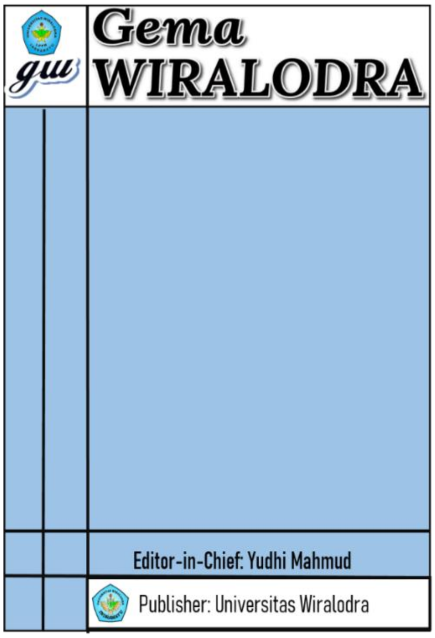
Gema Wiralodra

Publication details, including instructions for authors and subscription information:
https://gemawiralodra.unwir.ac.id



The analysis of causality analysis of money supply (M2) and interest rate (BI Rate) in Indonesia: an empirical study in 1990-2021

Roosaleh Laksono[a*], Ferry Mulyawan[b], Paulus Sugianto Yusuf[c]

[a]Universitas Widyatama, Indonesia, roosaleh.laksono@widyatama.ac.id
[b]Universitas Widyatama, Indonesia, ferry.mulyawan@widyatama.ac.id
[c]Universitas Widyatama, Indonesia, paulus.sugianto@gmail.com

To cite this article:
Rokib, R, Zaimudin, Z & Ghofur, A. (2023). The analysis of causality analysis of money supply (M2) and interest rate (BI Rate) in Indonesia: an empirical study in 1990-2021. *Gema Wiralodra, 14*(3), 1319-1325.
To link to this article:
https://gemawiralodra.unwir.ac.id/index.php/gemawiralodra
Published by:
Universitas Wiralodra
Jln. Ir. H. Juanda Km 3 Indramayu, West Java, Indonesia

Gema Wiralodra, 14(3), 1319-1325
https://gemawiralodra.unwir.ac.id/index.php/gemawiralodra
p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

Original Article

The analysis of causality analysis of money supply (M2) and interest rate (BI Rate) in Indonesia: an empirical study in 1990-2021

Roosaleh Laksono[a*], Ferry Mulyawan[b], Paulus Sugianto Yusuf[c]
[a]Universitas Widyatama, Indonesia, roosaleh.laksono@widyatama.ac.id
[b]Universitas Widyatama, Indonesia, ferry.mulyawan@widyatama.ac.id
[c]Universitas Widyatama, Indonesia, paulus.sugianto@gmail.com

*Corresponding author: roosaleh.laksono@widyatama.ac.id

Abstract
This research investigates the causal relationship between the Bank Indonesia (BI) Rate and the Money Supply (M2) in Indonesia, using annual time series data from 1990 to 2022. The study reveals that an increase in the Money Supply (M2) directly impacts the BI Rate, a policy instrument employed by Bank Indonesia to manage and curb inflation. Moreover, through the rigorous application of Granger Causality Tests, the research demonstrates that the relationship between the BI Rate and Money Supply (M2) is bidirectional. This bidirectional relationship implies that changes in the interest rate influence the money supply and vice versa. These findings provide valuable insights into monetary policy dynamics and its implications for the Indonesian economy.
Keyword: Causality Analysis, Interest Rate (BI Rate), Indonesia, Money Supply (M2)

1. Introduction

The macroeconomic factors that significantly impact monetary policy are the interest rate and money supply (George et al., 2018; Srithilat et al., 2017). Bank Indonesia regulates and oversees these two macroeconomic components (Sugarda & Wicaksono, 2017). Macroeconomic policies also include monetary policies to achieve economic growth, employment provision, price stability, and balance of payments equilibrium Onyeiwu, C. (2012). However, achieving and maintaining the strength of the rupiah value is the ultimate goal of monetary policy. Monetary policy plays a central role in regulating and overseeing the value of the Indonesian rupiah (Warjiyo & Juhro, 2019). Maintaining the rupiah value's stability includes preserving the rupiah's value against foreign currencies and the prices of goods and services with indications of inflation (Law No. 3 of 2004 concerning Bank Indonesia) (Alvyonita & Hidayat, 2017).

If the amount of money circulating in society is excessive, inflation will occur, which means that the prices of goods and services, especially necessities, will increase (Yolanda, (2017). To prevent the impact of inflation from becoming more extensive, the central bank (Bank Indonesia) must take action by changing its policies and increasing the interest rate. This is done to prevent excessive money circulating that leads to inflation. According to Law No. 3 of 2004 concerning Bank Indonesia, the Bank Indonesia Rate (BI Rate) is the interest rate referred to in this study. Maintaining the rupiah value's stability includes preserving the rupiah value's stability against the prices of goods and services and against foreign currencies.

The benchmark interest rate in Indonesia is the Bank Indonesia Rate or BI Rate. Bank Indonesia uses the BI Rate to control interest rates to achieve monetary policy objectives, including initial, intermediate, and final targets (Kemu & Ika, 2016). Achieving the levels of the Bank Indonesia Certificate (SBI) and the Interbank Money Market (PUAB) interest rates is an initial goal of monetary policy (Yanti, 2018). The intermediate targets involve deposit and credit interest rate changes, which impact the money supply. The ultimate targets are the desired price level, inflation, and economic growth (Mishkin & Posen, 1998).

p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

BI Rate consists of loan interest rate and savings interest rate. The loan interest rate is related to business capital, so the credit interest rate is closely related to investment. The relationship between credit interest rate and investment theoretically has a negative or inverse relationship, meaning that if the interest rate increases, entrepreneurs will reduce investment, and vice versa (Njoroge, 2013). This is because companies, to obtain capital, will borrow from banks at the predetermined interest rate, and the interest rate is a cost for companies as the cost of capital increases. The higher the interest rate, the less willingness for companies to invest. This is because entrepreneurs will increase their investment spending if the expected return on investment is greater than the interest rate to be paid as the cost of capital (Nopirin, 2014). As for the relationship between money supply and interest rate, as mentioned earlier, the interest rate is a monetary policy set by Bank Indonesia and announced to the public (Juhro & Njindan Iyke, 2019). The availability of money is influenced by the BI rate set by Bank Indonesia. People tend to deposit money in banks to lower the inflation rate when the savings BI rate increases. Conversely, if the savings BI rate decreases, people's interest in saving will decrease, which will trigger an increase in the money supply in society.

Table 1
BI Rate and Money Supply in Indonesia from 2010 to 2021

Year	BI Rate (%)	Money Supply (Billions of IDR)
2010	6.55	2,471,206
2011	6.54	2,877,220
2012	5.58	3,307,508
2013	6.84	3,730,409
2014	8.83	4,173,327
2015	7.56	4,548,800
2016	6.61	5,004,977
2017	6.20	5,419,165
2018	6.36	5,760,046
2019	6.45	6,136,552
2020	5.07	6,780,845
2021	4.87	7,560,967

Table 1 above presents data on the BI Rate and the money supply from 2010 to 2021. The data shows that as the amount of money circulating in society increases, the interest rate (BI Rate) decreases. This differs from the theory that states that as the amount of money circulating in the community grows, the central bank, such as Bank Indonesia, should raise the interest rate on bank savings. This is done to restrain the increasing amount of money circulating in society, encouraging people to save in banks, which would hinder the rise in the inflation rate.

A study conducted by Gbenedio et al. (1999) found a mutually influential relationship between the interest rate and the money supply in Nigeria in the long run (Alvyonita & Hidayat, 2017). Furthermore, Andreas Scharbert (2005) stated that the European Central Bank's interest rate target could stabilize the money supply in the long run (Alvyonita & Hidayat, 2017). If the money supply is too large, it will positively impact the interest rate target by gradually raising the interest rate to maintain a stable money supply.

Therefore, the role of Bank Indonesia is to carefully determine the interest rate to maintain a stable money supply in society and to preserve the stability of the rupiah currency against other foreign currencies. Based on the explanation above, this research aims to analyze the causal relationship between the money supply in society and the reference interest rate of Bank Indonesia (BI Rate) in Indonesia from 1990 to 2020. This research aims to better understand the relationship between the money supply and the interest rate in Indonesia. The government and the central bank can use the implications of the research findings in formulating more effective monetary policies to control inflation, enhance economic growth, and maintain financial stability in Indonesia.

2. Methods

The study uses quantitative secondary data, specifically time series data collected annually from 1990 to 2022. The data was gathered from diverse sources, including the Bank Indonesia website and the World Bank. The chosen method for analysis is Granger causality analysis, which examines whether the money supply variable (M_2) influences changes in the interest rate or vice versa in the short term. This analysis investigates a reciprocal or two-way relationship by testing the null hypothesis that M2 cannot predict the interest rate. Nonetheless, prior to conducting the Granger causality test, the following steps are implemented:

Step 1: Testing Data Normality. The data used must be tested for normality to ensure that the research results are BLUE (Best, Linear, Unbiased, and Estimator). This means that the data used in the research should follow a normal distribution and not contain outliers. The Jarque-Bera (JB) test is one method that can test for normality. The hypotheses for this test are as follows: H_0: The data is typically distributed. H_1: The data is not normally distributed.

Step 2: Testing Stationarity. This step determines whether all the data used in the research is stationary. Stationarity is crucial in time series analysis to avoid spurious results. Unit root tests, such as the Dickey-Fuller test (ADF test), are conducted to test for stationarity. The hypotheses for this test are Ho: $\rho = 1$, indicating the presence of a unit root (nonstationary data), and H_1: $\rho < 1$, indicating the absence of a unit root (stationary data). To determine whether the null hypothesis is accepted or rejected in the stationarity test, the calculated ADF value is compared with the critical value (5 percent). Suppose the ADF value exceeds the critical value (5 percent). In that case, the null hypothesis stating the absence of a unit root can be rejected, indicating that the observed variables are stationary.

Step 3: Cointegration Test. The next step after unit root testing is the cointegration test. This study uses the Johansen multivariate cointegration test. The cointegration test is conducted to determine whether the two variables, BI Rate and Money Supply, have a long-term equilibrium relationship if all the data are nonstationary at the level with the Dickey-Fuller test (ADF test).

Step 4: Determining the Optimal Lag Length. Since time series analysis is susceptible to the lag length used in the model, determining the optimal lag length is necessary. Additionally, the Granger causality method calculates the lag length in the research variables. If too many lag lengths are used in the model, it can lead to rejecting the null hypothesis (H0) because adding more parameters reduces degrees of freedom. To determine the best lag length, the VAR equation can calculate the smallest values of AIC, SIC, or HQ (Akaike Information Criterion, Schwarz Information Criterion, or Hannan-Quinn Criterion).

Step 5: Granger Causality Test. According to econometric approaches, causal relationships between specific groups occur in the short term. The purpose of the Engel-Granger Causality Test is to determine the influence of a variable in the past on the current condition of another variable. In other words, the Granger causality test can determine if forecasting variable y, by including lagged variable x, can be more accurate. Additionally, the Granger causality test is used to determine the cause-and-effect relationship between variables, testing a two-way reciprocal relationship

$$Y_t = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i=1}^{m} \beta_i X_{t-i} + e_t$$

$$X_t = \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i=1}^{m} \beta_i X_{t-i} + e_t$$

p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

Original Article

Where:
X = variable X
Y = variable Y
M = Lag order
et = disturbance variable
α, β = coefficients of each variable

Let us consider two variables, X and Y. Then the question arises whether variable X causes Y or Y causes X. In this research, the Granger causality test, or Granger causality test, involves the variables of the BI ratio and the money supply. Additionally, it is debated whether the BI ratio causes changes in the money supply or vice versa, whether the money supply causes changes in the BI ratio to become larger. The Engel-Granger Causality Test must be conducted to determine how these two variables are related. The hypotheses used in the Engel-Granger Causality Test are:

H_o: X does not cause Y
H_1: X causes Y
H_o: Y does not cause X
H_1: Y causes X

3. Results And Discussion

Normality Test

The results of the normality test conducted using the *Jarque-Bera* method with E-Views software are as follows (Table 2).

Table 2
Normality Test using Jarque-Bera method with E-Views software

	Test for Normality on Model Variables				
No.	Variables	Result	JB	Prob.	Explanation
1	Money Supply	Normal	2,87	0.1394	> α = 0.05
2	BI Rate	Normal	3,94	0.237	> α= 0.05

Resource: Output Eviews 6.0 (processed)

From the above output, it can be observed that the Jarque-Bera test result is greater than the probability value, and the probability value is more significant than alpha. This indicates the acceptance of Ho, suggesting that the data follows a normal distribution.

Stationarity Test

In the next stage, stationarity tests are conducted using the unit root test on all the data. Stationarity tests are performed to analyze the short-term relationships in the research data. The Dickey-Fuller (ADF) test is used for this purpose. Unit root tests at the First Difference or Second Difference level are conducted to ensure that the data is not stationary. The hypotheses for this test are as follows:

H_0: $\delta = 0$ (presence of a unit root, non-stationary)
H_1: $\delta \neq 0$ (absence of a unit root, stationary)

The output of the unit root testing using the ADF test for all the variables used is as follows:

Table 3
The result of the unit root testing (ADF-Test)

Variable	Stationarity level: Level		First Difference		Second Difference	
	Prob.	Information	Prob.		Prob.	Explanation
BI Rate	0.3179	No Stationary	0.0004	Stationary	---	
Money Supply	1.0000	No Stationary	0.9667	No Stationary	0.0393 (Stationary)	

Resource: Output Eviews 10.0 (processed)

p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

The output of the stationarity test with the ADF-Test above indicates that the critical value used as the statistical testing threshold is the MacKinnon critical value with a significance level of α = 5%. The output in Table 4.2 shows that all variables are not stationary at the Level. This can be observed from the probability values more excellent than α = 5%, indicating non-stationarity. Therefore, the next step is to proceed to the next level, the first difference level, where all the probability values become smaller than α = 5%, indicating that all the data is stationary.

Cointegration Test

After conducting the stationarity test, the next step is to perform a cointegration test on all the variables (groups) used in the research model using the Johansen Cointegration Test. As explained earlier, this cointegration test aims to determine whether there is a long-term equilibrium relationship between BI Rate and Money Supply. The obtained output is as follows (Table 4).

Table 4

The output of the cointegration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.551086	25.25681	15.49471	0.0013
At most 1 *	0.156751	4.432812	3.841466	0.0352

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.551086	**20.82400**	**14.26460**	**0.0040**
At most 1 *	0.156751	4.432812	3.841466	0.0352

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The cointegration test conducted above indicates a significant finding. The trace statistic value obtained is 25.25681, which surpasses the critical value of 15.49471 at the 5% significance level. Furthermore, the probability value of 0.0013 is smaller than 5 percent, reinforcing the test's significance. The Maximum Eigenvalue Statistic results were also examined to enhance these findings' reliability. The obtained value of 20.82400 exceeds the critical value of 14.26460 at the 5% significance level, and the probability value is 0.004, which is smaller than 5 percent. Based on these outcomes, it can be concluded that there exists cointegration between the two variables under investigation, namely BI Rate and Money Supply. This indicates the presence of a long-term equilibrium relationship between money supply and BI rate in the research. Moreover, these results ensure that the issue of spurious regression is avoided.

Optimum Lag Test

The lag test determines the optimal lag length for further analysis.

Table 5

The output of the optimum lag test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-439.1962	NA	3.18e+13	36.76635	36.86452	36.79239
1	-357.1689	143.5478	4.78e+10	30.26407	30.55859	30.34221
2	-350.5746	10.44087*	3.89e+10*	30.04789*	30.53874*	30.17811*
3	-346.7349	5.439684	4.03e+10	30.06124	30.74844	30.24355

* Indicates lag order selected by the criterion

 p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

Original Article

LR: sequential modified LR test statistic, with each test conducted at the 5% level
FPE: Final Prediction error
AIC: Akaike Information Criterion
SC: Schwarz Information Criterion
HQ: Hannan-Quinn Information Criterion

The lag test results above indicate that the optimal lag length is 2. This is done for the next step, which is to use the Granger Causality method.

Granger Causality Tests

The results of the Granger causality test are as follows (Table 6)

Table 6

Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
money_supply does not Granger Cause BI_RATE	28	4.36025	0.0471
BI_RATE does not Granger Cause Money_Supply		6.67171	0.0160

The Granger causality test results demonstrate that, specifically at lag 2, the probability value associated with the BI Rate affecting Money Supply is 0.0160. This probability value is below the 5 percent significance level, indicating the existence of a causal relationship (BI Rate does not Granger Cause Money Supply). Similar conclusions regarding the causality relationship between Money Supply and BI Rate can be drawn. In this case, the probability value of Money Supply affecting BI Rate is 0.0471, which is also smaller than the 5 percent significance level (Money Supply does Granger Cause BI Rate). Hence, considering the provided information and the output results, it can be inferred that a two-way (bidirectional) causality relationship exists between Money Supply (M2) and BI Rate.

4. Conclusion

Based on the analysis and discussion conducted, as well as the results from various stages of data processing, the following conclusions can be drawn: (a) BI Rate and money supply in broad terms (M2) fluctuate during the observation period. BI Rate responds to changes in M2. If M2 increases, the BI Rate will also increase to control inflation. (b) The cointegration test results indicate a long-term equilibrium relationship between the study's money supply and BI Rate. (c) Granger Causality Tests reveal a bilateral causality relationship between the BI Rate and money supply (M2). This means that the BI Rate influences changes in M2 and vice versa, affecting changes in the percentage of the BI Rate. (d) This study highlights the importance for central banks to exercise caution when determining interest rates and the money supply.

5. References

Alvyonita, M & Hidayat, P. (2017). Analisis kausalitas antara bi rate dengan jumlah uang beredar di indonesia. *Jurnal Ekonomi dan Keuangan*, *2*(10):623–33.

George, C., Suoyai, E., Tema, L., & Boloekeye, M. (2018). Impact of money supply on some macroeconomic variables on the Nigerian economy. *Journal of business management and economic research*, *2*(5), 32-46. https://doi.org/ 10.29226/TR1001.2018.32

Juhro, S. M., & Njindan Iyke, B. (2019). Monetary policy and financial conditions in Indonesia. *Bulletin of Monetary Economics and Banking*, *21*(3), 283-302.

Kemu, S. Z., & Ika, S. (2016). Transmisi BI rate sebagai instrumen untuk mencapai sasaran kebijakan moneter. *Kajian Ekonomi dan Keuangan, 20*(3), 261-284.

Mishkin, F. S., & Posen, A. (1998). Inflation targeting: lessons from four countries. https://www.nber.org/system/files/working_papers/w6126/w6126.pdf

p-ISSN: **1693 - 7945**
e –ISSN: **2622 - 1969**

Original Article

Njoroge, F. K. (2013). *Relationship between interest rates and financial performance of firms listed at the Nairobi securities exchange* (doctoral dissertation, university of nairobi).

Nopirin. (2000). Ekonomi Moneter edisi ke-4. Yogyakarta: BPFE

Nopirin. (2014). *Ekonomi Moneter Buku 1, Edisi 1, Cetakan 14*. Yogjakarta: BPFE

Onyeiwu, C. (2012). Monetary policy and economic growth of Nigeria. *Journal of Economics and Sustainable Development*, *3*(7), 62-70. http://dx.doi.org/10.5539/ijef.v5n3p196

Srithilat, K., Sun, G., & Thavisay, M. (2017). The impact of monetary policy on economic development: Evidence from Lao PDR. *Global Journal of Human-Social Science*, *17*(2), 9-15.

Sugarda, P. P., & Wicaksono, M. R. (2017). Strengthening Indonesia's Economic Resilience through Regulatory Reforms in Banking, Investment and Competition Law. *International Journal of Economic Perspectives*, *11*(3).

Warjiyo, P., & Juhro, S. M. (2019). Inflation Targeting Framework: Implementation in Indonesia. In *Central Bank Policy: Theory and Practice* (pp. 261-288). Emerald Publishing Limited.

Yanti, N. (2018). Pengaruh SBI, SBIS, Inflasi dan Nilai Tukar Rupiah terhadap transaksi pasar uang antar bank syariah. *AT-TAWASSUTH: Jurnal Ekonomi Islam, 3*(1), 120-141.

Yolanda, Y. (2017). Analysis of factors affecting inflation and its impact on human development index and poverty in Indonesia. *European Research Studies Journal*, *20*(4), 38-56.