	GAMMAD(56)	GAMMAD(57)	GAMMAD(58)	GAMMAD(59)	GAMMAD(60)
0.3522125	0.8332273	0.6145175	0.636972	0.5366192	1	1	1	0.9231237	0.9884425	0.9945924	0.5144517	0.786635	0.7813705	0.9434034
GAMMAD(61)	GAMMAD(62)	GAMMAD(63)	GAMMAD(64)	GAMMAD(65)	GAMMAD(66)									
0.9644389	0.847221	0.9932455	0.9633865	0.9638887	0.9883155									

$$KAPPAE(i) = \kappa_i^E; i = 1, 2, \dots, 66$$

KAPPAE( 1)	KAPPAE( 2)	KAPPAE( 3)	KAPPAE( 4)	KAPPAE( 5)	KAPPAE( 6)	KAPPAE( 7)	KAPPAE( 8)	KAPPAE( 9)	KAPPAE(10)	KAPPAE(11)	KAPPAE(12)	KAPPAE(13)	KAPPAE(14)	KAPPAE(15)
0.000000	0.002929	0.002430	0.002697	0.001637	0.035699	0.002654	0.000067	0.014431	0.003864	0.000000	0.615889	0.022659	0.078775	0.064283
KAPPAE(16)	KAPPAE(17)	KAPPAE(18)	KAPPAE(19)	KAPPAE(20)	KAPPAE(21)	KAPPAE(22)	KAPPAE(23)	KAPPAE(24)	KAPPAE(25)	KAPPAE(26)	KAPPAE(27)	KAPPAE(28)	KAPPAE(29)	KAPPAE(30)
0.547555	0.007059	0.005545	0.000106	0.000002	0.002673	0.029433	0.015531	0.415832	0.362006	0.010856	0.140073	0.667309	0.000786	0.029647
KAPPAE(31)	KAPPAE(32)	KAPPAE(33)	KAPPAE(34)	KAPPAE(35)	KAPPAE(36)	KAPPAE(37)	KAPPAE(38)	KAPPAE(39)	KAPPAE(40)	KAPPAE(41)	KAPPAE(42)	KAPPAE(43)	KAPPAE(44)	KAPPAE(45)
0.011274	0.052824	0.015296	0.033566	0.433896	0.334274	0.217007	0.276457	0.059380	0.198779	0.425434	0.325108	0.102265	0.019792	0.246794
KAPPAE(46)	KAPPAE(47)	KAPPAE(48)	KAPPAE(49)	KAPPAE(50)	KAPPAE(51)	KAPPAE(52)	KAPPAE(53)	KAPPAE(54)	KAPPAE(55)	KAPPAE(56)	KAPPAE(57)	KAPPAE(58)	KAPPAE(59)	KAPPAE(60)
0.824609	0.092200	0.194681	0.155554	0.454883	0.000000	0.000000	0.150869	0.116677	0.047890	0.074759	0.460838	0.114860	0.174281	0.100777
KAPPAE(61)	KAPPAE(62)	KAPPAE(63)	KAPPAE(64)	KAPPAE(65)	KAPPAE(66)									
0.013953	0.047153	0.015069	0.040583	0.016945	0.010302									

$$KAPPAD(i) = \kappa_i^D; i = 1, 2, \dots, 66$$

KAPPAD( 1)	KAPPAD( 2)	KAPPAD( 3)	KAPPAD( 4)	KAPPAD( 5)	KAPPAD( 6)	KAPPAD( 7)	KAPPAD( 8)	KAPPAD( 9)	KAPPAD(10)	KAPPAD(11)	KAPPAD(12)	KAPPAD(13)	KAPPAD(14)	KAPPAD(15)
1.000000	0.997071	0.997570	0.997303	0.998363	0.964301	0.997346	0.999933	0.985569	0.996136	1.000000	0.384111	0.977341	0.921225	0.935717
KAPPAD(16)	KAPPAD(17)	KAPPAD(18)	KAPPAD(19)	KAPPAD(20)	KAPPAD(21)	KAPPAD(22)	KAPPAD(23)	KAPPAD(24)	KAPPAD(25)	KAPPAD(26)	KAPPAD(27)	KAPPAD(28)	KAPPAD(29)	KAPPAD(30)
0.452445	0.992941	0.994455	0.999894	0.999998	0.997327	0.970567	0.984469	0.584168	0.637994	0.989144	0.859927	0.332691	0.999214	0.970353
KAPPAD(31)	KAPPAD(32)	KAPPAD(33)	KAPPAD(34)	KAPPAD(35)	KAPPAD(36)	KAPPAD(37)	KAPPAD(38)	KAPPAD(39)	KAPPAD(40)	KAPPAD(41)	KAPPAD(42)	KAPPAD(43)	KAPPAD(44)	KAPPAD(45)
0.988726	0.947176	0.984704	0.966434	0.566104	0.665726	0.782993	0.723543	0.940620	0.801221	0.574566	0.674892	0.897735	0.980208	0.753206
KAPPAD(46)	KAPPAD(47)	KAPPAD(48)	KAPPAD(49)	KAPPAD(50)	KAPPAD(51)	KAPPAD(52)	KAPPAD(53)	KAPPAD(54)	KAPPAD(55)	KAPPAD(56)	KAPPAD(57)	KAPPAD(58)	KAPPAD(59)	KAPPAD(60)
0.175391	0.907800	0.805319	0.844446	0.545117	1.000000	1.000000	0.849131	0.883323	0.952110	0.925241	0.539162	0.885140	0.825719	0.899223
KAPPAD(61)	KAPPAD(62)	KAPPAD(63)	KAPPAD(64)	KAPPAD(65)	KAPPAD(66)									
0.986047	0.952847	0.984931	0.959417	0.983055	0.989698									

$$BETA(i, j) = \beta_j^i, i = 1(\text{capital}), 2(\text{labour}), j = 1, 2, \dots, 66$$

BETA( 1 1)	BETA( 2 1)	BETA( 1 2)	BETA( 2 2)	BETA( 1 3)	BETA( 2 3)	BETA( 1 4)	BETA( 2 4)	BETA( 1 5)	BETA( 2 5)	BETA( 1 6)	BETA( 2 6)	BETA( 1 7)	BETA( 2 7)
0.825446843	0.174553157	0.844305512	0.155694488	0.863517174	0.136482826	0.883450068	0.116549932	0.808636965	0.191363035	0.880852456	0.119147544	0.481358244	0.518641756
BETA( 1 8)	BETA( 2 8)	BETA( 1 9)	BETA( 2 9)	BETA( 1 10)	BETA( 2 10)	BETA( 1 11)	BETA( 2 11)	BETA( 1 12)	BETA( 2 12)	BETA( 1 13)	BETA( 2 13)	BETA( 1 14)	BETA( 2 14)
0.654977188	0.345022812	0.803616842	0.196383158	0.683591114	0.316408886	0.588027818	0.411972182	0.745144744	0.254855256	0.640336877	0.359663123	0.784177672	0.215822328
BETA( 1 15)	BETA( 2 15)	BETA( 1 16)	BETA( 2 16)	BETA( 1 17)	BETA( 2 17)	BETA( 1 18)	BETA( 2 18)	BETA( 1 19)	BETA( 2 19)	BETA( 1 20)	BETA( 2 20)	BETA( 1 21)	BETA( 2 21)
0.85240733	0.14759267	0.838024198	0.161975802	0.683381338	0.316618662	0.742720884	0.257279116	0.704682299	0.295317701	0.556350414	0.443649586	0.780856939	0.219143061
BETA( 1 22)	BETA( 2 22)	BETA( 1 23)	BETA( 2 23)	BETA( 1 24)	BETA( 2 24)	BETA( 1 25)	BETA( 2 25)	BETA( 1 26)	BETA( 2 26)	BETA( 1 27)	BETA( 2 27)	BETA( 1 28)	BETA( 2 28)
0.772891025	0.227108975	0.802313444	0.197686556	0.826616878	0.173383122	0.908619916	0.091380084	0.626907509	0.373092491	0.730658666	0.269341334	0.651186522	0.348813478
BETA( 1 29)	BETA( 2 29)	BETA( 1 30)	BETA( 2 30)	BETA( 1 31)	BETA( 2 31)	BETA( 1 32)	BETA( 2 32)	BETA( 1 33)	BETA( 2 33)	BETA( 1 34)	BETA( 2 34)	BETA( 1 35)	BETA( 2 35)
0.799148832	0.200851168	0.679780441	0.320219559	0.65470744	0.34529256	0.684549607	0.315450393	0.584169096	0.415830904	0.697885555	0.302114445	0.78063776	0.21936224
BETA( 1 36)	BETA( 2 36)	BETA( 1 37)	BETA( 2 37)	BETA( 1 38)	BETA( 2 38)	BETA( 1 39)	BETA( 2 39)	BETA( 1 40)	BETA( 2 40)	BETA( 1 41)	BETA( 2 41)	BETA( 1 42)	BETA( 2 42)
0.658447013	0.341552987	0.715570296	0.284429704	0.69750313	0.30249687	0.722839137	0.277160863	0.657193177	0.342806823	0.816277956	0.183722044	0.638564335	0.361435665
BETA( 1 43)	BETA( 2 43)	BETA( 1 44)	BETA( 2 44)	BETA( 1 45)	BETA( 2 45)	BETA( 1 46)	BETA( 2 46)	BETA( 1 47)	BETA( 2 47)	BETA( 1 48)	BETA( 2 48)	BETA( 1 49)	BETA( 2 49)
0.636190116	0.363809884	0.70194136	0.29805864	0.828936499	0.171063501	0.672739407	0.327260593	0.632115048	0.367884952	0.705911911	0.294088089	0.661228538	0.338771462
BETA( 1 50)	BETA( 2 50)	BETA( 1 51)	BETA( 2 51)	BETA( 1 52)	BETA( 2 52)	BETA( 1 53)	BETA( 2 53)	BETA( 1 54)	BETA( 2 54)	BETA( 1 55)	BETA( 2 55)	BETA( 1 56)	BETA( 2 56)
0.587138263	0.412861737	0.883306925	0.116693075	0.61439099	0.38560901	0.705466741	0.294533259	0.630722119	0.369277881	0.36537409	0.63462591	0.582676958	0.417323042
BETA( 1 57)	BETA( 2 57)	BETA( 1 58)	BETA( 2 58)	BETA( 1 59)	BETA( 2 59)	BETA( 1 60)	BETA( 2 60)	BETA( 1 61)	BETA( 2 61)	BETA( 1 62)	BETA( 2 62)	BETA( 1 63)	BETA( 2 63)
0.636402087	0.363597913	0.515604757	0.484395243	0.594735556	0.405264444	0.797388339	0.202611661	0.70574182	0.29425818	0.832966744	0.167033256	0.118841632	0.881158368
BETA( 1 64)	BETA( 2 64)	BETA( 1 65)	BETA( 2 65)	BETA( 1 66)	BETA( 2 66)								
0.24598114	0.75401886	0.605565764	0.394434236	0.742833544	0.257166456								



