RELATIONSHIP BETWEEN CRUDE OIL PRICE FLUCTUATIONS, ECONOMIC GROWTH, INFLATION, AND EXCHANGE RATE IN INDONESIA 1967-2019

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Abstract

Economic fluctuations can be caused by demand shock and supply shocks. Supply shocks are caused by changes in world crude oil prices. As a net importer of crude oil, change in crude oil prices makes domestic economic activity vulnerable to these shocks. The purpose of this study was to determine the effect of fluctuations in world crude oil prices on economic growth, inflation, and exchange rates in Indonesia. The type of data used is secondary data sourced from the BP Statistical Review of World Energy and the Worldbank. This research uses the VAR/VECM method during the period 1967-2019. The results showed that world crude oil prices had a significant positive effect on economic growth and had a significant negative effect on inflation and the exchange rate in the long run. In the short term, world crude oil price fluctuations do not significantly affect economic growth, inflation, and the exchange rate. Overcoming world oil prices by increasing the availability of alternative energy and maintaining alternative energy prices through administered price policies. To reduce the depreciation of the exchange rate, larger foreign exchange reserves are needed as well as the development of research for the use of cheaper renewable energy.

Keywords: *World Crude Oil Price, Economic Growth, Inflation, Exchange Rate, VAR/VECM*

1. INTRODUCTION

The economy experiences fluctuations in economic activity as measured by real economic growth, both in the short and long term. Economic fluctuations are caused by changes in aggregate demand or aggregate supply. These changes are referred to as supply and demand shocks. Supply shocks are shocks that can change the cost of producing goods and services so that they have a direct impact on price changes, for example, an increase in world oil prices by OPEC (Organization of Petroleum Exporting Countries). Demand shocks occur due to changes in determinants of aggregate demand such as consumption, investment, government spending, net exports, national income, money supply, inflation, and exchange rates (Mankiw, 2006).

Crude oil is a fossil resource. This commodity is used as the main input in producing energy sources. Before it can be utilized, crude oil must go through an oil refinery to be processed into products that can be used directly, such as gasoline, diesel, kerosene, LPG and so on. It is these uses that make crude oil prices a hot topic at the international level. This is because not all countries have sufficient crude oil resources to meet their country's energy needs, while the crude oil

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commodity itself experiences fluctuating price movements.

Based on the BP Statistics Review of World Energy 2020 data report, during the period 1967 to 2019, the price of crude oil in the world initially fluctuated insignificantly, wherein 1967 the oil price of crude oil amounted to the US $ 1.80 per barrel which was able to last until 1970. Then in 1971 the price of crude oil rose to US $ 2.24 per barrel and continued to increase until 1974 amounting to the US $ 11.58 per barrel. Then in 1975, it decreased by the US $ 11.53 per barrel. However, it experienced a quite drastic increase again until 1980, amounting to the US $ 36.83 per barrel. Then the oil price decreased until 1986 by the US $ 14.43 per barrel. After that year, crude oil experienced fluctuating price fluctuations compared to the initial years where the price of crude oil was the only US $ 1.80 per barrel. The highest increase occurred in 2012 which was able to penetrate the price of US $ 111.67 per barrel and ended in 2019 the price of crude oil fell to the US $ 64.21 per barrel. Figure 1.1 shows briefly the fluctuations in the price of crude oil in the world.

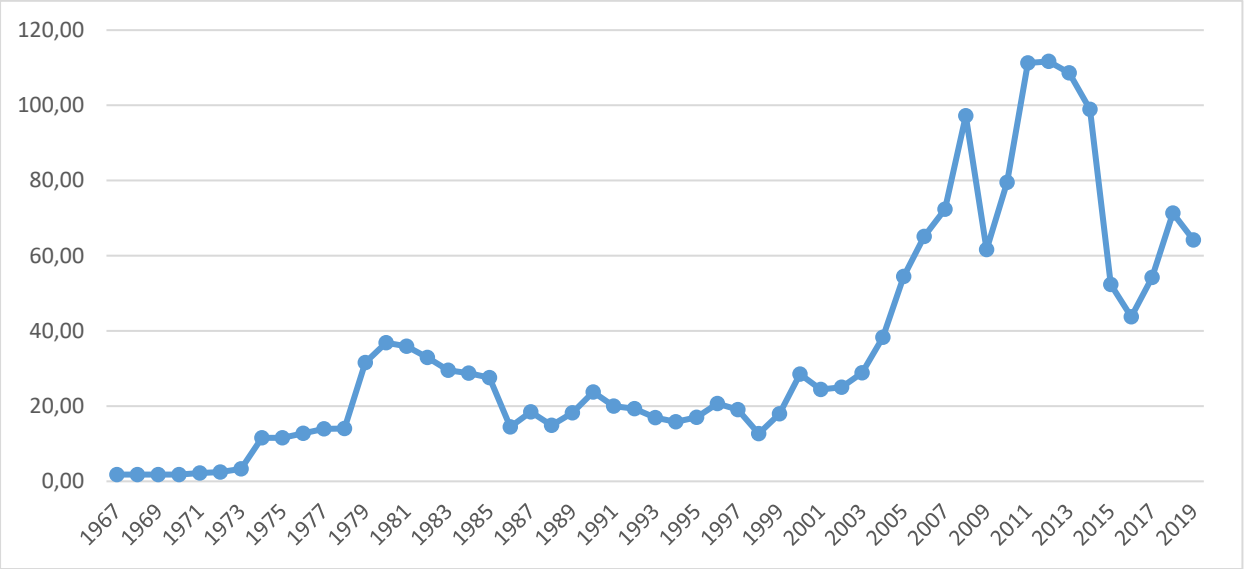

Figure 1.1 World Crude Oil Price 1967-2019 (US $ Per Barrel)

Source: BP Statistical Review of World Energy 2020

In general, the price is formed by the interaction of market supply and demand, so it is different from the commodity crude oil. The amount of demand for crude oil depends on the needs of the importing country, while the amount of supply depends on the amount of supply where climatic conditions also affect the size of the crude oil reserves owned by the exporting country. Muradov, et al (2019) revealed that political factors also affect oil prices because oil and oil products have a very prominent role in important areas of the country's economy.

Following this statement, the events of 1973 as a result of the fallen war and the Iranian revolution in 1979-1980 increased the price of crude oil which was originally only US $ 2.89 per barrel to the US $ 11.58 per barrel in 1974. Then, in 1980 the world crude oil price continued to rise, breaking through the price of US $ 36.83 per barrel. These factors cause crude oil to be different from other commodities because there are external factors that can influence the fluctuations in the price of crude oil in the world in addition to the prevailing axioms in the crude oil commodity market.

In the Indonesian economy, the commodity crude oil is used to support the domestic production of goods and services. Therefore, the increase in crude oil consumption in Indonesia is on average 0.5 percent per year (BP Statistical Review of World Energy, 2020). Seeing this condition, the domestic economy is very vulnerable to movements in the price of crude oil in

the world. This is due to changes in Indonesia's economic structure which have turned into a net importer of crude oil. Unlike the case with an export-oriented economy, it will be profitable because it will provide a windfall profit (sudden gain). Indonesia experienced such conditions during the New Order era, to be precise in 1973-1974, the boom in crude oil prices in that year gave benefits to the performance of the domestic trade balance. This is due to Indonesia's position at that time as a net exporter of crude oil. On the other hand, because crude oil is a non-renewable natural resource, this does not last long. It is proven that in 2001 the performance of domestic crude oil production began to decline. This condition made Indonesia have to leave OPEC's membership and officially became a net importer of crude oil in 2008.

After Indonesia resigned from OPEC, energy needs derived from crude oil were supported by imports from abroad. Although crude oil is the main input in driving the flow of goods and services, dependence on imports of crude oil will affect the domestic economy. Gonzalez and Sherzod (2009) state that oil is a commodity that is different from other commodities because oil is one of the production inputs capable of directly affecting economic growth, both positive and negative, causing inflation and a recession. Meanwhile, Nally (2017) states that oil as a strategic commodity drives the engine of economic growth, accelerates technological change, and increases productivity.

The relationship between fluctuations in world crude oil prices and economic growth in Indonesia means that when the price of crude oil rises, domestic companies should reduce their output because oil is considered one of the production inputs. So that the resulting output will decrease because the input costs are expensive. The effect is that this reduction in output in the aggregate will cause economic growth to decline. However, looking at real data in Indonesia, the level of domestic crude oil consumption shows a significant increase. (BP Statistical Review of World Energy, 2020). This increase in consumption indicates that the domestic economy is not affected by the fluctuating movement of crude oil prices in the world.

Over time, when Indonesia became an importer of crude oil and previously had the largest crude oil reserves, the fluctuations in crude oil prices in the world caused economic turmoil in the country. The data show that the increase in crude oil prices in 2004-2006 led to an increase in inflation which was originally 2004 amounted to 6.06 percent, increased to 10.45 percent in 2005. Then continued until 2006 to 13.10 percent. Also, in another period the increase in oil prices that occurred in 2011 led to an increase in inflation by 5.13 percent to 5.35 percent in 2011. Then in 2017 it also increased the increase in crude oil prices and inflation also increased the price of crude oil, where inflation rose by 3.80 percent which was originally only 3.52 percent. Although the increase in the price of crude oil in the world is in line with the increase in inflation in Indonesia, the increase in inflation is on a downward trend.

The development of Indonesia, which turned into a crude oil importer country, made the rupiah exchange rate vulnerable to the effects of these crude oil price movements. This is because the exchange rate is used as a means of exchange in trading crude oil. Crude oil import activities require foreign currency to pay import bills. If the price of crude oil in the world increases, the demand for foreign currencies will increase, which will result in the depreciation of the domestic rupiah.

2. LITERATURE STUDY

The theory of economic fluctuation is based on the effects of shocks that result from changes in aggregate supply and demand. OPEC's behavior in implementing policies to reduce crude oil supply has increased oil prices. In the short run, the supply curve (SRAS) will move upward to become the supply curve (SRAS2). If the aggregate demand (AD) is constant, the economy will move according to the supply curve, which is that from point A moves to point

B. In this case, it will automatically increase the price from P1 to P2, the output will fall from Y1 to Y2. Then the increase in price and decrease in output is known as stagflation, namely stagnation (decrease in output) and inflation (increase in prices). Figure 1.2 shows the economic fluctuation caused by supply shocks.

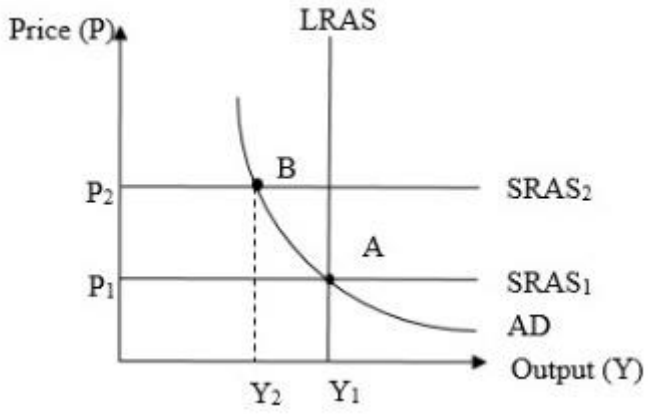

Figure 1.2 Supply Shock
Source : Mankiw (2006)

As shown in Figure 1.2, cases of stagflation throughout history have occurred in the 1970s, namely that some industrialized countries in the United States which at that time depended on imports of crude oil were affected by the reduction in oil supply by OPEC. This has increased the price of crude oil in the world. As long as Indonesia becomes a net exporter of crude oil, the abundance of production factors will provide an advantage when the price of crude oil in the world increases. However, the continuous exploitation caused a decrease in crude oil reserves in Indonesia and even made Indonesia a crude oil importer country and left OPEC membership in 2008. Such conditions make domestic economic activity vulnerable to shocks caused by fluctuations in crude oil prices. world.

An increase in world crude oil prices can cause cost-push inflation so that production will decrease which results in high production costs. The decline in production has an impact on unemployment so that economic growth decreases. The inflation that occurs causes the price of Indonesian products to be more expensive than foreign prices, resulting in a depreciation of the rupiah. Seeing the importance of oil commodities in influencing output in the domestic economy, this study analyzes the macroeconomic variables in Indonesia which can be affected by fluctuations in world crude oil prices. As for previous researchers who examined similar topics such as Ichsandimas and Cahyadin (2014) using research data for the years 1980-2010, the results show that world oil prices have a positive relationship to GDP and inflation. Syamila, et al (2020) in their research revealed that every movement in world oil prices does not affect inflation, but on the other hand GDP increases and the exchange rate appreciates, this study compares when Indonesia became a net exporter and net importer of crude oil in the 1991-2015 period. Besides, Nizar (2012) also researched in 2000-2011 using the VAR method. The difference between this study and the previous research is that during the research period it was carried out, starting from the period of Indonesia as a net exporter to the period when Indonesia turned into a net importer of crude oil.

3. RESEARCH METHODOLOGY

This study using the VAR/VECM analysis method. The model used refers to the standard VAR model issued by Sims, which is a model that functions to form relationships between variables and their past and by entering the lag of all variables in the model (Ekananda, 2016).

Meanwhile, VECM analysis will be used if a variable is found that is not stationary at the level and there is cointegration. The VAR model can be written in the following equation:

$$Y_t = \beta_0 + \sum_i^k \beta i Y_{t-i} + \sum_i^k \beta i X_{t-i} + \ldots + \varepsilon_t \quad (1)$$

$$COP_t = \beta_{01} + \sum_{i=1}^k \beta i COP_{t-i} + \sum_{i=1}^k \gamma i GDP_{t-i} + \sum_{i=1}^k \vartheta i INF_{t-i} + \sum_{i=1}^k \delta i OER_{t-i} + \varepsilon_{1t} \quad (2)$$

$$GDP_t = \beta_{02} + \sum_{i=1}^k \beta i COP_{t-i} + \sum_{i=1}^k \gamma i GDP_{t-i} + \sum_{i=1}^k \vartheta i INF_{t-i} + \sum_{i=1}^k \delta i OER_{t-i} + \varepsilon_{2t} \quad (3)$$

$$INF_t = \beta_{03} + \sum_{i=1}^k \beta i COP_{t-i} + \sum_{i=1}^k \gamma i GDP_{t-i} + \sum_{i=1}^k \vartheta i INF_{t-i} + \sum_{i=1}^k \delta i OER_{t-i} + \varepsilon_{3t} \quad (4)$$

$$OER_t = \beta_{04} + \sum_{i=1}^k \beta i COP_{t-i} + \sum_{i=1}^k \gamma i GDP_{t-i} + \sum_{i=1}^k \vartheta i INF_{t-i} + \sum_{i=1}^k \delta i OER_{t-i} + \varepsilon_{4t} \quad (5)$$

Where:

COP = World Crude Oil Price

GDP = Economic Growth

INF = Inflation

OER = Exchange Rate

β = Constant

i = Lag Length

ε = Shock

The data type in this research is time series from 1967-2019. The variables used are world crude oil price expressed in US dollar barrels, economic growth and inflation expressed in percent, and the exchange rate expressed in LCU per US dollar. The data sources used are from the world bank and the BP Statistical Review of World Energy. The test step begins with a data stationarity test to determine the stationarity of data that does not contain a unit root. The second step is to test the lag length to find out the optimal lag that can be determined. A lag that is too short causes a model that is not dynamic and a lag that is too long will reduce the degree of freedom. Then the third step is a stability test to determine the level of validity of the data to explain the Impulse Response Function, after that the fourth step is a cointegration test to find out the next step is to continue using VAR or switch to using VECM. The causality test is the fifth test that serves to determine the causality between variables. After that is the VECM estimation test to determine the long-term results (cointegration). Impulse response function (IRF) and Variance Decomposition (VD) tests are the last tests that are useful for determining the effect of shocks and the magnitude of their contribution to the variables being tested.

4. RESULT AND DISCUSSION

The results of the analysis in this study were carried out through several stages including the stationarity test, the lag length test, the stability test, the cointegration test, the causality test, the VAR / VECM estimation test, the impulse response function (IRF) test, and the variance decomposition (VD) test.

Stationarity Test

The stationarity test is carried out for each variable which functions to test the stationarity so that the variables used do not contain spurious regression. The probability value using the

Augmented Dickey-Fuller Test shows the stationarity test results as in Table 1.1 that only the variables of economic growth and inflation are stationary at the level. Meanwhile, the variables of world crude oil prices and exchange rates are not stationary at the level. This is because the probability value is greater than alpha 0.05. A probability value that is greater than alpha 0.05 indicates that the variable contains a unit root. Therefore, a stationary test was carried out at the first difference level and the overall stationary variables at the first difference level.

Table 1.1 ADF Stationarity Test Results

Variable	*Augmented Dickey-Fuller Test*			
	Level	**Information**	***First Difference***	**Information**
COP	0.5401	Not stasionery	0.0000	Stasionery
GDP	0.0000	Stasionery	0.0000	Stasionery
INF	0.0000	Stasionery	0.0000	Stasionery
ER	0.9473	Not Stasionery	0.0000	Stasionery

Source: Eviews data processing 10

Lag Length Test

Determination of the optimal lag is very important to determine. The lag length that is not optimal will cause biased estimates so that the predictions are inaccurate. To find out the optimal lag through various information from various lag criteria. Based on Table 4.2, it is shown that the selected lag is lag 2. This is because the results of the lag determination test on each criterion that has the highest number of stars (*) are lag 2. So that the optimal lag used is lag 2.

Table 1.2 Lag Length Test Results

Lag	Lag Criterion					
	LogL	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-866.6972	NA	6.70e+10	36.27905	36.43499*	36.33798*
1	-853.2277	24.13287	7.46e+10	36.38449	37.16416	36.67913
2	-833.9170	31.37996*	6.60e+10*	36.24654*	37.64994	36.77689
3	-821.5325	18.06076	7.97e+10	36.39719	38.42432	37.16324
4	-804.9289	21.44628	8.36e+10	36.37204	39.02291	37.37380

Source: Eviews data processing 10

Stability Test

Stability testing is one of the steps to determine the level of system stability in the model. To determine the level of stability by looking at the Polynomial Inverse Root characteristics through the modulus value in the table. If the modulus value <1, then the system is stable. Based on Table 1.3, it can be seen that in the VAR model that has been compiled it can be said to be stable, this is because the modulus value obtained in the stability test is <1 so

that the test in VAR can be continued. Besides that, the level of data stability in this model can also be seen through the Polynomial Inverse Root value which is presented in Figure 1.3.

Table 1.3 Stability Test Results

Root	Modulus
0.122720 - 0.591627i	0.604221
0.122720 + 0.591627i	0.604221
-0.170770 - 0.403271i	0.437938
-0.170770 + 0.403271i	0.437938
-0.008128 - 0.331156i	0.331255
-0.008128 + 0.331156i	0.331255
0.000602 - 0.130338i	0.130340
0.000602 + 0.130338i	0.130340

Source: Eviews data processing 10

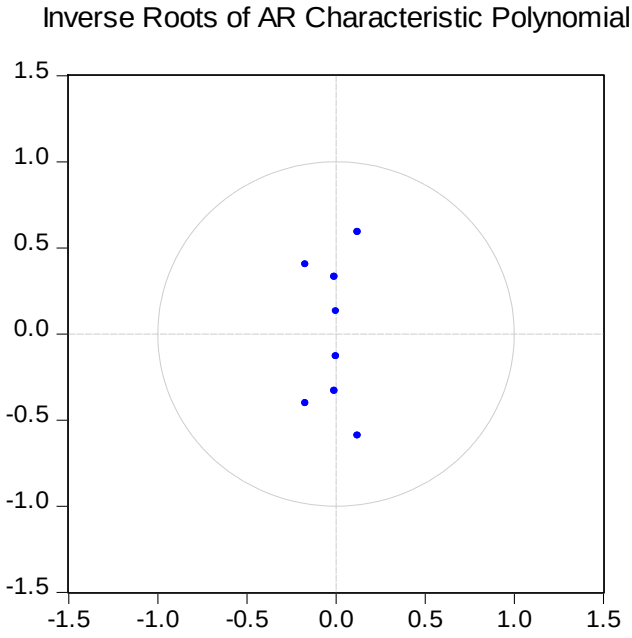

Figure 1.3 Stability VAR

Source: Eviews data processing 10

Cointegration Test

The cointegration test needs to be done to see the analysis in the long run. If after testing the data is integrated, the analysis model used is the VECM model. To see the integrated data together, it is shown by a comparison between the trace statistic value and the critical value with a significance level of 5 percent. Based on Table 1.4, it can be concluded that the four variables experience cointegration as indicated by the statistical value of each trace greater than the critical value of 5 percent. So that in the research model there is a long-term relationship.

Table 1.4 Cointegration Test Results

Level of Cointegration	Trace Statistic Value	*Critical Value*
None *	108.8342	47.85613
At most 1 *	56.75724	29.79707
At most 2 *	26.60590	15.49471
At most 3 *	12.30995	3.841466

Source: Eviews data processing 10

Causality Test

The causality test serves to determine the cause and effect relationship between the variables in the study. Causality testing can give the possibility of unidirectional causality, two-way causality, or no causality. To find out this relationship, it is seen through the probability value shown in Table 1.5. Based on Table 1.5, it can be concluded that the variables that have a probability value smaller than alpha 0.05 have a causal relationship. The causality relationship found a unidirectional causality, namely, the exchange rate statistically affects inflation and the exchange rate statistically affects the world crude oil price.

Table 1.5 Causality Test Results

Null Hypotesis	*Obs*	*Lag* 2	
		Probability	**Information**
INF *does not Granger Cause* GDP	51	0.9475	Not Causality
GDP *does not Granger Cause* INF		0.1768	
ER *does not Granger Cause* GDP	51	0.8253	Not Causality
GDP *does not Granger Cause* ER		0.8387	
COP *does not Granger Cause* GDP	51	0.8839	Not Causality
GDP *does not Granger Cause* COP		0.6101	
ER *does not Granger Cause* INF	51	0.0367	Unidirectional causality
INF *does not Granger Cause* ER		0.5863	
COP *does not Granger Cause* INF	51	0.0594	Not Causality
INF *does not Granger Cause* COP		0.8882	
COP *does not Granger Cause* ER	51	0.4972	Unidirectional causality
ER *does not Granger Cause* COP		0.0291	

Source: Eviews data processing 10

The causality in the direction of the exchange rate to inflation indicates that exchange rate fluctuations will cause the rise and fall of inflation in Indonesia. This is by the structuralist theory which states that the cause of inflation in developing countries is due to structural changes in the economy. Such structural changes include exchange rate fluctuations in which Indonesia is an open economy so that the domestic exchange rate may depreciate or appreciate any time. The causality of the exchange rate to the world crude oil price shows that the fluctuation of the rupiah exchange rate against the dollar in Indonesia can affect the price of crude oil in the world. In line with research conducted by Muradov, et al (2019) that the formation of crude oil prices in the world is driven by economic factors, one of which is influenced by the volatility of currency values. A study conducted by Brahmasrene, et al (2014) and Uddin et al (2013) states that crude oil prices are granger affected by exchange rate fluctuations. This happens because price movements will always occur after a short period of fluctuation in the exchange rate, coupled with the price of crude oil, which is the price of imported goods.

VECM Estimation Test

The VECM estimation step is used to determine the relationship between research variables both in the short term and in the long term. Based on Table 1.6, it can be shown that the t-statistic value obtained is less than the t-table value of 5 percent significance (1.98). So that there is no significant relationship between world crude oil prices, economic growth, inflation, and the exchange rate in the short term.

Meanwhile, in the long run, all variables have a significant relationship. As shown in Table 1.7, the t-statistic value is greater than the t-table value of 5 percent significance (1.98). The first result is that the world crude oil price has a positive and significant impact on the economic growth of 0.483347 percent. This means that when the price of crude oil has increased by 1 dollar per barrel, economic growth will increase by 0.483347 percent. This positive relationship is in line with research conducted by Ichsandimas and Cahyadin (2014), Septiawan, et al. (2016), with the increase in world crude oil prices causing energy consumption in the world to experience a transition to other alternative energy sources in the form of coal and natural gas. Therefore, Indonesia has benefited greatly from the consumption transition because the export value of coal and natural gas has experienced a surplus, thus increasing the component in the national income account.

Based on data from the National Energy Council (2019) that among the total primary energy production in Indonesia, which consists of petroleum, natural gas, coal, and new renewable energy, 64 percent or 261.4 MTOE is exported sourced from coal and LNG (Liquefied) Natural Gas). This shows that although imports of crude oil are still high, the exported oil and gas sector commodities still dominate the Indonesian economy.

The second long-term analysis is that the price of crude oil has a negative and significant effect on inflation of -0.854633 percent. This means that when the price of crude oil has decreased by 1 dollar per barrel, inflation will decrease by -0.854633 percent. Price stability is the goal of every country in the world, one of which is to maintain stability from world crude oil price shocks. Raheem, et al (2020) stated that each country has a different level of an economy, financial development, and energy laws so that the effect of oil prices will affect the economy differently.

The increase in world crude oil price can be transmitted into domestic prices through the company's production costs. When the price of crude oil in the world increases, it will be difficult for companies that import oil to produce goods and services. So the effect of this is the reduction of workers by the company which results in a decrease in supply (output). This will have an impact on the increase in prices consumed by consumers. In a long-term test, the increase in the price of crude oil causes deflation (price reduction) in Indonesia. This happens because of the substitution of energy from crude oil into other alternative energy, resulting in a decrease in demand for crude oil.

The result of the third analysis shows that the world crude oil price has a negative and significant effect on the exchange rate of -1734,997 rupiah per dollar. This means that when the price of crude oil increases by 1 dollar per barrel, the exchange rate will decrease or depreciate by -1734,997 rupiah per dollar. The results of this long-term research are in line with the research conducted by Nizar (2012) and Khaliq (2017) which shows that the increase due to world crude oil prices depreciates the exchange rate in Indonesia.

Indonesia's policy of adopting a free-floating exchange rate system determines the exchange rate which is influenced by the balance between supply and demand on the foreign exchange market. Along with the increase in imports of crude oil, the exchange rate will continue to follow suit with an increase in foreign exchange. This is because oil import activities require another country's currency that can be used as a transaction in the exchange.

Therefore, it can be shown that in the long run crude oil import activities cause the exchange rate to depreciate in Indonesia, that is, it responds negatively as a result of the increase in crude oil prices in the world.

Table 1.6 Short Term Estimation Results

Variable	Coefficient	T-Statistik
GDP	0.040536	0.58217
INF	-0.062551	-0.28817
ER	-14.89627	-0.58807

Source: Eviews data processing 10

Table 4.7 Long-Term Estimation Results

Variable	Coefficient	T-Statistik
GDP	0.483347	3.27838
INF	-0.854633	-3.05510
ER	-1734.997	-3.49337

Source: Eviews data processing 10

IRF (Impulse Response Function) Test

The IRF test is needed to determine the movement of variables in research caused by the effect of shocks or shocks from a particular variable. The vertical line is the response due to shocks from a variable and the horizontal line is the period of the response. Figure 4.3 shows that 1968 was the most influential period for the decline in economic growth due to the shock of world crude oil prices. This year, world crude oil price shocks caused economic growth to fall by -0.262128 percent. Then after that period, the response to economic growth increased in a positive trend until 1971 with a response of 0.094229 percent. After experiencing a positive increase, the response to economic growth tended to fluctuate until 1976. The peak of stability in 1980, namely the shock of world crude oil prices caused economic growth to return to a negative trend until 2019.

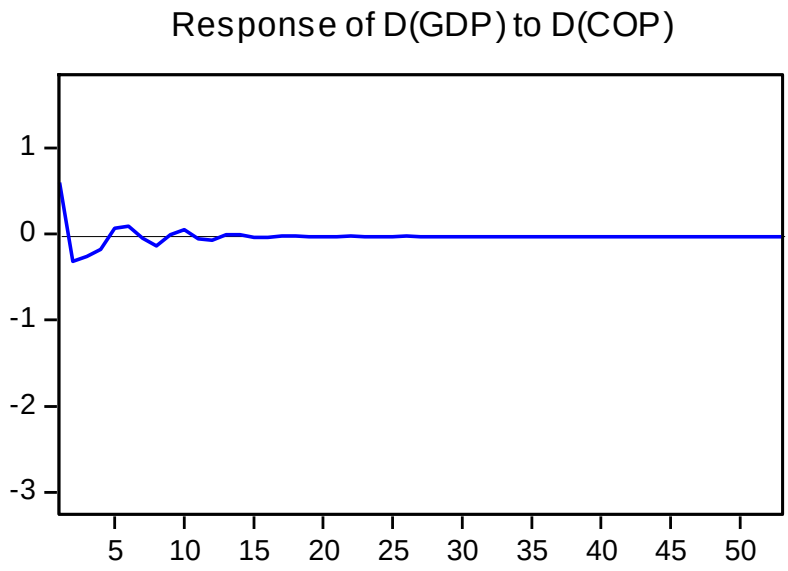

Figure 1.4 IRF Results of World Crude Oil Prices on Economic Growth
Source: Eviews data processing 10

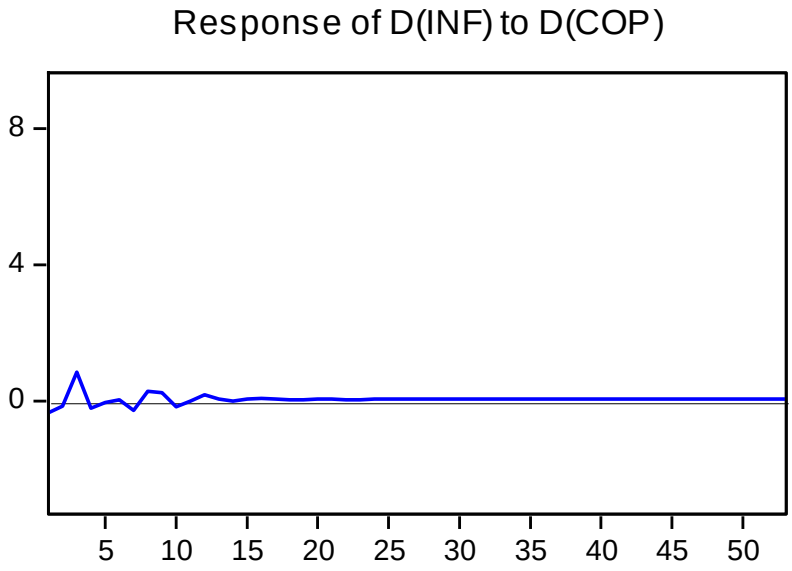

Figure 1.5 IRF Results of World Crude Oil Prices on Inflation
Source: Eviews data processing 10

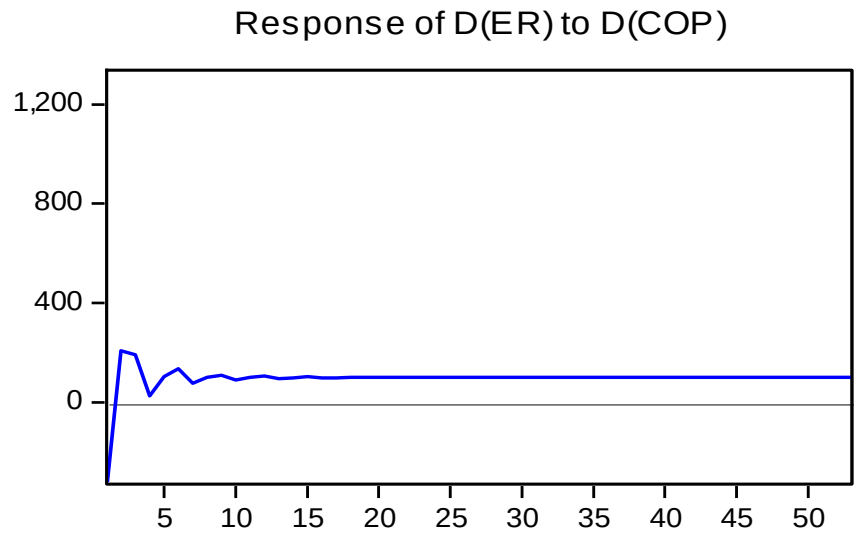

Figure 1.6 IRF Results of World Crude Oil Prices on Exchange Rate
Source: Eviews data processing 10

The IRF results for world crude oil prices with inflation are during 1967 to 2019 the period of world crude oil price shocks on inflation in Indonesia was most influential in 1969 where this shock increased inflation by 0.844949 percent. Then after this period of increase, the inflation response decreased until 1971 with a decrease of -0.051144 percent. However, after that the inflation response returned to a positive trend in 1972 and continued to fluctuate until 1980, the inflation response touched a negative number of -0.009482 percent. After that, the world crude oil price shock resulted in the inflation response starting to stabilize until 2019 on a positive trend.

Exchange rate movements resulting from world crude oil price shocks responded negatively in 1967 with a response of -323.0540 LCU. This year is the most influential exchange rate response due to the shock of world crude oil prices. After that year, the exchange rate response experienced an increase for the first time in 1968, this response was a period of the highest increase among other years. Until 1984 the exchange rate response was still on a positive trend with a response of 100.0661 LCU. After that year, the exchange rate showed a stable movement until 2019, amounting to 99,58667 LCU.

Test VD (Variance Decomposition)

Analysis of Variance Decomposition is used to determine the contribution or composition of each variable both from the composition of the variable itself and the composition of the other variables. Based on Table 1.8, it can be seen that during the years 1967-2019, the biggest contribution that influenced economic growth came from the economic growth itself. The highest contribution was in the first year, namely 96.23 percent, then decreased until the last year to 58.58 percent. The next contribution that affects economic growth is the variance of inflation, world crude oil prices, and exchange rates, respectively. Until the last year, the variance contribution continued to increase with a contribution value of 35.62 percent, 3.60 percent, and 2.18 percent.

The results of the variance in the composition of inflation during 1967-2019 show that the biggest contribution that affects inflation is inflation itself with a contribution value in the first year of 76.94 percent, decreasing until the last year with a contribution value of 70.24 percent.

The second-largest contribution affecting inflation is economic growth, with its contribution value increasing up to the sixth year of 32.98 percent. However, after that year, its contribution decreased until the last year to 29.23 percent. Then the next contribution that affects inflation, respectively, is the variance of world crude oil prices and exchange rates. Until the last year, the contribution value of each variance decreased by 0.27 percent and 0.23 percent. In summary, the VD inflation results can be shown in Table 1.9

Table 1.8 Variant Results of Economic Growth Composition

Period	*Variance Decomposition* GDP			
	COP	GDP	INF	ER
1	3.768055	96.23194	0.000000	0.000000
6	3.135644	79.77986	16.33289	0.751603
12	3.269567	74.14853	21.30950	1.272403
18	3.373636	70.06400	25.05186	1.510506
24	3.435203	66.94405	27.92631	1.694440
30	3.484491	64.49766	30.17933	1.838517
36	3.524086	62.52812	31.99321	1.954585
42	3.556679	60.90816	33.48512	2.050048
48	3.583954	59.55231	34.73379	2.129946
53	3.603504	58.58054	35.62874	2.187211

Source: Eviews data processing 10

Table 1.9 Variant Results of Inflation Composition

Period	*Variance Decomposition* INF			
	COP	GDP	INF	ER
1	0.741275	22.31630	76.94243	0.000000
6	0.601203	32.98911	65.52141	0.888281
12	0.517812	31.41799	67.45857	0.605630
18	0.429951	30.52656	68.57263	0.470861
24	0.375184	30.09185	69.14214	0.390820
30	0.339753	29.79749	69.52399	0.338769
36	0.314796	29.59108	69.79202	0.302109
42	0.296281	29.43780	69.99101	0.274910
48	0.281996	29.31957	70.14451	0.253926
53	0.272369	29.23989	70.24796	0.239784

Source: Eviews data processing 10

Based on Table 1.10, shows that during 1967-2019, the biggest contribution that influenced the exchange rate was the variance of economic growth. In the first year, its contribution was 60.26 percent which then decreased to 57.19 percent in the twelfth year. Then the next biggest contribution that affected the exchange rate was the variance of the exchange rate itself, world crude oil prices, and inflation with their respective contributions to in the last year amounted to 26.12 percent, 7.49 percent, and 9.00 percent.

Table 1.10 Variant Results of Exchange Rate Composition

Period	*Variance Decomposition* ER			
	COP	**GDP**	**INF**	**ER**
1	10.36980	60.26379	16.53768	12.82873
6	9.458474	57.20836	14.26890	19.06426
12	8.769782	57.19052	12.17474	21.86496
18	8.325261	57.24764	11.05534	23.37175
24	8.047883	57.28831	10.36991	24.29390
30	7.861630	57.31610	9.909433	24.91284
36	7.727948	57.33605	9.578866	25.35713
42	7.627308	57.35107	9.330000	25.69162
48	7.548805	57.36278	9.135875	25.95254
53	7.495469	57.37074	9.003985	26.12981

Source: Eviews data processing 10

5. CONCLUSION

Based on the results of the research that has been done, several conclusions can be obtained including:

a. In the long term, the increase in world crude oil prices will encourage the substitution of world crude oil into other alternative energy sources so that Indonesia's economic growth increases due to export flows and falling inflation due to reduced demand for crude oil. As a net importer of crude oil, the increase in world crude oil prices causes depreciation of the rupiah.

b. The causal relationship between world crude oil prices, economic growth, inflation, and the exchange rate has a one-way relationship. This relationship is that the exchange rate statistically has an influence on inflation in Indonesia and the exchange rate statistically influences world crude oil prices. So that there is no two-way causality relationship between world crude oil prices, economic growth, inflation, and the exchange rate.

c. The first response to world crude oil price shocks was the exchange rate variable with a negative trend. This is followed by the response to economic growth during the initial three periods. Inflation is the last variable that responds to world crude oil price shocks on a positive trend after the second period.

In general, the basic conclusion from this research is that the increase in world crude oil prices has resulted in a shift in world crude oil consumption to cheaper alternative energy. Policy recommendations that can be given to overcome the increase in world crude oil prices are by increasing the availability of alternative energy production as a substitute for world crude oil and the need for an "Administered Price" policy from the government to maintain the stability of alternative energy prices to substitute world crude oil. The depreciation of the exchange rate that occurs due to the behavior of crude oil imports is difficult to avoid. This is because as long as crude oil imports are still carried out, the exchange rate will continue to depreciate. Therefore, the effort that can be taken is to provide greater foreign exchange

reserves to stabilize the exchange rate and reduce dependence on world crude oil through the development of research for the use of cheaper renewable energy.

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