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Bidirectional relationships between inflation and key monetary indicators in Indonesia: Exploring short- and long-run dynamics

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Abstract
This study aims to analyse the effect of money supply, rupiah exchange rate, and interest rate (BI Rate) on inflation, and vice versa, in Indonesia from 2016 to 2024, with a total of 100 observations. The method employed is a quantitative approach utilizing Vector Autoregression/Vector Error Correction Model (VAR/VECM) analysis techniques to identify both short-term and long-term effects. The results of the study indicate that the money supply and inflation do not significantly influence each other in either the short or long term. The exchange rate has a negative and significant influence on inflation in the long term. In contrast, the interest rate shows a positive and significant influence on inflation only in the long term. The results of the Impulse Response Function (IRF) and Variance Decomposition (VD) analyses confirm that the exchange rate is the most effective variable in explaining variations in inflation. In contrast, the roles of money supply and interest rates are relatively low. These findings indicate the importance of exchange rate stabilization as the primary strategy in controlling inflation in Indonesia.

Keywords: Inflation, Money Supply, Rupiah Exchange Rate, BI Rate, VAR/VECM

Abstrak
Penelitian ini bertujuan untuk menganalisis pengaruh jumlah uang beredar, nilai tukar rupiah, dan suku bunga (BI Rate) terhadap Inflasi, serta sebaliknya di Indonesia pada tahun 2016-2024, dengan total 100 observasi. Metode yang digunakan adalah pendekatan kuantitatif dengan teknik analisis analisis Vector Autoregression/Vector Error Correction Model (VAR/VECM) untuk mengidentifikasi pengaruh jangka pendek dan jangka panjang. Hasil penelitian menunjukkan bahwa jumlah uang beredar dan inflasi tidak saling memengaruhi secara signifikan baik dalam jangka pendek maupun panjang. Nilai tukar memiliki pengaruh negatif dan signifikan terhadap inflasi dalam jangka panjang, sedangkan suku bunga menunjukkan pengaruh positif dan signifikan terhadap inflasi hanya dalam jangka panjang. Hasil analisis Impulse Response Function (IRF) dan Variance Decomposition (VD) menegaskan bahwa nilai tukar merupakan variabel paling efektif dalam menjelaskan variasi inflasi, sementara peran jumlah uang beredar dan suku bunga relatif rendah. Temuan ini mengindikasikan pentingnya stabilisasi nilai tukar sebagai strategi utama dalam pengendalian inflasi di Indonesia.

Kata kunci: Inflasi, Jumlah Uang Beredar, Nilai Tukar Rupiah, BI Rate, VAR/VECM

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1. Introduction

Economic stability plays a fundamental role in supporting national development and improving the welfare of society (Panjaitan et al., 2021). A crucial aspect that must be addressed by both developed and developing countries is ensuring stability in economic activities. Economic instability has the potential to trigger various problems. Inflation, in particular, remains one of the main issues that continues to draw the attention of governments around the world (Anilah et al., 2023). Inflation is a fascinating economic phenomenon to discuss due to its far-reaching impacts on various macroeconomic aspects. It remains a persistent dilemma haunting the economies of all countries, particularly those in the developing world (Sari & Nurjannah, 2023).

To achieve the goal of low and stable inflation, Bank Indonesia, as the central bank, adopted the Inflation Targeting Framework (ITF) in 2005. Following the global financial crisis of 2008/2009, the ITF evolved into a Flexible ITF. Within this framework, the inflation target and inflation behavior serve as the primary references in guiding monetary policy responses.

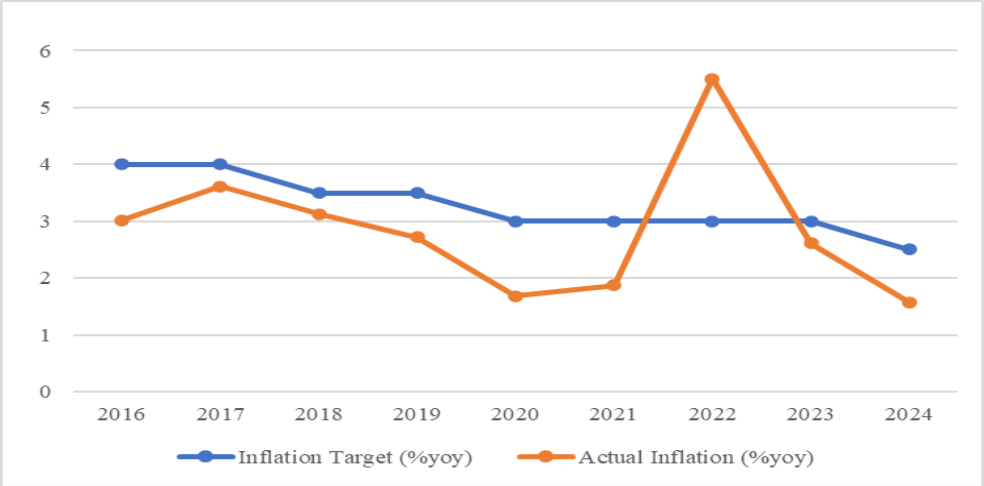

Figure 1. Actual Inflation and Inflation Target in Indonesia 2016–2024 (adapted from Bank Indonesia, 2025)

Based on Figure 1, it is evident that actual inflation did not meet the established target. This occurred because the inflation target announced by the central bank was not used as a reference for public expectations. As a result, a deviation emerged between actual inflation and the target, indicating a failure in the transmission of monetary policy to guide inflation toward its intended path. Therefore, understanding the factors that influence the inflation rate is essential in efforts to control inflation and to design effective monetary policies.

Monetary factors, such as the level of money supply, are a demand-side factor that contributes to inflation. When the amount of money available in society exceeds people's needs or desires, inflationary pressure tends to rise (Melisa et al., 2022). Therefore, controlling the money supply must be done carefully to maintain economic stability (Sriwahyuni et al., 2020). According to Irving Fisher’s quantity theory of money, an increase in the money supply can potentially drive inflation, as more money supply

may boost people's purchasing power, which in turn can lead to rising prices of goods and services.

Another factor that influences the level of inflation is the exchange rate of the Rupiah, which represents the value of the Rupiah relative to other currencies. Indonesia adopts a free-floating exchange rate system, where the Rupiah's value is largely determined by supply and demand dynamics in the foreign exchange market (Hani Mazaya, 2020). This system allows the exchange rate to fluctuate based on various market-driven factors, affecting inflation both in the short term and long term (Agustin, 2021). Exchange rate fluctuations can lead to two key conditions: appreciation and depreciation. When the Rupiah appreciates, imported goods become cheaper, reducing imported inflation, while exports become more expensive, potentially lowering foreign demand. Conversely, depreciation makes imports more expensive, contributing to higher domestic prices. These changes in currency value influence commodity prices and shift consumption patterns, which in turn affect the inflation rate (Mishkin, 2009).

In addition to the exchange rate, the interest rate, specifically the BI Rate, also plays a significant role in influencing inflation. As a key monetary policy instrument, the BI Rate is used by Bank Indonesia to regulate the money supply and stabilize prices (Fadilla & Aravik, 2018). When inflation increases, Bank Indonesia tends to raise the interest rate to reduce liquidity and suppress demand. Once inflationary pressures ease, the rate may be lowered to stimulate economic activity (Elvina et al., 2021). According to Keynesian theory, interest rates affect consumer and investor behavior through their influence on aggregate demand, making them a crucial factor in managing both short-term and long-term inflation (Sari & Nurjannah, 2023).

Previous studies on inflation have examined various independent variables, particularly the money supply, the exchange rate (in rupiah), and the interest rate (BI Rate). However, these studies often produced inconsistent and contradictory results, raising questions about the stability and direction of these relationships. For instance, Dzaky Abghian Taufik (2021) found that money supply had a positive and significant effect on inflation, interest rate had a negative and significant effect, and exchange rate had a positive but insignificant effect (Taufik, Abghian, 2021). On the other hand, Susmiati et al. (2021) reported opposing findings: money supply was found to have a negative and significant effect, while the exchange rate had a positive and significant effect on inflation (Susmiati et al., 2021).

These inconsistencies may stem from differences in periods, methodologies, or macroeconomic contexts, suggesting a lack of consensus in the existing literature. To address this gap, the present study updates the scope of research by using more recent data from the 2016–2024 period. It applies the Vector Autoregression (VAR)/Vector Error Correction Model (VECM) method to provide more robust and up-to-date insights into the dynamic relationship between these variables and inflation in Indonesia.

2. Research Method

The research method used is a quantitative approach. The data were obtained from Statistics Indonesia (BPS) and Bank Indonesia (BI), and thus classified as secondary data (Sugiyono, 2019).

Table 1. Data and Variables

Variable	Indicator	Measurement Scale	Data Source
Money Supply (JUB)	Broad money supply (M2)	Billion Rupiah	Statistics Indonesia (BPS)
Rupiah Exchange Rate (NTR)	Rupiah Exchange Rate	Rupiah Exchange Rate	Bank Indonesia (BI)
Interest Rate (SBI)	Bank Indonesia benchmark interest rate (BI Rate)	Percentage	Statistics Indonesia (BPS)
Inflation (INF)	Inflation based on the Consumer Price Index (CPI) in Indonesia	Percentage	Bank Indonesia (BI)

Source: Data processed by the researcher (2025)

The population in this study consists of all data on the inflation rate, broad money supply (M2), Rupiah exchange rate against the US Dollar (Kurs), and the interest rate (BI Rate) in Indonesia. The sample used is drawn from this population, limited to monthly data from September 2016 to December 2024, resulting in a total of 100 observations. This is because, during that period, Indonesia experienced significant economic dynamics, including challenges arising from the COVID-19 pandemic, which had a major impact on the Indonesian economy, as well as the adjustment of the BI Rate following its transition to BI7DR in September 2016. In addition, during this time frame, both Statistics Indonesia (BPS) and Bank Indonesia (BI) provided complete data, which supports the feasibility of this research.

Data processing was carried out using Microsoft Excel 2021 and EViews 12 Student Version. The analytical technique applied in this study is based on the Vector Autoregression (VAR) framework. However, if all variables are stationary at the first difference and cointegration exists among them, the Vector Error Correction Model (VECM) will be employed. Since VAR and VECM are conceptually related but methodologically different, this study will determine the appropriate model, VAR/VECM, based on the results of the stationarity and cointegration tests. Before conducting further analysis, pre-estimation tests for VAR/VECM are performed, including the stationarity test, the optimal lag test, the stability test, and the cointegration test. These are followed by the Granger-causality test, VAR/VECM model estimation, Impulse Response Function (IRF), and Variance Decomposition (VD). By the assumptions of the VAR/VECM model, the following system of equations is formulated:

$$INF_t = \alpha_{1i} + \sum\beta_{1i}\, INF_{t-1} + \sum\gamma_{1i}\, JUB_{t-1} + \sum\delta_{1i} NTR_{t-1} + \sum\varepsilon_{1i} SBI_{t-1} + e_t$$

$$JUB_t = \alpha_{1i} + \sum\beta_{1i}\, JUB_{t-1} + \sum\gamma_{1i}\, INF_{t-1} + \sum\delta_{1i} NTR_{t-1} + \sum\varepsilon_{1i} SBI_{t-1} + e_t$$

$$NTR_t = \alpha_{1i} + \sum\beta_{1i}\, NTR_{t-1} + \sum\gamma_{1i}\, INF_{t-1} + \sum\delta_{1i} JUB_{t-1} + \sum\varepsilon_{1i} SBI_{t-1} + e_t$$

$$SBI_t = \alpha_{1i} + \sum\beta_{1i}SBI_{t-1} + \sum\gamma_{1i}\ INF_{t-1} + \sum\delta_{1i}JUB_{t-1} + \sum\varepsilon_{1i}NTR_{t-1} + e_t$$

3. Results and Discussion

3.1 Result

Stationarity Test

The unit root test is used to examine the stationarity level of the data by applying the Augmented Dickey-Fuller (ADF) test. The ADF test is conducted using specifications that include an intercept and, where appropriate, a trend component. Several lag lengths are tested to address autocorrelation, with the optimal lag for each variable determined based on the Akaike Information Criterion (AIC).

Table 2. ADF Test Results

Variable	Data Level		First Difference	
	Probability	Description	Probability	Description
Inflation Rate (INF)	0.0772	Non Stationary	0.0163	Stationary
Money Supply (JUB)	0.9754	Non Stationary	0.0001	Stationary
Exchange Rate (NTR)	0.2088	Non Stationary	0.0000	Stationary
Interest Rate (BI Rate) (SBI)	0.5738	Non Stationary	0.0000	Stationary

As a result, all variables are stationary at the first difference level, as indicated by probability values less than 0.05, thereby meeting the stationarity requirement.

Lag Optimum Test

The lag length is determined by selecting the lag with the smallest value of the information criteria statistic. Commonly used criteria include the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn Criterion (HQ). The lag selection test was conducted using lags from 1 to 10.

Table 3. Optimum Lag Test Results

Lag	AIC	SC	HQ
0	40.30241	40.41426*	40.34750
1	39.98879*	40.54804	40.21421*
2	40.11894	41.12558	40.52469
3	40.18012	41.63415	40.76620
4	40.34991	42.25134	41.11632
5	40.34221	42.69103	41.28895
6	40.48563	43.28185	41.61270
7	40.61042	43.85404	41.91783
8	40.82806	44.51907	42.31580
9	40.83666	44.97507	42.50473
10	41.03323	45.61903	42.88164

Based on the AIC, SC, and HQ criteria, the optimal lag is found at lag 1. Although the three criteria do not fully align, lag 1 is selected because it is recommended by AIC, which has the smallest value among the options. The AIC criterion is commonly used

in time series analysis due to its ability to capture model complexity while minimizing information loss. Therefore, lag 1 is used for estimating the causality relationships and the VAR/VECM model.

Stability Test

A stability test is necessary to ensure that the VAR/VECM model has a high level of validity and to avoid misleading results in the Impulse Response Function (IRF) analysis.

Table 4. Stability Test Results

Modulus
0.562846
0.352191
0.086920
0.026912

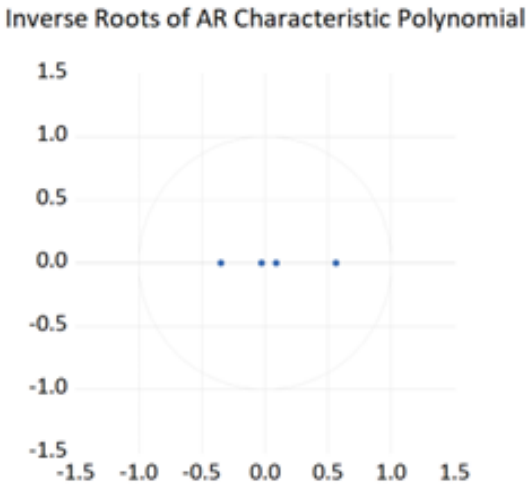

Figure 2. Inverse Roots of the AR Characteristic Polynomial

As a result, the model is considered stable starting from lag 1, as evidenced by modulus values being less than one and all polynomial roots lying within the unit circle. Therefore, this confirms that the results of the IRF and VD analyses are valid.

Cointegration Test

The cointegration test was conducted using the Johansen Cointegration Test, as this method can identify trends in the data, test for weakly exogenous variables, and evaluate linear hypotheses within the cointegration relationships.

Table 5. Johansen Cointegration Test Results

Hypothesized No. of CE(s)	Trace Statistic	0.05 Critical Value	Prob.**
None *	171.2405	47.85613	0.0000
At most 1 *	105.0770	29.79707	0.0000
At most 2 *	49.44722	15.49471	0.0000
At most 3 *	14.74512	3.841465	0.0001

Based on the test results above at the 5% significance level, it is indicated that there are four variables with cointegration relationships. This is shown by the Trace Statistic

values being greater than the Critical Values. It can be concluded that the variables are cointegrated within the model, indicating a long-term relationship. Therefore, the most appropriate model is the Vector Error Correction Model (VECM).

Granger Causality Test

The causality test can indicate either a one-way or two-way causal relationship between the independent and dependent variables. Granger causality testing is assessed based on the probability value. If the probability value is less than α = 5%, it indicates the presence of a causal relationship.

Table 6. Granger Causality Test Results

Causal Hypothesis	F-Statistic	Probability	Decision
JUB does not Granger-cause INF	0.44015	0.5086	No causality
INF does not Granger-cause JUB	0.34276	0.5596	No causality
NTR does not Granger-cause INF	2.83480	0.0955	No causality
INF does not Granger-cause NTR	0.00387	0.9505	No causality
SBI does not Granger-cause INF	6.36946	0.0133	Causality exists at 5%
INF does not Granger-cause SBI	16.8140	9.E-05	No causality

It is concluded that the interest rate variable (BI Rate or SBI) statistically affects the inflation rate (INF), but INF does not statistically affect SBI. Therefore, there is only a one-way (unidirectional causality) relationship between the two variables.

Estimation of the VAR/VECM Model

Table 7. Results of the VECM Model Estimation (Long-run)

Endogenous Variables	Exogenous Variables	Coefficient	*t-statistic*
INF	JUB(-1)	-1.46E-06	-0.38822
	NTR(-1)	-0.007503	-8.86778**
	SBI(-1)	2.564783	1.88231*
JUB	INF(-1)	-685585.9	-1.23466
NTR	INF(-1)	-133.2832	-1.24097
SBI	INF(-1)	0.389897	1.23901

Note: * Significant at the level α = 10%, ** Significant at the levelα = 5%

Table 8. Results of the VECM Model Estimation (Short-run)

Endogenous Variables	Exogenous Variables	Coefficient	*t-statistic*	*Adj. R-squared*
INF	D(INF(-1),2)	-0.533125	-5.85509**	0.251799
	D(JUB(-1),2)	-2.78E-08	-0.09743	
	D(NTR(-1),2)	-3.28E-05	-0.27690	
	D(SBI(-1),2)	0.004982	0.01864	
JUB	CointEq1	12094.23	1.83606*	0.434894
	D(INF(-1),2)	33533.05	1.20927	
	D(JUB(-1),2)	-0.596833	-6.86536**	
NTR	CointEq1	171.8826	8.44392**	0.547144
	D(INF(-1),2)	-153.4762	-1.79100*	
	D(NTR(-1),2)	0.227844	2.04419**	
SBI	CointEq1	-0.020099	-2.57030**	0.098433
	D(INF(-1),2)	-0.019032	-0.57815	
	D(SBI(-1),2)	-0.241277	-2.49651**	

Note: * Significant at the level α = 10%, ** Significant at the levelα = 5%

Impulse Response Function (IRF)

Impulse Response Function (IRF) analysis is used to observe the response or movement resulting from a shock in one of the exogenous variables and its effect on the endogenous variables over several periods. The results of the IRF analysis are presented as follows.

Figure 3. IRF Test Results up to the 12th Period

Based on the results of the Impulse Response Function (IRF), a detailed explanation is presented below:

1) The inflation rate responds negatively to shocks in the money supply. The negative response of inflation to a sudden increase in the money supply suggests that when there is a sudden surge in money supply, the inflation rate tends to decrease over several periods. This phenomenon can be explained from the perspective of contractionary policies or the influence of other dominant instruments, such as interest rates or exchange rates, which may offset the surge's impact. In the medium term, this response may reflect a shift in consumption toward investment or savings, as the public perceives that an increase in the money supply does not necessarily result in inflationary pressure.

2) The money supply responds positively to shocks in the inflation rate. The IRF findings suggest that a sudden surge in inflation results in an increase in the money supply. This reflects an adaptive mechanism within the economic system, where economic agents require more money for transactions due to rising prices. This response aligns with the classical theory of money demand, which suggests that higher inflation increases the demand for nominal money in order to maintain the same level of purchasing power.

3) The inflation rate responds positively to shocks in the Rupiah exchange rate against the US Dollar. The IRF shows that when a shock (such as a depreciation of the Rupiah) occurs in the exchange rate, inflation tends to increase. This reflects the basic theory of imported inflation, where a weakening currency makes imported goods more expensive, thereby driving up domestic consumer prices. According to open economy theory, countries that are heavily dependent on imported consumer goods, energy, and raw materials, such as Indonesia, are particularly sensitive to exchange rate fluctuations.

4) The Rupiah exchange rate against the US Dollar responds positively to shocks in the inflation rate. When an inflation shock occurs, the exchange rate responds positively, meaning that the Rupiah tends to depreciate. This is consistent with open macroeconomic theory, which posits that high inflation reduces domestic purchasing power, undermines investor confidence, and leads to a depreciation of the domestic currency relative to foreign currencies.

5) The inflation rate responds negatively to shocks in the interest rate (BI Rate). The IRF indicates that a sudden increase in the BI Rate is associated with a decline in inflation. This finding aligns with the conventional monetary policy framework, in which an interest rate hike leads to a reduction in aggregate demand, thereby lowering inflation. This response reflects the medium- to long-term effectiveness of interest rate policy in controlling inflation.

6) The interest rate (BI Rate) responds negatively to shocks in the inflation rate. This suggests that when there is a sudden spike in inflation, the interest rate tends to decline—contrary to the general expectation. This negative response may be attributed to policy lags or a trade-off between the objectives of controlling inflation and supporting economic growth. In such situations, Bank Indonesia may opt to maintain low interest rates to preserve household purchasing power and sustain consumption. A similar phenomenon was observed during the post-pandemic economic recovery period, when inflation rose due to supply chain disruptions. However, interest rates were kept low to avoid hindering the recovery process.

Variance Decomposition (VD)

Variance Decomposition (VD) is used to illustrate the proportion of variance in a variable that can be attributed to shocks from other variables, both in the current and future periods.

Table 8. Variance Decomposition Results

Variance Decomposition of D(INF):

Period	S.E.	D(INF)	D(JUB)	D(NTR)	D(SBI)
1	0.390745	100.0000	0.000000	0.000000	0.000000
2	0.430757	99.92176	0.029322	0.048788	0.000133
3	0.521437	99.91464	0.029636	0.055231	0.000492
4	0.571063	99.92397	0.029162	0.046247	0.000617
5	0.629730	99.93692	0.024236	0.038256	0.000591
6	0.676896	99.94427	0.022051	0.033112	0.000563
7	0.724112	99.95089	0.019284	0.029235	0.000595
8	0.766891	99.95578	0.017528	0.026101	0.000587
9	0.808151	99.96002	0.015808	0.023582	0.000594
10	0.847051	99.96336	0.014535	0.021517	0.000590
11	0.884404	99.96622	0.013380	0.019802	0.000594
12	0.920170	99.96862	0.012450	0.018341	0.000593

Variance Decomposition of D(NTR):

Period	S.E.	D(INF)	D(JUB)	D(NTR)	D(SBI)
1	367.7415	1.560826	15.91559	82.52359	0.000000
2	371.9809	1.530630	17.18476	80.88994	0.394668
3	382.4095	2.591272	16.66002	78.67638	2.072326
4	385.9600	2.938708	16.35773	77.79705	2.906521
5	389.7403	3.381865	16.05836	77.07808	3.481691
6	392.5387	3.792532	15.89718	76.06364	4.246644
7	395.3546	4.223736	15.68837	75.08378	5.004116
8	398.2797	4.634958	15.47545	74.18531	5.704283
9	401.0923	5.021433	15.27075	73.33378	6.374031
10	403.9071	5.411213	15.07831	72.46931	7.041162
11	406.6818	5.781968	14.88823	71.64196	7.687839
12	409.4631	6.148313	14.70261	70.83382	8.315256

Variance Decomposition of D(JUB):

Period	S.E.	D(INF)	D(JUB)	D(NTR)	D(SBI)
1	118999.9	0.026653	99.97335	0.000000	0.000000
2	127446.4	1.048447	95.32809	3.037726	0.585739
3	154712.7	0.751136	96.11403	2.682589	0.452246
4	166402.2	1.067533	95.58665	2.788033	0.557781
5	183190.4	0.881061	95.86901	2.731171	0.518761
6	194996.0	0.940813	95.63514	2.864964	0.559083
7	208102.1	0.837288	95.73903	2.871401	0.552277
8	219294.9	0.829818	95.69796	2.906738	0.565486
9	230569.0	0.773454	95.73735	2.923393	0.565805
10	240949.2	0.754134	95.72592	2.947705	0.572240
11	251112.1	0.720697	95.74345	2.961665	0.574191
12	260757.6	0.701808	95.74418	2.976295	0.577717

Variance Decomposition of D(SBI):

Period	S.E.	D(INF)	D(JUB)	D(NTR)	D(SBI)
1	0.141268	0.971805	0.606472	1.146078	97.27565
2	0.182077	1.854682	3.411736	6.892324	87.84126
3	0.218223	1.704582	3.665705	9.696483	84.93323
4	0.247240	1.940977	3.869846	9.922416	84.26676
5	0.273376	1.897675	3.871106	10.13099	84.10023
6	0.297583	1.962941	4.002177	10.46014	83.57474
7	0.319798	1.960713	4.042409	10.68612	83.31075
8	0.340574	1.986552	4.088578	10.81713	83.10774
9	0.360140	1.990874	4.115156	10.93032	82.96365
10	0.378725	2.003147	4.144733	11.02721	82.82491
11	0.396423	2.008498	4.164874	11.10605	82.72058
12	0.413369	2.015671	4.183506	11.17042	82.63041

The detailed explanation of the VD results is presented below:

1) The money supply provides a relatively weak contribution to inflation fluctuations. The VD results show that the proportion of inflation variance explained by the money supply is significantly smaller compared to other variables, such as the Rupiah exchange rate against the US Dollar. This indicates that, within the current structure of the Indonesian economy, the influence of the money supply on inflation is not dominant. This finding aligns with the shift in Indonesia's monetary policy, which has increasingly focused on controlling interest rates and exchange rates under the Inflation Targeting Framework.

2) The inflation rate contributes ineffectively to explaining fluctuations in the money supply. The VD findings reveal that the proportion of variance in the money supply attributable to inflation is relatively small compared to other variables, such as the exchange rate. This suggests that changes in the money supply are more strongly influenced by external factors and direct monetary policy instruments, such as foreign exchange reserves, credit activity, and exchange rates, rather than by inflationary pressures themselves.

3) The Rupiah exchange rate against the US Dollar is highly effective in contributing to inflation dynamics. The VD results show that the exchange rate plays a dominant role in explaining variations in the inflation rate, surpassing the influence of both the money supply and the interest rate. This indicates that the exchange rate is the primary driver of inflation in Indonesia over the long term. This finding is consistent with the structure of the Indonesian economy, which remains relatively open and heavily reliant on imported goods, particularly industrial raw materials and energy.

4) The inflation rate is highly effective in contributing to variations in the Rupiah exchange rate against the US Dollar. The VD findings reveal that, in the long run, inflation is one of the key exogenous variables influencing fluctuations in the

exchange rate. This reflects the high sensitivity of the exchange rate to domestic price conditions, particularly given Indonesia's open economic structure, which remains heavily influenced by external factors and overall macroeconomic stability.

5) The interest rate (BI Rate) is relatively ineffective in contributing to inflation dynamics. The VD results show that the proportion of inflation variation explained by the interest rate is minimal compared to that of the exchange rate or money supply. This suggests that, although the interest rate is the primary instrument used by Bank Indonesia within the Inflation Targeting Framework (ITF), its practical effectiveness in Indonesia remains limited. Several factors may explain this limitation, including low levels of financial literacy among the population, indirect interest rate transmission to the real sector, and a continued reliance on commodity prices and imported goods.

6) The inflation contributes ineffectively to variations in the interest rate (BI Rate). This finding indicates that when a sudden surge in inflation occurs, the interest rate tends to decline, contrary to general expectations. This negative response may be attributed to policy delays or a trade-off between controlling inflation and achieving the goal of sustaining economic growth. In times of rising inflation, Bank Indonesia may opt to maintain low interest rates to preserve household purchasing power and support consumption. A similar pattern was observed during the post-pandemic economic recovery period, where inflation rose due to supply chain disruptions. However, interest rates were kept low to avoid hindering the recovery process.

3.2 Discussion

Based on the research objectives, the VECM estimation results can be described as follows:

The Effect of Money Supply on Inflation

The short-term VECM estimation results show that the money supply from the previous month has a negative but statistically insignificant effect on the inflation rate in Indonesia. In the short term, this finding suggests that fluctuations in the money supply do not immediately have a significant impact on inflation. This could be due to a time lag between changes in the money supply and the response of goods and services prices in the market (Widyaningrum & Meliza, 2024). According to the Quantity Theory of Money developed by Irving Fisher through the equation MV = PT, an increase in the money supply will lead to higher prices (inflation) if the velocity of money and the volume of transactions remain constant. However, in the short term, variables such as the velocity of money and the level of production may adjust, making the relationship less apparent.

The long-term VECM estimation results indicate that the money supply has a statistically insignificant adverse effect on the inflation rate in Indonesia. Theoretically, in the long run, the money supply is expected to have a positive relationship with inflation, as increased liquidity in the economy tends to drive up prices. However, the estimation results indicate a negative and insignificant relationship. This phenomenon

can be explained by the effectiveness of Bank Indonesia's monetary policy in controlling inflation expectations and directing money supply growth toward productive sectors. One possible reason for this inconsistency is the abnormal economic conditions, such as during the COVID-19 pandemic. During the pandemic, although the money supply increased due to fiscal and monetary stimulus, public demand for goods and services tended to decline due to uncertainty and activity restrictions. This situation hindered the transmission of the increased money supply into inflation.

The Effect of Inflation on Money Supply

The short-term VECM estimation results show that the inflation rate from the previous month has a positive but statistically insignificant effect on the money supply in Indonesia. This indicates that, in the short term, rising inflation is not yet strong enough to significantly influence changes in the money supply. This may be due to the slow response of economic agents and monetary authorities to price dynamics. This finding is consistent with the study by Ningsih & Kristiyanti (2018), which states that inflation does not have a direct and significant effect on the money supply in the short term, as monetary policy responses to inflation often take time to be implemented and to generate real impact. The inconsistency in results may also be attributed to post-pandemic shifts in economic behavior, such as the increased use of non-cash instruments and the digitalization of transactions, which reduce reliance on conventional money (Ningsih & Kristiyanti, 2018). Fatmawati & Yuliana (2020) also noted that although inflation can trigger an increase in the money supply, other factors, such as public preferences for electronic money and government policies, also play a role in determining the money supply (Fatmawati & Indah Yuliana, 2020).

The long-term VECM estimation results show that the inflation rate has a negative and statistically insignificant effect on the money supply in Indonesia. In the long run, this negative and insignificant result suggests that rising prices do not necessarily lead to a significant reduction in the money supply. This can be explained by the central bank's role in maintaining price and liquidity stability. When inflation rises, Bank Indonesia tends to implement contractionary policies, such as raising interest rates or reducing the monetary base; however, the actual impact depends on the economic conditions. The relationship between inflation and money supply is insignificant in the long run, as inflation control policies in Indonesia tend to be more effective through interest rate adjustments and market interventions rather than merely managing the monetary base (Chandra & Wahyuningsih, 2021).

The Effect of the Rupiah Exchange Rate (Kurs) on Inflation

The short-term VECM estimation results show that the Rupiah exchange rate against the US Dollar from the previous month has a negative and statistically insignificant effect on the inflation rate in Indonesia. This finding indicates that, in the short term, depreciation or appreciation of the exchange rate does not yet have a significant impact on inflation. This may be due to domestic price protection mechanisms, such as subsidies, price controls on strategic goods, or the use of foreign exchange reserves to stabilize the prices of imported goods. According to the pass-through inflation theory, exchange rate fluctuations influence domestic prices, particularly through the prices of

imported goods. However, this pass-through is not always immediately visible in the short term, as market structures and government policies may delay it. This finding is consistent with the study by Anilah, Kamillah, & Stiawan (2023), which found that in the short term, the exchange rate does not significantly affect inflation, as the transmission of import prices into domestic prices experiences a time lag and depends on a country's level of dependence on imported goods (Anilah et al., 2023).

The long-term VECM estimation results show that the Rupiah exchange rate against the US Dollar has a negative and statistically significant effect on the inflation rate in Indonesia. In the long run, a depreciation of the Rupiah (a decline in its value against the US Dollar) is found to significantly reduce the inflation rate. While this may seem contrary to the standard expectation that currency depreciation should lead to higher inflation, it can be explained from the perspective of real sector resilience and the effectiveness of export-oriented policies. In the long term, a weaker Rupiah may stimulate exports and domestic production, thereby increasing the supply of goods and putting downward pressure on inflation. Moreover, if households and businesses adapt by using more domestic products and reducing their consumption of imported goods, the inflationary impact of exchange rate depreciation will be diminished.

The Effect of Inflation on the Rupiah Exchange Rate (Kurs)

The short-term VECM estimation results show that the inflation rate from the previous month has a negative and statistically significant effect on the Rupiah exchange rate against the US Dollar in Indonesia. This finding aligns with the Purchasing Power Parity (PPP) theory, which posits that differences in inflation rates between countries are reflected in changes in their exchange rates. The result suggests that when inflation increases in the previous month, the Rupiah tends to appreciate against the US Dollar in the short term. Theoretically, this can be explained by short-term portfolio adjustment effects, where investors may interpret rising inflation as a signal that Bank Indonesia will raise interest rates to stabilize prices, thereby attracting capital inflows and strengthening the exchange rate. However, this relationship is not always typical. Inflation typically puts downward pressure on the exchange rate; however, in the short term, monetary policy responses may have the opposite effect. High domestic inflation can reduce the attractiveness of Rupiah-denominated assets, leading to capital outflows and resulting in Rupiah depreciation.

The long-term VECM estimation results show that the inflation rate has a negative and statistically insignificant effect on the Rupiah exchange rate against the US Dollar in Indonesia. In the long run, although the relationship between inflation and the exchange rate tends to be negative (higher inflation leads to Rupiah depreciation), the effect is not significant. This suggests that other factors, such as the trade balance, foreign capital flows, foreign exchange reserves, and market expectations, play a more dominant role in determining the exchange rate than inflationary pressures alone (Harahap, 2023).

The Effect of Interest Rate (BI Rate) on Inflation

The short-term VECM estimation results show that the interest rate (BI Rate) from the previous month has a positive but statistically insignificant effect on the inflation rate in Indonesia. In the short term, the positive but insignificant relationship indicates that an increase in the BI Rate is not yet strong enough to directly reduce inflation. It tends to be followed by an increase in inflation, although this increase is not statistically significant. This can be explained by the monetary policy lag effect, which refers to the time required for changes in interest rates to influence aggregate demand and prices. Moreover, in Indonesia, the policy interest rate often becomes effective only after 3 to 6 months due to transmission through the banking sector, bond markets, and public consumption-investment behavior.

The long-term VECM estimation results show that the interest rate (BI Rate) has a positive and statistically significant effect on the inflation rate in Indonesia. This result may appear to contradict conventional theory, which states that higher interest rates should reduce inflation. However, the positive and significant relationship can be interpreted to mean that, in the long run, a higher policy interest rate is associated with higher inflation, not because the interest rate causes inflation, but because high inflation prompts monetary authorities to raise interest rates in response. This phenomenon is known as reverse causality or a two-way relationship. In other words, in the long term, the BI Rate increases as a response to high inflation, rather than causing it.

The Effect of Inflation on the Interest Rate (BI Rate)

The short-term VECM estimation results show that the inflation rate from the previous month has a negative and statistically insignificant effect on the interest rate (BI Rate) in Indonesia. In the short term, this finding indicates that inflation occurring in the previous month is not strong enough to significantly influence changes in the BI Rate. The negative and insignificant relationship suggests that Bank Indonesia does not automatically respond to monthly inflation changes with immediate interest rate adjustments. This aligns with the central bank's monetary policy strategy, which considers multiple factors simultaneously, including economic growth, exchange rates, financial system stability, and market expectations.

The long-term VECM estimation results show that the inflation rate has a positive but statistically insignificant effect on the interest rate (BI Rate) in Indonesia. The positive relationship between inflation and interest rates in the long run reflects the principle of the Taylor Rule, whereby central banks tend to raise interest rates in response to rising inflation to contain price increases. However, the insignificance of the relationship suggests that, in the context of Indonesia, structural factors and inflation expectations play a more dominant role in determining long-term interest rates than actual inflation itself. One possible explanation for this inconsistency is the presence of exceptional conditions during the study period, such as the COVID-19 pandemic and global economic uncertainty. During the pandemic, Bank Indonesia maintained low interest rates as a strategy to support economic recovery, despite fluctuating inflation. This policy was driven by considerations related to financial system

stability and the need to support domestic demand, meaning that responses to inflation were not directly reflected in changes to the BI Rate.

4. Conclusion

This study examined the bidirectional relationship between money supply, Rupiah exchange rate (Kurs), interest rate (BI Rate), and inflation in Indonesia from 2016 to 2024 using the VAR/VECM approach. The findings indicate that the Rupiah exchange rate has a significant and long-term influence on inflation. In contrast, the effects of money supply and interest rate on inflation are generally limited or insignificant in both the short and long term. Conversely, the impact of inflation on the money supply, exchange rate, and interest rate is primarily insignificant, suggesting weak reverse causality. Furthermore, the Impulse Response Function (IRF) reveals varied short-term reactions, while variance decomposition highlights the dominant role of the exchange rate in explaining fluctuations in inflation

The findings suggest that Bank Indonesia should focus on stabilizing the exchange rate, given its significant and effective long-term influence on inflation. A stable exchange rate policy may contribute to controlling inflation more effectively than solely relying on money supply or interest rate interventions. Furthermore, although the interest rate shows long-term significance, its ineffectiveness in the short run suggests the need for complementary policies, such as macroprudential and fiscal coordination.

The results of the study indicate that most of the variables have an insignificant effect on inflation. This suggests that there may be other factors outside the model that have a greater influence on the inflation rate. Consequently, this limitation may affect the completeness of the model and reduce the study's ability to comprehensively explain variations in inflation.

Future research is encouraged to conduct a more in-depth analysis of the causal relationships between variables, particularly those that do not exhibit significant effects in either the short or long term. Additionally, to achieve a more comprehensive understanding, subsequent studies should consider incorporating other relevant economic indicators that may directly or indirectly influence inflation.

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