




## THE EFFECTIVENESS OF MONETARY TRANSMISSION THROUGH INTEREST RATE AND EXCHANGE RATE CHANNELS ON INDONESIA'S INFLATION RATE

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### ABSTRACT

*The purpose of this research is to determine the effectiveness of monetary transmission on inflation in Indonesia through the interest rate and the exchange rate channel over a period of 2015Q1-2022Q4. This research analysis approach uses the variance decomposition and Vector Error Correction Model (VECM) methods. Quantitative methods are utilized, and the estimation tool used is Eviews 12. The findings of the variance decomposition analysis in this research indicate that to reduce inflation in Indonesia, monetary transmission through exchange rates is more effective than through the interest rate channel.*

**Keywords:** Effectiveness, Monetary Transmission, Interest Rate Channels, Exchange Rate Channels, Inflation

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### ABSTRAK

*Penelitian ini bertujuan untuk mengetahui efektivitas transmisi moneter terhadap inflasi di Indonesia melalui jalur suku bunga dan nilai tukar selama periode 2015Q1-2022Q4. Pendekatan analisis penelitian ini menggunakan metode Variance Decomposition dan Vector Error Correction Model (VECM). Metode yang digunakan adalah metode kuantitatif dan alat estimasi yang digunakan adalah Eviews 12. Temuan analisis Variance Decomposition pada penelitian ini menunjukkan bahwa untuk menurunkan inflasi di Indonesia, transmisi moneter melalui nilai tukar lebih efektif dibandingkan melalui jalur suku bunga.*

**Kata Kunci:** Efektivitas, Transmisi Moneter, Jalur Suku Bunga, Jalur Nilai Tukar, Inflasi

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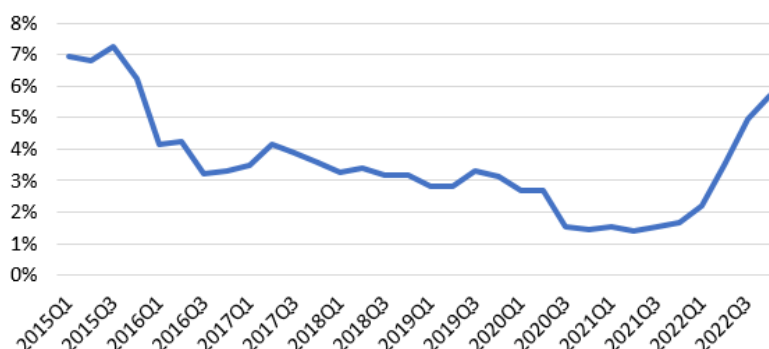
## Introduction

One of the instruments the central bank uses to control and influence the state of the economy of a country is monetary policy, which controls the money supply and interest rates. The goal of this control is to attain and preserve price stability. The central bank tries to keep a low and stable inflation rate. Inflation that is too high can reduce people's purchasing power and disrupt economic activity, while inflation that is too low can also have a negative impact, such as the risk of deflation. In addition, the role of monetary policy includes controlling currency fluctuations, reducing external imbalances, and supporting government fiscal policy in achieving economic goals.

A general and continuous rise in the price of goods and services within an economy is known as inflation. The negative impacts of high inflation include reducing people's purchasing power, reducing the value of money, and disrupting overall economic stability (Mankiw, 2010). Therefore, it is important to control inflation in order to remain within a controlled level. Efforts to keep inflation under control are carried out through certain measures to strengthen domestic economic resilience to various shocks that arise, both from within and from abroad. To achieve the inflation stability target in the long-term, adequate monetary policy is required to support more optimal economic stability and build a strong and anticipatory framework for monetary policy.

The purpose of monetary policy is to achieve both sustainable economic growth and monetary stability through the central bank's operations, which include regulating financial market liquidity and adjusting benchmark interest rates (Bank Indonesia, 2018). The monetary policy implementation process begins by setting the ultimate goal of controlling inflation which is then adjusted to economic conditions. In other words, inflation control will be adjusted to aggregate demand with aggregate supply (Goeltom, 2008). Initially, the implementation of monetary policy will have an impact on the financial industry which is reflected in interest rates and exchange rates, which will then influence consumption, investment, and inflation stability in the real sector.

The stages of the central bank's monetary policy implementation process are known as the "monetary policy transmission mechanism". Taylor (1995) defined the monetary transmission mechanism as the central bank's process of implementing monetary policy and then transmitting it so that it affects inflation and real output. According to Warjiyo (2004), the monetary policy transmission mechanism is the implementation of monetary policy carried out by the central bank, which aims to stabilize inflation and achieve economic growth. Based on these two opinions, it could be argued that the monetary transmission mechanism is the implementation process of monetary policy, which has the ultimate target of inflation. This is because inflation is an increase in an economy's pricing for goods and services, which can affect various aspects of the economy and people's lives.



**Figure 1: Inflation Rate in Indonesia, 2015-2022**

Source: Bank Indonesia (2022b)

Figure 1 illustrates the fluctuation Indonesia's inflation rate is. This is due to adjustments to fuel and electricity prices as well as fluctuations in the rupiah exchange rate against the US

dollar (Bank Indonesia, 2018). In 2018 and 2019, Bank Indonesia adopted a tight monetary policy by raising the benchmark interest rate to control inflation, which was followed by a decline in world oil prices, resulting in a decline in the inflation rate. A significant decline occurred in 2020 to 2021 due to the COVID-19 pandemic which limited economies throughout the world, including Indonesia. This situation also causes inflation which results in economic instability, decreased investment, decreased competitiveness, deteriorating balance of payments, disrupted financial market performance, and hampered optimization of production of goods and services due to high production costs (Kusumastuti et al., 2022).

The BI-7 Day Reverse Repo Rate (BI7DRR), which replaces the BI Rate, is a new benchmark interest rate that Bank Indonesia, as the central bank, has adopted to strengthen its monetary operational framework. The BI-7 Day Reverse Repo Rate instrument was selected due to its capacity to quickly and effectively impact the banking, real estate, and money market sectors (Mochtar et al., 2020).

As the monetary authority, Bank Indonesia commonly implements its monetary policy through the monetary transmission channel, using the BI-7 Day Reverse Repo Rate instrument as a benchmark. This helps control inflation. The presence of the BI-7 Day Reverse Repo Rate as the new benchmark interest rate is expected to have a more significant influence in regulating banking liquidity, controlling inflation and strengthening overall financial stability. However, in reality the volatility of the benchmark interest rate is still unstable.

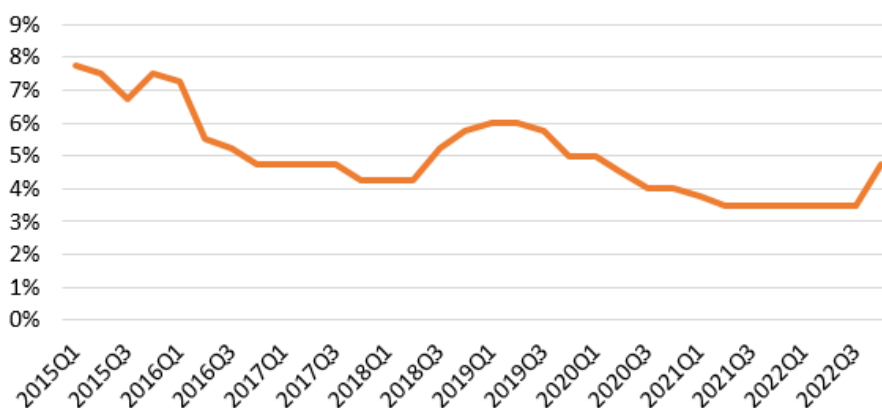


Figure 2: BI-7 Day Reverse Repo Rate, 2015 – 2022

Source: Bank Indonesia (2022a)

Figure 2 shows that in 2015, interest rates in Indonesia were still relatively high, at 7.5%. However, in 2022, interest rates in Indonesia are at their lowest point, at 3.5%. High interest rate volatility causes macroeconomic uncertainty and public concern (Galí & Monacelli, 2005). The impact of monetary policy in Indonesia by the channel of interest rates can be seen from changes in BI7DRR which affect deposit and bank credit interest rates. When the economy experiences a recession, Bank Indonesia will implement a loose monetary policy by lowering the benchmark interest rate to stimulate economic growth. The banking sector will respond to the decline in the BI7DRR interest rate by reducing its credit interest rates (Togatorop & Pratomo, 2014).

The exchange rate channel is another instrument that can be employed to measure the stability of inflation. Maintaining a relatively low exchange rate can encourage business certainty and increase investment. A sharp increase in currency exchange rates will make it difficult for businesses to plan their strategies, especially for business actors who buy raw materials from abroad or sell their products abroad. Therefore, relatively stable exchange rate management in each country is one of the monetary elements that support the macroeconomy.

Central banks can intervene in exchange rates through various policy measures and instruments, one of which is interest rate instruments. This can be seen in the flow of capital into or out of a country (Chaidir & Arini, 2019). If interest rates in Indonesia increase, foreign investors will be interested in injecting more capital into the country to take advantage of higher returns. This may lead to an appreciation of the rupiah exchange rate. Otherwise, if

rates of interest fall, foreign investors may tend to withdraw their capital, which can lead to exchange rate depreciation.

According to [Kumar & Dash \(2020\)](#), interest rate, exchange rate, and monetary channels are the three main ways that monetary policy transmission impacts prices and inflation in India. [Jawadi et al. \(2016\)](#) found that transmission of monetary policy has an impact on inflation in Brazil, Russia, India, and China. In addition, [Li et al. \(2021\)](#) observed that the monetary transmission relationship between the interest rate and the exchange rate channel is used to counter China's inflation rate, but the interest rate is thought to be more effective than the exchange rate channel.

Other research conducted by [Iddrisu & Alagidede \(2020\)](#) in South Africa shows the effectiveness of the interest rate channel, where changes in monetary policy can affect interest rates, investment, and inflation. However, there are several things that are no less important to discuss that may have an impact on the Indonesian economy. This channel is an exchange rate channel that emphasizes the perspective of changes in financial asset prices on economic activity. Research by [Zhang et al. \(2022\)](#) regarding the impact of the exchange rate on inflation has a very high bias in small open economies. Many question the effectiveness of this route due to Indonesia's low level of openness to trade and capital flows. However, the explanation from [Zhang et al. \(2022\)](#) can be used as an important basis in the transmission of exchange rate channels.

According to the background and results of previous research, a deeper investigation into the relationship between the monetary transmission of interest rates and exchange rates on the inflation rate is important, especially in developing countries where monetary policy dependent on the interest rate channel. The direction of monetary transmission policy is very complex and varies in each country. Therefore, this study aims to provide new information regarding the impact of monetary transmission mechanisms on inflation in Indonesia by analyzing the impact of the benchmark interest rate (BI7DRR), deposit interest rates, loan interest rates, interest rate parity, capital inflows and exchange rates on inflation in Indonesia from 2015Q1 until 2022Q4.

The gap in this research lies in the use of monetary transmission channels. Many studies only use one monetary transmission channel. [Herianingrum & Syapriatama \(2016\)](#) examined how effectively monetary transmission works through the interest rate channel and discovered that it can accomplish macroeconomic objectives like inflation. [Wulandari \(2012\)](#) also found that a key factor in controlling inflation is the interest rate channel. However, outside the interest rate channel, there is another monetary transmission channel that has the potential to influence the Indonesian economy, namely the exchange rate channel. [Astuti & Hastuti \(2020\)](#) found that monetary transmission through the exchange rate channel was able to effectively promote inflation stability.

The use of different monetary transmission variables, interest rate or exchange rate channels, causes in differing findings between research about how effective it is to achieve inflation stability. To ascertain the effect of interest rate and exchange rate transmission channels on the inflation rate, this study employs both of these channels.

## Literature Review

### *Monetary Transmission Mechanism*

The process of monetary policy by a central bank to influence the economy as a whole is known as the "monetary transmission mechanism". In this mechanism, changes in monetary policy variables, such as benchmark interest rates, influence the behavior and interactions of various economic actors, including commercial banks, the business world and households ([Bank Indonesia, 2011](#)). This impact then spreads to various economic sectors, giving rise to a series of impacts that affect all economic activities, including the stability of prices of goods and services which can be seen in the inflation rate.

[Mishkin \(2001\)](#) says there are several monetary transmission channels, such as the interest rate, credit, financial asset, and exchange rate channels. Monetary transmission in

the interest rate channel refers to the method by which a central bank's monetary policy can affect economic activity by causing changes in interest rates.

Two aspects are impacted by the monetary transmission mechanism through the interest rate channel. First, rising interest rates increase the cost of capital thereby reducing incentives to invest. If monetary policy is accompanied by an increase in interest rates and it is assumed that all other variables are constant, then a decrease in investment will reduce aggregate supply. Second, savers' interest income will increase when interest rates increase. On the one hand, this will increase purchasing power through income effects. However, on the other hand, this can reduce interest in consuming through a substitution effect. The impact of these two factors will influence consumption levels which will ultimately affect aggregate demand (Mishkin, 2007)

The Indonesian government generally uses the interest rate channel in implementing monetary policy (Astuti & Hastuti, 2020). The main task of Bank Indonesia is to preserve the value of the rupiah and the stability of the financial system. One of the instruments that Bank Indonesia often uses in carrying out its duties is the BI Rate 7 Day interest rate policy. The 7 Day BI Rate policy can also be reduced to credit interest rates which can affect investor investment demand. The transmission of monetary policy through the interest rate channel in Indonesia can be observed through the influence of changes in BI 7DRR on deposit and bank credit interest rates (Mochtar et al., 2020). Bank Indonesia will implement a loose monetary policy by decreasing the benchmark interest rate during a recession. This aims to encourage increased economic activity.

Can et al. (2020) examined the transmission of monetary policy through the interest rate channel in Turkey for the 2006–2018 period. By using the VAR, Granger Causality, and KPSS methods, the results of this research show that the central bank's interest rate policy influences domestic prices and output, respectively, but does not affect inflation. Apart from that, research conducted by Iddrisu & Alagidede (2020) in South Africa for the 2000–2018 period using the Three-stage least squares method showed different results. The results of this research indicate that monetary transmission through the interest rate channel is able to reduce overall aggregate inflation. The next research was by Zhang et al. (2022), using the SVAR method, the results show that monetary policy through the interest rate channel can influence changes in output values and inflation in China for the 2007–2020 period.

Monetary transmission of exchange rate channel is one of the monetary policy transmission methods used by central banks to influence interest rates and exchange rates of a country's currency. Through this method, central banks influence local currency exchange rates by engaging in the foreign exchange market (Mishkin, 2007). Through this channel, the central bank can buy or sell the domestic currency using its foreign exchange reserves. For example, if the domestic currency exchange rate (in this case the Rupiah) depreciates too deeply and too quickly, then Bank Indonesia can buy Rupiah in the foreign exchange market using foreign exchange reserves. By buying Rupiah on the foreign exchange market, the money supply will decrease. This can reduce pressure on Rupiah depreciation.

Transmission of monetary policy through the exchange rate channel involves changes in interest rate policy that impact the gap between domestic and international interest rates. This interest rate disparity will have an impact on the movement of a country's capital inflow and capital outflow. If the interest rate gap widens, expectations of investment returns will increase thereby encouraging foreign investment. Changes in a country's capital inflow and capital outflow affect exchange rate movements which in turn affect the inflation rate. Mundell's hypothesis says that interest rates and exchange rates with perfect capital mobility have a short-term relationship. The interest rate parity relationship, as defined by Mundell (1963), states that the expected value of changes in exchange rates equals the difference in interest rates between two countries. At a later stage, changes in the exchange rate of that country's currency will have an impact on the prices of goods and services. Then, both the import and export components will be impacted by the change in exchange rates. Changes in currency exchange rates will affect the prices of products and services in that country at a later stage. Changes in exchange rates will have an impact on export and import components. This

will increase aggregate demand which will ultimately affect real output (Juhro & Goeltom, 2013).

Research on monetary transmission through the exchange rate channel was carried out by Galí & Monacelli (2005) for the 1997-2017 period using the TVP-FAVAR model method. The results of this research show that monetary policy through the exchange rate channel reduced aggregate and sectoral inflation during the research period. This policy is more effective in restraining aggregate and sectoral inflation than monetary policy via the interest rate channel. The same findings were shown by Primus (2016), whose study employed the VARX approach and found that monetary policy and exchange rates have directly impacted the rate of inflation in Barbados, Jamaica, Trinidad, and Tobago for the 2002-2014 period.

### ***Mundell-Fleming IS-LM Theory***

Mundell-Fleming theory is a macroeconomic theory that explains the relationship between monetary policy, fiscal policy and international trade in an open economy (Mankiw, 2010). The Mundell-Fleming theory states that in an open economic system, monetary policy and fiscal policy can influence interest rates and exchange rates. This theory says that if a country wants to maintain low interest rates, then that country must implement a strict fiscal policy. Conversely, if a country wants to maintain a loose fiscal policy, interest rates will increase. Apart from that, this theory also says that if a country wants to keep the exchange rate stable, then that country must use foreign exchange reserves for market intervention. The IS-LM model is a model commonly used to analyze how monetary policy works in an open economy in macroeconomic models.

The IS (Investment-Saving) curve represented the correlation between the interest rate ( $r$ ) and national income ( $Y$ ). According to this theory, a decrease in interest rates will encourage increased investment because borrowing costs will be lower. This situation will shift the IS curve to the right, resulting in an increase in national income. When interest rates fall, investment and consumption will increase, thereby increasing demand for goods and moving the economy towards growth. On the other hand, if interest rates rise, it will reduce investment and consumption, then reduce demand for goods and can hamper economic growth. Therefore, the IS curve is important for economic policy makers to manage interest rates to influence economic growth (Mankiw, 2010).

The LM (Liquidity Preference-Money Supply) curve shows the relationship between the level of national income and the level of money supply ( $M/P$ ). Changes in interest rates will affect liquidity preferences and money demand. If interest rates fall, the demand for money also falls, so more money is available for economic activity. The LM curve will move to the right under these situations.

The IS-LM model considers capital flows and financial flows from abroad as variables that influence the domestic economy (Mankiw, 2010). This model allows analysis of the impact of changes in international trade policy and foreign exchange policy, as well as the impact of changes in the global economy on the domestic economy.

### ***The Impossible Trinity Theory***

The Impossible Trinity and Mundell-Fleming IS-LM concepts relate to economic analysis in the context of an open economy and the relationship between monetary policy, fiscal policy and exchange rates. According to the international economics theory known as the "Impossible Trinity Theory," a nation cannot simultaneously accomplish three goals: free flow of capital, fixed exchange rate, and independent monetary policy.

The "trilemma" or "unholy trinity" are other names for this theory. The impossible trinity theory says that a country can only achieve two of these three goals in a certain time, but cannot achieve all three goals at once. This concept illustrates that it is impossible to maintain a fixed exchange rate, have free capital mobility, and run an independent monetary policy simultaneously. The Impossible Trinity Theory has important implications for policy makers and investors because this theory highlights the existence of trade-off between these goals in macroeconomic policy (Mishkin, 2007).

### **Interest Rate Parity Theory**

The theory of interest rate parity is closely related to monetary transmission, especially in terms of using monetary transmission through the exchange rate channel. According to this theory, changes in interest rates between the two countries will have an effect on their exchange rates, which will ultimately have an effect on the transmission of monetary policy (Mishkin & Eakins, 2012).

Changes in interest rates made by a country's central bank can affect capital flows and demand for that country's currency. If country A's interest rate is higher than country B's interest rate, then this will make investors tend to shift their investments to country A to obtain a higher return. Demand for country A's currency will increase, so that the exchange rate of country A's currency tends to strengthen against country B's currency. In the context of closed interest rate parity, if there is a difference in interest rates between two countries, changes in the exchange rate are expected to compensate for this difference. Even though interest rates are different, investment returns in foreign currency are expected to be the same as investment returns in domestic currency after considering changes in exchange rates (Krugman & Obstfeld, 2003).

However, in situations where interest rate parity is not covered, interest rate differences can have a more direct impact on investment decisions. Investors will review the projected rate of return on foreign currency investments, including exchange rate risk. Differences in interest rates between countries have an impact on relative rates of return, which in turn affect capital flows and currency exchange rates (Levi, 2009).

### **Inflation Theory**

Inflation can be explained as the phenomenon of general and continuous increases in the prices of goods and services that occur in an economy (Samuelson & Nordhaus, 2009). Inflation and monetary transmission are interrelated because one of the main goals of monetary policy is to control inflation, and monetary transmission is one of the mechanisms used by central banks to achieve this goal. The central bank will tighten monetary policy by raising interest rates or limiting the money supply in the market to reduce the inflation rate.

The concept of inflation in monetary transmission refers to how monetary policy taken by the central bank can influence the level of inflation in the economy (Warjiyo, 2004). In the interest rate channel, when the central bank increases the benchmark interest rate, this can reduce credit distribution and investment due to higher borrowing costs. Thus, consumer and business spending tend to decline, which in the end can reduce aggregate demand and suppress inflationary pressures. On the other hand, changes in interest rates can also affect the national currency exchange rate through the exchange rate channel. The increase in interest rates carried out by the central bank will encourage the inflow of foreign capital. This can lead to a strengthening of the national currency, which in turn can reduce import prices and reduce inflation.

### **Hypothesis**

Based on the problem statements, theoretical review, and supporting empirical review, the hypothesis of this research is as follows:

1. The effectiveness of monetary transmission by the interest rate channel on Indonesia's inflation rate.  
 $H_0$ : Monetary transmission by the interest rate channel is ineffective in influencing the Indonesia's inflation rate.  
 $H_1$ : Monetary transmission by the interest rate channel effectively influences Indonesia's inflation rate.
2. The effectiveness of monetary transmission by the exchange rate channel on Indonesia's inflation rate.  
 $H_0$ : Monetary transmission by the exchange rate channel is ineffective in influencing Indonesia's inflation rate.

H<sub>1</sub>: Monetary transmission by the exchange rate channel effective influences Indonesia's inflation rate.

### Data and Research Methods

Quantitative analysis techniques are used in this research to determine the relationship between the dependent variable and the independent variable. This research uses time series data, which is a series of quarterly data used in Indonesia.

The focus of this research is to measure the impact of monetary transmission through interest rates and exchange rates on the inflation rate in Indonesia in the short, medium, and long-term. The period analyzed is 2015Q1-2022Q4. Eviews software is used for data processing. The Vector Error Correction Model (VECM) is used to measure short-term and long-term impacts. In addition, variance decomposition (VD) is used to determine the contribution of monetary transmission variables to inflation.

This research uses secondary data obtained from various sources with the data units used are percent and rupiah. Table 1 shows the variables used in this research.

**Table 1: List of Variables and Data Sources**

Variable	Definition	Data Source
Inflation rate (INF)	The rate of inflation is represented by the consumer price index (CPI), which is the average change in the price of a group of goods and services consumed by households in a certain area. The following formula is used to calculate inflation (CPI): $\text{inflation} = \frac{CPI_t - CPI_{(t-1)}}{CPI_{(t-1)}} \times 100\%$	Bank Indonesia
Benchmark interest rate (BI7DRR)	BI7DRR is a benchmark interest rate set by Bank Indonesia as one of the monetary policy instruments to control economic liquidity.	Bank Indonesia
Deposit interest rate (rDEPO)	The deposit interest rate is the interest rate given by the bank to customers who place their funds as deposits within a certain period of time. The general formula used to calculate deposit interest rates is: $\text{Deposit Interest Rate} = (\text{Interest Rate/Amount of Money}) \times (100/\text{Time Period})$	Trading Economics
Credit interest rates (rCREDIT)	Credit interest rates refer to the percentage or amount of interest charged by lenders to borrowers as a cost for using loan funds. The general formula used to calculate credit interest rates is: $\text{Credit interest Rate} = \left[ \left( 1 + \frac{\text{Interest Rate}}{\text{Number of Periods}} \right)^{\text{Number of Periods}} \right] \times 100$	Trading Economics
Interest rate parity (PSB)	Interest rate parity refers to the concept of interest rate comparison between two countries as a basis for estimating changes in the exchange rate of their currencies thus affecting capital inflows. This research uses uncovered interest rate parity with the following formula: $\text{Uncovered Interest Rate Parity} = \text{Domestic Interest Rates (IDR)} - \text{Foreign Interest Rates (USD)}$	Trading Economics
Capital inflow (CI)	Capital inflow is the amount of foreign funds entering Indonesia for investment purposes. The general formula used to calculate capital inflows is: $\text{Capital Inflow} = \text{FDI} + \text{Portfolio Investment} + \text{Other Investment}$	Trading Economics
Exchange rate (KURS)	This research uses the variable nominal exchange rate of the Rupiah against the United States Dollar. The formula for calculating the exchange rate between two currencies is as follows: $\text{Nominal Exchange Rate} = \frac{\text{Foreign currency}}{\text{Domestic Currency}}$	Bank Indonesia



The empirical model used to explain the correlation between the independent and dependent variables is presented as follows:

1. Monetary transmission mechanism by the interest rate channel

$$INF = \beta_0 + \beta_1 BI7DRR + \beta_2 rDEP0 + \beta_3 rCREDIT + e_t \quad (1)$$

2. Monetary transmission mechanism by the exchange rate channel

$$INF = \beta_0 + \beta_1 BI7DRR + \beta_2 PSB + \beta_3 \ln CI + \beta_4 \ln KURS + e_t \quad (2)$$

Where:

$INF$	: Inflation
$\beta_0$	: Intercept
$\beta_1 BI7DRR$	: Benchmark interest rate coefficient
$\beta_2 rDEP0$	: Deposit interest rate coefficient
$\beta_3 rCREDIT$	: Credit interest rate coefficient
$\beta_2 PSB$	: Interest rate parity coefficient
$\beta_3 \ln CI$	: Capital inflow coefficient
$\beta_4 \ln KURS$	: Exchange rate coefficient
$e_t$	: Error term

This Vector Error Correction Model (VECM) is employed in this research. Testing the data's stationarity is the first step in the VECM method. If a time series data set lacks a unit root, it is deemed stationary. The Augmented Dicky-Fuller test is used in this study's stationarity test. It is necessary to do data stationarity checks, particularly in studies involving relatively large time series data (Gujarati, 2003). In the ADF test, the null hypothesis ( $H_0$ ) is that the data contains a unit root, while the alternative hypothesis ( $H_1$ ) is that the data does not contain a unit root. If  $H_0$  is accepted, it means that there is a unit root in the equation, which implies that the data is not stationary. On the other hand, if  $H_0$  is rejected, it means that the equation does not have a unit root, which implies that the data is stationary.

Determining the optimal lag is the second step. Optimal lag selection is employed to overcome the autocorrelation problem in the VAR model. Optimal lag can be determined using several methods including AIC (Akaike Information Criteria), SC (Schwarz Information Criteria), and HQ (Hannan-Quinn Information Criteria). The optimal lag can be determined by looking at the asterisk (\*) on the recommended lag.

The third step is to perform a cointegration test using the Johansen test. Cointegration occurs when the linear relationship of nonstationary variables is integrated at the same level. If no cointegration relationship is found, the estimation technique used is the VAR difference method. Meanwhile, if a cointegration relationship is found, the method used is VECM. Comparing the Max Eigen value with the Trace value is one way to determine cointegration. If the Max Eigen and Trace values are greater than the significance value (1% and 5%), then it can be concluded that all variables are cointegrated and have a long-term relationship. So VECM is used as an estimation technique (Gujarati & Porter, 2009).

The Granger causality test is the fourth step. The aim of this test is to determine whether variables have a short- and long-term causal relationship. There are three types of Granger causal relationships, including unidirectional causality, bilateral causality, and independence.

To determine how the independent variable affects the dependent variable, the next step includes VECM estimation using a statistical t-test. According to  $H_0$  in this test, there is no significant impact between the independent and dependent variables.  $H_1$  on the other hand says that there is a significant impact relationship between the independent and dependent variables.

After estimating the VECM, the next step is to construct the impulse response function (IRF). The purpose of preparing the IRF is to determine the dynamic reaction of each variable to changes in the specified standard deviation. Dynamic reactions can describe expected prediction errors caused by changes in other variables in a certain period. IRF shows the direction of the relationship, speed, and strength of influence between variables and the variables themselves.

The final step in VECM analysis is carrying out variance decomposition (VD) analysis. Variance decomposition is a method used in econometric analysis to identify the contribution of each factor to the variance of a dependent variable. This method provides an illustration of the extent to which the variance of endogenous variables can be explained by certain factors. The results of variance decomposition are used to determine the contribution of each factor to the variation of other endogenous variables (Gujarati, 2003). In addition, the variance decomposition results indicate the strong Granger causality relationship that may exist between variables.

## Finding and Discussion

### Descriptive Statistics

To describe, organize, and summarize data more simply so that it can be understood easily, descriptive statistics are prepared. Through descriptive statistics, a general overview of the characteristics of the data being analyzed will be provided without the need to carry out complex and in-depth statistical analysis. The descriptive statistics of this research are presented in Table 2.

**Table 2: Descriptive Statistics**

Variable	Observation	Minimum	Maximum	Mean	Standard Deviation
<i>INF</i>	32	1.420	7.260	3.537	1.618
<i>BI7DRR</i>	32	3.500	7.750	5.000	1.283
<i>rDEPO</i>	32	2.250	5.500	3.982	0.932
<i>rCREDIT</i>	32	4.250	9.090	6.146	1.434
<i>PSB</i>	32	1.582	5.250	2.913	1.188
<i>KURS</i>	32	9.431	9.701	9.557	0.056

The mean indicator is taken from the sum of all data values divided by the number of observations with the aim of providing an indication of the middle value of the data. Then, the standard deviation indicator is used to measure the extent to which the values in the data set are dispersed from the mean. A high standard deviation value indicates large data variability. Therefore, there is a great level of variation in data sets or uncertainty.

### Data Stationary Test

To find out whether the time series data used for the study had a consistent or fixed average and variance value during the period of the study, the data stationarity test was employed. The Augmented Dickey-Fuller test was applied in this study's stationarity test, with a significance level of 5%. If the test probability value is less than the 5% significance level, the data is considered stationary. The results of the stationarity test at level can be seen in Table 3.

**Table 3: Augmented Dickey Fuller Test at Level**

Variable	ADF t-statistics	ADF Critical Value Level 5%	Prob. 5%	Result
<i>INF</i>	-2.178	-2.964	0.218	Not stationary
<i>BI7DRR</i>	-2.271	-2.964	0.188	Not stationary
<i>rDEPO</i>	-1.411	-2.964	0.564	Not stationary
<i>rCREDIT</i>	-1.936	-2.964	0.312	Not stationary

Variable	ADF t-statistics	ADF Critical Value Level 5%	Prob. 5%	Result
<i>PSB</i>	-1.406	-2.964	0.566	Not stationary
<i>CI</i>	0.436	-2.964	0.981	Not stationary
<i>KURS</i>	-2.912	-2.964	0.055	Not stationary

According to the the Augmented Dickey-Fuller (ADF) test's results at level show that for each research variable, the probability value obtained is > 5% at the significance level. This shows that the stationarity level of the data used has not been met. To overcome these results, ADF test is performed at the first difference level as shown in Table 4.

**Table 4: Augmented Dickey Fuller Test at First Difference Level**

Variable	ADF t-statistics	ADF Critical Value Level 5%	Prob 5%	Result
<i>INF</i>	-3.520	-2.964	0.014	Stationary
<i>BI7DRR</i>	-3.935	-2.964	0.005	Stationary
<i>rDEPO</i>	-5.200	-2.964	0.000	Stationary
<i>rCREDIT</i>	-5.621	-2.964	0.000	Stationary
<i>PSB</i>	-3.703	-2.964	0.009	Stationary
<i>CI</i>	-4.732	-2.964	0.000	Stationary
<i>KURS</i>	-5.915	-2.964	0.000	Stationary

**Optimal Lag Test**

The optimal lag test in this research was carried out using the VAR Lag Order Selection Criteria for each monetary policy. The optimal lag test results are as follows:

**Table 5: VAR Lag Selection Criteria Results for Interest Rate Channel**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-107.9144	NA	0.026432	7.718233	7.906826*	7.777298*
1	-90.05286	29.56390*	0.023571*	7.589853	8.532815	7.885177
2	-73.37796	22.99987	0.024148	7.543307*	9.240640	8.074891

The results of the optimal lag test of the monetary policy interest rate channel in table 5 show that the \* sign is most prevalent in lag 1, excluding Lag 0 which is not taken into account in the VAR estimate.

**Table 6: VAR Lag Selection Criteria Results for Exchange Rate Channel**

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-600.3863	NA	3.77e+12*	43.13009*	44.30879*	43.49925*
2	-576.9273	30.73933	4.77e+12	43.23637	45.59378	43.97468

Meanwhile, the results of the optimal lag test for monetary policy on the exchange rate path shown in Table 6 show that the optimal lag is also found at lag 1, leaving aside the results at Lag 0 which were not taken into account. in VAR estimation. Referring to the results of the VAR lag order selection criteria test, VAR estimates for both the interest rate path and the exchange rate path will produce better predictors using data at Lag 1 compared to estimates using lag 2 data.

**Lag Stability Test**

The lag stability test is carried out to determine whether the VAR estimate is stable or not. In the previous test, it was found that the optimal lag was lag 1 for both models. The results of the lag stability test are presented in table 7.

**Table 7: Lag Stability Test Results for Interest Rate Channel Model**

Root	Modulus
0.630535	0.630535
-0.239435 - 0.227922i	0.330572
-0.239435 + 0.227922i	0.330572
-0.079019	0.079019

Table 7 shows that the characteristic polynomial root results have an absolute value smaller than 1, so that the stability of the VAR model is fulfilled. Meanwhile, the results of the lag stability test of the exchange rate path model in Table 8 also show that the absolute value of the characteristic polynomial root is smaller than 1. Thus, the stability of the exchange rate path model is also fulfilled.

### **Cointegration Test**

A cointegration test is performed to determine whether the equation model has a long-term relationship or not.

**Table 8: Lag Stability Test Results for Exchange Rate Channel Model**

Root	Modulus
0.698682	0.698682
0.220900 - 0.220829i	0.312349
0.220900 + 0.220829i	0.312349
-0.104967 - 0.280723i	0.299706
-0.104967 + 0.280723i	0.299706

Table 9 shows that there are 3 cointegrated equations (indicated by \*) at a critical value of 5%. These results show that the equation model has a short-term and long-term relationship, so the Vector Error Correction Model (VECM) is more suitable than the VAR model. Meanwhile, the Johansen cointegration test for the exchange rate path equation model is presented in Table 10.

**Table 9: Johansen Cointegration Test Results for the Interest Rate Channel Model**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.704502	65.00059	47.85613	0.0006
At most 1*	0.411941	29.64692	29.79707	0.0260
At most 2	0.297238	14.24999	15.49471	0.0763
At most 3*	0.129460	4.020616	3.841466	0.0449

The results of the Johansen exchange rate path cointegration test also show that there are 4 cointegration equations (marked with \*) at a critical value of 5%. These results indicate that the exchange rate path equation model is also more suitable using the Vector Error Correction Model (VECM).

**Table 10: Johansen Cointegration Test Results for the Exchange Rate Channel Model**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.828857	104.3541	69.81889	0.0000
At most 1 *	0.532516	53.16177	47.85613	0.0146
At most 2 *	0.422575	31.11043	29.79707	0.0351
At most 3	0.316315	15.18432	15.49471	0.0556
At most 4 *	0.133540	4.156839	3.841466	0.0415

### Granger Causality Test

To determine whether the study's variables affected one another, Granger's causality test is used. Table 11 shows the findings of the Granger causality test for the interest rate channel. Variables in bold indicate the existence of a causal relationship between variables because the probability value is < 10%. The test findings show that the *INF* variable has a significant influence on the *BI7DRR* and *rCREDIT* variables. In addition, there is a two-way causal relationship between the *rDEPO* and *INF* variables. Meanwhile, there is no causal relationship between the variables *rCredit* and *rDepo*.

**Table 11: Granger Causality Test for the Interest Rate Channel**

Null hypothesis ( $H_0$ )	Probability
<b>BI7DRR does not Granger Cause INF</b>	<b>0.0876</b>
<b>INF does not Granger Cause BI7DRR</b>	<b>0.0021</b>
<b>rDEPO does not Granger Cause INF</b>	<b>0.0789</b>
<b>INF does not Granger Cause rDEPO</b>	<b>0.0591</b>
rCREDIT does not Granger Cause INF	0.4094
<b>INF does not Granger Cause rCREDIT</b>	<b>0.0111</b>
rDEPO does not Granger Cause BI7DRR	0.3434
<b>BI7DRR does not Granger Cause rDEPO</b>	<b>0.0637</b>
<b>rCREDIT does not Granger Cause BI7DRR</b>	<b>0.0609</b>
BI7DRR does not Granger Cause rCREDIT	0.7948
rCREDIT does not Granger Cause rDEPO	0.4464
rDEPO does not Granger Cause rCREDIT	0.8964

Meanwhile, the results of the Granger causality test for the exchange rate path equation model can be seen in Table 12. These results show the existence of two-way causality between the *INF* variable and the *BI7DRR* variable. Furthermore, the *INF* and *PSB* variables are influenced by the *CI* variable. Meanwhile, the *PSB* variable influences the *BI7DRR* variable.

**Table 12: Granger Causality Test for the Exchange Rate Channel**

Hipotesis nol ( $H_0$ )	Probabilitas
<b>BI7DRR does not Granger Cause INF</b>	<b>0.0876</b>
<b>INF does not Granger Cause BI7DRR</b>	<b>0.0021</b>
PSB does not Granger Cause INF	0.3602
INF does not Granger Cause PSB	0.7115
<b>CI does not Granger Cause INF</b>	<b>0.0019</b>
INF does not Granger Cause CI	0.7989
<b>KURS does not Granger Cause INF</b>	<b>0.0886</b>
INF does not Granger Cause KURS	0.8831
<b>PSB does not Granger Cause BI7DRR</b>	<b>0.0414</b>
BI7DRR does not Granger Cause PSB	0.1782

Hipotesis nol ( $H_0$ )	Probabilitas
CI does not Granger Cause BI7DRR	0.7037
BI7DRR does not Granger Cause CI	0.6310
KURS does not Granger Cause BI7DRR	0.7443
BI7DRR does not Granger Cause KURS	0.4894
<b>CI does not Granger Cause PSB</b>	<b>0.0001</b>
PSB does not Granger Cause CI	0.1595
KURS does not Granger Cause PSB	0.8119
PSB does not Granger Cause KURS	0.1652
KURS does not Granger Cause CI	0.2688
CI does not Granger Cause KURS	0.5468

### VECM Estimation Results

The VECM estimation, which explains the long- and short-term relationships between various variables in the econometric model, is the next step in the process of forming the VECM model. Table 13 shows the VECM estimation results using lag 1. If the t-statistic value is greater than the t-table value, it can be concluded that there is a significant long-term correlation between the dependent and independent variables.

**Table 13: Long-Term VECM Estimation Results for the Interest Rate Channel Model**

Variable	Coefficient	t-statistics	Results
<i>INF (-1)</i>	1.000000		
<i>BI7DRR (-1)</i>	-9.582085	-6.78632	Significant
<i>rDepo (-1)</i>	7.384563	5.18852	Significant
<i>rCREDIT (-1)</i>	2.433644	2.77923	Significant
<b>T-Tabel = 2.039</b>			

Based on Table 13, in the long-term the BI7DRR variable has a significant negative effect on the inflation rate. A significant negative result indicates the existence of a strong and statistically significant relationship between certain variables in opposite directions. This shows that the higher the BI7DRR value, the lower inflation will be. Meanwhile, the savings interest rate and loan interest variables have a significant positive influence on the inflation variable. This means that the higher the deposit interest rate, the higher inflation will be.

**Table 14: Short-Term VECM Estimation Results for the Interest Rate Channel Model**

Variable	Coefficient	t-statistics	Results
<i>INF (-1)</i>	-0.333758	-1.75352	Not significant
<i>BI7DRR (-1)</i>	-0.768531	-2.50585	Significant
<i>rDepo (-1)</i>	0.803990	3.25557	Significant
<i>RCREDIT (-1)</i>	0.280234	2.13044	Significant
<b>ECT -0.115139</b>			
<b>T-Tabel = 2.039</b>			

The VECM method has the ability to estimate the relationship between variables in the short-term. Information on short-term relationships can be seen through the error correction term (ECT) on the dependent variable and a comparison between the t-statistic value and the

t-table critical value. Table 14 shows that in the short-term, inflation is influenced by BI7DRR, loan interest rates and deposit interest rates. BI7DRR for the previous period was known to have a negative influence on inflation in the short-term. Meanwhile, deposit interest rates and loan interest rates have a positive influence on inflation.

**Table 15: Long-Term VECM Estimation Results for the Exchange Rate Channel Model**

Variable	Coefficient	t-statistics	Results
INF (-1)	1.000000		
BI7DRR (-1)	-1.248551	-5.40603	Significant
PSB (-1)	0.000163	1.13805	Not significant
CI (-1)	-0.037821	-3.01037	Significant
KURS(-1)	0.001233	5.88624	Significant
<b>T-Table = 2.039</b>			

Table 15 shows that in the long-term, the BI7DRR variable does not have a significant effect on inflation. Meanwhile, interest rates and exchange rate parity have a significant positive influence. This means that the higher the interest rate parity value, the higher inflation will be. The capital inflow variable has a significant negative influence on inflation. This means that the higher the value of capital inflow in the previous period, the lower inflation will be.

**Table 16: Short-Term VECM Estimation Results for the Exchange Rate Channel Model**

Variable	Coefficient	t-statistics	Results
INF (-1)	-0.111876	-0.64584	Not significant
BI7DRR (-1)	-0.180571	-0.94676	Not significant
PSB (-1)	0.000254	2.23412	Significant
CI (-1)	-0.019789	-2.31054	Significant
KURS(-1)	0.000452	2.54897	Significant
<b>ECT -0.589554</b>			
<b>T-Table = 2.039</b>			

Table 16 shows the short-term exchange rate channel's VECM estimation findings. This table explains how BI7DRR, capital inflow, and the exchange rate from the previous period all affect inflation. Meanwhile, interest rate parity in the previous period had no effect on inflation. BI7DRR and capital inflow in the previous period had a negative influence on inflation in the short-term. The negative influence means that the higher the value of BI7DRR and the capital inflow variable, the lower inflation will be. Meanwhile, the exchange rate variable from the previous period has a positive influence on inflation in the short-term.

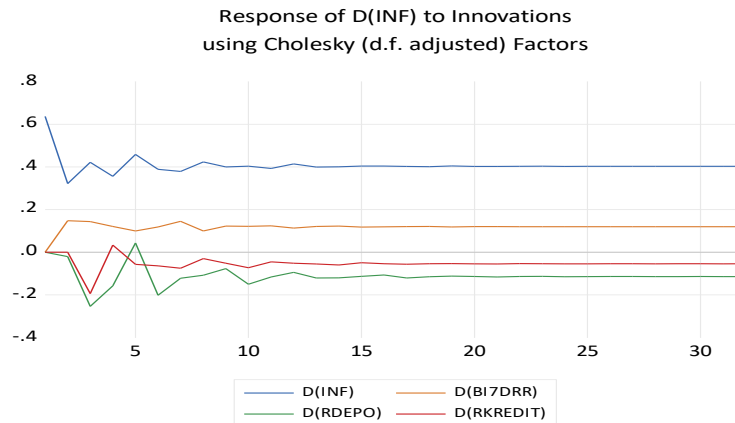
**Impulse Response Function (IRF) Analysis**

Impulse Response Analysis is carried out to see the response of a variable when a shock occurs to another variable. The IRF results of the interest rate path monetary policy equation model are shown in Figure 3. The IRF results in Figure 3 show that in the short, medium and long-term, the value of inflation (INF) responds negatively by BI7DRR.

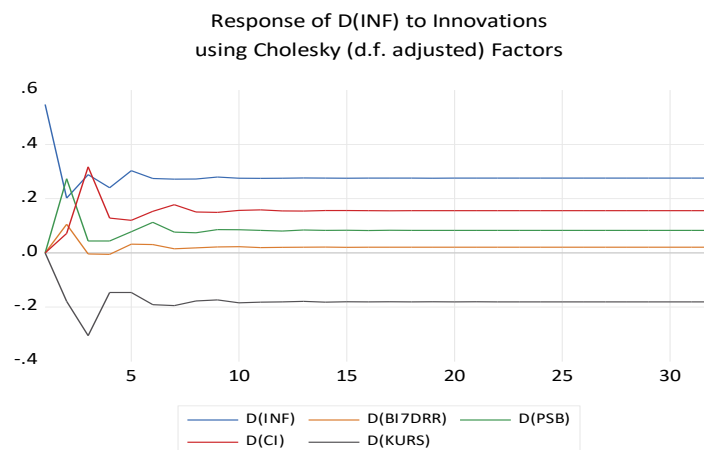
In other IRF results, the decline in inflation was also responded by a decrease in deposit rates and loan rates in the short, medium and long-term. This shows that the inflation rate over time is responded to by other variables, namely BI7DRR, deposit interest rates (rDEPO), and loan interest rates (rCREDIT).

The IRF exchange rate channel results in Figure 4 show that in the short, medium, and long-term, the decline in the inflation rate (INF) is responded negatively by the BI7DRR. In addition to the BI7DRR, the response to capital inflows is also inversely proportional to the inflation trend. Meanwhile, lower inflation was also responded by a decrease in interest rate

and exchange rate parity in the short, medium and long-term. This shows that the value of inflation over time is responded to by other variables, namely BI7DRR, interest rate parity, capital inflows, and exchange rates.



**Figure 3: IRF for Interest Rate Channel**



**Figure 4: IRF for Exchange Rate Channel**

**Analysis of Variance decomposition**

An approach to understanding how different factors contribute differently to a given variable’s fluctuation or change is called variance decomposition. The variance decomposition results in Table 17 show that the contribution of the BI7DRR shock to variations in the inflation rate after 5 quarters was 5.46%, while the contribution of the inflation shock itself was 84.64%. The contribution of other variable shocks of 7.46% came from deposit interest rate shocks (rDepo) and 3.42% from credit interest rate shocks (rCREDIT). The variance decomposition results appeared to stagnate until the 32nd quarter. The BI7DRR shock contribution was 7.10%, the deposit interest rate shock contribution was 7.32%, the credit interest rate shock contribution was 1.92%, and the inflation shock contribution itself was 83.64%.

**Table 17: Variance decomposition for Interest Rate Channel Model**

Response of D(INF): Period	S.E.	D(INF)	D(BI7DRR)	D(rDEPO)	D(rCREDIT)
1	0.636710	100.0000	0.000000	0.000000	0.000000
2	0.728957	95.80719	4.113472	0.079342	9.55E-08
3	0.911842	82.59487	5.105187	7.776770	4.523178
4	0.999428	81.45145	5.708689	8.960949	3.878907
5	1.106496	83.64321	5.466120	7.463881	3.426792
6	1.197727	81.93557	5.643568	9.210126	3.210740



Response of D(INF): Period	S.E.	D(INF)	D(BI7DRR)	D(rDEPO)	D(rCREDIT)
7	1.272647	81.43415	6.295343	9.078066	3.192437
8	1.349590	82.26308	6.141753	8.707884	2.887281
9	1.415997	82.71461	6.329301	8.202346	2.753742
10	1.486700	82.39048	6.411781	8.461889	2.735854
11	1.547749	82.46383	6.558616	8.368517	2.609036
12	1.609822	82.84737	6.558496	8.080071	2.514063
13	1.668231	82.87295	6.632695	8.044806	2.449551
14	1.725275	82.87379	6.708663	8.007703	2.409840
15	1.780058	82.99529	6.739701	7.925527	2.339479
16	1.833170	83.11927	6.778253	7.809902	2.292575
17	1.885274	83.13564	6.815458	7.791898	2.257006
18	1.935429	83.18176	6.856166	7.743524	2.218552
19	1.984634	83.26109	6.877211	7.680564	2.181139
20	2.032478	83.30648	6.905746	7.636761	2.151016
21	2.079382	83.33604	6.931757	7.606896	2.125308
22	2.125104	83.37851	6.953758	7.569998	2.097731
23	2.169927	83.42257	6.972836	7.530727	2.073862
24	2.213857	83.45073	6.992137	7.504388	2.052743
25	2.256901	83.47920	7.010419	7.477558	2.032822
26	2.299153	83.51079	7.025678	7.449964	2.013568
27	2.340632	83.53797	7.040748	7.424973	1.996310
28	2.381410	83.56068	7.054929	7.403959	1.980429
29	2.421478	83.58395	7.068080	7.382825	1.965142
30	2.460906	83.60673	7.080047	7.362322	1.950899
31	2.499710	83.62653	7.091609	7.344166	1.937698
32	2.537922	83.64516	7.102501	7.327077	1.925263

These findings indicate that the variability in inflation rates is dominated by the shock itself. This shows that all independent variables, namely BI7DRR, deposit interest rates and loan interest rates are less effective in overcoming or reducing the impact of changes that occur in inflation. Therefore, the hypothesis that can be taken based on the results of this study is to accept the null hypothesis ( $H_0=0$ ). This is because there is not enough strong statistical evidence to conclude that there is a significant influence or relationship. The variance decomposition analysis found that the variables BI7DRR, deposit interest rates, and loan interest rates do not have a significant influence on the variability of the inflation variable. This means that this study shows that changes in BI7DRR, deposit interest rates, and loan interest rates do not have a significant effect on fluctuations or variations in the inflation rate.

**Table 18: Variance decomposition for Exchange Rate Channel Model**

Response of D(INF): Period	S.E.	D(INF)	D(BI7DRR)	D(PSB)	D(CI)	D(KURS)
1	0.547544	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.680875	73.47273	2.393116	16.10372	1.114791	6.915646
3	0.861852	57.07426	1.495680	10.30648	14.24410	16.87948
4	0.916689	57.31370	1.325651	9.336920	14.55098	17.47274
5	0.987468	58.81115	1.247364	8.672926	14.02229	17.24627

Response of D(INF): Period	S.E.	D(INF)	D(BI7DRR)	D(PSB)	D(CI)	D(KURS)
6	1.060222	57.70476	1.165201	8.653277	14.25979	18.21697
7	1.128511	56.74104	1.046456	8.095718	15.06717	19.04961
8	1.186534	56.60109	0.970433	7.713696	15.24976	19.46502
9	1.243488	56.59165	0.915047	7.499395	15.32733	19.66658
10	1.299424	56.31831	0.868252	7.300508	15.48634	20.02658
11	1.352570	56.10689	0.822274	7.114728	15.66878	20.28733
12	1.403198	55.98666	0.785549	6.941323	15.77705	20.50942
13	1.452124	55.89330	0.754349	6.817873	15.86292	20.67156
14	1.499808	55.77609	0.726974	6.696596	15.95223	20.84811
15	1.545819	55.67993	0.701980	6.594081	16.03444	20.98957
16	1.590516	55.60012	0.680214	6.497021	16.10204	21.12061
17	1.633952	55.53045	0.660736	6.416595	16.16152	21.23070
18	1.676349	55.46240	0.643229	6.340266	16.21728	21.33683
19	1.717640	55.40266	0.627250	6.273262	16.26779	21.42904
20	1.757985	55.34863	0.612810	6.210591	16.31311	21.51485
21	1.797406	55.29971	0.599603	6.154911	16.35434	21.59144
22	1.836003	55.25395	0.587509	6.102825	16.39251	21.66321
23	1.873789	55.21229	0.576355	6.055531	16.42756	21.72827
24	1.910836	55.17375	0.566077	6.011393	16.45987	21.78891
25	1.947173	55.13817	0.556551	5.970902	16.48976	21.84462
26	1.982849	55.10497	0.547709	5.933031	16.51758	21.89672
27	2.017891	55.07415	0.539471	5.897944	16.54346	21.94498
28	2.052337	55.04534	0.531785	5.865065	16.56762	21.99019
29	2.086212	55.01842	0.524592	5.834401	16.59021	22.03237
30	2.119548	54.99315	0.517850	5.805582	16.61141	22.07201
31	2.152366	54.96943	0.511514	5.778555	16.63131	22.10919
32	2.184692	54.94709	0.505552	5.753081	16.65005	22.14422

The path decomposition results of exchange rate variance in Table 18 show that the contribution of the BI7DRR shock to variations in the inflation rate after 2 quarters was 2.39%, while the contribution of the inflation shock itself was 73.47%. The contribution of other variable shocks of 16.10% came from interest rate parity shocks (PSB), 1.11% from capital inflow shocks (CI), and 6.91% from exchange rate shocks (KURS). The variance decomposition results show that this contribution decreased in the following quarter. In quarter 32, the contribution of the BI7DRR shock was 0.50%. Meanwhile, the contribution of interest rate parity shocks was 5.753%. In addition, the contribution of capital income shocks was 16.65% and the contribution of exchange rate shocks was 22.14%. The contribution of inflation shocks itself was 54.94%. Based on these results, it is known that the largest contribution to inflation in the short-term is provided by the inflation value itself and the value of the interest rate parity variable (PSB). Meanwhile, in the medium and long-term, the biggest contributors to inflation are the inflation variable itself and the exchange rate variable.

Based on the research results, the hypothesis that can be taken is to accept the alternative hypothesis ( $H_1 \neq 0$ ), so that monetary transmission through the exchange rate channel effectively influences the inflation rate in Indonesia. The findings of statistical tests show that there is evidence that is strong enough to conclude that there is a significant influence or relationship between the variables tested. variance decomposition analysis shows the large contribution of independent variables to fluctuations or variations in inflation

shocks. The results of this analysis conclude that independent variables such as *BI7DRR* (Bank Indonesia benchmark interest rate), *PSB* (interest rate parity), *CI* (capital inflow), and *KURS* (exchange rate) have a more effective contribution in influencing inflation shocks. In this channel, the contribution of these variables is more dominant in explaining variations in inflation fluctuations and plays a greater role in influencing inflation dynamics.

### **Discussion**

The importance of price factors in financial markets on various aspects of real-sector economic activity is emphasized by the interest rate channel. Monetary policy carried out by the central bank will effect the development of various interest rates in the financial sector, which will then influence the inflation rate and real output. The findings of this study show that the monetary transmission mechanism through the interest rate channel is less effective.

This is proven by the variance decomposition estimation results, which show that in the short, medium, and long-term, monetary transmission through the interest rate channel does not have a significant effect on inflation. This is due to the small contribution of the *BI7DRR* variable shock, credit interest rates, and deposit interest rates to the reduction in the rate of inflation.

In theory, the interest rate monetary policy issued by the central bank can influence banking liquidity and in turn influence banking decisions in providing credit. Based on the research results, changes that occurred in the benchmark interest rate (*BI7DRR*) did not have much effect on disbursed bank credit. This can be caused by banking behavior in carrying out its intermediation function. The uncertain economic situation makes banks prefer to circulate their money in the interbank money market rather than channel it to the public.

The results of this study are different from those of Iddrisu & Alagidede (2020) and Li et al. (2021), which state that controlling the inflation rate is influenced by monetary transmission through the interest rate channel. However, this research is in line with Kumar & Dash (2020), where monetary transmission through the interest rate channel has no effect on reducing the rate of inflation. One of the reasons this is not effective is the instability of global economic conditions or global financial market turmoil.

During this pandemic, many companies and households are facing financial difficulties, so banks may become more selective in providing credit. Because of the public's lack of interest in and ability to borrow money, the demand for loans may stay low despite low interest rates, which could impair the effectiveness of monetary transmission.

Credit and deposit contracts can also influence the effectiveness of monetary transmission through the interest rate channel. Interest rates in credit and deposit contracts will affect borrowing costs and savings yields. If the central bank reduces the benchmark interest rate, then the interest rates on credit and deposit contracts will also change in accordance with the contract mechanism established by the financial institution. If changes in the benchmark interest rate are not fully or quickly transmitted to credit and savings contracts, monetary policy's effects will therefore be more slow (Herlina, 2018).

Granger Causality results show that inflation has a causal relationship with *BI7DRR* and credit interest rates. This causal relationship shows that changes or movements in the inflation variable influence changes or movements in the *BI7DRR* variable and credit interest rates. In addition, there is a bidirectional causal relationship between *rDEPO* and *INF*, as indicated by the Granger causality results. This means that changes in deposit interest rates can influence the rate of inflation and vice versa.

When deposit rates change, for example increase, this can have an impact on consumer and investor behavior. When there is an increase in deposit interest rates, it will affect consumer and investor behavior. People will prefer to keep their money in the bank in the form of deposits rather than spending it when this happens. Ultimately, the money supply will decline.

An increase in deposit interest rates can encourage people to prefer to keep their money in banks in the form of deposits rather than spend it, which in turn can reduce the money supply in the market. As a result, lower demand can contribute to lower inflation rates. Then, changes in the inflation rate can also affect deposit interest rates. If inflation increases, the purchasing power of money will decrease, and in response, banks may raise interest rates on deposits to maintain their attractiveness in the eyes of customers. This can encourage more people to keep their money in deposits, potentially decreasing the money supply and interest rate.

The VECM estimation results show that in the short-term, the inflation rate is influenced by important factors such as BI7DRR (Bank Indonesia's benchmark interest rate), loan interest rates and deposit interest rates. In a relatively short period of time, changes in these variables together influence the inflation rate. In the long-term, it appears that the rate of inflation is significantly influenced by deposit interest rates and loan interest rates. This means that changes in deposit interest rates and loan interest rates have a strong impact on long-term inflation trends. In this case, the inflation rate increases when deposit interest rates and loan interest rates become higher.

The results of the impulse response function (IRF) analysis of the interest rate channel show that in the short, medium and long-term, changes in BI7DRR have a negative impact on the inflation rate. This phenomenon shows that when Bank Indonesia's benchmark interest rate (BI7DRR) increases, inflation tends to respond with a decrease. Moreover, the IRF results also show that a decrease in the inflation rate tends to be responded to by a decrease in deposit interest rates and loan interest rates. This condition applies in the short, medium, and long-term. When inflation decreases, it seems that deposit interest rates and loan interest rates also decrease. This explanation leads to be the conclusion that there is a strong correlation between rate of interest and rate of inflation, and changes in monetary policy and interest rates can influence the overall inflation response.

Changes in the domestic currency exchange rate (rupiah) can have an impact on the level of inflation in the economy; this is known as the effectiveness of monetary transmission through the exchange rate channel on inflation. The findings of the variance decomposition analysis in this study demonstrate the short, medium, and long-term effects of each variable on the transfer of money through the exchange rate channel. This can be seen from the contribution of the exchange rate and capital inflow variables which have the greatest influence in reducing inflation. Zhang et al. (2022) also found something similar, where the results of variance decomposition show that the exchange rate channel can influence inflation quickly. The influence of monetary transmission on the exchange rate channel is in accordance with the Mundell-Fleming IS-LM theory.

The Mundell-Fleming IS-LM theory explains that changes in monetary policy that affect interest rates will have an impact on the exchange rate. Monetary policy that leads to an increase in interest rates tends to increase demand for domestic currency, which in turn will increase the exchange rate. An increase in the exchange rate can reduce the price of imported goods, including raw materials and components, thus potentially reducing the production costs of domestic companies. This can encourage an increase in domestic investment and production. In addition, with a higher exchange rate, cheaper prices of imported goods can help control domestic prices and reduce inflation.

The results of this research are also in accordance with the concept of the monetary policy trilemma, where a country cannot simultaneously have a stable exchange rate, independent monetary policy and financial openness. Based on this concept, it is known that only two of the three goals can be achieved, so policy makers must decide which goals to abandon. In this research, it can be seen that Indonesia has chosen an independent capital and monetary freedom policy. When a country allows cross-border capital flows and foreign investor participation in its domestic financial markets, it must allow its currency exchange rate to move freely in line with market forces. Financial openness can also have an impact on price stability, export and import performance, and overall national financial conditions. However, with independent monetary policy, countries have the flexibility to adjust interest rates and

other monetary policy instruments to address exchange rate fluctuations and manage their impact on the domestic economy. This can help the country maintain price stability, control inflation, and respond to changes in economic conditions (Obstfeld et al., 2005).

The concept of interest rate parity regarding changes in interest rates that can respond to exchange rates and have an impact on inflation is not fully in accordance with the results of variance decomposition which shows that the role of the interest rate parity variable is not significant. Although the concept of interest rate parity can provide an idea of how changes in interest rates can affect exchange rates and inflation. However, there are certain factors in the Indonesian economy that can cause differences in these concepts. Factors such as political uncertainty, commodity price fluctuations, and market responses to various economic policies can have an impact on exchange rates (Chaidir & Arini, 2019).

Furthermore, based on Granger causality analysis, this research found a significant relationship between the inflation and interest rate parity variables and the BI7DRR variable. Moreover, this research also shows that the inflation variable and interest rate parity have a significant influence on the capital inflow. This indicates that the BI7DRR variable not only influences inflation and interest rate parity, but there is also a reciprocal relationship shown by the capital inflow which also plays an important role in influencing inflation and changes in interest rates in monetary transmission.

The short-term VECM estimation results show that the inflation variable is influenced by the BI7DRR variable, capital inflows, and the exchange rate value of the previous period. This means that fluctuations in the BI7DRR benchmark interest rate, capital inflows and changes in exchange rates in previous periods have a temporary impact on changes in the inflation rate. On the other hand, the interest rate parity variable for the previous period does not have a significant influence on changes in the inflation rate in the short-term. This shows that the BI7DRR variable has an instant influence on inflation in the short-term, while other variables such as capital inflows and exchange rates also have an important influence in influencing the inflation rate in Indonesia.

Then, long-term VECM estimation results indicate that the BI7DRR variable has an insignificant influence on the rate of inflation. Nonetheless, the exchange rate, capital inflow, and interest rate parity all have significant effects on inflation. This shows that in the long-term, changes in the BI7DRR benchmark interest rate have no a significant influence on rate of inflation, but the variables of interest rate differences, capital inflows and changes in exchange rates have an influence in determining the inflation rate.

Finally, the IRF analysis found that the exchange rate channel show a consistent response pattern in the short, medium, and long-term. It is evident that the BI7DRR and capital inflow variables respond negatively to a gradual decrease in the inflation rate across the short, medium, and long-terms. This response shows that changes in the benchmark interest rate and capital inflow have an influence on reducing the inflation rate. In addition, the results of the IRF analysis also illustrate that the downward trend in inflation is also responded by a decrease in interest rate parity and exchange rate. This response is seen in the short, medium and long-term. This shows that fluctuations in the interest rate difference between currencies and exchange rates also have an impact on reducing inflation.

## Conclusion

Based on the estimation and analysis results, several conclusions were obtained. First, the use of monetary transmission through the interest rate channel does not have a significant effect on the inflation rate. This condition is because changes in the benchmark interest rate (BI7DRR) require time (time lag) to be responded to by loan interest rates and deposit interest rates. This time delay can occur because banks have credit and deposit contracts with different time periods for their customers. If there is a long-term contract with a predetermined interest rate, then changes in the benchmark interest rate will not directly affect the contract interest rate. In addition, the prolonged impact of the COVID-19 pandemic has also hampered the effectiveness of monetary transmission through the interest rate channel.

Second, because fluctuations in the exchange rate can have an impact on import prices, the role of monetary transmission through the exchange rate channel has a significant influence on inflation. Apart from that, the exchange rate also determines the amount of capital entering a country. When capital inflows are large, monetary authorities may face pressure to adjust interest rate policies to maintain economic stability. If interest rates are lowered in response to capital inflows, this could encourage credit growth and consumer spending, which could impact inflation.

Based on the conclusions above, there are several suggestions that can be used. The conditions of the financial, banking and real sectors play an important role in determining whether the monetary policy transmission process is effective or not. Therefore, policy coordination between central banks in the monetary sector and governments in the real sector is needed in an effort to improve the effectiveness of monetary policy transmission. Additionally, policymakers need to monitor relevant economic indicators such as unemployment rates, investment, and domestic demand. With this indicator, it is expected that policy makers can be more responsive to changes in the real sector and take appropriate measures so that there is policy alignment between the monetary sector and the real sector in an effort to overcome inflation challenges and achieve sustainable economic stability.

This study still has some limitations. The use of monetary transmission variables through interest rates and exchange rates is still limited to only considering a few variables. This is because monetary transmission is a complex phenomenon and is influenced by many factors. The data in this study is only from 2015Q1 to 2022Q4 and the sample used is only in Indonesia. It is hoped that future research can examine other monetary transmission channels that are correlated with inflation by taking samples not only at the national level, but also at the international level. This is because the conditions of each country require different monetary policies according to the economic capabilities of each country. This aims to be a functional comparison in designing effective monetary policy.

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