The Impacts of the Domestic Fuel Increases on Prices of the Indonesian Economic Sectors

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Abstract

Fuel price subsidy policy in Indonesia has hindered other energy programs, namely energy conservation and energy diversification. This study tries to analyze the impact of fuel price hike to the economic sector. This study utilizes the IO table analysis of Indonesia in 2005, a 66 X 66 classification of domestic transactions on the basis of producer prices. This study examines the impact of the increasing 10 percent, 20 percent and 30 percent of fuel prices to the economic sector. The analysis found that the increasing fuel price would have a devastating impact on the transportation sector. The government should preserve those sectors which exposed the largest impact from the increasing of the fuel price.

Keywords: IO table analysis; fuel prices; subsidy; economy; Indonesia.

Nomenclature

IO Table | Input Output Table Analysis
IMF | International Monetary Fund
LPG | Liquid Petroleum Gas
SUSENAS | Indonesian Social Economy Survey Statistics Data
CGE Model | Computable General Equilibrium Model
BPS | Indonesian Statistic Bureau Agency
RT Sector | Road Transport Sector

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1. Introduction

International fuel prices have demonstrated a substantial volatility in recent years. Within end-2003 until the mid-2008, nominal international fuel prices heightened more than four times, with most of the growth taking place on 2007 and the first half of 2008 [1]. Many countries have been reluctant to fully infiltrate growths in world prices [2]. The mounting of world oil prices have apposed difficult policy alternatives for oil importers and exporters alike. With oil consumption persisting to soar up while the production stagnating, Indonesia has lately become a net-oil importer, a trend that has been indicated by many experts back in the 1990s.

Anxiety over fossil fuel subsidies has increased, since the importance of fossil fuel as sources of both energy and pollutants. The fossil fuel subsidy is considered as a primary stimulant of environmental problems, not only from the pollution produced by extravagant fossil fuel combustion of industry and vehicles, but also due to overweening traffic and the inconvenience it causes. The fuel subsidy also deters the advancement of a more traffic-free public transport infrastructure. In most big Indonesian cities, this condition is already become one of the major public concerns [3].

Indonesia as the country of crude oil producer, its consumption is still depends on imports fuel. This is due to the decrease of domestic crude oil production and also most of the Indonesia's crude oil is exported, as a result the domestic fuel production can not meet the public consumption. As the world crude oil prices surged, domestic fuel prices should also increased but due to the fuel as a needs of people living, the government made a policy in the provision and Petrol pricing in Indonesia, so that the domestic fuel prices are not too volatile.

Fuel subsidies are almost incessantly poorly targeted. Subsidy measures increment with income because higher-income households consume greater amounts of fuel products. For instance, the IMF survey for country studies [1] discovered that, on moderate, over 80 percent of the gains of fuel subsidies, presuming a consistent subsidy over varied products, led to the top three income quantiles. The World Bank figured that in Venezuela in the early 1990s the richest fifth of the population received 6½ times more in fuel subsidies per person than the poorest third [4, 5] also provide similar evidence for several countries.

Conditions in the Indonesian domestic fuel prices are far below of the world increasing crude oil price. Hence, in the condition of the Government still subsidizes fuel, the total subsidy would increase with the rising of the world crude oil prices. Government policy to reduce the burden on the state budget, by reducing the subsidies gradually, either through withdrawal of such subsidies on oil conversion to LPG policy or by reducing the fuel subsidy with raising the price of fuel such as gasoline (Premium) and diesel (Solar) within the country.

Alleviating subsidies can be very hard [1]. Firstly, the price and social encroachment of subsidies are often poorly realized, which hinders their evaluation and the purpose of reform. Secondly, subsidies can produce unconditional concerns that may be hard to subdue politically. Thirdly, diluting subsidies that mainly gain the rich may also adversely strike the poor and hence mitigation devices must be set. Though, some countries find out it hard to organize and manage a good mitigation schemes because of the delicate institutions and administrative capability. Lastly, even when governments cut down subsidies, they can reappear over time if governments are uneager to set prices on a standard basis.

Law no. 22 year 2001 [6], stated that the price of fuel and gas are delivered with a fairly market mechanism, eventhough this law emphasized the government to not reduce its social responsibility towards a particular group in the society. The government can provide assistance (a special subsidy) to a certain consumers for consumption certain fuel types, therefore, there are some exceptions to that fuel and gas prices that is not given to the market mechanism. The elimination of kerosene subsidized and other fuel from the first of May 2008 is expected to results in no more smuggling of fuel. Policy on this issue of fuel is very important, such conducted with distinguishing fuel prices, so that can be reached by all levels of the society. Government commits oversight in the distribution of fuel,
so there will be no smuggling which will cost the state and the society.

Thus, assessing the total economic expenditures of subsidies is a complicated task. Costs accrue at different tier of consumers, producers, and the public sector. At each tier, subsidies have impacts for efficiency and interests. In sum, measuring the costs of subsidies needs a complete social cost-benefit analysis to examine the result of the economy in the notion and the lack of subsidies. As mentioned above, the rest of this paper will emphasis only on the diversions of prices from their benchmark levels and from efficiency costs.

The purposes of this study is to predicting the key sectors that would be most affected by the rising of the fuel prices and the rate of inflation resulted from the policy of raising fuel prices, so that it can be an input for the government in determining further policy.

This study uses the IO table analysis of Indonesia in 2005, a 66 X 66 classification of domestic transactions on the basis of producer prices. The impact analysis used in this study is by stimulating the raising of 10 percent, 20 percent and 30 percent fuel prices. Analysis of the impact of fuel price increases in this study, only using IO table 2005 so that it cannot measure either the substitution effect or income effect from the impact.

Input-output analysis was selected as the framework for the analysis, since; the IO table will give a thorough description of:
- The economic structure of the national / regional which include output and the value added of each sector.
- The intermediate input structure, i.e. the use of many goods and services by each production sector.
- The structure of the goods and services either in the form of domestic production as well as goods from import.
- The structure of demand of goods and services, both demand between production sectors and final demand for consumption, investment and exports (Statistic Bureau Agency, 2008).

2. Research methodology

In the study by Saari, Yusof Radam, Alias, Abdullah, Amin Mahir (2008), argue that the Malaysia’s agricultural sector are mostly affected by the increase of the domestic petroleum price [7]. The study’s objective was to analyze the effects of petroleum price changes on the costs production in the agricultural and agro-based sectors. The study only concerned the domestic petroleum products’ price effects; it simulates 30%, 60%, and 90% increases in the domestic petroleum price on cost production in the agricultural and agro-based sectors respectively.

Saari’s team concluded that the agro-based sector is not significantly affected by the increase in the domestic petroleum prices. In contrast, the simulation results indicated that the agricultural sector particularly fishing, forestry and logging, and oil palm primary products were among the top three industries which were most affected by the increase in the domestic petroleum prices. The increase in the cost of production in these sectors was mainly due to interdependencies among the industries. These industries used large amount of petroleum as intermediate inputs that needed to be procured from petroleum product industry. This highly dependence on petroleum products would influence the cost of production directly whenever the price of petroleum changes.

Another study of the World Bank (2006) examines at the affect of the heighten in various fuel prices on household spending by utilizing SUSENAS 2004 data [8]. The conclusion proposes that, in the lack of any compensatory policies, the policy package would have contributed to a 5.6 percentage point increase in poverty incidence. Compensation in the form of an unconditional cash transfer to poor and near-poor households would, on average, more than offset the negative impact of the fuel price increase. The World Bank (2006) is the only available study that evaluate the distributional impact of the fuel price hike policy.

Another studies by Abbas Valadkhani and Willliam F. Mitchell (2001), argue that “the Australian economy is now less susceptible to oil price rises than it was in the 1970s when the first major oil prices occurred” [9]. Their study’s objective was to measure the impact of a two-fold increase in the price of the petroleum and coal products industry (as an important intermediate input provider) on the sectoral and aggregate price indices in Australia, employing a modified version of the Leontief IO price model. Abbas team’s concluded that the fuel hikes will give a deteriorate impact to the transport sector and agricultural sectors. They find that the petrol-price induced rises impact relatively more on the lowest income group (first quintile of the income distribution) than on the top income group (fifth quintile). The poor spend a higher proportion of their total expenditure on diesel fuel, kerosene, heating oil, lubricant and other oil, and meat and dairy products, other food products, LPG and other gas fuels than the rich.

Ikhsan et al. (2005) investigates the distributional impact of the Indonesian fuel price policy improvement that enhanced the cost of kerosene to industry by 22.22%; gasoline by 32.60%; diesel for transportation by 27.27%;
diesel for industry by 33.33; and diesel oil and fuel oil by 39.39% [10]. They utilized a mixture of a Computable General Equilibrium (CGE) model and a simulation employing household survey data. The conclusion suggests that poverty mounts by 0.24% without compensation, whereas poverty falls by 2.6% with fully-effective and by 1.89% with compensation that is 75% effective. It also concluded that the policies will dilute inequality for a small degree.

Indonesian fuel price policy adjustment is also analyzed by Sugema et al. (2005) whereas a SUSENAS-based micro-simulation examined the poverty impact analysis, and the macro-impact is examined utilizing an ORANI-based CGE model [11]. They concluded that poverty would go up by 1.95%. Clements et al. (2003) analyze the assumption of raising the price of petroleum products by 25% using a CGE model [12]. The study suggests aggregate real household consumption falls from 2.1% to 2.7% following a 25% increase in the price of petroleum products. Urban and high income households suffer the most, indicating the progressivity of the reform.

Data for this analysis is a secondary data, i.e. data input-output tables (IO) 2005 classification 66 X 66 that is aggregated from Indonesian IO table classification of 175 X 175 for domestic transactions on the basis of producer prices. This data were obtained from the Statistic Bureau Agency – BPS [13]. The impact analysis is by simulating increased in the fuel price of 10 percent, 20 percent and 30 percent. In the Indonesian IO table 2005, the classification of 175 X 175 sectors of petroleum refineries (104), the output value, is still fused between the petroleum output and non petroleum output. This study conducted more aggregation and processing information, so we aggregated it in to 66 X 66 classification sector, in which petroleum refining sector has its own classification (41). The processing (calculations) of data in impact analysis is using MS-Excel XP assistance, 2007.

IO table analysis was first discovered by Wassily Leontief at the end of the decade in 1930s. During its development, the methods derived from an IO table increasingly applied as a tool of economic analysis and planning. The model is based on equilibrium model (general equilibrium).

The analytical method used in this study is an impact analysis. From this impact analysis we can see, how much the direct and indirect impact and also the rate of sector cost of production resulted from the increased of the fuel prices.

To count the multiplier matrix, a matrix of technical coefficient (A) must be constructed.

\[
\begin{bmatrix}
  a_{11} & a_{12} & a_{13} \\
  a_{21} & a_{22} & a_{23} \\
  a_{31} & a_{32} & a_{33}
\end{bmatrix}
\]  

(1)

Each element of Matrix A is calculated as follows:

\[ a_{ij} = \frac{z_{ij}}{x_j} \]  

(2)

Where:

\[ a_{ij} = \text{coefficient input i to industry j} \]

\[ z_{ij} = \text{the sale of input i to industry j} \]

\[ x_j = \text{the total output of industry j} \]

The matrix of technical coefficient must then be subtracted from the identity matrix (I)

\[
\begin{bmatrix}
  (1 - a_{11}) & (1 - a_{12}) & (1 - a_{13}) \\
  (1 - a_{21}) & (1 - a_{22}) & (1 - a_{23}) \\
  (1 - a_{31}) & (1 - a_{32}) & (1 - a_{33})
\end{bmatrix}
\]  

(3)

The resulting matrix (I-A) is then inverted, giving the equilibrium matrix (1-A)-1. This is the multiplier matrix, which is used to calculate the total impact of an economic shock.

The impact of fuel price changes on the other sectors can be calculated by inverse matrix transpose. Transpose matrix is assumed to be done because that fuel price increases will affect the inputs between these sectors. So to see the impact, we make a multiplication between the matrix multiplier with the petroleum input matrix which sectors have experienced price increase (matrix diagonal sector).
\[ P = [(I - A)^{-1}]^T \pi V \]  

where:

\[
P = \text{percentage impact matrix of the increased of the fuel price}
\]

\[
[(I - A)^{-1}]^T = \text{inverse matrix transpose}
\]

\[
\Pi = \text{constant or percentage of the increased fuel price}
\]

\[
V = \text{matrix diagonal of fuel sector}
\]

Total impact of fuel price increases can be obtained by adding up the impact of fuel price percentages increases with each column. This fuel price increases has a direct and indirect impact on production cost increases in the other sectors. The direct impact of a sector is because this sector using the direct fuel costs which increased its cost. While the indirect impact of Petrol price increased as a result of these sectors using the other sector for its inputs but its cost is also increased (affected indirect by the increasing of the fuel price). So that, to get the amount of its indirect impact, we can deducted the percentage of the total impact on the percentage of the direct impact of each sector.

Increase in fuel prices caused by total output differences before the fuel price increase and after the fuel price increase. Where the total output after increased is obtained from multiplying the percentage of the total impact increases in fuel prices with an output of each sector before the fuel price hike in each sector.

3. Results and discussion

This study utilize impact analysis with exerting three different simulation process i.e. the impact of 10 percent, 20 percent, and 30 percent increases of fuel prices to the Indonesian economic sectors. One of the reasons for setting the range prices between 10 to 30 percent is based on the literatures and expert judgments that concluded the implications of fuel price rise will give its impact after 10 percent hikes. In the middle of 2005, the Government of Indonesia had enacted to cut oil subsidized to a more than 120 % of the average fuel prices. This policy has resulted a widespread domestic objections and critics, devolving socioeconomic conditions and political instability [14].

Therefore, imposing more than 30 percent of fuel price hike is unlikely possible to be applied in Indonesia currently, since by law the fuel is one of the basic community needs. Therefore, the government will think over to increase the fuel prices sharply. The increases of 10 percent fuel price is assumed to raise coefficient output within oil refining sectors, while the sector output is presumed to be unchanged. In addition, it also raises the production costs in the other sectors, since the utilization of fuel products in a certain sectors will give a direct impact on the other sector.

From the simulation results it can be concluded that the Road Transport (RT) is the largest sector bear upon the imposing of fuel price hike policy. The increasing of fuel price hike of 10 percent contributes to the raise of 12.78 percent of production costs in the RT sector. In addition, there is also indirect impact to the RT sector by 5.13 percent. The Indirect impact is induced by the changes of other sector products usage due to the alters of fuel price. The total impact of 10% increased of fuel price is reaching 17.91 % to the total price in the RT sector.

RT sector such as bus, taxi and motorcycle are depending on the gasoline price as well as depend on the changes of spare part price and vehicle services price (which the price can also mounted due to the gasoline price hikes). RT sector is one of the basic consumer goods that its price is preserved by the government with the purpose to ensure an affordable transportation price for the people. The increases price in this sector will trigger the raise of price in the other related sectors for instance the raises of the transportation tariffs will induce food price hike, as a result of a higher distribution cost from the seller to the customers. The skyrocketing of basic food price will lead to the increasing number of poor people. A market operation policy will be needed in order to protect the poor people from the possibility of scarcity of certain food products as a result of the fuel price policy. Besides the market operation policy, the government needs to have a firm action against the speculators who hoard goods.
Table 1. Scenario 1: The impact to the five largest sectors caused by an increasing of 10% gasoline prices.

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Sector</th>
<th>10% increased in the gasoline price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Direct Impact</td>
</tr>
<tr>
<td>1</td>
<td>56</td>
<td>Road transport</td>
<td>12.78</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>Electricity, gas and water supply</td>
<td>11.75</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>Air transport</td>
<td>11.08</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>Manufacture of Chemicals</td>
<td>8.08</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>Water transport</td>
<td>6.72</td>
</tr>
</tbody>
</table>

Following the Road Transport sector, the impact of gasoline price hike also influences the changes to the Electricity, Gas and Water supply (EGW) sector. The 10% increases of fuel price generate an increasing of total production cost in the EGW sector for 18.67 percent. In addition, the increases of 20% and 30% of fuel price generate a total impact to the EGW sector production cost for about 37.34% and 56.00% (scenario 2 and 3).

The soaring of production cost in EGW sector is due to fuel is one of the main inputs structure in generating electricity in Indonesia. In 2011, State Electricity Company (PT. PLN) produced electricity up to 183,421 GWh, whereas around 35 per cent of its total electricity capacities were generated from fuel. The fuel price soaring will either directly or indirectly result in the increased of production costs which will affect to the increases of electricity price.

In the period of 2004 until 2009, the government of Indonesia had decided to hold up the rising of the basic electricity tariff (Tarif Dasar Listrik - TDL). One of the reasons for this decision was the unbearable of the Indonesian economy and the deteriorating of the purchasing power. The consequence of this decision made the government to add up the total subsidies for the PT. PLN in order to cover the increasing of the electricity production costs. Following with this, the government should also monitor PT.PLN in order to reduce fuel consumption as well as exploring other alternative energy sources such as micro hydro or solar power.

Imposing fuel price hike should be observed carefully by the government, since the impact of this policy would inflate other sector production costs. As one of the strategic commodities inputs for other sector, imposing a less appropriate policy in electricity will result to a deteriorating of the purchasing power and the overall economic situation.
Table 2. Scenario 2: The impact to the five largest sectors caused by an increasing of 20% fuel prices.

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Sector</th>
<th>Direct Impact</th>
<th>Indirect Impact</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56</td>
<td>Road transport</td>
<td>25.56</td>
<td>10.26</td>
<td>35.81</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>Electricity, gas and water supply</td>
<td>23.50</td>
<td>13.83</td>
<td>37.34</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>Air transport</td>
<td>22.16</td>
<td>2.83</td>
<td>24.99</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>Manufacture of Chemicals</td>
<td>16.16</td>
<td>16.15</td>
<td>32.31</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>Water transport</td>
<td>13.45</td>
<td>13.21</td>
<td>26.66</td>
</tr>
</tbody>
</table>

The Air Transport Sector (AT) is the third largest sector impinges on the heightening of the fuel price. The AT sector has a large direct impact because this sector use Avtur as one of the component of the production cost. The increasing of the fuel price of 10%, 20% and 30% will result to the increased of the cost production for this sector for about 12.5%, 24.99% and 37.49%. This impact will may result in an increasing of the airplane tickets. The indirect impact of the AT sector is not to be so high (1.42%, 2.83%, and 4.25%), it is because the spare part of the airplane are an import products which is not have a significant impact with the increasing of the domestic fuel price.

The fifth largest impact to the increased of the fuel price is Water transport (WT) sector. The direct impact of the increased of the fuel price resulted to this sector is because this WT use solar as the fuel engine.

Table 3. Scenario 3: The impact to the five largest sectors caused by an increasing of 30% fuel prices.

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Sector</th>
<th>Direct Impact</th>
<th>Indirect Impact</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56</td>
<td>Road transport</td>
<td>38.34</td>
<td>15.38</td>
<td>53.72</td>
</tr>
<tr>
<td>2</td>
<td>51</td>
<td>Electricity, gas and water supply</td>
<td>35.25</td>
<td>20.75</td>
<td>56.00</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>Air transport</td>
<td>33.24</td>
<td>4.25</td>
<td>37.49</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>Manufacture of Chemicals</td>
<td>24.24</td>
<td>24.22</td>
<td>48.46</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>Water transport</td>
<td>20.17</td>
<td>19.82</td>
<td>40.00</td>
</tr>
</tbody>
</table>
Table 4. The impact of increasing fuel price to the output of the five largest sectors in Indonesia 2005.

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Sector</th>
<th>The impact of the raising fuel price to the output (Million Rp)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 percent</td>
</tr>
<tr>
<td>1</td>
<td>53</td>
<td>Trade</td>
<td>433,170</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>Construction</td>
<td>331,094</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>Petroleum Refinery</td>
<td>142,068</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>Manufacture of chemicals</td>
<td>163,999</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>Manufacture of textile, wearing apparel and leather</td>
<td>166,560</td>
</tr>
</tbody>
</table>

From the table IO 2005, the largest output is held by the trade sector in which reach Rp. 433,170 million and in case of rising 10% of fuel price it will be increased to Rp. 474,170 million, if fuel prices rose by 20 percent the output will raise larger to Rp. 516,337 million, as well as fuel price increases amounting to 30 percent, the output will increase larger which reached Rp. 557,921 million. The second largest output is construction sector, the increasing 10% percent fuel price will increase from Rp. 331,094 million to Rp. 348,770 million, as well as with the 20% increase and 30% increase of fuel price, it will increase the construction sector output to Rp. 366,445 million and Rp. 384,120 million. The other sector like petroleum refinery, manufacture of chemicals and others will experienced an increase in output in line with increase in fuel price. The increased output of the affected economic sectors is the effect of increasing the price of goods produced while the quantity of goods produced is assumed to be fixed. So the increase in output from the impact of this fuel is not an indicator of an increased in productivity but it’s a result of the encouragement of inflation in each sector.

4. Conclusion and recommendations

From the results show conclusively that sectors most affected by the higher of fuel prices is the transport sector whether by land, air and water are also affected enormously from the increase in fuel prices, because vehicles in operate depending on the fuel. This fuel price increase will leads to an increase in transportation tariffs. The electricity sector also primarily impact because of this sector needs fuel in generate electricity which is very large. The increases of fuel price impact to this sector will cause the increases of production costs in generating electricity. The increases in fuel prices also have a major impact on the Manufacture of Chemicals sectors, where petrol is an important component in the providing chemical materials.

The fuel price hike impact on the increasing cost of production in each economic sector will aggregately impact to the increase of the price at each sector, and jointly led the national inflation. Inflation will rise in line with the rise in fuel prices. According to the results of this paper, there are some policies to be considered and important to be implemented, i.e.

- The government monitoring those sectors which exposed the largest impact from the increasing of the fuel price and make efficient for the consumptions and productions of the fuel.
- Government should conduct market operations in the early stage of the increasing prices of the basic needs affected by the increasing of the fuel prices so there is no scarcity of the goods.
- Government seeks to obtain the fuel substitution with actively search for alternative fuels.
- The government should set the fuel price gradually to avoid the increasing price in the other sectors of strategic commodities such as Basic Electricity Tariff (TDL), basic food needs, and transportation tariff with giving subsidies on those commodities.

Analysis of the impact of fuel price increases in this study, only using IO table 2005 so that it cannot measure either the substitution effect or income effect from the impact of the increasing in the fuel price.

References