The Impact of the Increase of Oil Fuel Price and Government Subsidy on Indonesia's Economic Performance

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ABSTRACT

The policy of increasing domestic fuel oil, as a consequence of rising world oil prices, has resulted in changing economic conditions, bearing in mind that oil prices and production are wrong macroeconomic assumptions and are included in the State Revenue and Expenditure Budget. This study aims to determine the impact of rising fuel prices and government subsidies on Indonesia's economic performance. The data used in this study are time series data from 2000 to 2022. Data were obtained from the Indonesian Central Bureau of Statistics, the Ministry of Energy and Mineral Resources, the Ministry of Finance, and Bank Indonesia. This study uses an econometric model using a system of simultaneous equations. The research results show that; the main factors that caused the increase in domestic fuel prices, including crude oil prices, gasoline, diesel, kerosene and aviation fuel, were the increase in world oil prices and the previous year's oil prices. The estimation results also show that the increase in gasoline and diesel fuel can increase the number of poor people, unemployment and inflation in Indonesia. The policy simulation results show that the increase in oil prices has a significant impact on increasing the number of poor people, increasing unemployment and inflation, if this increase is not followed by subsidies in the form of non-energy.

Keywords: Fuel Prices, Subsidies, Simultaneous Equations, Economic Performance
JEL Classifications: C32, E62, F62, Q43

1. INTRODUCTION

Fluctuations in world oil prices will certainly have an impact on the national economy, considering that world oil prices are one of the macroeconomic assumptions and are contained in the State Budget (Nizar, 2012). Therefore, whenever there is an increase in world oil prices, the government needs to conduct a review of domestic oil prices, this is related to the size of the fuel oil (BBM) subsidy which has a large influence on the state budget (Nugroho et al., 2015).

Fuel oil (BBM) is a product that plays an important role in economic activity. Therefore, the government's policy to increase fuel prices will cause significant changes in the economy (Indonesian National

Energy Council, 2022; Elinur et al., 2010). The increase in fuel prices, of course, will be followed by an increase in the price of goods and services for the community (Media Indonesia, 2022). In the last 10 years, fuel prices in Indonesia have increased several times. Finally on September 3, 2022. The main reason is the swelling of the state's financial burden in response to the increase in world oil prices, (Kompas Daily, September 3, 2022).

The issue of fuel subsidies is a classic problem, and has long been the subject of discussion among policy makers and academics both at home and in the country. The significant increase in world oil prices occurred in 2005, and forced fuel subsidies to be reduced by increasing oil prices in March 2005, Oktaviani and Sahara 2005; Ikhsan et al. (2005). The increase in fuel prices was due to

a repeated increase in world oil prices in 2008, and most recently on September 3, 2022. The amount of energy and non-energy subsidies in Indonesia in 2015-2022 can be seen in Figure 1.

An increase in the price of fuel oil (BBM) can have a significant impact on the Indonesian economy. Some possible impacts, such as economic growth, poverty, inflation, and cost of living, (Aswicahyono et al., 2011; Ermawati, 2015; Nugroho et al., 2015).

Economic growth: Increases in fuel prices can affect overall economic growth. If production and transportation costs rise, businesses and industries may face pressure to increase the prices of their products. This can reduce the competitiveness of Indonesian products, both in domestic and international markets (Akhmad et al. 2019; Usman et al., 2022). In addition, people's consumption can also be affected, as they may reduce purchases of non-essential goods and services to offset rising costs of living. This can hamper overall economic growth (Pasaribu et al., 2023).

Increases in fuel prices can have a direct impact on inflation. Fuel is an important commodity that is used in almost all economic sectors, including transportation, agriculture, industry and other sectors, (Harunurrasyid, 2013; Sarbaini and Nazaruddin, 2023). An increase in fuel prices will cause production costs and transportation costs to rise, which will ultimately increase the price of goods and services in general. This can trigger inflation and reduce people's purchasing power, (Simatupang and Friyatno, 2016; Suryadi, 2015).

Cost of living: The increase in fuel prices will directly impact people's living costs. Transport is becoming more expensive, which means everyday transportation costs such as the cost of taking public transport or fuel for private vehicles will increase. This increase in costs can cause a greater financial burden for society, especially for those who have low incomes (Muhardi, 2005; Yuliani et al., 2022).

If the Indonesian government chooses to reduce fuel subsidies in response to rising prices, there will be an impact on the state budget. Fuel subsidies have become a significant burden on the government budget in recent years (Ermawati, 2015; Soleh, 2020). If subsidies are reduced, then the funds allocated for these subsidies can be diverted to other more urgent sectors, such as education,

health or infrastructure. However, reducing subsidies can also trigger public protests or discontent (Priyadi et al., 2022). Based on the background of these problems, this study aims to determine the impact of rising fuel prices and government subsidies on the performance of the Indonesian economy.

2. LITERATURE REVIEW

Almost all countries in the world provide subsidies to their citizens. Subsidies are given to producers with the aim of increasing the amount of production or increasing the competitiveness of their production, while subsidies are given to consumers with the aim of increasing consumer purchasing power, (Pindyck and Rubinfeld, 2013, Akhmad, 2014).

Energy subsidies, in this case fuel, LPG and electricity, are a form of subsidy provided by the government to PT. Pertamina as the only company assigned by the government in the supply of fuel and LPG in Indonesia and PT. PLN is the only company that provides electricity to the people of Indonesia (Nugroho, 2005, Karim et al., 2021; Romadhoni and Akhmad, 2020). One of the macroeconomic assumptions listed in the State Revenue and Expenditure Budget is world oil prices and national oil production. Therefore; fuel plays an important role in national development. An increase in the price of fuel oil (BBM) can have a significant impact on the Indonesian economy. Samuelson and Nordhaus (2009) describes the picture that will happen to countries in the world. That the shock of rising world oil prices will affect macroeconomic conditions which will be reflected in the decline in gross domestic product, rising unemployment and inflation (Todaro and Smith, 2015; Salvatore, 2006; Dornbusch et al., 2017; Mira et al., 2014; Adelegan et al., 2021).

Another problem that will arise as a result of the increase in fuel prices is the concern that economic growth will be hampered Mankiw (2020); Romer (2012), Akhmad et al. (2012). This occurred due to the impact of rising prices of goods and services that occurred as a result of the increased cost components. Indonesia's economic condition will also experience problems. People's purchasing power will decrease, the emergence of new unemployment, and so on.

Research on subsidies and rising fuel prices has been carried out in Indonesia, among others; Oktaviani and Sahara (2005), Iksan et al. (2005), Aswicahyono et al. (2011), Dartanto (2013), Setyawan (2014), Akhmad and Amir (2018), Aimon et al. (2020), Mardiana et al. (2020), Srinita and Effendi (2021), Nairobi et al. (2022), Muzayanah et al. (2022), Pasaribu et al. (2023), and Muthalib et al. (2023). The results of this study can represent a study of the impact of rising fuel prices on the economy in the period 2010-2022. The results of the study can be concluded that the increase in fuel prices has led to a decrease in people's purchasing power. This happened because of an increase in the price of goods in general (inflation). Meanwhile, the compensation given by the government as a consequence of the increase in fuel prices is less able to increase people's purchasing power. This means that the increase in the price of goods in general is higher than the compensation received by the recipient household group.

Figure 1: Development of Subsidies in Indonesia 2015-2022 (trillion rupiah)
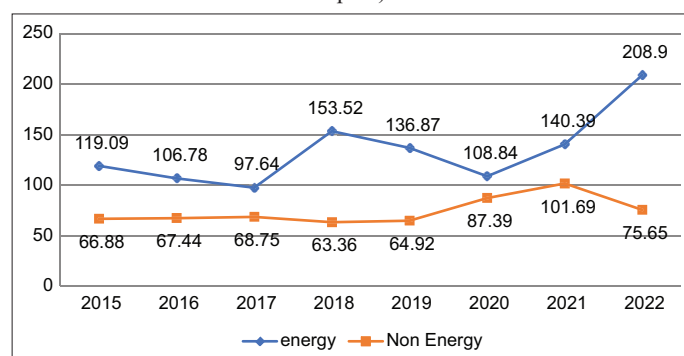
Source: Ministry of Finance of the Republic of Indonesia. (State budget)

3. RESEARCH METHODS

3.1. Types and Resources
This research was conducted in Indonesia. This study uses time series data from 2000 to 2020. The data used was obtained from the Indonesian statistics centre, the Ministry of Energy and Human Resources, the Ministry of Finance, Bank Indonesia, and other legitimate and reliable sources.

3.2. Model Specifications
The econometric model is divided into single equations and simultaneous equations. A single equation is an equation in which the dependent variable is expressed as a function of one or more independent variables, so that the causal relationship between the dependent variable and the independent variable is a one-way relationship. Meanwhile, the simultaneous equations of Gujarati (2003), Sitepu and Sinaga (2006), Krichene (2005), are equations that form a system of equations that describe the dependence between various variables in the equation.

In this section an econometric model is formulated for the impact of the fuel price increase and government subsidies on Indonesia's economic performance which is a system of simultaneous equations with 20 equations which include 16 structural equations and 4 identity equations. Structural equations are representations of endogenous and exogenous variables which operationally produce the signs and magnitudes of estimator values according to theoretical expectations a priori.

The system of simultaneous equations built in this study is divided into four blocks, namely: (1) fiscal block, (2) fuel price block and (3) fuel consumption block and (4) economic performance block.

3.2.1. Fiscal block
The government spending block is formulated in three equations, two structural equations and one identity equation, namely: Government revenue equation, government spending equation, and total government spending equation:

3.2.1.1. Government revenue equation
Government revenue as the main determining factor for government spending to provide fuel subsidies. In this model, the revenue equation is influenced by gross domestic product, taxes and government revenue in the previous year. So the government revenue equation is formulated:

$$RG_t = a_0 + a_1 PDB_t + a_2 TAX_t + a_3 LRG_{t-1} + e_1 \tag{1}$$

Estimated parameters are expected a_1, a_2 and $a_3 > 0$.

3.2.1.2. Energy subsidy equation
Spending on government subsidies for energy is influenced by government revenues, fuel consumption, the rupiah exchange rate against the dollar, and energy subsidy variables in the previous year. Therefore the energy subsidence equation is formulated:

$$SUBENG_t = b_0 + b_1 RGt + b_2 CBBM + b_3 NTRP_t + b_4 LSUBENG_{t-1} + e_2 \tag{2}$$

Expected parameters b_1, b_2, b_3 and $b_4 > 0$.

3.2.1.3. Equation of non-energy subsidies
Government subsidies for non-energy, are influenced by government revenue, the number of poor people, energy subsidies, and previous year's non-energy subsidies.

$$SUBNENG_t = c_0 + b_1 RGt + c_2 MISK_t + c3 SUBBBM_t + c_4 LSUBNENG_{t-1} + e_2 \tag{3}$$

Expected parameters c_1, c_2, $c_4 > 0$ and $c_3 < 0$.

3.2.1.4. The total government spending equation
The government spending equation is formulated in the form of an identity equation, namely; the sum of: non-subsidized government spending, government spending on Energy subsidies and government spending on non-Energy subsidies.

$$TGE_t = GENSUB_t + G SUBENG_t + SUBNENG_t \tag{4}$$

3.2.2. Fuel price block
The fuel price block consists of six equations, namely; domestic crude oil price equation, gasoline price equation, diesel fuel price equation, kerosene price equation, avtur price equation and fuel oil supply equation.

3.2.2.1. Domestic crude oil price equation
The price of domestic crude oil is affected by world crude oil prices, spending on government subsidies for fuel, fuel consumption, and the price of domestic crude oil in the previous year, thus the equation for the price of domestic crude oil is formulated:

$$PMMDN_t = d_0 + d_1 PMMTW_t + d_2 ESUBBBM_t + d_3 CBBM + d_4 LPMMDNt-1 + e_3 \tag{5}$$

Expected parameters d_1, d_2, $_{<0}$ and d_3, d_4 $d_5 > 0$.

3.2.2.2. Gasoline price equation
The price of gasoline is influenced by the supply of gasoline, government spending on fuel subsidies, gasoline consumption, world crude oil prices, and the previous year's gasoline price. So the machine price equation is formulated:

$$PBEN_t = e_0 + e_1 SBEN_t + e_2 GSUBBBM_t + e_3 COMBEN_t + e_4 PMMTW_t + e_5 LPBEN_{t-1} + e_4 \tag{6}$$

Expected parameters e_1, e_2, $_{<0}$ and e_3, e_4, e_5, $e_6 > 0$.

3.2.2.3. Solar price equation
Diesel prices are influenced by the supply of diesel fuel, diesel consumption, government spending on fuel subsidies, world crude oil prices, and diesel prices in the previous year. The diesel price equation is formulated

$$PSOL_t = f_0 + f_1 SSOL_t + f_2 CSOL_t + f_3 GSUBBBM_t + f_4 PMMTW_t + f_5 LSOL_{t-1} + e_5 \tag{7}$$

Expected parameters f_1, f_3, < 0 and f_2, f_4, f_5, $f_6 > 0$.

3.2.2.4. Kerosene price equation

The price of kerosene is influenced by the supply of kerosene, government spending on fuel subsidies, consumption of kerosene, world crude oil prices and the previous year's kerosene price. Thus the kerosene price equation is formulated:

$$PMT_t = g_0 + g_1 SMTL_t + g_2 GSUBBBM_t + g_3 CMT_t + g_4 PMMTW_t + g_5 LPMT_{t-1} + e_6 \quad (8)$$

Expected parameters $g_1, g_2, <0$ and $g_3, g_4, g_5 > 0$.

3.2.2.5. Avtur price equation

Avtur prices are influenced by avtur consumption, government spending on fuel subsidy, avtur supply, world crude oil prices, and avtur prices in the previous year.

$$PAVT_t = h_0 + h_1 CAVT_t + h_2 GSUBBBM_t + h_3 SAVT_t + h_4 PMMTW_t + h_5 LAVT_{t-1} + e_7 \quad (9)$$

Expected parameters $h_1, h_3, h_4 > 0$ and $h_2 <0$.

3.2.2.6. Fuel supply equation

The fuel supply equation, is an identity equation, where the fuel supply is the sum of domestic fuel production plus fuel imports and reduced by fuel exports, so the formulation of the fuel supply equation is:

$$SBBM_t = PROBMMD_t + IMBBM_t – XBBM_t \quad 10)$$

3.2.3. Fuel consumption block

In the fuel consumption block, it is divided into 6 equations, respectively; the equation for domestic crude oil consumption, gasoline consumption, diesel consumption, kerosene consumption, avtur consumption, and the equation for total fuel consumption.

3.2.3.1. Crude oil consumption equation

The crude oil consumption equation is influenced by world crude oil prices, gross domestic product, investment and fuel consumption in the previous year, thus the fuel consumption equation is formulated

$$CMMT_t = ih_0 + i_1 PMMTW_t + i_2 PDB_t + i_3 INVES_t + i_4 LCMMT_{t-1} + e_8 \quad (11)$$

Expected parameters $i_2, i_3, i_4 >0$ and $i_1 <0$.

3.2.3.2. Gasoline consumption equation

The gasoline consumption equation is influenced by gasoline prices, the number of motoR vehicles, GDP, investment, and gasoline consumption in the previous year

$$CBEN_t = j_0 + j_1 PBEN_t + j_2 JKBR_t + j_3 PDB_t + j_4 INVES_t + j_5 JKBR_{t1} + j_6 LCBEN_{t-1} e_9 \quad (12)$$

Expected parameters $j_2, j_3, j_4, j_5, j_6 >0$ and $j_1 <0$.

3.2.3.3. Solar consumption equation

The diesel consumption equation is influenced by the price of diesel, the number of motor vehicles, GDP, investment and consumption of diesel in the previous year.

$$CSOL_t = k_0 + k_1 PSOL_t + k_2 JKBR_t + k_3 PDB_t + k_4 INVES_t + k_5 JKBR_t + k_6 LSOL_{t-1} e_{10} \quad (13)$$

Expected parameters $k_2, k_3, k_4, k_5, k_6 >0$ and $k_1 <0$.

3.2.3.4. Kerosene consumption equation

The kerosene consumption equation is influenced by the price of kerosene, GDP, and consumption of kerosene in the previous year.

$$CMT_t = l_0 + l_1 PMT_t + l_2 PDB_t + l_3 LCMT_{t-1} + e_{11} \quad (14)$$

Expected parameters $l_2, l_3, >0$ and $l_1 <0$.

3.2.3.5. Avtur consumption equation

The equation for avtur consumption is influenced by the price of avtur, GDP, investment, and avtur consumption in the previous year.

$$CAVT_t = m_0 + m_1 PAVT_t + m_2 PDB_t + m_3 INVES_t + m_4 LCAVT_{t-1} + e_{12} \quad (15)$$

Expected parameters $m_2, m_3, m_4 > 0$ and $m_1 <0$.

3.2.3.6. Equation of total fuel consumption

The equation for total fuel consumption is an identity equation which is the sum of gasoline consumption, diesel consumption, kerosene consumption, avgas consumption, and other fuel consumption. Thus the total fuel consumption equation is formulated:

$$TCBBM_t = CBEN_t + CSOL_t + CMT_t + CAVT_t + CBBML_t \quad (16)$$

3.2.4. Economic performance block

In the economic performance block, it consists of 4 equations, namely the gross domestic product (GDP) equation, the poverty rate equation, the unemployment equation, and the inflation equation.

3.2.4.1. Gross domestic product equation

The gross domestic product equation is influenced by employment, total fuel consumption, investment, and the previous year's gross domestic product.

$$PDB_t = n_0 + n_1 PTK_t + n_2 TCBBM_t + n_3 INVET + n_4 LPDB_t + e_{13} \quad (17)$$

Expected parameters $n_1, n_2, n_3, n_4 > 0$.

3.2.4.2. Poverty level equation

The equation for the number of poor people is influenced by gross domestic product, prices, petrol, prices, diesel, labour absorption and the previous year's poverty rate.

$$MISKt = o_0 + o_1 PDB_t + o_2 PBEN_t + o_3 PSOl_t + o_4 LMISK_t + e_{14} \quad (18)$$

Expected parameters $o_2, o_3, o_4 > 0$ and $o_1 <0$.

3.2.4.3. Unemployment rate equation

The unemployment equation is influenced by investment, economic growth, total fuel consumption, and unemployment in the previous year

$$UNIF_t = p_0 + p_1 INVt + p_2 GECO_t + p_3 TCBBM_t + p_4 LUNIF_t + e_{15} \quad (19)$$

Expected parameters $p_3, p_4 > 0$ and $p_1, p_2 < 0$.

3.2.4.4. Inflation equation
The inflation equation is influenced by the price of gasoline, the price of diesel, the Indonesian bank's interest rate, and the gross domestic product.

$$INFL_t = q_0 + q_1 PBEN + q_2 PSOL_t + q_3 SBI_t + q_4 PDB_t + e_{16} \quad (20)$$

Expected parameters $q_1, q_2, q_4 > 0$ and $q_3 < 0$.

3.3. Model Identification
Model identification is determined on the basis of an order condition as a mandatory condition and a rank condition as an adequacy requirement. According to Koutsoyiannis (1982), Sitepu and Sinaga (2006) the formula for identification of structural equation models based on order conditions is determined by:

$$(K–M) > (G–1) \quad (21)$$

Where:

K: Total variables in the model, namely endogenous variables and predetermined variables.

M: The number of endogenous and exogenous variables included in a particular equation in the model.

G: Total equations in the model, namely the number of endogenous variables in the model. Based on the order condition, if:

(K-M) > (G-1): Then the equation is declared over identified
(K-M) = (G-1): Then the equation is stated to be identified exactly
(K-M) < (G-1): Then the equation is declared unidentified

Identification results for each structural equation must be exactly identified or over identified in order to estimate the parameters (Intriligator, 1978; Koutsyiannis, 1982).

3.4. Model Estimation Method
From the results of model identification, the model is stated to be over identified, so in this study the model estimation was carried out using the 2SLS method (two stage least squares) because the 2SLS method is suitable for simultaneous equations that are over identified, can be used in a relatively small number of samples and is not sensitive to modification (respecification) of the model, both for structural analysis and for simulation analysis. Data processing was carried out using the SAS computer software program version 9.2.

3.5. Policy Simulation
After the model has been validated and meets the statistical criteria, the model can be used to carry out policy simulations (Juanda, 2009). Policy simulations were carried out with the aim of seeing the impact of the fuel price hike policy on Indonesia's economic performance. Therefore, the policy simulation in this study is divided into three simulations, namely (1) increasing the price of gasoline and diesel by 20%, (2) increasing only gasoline and diesel by 20% each and increasing non-fuel subsidies by 20%, and (3) reduce energy subsidies by 10% and increase the price of petrol and diesel by 10% each.

4. RESEARCH RESULTS

The availability of sustainable and sufficient energy is a necessity in the development of a nation. In development in Indonesia, the supply of energy is a very important factor in driving economic growth. Research only focuses on fuel oil, which in Indonesia gives confidence to state companies, in this case PT. Pertamina in producing and providing fuel oil in Indonesia.

4.1. Model Estimation Results
The results of the estimation model for the impact of price increases (fuel) and government subsidies on economic performance are quite good, although modifications have been made several times, because some results are found that are not consistent with theory. It is said that because most of the variables included in the structural equation have signs that are in accordance with expectations, and are considered logical from an economic standpoint.

The estimation of the model was carried out using the 2SLS method (two stage least squares) to obtain the results of the factors that influence the endogenous variables, where there are 4 blocks, consisting of 16 structural equations and 4 identity equations, overall giving a fairly good estimation result.

4.1.1. Fiscal block model estimation results
The estimation results of the fiscal block model consist of 3 structural equations namely; the government revenue equation, the energy subsidy equation and the non-energy subsidy equation can be seen in Table 1. The results of the estimation model have the government revenue equation obtained that government revenue is significantly affected by government revenue the previous year $\alpha = 0.01$, while taxes have a positive and significant effect at the level of $\alpha = 0.1$. Furthermore, the gross domestic product variable has a positive but not significant effect on government revenue. All explanatory variables are not responsive to government revenue.

The results of the estimation model for energy subsidies show that energy subsidies are positively and significantly affected by domestic consumption of fuel oil, and energy subsidies in the previous year at a significant level of $\alpha = 0.05$, while the rupiah exchange rate has a negative and significant effect on the magnitude of energy subsidies. Furthermore, the government revenue variable has a positive but not significant effect on fuel subsidies. All explanatory variables are not responsive to fuel subsidies.

The estimation results for non-energy subsidies show that the number of poor people and non-energy subsidies in the previous year had a positive and significant effect on non-energy subsidies

Table 1: Fiscal block estimation results

Variables	Estimates	P>T	Elasticity	Variable name	F	R²
Government revenue equation (RG)						
Intercept	173,274.5	0.3251	-	Intercept	39.92	0.8721
PDB	132.0321	0.0345	0.1943	Gross domestic product		
TAX	0.934249	0.0917	0.1432	Tax		
LRG	0.543211	0.0011	-	GDP of the previous year		
Energy subsidy equation (SUBENG)						
Intercept	−31,506.22	0.2206	-	Intercept	76.31	0.894
RG	0.020033	0.1121	0.2132	Government revenue		
CBBM	0.00649	0.0204	0.1076	Consumption of fuel oil		
NTRP	−0.14391	0.0304	−0.2303	Rupiah exchange rate against USD		
LSUBENG	0.432104	<0.0001		Previous year's fuel consumption		
Equation of nonenergy subsidies (SUBNENG)						
Intercept	−22,312.71	0.2206	-	Intercept	101.02	90.21
RG	0.13234.3	0.3212	0.2112	Government revenue		
MISK	0.143219	0.0604	0.2706	Number of poor population		
SUBBBM	−0.321211	0.3211	−0.3413	Fuel subsidies		
LSUBNENG	0.321432	0.0021	-	Nonenergy subsidies in the previous year		

Source: Processed data. GDP: Gross domestic product

at a significant level of $\alpha = 0.05$. While the variable amount of government revenue has a positive but not significant effect on non-energy subsidies. On the other hand, the fuel subsidy variable has a negative but not significant effect on the size of non-energy subsidies. All explanatory variables are not responsive to non-energy subsidies.

4.1.2. Estimation results of the fuel oil price block model
In the fuel price block, it consists of 5 structural equations, namely the domestic crude oil price equation, the gasoline price equation, the diesel price equation, the kerosene price equation and the avtur price equation. The results of the model estimation show that all explanatory variables have signs according to expectations, although in general the variables do not have a significant effect as shown in Table 2.

The estimation results of the domestic crude oil price equation model show that; the variables of world oil prices, fuel consumption and crude oil prices in the previous year have a positive and significant effect on crude oil prices with estimated values of 0.110, 0.325 and 0.133 respectively, meaning that for every 1% increase in world crude oil prices, fuel consumption and oil prices the previous year's crude oil price will increase the current year's crude oil price by 0.110, 0.325 and 0.133%. While government subsidies have a negative but not significant effect on domestic crude oil prices. All explanatory variables are not responsive to domestic crude oil prices.

The estimation results of the gasoline price equation model are positively and significantly influenced by world crude oil prices and gasoline prices in the previous year. The estimated coefficient values are 0.223 and 0.831, respectively. This means that if there is an increase in the price of world crude oil and the price of engines in the previous year increased by 1%, then the price of gasoline for the current year would increase by 0.223 and 0.831%, respectively. Meanwhile, gasoline supply and gasoline consumption variables have a positive but not significant effect on gasoline prices. On the other hand, government subsidies have a significant and negative effect on gasoline prices with a coefficient value of −0.321,

meaning that if the government increases fuel subsidies by 1%, gasoline prices will decrease by 0.321%.

As with the gasoline price equation, the estimation results for the diesel price equation show that diesel prices are positively and significantly influenced by world crude oil prices and diesel prices in the previous year. The estimated coefficient values are 0.321 and 0.543 respectively, meaning that a 1%t increase in world crude oil and diesel prices for the current year means that domestic diesel fuel will increase by 0.321 and 0.543%, respectively. While the variable diesel fuel supply and diesel consumption have a positive but not significant effect on diesel prices. On the other hand, government subsidies for fuel have a significant and negative effect on diesel prices, with an estimated coefficient of −0.321. This means that if the government increases its fuel subsidy by 1%, the price of diesel will decrease by 0.321%. All explanatory variables are not responsive to the price of diesel oil.

The results of the estimation of the kerosene price equation, it was found that the price of kerosene was positively and significantly affected by the supply of kerosene and the price of kerosene in the previous year. While the variable consumption of kerosene and world crude oil prices have a positive but not significant effect on only kerosene. This finding is very logical to increase Indonesia's success in shifting consumption of kerosene to LPG in the last 15 years. Meanwhile, the fuel subsidy variable has a negative but not significant effect on domestic kerosene prices.

The results of the estimation of the avtur price equation show that the avtur price is only positively and significantly influenced by the previous year's avtur price, while avtur consumption, avtur supply, and world oil prices only have a positive but not significant effect on avtur prices. On the other hand, government subsidies in fuel have a negative but not significant effect on avtur prices.

4.1.3. Estimation results of the fuel oil consumption block model
The oil consumption block consists of five structural equations namely; domestic crude oil consumption equation, gasoline

Table 2: Estimation results of the fuel oil price block model

Variables	Estimates	P>T	Elasticity	Variable name	F	R^2
Domestic crude oil price equation (PMMDN)						
Intercept	73,218.018	0.5321	-	Intercept	222.17	0.951
PMMW	0.110212	0.0217	0.1214	World crude oil prices		
ESUBBBM	−0.124328	0.5321	−0.1113	Government subsidies for fuel		
CBBM	0.325312	0.0121	0.2032	fuel consumption		
LPMMDN	0.133451	0.0002	-	Price of crude oil last year		
Gasoline price equation (PBEN)						
Intercept	213411.43	0.5306	-	Intercept	89.82	0.8021
SBEN	0.223102	0.6432	0.2202	Gasoline supply		
GSUBBBM	−0.321129	0.0142	−0.2201	Government fuel subsidies		
COMBEN	0.661241	0.2341	0.2101	Gasoline consumption		
PMMTW	0.04321	0.0212	0.0321	World oil prices		
LPBEN	0.831304	0.0032	-	Gasoline consumption the previous year		
Solar price equation (PSOL)						
Intercept	882,119.7	0.2206	-	Intercept	69.88	0.7175
SSOL	0.421123	0.3242	0.2111	Diesel oil supply		
CSOL	0.186321	0.3321	0.1232	Diesel consumption		
GSUBBBM	−0.321131	0.0212	−0.1123	Government subsidies for fuel		
PMMTW	0.321321	0.0121	0.0672	World oil prices		
LSOL	0.543211	0.00021	-	Previous year's diesel prices		
Kerosene price equation (PMT)						
Intercept	43,619.7	0.4221	-	Intercept	21.43	0.62775
SMTL	0.212333	0.0421	0.0132	Kerosene supply		
GSUBBBM	−0.641112	0.3304	−0.2706	Government fuel subsidies		
CMT	0.321112	0.2332	0.1231	Kerosene consumption		
PMMTW	0.123281	0.1915	0.2214	World oil prices		
LPMT	0.211301	<0.0001	-	Price of kerosene last year		
Avtur price equation (PAVT)						
Intercept	506,001.99	0.4322	-	Intercept	131.54	0.8978
CAVT	0.773044	0.2321	0.0213	Avtur consumption		
GSUBBBM	−0.111219	0.2001	−0.0026	Government subsidies for fuel		
SAVT	0.4321351	0.1121	0.2311	Avtur supply		
PMMTW	0.1114311	0.1533	0.01121	World oil prices		
LPAVT	0.130413	0.0002	-	Avtur prices for the previous year		

Source: Processed data

consumption, diesel consumption, kerosene consumption and avgas consumption equation. In general, the results of model estimation show quite good results, where all explanatory variables have signs that match expectations, as in Table 3.

The estimation results of the crude oil consumption equation model show that domestic crude oil consumption is only significantly affected by the previous year's crude oil consumption. Meanwhile, gross domestic product and investment have a positive but not significant effect on crude oil consumption. Conversely, world crude oil prices have a negative but not significant effect on domestic crude oil consumption. All explanatory variables are not responsive to domestic consumption of crude oil.

The estimation results of the gasoline consumption equation model show that gasoline consumption is positively and significantly affected by the number of motorised vehicles, and gasoline consumption in the previous year. The estimated coefficient values are 0.121 and 0.432. This shows that every 1% increase in the number of motorised vehicles and the increase in gasoline consumption in the previous year, will increase the current year's total gasoline consumption by 0.121 % and 0.432%, respectively. While the investment variable, the gross domestic product variable has a positive but not significant effect on gasoline consumption.

On the other hand, the price of gasoline has a negative but not significant effect on gasoline consumption. All explanatory variables are unresponsive to gasoline prices.

As is the case with the gasoline consumption equation, the estimation results on diesel consumption are positively and significantly affected by the number of motorised vehicles and the price of diesel in the previous year. The estimation results show a coefficient of 0.321 and 0.332. This shows that every 1% increase in the number of motorised vehicles and diesel consumption in the previous year, will increase diesel consumption by 0.321 and 332% respectively. Meanwhile, the variables of investment and gross domestic product have a positive but not significant effect on domestic diesel consumption.

The results of the estimation of the kerosene consumption equation model, it was found that kerosene consumption was significantly affected by the previous year's kerosene consumption with a coefficient value of 0.323. This means that for every 1% increase in kerosene consumption in the previous year, kerosene consumption would increase by 0.323%. While gross domestic product has a positive but not significant effect on kerosene consumption. On the other hand, the price of kerosene has a negative but not significant effect on kerosene consumption.

Table 3: Estimation results of the fuel oil consumption block model

Variables	Estimates	P>T	Elasticity	Variable name	F	R²
Crude oil consumption equation (CMMT)						
Intercept	63,894.889	0.4328	-	Intercept	212.02	0.8904
PMMTW	0.101219	0.6717	0.1052	World crude oil prices		
PDB	0.323781	0.5411	0.1143	Gross domestic product		
INVEST	0.223212	0.0321	0.2242	Investment		
LCMMT	0.232125	0.0032	-	Consumption of crude oil the previous year		
Gasoline consumption equation (CBEN)						
Intercept	12,506.19	0.2406	-	Intercept	87.45	0.8122
PBEN	−0.112133	0.2122	−0.1012	Gasoline prices		
JKBR	0.121234	0.0024	0.1216	Number of motorised vehicles		
PDB	0.222329	0.1311	0.3211	Gross domestic product		
INVEST	0.121232	0.1115	0.0129	Investment		
LCBEN	0.432114	<0.0001	-	Previous year's gasoline consumption		
Solar consumption equation (CSOL)						
Intercept	950,619.7	0.1512	-	Intercept	77.31	0.7987
PSOL	−0.112133	0.8322	−0.1131	Price of diesel oil		
JKBR	0.321264	0.0104	0.1435	Number of motorised vehicles		
PDB	0.211121	0.4321	0.2321	Gross domestic product		
INVEST	0.002112	0.4211	0.1432	Investment		
LCSOL	0.332131	<0.0001	-	Previous year's diesel consumption		
Kerosene consumption equation (CMT)						
Intercept	332,119.7	0.3211	-	Intercept	67.43	0.7881
PMT	−0.432121	0.6432	−0.1142	Kerosene price		
PDB	0.021321	0.1102	−0.1324	Gross domestic product		
LCMT	0.323421	<0.0001	-	Previous year's consumption of kerosene		
Avtur consumption equation (CAVT)						
Intercept	872,112.75	0.2206	-	Intercept	104.54	0.7965
PAVT	−0.432121	0.5321	−0.1321	Avtur price		
PDB	0.324391	0.2321	0.2342	Gross domestic product		
INVEST	0.121512	0.0232	0.2311	Investment		
LCAVT	0.773214	<0.0001	-	Consumption of avtur the previous year		

Source: Processed data

The avtur consumption equation shows that avtur consumption is positively and significantly influenced by investment and avtur consumption in the previous year, with coefficient values of 0.122 and 0.773. This means that every 1% increase in total investment and the increase in avtur consumption in the previous year will increase the current year's avtur consumption, respectively by 0.122 and 0.773%. While the gross domestic product has a positive but not significant effect on avtur consumption. On the other hand, the price of avtur has a negative but not significant effect on domestic avtur consumption.

4.1.4. Economic performance block model estimation results
Economic performance in this model consists of four structural equations, namely the gross domestic product equation, the number of poor people, the number of unemployed and inflation. In general, the estimation results show quite good results, marked by all R2 values above 60%, while indicating that the included explanatory variables can explain economic performance well. The estimation results also show that the explanatory variables have the same direction as economic theory and logic. The results of economic performance block estimation can be seen in Table 4.

The results of the estimation of the gross domestic product equation show that the gross domestic product is positively and significantly affected by investment and the previous year's gross domestic product. The estimated coefficient values are 0.234 and 0.231 respectively. This shows that every 1% increase in investment

and gross domestic product in the previous year, will increase the current year's gross domestic product by 0.234% and 0.231%, respectively. While employment and total fuel consumption have a positive but not significant effect on gross domestic production. All variables are not sensitive to gross domestic product

The results of the estimation of the equation for the number of poor people show that the number of poor people is only positively and significantly affected by the number of poor people in the previous land. While the price of gasoline and diesel had a positive but not significant effect on the increase in the number of poor people. On the other hand, gross domestic product and investment have a negative effect on the number of poor people. This is very logical considering that increasing gross domestic product can reduce poverty, meaning that there is an element of income distribution. Likewise with investment, with increased investment it will automatically absorb a lot of labour, which of course will result in reduced unemployment, and in turn will reduce the number of poor people.

The estimation results of the unemployment equation model show that the number of unemployed is only positively and significantly affected by the number of unemployed in the previous year. On the other hand investment has a negative and real effect on the number of unemployed. This shows that existing investments can absorb a lot of jobs. While economic growth and total fuel consumption have a negative but not significant effect on reducing unemployment.

Table 4: Estimation results of economic performance block models

Variables	Estimates	P>T	Elasticity	Variable name	F	R²
Gross domestic product equation (PDB)						
Intercept	6,802,341.89	0.3342	-	Intercept	752.09	0.9704
PTK	0.1654321	0.4341	0.0987	Employment		
TCBBM	0.4321321	0.3212	0.3211	Total fuel consumption		
INVEST	0.2341212	0.0211	0.2341	Investment		
LPDB	0.231234	0.0012	-	Gross domestic product of the previous year		
Equality number of poor people (MISK)						
Intercept	234,106.19	0.4406	-	Intercept	33,76	0.6752
PDB	−0.324211	0.3211	−0.2112	Gross domestic product		
PBEN	0.234221	0.3322	2763	Gasoline prices		
PSOL	0.432129	0.1165	0.4321	Diesel prices		
INVEST	−0.234532	0.0211	−0.1309	Investment		
LMISK	0.765432	<0.0001	-	The number of poor people in the previous year		
Equation of total unemployment (UNIF)						
Intercept	7,655,431.27	0.3321	-	Intercept	55.43	0.7775
INVEST	−0.042128	0.0231	−0.3342	Investment		
GECO	−0.188211	0.2311	0.1141	Economic growth		
TCBBM	−0.231211	0.3421	−0.2111	Total fuel consumption		
LUNIF	0.334321	<0.0001	-	Number of unemployment in the previous year		
Inflation equation (INFL)						
Intercept	9.117111	0.3421	-	Intercept	17.21	0.6055
PBEN	0.321123	0.4432	0.3212	Gasoline prices		
PSOL	0.232112	0.3211	0.4321	Diesel prices		
SBI	−0.321211	−0.0221	−0.1231	Indonesian bank interest rates		
PDB	0.321211	0.2111	0.3221	Gross domestic product		

Source: Processed data

The results of the model estimation of the inflation equation, it was found that inflation was only negatively and significantly affected by the Indonesian bank's interest rate. This result is very logical, because it increases interest rates, so people generally save their money in banks, so that the amount of money in circulation becomes limited. Meanwhile, the variable price of gasoline, diesel price and gross domestic product have a positive but not significant effect on inflation. All parameters are not sensitive to inflation.

4.2. Policy Simulation Results

With the increase in world oil prices, several alternative policies can be carried out by the government in anticipating world oil price shocks. In this study policy simulations were carried out with three alternatives, namely: (1) increasing the price of gasoline and diesel by 20% each, (2) increasing only gasoline and diesel by 20% each and increasing non-fuel subsidies by 20%, and (3) increasing non-energy subsidies by 10% and increasing the price of petrol and diesel by 10% each. The policy simulation results can be seen in Table 5.

The policy simulation results by increasing the prices of gasoline and diesel fuel by 20% each, have the following results: From the fiscal side, it can be seen that there was an increase in government revenue by 0.001% while government spending increased to 0.102%. On the economic performance side, it was found that the gross domestic product decreased slightly, namely 0.001%, while the number of poor people increased by 0.208%, as well as unemployment also increased by 0.217 people. The biggest loss occurred in inflation which increased by 1.112%. This condition is very logical economically because fuel oil, in the form of gasoline and diesel, is the main fuel for land and sea transportation vehicles which directly affect economic activity.

Table 5: Policy simulation results

Variables name	Basic value	Change after simulation (%)		
		S1	S2	S3
Government revenue	1,894,565,431.12	0.001	0.000	0.001
Energy subsidies	1,874,330.31	0.001	0.001	0.006
Nonenergy subsidies	1,565,432.42	0.001	2.115	1.118
Total government spending	2,545,632,112.04	0.102	1.231	0.702
Domestic crude oil prices	60,762.21	3.121	3.061	3.103
Gasoline prices	24,354.21	4.101	4.421	2.405
Diesel prices	17,424.13	5.029	5.501	2.624
Price of kerosene	131,186.22	0.001	0.011	0.004
Avtur price	362,027.80	0.126	0.114	0.094
Provision of fuel	94,578,605.00	0.411	0.502	0.471
Crude oil consumption	86,543,213.00	−0.004	0.104	0.054
Gasoline consumption	45,675,432.20	−0.001	0.004	0.001
Diesel consumption	34,567,321.41	−0.001	0.002	0.001
Consumption of kerosene	23,673,211.32	−0.001	0.001	0.001
Avtur consumption	8,954,321.87	−0.001	0.001	0.001
Total fuel consumption	17,654,322.00	−0.011	0.001	0.001
Gross domestic product	18,099,963.30	−0.001	0.001	0.001
Number of poor people	30,321,114.00	0.208	0.043	0.103
Unemployment number	15,432,004.00	0.217	0.102	0.100
Inflation	0.0423	1.112	1.727	1.422

Source: Processed data

The combined policy simulation results by increasing the price of gasoline and diesel fuel by 20% each and followed by the policy of increasing non-energy subsidies by 20% had an impact, government revenue did not change and government spending increased by 2.115%. In terms of economic performance, there was an increase in gross domestic product by 0.001%, followed by an increase in the number of poor people by 0.034%, and

unemployment by 0.102%, while inflation increased quite high to 1.727%.

The results of the third simulation (S3), namely the simulation of reducing energy subsidies by 10% and increasing the prices of gasoline and diesel fuel by 10% each, found that government revenues increased by 0.001% and government spending increased by 0.702%. On the economic performance side, it shows that the gross domestic product increased, 0.001%, followed by the number of poor and unemployed people increased by 0.103% and 0.100% respectively. Furthermore, inflation increased quite high, namely 1.422%.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Conclusion
The results of the model estimation show that the main factor causing the increase is only domestic oil, in the form of crude oil, gasoline and diesel, namely the increase only in world crude oil. The estimation results of the model show that world crude oil prices have a positive and significant effect on domestic crude oil prices, gasoline and diesel prices, while kerosene and avtur prices have a positive but not significant effect. The estimation results also show that the increase in domestic fuel prices, in the form of gasoline and diesel, can increase the number of poor people, unemployment and inflation in Indonesia.

The results of the policy simulation show that the increase in fuel prices in the form of crude oil and gasoline, diesel, kerosene and avtur has an unfavourable impact on economic performance. The results of policy simulations show that an increase in fuel prices without being followed by an increase in subsidies can have a significant impact on increasing the number of poor people, increasing unemployment and inflation. Likewise with the combination simulation (simulations 2 and 3), but with the addition of non-energy subsidies, the number of poor and unemployed people can be reduced, but inflation will increase higher.

5.2. Policy Recommendations
The increase in the price of fuel oil has had an unfavourable impact on Indonesia's economic performance. Therefore, in the long run, it is necessary to look for renewable energy sources. Such as the use of energy from biofuels (biomass, biodiesel, biogas, and others) as well as other sustainable energy sources. This is necessary for the sake of sustainable development and sustainable economic growth in the future.

6. ACKNOWLEDGMENT

On this occasion the author would like to thank the Chancellor of the University of Muhammadiyah Makassar, Chair of the LP3M, University of Muhammadiyah Makassar and the Dean of the Faculty of Economics and Business, University of Muhammadiyah Makassar and their staff, for the opportunity given. To study the impact of rising fuel prices and government subsidies on Indonesia's economic performance.

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