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Structural Decomposition of the Impact of World Oil Price Shock Economic Growth in Indonesia

Fahmi Aziz[1*]
Faculty of Economics, UPN "Veteran" Yogyakarta[1]
Jl. Padjajaran No.104, Ngropoh, Condongcatur, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55283
Corresponding Email: fahmizz21oke@gmail.com[1]

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ABSTRACT

The aim of this research is to determine the response of economic growth in Indonesia to shocks or variable shocks in world oil prices, gold prices, inflation, exchange rates, and interest rates. This research uses time series data for 12 years (2010-2021) using the Vector Auto Regressive (VAR) method. The results show that based on the results of the Impulse Response Function (IRF) test, world oil price shocks responded positively to economic growth in the 2nd period, 5-6th period, and 9-10th period, while the response was negative in the 3rd-4th period and the 2nd period. 7th-8th. Gold price shocks were responded positively by economic growth in periods 3-4 and 7-8, while the response was negative in periods 2, 5-6, and 9-10. Inflation shocks were responded to positively by economic growth in periods 2, 4-5, and 8-9, while negative responses were in periods 3, 6-7, and 10. Exchange rate shocks were responded to positively by economic growth in periods 3- 4 and 7-8, while the response was negative in the 2, 5-6, and 9-10 periods. Interest rate shocks responded positively to economic growth in periods 2, 5-6, and 9, while negative responses in periods 3-4, 7-8, and 10. Based on the results of the Variance Decomposition test, oil prices contributed 4,886%, gold contributed 5,545%, inflation contributed 0.306%, interest rates contributed 1,197%, and the exchange rate was the variable that contributed the most, namely 6,396%.

Keywords: Economic Growth; Gold Prices; Inflation and Exchange Rates; Interest Rates; Oil Prices

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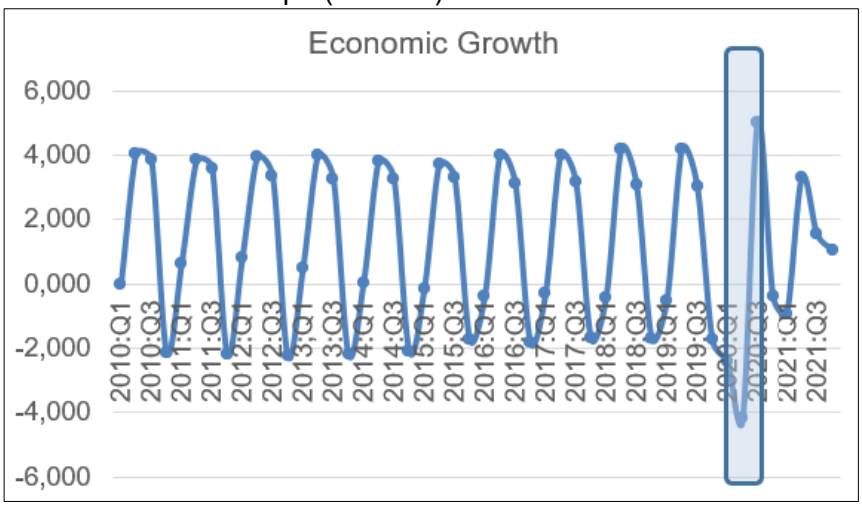
INTRODUCTION

Economic growth is an indicator of the success of a country's development, which refers to an increase in national output from period to period. This process, known as Modern Economic Growth (MEG), describes changes in output that reflect long-term economic development (Todaro & Smith, 2020). Economic growth is important in achieving social prosperity, which is reflected in increasing living standards and fulfilling basic needs. According to Untono (2015), the economy grows if the output produced is greater than the previous year.

Fluctuations in economic growth can be caused by changes in aggregate supply, such as oil price spikes, crop failures, climate change, or production policies (Gordon, 1990). In Indonesia, economic development is influenced by abundant natural resources and development efforts that focus on equality and stability. Even though there is turmoil, such as a recession or the COVID-19 pandemic, Indonesia's economic growth between 2010 and 2021 continues to show fluctuating movements. The year when there was turmoil in economic growth was during the Covid-19 pandemic. This can be seen in the graph as follows:

Figure 1. Economic Growth Graph (Percent)



Source: Central Statistics Agency (CSA)

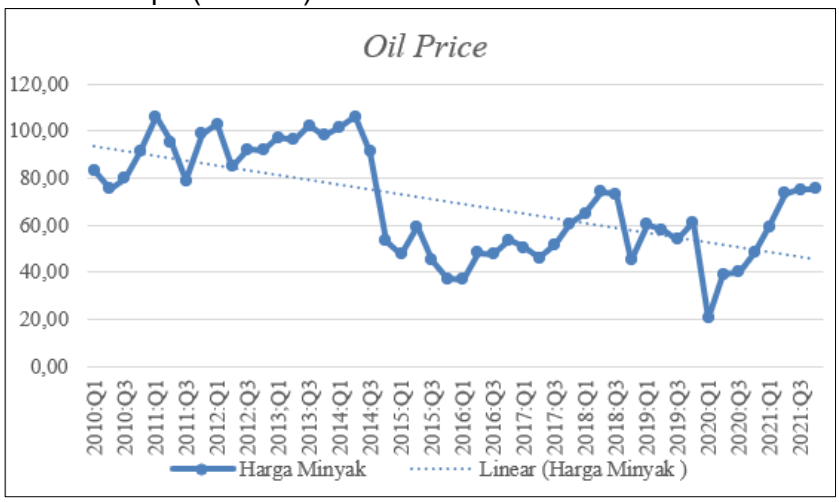
From Figure 1, it can be seen that the lowest level of economic growth occurred in the second quarter of 2020, namely -4.19%, while in the following quarter, there was a significant increase, namely in the third quarter of 2020, namely 5.05%. According to the Central Statistics Agency (BPS), Indonesia experienced a contraction in economic growth in 2020 of -2.07%. This caused the Indonesian economy in 2020 to experience deflation or a drastic decline because economic development in Indonesia has an unstable movement. The Covid-19 pandemic has greatly affected the Indonesian economy starting in the second quarter of 2020. This was due to regulations regarding Large-Scale Social Restrictions (PSBB), which resulted in lockdowns in several areas to break the chain of spread of COVID-19. However, this policy caused a reduction in the amount of household consumption (RT) and consumption of non-profit institutions that serve households (LNPRT), both of which greatly influenced the contraction in GDP.

In 2020, Indonesia experienced an economic contraction due to the COVID-19 pandemic, which forced the government to issue an economic recovery policy. This policy includes the allocation of APBN funds to increase domestic consumption, support business activities, and maintain economic stability through monetary expansion. The synergy between fiscal, monetary, and related institutional policies aims to restore GDP

income, reduce inflation, and reduce the unemployment rate. As a result, Indonesia's GDP grew by 3.69% in 2021, with the highest spike in the second quarter of 3.30%.

Energy, especially oil, plays an important role in economic growth. Fluctuations in world oil prices affect the Indonesian economy because of their impact on production costs and economic output. When oil prices rise, production costs increase, reducing the production of related industries, which ultimately affects economic growth. Despite this, oil remains an important factor in supporting sustainable economic and social development. Oil price fluctuations tend to increase, affecting both oil-importing and exporting countries. It can be seen from developments that oil prices are experiencing fluctuations which tend to increase. This can be seen in the graph as follows:

Figure 2. Oil Price Graph (Percent)



Source: West Texas Intermediate (WTI)

From the oil price in Figure 2, it can be seen that oil price fluctuations in the 2010-2021 quarter experienced fluctuating movements. The highest price occurred in the first quarter of 2011, namely 106.19, while the lowest price occurred in the first quarter of 2020, amounting to 20.51. However, in the third quarter of 2014, there was a significant decline until the first quarter of 2015. This was because the Organization of Petroleum Exporting Countries (OPEC) always increased its oil production.

World oil prices have experienced quite significant fluctuations in recent years, with increases tending to occur between the first quarter of 2016 and the fourth quarter of 2021. However, in the first quarter of 2021, oil prices experienced a decline of 20% due to the Covid-19 pandemic. -19 pandemic which reduced global consumption demand. Production continues despite limited storage capacity, and OPEC cuts production. After the pandemic, oil prices slowly recovered, thus having a significant impact on the Indonesian economy, both for exporting and importing countries.

Oil has an important role in supporting economic and social development. Apart from oil prices, other factors such as gold prices, inflation, exchange rates, and interest rates also influence the Indonesian economy. High inflation can reduce public demand, while exchange rate depreciation can affect oil prices and foreign investment. Previous research shows that oil prices, inflation, and exchange rates have a significant influence on economic growth, although research results differ in terms of significance and direction of influence.

This research is important to understand the impact of world oil price fluctuations on Indonesia's economic growth. Using the VAR method, this research aims to analyze

shocks from variables such as oil prices, gold prices, inflation, exchange rates, and interest rates on Indonesia's economic growth in the 2010-2021 period. It is hoped that this research can provide a solution to stabilizing the Indonesian economy.

LITERATURE REVIEW

Economic Growth

According to Sukirno (2011), economic growth includes developments in the production of goods and services, such as industrial production, infrastructure, education, the service sector, and capital goods. Economic improvement has an impact on people's welfare, employment opportunities, and income (Kolinug & Winerungan, 2022). If production and income increase, then the country's economy also develops (Rumawir, 2019). To maintain economic balance, every economic variable needs to be involved (Prasetiono, 2010).

Boediono (1992) defines economic growth as a long-term increase in output per capita, which is reflected in changes in a region's GDP. GDP calculated based on constant prices can show economic development. Classical growth theory focuses on the supply side, while Keynesian theory emphasizes the demand side, where the expenditure of households, entrepreneurs, the government, and the foreign sector influences aggregate demand and national income (Yuniarti et al., 2020).

Oil Prices

Oil is a strategic energy source that affects a country's economy. Tang & Zhang (2010) explain that the increase in the value of the US dollar causes world oil prices to rise, which benefits oil companies, including in Indonesia. Crude oil is also an important commodity that influences the economy (Kurihara, 2015). Almaya et al. (2021) added that oil prices have a significant influence on Indonesia's economic growth. Oil price fluctuations affect production costs and national income (Desi Mariaty Padang, Ali Anis, 2019). Rising oil prices often cause inflation and affect people's purchasing power (Setiono, 2014).

Gold Price

Gold is a form of investment that has an impact on the economy, especially through gold consumption and investment. Sukirno (2006) states that increasing income encourages consumption and savings, which are also influenced by the price of gold. According to Muzakky et al. (2015), a decline in world gold prices that is not followed by a sharp decline in Indonesia can increase the purchasing power of gold. Gold prices are influenced by changes in the rupiah exchange rate against the US dollar, which in turn affects Indonesia's economic growth.

Inflation

Inflation is a general and sustainable increase in the prices of goods and services, which can affect the economy (Dwi, 2016). Bank Indonesia (BI) explains that high inflation harms the competitiveness of domestic goods in international markets and reduces exports (Indriyani, 2016). Unstable inflation can reduce consumption, investment, and production, which ultimately hampers economic growth.

Exchange Rates

The exchange rate is a comparison between two currencies, which affects a country's economy. Nopirin (2012) and Tandelilin (2008) explain that the strengthening of the rupiah exchange rate against foreign currencies is positive for investors. Mankiw (2007) adds that exchange rates facilitate trade between countries. Sukirno (2005) stated that

the exchange rate affects monetary stability, and central bank intervention is needed to maintain its stability, especially in the face of economic turmoil.

Interest Rates
Interest rates are the price for using investment funds (Karl and Fair, 2001). An increase in interest rates can reduce consumption and reduce economic activity (Indriyani, 2016). Interest rates are influenced by the supply and demand for money (Mishkin, 2008) as well as monetary policy which can regulate inflation and influence investment decisions. Changes in interest rates affect the amount of money in circulation and economic growth.

RESEARCH METHOD

This research uses secondary data related to economic growth, oil prices, gold prices, inflation, exchange rates, and interest rates from official websites. The method used is quantitative descriptive analysis, namely processing numerical data and describing findings based on that data. The analysis method chosen is the VAR (Vector Autoregressive) model, which is used to predict economic variables and identify relationships between these variables. The VAR model considers several endogenous variables that influence each other in one model, taking into account interactions between these variables in the past.

The VAR method, introduced by Sims (1980), is considered more appropriate than multiple linear regression because it can handle dynamic causality and simultaneous relationships between variables. This model also makes it possible to handle time series data and take into account lags in monetary policy towards the real sector.

In general, the VAR model of order p can be formulated as:

$$xt=A0+A1xt-1+A2xt-2+...+Apxt-p+etxt = A0 + A1xt-1 + A2xt-2 + ... + Apxt-p + etxt=A0+A1xt-1+A2xt- 2+...+Apxt-p+et$$

With a model for economic variables that can be described in equations such as:

$$PE=\beta0+\beta1PEt-1+\beta2HMt-1+\beta3HEt-1+\beta4INFt-1+\beta5NTt-1+\beta6SBt-1+EtPE = \beta_0 + \beta_1PE_{t-1} + \beta_2HM_{t-1} + \ beta_3HE_{t-1} + \beta_4INF_{t-1} + \beta_5NT_{t-1} + \beta_6SB_{t-1} + EtPE=\beta0+\beta1PEt-1+\beta2HMt-1+\beta3HEt-1+\beta4INFt-1+\beta5NTt-1+\beta6SBt-1+Et$$

Analysis Stages
Stationarity Test
The Augmented Dickey-Fuller (ADF) test is used to test the stability of variable patterns. If the test results show a probability smaller than 0.05, then the data is not stationary and needs transformation.

Determination of Optimum Lag Length
Proper use of lag is very important for VAR models. A lag that is too long reduces the degrees of freedom, while a lag that is too short can introduce errors in the model. The criteria used to determine the optimal lag are AIC, SIC, and LR.

Model Stability Test
The VAR model is stable if all AR roots are in the unit circle (modulus value below 1).

VAR Model Estimation
After determining the optimal lag, VAR model estimation is carried out using the Eviews program. The estimation results produce an equation for each endogenous variable.

Impulse Response Function (IRF)
Measures the impact of changes in one variable on another variable by providing a shock to a particular variable, and describes how the variable returns to balance after experiencing a shock.

Variance Decomposition
This analysis shows the contribution of variables to changes in other variables, as well as their influence on movements in these variables in the future period.

RESULTS

The results of this analysis contain statistical tests which are described in the stages of the Vector Autoregressive (VAR) analysis method.

Stationary Test

The first stage in VAR analysis is the data stationarity test to ensure that the variables meet the stationary requirements. This test is carried out with the Augmented Dickey-Fuller (ADF) statistical test to find out whether the data contains a unit root. If the variable contains a unit root, then the data is not stationary. On the other hand, if it does not contain a unit root, the data can be said to be stationary and ready for further analysis. If the data is not stationary, a differencing process is carried out until the variable becomes stationary.

In testing stationarity, this research uses the Augmented Dickey-Fuller unit root test approach. Data is said to be stationary if the Augmented Dickey-Fuller value is greater than the MacKinnon test critical values at the 1%, 5%, or 10% level. The results of the uni root test in this study are shown in Table 1.

Table 1. Level Augmented Dickey-Fuller Stationarity Test Results

Variable	Level			
	ADF test statistic	1%	5%	10%
Economic Growth	-12.048	-3.584	-2.928	-2.602
Oil Price	-2.010	-3.578	-2.925	-2601
Gold Price	-1.432	-3.584	-2.928	-2.602
Inflation	-1.287	-3.581	-2.927	-2.601
Exchange Rates	-1.252	-3.581	-2.927	-2.601
Interest Rates	-1.125	-3.581	-2.927	-2.601

Source: Data Processing Results (2024)

Table 2. Augmented Dickey-Fuller Stationarity Test Results for Level 1 Difference

1st Difference				
Variable	Level			
	ADF test statistic	1%	5%	10%
Economic Growth	-5.886	-3.61	-2.939	-2.607
Oil Price	-7.409	-3.581	-2.927	-2.601
Gold Price	-7.636	-3.592	-2.931	-2.604
Inflation	-8.886	-3.581	-2.927	-2.601
Exchange Rates	-9.771	-3.581	-2.927	-2.601
Interest Rates	-4.722	-3.581	-2.927	-2.601

Source: Data Processing Results (2024)

Based on the unit root test with Augmented Dickey-Fuller (ADF), the results in Table 2 show that at a level of none, variables such as economic growth, oil prices, gold prices, inflation, exchange rates, and interest rates are not stationary. However, at the 1st

difference level, all variables become stationary because the ADF test statistic value is greater than the critical values at alpha 1%, 5%, and 10%. Thus, these results support the use of VAR analysis in this study.

Lag Optimum

After testing the data stationarity, the next step is to determine the optimum lag. The lag test in the VAR estimation is used to see the length of the period of influence between variables. The criteria for determining lag in this study used Likehood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), SHarz Information Criterion (SIC), and Hannan Quinn (HQ). The following are the results of the optimum lag test that has been carried out:

Table 3. Table of Optimal Lag Length Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-175.5595	NA	0.000229	8.645688	8.89393	8.736678
1	4.384952	299.9073	2.46E-07	-1.791193	-53.528862*	2.428117
2	57.39216	73.20043*	1.22e-07*	-0.981326*	4.20843	2.164186*

Source: Data Processing Results (2024)

Based on Table 3, it can be seen that the lag 2 results are supported by LR of 73.20043, FPE of 1.22e-07, AIC of -0.981326, SC of 4.20843, and HQ of 2.164186 and there is an asterisk (*) indicating optimal lag. This condition provides a relationship between the variables used in VAR analysis, namely up to lag 2. The choice of this lag is determined based on the number of approaches that choose that lag.

Stability Test Model

Next, a stability test for the VAR model estimation was carried out using a polynomial test with the results below:

Table 4. Model Stability Test Results

Root	Modulus
0.954069	0.954069
-0.073987 – 0.9913790i	0.916780
-0.073987 + 0.9913790i	0.916780
0.796757	0.796757
0.717199 – 0.217461i	0.749442
0.717199 + 0.217461i	0.749442
0.665582	0.665582
-0.405382 – 0.170035i	0.439598
-0.405382 + 0.170035i	0.439598
0.096452 - 0.069253i	0.118739
0.096452 + 0.069253i	0.118739
0.043827	0.043827

Source: Data Processing Results (2024)

Based on the data in Table 4, the results of the VAR stability test in the form of roots of characteristics polynominal show that the resulting modulus value is less than 1. The test results above show that the VAR model is stable.

Figure 3. Model Stability Test Results

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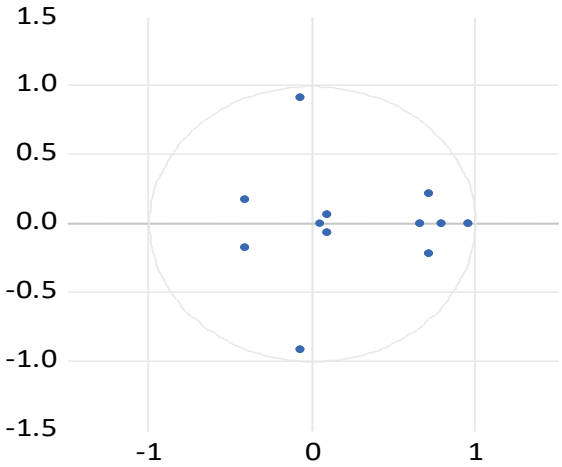


Apart from the table, the polynominal test can also be observed in Figure 3. It can be seen that the inverse roots of AR polynominal from the image above are inside the circle. This shows that the VAR model is stable.

Variance Decomposition

Variance Decomposition is an analysis tool in the VAR model that provides information regarding the proportion of variation in each variable due to changes in certain variables. The purpose of variance decomposition in the VAR model is to measure the magnitude of the contribution or composition of influence of each independent variable, in this case namely oil prices, gold prices, inflation, exchange rates, and interest rates on the dependent variable, namely economic growth through variance. Error. Below are the results of the Variance Decomposition test which focuses on variables that contribute to influencing changes in economic growth in Indonesia.

Table 5. Variance Decomposition Test Results

Period	S.E	Economic Growth	Oil Price	Gold Price	Inflation	Exchange Rates	Interest Rates
1	1.26186	100	0	0	0	0	0
2	1.43265	83.192	4.886	5.372	0.021	6.233	0.294
3	1.71344	85.968	3.468	3.835	0.25	5.536	0.94
4	1.78816	83.283	3.971	5.529	0.276	5.936	1.003
5	1.94255	84.287	3.460	4.874	0.249	6.008	1.119
6	2.00902	83.369	3.671	5.393	0.276	6.236	1.053
7	2.0933	83.469	3.512	5.255	0.304	6.261	1.197
8	2.14975	83.352	3.604	5.545	0.291	6.071	1.136
9	2.19588	83.037	3.548	5.506	0.279	6.397	1.232
10	2.24174	83.306	3.504	5.477	0.306	6.223	1.183

Source: Data Processing Results (2024)

Based on the Variance Decomposition test in Table 5, it can be seen that variations in economic growth values are largely influenced by shocks to the variables themselves. In the first period, the variation in economic growth values came entirely from the economic growth variable itself, namely 100%, while oil prices, gold prices, inflation, exchange rates, and interest rates had no influence.

In the following period, changes in economic growth were still dominated by the economic growth variable itself at 83,192%, followed by the dominance of the exchange rate variable at 6,233%. The contributions from other variables are as follows: gold price 5.372%, oil price 4.886%, inflation 0.021%, and interest rate 0.294%.

The results of the variance decomposition test show that the contribution of each variable to economic growth varies in each period. The contribution of the exchange rate variable remains the largest, despite experiencing fluctuations, which tends to increase until the tenth period but decreases slightly in the tenth period (6.233% to 6.223%). The contribution of gold prices also increased from 5,372% in the first period to 5,447% in the tenth period. Oil prices experienced fluctuations which tended to decrease, from 4,886% in the first period to 3,504% in the tenth period. Interest rates experienced the highest increase, from 0.294% to 1.183% in the tenth period.

Overall, apart from the exchange rate, the variables of oil prices and interest rates show quite significant fluctuations. Gold price variables and inflation also contributed to fluctuating movements which tended to increase until the tenth period. In the tenth period, the largest contribution to changes in economic growth came from the exchange rate (6.223%), followed by gold prices (5.477%), oil prices (3.504%), interest rates (1.183%), and inflation (0.306%).

From the results of this variance decomposition test, it can be concluded that changes in economic growth are more influenced by exchange rates, gold prices, oil prices, interest rates, and inflation, with the exchange rate being the most dominant factor.

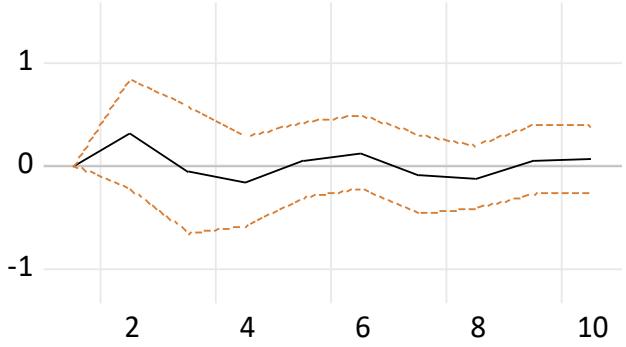
DISCUSSION

Impulse Response Function (IRF)

Impulse Response Function (IRF) is a method in the VAR model to analyze the response of endogenous variables to shocks from other variables in the model. IRF is used to determine changes in a variable due to an event (shock) in a certain period, as well as the duration of time needed for the dependent variable to respond to the shock. In this research, IRF is used to observe how Indonesia's economic growth responds to changes in oil prices, gold prices, inflation, exchange rates, and interest rates. The IRF results show the response of economic growth to shocks to these variables as follows:

Economic Growth Response to Oil Price Shocks

Figure 4. Graph of Oil Price IRF Test Results



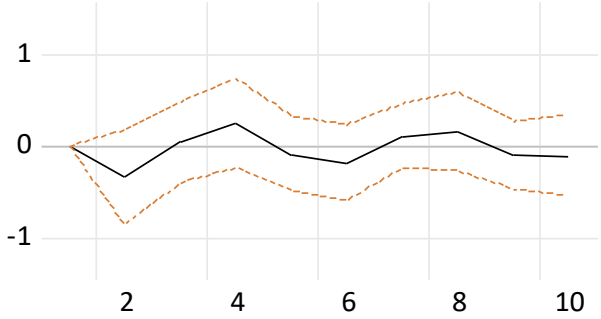
The VAR impulse response estimate in Figure 4 shows the response of economic growth to oil prices which is depicted by the blue line. Over 10 periods, the response to economic growth experienced fluctuations. In the initial period, economic growth did not respond to shocks or changes in oil prices because the standardized value was zero. However, in the second period, economic growth responded positively to oil prices by 0.316. In the 3rd and 4th periods, the response became negative. In the 5th and 6th periods, the economic growth response was again positive with values of 0.059 and 0.132, which tended to increase. This supports research conducted by Septiawan et al. (2016), which states that oil prices have a significant effect on economic growth, as well as research

by Arifin (2024) which also finds that world oil prices have a significant effect on economic growth.

However, in the 7th and 8th periods, the response of economic growth became negative to the oil price shock with a value of -0.075 in the 7th period and -0.112 in the 8th period. This supports research conducted by Yanti and Ratna (2019), which states that world oil prices have a significant negative effect on economic growth. In the 9th to 10th period, the shock value of oil prices was again responded positively by economic growth.

The response of economic growth to the exchange rate variable shows quite large fluctuations but tends to decrease, from 0.136 to 0.070. With oil price fluctuations, economic growth will respond in a fluctuating manner. An increase in oil prices can cause a budget deficit which has the potential to reduce economic growth. Rising oil prices also increase production costs, which in turn can reduce output and trigger production-side inflation. Therefore, the long-term impact of rising oil prices could increase inflation, which has the potential to reduce economic growth.

Response of Economic Growth to Gold Price Shocks
Figure 5. Graph of Gold Price IRF Test Results



The VAR impulse response estimate in Figure 5 shows the response of economic growth to the gold price shock which is depicted by the blue line. From this graph, it can be seen that the response to economic growth has fluctuated. In the initial period, economic growth did not respond to gold price shocks because the standard deviation value was zero. In the second period, the economic growth response was negative at -0.332. However, this response changed to positive in the third to fourth periods, then returned to positive in the fifth and sixth periods.

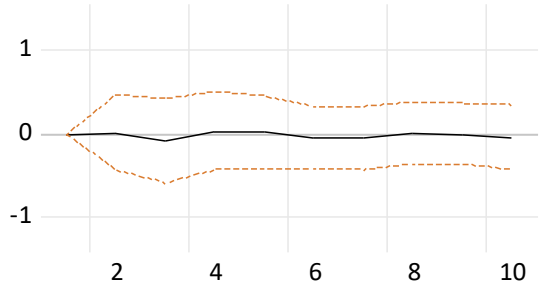
In the 7th to 8th period, the economic growth response showed a positive figure with a standard deviation that tended to increase, from 0.112 to 0.161. This supports the research of Muzakky et al. (2015), which states that the price of gold has a significant effect on economic growth in Indonesia. Furthermore, in the 9th and 10th periods, the response to economic growth was negative again, which is in accordance with the findings of Syahtria et al. (2016) which stated that world gold prices had a significant negative effect on economic growth.

In general, it can be understood that in the short term, gold prices have a negative influence on economic growth in Indonesia. This is related to the law of supply and demand for gold. When demand for gold is greater than supply, gold prices tend to rise. Conversely, if supply is greater than demand, the price of gold falls. If the price of gold rises, demand for gold decreases, which has a negative impact on economic growth. The decline in demand for gold causes reduced public interest in investing in gold, which in turn has an impact on decreasing economic growth.

However, gold prices also act as an alternative investment, especially when the currency weakens. When the rupiah exchange rate weakens against the US dollar, the price of gold in Indonesia will increase, encouraging people to invest in gold as a way to protect the value of their wealth from inflation. On the other hand, when the price of gold falls, people tend to buy gold as an investment, which can have a positive impact on economic growth in the long term.

Overall, it can be concluded that the gold price shock has a fluctuating impact on economic growth in the short term, but has the potential for a positive impact in the long term, especially through gold investment which can help maintain economic stability.

Economic Growth Response to Inflation Shock
Figure 6. Graph of IRF Inflation Test Results



The VAR impulse response estimate in Figure 6 shows the response of economic growth to oil price shocks, which is depicted by the blue line. Over 10 periods, the response of economic growth to changes in the inflation variable experienced fluctuations. In the initial period, changes in inflation were not responded to by economic growth because the standard deviation value was zero. In the second period, economic growth gave a positive response with a standard deviation of 0.020. However, in the third period, the response became negative, with a standard deviation value of -0.083.

Economic growth again responded positively to inflation in the fourth and fifth periods but tended to decline, with the standard deviation falling from 0.038 to 0.023. This finding is in line with research by Syahtria et al. (2016) which states that inflation has a significant positive effect on economic growth, as well as research by Septiawan et al. (2016) which also shows similar results.

In the sixth and seventh periods, economic growth responded negatively to the inflation shock, with standard deviations of -0.0421 and -0.0466, respectively. This decrease supports the research of Silvia et al. (2013) who found that inflation had a significant negative effect on economic growth, as well as research by Pratiwi (2015) and Almaya et al. (2021) which also shows a significant negative impact of inflation on economic growth.

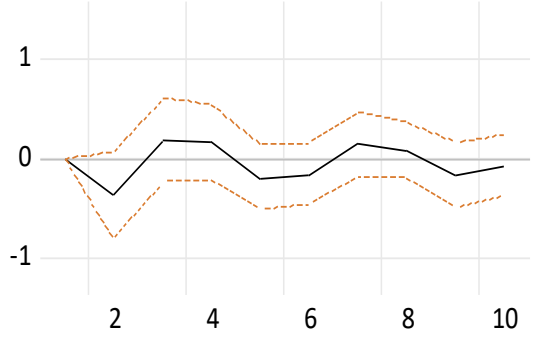
In the eighth and ninth periods, the response of economic growth to inflation was positive again, although it tended to decline, with a standard deviation of 0.0108 and 0.0019. After that, the response returned negative in the tenth period with a standard deviation of -0.0441. Overall, the response of economic growth to inflation shocks showed fluctuations up to the tenth period, but tended to decrease, from 0.0208 in the second period to -0.0441 in the tenth period.

From these findings, it can be concluded that there is a short-term and long-term relationship between inflation variables and economic growth. Inflation volatility will be responded to by fluctuating economic growth. When inflation increases, economic

growth tends to decrease, and conversely, when inflation decreases, economic growth increases. Low and stable inflation is a prerequisite for sustainable economic growth, which ultimately supports increased social welfare.

High inflation causes people's real income to continue to decline, which has an impact on lowering living standards. In addition, unstable inflation creates uncertainty for economic actors, hampering decisions in consumption, investment, and production, which in turn reduces economic growth.

Economic Growth Response to Exchange Rate Shocks
Figure 7. Graph of IRF Exchange Rate Test Results



The VAR impulse response estimate in Figure 7 shows the response of economic growth to the exchange rate which is depicted by the blue line. Over 10 periods, the response of economic growth to shocks or changes in exchange rates experienced fluctuations. In the initial period, there was no response from economic growth to changes in the exchange rate because the standard deviation value was zero. In the second period, economic growth responded negatively with a standard deviation value of -0.3577, which decreased from zero in the first period.

In the third and fourth periods, the response of economic growth to the exchange rate shock turned positive but tended to decrease, with standard deviations of 0.1860 and 0.1650 respectively. Furthermore, in the fifth and sixth periods, the economic growth response became negative again, with a standard deviation of -0.1921 and -0.1580. However, in the seventh and eighth periods, the economic growth response was again positive, in accordance with the findings of Septiawan et al. (2016), which states that the exchange rate has a significant positive effect on economic growth.

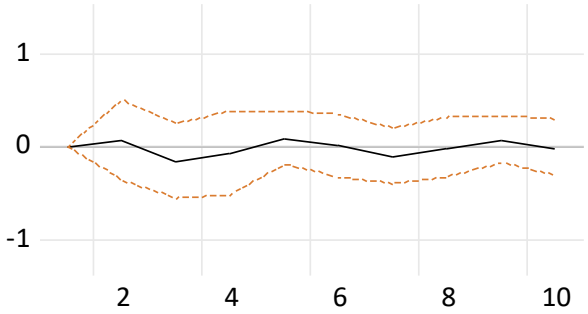
In the ninth and tenth periods, the response was negative again, which is in accordance with research by Arifin (2024) and Pratiwi (2015), which shows that the exchange rate has a significant negative effect on economic growth. Overall, the response of economic growth to shocks or changes in exchange rates shows fluctuations up to the tenth period, which indicates the existence of short-term and long-term relationships between exchange rate variables and economic growth.

Exchange rate fluctuations will be responded to by fluctuating economic growth. In general, exchange rates have a negative relationship with economic growth. The weakening of the rupiah exchange rate can cause the price of imported goods to increase, which will encourage people to switch to more affordable local products. Exchange rate instability can also affect international trade because the weakening of the rupiah will affect the value of foreign exchange used in trade between countries. This has the potential to reduce economic growth.

Conversely, the stronger a country's currency exchange rate is against other countries, the better the country's economic condition. Exchange rates influence the prices of goods and services, which impacts a company's revenues and costs. As an important component of international trade, exchange rates enable comparisons of prices of goods and services between countries. Therefore, exchange rate stability is very important to support sustainable economic growth.

Economic Growth Response to Interest Rate Shocks

Figure 8. Graph of IRF Interest Rate Test Results



The VAR impulse response estimate in Figure 8 shows the response of economic growth to interest rates which is depicted by the blue line. Over 10 periods, the response of economic growth to shocks or changes in interest rates experienced fluctuations. In the initial period, there was no response from economic growth to changes in interest rates because the standard deviation value was zero. In the second period, economic growth began to respond positively with a standard deviation value of 0.0776.

In the third and fourth periods, the response of economic growth to shocks or changes in interest rates became negative, with standard deviation values of -0.1469 and -0.0666, respectively. Furthermore, in the fifth and sixth periods, the response of economic growth was positive again to changes in interest rates, but tended to decrease, with standard deviation values of 0.1007 and 0.0164.

In the seventh and eighth periods, the response to changes in interest rates is again negative with standard deviation values of -0.0997 and -0.0079. Then, in the ninth period, the response was positive again, but in the tenth period, economic growth again responded negatively. Overall, the response of economic growth to interest rate shocks up to the 10th period shows that there is a short-term and long-term relationship between interest rate variables and economic growth.

Interest rate fluctuations that are responded to fluctuating by economic growth can be understood as follows: when interest rates are low, people tend to be more interested in borrowing money from banks to meet their needs or business expansion, which can encourage economic growth through increasing people's purchasing power and consumption.

On the other hand, interest rates can also be used as a policy to stabilize the economy, especially in crisis conditions. An increase in interest rates is usually done to suppress inflation by increasing borrowing costs, which reduces the amount of money circulating in society and reduces economic activity. However, if interest rates are increased when the economy is experiencing deflation, this could have a negative impact on economic growth. Therefore, interest rate policy needs to be kept stable to support the sustainability of economic activity.

CONCLUSION

Based on the research findings regarding the influence of oil prices, gold prices, inflation, exchange rates, and interest rates on Indonesia's economic growth from 2010 to the first quarter of 2021, several conclusions can be drawn. The impulse response analysis reveals that economic growth responds variably to shocks in these key variables. Specifically, economic growth exhibited a positive response to oil price shocks during the 2nd, 5th, 6th, and 9th to 10th periods. Conversely, it responded negatively to gold price shocks in the 3rd to 4th and 7th to 8th periods. Similarly, economic growth displayed positive reactions to gold price shocks in the 3rd to 4th and 7th to 8th periods, while negative responses were observed in the 2nd, 5th to 6th, and 9th to 10th periods.

Economic growth also showed positive responses to inflation shocks during the 2nd, 4th, 5th, and 8th to 9th periods, with negative responses occurring in the 3rd, 6th to 7th, and 10th periods. For exchange rate shocks, economic growth responded positively in the 3rd to 4th and 7th to 8th periods, but negatively in the 2nd, 5th to 6th, and 9th to 10th periods. Lastly, economic growth demonstrated positive reactions to interest rate shocks in the 2nd, 5th, 6th, and 9th periods, while negative responses were recorded in the 3rd to 4th, 7th to 8th, and 10th periods.

The Variance Decomposition test further highlights the contributions of these variables to changes in economic growth. Oil prices, gold prices, and interest rates significantly impact economic growth, with the exchange rate contributing the largest share and inflation making the smallest contribution.

In light of these findings, several recommendations can be made. Future research should consider additional variables beyond those analyzed in this study to capture broader phenomena and provide more comprehensive results. Given the significant influence of oil price fluctuations on economic growth, which can lead to budget deficits and economic slowdowns, it is essential for the government to anticipate global oil price dynamics, inflation trends, and exchange rate movements. These measures aim to achieve economic stability and promote sustainable growth.

The role of economic growth is crucial in measuring societal welfare. To enhance economic growth quality and realize public welfare, a synergistic approach between monetary and fiscal policies is imperative. Such collaboration will strengthen Indonesia's economic stability and resilience in the face of fluctuating global and domestic conditions.

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DECLARATION OF CONFLICTING INTERESTS
The authors declared no potential conflicts of interest.

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