



Structural Break and The Period of Indonesia's Post-Pandemic Economic Recovery

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The Covid-19 pandemic in 2020 caused economic contraction of 2.07 percent in Indonesia. Knowing the similar economic conditions in the past period and how long is the period of Indonesia's economic recovery after the pandemic are important. Therefore, this study aims to determine the period of economic structural break that has occurred in Indonesia and to determine the period of economic recovery. The analytical method used is the Bai-Perron, cointegration test, and VECM. The variables used are economic growth, exports, and inflation. The results of this study indicate the occurrence of structural break periods in the Indonesian economy in 1989, 1998 and 2004. Furthermore, based on the long-term VECM equation, exports have a positive but insignificant effect on economic growth. In contrast, inflation has a significant negative impact on economic growth. By using the IRF, it showed that economic growth will achieve stability or recovery after the occurrence of shocks to economic growth itself within a period of 5 to 10 years. If there is a shock to exports, economic stability can be achieved in a period of 5 to 10 years. Meanwhile, if there is a shock to inflation, stability can be achieved in less than 5 years

INTRODUCTION

Early in 2020 WHO announced Covid-19 as a pandemic phenomenon. This was due to its global spread and severity of the disease. In addition, the issuance of this pandemic statement was also because Covid-19 was not only a health issue, but also a multidimensional issue (Açikgöz and Günay, 2020). The economic, political and social dimensions are the chain of impacts of Covid-19. According to data from Our World in Data (2021), by the end of 2020 the number of confirmed positive cases in the world reached more than 83 million people with a death rate of 2.18 percent. Not much different from the case in Indonesia, the percentage of deaths due to Covid-19 reached 2.98 percent of the total confirmed positive cases of 743,198 people.

The Covid-19 pandemic in 2020 was the main reason for the shaking of the Indonesian economy which fell to -2.07 percent. This negative economic growth was the first to have occurred since the economic crisis in 1998. This condition caused concern for the government and society. This is what prompted the government to focus on handling the Covid-19 pandemic. Various policies have been implemented by the Indonesian government to reduce the impact of the pandemic. Early in 2021 several policies implemented are related to the imposition of restrictions on micro-based community activities, prohibition of Eid homecoming, and administering vaccines. However, what needs to be considered in making a policy to be more effective and efficient is to know the similar conditions in the past period and evaluate the policies in that period. To find out the economic shocks that have occurred in Indonesia before, this study uses the structural break method so that it becomes one of the lessons in dealing with the impact of the current pandemic.

In addition, knowing the recovery period after a similar condition can assist in planning more accurate policies. Therefore, this study also aims to determine how long is the period of Indonesia's economic recovery after the

pandemic. There are several studies related to the economic impact of the pandemic, but there are limited research that can determine when economic conditions stabilize or recover. Several studies related to the impact of the Covid-19 pandemic on the economy has been carried out, such as Supriatna (2020), Abiad (2020), Susilawati, Falefi and Purwoko (2020), Atkenson (2020), Garg, Gupta and Kumar (2021), and Kareemulla et al (2020). Several further studies to determine the long-term economic impact have also been carried out by Caballero & Valdés (2020), Jordà et al (2020), Hur and Jenuwine (2020), Cheah et al. (2018), Geweke and Porter-Hudak (1983), Granger & Joyeux (1980), Morana and Beltratti (2004), and Gil-Alana (2003). Besides, different from those previous research, this study uses structural break method to explain condition of Indonesia's economy in pandemic era and uses Vector Error Correction Method (VECM) for more details.

RESEARCH METHODS

This study uses secondary data. The data source is obtained from the World Bank with an annual period from 1975 to 2020. The data collected is the growth of Gross Domestic Product (GDP) as the main variable. Other variables collected were exports and inflation as control variables. The method used to obtain the structural break conditions is the Bai-Perron method. Furthermore, to determine the period of Indonesia's economic recovery, the Vector Auto Regression (VAR) method is used.

More than one structural break can be found in macroeconomic time series. To this purpose, Bai and Perron (1998) recently published a comprehensive examination of a number of concerns in the context of numerous structural change models, as well as several tests that rule out the presence of trending regressors. Bai and Perron proposed a test to break at L and $L + 1$ which is referred to as $supF_T(L + 1|L)$ (Bai and Perron, 2003). This method is a test application ($L + 1$) of the null hypothesis of no structural change versus the alternative hypothesis that there is a

change. The least squares principle is used in the estimate procedure. The corresponding least squares estimate of δ_j is produced by minimizing the sum of squared residuals $\sum_{i=1}^{m+1} \sum_{T_{i-1}+1}^{T_i} (y_t - z_t \delta_i)$ for each m-partition (T_1, \dots, T_m) , denoted T_j . The Bai-Perron method was used in this study to obtain the structural break period. Structural breaks are a shift in behavior over a time series, usually in an economic structure, which is the result of permanent changes (Syapriatama, 2019).

The next method in this research is Vector Auto Regression (VAR). VAR is a method that can be used to characterize time series data. Time series data is a collection of variable observation values at different times (Rahayu *et al.*, 2021). VAR can be used to project a variable and analyze the dynamic impact of disturbance factors on the variable system (Tesa, 2012). According to Stock (2001), VAR can perform four tasks related to macroeconometrics namely data description, forecasting, structural inference, and policy analysis.

Because VAR involves both the present value and the lagging value over several time series, it captures comparisons that cannot be detected in univariate or bivariate models. Standard VAR summary statistics such as the Granger causality test, impulse response function, and variance decomposition are well accepted and widely used methods of describing these comparisons. These summary statistics are useful because they provide targets for theoretical macroeconometrics.

VAR with two or three variables is often unstable, making it a weak predictor of the future (Stock & Watson, 1996). However, adding a variable to VAR creates complexity, as the number of VAR parameters increases as the square of the number of variables is. However, macroeconomic time series data cannot provide reliable estimates of these coefficients without further limitations.

VAR can also perform structural inference task. In general, shocks in VAR, as in conventional regression, reflect factors that were omitted from the model. If these factors are

correlated with the included variables, then the VAR estimate will have the variable bias removed.

In addition, policy analysis can also be obtained from the results of VAR. Two types of policies can be analyzed using VAR, namely one-time innovations in which the same rules are maintained; and changes to policy rules. The estimated effect of a one-time innovation is a function of the impulse response to policy innovation.

The VAR model is a multi-equation system where all variables are treated as endogenous (Oguntade and Zubair, 2015). Thus, there is one equation for each variable as the dependent variable. Each equation has a lag value of all variables included as the dependent variable, including the dependent variable itself. Lütkepohl (2005) introduced the VAR model as follows.

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + B_0 x_t + \dots + B_q x_{t-q} + CD_t + u_t \dots \dots \dots (1)$$

Which $y_t = (y_{1t}, \dots, y_{kt})$ is endogenous variable of vector $k \times 1$, $x_t = (x_{1t}, \dots, x_{Mt})$ is exogenous variable of vector $M \times 1$, and D_t includes all pre-determined variable.

If the VAR model has non-stationary and co-integrated variables, then the research can be continued by using the Vector Error Correction Model (VECM). VECM has a long-term cointegration relationship, but it still allows for short-term adjustment for the dynamics (Azizatunnishak, 2018). However, before entering the VAR / VECM modeling stage, it is necessary to carry out several tests, namely the stationarity test, the optimum lag test, the cointegration test, and the stability test.

In the VAR/VECM model, an Impulse Response Function (IRF) analysis is found. The IRF is the response of the present and future values of each variable to a one-unit increase in the present value of one of the VAR/VECM errors. This IRF assumes that the error returns to zero in the next period and that all other errors are equal to zero (Stock, 2001). IRF analysis is also used to measure how big the short-term and

long-term impacts are caused by changes in the standard deviation of one endogenous variable to all endogenous variables in the VAR/VECM model (Azizatunnishak, 2018).

RESULTS AND DISCUSSION

During 1975 - 2020, the Indonesian economy had an increasing trend. However, in several periods there were economic events/shocks that caused a structural break in the pattern. To find out which period there was a break in Indonesia's economic history, a structural change was used using the Bai-Perron method. The confidence level used in this structural change model is 95 percent.

Figure 1 shows the results of structural change in the Indonesian economy for nearly half a century. The first period of the outbreak was 1989, in which year the world economic conditions had changed because globalization was getting more real (Mubyarto, 2001). In

addition, from 1989 to 1991 the communism system had disappeared, replaced by the free-market capitalism system. The next break period is the monetary crisis period in 1998. These results are in line with the findings Deviyantini et al. (2018) and Mustafa (2015). This event was initiated by a shock in the monetary sector, namely the depreciation of the rupiah against the dollar Ningrum, *et al.* (2017). The shock eventually spread to almost all aspects of the economy in Indonesia. Then 2004 became the last break period in the Indonesian economy in the 1975-2020 period. This break period was also found in research Deviyantini et al (2018) and Alamsyah (2019). In that year, the Indonesian economy was affected by global conditions, namely changes in US monetary policy which became increasingly tighter (Mahardika, 2014). The year 2004 also saw an upward trend in interest rates that led to the collapse of the housing market in the United States.

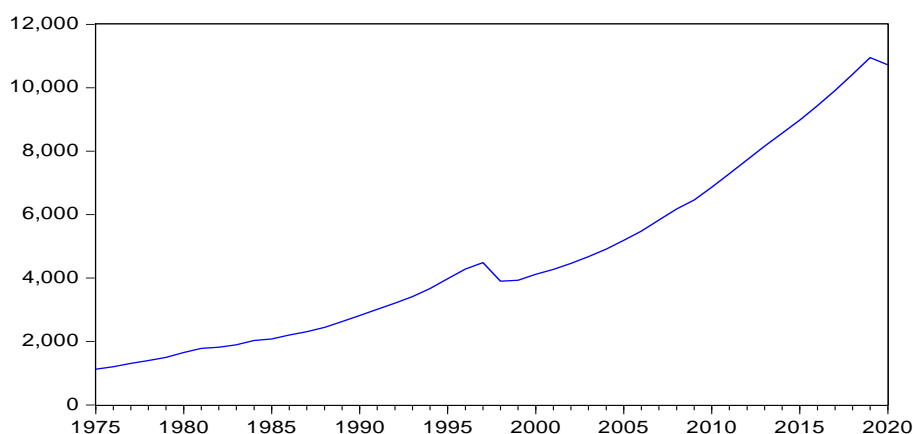


Figure 1. Gross Domestic Product of Indonesia for 1975-2020 and Structural Break Periods are Shown with Dashes Vertically.

The next stage is to conduct a stability test for Indonesia's Gross Domestic Product data using the cumulative sum (CUSUM) Test. The CUSUM Test detects data instability by paying attention to the systematic movement of the data (Farhani, 2012). If the plot of the test results is outside the CUSUM limit with a significance level of 95 percent, it is considered that the condition is out of control.

In Figure 2, it can be seen that the economic conditions in 2020 are outside the CUSUM range, which means that there is economic instability in that period. This is in accordance with the current phenomenon where economic growth in 2020 has contracted by 2.07 percent as a result of the Covid-19 pandemic. If an estimate is made for the next few years, it will be found that the Indonesian economy in 2020 will be one of the periods that will experience a structural break.

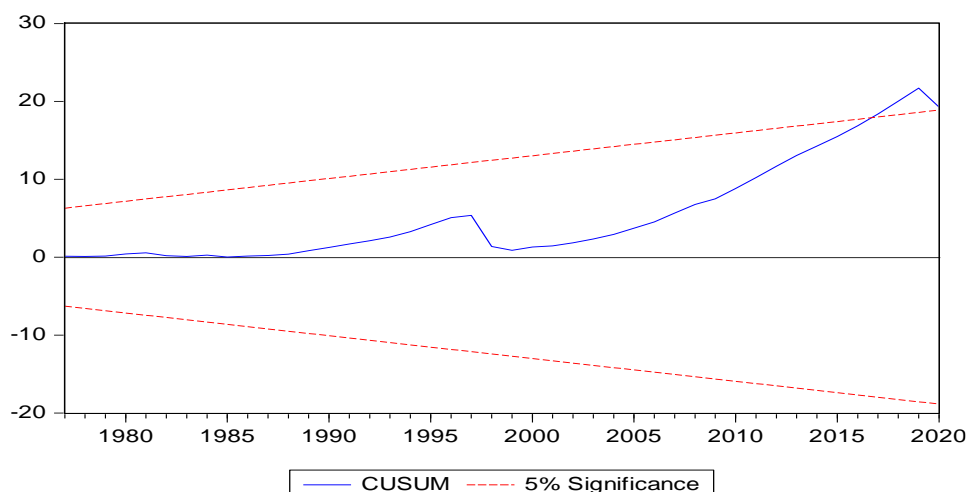


Figure 2. CUSUM Stability Test of Indonesia's Gross Domestic Product, 1975-2020

For three consecutive quarters in 2020, Indonesia experienced negative economic growth. In the second quarter of 2020, the Indonesian economy contracted by 5.32 percent, and the third and fourth quarters of 2020 grew negatively by 3.49 percent and 2.19 percent, respectively (BPS, 2021). This shows that Indonesia has experienced a recession due to the pandemic. The economic component most affected by this condition was exports of goods and services, which contracted by 7.70 percent. Household consumption, which is the largest contributor to the Indonesian economy, was negatively impacted in 2020, where growth contracted by 2.63 percent.

Before modeling Indonesia's economic variables, it is necessary to conduct a stationarity

test using the unit root test. This test is an initial step in the future to get better accuracy on the econometric model that will be used (Sutawijaya and Lestari, 2013). This study used the Phillips-Perron statistical test by comparing the absolute value of the statistical test and the critical value at the significance level $\alpha = 1$ percent. The results of statistical tests in Table 1 show that the variables (economic growth, exports, and inflation are not stationary at the level. Furthermore, these three variables need to be differentiated in order to re-test the stationarity. It can be seen in Table 1 that the significance of the three variables in the first difference is below 0.01). This shows that the three variables are stationary in the first difference condition.

Table 1. Stationarity Test of Phillips-Peron

Variable	Level			First Difference			Description
	Adj. t-Stat	Test critical values (1% level)	Sig	Adj. t-Stat	Test critical values (1% level)	Sig	
Economic Growth	-2.122113	-2.617364	0.0339	-8.364151	-2.618579	0.0000	Stationary in first differences
Export	2.662163	-2.617364	0.9977	-4.649724	-2.618579	0.0000	Stationary in first differences
Inflation	3.673295	-2.617364	0.9999	-2.818430	-2.618579	0.0059	Stationary in first differences

Source: Data Processed, 2021

The next step for processing data in the VAR / VECM model is to determine the optimum amount of lag that will be used. The criteria for determining the optimum lag can be

seen from the Final Prediction Error FPE, Akaike Information Criteria AIC, Schwarz Criteria SC, and Hannan-Quinn HQ. The four criteria refer to the same amount of lag, namely lag 1.

Table 2. Results of Determination of the Optimum Lag Length

Lag	FPE	AIC	SC	HQ
0	0.726962	8.194724	8.318843	8.240218
1	0.000378*	0.631672*	1.128149*	0.813651*
2	0.000408	0.700248	1.569083	1.018711

Source: Data Processed, 2021

The cointegration test is used to determine whether there will be equilibrium in the long run, that is, there is a similarity in movement and stability of the relationship between the variables in the study or not. This cointegration test determines whether the model used is VECM or

VAR (Satrianto, 2017). If there is cointegration, this means that the model used is VECM. On the other hand, the model used is VAR. Table 3 shows that there is at least 1 cointegration in the formed model. This shows that the model that can be used is VECM.

Table 3. Cointegration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.404705	47.51170	35.19275	0.0015
At most 1 *	0.306481	24.68896	20.26184	0.0115
At most 2	0.177277	8.585984	9.164546	0.0643

Source: Data Processed, 2021

One of the economic progress of a country can be seen from the indicators of economic growth. The higher the growth, the more prosperous the country's economy. Conversely, low or negative economic growth is interpreted as a warning of an economic downturn or an

economic crisis. This shows the need to know the future impact of economic conditions. In this study, to see the impact of the Covid-19 pandemic that occurred in Indonesia with economic conditions used variables of exports and inflation as controls.

Table 4. Long-Run Equation Results

Growth(-1)	LN Ekspor(-1)	LN IHK(-1)	C
1	-1,1625 (1,5489) [-1,0669]	2,4428* (1,1571) [2,111]	4,3805

() is the standard error; [] is t-statistics; * Significance 5%

Source: Data Processed, 2021

The results of the long-term relationship in Table 4 have a sign that is opposite to the sign in the equation, where the negative coefficient is interpreted as a positive influence. The long-term equation that is formed is as follows.

$$\text{Growth}_{t-1} = -4,3 + 1,16 (\text{LNEkspor})_{t-1} - 2,44 (\text{LNIHK})_{t-1} \dots \dots (1) \dots \dots (2)$$

Based on this equation, it is known that in the long run, exports have a positive effect although not significant on economic growth, while inflation has a significant negative effect on economic growth. If there is an increase in

exports of 1 percent, it will cause an increase in economic growth of 1.16 percent. The results of this study which state that there is a positive relationship between exports and economic growth are in line with research Dinç and Gökmen (2019), Tampubolon and Nababan (2018), and Sedyaningrum et al (2016). The relationship between exports and economic growth is in accordance with the theory of international trade which states that the higher the export transaction, the higher the production of domestic goods and services will be to provide these export products (Astuti and Ayuningtyas,

2018). It is this product increase that ultimately encourages increased economic growth. In addition, the decline in exports of leading commodities will also have an impact on slowing economic growth (Sukma et al, 2018).

Another control variable used to determine the long-term impact of economic growth is inflation. In the long run, if inflation increases by 1 percent, economic growth will decline by 2.44 percent. These results are in line with research Sahnoun and Abdennadher (2019), Ramlan et al (2017), and Fischer (1993).

IRF in Figure 3 shows the response of economic growth if there is a shock event. When a shock occurs in economic growth, economic growth responds with a drastic decline in the initial period. One form of shock was the Covid-19 pandemic which caused economic growth to decline by 2.07 per cent. It is in line with Coccia (2021), where the negative impact of the Covid-19 pandemic on society and restrictions on

economic and social activities have exacerbated structural indicators of the economy.

In addition, based on the results of the IRF, Indonesia's economic conditions when there is a shock will begin to stabilize in the next 5 to 10 years. However, for the case of the Covid-19 pandemic according to research conducted Ozili and Arun (2020), several things that can affect the worsening of a country's economy are the duration of the lockdown policy, restrictions on international travel, and the level of monetary policy. ASEAN (2020) has also designed the ASEAN Comprehensive Recovery Framework (ACRF) in relation to the Covid-19 pandemic at the 37th ASEAN Summit. The ACRF is divided into five stages, namely improving the health system, strengthening public security, maximizing market potential between ASEAN and greater economic integration, accelerating digital transformation inclusively, and towards a more sustainable and resilient future

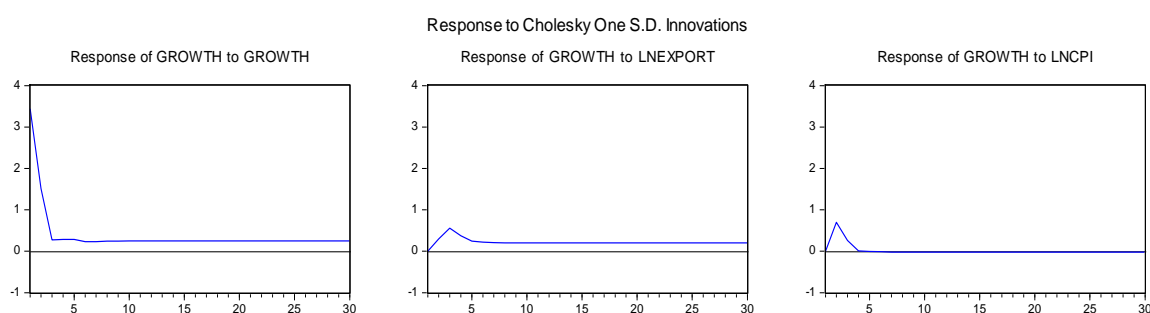


Figure 3. Results of Impulse Response Function (IRF).

Like economic growth, shocks that occurred in exports and inflation were also responded to by economic growth in the initial period. However, the shock to inflation has a stable response by economic growth that is faster than the shock to economic growth itself and exports. Stable economic conditions due to shock to inflation can be achieved in a period of less than 5 years. Unlike the case with exports, when there is a shock in the export variable, economic growth begins to stabilize in the next 5 to 10 years.

The result of economic recovery, which takes some time, is recognized by study of Mureşan (2021). It stated that U-shaped economic recovery, which envisions a slower

return to the pre-pandemic economic process, is a possible option occurred because the crisis has not yet finished and the health of the economy prior to the start of this recovery is unknown. In addition, Ranashighe and Carvalho (2020) was also suggested that a U-shaped economic recovery is the most likely conclusion because economies have experienced a faster and deeper contraction than in 2008-2009. However, this is despite the occurrence of the second wave, where the shock that will occur again will add to the complexity of the global economy, where direct losses to one industry have second-order effects on other sectors and foreign trade partners, adds to the uncertainty about the economic ramifications Spelta et al. (2020).

In keeping with the prior judgment, the OECD (2021) predicts that Indonesia's economic recovery will be sluggish, with a significant downside risk. In terms of preventive measures, mitigating measures, and the effective launch of the free immunization program, current conditions do not provide a clear signal and are loaded with uncertainties. Due to the loss of income, private consumption will take time to restore to pre-crisis levels. Although the new Omnibus Law on Job Creation is projected to improve the business climate, investment growth is expected to remain modest. The slow expansion of global trade will also have an effect.

One of the things that can boost the current economic condition is improving the

performance of state-owned enterprises (SOEs) (OECD, 2021). Although SOEs have favorable operating conditions, their inconsistent performance and growing leverage provide a concealed fiscal risk. Important and comprehensive agreements might also open up new possibilities. The Regional Comprehensive Economic Partnership, the Indonesia-Australia Comprehensive Economic Partnership Agreement, and possible agreements with the European Union and EFTA will let Indonesia and some of its key partners move commodities, services, investment, and people. Exporters may benefit from preferential market access, but it must be accompanied by improvements in trade facilitation, product quality, and other areas.

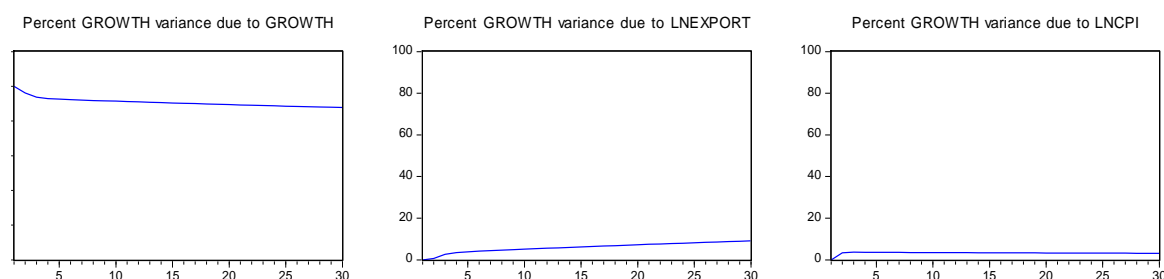


Figure 4. Results of Variance Decomposition

Besides IRF, another result from VECM is variance decomposition. The result is used to see how the studied factors contribute to changes in economic growth. Figure 4 shows the results of this variance decomposition. In the first year, variations in economic growth can be explained by the variable itself by 100 percent, while the export and inflation variables have no effect. However, in the following year exports and inflation began to contribute in explaining economic growth. In the long term, the contribution of exports in explaining variations in economic growth is estimated at around 9 percent, while inflation contributes 3 percent. The contribution of other variables with a trend that continues to increase from year to year has brought attention to policy makers that the main focus in restoring the economy does not only rely on the component of economic growth itself, but needs to pay attention to other factors that support its development, such as exports and inflation.

CONCLUSION

Based on the results and discussion, it can be concluded that the Indonesian economy has experienced a structural break in three periods, namely 1989, 1998, and 2004. 1998 was a period of economic growth where it was clearly seen that there was an extreme decline reaching -13.13 percent. However, in the following periods, Indonesia's economic growth gradually improved. This contraction in economic conditions occurred again in 2020 where there was economic instability in that period. The main cause is the Covid-19 pandemic. By using the IRF from the VECM method, it can be estimated that the stable condition of Indonesia's economic growth when a shock occurs in the economy itself will occur in the next 5 to 10 years. If there is a shock in the export control variable, economic growth will reach a stable condition in the next 5 to 10 years. Slightly different from the previous variable, when there is a shock to inflation, the

Indonesian economy will improve more rapidly in less than 5 years.

The policy implication that can be carried out by the government is by evaluating policies that are being and have been carried out related to the handling of Covid-19. By knowing the effectiveness and efficiency of these policies, it is hoped that it can optimize the economic recovery that can be achieved in the next few years. In addition, it is also necessary to pay attention to whether policies related to improving the health system related to Covid-19 will worsen economic conditions or can help the Indonesian economy in a stable condition.

The weakness of this study is the limited number of samples. This resulted in the R-squared value of the model being below 0.500. Future studies are expected to use methods other than VECM that can accommodate the limitations of this sample or can increase the number of samples studied.

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