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Jl. Letjen S. Parman No. 1, Jakarta Barat 11440
P: 021 - 5695 8744 (Humas)
E: humas@untar.ac.id

Untar Jakarta
untar.ac.id

Cointegration of Interest Rate, Inflation, Exchange Rate, and Economic Growth in Indonesia

Margarita Ekadjaja[1], Halim Putera Siswanto[1], Rorlen Rorlen[1], Christiandinata Tjandra Bravo[1] and Wilson Wijaya[1]

[1] Universitas Tarumanagara, Jakarta – 11470, Indonesia
margaritae@fe.untar.ac.id

Abstract. The economy is the most important thing for a country and plays a big role for the people in that country. The economy of a country that continues to experience consistent growth can make that country undergo a transformation in a better direction so that it can compete with the economies of other countries so that it can improve the welfare of its people and stimulate investor intentions to invest in that country. However, movements in inflation, interest rates and exchange rate fluctuations that continue to fluctuate from year to year can make the economy in Indonesia inconsistent and vulnerable to changes in economic conditions. The purpose of this study is to analyze the cointegration between interest rate movements, inflation, and exchange rate fluctuations with the economic transformation in Indonesia. This research uses data that has been collected based on time intervals, which are measured monthly for the period 2020 to 2022. The results show that there is cointegration and a short-term causal relationship between interest rate movements, inflation, and exchange rate fluctuations on the Indonesian economy during a pandemic and endemic.

Keywords: Interest, inflation, exchange rate, GDP

1. Introduction

The daily activities carried out by the entire community in their lives certainly have a relationship with the scope of the economy. Every activity that is usually carried out such as investing, trading, or providing services is certainly carried out to achieve a standard of satisfaction in itself, one of which is to obtain a reward in the form of increased income, they certainly carry out these activities to get benefits that are beneficial to themselves, and also for the growth of the national economy as a whole.

The economy of Indonesia continues to grow in a positive direction over time. The growth that occurs is in line with the era of globalization that is being faced by all people in the world. This will eventually lead to changes in patterns of thought and life in society. In addition, this also results in changes in behavior, to economic transformation. This certainly has an impact on changes in people's welfare for the better. In Indonesia, there has actually been a significant economic transformation in recent decades. The existence of economic transformation has made Indonesia experience more advanced economic growth, from all known as an agrarian country that only relies on the agricultural sector, now the economy in Indonesia already has a variety of sectors that can support the running of the country's economy, such as:

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manufacturing, services, and a growing industrial sector. Talking about economic growth, of course, cannot be separated from the role of the industrial sector. One of the sectors in Indonesia that can make a major contribution to accelerating economic growth so that it can move in a positive direction is the industrial sector. The growth of the industrial sector in Indonesia itself has been quite stable recently.

Indonesia itself actually has many industries that have certain specializations in each field, both in the food sector such as: Agricultural industry, animal husbandry, as well as in the non-food sector, such as in the manufacturing industry and various other industrial fields that stand in Indonesia Santika [1]. These two types of industries can certainly play a significant role in contributing to the national economic growth of the Indonesian state as a whole so that they can support economic growth in Indonesia. Speaking of the food industry, the agricultural sector is one of the sectors that has a very important role for economic growth in Indonesia, Darmawan [2]. According to BPS, the agricultural sector in Indonesia has experienced a growth of 2.25 percent in 2022, and continues to experience an increasing trend until now Darmawan [2].

Meanwhile, in 2021, the processing industry has experienced a growth of 3.4% compared to the previous year, Bappenas [3]. This industry continues to make a very large positive contribution to the value of national exports consistently every year. We can see that from January to April 2023 alone, the export value of the processing industry has contributed 70.21% of the total value of exports in Indonesia, Menpan [4]. Seeing the positive growth in various industrial sectors in Indonesia which can contribute to the overall economic growth of the country, the active role of various parties such as the government, entrepreneurs, and the community, is very important to support and continue the positive trend that has occurred, so as to create consistent demand Moegiarso [5]. The occurrence of increased business growth in various sectors can have a positive impact on both business managers and the economy as a whole, such as increasing demand in various industrial sectors in Indonesia, attracting investors to invest, and many more.

If this continues to happen, it will certainly have an impact on the value of Indonesia's GDP. According to BPS, Gross Domestic Product or GDP is an added value created by all business units in a particular country, Idris [6]. The value of GDP itself is actually influenced by the components of household consumption, investment, government spending, as well as export and import activities carried out by the country of Indonesia.

Export and import activities that occur can affect exchange rate fluctuations. The exchange rate can continue to move at any time, where the movement depends on the demand and supply that occurs in the foreign exchange market.

Seeing that GDP consists of several components, these components should actually receive special attention so that the growth of Indonesia's GDP is maintained and does not experience a decline. However, the Covid-19 pandemic that hit Indonesia some time ago has made our country's economic conditions unstable even though the Covid-19 pandemic has subsided. This can make demand for various industrial sectors in Indonesia vulnerable to change. When this happens, it can cause business owners to look for other ways to ensure that their company continues to run amidst uncertain economic conditions.

One of the ways that business owners may do to ensure that their businesses remain consistent is to carry out various policies related to prices, such as increasing prices, and borrowing business capital from banks. This can certainly affect the overall bank interest rate.

When we borrow funds from a bank, it is certain that the bank will charge an interest rate to us as borrowers. The interest rate set by the bank will have an impact on the funds raised by the public and entrepreneurs in the bank. If this is not controlled further, the money circulating in the community will certainly be more and more which can lead to inflation. Inflation that is at a very high level can potentially destabilize the economy as a whole. This is because, in addition to reducing purchasing power, and decreasing the value of the currency, inflation can also increase the risk of a reduction in people's real income. In the context of investment, high inflation rates require investors to be more cautious when selecting and executing their transactions, so that often investors postpone investment decisions until economic conditions become more conducive, with the aim of avoiding potential risks that may arise due to high inflation rates In addition to the threatening inflation, continued government spending to build infrastructure projects in Indonesia as well as to carry out various import activities can also affect economic conditions. As a result, this will certainly impact investors' interest in investing in Indonesia.

According to Mahzalena & Juliansyah [7] the inflation rate can have an impact on the economy of a region. In a sense, if the inflation rate is low, the economy of a region will strengthen, and vice versa. This is certainly due to the fact that there are many people who undo their intention to buy something because the price has increased significantly continuously. Of course, this can weaken the purchasing power of the goods so that companies have to reduce production in such circumstances, and this will also discourage investors from investing, so that economic growth has the potential to decline.

This study further examines the cointegration of interest rate movements, inflation, and exchange rate fluctuations with the Indonesian economy proxied by GDP. Based on this background, the research problem formulation is as follows: (1) Is there cointegration between interest rate movements and economic transformation in Indonesia? (2) Is there cointegration between inflation and economic transformation in Indonesia? (3) Is there cointegration between exchange rate fluctuations and economic transformation in Indonesia?

2. Literature Review

The theory used in this study is contingency theory Lawrence & Lorsch (1967). This theory focuses on observing the dependency effect that occurs between the structure in an organization with the environment and strategy in creating performance. The structural contingency model contains three elements, namely: (1) It is assumed that there is a relationship between organizational control and contingency; (2) The possibility will determine the structure of a company; (3) The match between organizational structure and contingency results in superior performance.

Indriyani [8] has conducted research with the title Analysis of the Effect of Inflation and Interest Rates on Economic Growth in Indonesia in 2005-2015. The study used multiple regression analysis. This study provides findings that between inflation and Indonesia's economic growth in the 2005-2015 period has a positive relationship. Meanwhile, research conducted by Asnawi [9] entitled The Effect of Money Supply, Interest Rates and Inflation on Economic Growth in Indonesia, found that interest rates have a positive influence on economic growth in Indonesia.

Research conducted by Purnamasari et al [9], which examines the effect of inflation on the Indonesian economy using data taken in the 2016-2020 period. The results show that inflation has a positive influence on the Indonesian economy. This result was obtained after inflation had a t-count value of 3.532 (> t-table of 2.306) with a significant level of 0.039 (< 0.05). Meanwhile, research conducted by Kartika et. al [10], which was conducted with data collection techniques in the form of documentation and using linear regression analysis, gave the result that the known t-value of 3.063 (> t-table of 2.035), which indicates that the inflation variable has a positive and significant effect on the economic growth variable.

Basically, GDP itself has important components such as: Consumption by households, investment, spending by the government, and export and import activities. Some of these components can certainly have an influence on economic growth, especially in Indonesia. Research conducted by Fikriah [11] found that GDP has a positive influence on Net Capital Inflow. In a sense, if GDP increases every logarithmic unit, it will cause an increase in the value of NCI. The increase in NCI value will affect economic growth in Indonesia. The Rupiah exchange rate against the USD also has a positive and significant effect on NCI. The appreciation of the Rupiah exchange rate against the USD causes an increase in NCI, an increase in NCI indirectly causes an increase in the economy in Indonesia.

Based on the results of previous research, the hypothesis of this research is:

H_0 = There is no cointegration between interest rates, inflation, exchange rates and GDP

H_1 = There is cointegration between interest rates, inflation, exchange rates and GDP

2.1. Interest Rate

Interest rates themselves basically refer to the interest rates charged on loans and investments. The interest rate is an indicator and is something that can be a determinant for someone in determining the choice between investing or saving. The interest rate, within the framework of classical theory, is divided into two main components, namely the real interest rate and the nominal interest rate. The real interest rate is an economic concept that refers to the interest rate adjusted for the effects of inflation. In simple terms, the real interest rate reflects the actual interest rate earned by borrowers or received by lenders after accounting for the rate of inflation. In other words, it is the interest rate that actually affects the purchasing power of money and the actual value of an investment or loan. The real interest rate is very important in economic analysis, investment decision-making, monetary policy, and assessing the financial health of a person or business entity.

The nominal interest rate plays a central role in the development of the financial system because the nominal interest rate is effectively a determining factor in the formation of the real interest rate. In a situation where the government does not impose certain restrictions on the nominal interest rate, the nominal interest rate has a tendency to adjust to movements in the inflation rate. There are several concepts that are important in understanding the impact of interest rates on the economy:

First, the effect of interest rates on investment. According to classical economic theory, lower interest rates will encourage increased corporate investment as borrowing costs become more affordable. Higher investment, in turn, can trigger higher economic growth. On the other hand, higher interest rates may reduce investment, which may hinder economic growth.

Second, the effect of interest rates on consumption. Interest rates can also affect household consumption. Lower interest rates may encourage households to borrow and spend more, driving economic activity. While higher interest rates can make debt more expensive, which can reduce consumer spending. This creates a trade-off between borrowing and saving in consumer choices.

Third, the relationship between interest rates and inflation. Fisher's theory states that the nominal interest rate is the sum of the real interest rate (nominal interest rate minus inflation rate). This implies that lower interest rates will essentially affect the inflation rate as it encourages higher economic activity. However, this relationship is not always linear and can be affected by other factors such as inflation expectations and monetary policy.

2.2 Inflation

Inflation is an event where the prices of goods and services experience a sustained increase over a certain period, as explained by Stievany et al [12]. Inflation is an economic phenomenon that refers to a generalized and continuous increase in the prices of goods and services in a country or region over a certain period. On the other hand, according to a further explanation by Utama & Wardana [13], inflation is a situation that arises from an imbalance between the demand and supply of commodities, occurring when demand exceeds supply, and the larger the gap between the two, the greater the threat faced by the economy. Inflation can best be explained as a general rise in prices, where the rate of inflation is determined by the market with or without government intervention in an attempt to measure the purchasing power of the currency, as stated by McConnel & Brue [14]. Inflation can be caused by a variety of economic factors, The two main categories of causes of inflation are: (1) Demand-Pull Inflation: This category of inflation means that inflation can occur when consumer demand and investment exceed the production capacity of a country's economy. This high demand may prompt producers to raise the prices of their goods and services as they are unable to meet the increased demand; (2) Cost-Push Inflation: This type of inflation is caused by an increase in the cost of production. These costs include: Labor costs, raw material costs, packaging costs, and other costs. If the costs incurred by the producer or company increase, the producer or company is forced to adjust the selling price of the product by increasing it so that they can maintain the desired profit.

Besides these two main categories, there are other factors that can cause inflation (McConnel & Brue [14]), such as: (1) Inflation Expectations: This type of inflation is the belief of consumers, businesses, and policymakers about how much inflation will occur in the future. If inflation expectations become high, it can create an inflationary spiral. Consumers and businesses may raise the prices of their current goods and salaries to protect themselves from expected inflation. This, in turn, may lead to actual inflation due to increased prices and salaries; (2) Currency Devaluation: Currency devaluation is a decrease in the value of the national currency against foreign currencies. When a country's currency devalues, the price of imported goods will increase, as those goods become more expensive in domestic currency. This can encourage domestic producers to raise the prices of their products, and can create inflation. Devaluations often occur in response to economic pressures or in an effort to increase export competitiveness; (3) Low-Interest Rates: Low interest rates, which is the monetary policy of the central bank, can be a contributing factor to inflation. When interest rates are low, loans become cheaper, and this encourages consumers and companies to borrow and spend more money. High demand, fuelled by low interest rates, can push up the prices of goods and services. This is especially the case when central banks pursue a low interest rate policy to stimulate economic growth.

2.3 Exchange Rate Fluctuations

There are two categories of exchange rates that we all need to know. These categories are: Nominal exchange rate and Real exchange rate. The nominal exchange rate is a rate that allows a person to trade currencies in a different country from their own. In the nominal exchange rate, there are 2 terms that we need to know, namely: Appreciation and Depreciation. A currency is said to appreciate if it is appreciating. This allows us to buy more foreign currency. Whereas when a currency value is depreciating, then the currency in a country is weakening. The real exchange rate is a type of exchange rate that allows individuals to exchange goods and services from one country for goods and services from another country.

The foreign exchange rate refers to the price of one unit of one country's currency against another country's currency, and the determination of this value occurs in the foreign exchange market. The basic theory is that the comparison between the value of one currency and another is determined by the purchasing power of the currency in each country, as stated by Mokodongan et al [15]. There are 3 (Three) types of exchange rate setting systems, namely: Fixed exchange rate, free exchange rate, and controlled inflation rate, Masri et al [16]. The fixed exchange rate talks about the exchange rate related to gold or a strong currency as a reference, and regarding the demand for currency or forex, the amount has been guaranteed by the government. In the free exchange rate system, the exchange rate can move freely according to the demand and supply that occurs, and the government can intervene or not intervene (clean float). While in a controlled floating exchange rate system, the exchange rate can be set through government intervention or can also be set within certain limits.

2.4 Indonesian Economy

The economy is a situation that shows an increase that occurs on the GDP and GNP sides whose growth is not in accordance with the population growth rate which can cause changes in the structure of the economy. GDP or Gross Domestic Product is the overall product in the form of goods and services that have been created by all units of production within a country within a period of 1 year, Qothrunnada [17]. GDP is the sum of the value of final goods and services produced by residents of a country and by foreign nationals residing in the country within a certain period of time.

GDP itself can actually be measured using several approaches. There are three approaches that can be used to measure GDP. These approaches are production, expenditure, and income. Of the three approaches, the expenditure approach is one of the most widely used approaches to measuring the value of GDP. This approach calculates the total consumer spending, investment, government spending, and export-import value of a country. When we want to know the economic health of a country, GDP is often used as the most appropriate indicator. When GDP grows, it is often considered a positive sign, indicating economic growth. In line with this, governments often consider it the result of good policies and try to maintain this growth. However, rapid GDP growth can also cause inflation if demand in the market exceeds supply. Governments themselves often use GDP as a benchmark to assess the effectiveness of their economic policies.

3. Research Method

This research is descriptive research and uses time series data for the quarterly period starting from January 1, 2020 to December 31, 2022. The object of research is the Indonesian economy proxied by GDP. The population used is all data on interest rates, inflation, exchange rate fluctuations, and GDP. The stages in testing cointegration between variables as follows are shown in **Figure 1**. Data analysis using the EViews application and describing the results of data analysis refers to the statement (18).

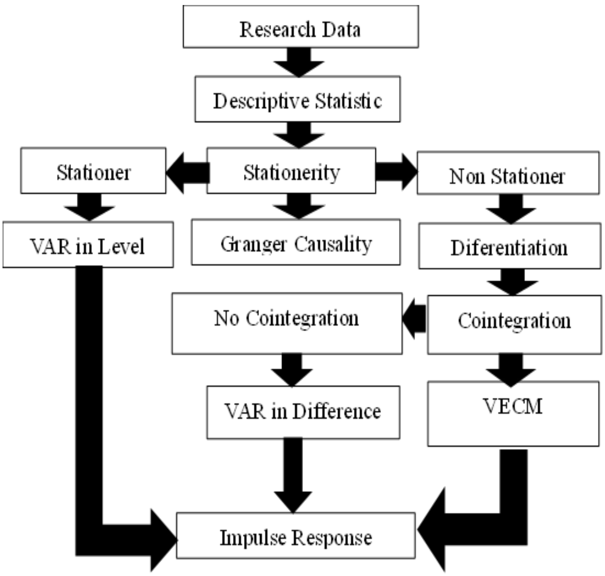


Figure 1 Stages of Data Analysis
Source: Author (2023)

4. Result And Discussion

The initial stage of the test is a stationarity test conducted to avoid spurious regression, shown in Table 1.

Table 1. First-Difference Root

Method	Stat	Prob	Cross-sections	Obs
Levin, Lim & Chut*	-4.365	0.000	4	131
Im, Pesaran and Shin W-stat	-6.095	0.000	4	131
ADF - Fisher Chi-square	52.897	0.000	4	131
PP - Fisher Chi-square	79.707	0.000	4	136

Table 1 shows that the stationarity test results are seen in the first difference root test results. This shows that the data is stationary at the first level.

Table 2. Granger-Causality Test

H0: Granger Cause	Obs	F-Stat	Prob.
Inflation ≠ Interest Rate	33	5.404	0.005
Interest Rate ≠ Inflation		5.340	0.005
Exchange Rate ≠ Interest Rate	33	4.100	0.017
Interest Rate ≠ Exchange Rate		4.943	0.008
GDP ≠ Interest Rate	33	1.017	0.401
Interest Rate ≠ GDP		1.288	0.299
Exchange Rate ≠ Inflation	33	1.661	0.200
Inflation ≠ Exchange Rate		19.561	0.000
GDP ≠ Inflation	33	0.547	0.655
Inflation ≠ GDP		1.728	0.186
GDP ≠ Exchange Rate	33	0.714	0.553
Exchange Rate ≠ GDP		10.721	0.000

Based on Table 2, the results show that with a significant level of less than 0.05, changes in interest rates do not lead to ups and downs in inflation and vice versa. Fluctuations in exchange rates also do not result in changes in interest rates.

Table 3. Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized	Eigenvalue	Trace Statistic	0.05 CV	Prob.**
0 *	0.764458	111.3901	47.85613	0.0000
1 *	0.682671	65.12232	29.79707	0.0000
2 *	0.469280	28.39222	15.49471	0.0004
3 *	0.224103	8.119538	3.841466	0.0044
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
0*	0.764458	46.26776	27.58434	0.0001
1 *	0.682671	36.73010	21.13162	0.0002
2 *	0.469280	20.27268	14.26460	0.0050
3 *	0.224103	8.119538	3.841466	0.0044

Based on Table 3, it can be seen that the trace statistic is greater than the critical value, this indicates the cointegration between changes in interest rates, inflation, and exchange rate fluctuations in the national economy.

Table 4. VECM Test

Error Correction:	D(Interest)	D(Inflation)	D(Exc.rate)	D(GDP)
CointEq1	[-0.514]	[0.684]	[2,207]	[2,885]
	(0.058)	(0.156)	(7182.420)	(4,167)
D(Interest(-1))	0.498	0.201	51948.170	45,659
	[1,526]	[0.228]	[1,282]	[1,942]
D(Inflation(-1))	0.022	0.036	24378.520	20,896
	[0.197]	[0.120]	[1,772]	[2,617]
D(Exc. rate(-1))	0.000	0.000	0.574	0.000
	[0.068]	[0.611]	[2.042]	[1,723]
D(GDP(-1))	-0.002	0.012	1177.149	0.516
	[-0.377]	[0.906]	[1,964]	[1,482]
VS	0.000	-0.000	-113.163	-0.051
	[0.557]	[-0.532]	[-1.825]	[-1.415]
R-squared	0.671831	0.439881	0.665282	0.940952

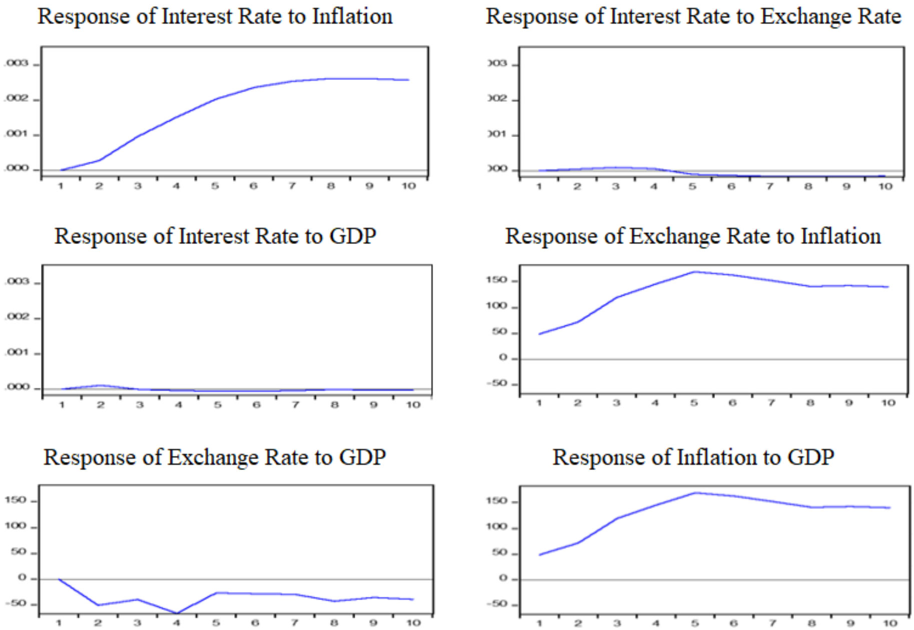
Table 4 shows that there is a short-term causality between GDP and changes in interest rates, inflation, and exchange rate fluctuations, it is seen from the t-statistic error correction variable GDP is greater than the results of the calculation of the t-table (2.037) using Microsoft Excel applications. The magnitude of the effect of changes in interest rates, inflation, and exchange rate fluctuations on GDP is 94.10 percent.

Changes in interest rates have a significant effect on the Indonesian economy as proxied by GDP. This shows that the number of investors causes an increase in the Indonesian economy. One proof of investors' interest in investing in Indonesia is the number of foreign automotive manufacturers that open factories in Indonesia to produce electric cars. Some of them are the Hyundai automotive factory from South Korea and also Wuling which opened its factory in Cikarang to produce electric cars in Indonesia (19).

The government itself has shown its active role in creating and maintaining economic growth in Indonesia (20). The implementation is carried out by creating several programs and policies that can stimulate economic growth in Indonesia, one of which is by developing various infrastructure through the National Strategic Project program (21). Some of the National Strategic Project programs that are still being intensified by the government to facilitate national economic activities as a whole are the construction of the MRT (22), the construction of the LRT, and the completion of the Jakarta-Bandung fast train project (23).

The development of various transportation infrastructure that is being intensified by the government certainly costs a lot of money and has many impacts on the economy as a whole. The development of transportation infrastructure, in addition to increasing community mobility, can also increase business growth in the property sector (24), as well as in other sectors in Indonesia.

Figure 2. Impulse Response



Based on Figure 2, it can be seen that the interest rate affects GDP or GDP, where an increase in interest rates is also followed by an increase in GDP or GDP, as well as the relationship between the exchange rate and inflation, the movement of the exchange rate will give movement to the inflation rate as well. While from the graph it can also be seen that the exchange rate will have a short-term influence on the country's economic level (GDP or GDP) but afterwards it will tend to stabilize again. However, it can also be noted that the interest rate and inflation do not affect the economy (GDP or GDP), and the interest rate does not affect the exchange rate.

5. Conclusion

The implications of the research results prove the existence of cointegration and short-term causality between changes in interest rates, inflation, and exchange rate fluctuations on the economy in Indonesia as proxied by the Gross Domestic Gross (GDP) variable. However, the spread of the Covid-19 virus has caused unexpected phenomena for the economy in Indonesia, namely: (1) Unstable economic conditions after the Covid-19 pandemic; (2) Changes in demand in several industrial sectors that can cause inflation; (3) Considerable government spending to build transportation infrastructure in Indonesia.

The weakness of this study is the limited macro variables measured, so as a suggestion, it is necessary to continue research to measure the growth rate of the Indonesian economy by adding other macro variables.

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Cointegration of Interest Rate, Inflation, Exchange Rate, and Economic Growth in Indonesia

Authors

Margarita Ekadjaja[1, *], Halim Putera Siswanto[1], Rorlen Rorlen[1], Christiandinata Tjandra Bravo[1], Wilson Wijaya[1]

1 Universitas Tarumanagara, Jakarta, 11470, Indonesia

* Corresponding author. Email: margaritae@fe.untar.ac.id

Corresponding Author

Margarita Ekadjaja

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