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Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan, 24 (1), 2023, 95-111

Pandemic Shock and Economic Variables Responses in ASEAN Countries Using Panel Vector Autoregressive Model

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Received: September 2022 | Revised: February 2023 | Accepted: April 2023

Abstract

Economic shocks in a country can affect other countries due to openness and cooperative relations between these countries. In addition, the effect on an economic variable will be responded by other related variables such as Economic Growth, Inflation, Money Supply, and Unemployment Rate. This quantitative research aims to measure the factors that affect the economy in 10 ASEAN countries in 2014-2020. The method used is panel vector autoregressive (PVAR). The results of the research were divided into several tests. First, the causality test shows that GDP has an effect on inflation and money supply with a one-way causality. Second, the PVAR test shows that the money supply significantly affects inflation and unemployment rate at lags 1 and 2. The follow-up test, namely IRF, shows that the shocks of GDP responded by all economic variables are greater than shocks to other variables. While the results of the VD test show that GDP is the largest contributor to the variation in the value of all economic variables studied, both in the short and long term.

Keywords: GDP, Inflation, Money Supply, Unemployment Rate, PVAR
JEL classification: E01, E24, E31, E51, C33, C53

How to Cite: Retnasih N. R., Herdianti Y. M. (2023). Pandemic Shock and Economic Variables Responses in ASEAN Countries Using Panel Vector Autoregressive Model, 24(1), 95-111. doi:https://doi.org/10.23917/jep.v24i1.19850

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1. Introduction

The success of the development is reflected through increased welfare in a broad sense. For countries with an open economic system, this stage can be achieved by establishing cooperative relations with other countries. The Association of Southeast Asian Nations (ASEAN) is a regional organization between countries in Southeast Asia that facilitates cooperation among its member countries in various fields, including the economy. According to Chia (2013), the existence of this organization has the aim of becoming a single market and production base, so that the economy becomes a competitive region with equitable economic development, and is integrated into the global economy. To achieve these conditions, it is necessary to liberalize and facilitate trade in goods, services, and investment, in addition to protecting and promoting investment; as well as narrowing the development gap; and a freer flow of skilled labor and capital. So in a combined economy, all factors of production are predicted to be identical to one another. In other words, Anggraini et al. (2020) this collaboration prioritizes achieving economic growth through the integration of the domestic market into the world market so that it can increase the national income of its member countries. In general, countries in ASEAN show an increase in the level of economic development, per capita income, inflation, and anxiety levels. However, because they are in the form of an open economy, these countries are vulnerable to being affected by one another due to global economic shocks.

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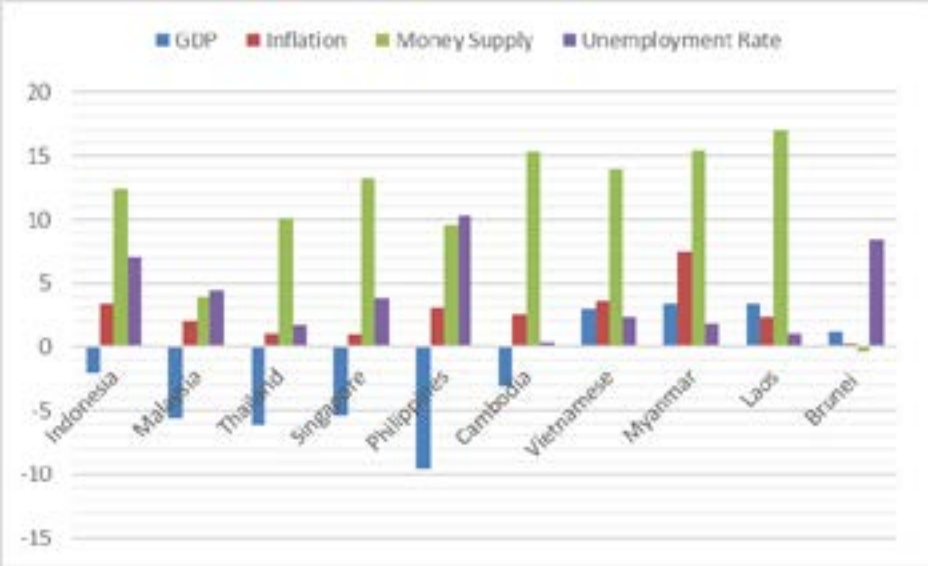

Figure 1. Economic Variables of ASEAN Countries in 2020

In 2020, the world was hit by a health crisis with the emergence of the Coronavirus Disease (Covid-19). This epidemic shook the economies of countries around the world, causing the economy to experience a sharp contraction, including in ASEAN countries. According to Adam et al. (2020), the policies implemented by the government to reduce the spread of epidemics such as lockdowns, social distancing, or other forms have had a very big impact. These policies halt economic activities that support livelihoods and attack the public financial sector with reduced revenues and increased spending on health and social protection. The effects of the ongoing global recession have been causing severe hardships for a long time for various sectors of the economy such as trade and tourism. Following are the economic conditions in ASEAN countries throughout 2020.

Figure 1 explains that despite having various similarities, the economic conditions of each country tend to be different in responding to shocks. In general, shocks affect economic performance in a country which is reflected through its economic variables. Based on published data from the Asian Development Bank (ADB), the highest level of Gross Domestic Product (GDP) in ASEAN was achieved by Myanmar and Laos at 3.3 percent and the lowest by the Philippines at -9.6 percent. The GDP data shows that all ASEAN countries experienced a decline in economic growth, but Vietnam, Myanmar, Laos, and Brunei Darussalam were able to maintain their country's GDP in a positive trend. Furthermore, shocks also had an impact on other indicators such as inflation, where the highest value was achieved by Myanmar at 7.5 percent and the lowest by Brunei Darussalam at 0.2 percent. Most countries are experiencing quite low inflation, this indicates sluggish economic activity because, at the beginning of the pandemic, many people's activities were restricted so economic activity did not run optimally. The unemployment rate also increased in each country, the highest was in the Philippines at 10.3 percent and the lowest was in Cambodia at 0.3 percent. However, a different thing happened to the money supply indicator which tended to experience a significant increase from the year before the pandemic, namely Laos at 17 percent, Myanmar at 15.4 percent, Cambodia at 15.3 percent, Vietnam at 13.9 percent, Singapore at 13.3 percent, and Indonesia 12.4 percent. The economic shock due to the pandemic and technological advances have created new habits so that even though people's activities are limited, financial transactions can be circulated digitally.

The value of one variable will affect other variables so shocks to one variable will trigger

shocks to other variables. According to Gnangnon (2022), the Covid-19 pandemic has increasingly weakened the economic structure of developing countries and revealed the level of vulnerability of these countries to external shocks. Developing countries are more exposed to external environmental, economic, and financial shocks than developed country economies, with a higher frequency of shocks. Therefore, ASEAN countries become small open economic countries. Bozkurt (2014) explains that an increase in the money supply can cause price increases or what is known as inflation. This inflation rate has a sustainable effect on economic growth as measured by Gross Domestic Product (GDP) positively in the Keynesian view and negatively in the Neoclassical view. Within normal limits, inflation can encourage the movement of production activities that increase GDP and open up employment opportunities to reduce the unemployment rate. This is following what was explained by Michael et al. (2016) that according to Okun's law, GDP and unemployment have a negative relationship with each other. Thus, when inflation reaches a sufficiently high level, this can disrupt smooth production activities, resulting in a reduction in the workforce and an increase in unemployment.

Specifically, this study uses the variables economic growth (GDP), inflation, money supply, and unemployment rate in econometric modeling because these variables are considered capable of describing economic conditions in a country. Fluctuations from one variable will affect other variables either directly or indirectly so this can affect overall economic stability. These variables are measured in time series and also cross-section using data from 10 countries in ASEAN. So the right model to use is in the form of a panel model. The analysis is focused on the response of each variable to the economic shocks that occurred from 2014 to 2020. So, the method used is Panel Vector Autoregressive (PVAR). This method is used to project the system with time variables to analyze the dynamic impact of each variable. If you look at the theory of an open economy, countries that have a cooperative relationship are vulnerable to being affected by one another. As is known, the economic shock caused by the Covid-19 pandemic has become the biggest in recorded history. The impact is evenly distributed throughout the world, both developing and developed countries, none of which is free from these shocks. ASEAN countries were chosen because they are geographically located close to each other in Southeast Asia. This closeness makes the flow of cooperation between countries even greater so that each country is dependent on one other. The attachment to this relationship is the for researchers to see the response of economic variables due to shocks that occur and their influence on one another.

This research refers to previous research by Agirkaya et al. (2021) which discussed the impact of Covid-19 on the economy of selected Asian Countries. The countries in the study included South Korea, Singapore, Vietnam and Taiwan, where the country responded very quickly to Covid-19 early in the outbreak. The main focus in this study is discussing the effects of Covid-19 on macroeconomic variables such as GDP, unemployment, inflation, and foreign trade with the analytical methods used, namely comparative and descriptive. In addition, this study also refers to the research of Hicham (2020); Inam (2014); Masnan et al. (2013); Sahnoun and Abdennadher (2019) which measures the performance of economic variables such as economic growth, inflation, money supply, and unemployment rates in several countries including North African countries, Nigeria, and countries in Southeast Asia. The difference lies in the selection of variables where some previous researchers only used some economic variables with time series data types. In addition, the methods used are adjusted to the objectives of each study so that one study tends to be different from other studies. Overall, each study has varied results, where the relationship between the variables tested has different results from one another. This is because the research periods are different so economic phenomena such as economic shocks that occur in each country are also not the same.

2. Research Method

This study uses a quantitative approach using secondary data published by the Asean Development Bank (ADB) website. The variables

chosen are proxies for economic variables, namely Gross Domestic Product (GDP), Inflation, Money Supply, and Unemployment Rate. All data in the form of percentages (%) were taken from 2014 to 2020. The object of this research uses 10 ASEAN countries, namely Indonesia, Malaysia, Brunei Darussalam, Singapore, Thailand, Philippines, Vietnam, Myanmar, Cambodia, and Laos. The selection of the object was based on several criteria, namely the geographical location of each country which is close to each other in the Southeast Asia region, having cooperative relations between countries, and the availability of published economic variable data during the research period.

The data analysis model uses the Panel Vector Autoregressive (PVAR) method which combines time series and cross section data. Zuhroh et al. (2018) explained that the VAR model was first proposed by Sims in 1980. In general, this model is used to analyze the relationship between time series variables and to analyze the dynamic impact of disturbance factors in system variables. This approach is a modification or combination of multivariate regression with time series analysis. Each variable, apart from being explained by its past value, is also influenced by the past values of all other endogenous variables in the observed model. In addition, in the VAR analysis, all variables used were considered endogenous variables. The PVAR model is a specification of the VAR model that uses panel data in it. According to Abrigo and Love (2016), systematic cross-sectional heterogeneity is modeled as panel-specific fixed effects. This setting is contrasted with time series VAR, whereby construct, the parameters are specific to the unit studied, or with random coefficient panel VAR, where the parameters are estimated as distributions.

Some of the tests carried out in this study were divided into several stages as follows.

2.1 Descriptive Statistical test

According to Kaur et al. (2018), this test is used to summarize data in an organized manner without making generalizations by describing the relationship between variables in a sample or population. Descriptive statistical tests are carried out early when conducting research and should always be performed before making inferential statistical comparisons. Descriptive statistics cover various types of variables such as nominal, ordinal, interval, and ratio, as well as measures of frequency, central tendency, dispersion/variation, and position. As a result, the data is summarized simply, making it easier to make decisions about assessing a particular population in a more manageable form.

2.2 Stationarity Test

Stationary test or unit root of panel data using Fisher's PP Test. Birinci and Kirikkaleli (2021) explained that the unit root test is used to detect the stationarity of time series variables in panel modeling. That's because the use of non-stationary data in a regression model can lead to spurious regression, implying invalid statistical conclusions. The basic equation of the unit root test can be as follows.

$$\Delta Y_{it} = m_{it}a_i + \beta y_{it-1} + \Sigma_{j=1}^{pi} g_i \Delta y_{it-j} + u_{it} \quad (1)$$

Where Δy_{it} represents the first difference for country i in the time period t=1. $\hat{a}i$ identical for all country. m_{it} is the deterministic components, u_{it} represents the error term and pi represent the lag order. We test the null hypothesis $\hat{a}i = 0$ for all countries against the alternative H_1 : $\hat{a}i < 0$, suggesting that all variables are stationary.

According to Akay et al. (2020), the unit root test calculates the specifications for a time series data set including deterministic, trend, nonlinear, and structural breaks. This test can make stronger and more precise estimates, making it possible to describe the structure of the data accurately. Thus, incomplete data and/or misidentification results in inadequate and inaccurate predictions.

2.3 Co-integration test

According to Taiwo and Olayemi (2015) in this test, the cointegration equation is estimated separately for each panel member, and the residue is examined to the unit root. If the null hypothesis of the unit root is rejected, then there is a long-term relationship in the model with different vectors in each cross-section. Among Pedroni's

seven statistics, four incorporate residuals along the dimensions in the panel including the v-panel statistic, rho(r panel), non-parametric (PP) panel, and parametric (ADF) panel. Meanwhile, three other statistics were obtained by combining the residuals between panel dimensions including the rho-group, PP-group, and ADF-group statistics. The hypotheses tested in the cointegration test with Pedroni are as follows.

H_0: probability > 0.05 or no cointegration relationship

A cointegration test is carried out to ensure that the next test will be carried out because individually the variables that have unit root problems at the level will automatically create a cointegration relationship when combined.

2.4 Causality Test

Causality test by using the Granger Causality test. The causality test is used to see the mutual relationship between variables in the VAR. According to Taiwo and Olayemi (2015), this test is grouped into four parts. First, the non-causality relationship is homogeneous, which means that there is no individual causality relationship. If the results of the F-statistic are significant, then the homogeneous non-causality hypothesis is rejected, i.e. there is causality for at least one member of the panel. On the other hand, if the homogeneous non-causality hypothesis is accepted, then there is no causality relationship among all panel members. Second, the causality relationship is homogeneous, which means that there are N causality relationships in all panel data. If the F-statistic is not significant, the homogeneous causality hypothesis is accepted, meaning that there is a causal relationship between all panel members. Whereas, if the homogeneous causality hypothesis is rejected, this implies that there is no causality relationship at least in one of the panel members. The third is heterogeneous causality and the implication of this is that there exists a causality relationship for at least one individual, and causality can increase up to a maximum of N. Fourth is heterogeneous non-causality, which implies that, for at least one individual, and at most N − 1 individuals, the causality relationship does not exist.

The statistics of the causality test in panel data are described according to Lopez & Weber (2017) as follows.

$$Y_{i,t} = \acute{a}_i + \sum_{K=1}^{K} \tilde{a}iky_{i,t-k} + \sum_{K=1}^{K} \hat{a}ikx_{it-k} + \mathring{a}_{i,t} \quad with\ i = 1 \ldots\ldots N\ and\ t = 1 \qquad (2)$$

Where $x_{i,t}$ and $y_{i,t}$ are the observations of two stationary variables for individual i during period t. Although coefficients are assumed to be time-invariant, they are permitted to differ between individuals (remember the i subscripts attached to coefficients). The panel must be balanced because it is assumed that the lag order K is the same for all individuals.

2.5 Panel Vector Autoregressive Test

Sigmund and Ferstl (2018) explained that the PVAR model was introduced by Holtz-Eakin et al. in 1988. The PVAR model is a combination of the single equation dynamic panel model and the VAR model. PVAR Test Statistics are as follows.

$$Y_{i,t} = \grave{\imath}_i + \sum_{l=1}^{P} A_l Y_{i,t-1} + Bx_{i,t} + Cs_{i,t} + \hat{a}_{i,t} \qquad (3)$$

Where $Y_{i,t}$ refers to economic variables or m x 1 vector of endogenous variables for the i^{th} cross-sectional unit at time t. $\grave{\imath}_i$ is the intercept parameter. Let $X_{i,t}$ be an k×1 vector of predetermined variables that are potentially correlated with past errors. Let $S_{i,t}$ be an n×1 vector of strictly exogenous variables that neither depend on $\mathring{a}_{i,t}$.

2.6 Impulse Response Function (IRF) test

Sebastine et al. (2016) explained that the function of IRF is to analyze the dynamic effects of the system when the model receives an impulse. The impulse response function shows the effect of shock on the variable adjustment path. The impulse response function traces the effect of one standard deviation shock to one of the innovations on the values of current and future endogenous variables.

2.7 Variance Decomposition (VD) test

According to Abidin et al. (2020) VD test is to identify the variation of a variable as a result of self-shock or shock on other variables. VD analysis can determine the percentage of variation values contained in one variable as a result of other variables in the system. Therefore, this method can provide information about the importance of a variable to other variables.

3. Results And Discussion

3.1 Results

3.1.1 Descriptive Statistical Test

The results of the descriptive statistical test can be seen in the following table.

Table 1. Descriptive Statistical Test Results

	GDP	Inflation	Money Supply	Unemployment Rate
Mean	3.980000	2.450000	10.89714	3.258571
Median	5.050000	2.250000	10.05000	2.700000
Maximum	8.000000	10.00000	31.50000	10.30000
Minimum	-9.600000	-0.900000	-1.800000	0.100000
Std. Dev.	3.732140	2.214887	7.409746	2.648953
Observations	70	70	70	70

Source: Author (2022)

The results of the descriptive statistical test show that the economic variables used, namely GDP, Inflation, Money Supply, and Unemployment Rate tend to have relatively small values. This can be seen from the average value of each variable which is close to its minimum value, while the data variance also tends to be small. seen from the closeness of the average value to the standard deviation of each variable.

3.1.2 Stationary Test

The results of the panel unit root test using PP Fisher Chi-Square are shown in the following table.

Table 2. Unit Root Test Results

Variable	Statistic	Value Prob.	Information
GDP	34.2699	0.0244	Stationary at 1st Difference
Inflation	122.351	0.0000	Stationary at 1st Difference
Money Supply	98.6632	0.0000	Stationary at 1st Difference
Unemployment Rate	55.7413	0.0000	Stationary at 1st Difference

Source: Author (2022)

Table 2 above shows that the data used in the research is stationary at the first difference, this is seen from the probability value of each variable below the significance level (α) 5 percent or 0.05. Thus, the next test in this study uses data on the first difference.

3.1.3 Co-integration Test

The results of the panel cointegration test using the Pedroni Residual Cointegration test are shown in the Table 3. Table 3 below shows the results that there is no cointegration in the panel data used in the study, this is seen from the probability value above the significance level (α) 5 percent or 0.05. Thus, this study can use the PVAR model for the first difference. According to Sulistiana et al. (2017) explained that if some variables contain unit roots and are not cointegrated with each other, the research model can still use VAR but variables containing unit roots must be differentiated and the results of the differentiation are free from unit root problems.

Table 3. Co-integration Test Results

Cointegration Test	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.555375	0.9401	-2.014621	0.9780
Panel rho-Statistic	0.989532	0.8388	0.931432	0.8242
Panel PP-Statistic	-0.777896	0.2183	-0.267974	0.3944
Panel ADF-Statistic	0.288455	0.6135	0.821471	0.7943

Source: Author (2022)

3.1.4 Causality Test

The results of causality test using the Granger Causality test are shown in the Table 4. Table 4 below shows that not all variables show a causal relationship. GDP has a one-way effect on Inflation with a probability value below 0.05. GDP also has a one-way effect on Money Supply, but not vice versa. While the other variables, namely Unemployment Rate to GDP, Money Supply to Inflation, Unemployment Rate to Inflation, and Unemployment Rate to Money Supply have no causal relationship with each other because the estimation results show a probability value above 0.05.

Table 4. Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
Inflation does not Granger Cause GDP	60	0.21934	0.6413
GDP does not Granger Cause Inflation		**4.61628**	**0.0359**
Money Supply does not Granger Cause GDP	60	1.60441	0.2104
GDP does not Granger Cause Money Supply		**4.94585**	**0.0301**

Source: Author (2022)

3.1.5 Panel Vector Autoregressive Test

Based on the results of PVAR test, the model estimation equation is obtained as follows.

GDP_t = -1.341370 + 1.018208 $GDP(-1)_{t-1}$ - 0.314037 $GDP(-2)_{t-1}$ + 0.029045 $Inflation(-1)_{t-1}$ - 0.154952 $Inflation(-2)_{t-1}$ + 0.120955 $Money\ Supply(-1)_{t-1}$ + 0.010717 $Money\ Supply(-2)_{t-1}$ + 0.249745 $Unemployment\ Rate(-1)_{t-1}$ - 0.134903 $Unemployment\ Rate(-2)_{t-1}$

Inflation has a positive effect on GDP at lag 1 and a negative effect on lag 2. Furthermore, Money Supply has a positive effect on GDP both in lag 1 and 2. Finally, Unemployment Rate has a positive effect on GDP in lag 1 and a negative effect on lag 2. Overall the variable does not show a significant effect because the estimation results show a probability value above 0.05.

$INFLATION_t$ = -0.336910 + 0.140321 $GDP(-1)_{t-1}$ + 0.025349 $GDP(-2)_{t-1}$ + 0.564351 $Inflation(-1)_{t-1}$ + 0.024786 $Inflation(-2)_{t-1}$ + 0.044938 $Money\ Supply(-1)_{t-1}$ - 0.005737 $Money\ Supply(-2)_{t-1}$ + 0.324095 $Unemployment\ Rate(-1)_{t-1}$ - 0.274828 $Unemployment\ Rate(-2)_{t-1}$

GDP has a positive effect on Inflation in lag 1 and lag 2. Furthermore, Money Supply has a significant positive effect on Inflation in lag 1 and has a significant negative effect on lag 2. Finally, Unemployment Rate has a positive effect on Inflation in lag 1 and has a negative effect on lag 2. GDP and Unemployment Rate do not show a significant effect because the estimation results show a probability value above 0.05. While Money Supply has a significant effect with a probability value of 0.04 in lag 1 and 0.03 in lag 2, meaning that every time there is an increase in Money Supply by 1 point, it will increase Inflation by 0.044938 in lag 1 and reduce Inflation by 0.005737 in lag 2.

$MONEY\ SUPPLY_t$ = 2.758408 - 0.350677 $GDP(-1)_{t-1}$ + 0.589131 $GDP(-2)_{t-1}$ + 0.222768 $Inflation(-1)_{t-1}$ - 0.258936 $Inflation(-2)_{t-1}$ + 0.429960 Money

Supply(-1)$_{t-1}$ + 0.250030 M2oney Supply-2)$_{t-1}$ + 1.034826 Unemployment Rate(-1)$_{t-1}$ - 1.198738 Unemployment Rate(-2)$_{t-1}$

GDP has a negative effect on Money Supply in lag 1 and a positive effect on lag 2. Furthermore, Inflation has a positive effect on Money Supply in lag 1 and a negative effect on lag 2. Finally, Unemployment Rate has a positive effect on Money Supply in lag 1 and a negative effect on lag 2. All variables do not show a significant effect because the estimation results show a probability value above 0.05.

UNEMPLOYMENT RATE$_t$ = 0.560272 + 0.014271 GDP(-1)$_{t-1}$ - 0.025580 GDP(-2)$_{t-1}$ - 0.096503 Inflation(-1)$_{t-1}$ + 0.158885 Inflation(-2)$_{t-1}$ - **0.021327 Money Supply(-1)$_{t-1}$ - 0.010380 Money Supply(-2)$_{t-1}$** + 0.565540 Unemployment Rate(-1)$_{t-1}$ + 0.387240 Unemployment Rate(-2)$_{t-1}$

GDP has a positive effect on Unemployment Rate in lag 1 and a negative effect on lag 2. Furthermore, Inflation has a negative effect on Unemployment Rate in lag 1 and a positive effect on lag 2. Finally, Money Supply has a significant negative effect on Unemployment Rate in lag 1 and lag 2. GDP and Inflation do not show a significant effect because the estimation results show a probability value above 0.05. While Money Supply has a significant effect with a probability value of 0.04 in lag 1 and 0.03 in lag 2, meaning that every time there is an increase in Money Supply by 1 point will reduce Unemployment Rate by 0.15181 in lag 1 and 0.28320 in lag 2.

3.1.6 Impulse Response Function Test

The results of IRF test are shown in the Figure 2. During the 20 research periods, GDP responds to shocks in economic variables both positively and negatively. In the short term, GDP responds more due to shocks to the variable itself by 3.75 points in the 1st period. Shocks to inflation, money supply, and unemployment rates were responded with small percentages in the short term. Meanwhile, in the long term, the GDP response shows a downward trend toward shocks in all variables. Furthermore, the Inflation variable tends to respond to small amounts of economic variable shocks. Inflation responded to GDP shocks of -0.02 points in the 1st period and increased by 0.08 points in the 4th period, after which the response continued to decline until the 20th period. Likewise with other variables, in the short term Inflation responds to shocks in Money Supply and Unemployment but in the long term, the response decreases.

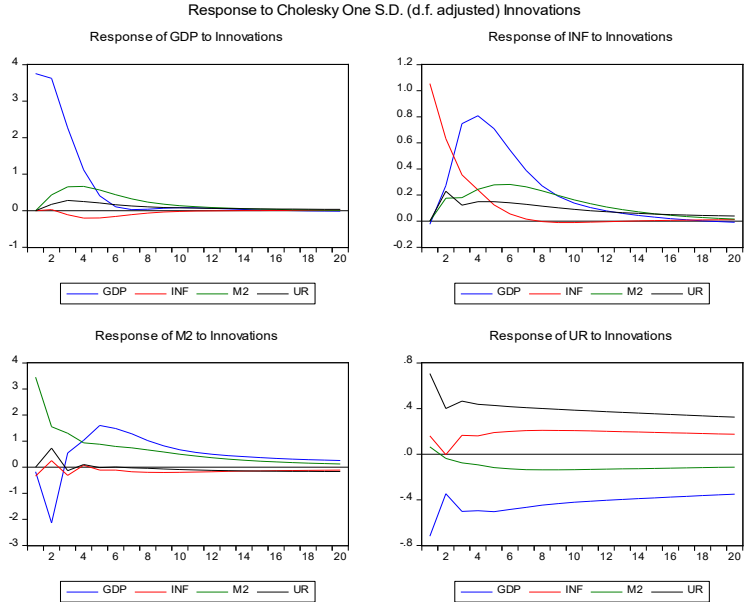

Figure 2. IRF Test Results

On the other hand, shocks to economic variables during the 20 research periods were responded to by the Money Supply both positively and negatively. The Money Supply responded negatively to shocks to GDP in periods 1 and 2 of -0.17 and -2.1 points. After that, the response turned positive which initially had an increasing trend but continued to decrease until the 20th period. Money Supply responds negatively to inflation shocks throughout the study period. Whereas in the Unemployment Rate variable, the response is positive in the short term and turns negative in the long term. And finally, the Unemployment Rate responds to shocks to economic variables negatively during the study period. The Unemployment Rate responded positively to shocks to inflation and money supply in several periods, but in the end, the response turned negative again.

3.1.7 Variance Decomposition Test

The VD test results are shown in the Table 5. Based on table 5 above, it can be concluded that the variation in the value of economic variables in 10 ASEAN countries is more influenced by the variable itself than other variables throughout the study period. Variations in the value of GDP are more influenced by the variables themselves, both in the short and long term. Inflation's contribution was 0.003 percent in the short term and an increase of 0.37 percent in the long term. The contribution of Money Supply in the 2nd period was 0.68 percent and increased by 5.03 percent in the 20th period. This variable is also the biggest contributor compared to other variables. Unemployment Rate contribution was 0.11 in the 2nd period and increased by 0.86 in the 20th period.

The variation in the value of Inflation is influenced more by the variable itself in the 1st period by 99.9 percent and continues to decrease to 35.4 percent at the end of the period. The contribution of GDP is quite large to Inflation value in the long term reaching 49.4 percent, while the contribution of Money Supply only reaches 10.7 percent and Unemployment Rate is 4.3 percent in the 20th period. Furthermore, the variation in the value of Money Supply variable is influenced more by the variable itself by 98.7 percent in the 1st period and decreases to 54 percent in the 20th period. The contribution to GDP was very small at the beginning of the period at 0.25 percent but continued to increase significantly to reach 42.1 percent in the 20th period. This variable is also the biggest contributor to forming the Money Supply value from other variables. Meanwhile, Inflation and Unemployment Rate only contributed 1.75 and 2.08 percent until the 20th period.

Finally, variation on Unemployment Rate variable. Throughout the research period, variations in the value of Unemployment Rate are more influenced by GDP both in the short and long term. The influence of GDP is 49.3 percent in the 1st period and decreases to 47.5 percent in the 2nd period. This contribution is greater than the variable itself which only contributed 47.8 percent in the 1st period and 40.5 percent in the 20th period. Meanwhile, Inflation variable contributed 2.4 percent and continued to increase to 8.4 percent at the end of the period. Money Supply contributed the least to Unemployment Rate value, which was 0.38 percent in the 1st period and increased to 3.4 percent at the end of the study period. From the four economic variables tested by VD, it can be concluded that GDP is the largest contributor to all economic variables in the model.

Table 5. VD Test Results

Variance Decomposition of GDP:					
Period	**S.E.**	**GDP**	**Inflation**	**Money Supply**	**Unemployment Rate**
1	3.755856	100.0000	0.000000	0.000000	0.000000
2	5.239593	99.19775	0.003166	0.685419	0.113662
10	6.003182	93.87810	0.373695	4.955332	0.792871
15	6.008477	93.75336	0.373408	5.031826	0.841406
20	6.009500	93.72238	0.374570	5.038205	0.864848

Variance Decomposition of INFLATION:					
Period	**S.E.**	**GDP**	**Inflation**	**Money Supply**	**Unemployment Rate**
1	1.054689	0.050208	99.94979	0.000000	0.000000
2	1.292099	4.498086	90.50159	1.852812	3.147512
10	2.174652	50.06272	36.23588	9.886946	3.814454
15	2.195646	49.59928	35.54837	10.64677	4.205580
20	2.199209	49.45047	35.44194	10.70975	4.397848
Variance Decomposition of MONEY SUPPLY:					
Period	**S.E.**	**GDP**	**Inflation**	**Money Supply**	**Unemployment Rate**
1	3.476132	0.250674	0.961696	98.78763	0.000000
2	4.435439	23.44710	0.919725	72.91000	2.723175
10	5.955088	40.95412	1.296274	56.11928	1.630322
15	6.106027	41.81571	1.589537	54.80844	1.786306
20	6.168547	42.11617	1.751245	54.04841	2.084168
Variance Decomposition of UNEMPLOYMENT RATE:					
Period	**S.E.**	**GDP**	**Inflation**	**Money Supply**	**Unemployment Rate**
1	1.022883	49.33586	2.462458	0.386821	47.81486
2	1.152369	47.92466	1.941195	0.411836	49.72231
10	2.216111	48.98582	6.643849	2.542312	41.82802
15	2.579343	48.04284	7.836809	3.132020	40.98833
20	2.848175	47.54006	8.452162	3.426595	40.58118

Source: Author (2022)

3.2 Discussion

3.2.1 Gross Domestic Product in ASEAN

Gross Domestic Product is one of the most important indicators in measuring a country's economic growth. According to Wu et al. (2021) GDP is a macroeconomic indicator that measures the level of economic development in a country or region. This variable has a major influence on the determination of macroeconomic goals and the formulation of regulations in the future. In addition, GDP is also influenced by several factors, such as the level of economic development, policy orientation, climate environment, and the standard of living of the population, etc.

Throughout the research period, economic growth in ASEAN countries tended to be stable with different achievements between countries. The highest growth was achieved by Myanmar in 2014. However, the existence of a pandemic that rocked the world economy resulted in a simultaneous decrease in GDP in 10 ASEAN countries in 2020. Economic growth contracted sharply to touch negative numbers in 6 countries including Indonesia, Malaysia, Thailand, Singapore, Philippines, and Cambodia where the lowest GDP occurred in the Philippines. Meanwhile, 4 other countries namely Vietnam, Myanmar, Laos, and Brunei Darussalam were able to maintain a positive value in their GDP even though the trend was also experiencing a significant decline. Cases infected with Covid-19 and the number of people who died in these countries are relatively low when compared to other ASEAN countries. In addition, the government made decisions quickly and comprehensively during the first wave of Covid-19, so quick and good handling resulted in the shocks not causing a recession.

The main factor causing the decline in GDP in ASEAN countries is the result of policies taken by the government to reduce the spread of the Covid-19 virus. Even though they have different names, all countries implement a policy of limiting people's activities outside the home. As a result, businesses in various sectors experienced a decline, so the rotation of the economic wheel was hampered. Significant declines occurred in countries that rely on foreign trade and tourism. To overcome this, several countries have implemented a policy of injecting funds into various business sectors, and providing social assistance to their communities so that their

purchasing power is maintained and economic recovery can be maximized.

The results also show that the value of GDP cannot be separated from fluctuations in other economic variables. From these results, GDP becomes a variable that dominates other economic variables throughout the study period both in the short and long term. The test results show that GDP has a one-way relationship with influencing inflation and also the money supply. Furthermore, GDP shocks also can potentially affect the value of inflation, money supply, and unemployment rate. Therefore, GDP is also the largest contributor to variations in the value of inflation, money supply, and unemployment rates both in the short and long term.

Apart from affecting other variables, the research results also show that GDP is also influenced by inflation, money supply, and unemployment rate even on a small scale. Shocks to Inflation, Money Supply, and Unemployment have little effect on changes in the value of GDP. Likewise, with the variation in value, GDP is more influenced by the variable itself than other variables. This shows that many other economic factors are not included in the model that also affects GDP. According to Yuliadi and Yudhi (2021), several economic variables affect GDP, namely total population, interest rate, money supply, human development index, energy consumption, foreign debt, corruption perception index, financial literacy index, foreign direct investment, and vice versa.

Fluctuations in the value of GDP are generally used as a basis for consideration for decision-making and policy-making by the government. There is always a trade-off between GDP and inflation so both are related to one another. When the government focuses on increasing GDP, the consequence that must be faced is an increase in inflation and money supply. Conversely, if policies focus on controlling inflation, economic growth will decline. Inflation that is too low indicates a sluggish economy, so its existence is considered a trigger for the wheels of the economy to move. Some of the results from this study are in line with Hicham (2020); Inam (2014); Masnan et al. (2013); Sahnoun and Abdennadher (2019); Yuliadi and Yudhi (2021).

3.2.2 Inflation in ASEAN

Inflation is also an important indicator in the economy that measures the level of price increases. According to Jain et al. (2022), inflation can increase the overall cost of living so that the demand for the value of money decreases significantly and reduces people's purchasing power. Inflation is divided into two types, namely, demand-pull inflation and cost-push inflation. Demand-pull inflation is caused by an increase in consumer aggregate demand for goods and services. This phenomenon reflects an imbalance between aggregate supply and demand where extensive pressure caused by consumer demand on the output capacity of supply forces prices to rise irrationally. While cost-push inflation occurs due to an increase in supply costs caused by an increase in production factor costs such as labor costs, raw material costs, and capital goods costs. An increase in production costs will force product prices to increase higher as manufacturers strive to maintain sustainable profitability.

The trend of inflation in several countries has tended to decrease since 2014. When a pandemic occurred, most countries showed low inflation rates. Singapore and Brunei Darussalam recorded their inflation at 0 percent in 2020. The average inflation rate for 10 ASEAN countries during 2020 was 2.6 percent. Despite these shocks, Myanmar became the country with the highest inflation among 9 other countries. Even in 2015, inflation was recorded at 10 percent, and during the pandemic, it was 7.5 percent. High inflation can indicate a fast and large amount of money circulating. This could happen due to high demand in the market. When the pandemic occurred, panic buying occurred in several countries. This condition can trigger scarcity and ultimately increase prices. Conversely, low inflation can even cause deflation indicating sluggish economic activity in a country. Low demand in the market indicates low public purchasing power. During the pandemic, there were layoffs, delays in production and trade activities and the cessation

of various businesses reduced people's welfare. At that point, people reduce purchases and only focus on consuming their basic needs.

During the research period, inflation tends to be influenced by GDP, money supply, and unemployment rates both in the short and long term. On the other hand, the presence of inflation in influencing changes in other economic variables is still of very little value, as is the variation in its value for other variables. All variables tend to contribute to inflation, with GDP being the biggest contributor. Inflation can be a problem that can disrupt economic stability. According to Cili and Alkhaliq (2022), high inflation indicates prices will continue to increase, the value of the currency decreases, and people tend to dislike cash, followed by a decrease in production activity. Ahmad et al. (2014) added that high inflation uncertainty also makes the availability of external funds more expensive and as a result, managers delay or cancel fixed investment projects. Thus, the reduced rate of investment hinders economic growth. On the other hand, inflation can also be a trigger for economic turnover. According to Ofori et al. (2017), positive effects of inflation include ensuring that the central bank can adjust real interest rates (to reduce recession) and encourage investment in non-monetary capital projects. Some of the results of this study are in line with the research of Hicham (2020); Lisani et al. (2020); Masnan et al. (2013); Sahnoun and Abdennadher (2019); Wulandari et al. (2019).

3.2.3 Money Supply in ASEAN

The percentage of money supply in each country has a different trend, although it tends to increase when economic shocks occur in 2020. Throughout the study period, Cambodia was the country with the highest increase in currency circulation. During times of economic shock, several countries had an increase in the percentage of money supply, namely Cambodia by 15.3 percent, Vietnam by 13.9 percent, Myanmar by 15.3 percent, Laos by 17 percent, Singapore by 13.2 percent, and Indonesia by 12.4 percent. Meanwhile, since 2014 Thailand has recorded a stable percentage of its money supply, namely 4.4 percent, but during the pandemic, it increased by 10.1 percent. Two other countries, namely Malaysia and Brunei Darussalam, recorded quite low percentages of the money supply. When a shock occurs, the money supply shows a negative percentage of 0.4 percent for Brunei Darussalam and 4 percent for Malaysia.

The high money supply in most ASEAN countries is supported by the consumption of the middle and upper-class people or groups of people who are not financially affected by the pandemic so they can still maintain their purchasing power. Apart from that, the circulation of money can also come from injections of government funds, bearing in mind that several countries implement policies of injection of funds in various business sectors and social assistance to the community to maintain their purchasing power. On the other hand, the pandemic has also created new habits in society in carrying out economic activities such as buying and selling and online transactions.

The money supply plays a role in maintaining domestic financial flows and stability. The existence of the money supply in the economy must be balanced, meaning that it cannot be too little and not too much. This is because an imbalance in currency circulation will have a significant impact on the economy as a whole. The results show that throughout the study period, changes in the value of the Money Supply are more influenced by shocks and also variations in GDP than other variables which only affect a small amount. On the other hand, the money supply has a significant influence on inflation and the unemployment rate.

According to Sumaryoto et al. (2021), excessive money circulation in the economy can trigger high inflation rates. An increase in the inflation rate can reduce the overall value of the money supply, resulting in a negative impact on the economy as a whole, which in turn will drive many companies into bankruptcy. In general, the central bank will respond to the high amount of money in circulation and inflation that occurs through contractionary policies. Zhao (2021) adds that Irving Fisher's theory can explain the relationship between inflation and the money supply through the formula for the quantity of money: MV=PT. M is the money supply; V is

circulation speed; P is the average price level; and T is the volume of goods and services transactions. If the money supply increases on the left side of the equation, the average price level will increase at the same rate, which we can clearly observe from market conditions. This phenomenon illustrates that there is too much money in circulation but the availability of goods is very limited. Price increases can motivate producers to increase their production capacity and gain profits. However, this only applies in the short term because, in the long term, profits do not increase significantly.

According to Mahadika and Wibowo (2021), an increase in unemployment indicates a decline in economic performance. An increase in the money supply can encourage inflation, according to Philips' theory, an increase in inflation can ultimately reduce the number of unemployed. In macroeconomics, an increase in aggregate demand will cause prices to rise. To meet this demand, producers increase their production capacity by adding workers (assuming that labor is the only factor that can increase output). Thus, it is concluded that the money supply and unemployment are negatively related.

Furthermore, According to Antoni (2015), the money supply can affect the running of productive investment projects, so that it can trigger economic growth in a country. Chaitip et al. (2015) added that in the last decade when the global financial crisis occurred, the money supply also affected the occurrence of a global economic recession in developed and developing countries. The economic consequences in many developing countries of this indirect effect are as severe as the direct effects in developed countries. Ihsan and Anjum (2013) added that an increase in the money supply has a strong impact on economic activity by lowering interest rates and increasing investment. In this condition, consumers will spend more money and this will have an impact on increasing production. Rapid business development will create employment opportunities and increase capital goods. Therefore, according to Inam (2014) maintaining monetary stability (including through the supply of money) is also one of the conditions for achieving long-term and sustainable economic growth as a whole. More than that, the implementation of a sound monetary policy coordinated with the prudent fiscal policy will create macroeconomic stability to guarantee sustainable economic growth. This research is in line with the research of Hicham (2020); Inam (2014); Masnan et al. (2013); Yuliadi and Yudhi (2021).

3.2.4 Unemployment Rate in ASEAN

Another problem that is no less important in the economy is the unemployment rate. Low employment opportunities are a major problem, especially in developing countries with high population numbers. The economic shock that occurred in 2020 caused almost all ASEAN countries to experience an increase in the percentage of unemployed except for Myanmar which experienced a decline. The highest increase in unemployment occurred in the Philippines and the lowest in Cambodia. Several factors cause high levels of unemployment in several countries. This is closely related to the decline in economic performance in ASEAN countries. The government's policy to tackle the spread of the Covid-19 virus is a tradeoff for the economic sector which continues to experience a decline. Restrictions on social activities imposed by the government resulted in a cessation of economic activity such as closing malls and shopping centers, closing tourism, postponing events, and others which slowed down the economic cycle. The impact is a huge loss that triggers the bankruptcy of business sectors in various fields. In line with this, layoffs contributed to an increase in unemployment.

The results of the study show that the money supply has a significant effect on the unemployment rate. In addition, shocks from all economic variables also affect the value of the unemployment rate, with GDP as the variable that has the greatest influence. Likewise, with the variation in value, the unemployment rate is more influenced by GDP both in the short and long term. On the other hand, shocks and variations in the unemployment rate also affect all economic variables in this study, but only in small amounts. The shock caused by the Covid-19 pandemic that occurred proves that the majority

of recessions that occur in a country can increase its unemployment rate. This indicates a reduced level of people's welfare and can contribute to increasing the level of poverty in the country. To avoid this, of course, various countries are trying to formulate effective policy packages so that they can increase their economic growth again.

The unemployment rate is a trade-off of inflation in the economy. That is, when the government wants to reduce the inflation rate, the unemployment rate will certainly increase, and vice versa. This was also stated by Qin (2020) a negative relationship between unemployment and inflation, which is manifested by a cumulative impulse response which explains that expansionary fiscal policy contributes to contractionary monetary policy, and cannot be reversed. Contractionary policies can be adopted to exchange high unemployment for low inflation, which provides a theoretical basis for selecting economic policies. Therefore, according to Wulandari et al. (2019), policymakers must consider overcoming inflation or unemployment first. In other words, when the government wants to increase employment opportunities, it has an impact on price stability. Conversely, when policymakers keep prices stable, they should not consider having more employment opportunities. Therefore, the unemployment rate becomes an important variable similar to inflation to maintain its stability so that the economy runs well.

Furthermore, the relationship between unemployment and economic growth can be explained by Okun's law. According to Mandel and Liebens (2019), GDP has a negative relationship with unemployment. A high unemployment rate indicates that many people live below the poverty line. From an economic perspective, a high unemployment rate indicates that the availability of labor is not used efficiently in production activities. Therefore, total output in aggregate will also decrease. Nagel (2015) adds that low economic growth in a country can result in an increase in the unemployment rate in the long run. In addition, high and persistent unemployment can also be a barrier to economic growth. Unemployment indicates low global demand and investment in human capital. Consequently, in the long term, the unemployed group loses some or all of their qualifications, while their skills become obsolete in an age of rapid technological progress. In addition, fiscal costs indicate lower budget revenues and higher social spending, resulting in lower public investment and increased public debt. Ultimately hindering growth opportunities. This research is in line with Lisani et al. (2020); Sahnoun and Abdennadher (2019); Wulandari et al. (2019); Yuliadi and Yudhi (2021).

4. Conclusions

The success of economic development in ASEAN countries can be seen from the performance of economic variables including GDP as an indicator that measures the country's economic growth, money supply, inflation rate, and unemployment rate. This variable is influenced by various factors so shocks in the economy can affect the level of stability. Indicators for measuring economic performance are not limited to these four variables, there are other variables such as exchange rates, interest rates, employment opportunities, trade flows, the balance of payments, investment levels, and so on. However, all of these variables are not used in this research model. This is due to the limited availability of data published by the ASEAN Development Bank (ADB) in 10 ASEAN countries in the 2014 - 2020 period, which is a limitation in this study.

The results of this study indicate that GDP affects inflation and money supply with a one-way relationship. Furthermore, the money supply has a significant effect on inflation and the unemployment rate at lags 1 and 2. Shocks to GDP, inflation, money supply, and unemployment rate due to economic instability can also affect the value of each variable. GDP shocks are responded to by economic variables that are greater than shocks to other variables. In addition, GDP is also the largest contributor to variations in the value of economic variables both in the short and long term. Based on these results, this study can be input for policymakers in 10 ASEAN countries to focus on achieving a high and stable GDP value. This is because, during the research period, GDP became

the dominating factor in influencing the stability of inflation, money supply, and unemployment variables. In the event of a shock that disrupts economic stability, policymakers can immediately respond with a policy package that prioritizes GDP to be immediately re-stabilized. The hope is that stability in GDP will automatically stabilize other economic variables. Good GDP performance reflects good economic growth and this is largely due to the positive interaction of economic, political, social, and institutional factors that effectively reflect monetary policy into achieving sustainable growth that will bring prosperity to the whole society.

5. References

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