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PROCEEDING

THE 14th IRSA INTERNATIONAL CONFERENCE 2018

Strengthening Regional and Local Economies

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TRANSMISSION MECHANISM OF WORLD OIL PRICE FLUCTUATIONS EFFECTS ON MACROECNOMICS IN INDONESIA (IS-MP-PC MODEL)

Hom Ria Anjasari, Sebastiana Viphindrartin, Aisah Jumiati
Departement of Economics, Faculty of Economics and Business,
University of Jember
Corresponding Author:
Pipin_center@yahoo.com

ABSTRACT

The issue of world oil price fluctuations has been a concern in recent decades, as countries in the world both exporting and oil importing countries are affected by world oil price fluctuations. Indonesia as a country that has the characteristics of small open economy certainly can not be separated from the effects of world oil price shocks. This study aims to see whether or not the effect of short-term and long-term effects of world oil price fluctuations on macroeconomics in Indonesia from 1985 to 2016 using the Vector Error Correction Model (VECM). The Indonesian macroeconomic variables used are economic growth, exchange rate, government expenditure and tax revenue included into Investment-Saving (Model IS), interest rate included into Monetary Policy (MP Model), and inflation included into Philips Curve (PC Model). Impulse response functions (IRF) are used to describe the response of world oil price shocks to macroeconomics in Indonesia. The results of this study indicate that in the short term all variables included in the model of IS-MP-PC in the previous year have a significant effect due to the effects of world oil price fluctuations. However, in the long run only four variables that have a significant effect on the effects of world oil price fluctuations include inflation, interest rates, government spending and tax revenues. Meanwhile, the response shown by each macroeconomic variables on the effect of world oil price fluctuation varies according to the condition of Indonesian economy. Overall all macroeconomic variables show stability response in the period of 10 to the end of the period. However, of all variables only economic growth variables and exchange rates that respond negatively to the effects of world oil price fluctuations.

Keywords: World Oil Price, Government Expenditure, Tax Revenue and VECM.

INTRODUCTION

The oil price shocks have been one of the issues discussed in the energy economy literature since the mid-1970s. Therefore, the oil price shock in 1973 continued to increase and become the talk of the economy that has never happened before. Changes and fluctuations in oil prices can directly hamper the growth of emerging economies and oil importing countries (Aimer, 2016). Indonesia as a developing country highly vulnerable to affected world oil price shocks. The increase in world oil prices continue to cause rising prices in the country increased the impact will be inflation.

The movement of world oil prices fluctuated causing almost all countries to worry about this condition. The increase of world oil prices could put pressure on macroeconomic variables of a country. Based on the results of research Cunado and de Garcia (2005) states that in the short term the world oil price shocks have a less significant effect on inflation and economic activity in Asian countries. While Jimenez and Sanchez (2004) stated that the increase in oil prices had a significant effect on inflation only in a few countries that joined the OECD in the short term.

Brown and Yucel (2002) stated that the increase in oil prices is temporary, the effect on output in the short term becomes greater in than the long-term effects can be managed so that the level of consumption. In addition, it can increase the real interest rate in equilibrium conditions. With the slowdown in output growth and rising real interest rates, the demand for real cash balances fall, and to a certain monetary aggregate growth rate, inflation rate increases. Therefore, the oil price increase lowers GDP growth and increases in real interest rates and the inflation rate measured (Ito, 2010).

Based on the data Reports U.S. Energy Information Administration The development of world oil prices from 1985 to 2016 as a whole can be said to have 4 fluctuations.

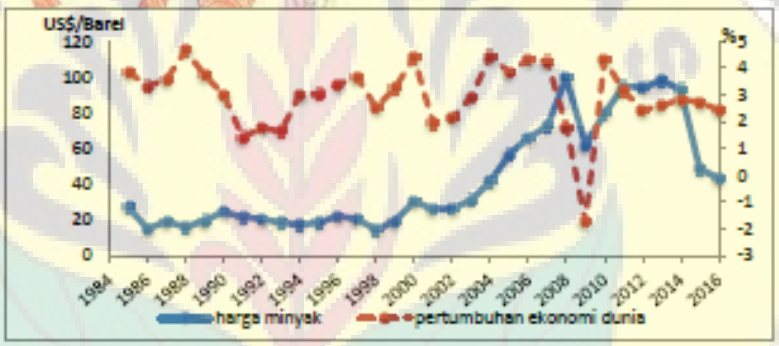


Figure 1. The movement of world oil prices and World Economic Growth Year 1985-2016 (Source: U.S. Energy Information Administration and the World Bank, processed).

World oil price in 1985 reached 27.01 US $ / barrel ago in 1986 decreased by 15,05 US $ / barrel then increase until 1990 become equal to 24,53 US $ / Barel. In 1991 the world oil price again decreased by 21.54 US $ / barrel and the lowest point was in 1998 which amounted to 14.42 US $ / barrel, then increased drastically until the year 2008 amounted to 99.67 US $ / Barel. In 2009 it decreased by 61.95 US $ / barrel and increased again from 2011 to 2013 at 94.05 US $ / Barel to 97.98 US $ / Barel but in the following year decreased until 2016 by 43 , 29 US $ / Barrel. On the demand side, the behavior of oil prices is strongly influenced by world economic growth. Experience has shown that an increase in demand for oil which then drives up oil prices is preceded by high global economic growth.

From the facts of world oil price movements indicate that Indonesia needs to understand the conditions in the global market. Therefore, if the Government of

Indonesia misunderstands the impact of world oil price fluctuations shocks, it will be under threat in the economic instability of the country. Efforts to anticipate and soak the negative impact of world oil price shocks required an effective and efficient macro policy. Macro policies are essential to maintain economic stability by promoting economic growth and people's welfare by utilizing a transmission mechanism to overcome the effects of world oil price fluctuations on macroeconomics in Indonesia. The purpose is to analyze the influence of the mechanism of transmission of the effects of world oil price fluctuations on macroeconomics in Indonesia in the long run.

METHODOLOGY

This research uses Vector Autoregressive (VAR)/VECM method to know the influence and response of world oil price fluctuation in influencing macroeconomic variable in Indonesia. The model specification used in this study IS-MP-PC model or also called Three Equation Model is a macroeconomic model used to combine demand side, economic supply side, and monetary regulation from central bank at any given period (Whelan, 2015) .

The IS function (Investment-Saving) model

$$Y = f(Y,\ r,\ Tx,\ G,\ \varepsilon)$$

The MP function (Monetary Policy) model

$$r = f(r,\ \pi,\ \pi^{*})$$

The PC function (Philips Curve) model

$$\pi = f_{\pi}(\pi^{h}, \epsilon^{*})$$

where Y is GDP, r is the interest rate, Tx is tax revenue, G is government expenditure. while ε is the exchange rate, π is inflation, π^{*} as inflation expectation and π is the world oil price. the adoption of the model will then get the simplification of the model in accordance with the proxy macroeconomic variables. So get the economic model as follows:

$$OIL = f(GDP, INF, INTR, ER, TX, GOV)$$

INF as inflation notation, INTR is the interest rate, ER as the exchange rate. While Tx is tax revenue and GOV is government expenditure. The characteristics of the VAR / VECM model lie in the variables present in the VAR / VECM model in which between the endogenous and exogenous variables are indistinguishable, but all endogenous and exogenous variables are treated equally without distinction (Gujarati, 2004; Nachrowi, 2006). In general can be written the basic form of VAR model that is (Gujarati, 2004):

$$X_t = \beta_0 + \beta_1 X_{t-1} + \beta_n X_{t-n} + e_t$$

Then the above VAR model is derived into the basic model of VECM. The basic model formulation of VECM can be written as follows: (Achsani et al, 2005).

$$\Delta X_{t-1} = \alpha_0 + \sum_{i=1}^{k-1} \Gamma \Delta X_{t-i} + \alpha\beta' X_{t-k} + \varepsilon_t$$

Where, $\Gamma \Delta X_{t-i}$ is a short-term relationship variables, α_0 is the intercept coefficient, α yaitu *parameter atau speed of adjustment* . β' is a long-term equilibrium coefficients, and k is the length of the lag. To overcome the first-difference VAR and to recover the long-term relationship between variables, VECM can be used, as long as there is cointegration between variables. The trick is to put the original equations in the level into the new equation. The following equation VECM models (Ascarya, 2012):

$$\Delta Y_t = b_{10} + b_{11}\Delta Y_{t-1} + b_{12}\Delta Y_{t-1} - \lambda(y_{t-1} - \alpha_{10} - \alpha_{11} y_{t-2} - \alpha_{12} z_{t-1}) + \varepsilon_t$$

$$\Delta Z_t = b_{20} + b_{21}\Delta Y_{t-1} + b_{22}\Delta Y_{t-1} - \lambda(y_{t-1} - \alpha_{20} - \alpha_{21} y_{t-2} - \alpha_{22} z_{t-1}) + \varepsilon_t$$

Where α is the long-term coefficient, and b is the short-run coefficient, λ is the error correction parameter, and the y and z variables must indicate cointegration or phrase in parentheses denoting cointegration between variables y and z.

RESULTS AND DISCUSSION

Estimation of Vector Error Correction Model (VECM) is a form of VAR model terestriksi. Additional Restriction of this VAR model can be done because of a data that is not stationary but occurs cointegration. VECM model estimation is able to see a long-term relationship endogenous variables that converge into a cointegrated relationship, but still allowed and can explain the existence of dynamic models in the short term. in Table 1. It shows that there are several variables that show significant in the long run against other variables such as inflation, interest rate, government expenditure and tax revenue. A significant variable can be determined by looking at and comparing t-statistics with t-tables of 1%, 5%, and 10%. In this study, t-tables were used in sequence ie 2.78744; 2.05954; and 1.70814.

Table 1. Test Results VECM estimates in the Long Term

	Long Run	
Variables	Coefficient	T-statistik
LOGOIL(1)	1.00000	-
GDP(-1)	0.05523	0.53528
INF(-1)	0.253274	6.40571*
INTR(-1)	0.155922	4.36669*
LOGER(-1)	0.20953	0.95013
GOV(-1)	-0.604524	-4.41521*
TR(-1)	0.202043	2.19470**

Description: *) significant at α = 1%, **) significant at α = 5%, ***) significant at α = 10%,

Based on the results of VECM estimates in the short term in Table 2 below, it shows that in one lag the pattern of world oil price developments is influenced by interest rate variable in the previous year. Economic growth, inflation, government spending are affected by world oil prices in the previous year in the short term.

Table 1. Test Results VECM estimates in the Short Term

	Jangka Pendek		
Variabel Dependen	variabel Independen	Koefisien	T-statistik
D(LOGOIL)	D(INTR(-1))	0.020909	1.81812***
D(GDP)	D(LOGOIL(-1))	4.309938	2.10771**
	D(OOV(-1))	2.280879	2.46243**
D(INF)	D(LOGOIL(-1))	12.75006	2.15346**
	D(GDP(-1))	-2.191486	-2.01205***
	D(INF(-1))	-0.836885	-1.92623***
	D(OOV(-1))	-7.411235	-2.75823**
D(INTR)	D(GDP(-1))	-2.186001	-1.43283*
	D(INF(-1))	-0.972412	-3.58863*
	D(OOV(-1))	-4.27624	-2.49383**
D(LOGER)	D(INF(-1))	-0.023511	-2.27063**
	D(LOGER(-1))	0.628003	1.71046***
	D(OOV(-1))	-0.162636	-2.47934**
	D(TR(-1))	0.031476	1.84851***
D(OOV)	D(LOGOIL(-1))	1.376196	3.00034*
	D(OOV(-1))	0.379734	1.82423***
D(TR)	D(TR(-1))	-0.462946	-2.74697

Description: *) significant at α = 1%, **) significant at α = 5%, ***) significant at α = 10%,

First, the long-term estimation results are seen in the PC model (Phillips Curve), which has significant and positive impact on the world oil price uncertainty. The world oil price fluctuations can result in high inflation pressures in the economy (Hooker, 2002 and Tang et al, 2010). The increase in world oil prices create high inflation rate by providing a consequence for oil importing countries to keep oil imports at high prices (Barsky and Kilian, 2004; Farzanegan and Markwardt, 2009). In the short term shows that the world oil price fluctuations positively significant effect on inflation. This is consistent with the results of research from Wake, Dhany (2012) where the world oil price shocks have an impact on the high inflation rate in the short term. This means that an increase in world oil prices may increase the price of oil-based products and industrial costs in importing countries which are then transmitted to the inflation path and encourage an overall price increase in the country (Mariyani, 2007: 78).

Second, the long-term estimation results are seen in the MP model (Monetary Policy), which indicates that the interest rate variable has significant and positive influence on the fluctuation of world oil price. The results of this analysis is congruent with research conducted by Ito (2010) which states that the increase in oil prices can be reduced GDP and may increase the interest rate and inflation targets. The decline in industrial production growth triggered a rise in price of the product (cost push inflation) along with rising inflation due to world oil price innovation. In an effort to curb inflation and as a result of world oil price shock that the central bank issued a tight monetary policy (tight money policy) as seen from the increase in the domestic interest rate or BI rate (Kumar, 2009).

While in the short term, the estimation of MP (Monetary Policy) model is the interest rate of the year is now influenced by other macroeconomic variables such as economic growth, inflation and government expenditure in the previous year. It is indicated that economic growth, inflation and government expenditures significantly and negatively affect interest rates in Indonesia. These results are in line with the findings of Harahap, et al (2015) that external shocks can respond to an increase in the interest rate of the United States of America in line with the pressure of capital outflow and a negative impact on economic growth in Indonesia.

Third, the long-term estimation result is seen in the IS-Investment (Saving) model, which is Government Spending variable indicated to have a significant and negative influence on the fluctuation of world oil price. The result of this analysis is similar to the research conducted by Dizaji (2014) stating that the existence of world oil price shocks causes state spending to decline in the long term. In addition, in the long run the government will reduce the level of economic dependence on the use of oil and switch to more environmentally friendly energy sources. This has prompted the government's efforts to slowly reduce subsidies to allow people to shift to the use of cleaner and environmentally friendly energy sources.

While in the short run the estimation result of IS (Investment-Saving) model that is Government expenditure year is now influenced by variable of world oil price in previous year. Indicated that world oil prices in the previous year had a significant and positive effect on government spending in the current year in Indonesia. These results are in line with the findings of Aprilta (2011), namely the fluctuation of world oil prices in the short term affect the government spending through fuel subsidies (Fuel Oil). To ensure the purchasing power of the people at a time when world oil prices are soaring,

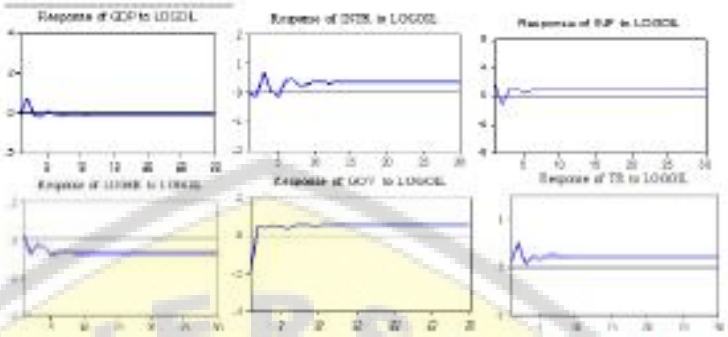
the government continues to implement subsidized policies. The burden of subsidies to be borne by the government is greater when oil prices continue to increase.

Fourth, the long-term estimation is seen in the IS-Investment (Saving) model, which indicates that tax revenue variable has significant and positive influence on the fluctuation of world oil price (Table 4.9). The results of this analysis are consistent with research conducted by Farzanegan (2011) which states that when world oil prices experience a shock will cause a budget deficit that the government begins to pay attention to state revenues by encouraging increased tax revenues to cover the fiscal deficit in the state budget.

Fifth, the long-term estimation is seen in the IS (Investment-Saving) model, which is the indicator of economic growth indicated to have an insignificant effect on the fluctuation of world oil price. The result of this analysis is similar to the research conducted by Nuraini, 2012 which stated that the GDP response to the shock of world oil price is due to the subsidized domestic fuel price. So that the world oil price hike responded by increasing the subsidy of domestic fuel price in order to be able to reach the society, then economic growth will remain stable will not be affected by the fluctuation of world oil price. But in the short run, the estimates show that economic growth is affected by fluctuations in oil prices in the previous year and government spending in the previous year.

Sixth, long-term estimation results are seen in the IS-Investment (Saving) model, which indicates that the exchange rate variable has no significant effect on the fluctuation of world oil price. This result is in line with Aprilia research, F (2011) which states that the increase of world oil price has no significant effect on rupiah exchange rate. Then, the exchange rate will be maintained or stabilized when the world oil fluctuates, because the government's exchange rate system in maintaining the stability of the rupiah is from the floating exchange rate system is controlled to float free despite rising world oil prices. While in the short term, the estimation result on IS model (Investment-Saving) model indicates that the exchange rate variable is not influenced by the fluctuation of world oil price in the previous year. But it is influenced by the exchange rate itself, government spending and tax revenue in the previous year.

In this study, in analyzing the response of world oil price shocks can be proxyed with macroeconomic variables that enter into IS-MP-PC model during the next 30 periods. From the IRF test results found that all macroeconomic variables in Indonesia responded to the world oil price shocks in the early period until the 9th period. However, in the period 10 to the end of the macroeconomic variable response period it shows the pattern of development of the response to balance and stable.



Overall, in relation to the transmission mechanism is not the main focus of the analysis in this study, since the VECM model has restricted the VAR model according to the theoretical relation so that the relation between the mechanism of transmission of the effects of fluctuations and the shocks of world oil prices becomes clear. Disclosure of the transmission mechanism in this study is intended to strengthen the suspicion of transmission of oil price shocks to macroeconomic variables. However, in analyzing the transmission mechanism (relationship map), the main analysis of the study remains based on analysis of VECM estimation results and impulse response functions (IRF).

Figure 3. Transmission Mechanism Effects of World Oil Price Fluctuations on Macroeconomics in Indonesia (Source: Prepared Writers, 2018)

The relationship mapping (mechanism of transmission) of the impact of world oil prices on Indonesia's macroeconomic variables in this study, uses the VECM estimation model results seen in (Figure 3). Simply put, the mechanism of external shock transmission to macroeconomic variables can be seen through the shocks of world oil and food prices. Furthermore, world oil price shocks can push the real exchange rate depreciate and inflation. The rise in prices of domestic goods causes consumer purchasing power to decline. While on the industrial side, high world oil prices are transmitted through inflation and impact on increased production costs. Then, the output produced by the company or industry decreases. The fall in output causes unemployment to increase so that economic growth slows.

CONCLUSION

1. In the short run oil price fluctuations have a significant and positive effect on economic growth (GDP), but in the long term economic growth (GDP) does not significantly influence the fluctuation of world oil prices.
2. In the short run and long term oil price fluctuations have a significant and positive effect on inflation.
3. In the short term oil price fluctuations have a significant and negative effect on the interest rate through the variable of economic growth (GDP), inflation, and government expenditure. However, in the long term the interest rate has a significant positive effect.
4. In the long term oil price fluctuations have no significant effect on the exchange rate. However, in the short term the exchange rate has significant and negative effect through inflation variable and government expenditure on the fluctuation of world oil price.
5. In the short run oil price fluctuations have a significant and positive effect on government spending. However, in the long run, government expenditures have significant and negative effect on world oil price fluctuation.
6. In the short term oil price fluctuations have no significant effect on tax revenues. However, in the long term, tax revenues have a significant and positive effect on world oil price fluctuations.

Based on the results of Impulse Response (IRF) that has been done can be concluded that the response of macroeconomic variables Indonesia over the shocks of world oil prices found more significant and permanent. Overall all macroeconomic variables in Indonesia show stability response from period to 10 until the end of period. Meanwhile, world oil price shocks are responded negatively by economic growth (GDP) and exchange rate (LOGER). While other variables such as inflation (INF), interest rate (INTR), government expenditure (GOV), and tax revenues respond to world oil price shocks positively.

Then for the transmission mechanism itself in this study is not the main focus in analyzing the estimation results. However, from various empirical studies it can be seen that the effects of external shocks through world oil prices are directly seen most dominantly transmitted through inflationary channels, interest rates and government spending. While other variables transmit the external shock effect of world oil prices indirectly. It can be concluded that to reduce the effects of external shocks that fluctuations in world oil prices can be used by using policy approaches on the visible side with macroeconomic variables in determining the policies used for the world oil price shocks, especially Indonesia as an oil importer country.

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