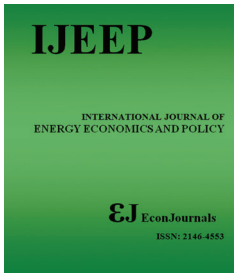

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The Impact of Fuel Oil Price Fluctuations on Indonesia's Macro Economic Condition

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ABSTRACT

Since the beginning of the new order government up to now, Indonesia's economic development constantly influences by fluctuation in fuel oil price. This paper aims to know the impact of fuel oil price change on economic growth, inflation, and poverty in Indonesia using vector auto regression method. Data used in the research are quarterly time series data for 1980-2017 period. The research result indicates that an increase in fuel oil price gives negative impact on Indonesia's economy. Therefore, the government as well as all stakeholders needs to cooperate to reduce the negative impact of fuel oil price on economy.

Keywords: Fuel Oil price, Economic Growth, Inflation, Poverty
JEL Classifications: C32, Q43, Q48

1. INTRODUCTION

The constitution has mandated that production sectors that are vital to the state and that affect the livelihood of a considerable part of the population are to be controlled by the state. Therefore, fuel oil (BBM) as a strategic product and relates to the livelihood of a considerable part of the population should be controlled by the state. In order to encourage economic growth and reduce the society burden, the government takes a policy by setting a fuel price lower than the actual price. The government gives fuel price subsidy to the societies. Thus, the price should be paid by every individual or a company for the fuel is subsidized by the government and the cost is charged to the State Budget (APBN) every year. Due to the increase in consumption volume and world fuel price the fuel oil subsidy is increasing and it is threatening the APBN. In this condition, the government has no other choice than increasing the fuel oil price in the country and adjusts it to the fuel oil price in world market (The Ministry of Finance of the Republic of Indonesia, 2017; Center for Data and Information Technology of Energy and Mineral Resources, 2015).

The fluctuation of world fuel price is increasing in the reform era. The year of 1998 is marked with monetary and economic crisis and the fluctuation in international fuel price that tends to increase causes the government of Indonesia is struggling to meet the state budget (the Ministry of Finance of the Republic of Indonesia, 2017). It is due to, among others, one of the APBN assumptions is world oil price. On the other hand, Indonesia has became a net importer of fuel oil.

In the macroeconomic perspective, the increase in fuel oil price usually follows by a decrease in production volume. In aggregate, it will cause a decrease in total production as well as national income and an increase in unemployment. These conditions are

unexpected by the government, business people, or the society in general. Mankiw (2003) stated that short term fluctuation often occurs in economy. The fluctuation will surely influence the macroeconomic condition, especially national income, inflation, poverty, and job opportunity. The macroeconomic condition of Indonesia, especially in economic growth, inflation, and poverty in 1980-2017 can be seen in Figure 1.

Due to the strategic role of fuel in Indonesia's economy the impact of fuel price fluctuation varies. Several studies have been conducted after oil price crisis in 1970s indicated that the increase in fuel price shock had negative and significant influence on national income. The research result was then made as the basic of justification that the cause of economic crisis is oil price crisis. It occurs in several west Europe countries and the United States of America in the 70s (Hamilton, 1988; 1996).

Actually, since 1997 the government of Indonesia has made several policies to stimulate economic growth in order to reduce poverty in Indonesia. In macro-economy, however, the government still faces two problems that give a short as well as long term important impact. Those problems are: (1) An ever increasing deficit in the state budget, and (2) the slow progress of banking restructurization (Oktaviani, 2000; Yusuf and Resosudarmo, 2008; 2011). An increasing budget deficit gives pressure to state budget, especially in expenses side since the government should pay principal repayments and the interest. It causes the APBN continues to experience a deficit from year to year.

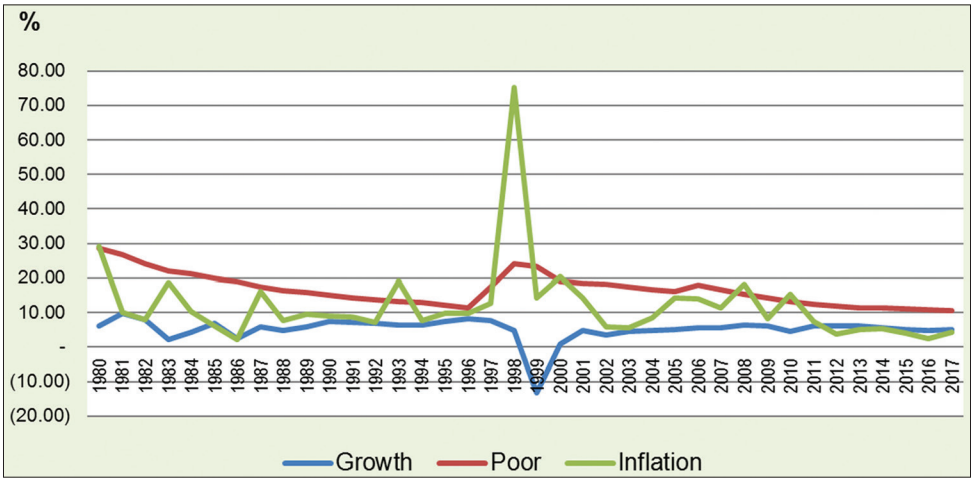
The supply-side fuel price shock effect on economy is, among others: An increase in fuel price causes a decrease in production. The reason is that increases in price affect a decrease in the availability of basic input for production. Therefore, economic growth rate and productivity is decreasing (Nyangarika et al., 2018; Qianqian, 2011; Oktaviani and Sahara, 2005; Nizar, 2012). Fuel price shock could cause an increase in industrial production cost thus decreases the production and increases the number of unemployment (Dogrul and Soytas, 2010; Brown and Yucel, 2002; Lardic and Mignon, 2008; Akhmad, 2014; Akhmad and Amir (2018). Second, consumption and investment effect. An increase in fuel price gives negative impact on consumption and investment. In terms of consumption, it is related to a decrease in society income due to the increase in the price of basic necessities caused by an increase in fuel price. For the company, it causes an increase in the production cost and automatically influences the businessmen in their investment (Kilian, 2008; Henriques and Sadorsky, 2011).

Another impact of an increase in fuel price is inflation. An increase in fuel price also causes an increase in inflation. The increase in fuel price is followed by an increase in the price of non-oil products, such as basic necessities and other consumer goods (Cologni and Manera, 2008). In addition to the direct impacts, there are indirect impacts that related to the company response and worker behavior (second round effects). In general, a company tries to divert an increase in cost production by increasing the product selling price to the consumers. On the other hand, the workers response by demanding a higher wage (Lardic and Mignon, 2008).

In Indonesia, studies on the impact of fuel oil price change on macroeconomic level were conducted by Ikhsan et al., 2005; Aswicahyono et al., 2011; Dartanto, 2013; Oktaviani and dan Sahara, 2005; and Setyawan, 2014. The studies represent a study on fuel oil price increase and its impact on Indonesia's macro-economy. When the oil price in international market in 2003 is under USD23 per barrel it continues to increase until it reaches the peak in 2008, which is USD140 per barrel. In early 2009 the price experiences a sharp decrease to about USD40 per barrel but it is not in a long time. The price is increasing again to about USD90 - USD 110 per barrel in 2011-2013.

Ikhsan et al. (2005) studied the impact of fuel oil price increase in 2005 on poverty using Indoceem Model, which is a computable general equilibrium model developed in 2002 for the Ministry of Mineral Resources Economy aiming to study the energy policies and integrate it with a method for poverty impact developed by the Institution of Economic and Community Investigation, Faculty of Economy and Business, University of Indonesia. The research result indicated that the increase in fuel oil price has potential to increase the absolute poverty rate, nevertheless the poverty rate will decrease if the government includes compensation policies of *raskin* (rice for the poor) and education scholarship to the underprivileged families.

Figure 1: Economic growth, poverty, and inflation in Indonesia in 1980-2017



Based on the reality that fuel price tends to fluctuate and increase as well as several previous studies this research aimed to know the impact of fuel price fluctuation on Indonesia's economy. In the research, there are several macroeconomic variables chosen to know the influence of fuel oil price fluctuation, namely: Gross domestic product (GDP) growth, inflation rate, and poverty rate.

2. DATA AND METHOD

2.1. Data

Data used in the study were time series data for the period of 1980:Q1 – 2017:Q4. The data consisted of: (1) GDP growth, (2) fuel price with premium oil price proxy, (3) inflation rate, and (4) percentage of poor population. The data obtained from Bureau of Statistics, the Ministry of Finance, the Ministry of National Development Planning, and the Ministry of Energy and Mineral Resources of the Republic of Indonesia.

2.2. Analysis Method

The study used vector autoregressive (VAR) model. The analysis chosen with consideration that the method is appropriate to be used in an econometric model that less dependent on theoretical approach aiming to capture the economic phenomenon well. The method is one of time series methods often used in a research, especially in economic field. Gujarati (2004) stated there are various advantages in the use of VAR method compared to other methods: (1) It is simpler since it does not need to separate the independent variables to dependent variable, (2) simple estimation since it uses regular ordinary least square method, and (3) better estimation result than other methods that are complicated.

Regarding the link between variables chosen against the shock in fuel oil price variable and macroeconomic variable in VAR model with order (k), where order (k) indicated lag length (k), VAR model used in the study can be specified in the following equation:

$$VAR\ (k),\ Zt = A1Zt\text{-}1 + A2Zt\text{-}2 + \ldots + AkZt\text{-}k + \varepsilon t \qquad (1)$$

Where:
Zt = Specified time series variable,
Ak = Parameter matrix of n × 1.

If k = 2, specification of VAR model in the research is comprised as follows:

$$X_{it} = \sum_{k=1}^{2} a_{1i} \Delta X_{it-k} + \varepsilon_t \qquad (2)$$

Where:
xi = Fuelp, growth, inflation, poor,
εt = Error term vector (white noise),
i = 1, 2, 3, 4, and
t = time.

The amount of optimal order/lag (k) was tested by looking at Akaike information criterion (AIC) and *Schwartz Bayesian Criterion*.

VAR model in the research included several endogenous variables, namely: Fuel oil price (denoted as FuelP), GDP growth (denoted as growth), inflation rate (denoted as inflation), and percentage of poor population (denoted as poor).

Several tests were conducted before estimation using VAR mode, among others:

1. Stationarity test (unit root test) aims to proof the stability (normality) of pattern in each variable so that the regression result is not fake thus it does not produce wrong interpretation. Therefore, the research used Augmented Dickey-Fuller (ADF) test with the following test criteria: If the absolute value of statistic of the ADF test is greater than the critical value of statistic distribution of MacKinnon (test critical values), which means the probability value is smaller than alpha 0.05, H_0 is rejected meaning that the observed time series data has been stationary. On the other hand, if the absolute value of statistic of the ADF test is smaller than the critical value of statistic distribution of MacKinnon (test critical values), which means the probability value is greater than alpha 0.05, H_0 is accepted meaning that the observed time series data is not stationary.
2. An optimal lag length aims to know the length of period a variable is influenced by its past variables and other endogenous variables. Since VAR model is very sensitive to the number of data lag used, if the lag number set is too long, the degree of freedom will decrease thus eliminate information needed. On the contrary, if the lag number chosen is too short the modeling produced can be wrong (misspecification model). It is marked by the high standard error. There are common parameters used in determining the optimal lag length in VAR model, among others: Likelihood ratio (LR), final prediction error (FPE), AIC, Schwarz information criterion (SC) and Hannan Quinn (HQ). The determination of optimal lag length was obtained from VAR with the AIC, SC or the least LR values (Enders Walter, 2004).
3. Granger's causality test aims to know the existence of causality relationship between two variables. The predictive power of previous information could show the existence of causality relationship between x and y in a long period. The result of Granger's causality is expected to give indication on the existence of causality relationship and the direction of influence between fuel price and the macroeconomic performance of Indonesia.

3. RESULTS AND DISCUSSION

3.1. Result of Stationary Test

The result of unit root test using ADF test method indicated that there was only one variable, economic growth variable, that was stationary in a level, whereas other variables, inflation and poverty, were not stationary in the level. Therefore, stationarity test must be conducted in first difference. After a test in the first difference using ADF Test, all variables had been stationary in a significance level of 5% and 1% (did not contain unit root).

3.2. Optimal Lag Length

To determine the lag length in the research, approaches used were LR, FPE, AIC, SC and HQ. Lag length using the criteria of LR,

FPE, AIC and HQ resulted the least value and most indicated by lag 2, as indicated by mark (*). Therefore, in the following process, to estimate the model of the impact of fuel price change on GDP growth, inflation rate, and poverty rate, lag 2 was used (Table 1).

3.3. Granger's Causality Test

The result of Granger's Causality Test indicated that economic growth had no significant influence on fuel price (Table 2). On the contrary, fuel price statistically had significant influence on economic growth. Next, inflation had no significant influence on fuel price; however, fuel price had a significant influence on inflation.

In addition, poverty had no significant influence on fuel price as well as fuel price statistically had no significant influence on poverty in Indonesia. Further, inflation had a significant influence on economic growth, whereas economic growth statistically had no significant influence on inflation. Poverty had no significant influence on economic growth, on the contrary economic growth had a significant influence on poverty. Lastly, poverty had no significant influence on inflation as well as inflation statistically had no significant influence on poverty.

3.4. VAR Model Estimation Result

Based on the VAR model estimation result, it can be seen that the change in fuel price was positively and significantly influenced by previous fuel price ($FuelP_{t-1}$) and the previous two periods of economic growth ($Growth_{t-2}$). Meanwhile, the previous two periods of fuel price ($FuelP_{t-2}$), previous economic growth ($Growth_{t-1}$), previous inflation rate ($Inflation_{t-1}$), the previous two periods of inflation rate ($Inflation_{t-2}$), previous poor population ($Poor_{t-1}$), and the previous two periods of poor population ($Poor_{t-2}$) had a positive but insignificant influence on fuel price (Table 3).

Further, economic growth was positively and significantly influenced by previous economic growth ($Growth_{t-1}$) and negatively and significantly influenced by previous fuel price ($FuelP_{t-1}$) and the previous two periods of inflation rate ($Inflation_{t-2}$). Meanwhile, the previous two periods of economic growth ($Growth_{t-2}$) had a positive but insignificant influence. Moreover, the previous two periods of fuel price ($FuelP_{t-2}$), previous inflation rate ($Inflation_{t-1}$), previous poor population ($Poor_{t-1}$) and the previous two periods of poor population ($Poor_{t-2}$) had a negative but insignificant influence on economic growth.

Table 1: Optimum lag test results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−2608.873	NA	0.00000000677	36.28990	36.37240	36.32342
1	−1986.940	1200.676	14988184.0	27.87417	28.28664*	28.04178
2	−1849.902	140.6807*	5480016.0*	26.85975*	28.59214	27.56370*
3	−1846.280	5.986582	6546019.0	27.03166	29.09403	27.86969
4	−1833.780	11.59186	8746292.0	27.30250	30.02483	28.40870

Source: LR: Likelihood ratio, FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan Quinn

Table 2: Granger's causality test results

Null hypothesis	Observation	*F*-statistic	*P*
GROWTH does not Granger Cause FUEL_PRICE	150	1.10264	0.4084
FUEL_PRICE does not Granger Cause GROWTH		3.80213	0.0079
INFLATION does not Granger Cause FUEL_PRICE	150	1.63352	0.4322
FUEL_PRICE does not Granger Cause INFLATION		4.69611	0.0032
POOR does not Granger Cause FUEL_PRICE	150	1.20139	0.3178
FUEL_PRICE does not Granger Cause POOR		0.82122	0.4419
INFLATION does not Granger Cause GROWTH	150	10.7313	0.0005
GROWTH does not Granger Cause INFLATION		0.38775	0.6793
POOR does not Granger Cause GROWTH	150	1.05877	0.3495
GROWTH does not Granger Cause POOR		3.99338	0.0099
POOR does not Granger Cause INFLATION	150	0.64735	0.5249
INFLATION does not Granger Cause POOR		0.45564	0.6349

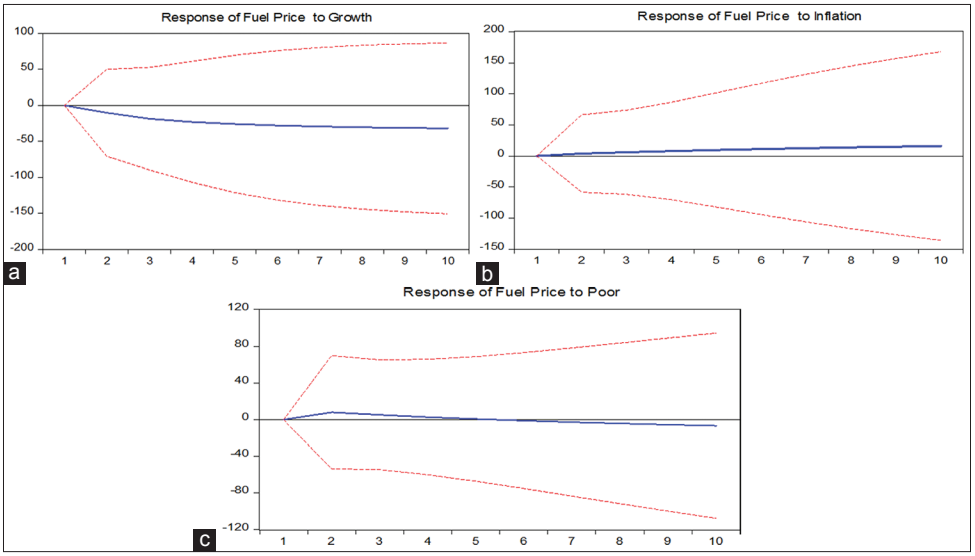
Source: Statistics Indonesia and Ministry of Energy and Mineral Resources, data processing

Table 3: Vector autoregression estimates

Variable	Co	$FuelP_{t-1}$	$FuelP_{t-2}$	$Growth_{t-1}$	$Growth_{t-2}$	$Inflation_{t-1}$	$Inflation_{t-2}$	$Poor_{t-1}$	$Poor_{t-2}$	R^2
$FuelP_t$	141.197	0.98448	0.0076	0.2574	0.1782	1.7454	1.3845	10.554	1.2103	0.980
t-stat	[0.749]	[11.38]	[0.087]	[0.139]	[3.001]	[0.325]	[0.256]	[0.258]	[0.301]	
$Growth_t$	2.0064	−0.2228	−0.1324	0.8258	0.0586	−0.02447	−0.1458	−0.1515	−0.1406	0.892
t-stat	[2.082]	[−3.051]	[−1.072]	[8.774]	[0.637]	[−0.893]	[−2.675]	[−0.726]	[−0.696]	
$Inflation_t$	3.6714	0.1130	0.1007	0.2432	0.1691	0.8572	0.1461	−0.3791	−0.3368	0.775
t-stat	[0.960]	[3809]	[3.153]	[0.651]	[0.469]	[7.889]	[1.345]	[−0.458]	[−0.418]	
$Poor_t$	0.5651	0.0160	0.0570	−0.0184	−0.0267	0.0023	0.0059	0.9068	0.0360	0.957
t-stat	[1.171]	[0.049]	[3.288]	[−0.391]	[−0.581]	[0.213]	[0.432]	[8.689]	[0.360]	

Source: Statistics Indonesia and Ministry of Energy and Mineral Resources, data processing

Figure 2: (a-c) Impulse respon fuel price to growth, inflation, and poor



Source: Results of data processing

Further, inflation was influenced negatively and significantly by previous fuel price ($FuelP_{t-1}$), the previous two periods of fuel price ($FuelP_{t-2}$), and previous inflation rate ($Inflation_{t-1}$). Meanwhile, previous economic growth ($Growth_{t-1}$), the previous two periods of economic growth ($Growth_{t-2}$), and the previous two periods of inflation rate ($Inflation_{t-2}$) had a positive but insignificant influence. Whereas, previous poor population ($Poor_{t-1}$) and the previous two periods of poor population ($Poor_{t-2}$) had a negative but insignificant influence on economic growth.

Regarding the percentage of poor population it was positively and significantly influenced by the previous two periods of fuel price ($FuelP_{t-2}$) and previous poor population ($Poor_{t-1}$). In addition, previous economic growth ($Poor_{t-1}$) and the previous two periods of economic growth ($Growth_{t-2}$) had a negative but insignificant influence on the percentage of poor population. Previous inflation ($Inflation_{t-1}$), the previous two periods of inflation rate ($Inflation_{t-2}$), and the previous two periods of poor population percentage ($Poor_{t-2}$) had a positive but insignificant influence on poor population percentage.

3.5. Impulse Response Function (IRF)

IRF aims to know the behavior of a variable in responding a shock. IRF analysis in this research was used to know the response of change, economic growth, inflation, and poor population percentage towards shock in fuel oil price change. Based on the result of IRF analysis, variables of economic growth, inflation, and poor population percentage included in the model indicated a response as showed in Figure 2.

Shock of one deviation standard of fuel variable in the first quarter was directly responded negatively by economic growth in the first quarter of 0.1648. The negative response of fuel price change towards economic growth continued for a long period and there was no indication towards a balance point or close to zero (convergence). It means that an increase in fuel oil price would continue to be responded negatively by economic growth permanently (Figure 2a).

Shock on fuel price variable in the first quarter was directly responded positively by inflation in the first quarter of 0.0024. The positive response of fuel price change towards inflation would continue in a long term and there was no indication towards a balance point or close to zero (convergence). It indicated that fuel price change will continue to be responded positively by an increase in inflation permanently (Figure 2b).

Further, shock in fuel price change in the first quarter was directly responded positively by poor population in the first quarter of 0.0036. The positive response of fuel change towards poverty would continue until the fourth quarter. In the fifth quarter, there was an indication towards a balance point or close to zero (convergence). Entering the sixth quarter, the impact of fuel prince increase on poverty became negative. It means that in a long term, the change in oil price would be responded negatively by poverty rate (Figure 2c).

4. CONCLUSION AND POLICY IMPLICATION

The occurred shock towards fuel price increase had a negative impact on economic growth and would continue in a long term, permanently. It is an indication that an increase in fuel price causes a slow economic growth. In addition, an increase in fuel price also had a positive impact on inflation and it continued in a long term. Moreover, an increase in fuel price also had positive impact on poverty in a short term. It indicated that an increase in fuel price caused an increase in the number of poor population in Indonesia in a short term. The result indicated that an increase in fuel price, generally, gave negative impact on Indonesia's economy. Therefore, the government along with all stakeholders need to work together to reduce the negative impact of fuel price increase on macro economy.

In a condition of high world fuel price, oil import will give more weight to the state and society in general. Therefore, it is time for

the government to shift into available and abundant alternative energy sources. In addition, the government needs to find and use renewable energy sources. The government also needs to shift to the use of energy sourced from renewable energy sources, such as the use of water, wind, biofuels, and other renewable energy sources.

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