Research Article

Analysis of the Use of E-Money, Money Supply, and Gross Domestic Product on Interest Rate

Rini Setyowati[1], Diana Zuhroh[1]*, Sri Werdiningsih[2], Suprapti[2], Listyowati[1]

[1]Accounting Department Post Graduate, University of Merdeka Malang, Malang, Indonesia
[2]Accounting Department Faculty of Economic and Business, University of Merdeka Malang, Malang, Indonesia

ORCID
Rini Setyowati: https://orcid.org/0009-0002-8416-9235

Abstract.
This research aims to examine the effect of a direct relationship between the use of e-money and the circulation of money on interest rates, as well as an indirect effect, namely through the intervening variable gross domestic product. This research method uses a statistical model of path analysis. The sample used was secondary data fetched from the Website of Bank Indonesia (BI) and the Central Bureau of Statistics (BPS), since regulation on electronic payment method was officially issued by Bank Indonesia in May 2009-March 2023. The test results shows that e-money and money supply each, have a significant positive effect on gross domestic product variables. Gross domestic product variables had a negative effect on interest rates. E-money and money supply variables has a negative effect on interest rates, both directly or indirectly through the intervening variable of gross domestic product. Increasing e-money user and money supply, preponderant to gross domestic product, can decrease the interest rate. The results of this research are expected to provide benefits as a prediction of the Indonesian economy in the future, as a result of the issuance of electronic payment instruments. So for the regulators, they can set the right interest rate policy to be able to maintain stable economic conditions.

Keywords: electronic money, money supply, gross domestic bruto, interest rate

Corresponding Author: Diana Zuhroh; email: diana.zuhroh@unmer.ac.id

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1. Introduction

Entering era 4.0, online product sales have become a means for developing marketing techniques to increase product sellers [1]. On April 13, 2009, Bank Indonesia officially introduced e-money in Indonesia as a non-cash payment instrument through Indonesian Banking Regulations No. 11/12/PBI/2009 (bi.go.id December 11, 2020) [2]. The use of e-money has led to an increase in consumers engaging in shopping activities and other transactions easily through electronic payment methods [3]. The convenience of using e-money have positive impact on consumer behavior [4]. According to Perry Warjiyo, the Governor of BI, e-money transactions increased by 28.72% in 2022 compared to the previous year, reaching Rp. 52,545.8 trillion. Furthermore, for the year 2023, BI

projects a continued growth of 30.84% in e-money transactions compared to 2021 (indonesia.go.id April 3, 2023). The use of e-money has contributed to increased consumer spending and accelerated money circulation [5]. E-money has the potential to boost private consumption expenditure [6]. Constant-price GDP is a benchmark for determine economic growth from year to year [7]. Increasing electronic payments can impact on lower demand for cash [8]. As Keynes, known for the liquidity preference theory, pointed out, if supply and demand for money impact to changes rate of interest [9]. Previous research indicates that the money supply has a significant influence and a two-way relationship with the interest rate [10,11]. Hollis Chenery's theory in his book "Pattern of Development" suggests that the economic development of a country is accelerated through the contributions of four factors: an increase in domestic demand, export development, import surrogate, transformation of technologi [12]. E-money, as a form of technological change, affects consumer spending and consequently impacts to GDP [13]. Changes of GDP can influence inflation rate in the country [14]. Based on previous theories and research findings, the author formulates the following research ideas: Does the use of e-money influence on GDP? Does money supply affect on GDP? Does GDP influence on interest rate? Do the use of e-money and the money supply affect the interest rate? Does e-money influence on interest rate through GDP? Does money supply influence on interest rate through GDP?

2. Literature Review

2.1. Theoretical review

2.1.1. E-money

Electronic Money is a form of electronic based paying tool, with a prepaid system. That is, a certain monetary value is attached to it, can be refilled and can be used as a transaction tool at merchants providing e-money services. Money is categorized as e-money if it meets the following criteria.

(1) Issuance of e-money based on pre-deposited money value from the holder.

(2) Value of money electronic, keep in a medium like a server or a chip.

(3) Can use for payment instrument.

(4) The value of money stored in emoney, is not classified as a deposit according to banking law.

2.1.2. Money supply

The money supply of narrow sense (M1) is defined as, money circulating in society consisting of currency and demand deposits. According to Keynesian theory [9], rate of interest be affected by demand and supply of money. Based on purpose, demand for money is influenced by the motivation to: transactions demand, precautionary demand, and speculative demand.

2.1.3. Inflation

Bank Indonesia defines inflation simple terms, namely the condition of prevalent and continuous prices increases certain period of time. That condition result in a decrease value of money. The following are factors that influence inflation, including:

(1) Increased demand for a particular type of goods.

(2) Increased production costs of goods or services.

(3) The high amount of money circulating in society.

2.1.4. Gross Domestic Product (GDP)

One indicators used to measure off economic transformation of a country is Gross Domestic Product (GDP). GDP can be divided into two types:

(1) Current prices, which represent the value added of consumption based on prices in every year.

(2) Constant prices, which shows the value-added of consumption based on price from a specific base year.

2.1.5. Interest rate

Bank Indonesia sets interest rate policies through an instrument called the BI Rate, reflecting the monetary policy stance. The factors determining the BI Rate are inflation conditions, and thus the BI Rate fluctuates depending on changes in inflation.

2.2. Relationship of variables and hypothesis formulation

2.2.1. E-Money and GDP

Easy access, numerous promotions, and the convenience of transacting using emoney will increase consumer interest in [15,16]. The easy payment method through e-money also influences hedonic and social behaviors of society [17]. Consumer behavior in using e-money will increase the income of Gross Domestic Product, an indicator for measuring the value of societal consumption [18,19]. From the research findings, the hypothesis can be formulated as follows:

H1 : E-money influences Gross Domestic Product

2.2.2. Money supply and GDP

Changes in the amount of money circulating in society will cause changes in Gross Domestic Product [20]. An increased money supply will alter the economic structure [21]. Gross Domestic Product will increase when the money supply increases [22]. From research conclusions, the hypothesis formulated is:

H2 : Money Supply affects Gross Domestic Product.

2.2.3. E-money and interest money

Transactions through E-money will increase the desire to engage in consumption activities and increase the need for money [15]. The interest rate will negatively affect the increase in e-money usage [19]. From research findings, the hypothesis formulated is:

H3 : E-money influences the Interest Rate.

2.2.4. Money supply and interest rate

An increase in the money supply will lead to a decrease in the interest rate [23]. To maintain economic stability against inflation, monetary policies are implemented through determining the appropriate interest rate [8]. Money supply will have a negative effect on inflation and rate of interest [24]. From research findings, the hypothesis formulated is:

H4 : Money Supply affects the Interest Rate.

2.2.5. GDP and interest rate

Changes in the value of Gross Domestic Product will affect monetary policy through the interest rate [6]. Gross Domestic Product has a significant positive effect on the interest rate [19,22] in the short term, while in the long term, it has a negative effect. From research findings, the hypothesis can be formulated as follows:

H5 : Gross Domestic Product influences the Interest Rate.

2.2.6. E-Money and interest rate through gross domestic product

Electronic payment systems can support economic growth and affect interest rates as a policy for economic stability [5]. E-money transactions, in the long run, will affect the money supply and negatively impact the interest rate [19]. E-money payment instruments influence an increase in societal consumption [25]. From research findings, the hypothesis formulated is:

H6 : E-money affects the Interest Rate through the intervening variable of Gross Domestic Product.

2.2.7. Money supply and interest rate through gross domestic product

Money supply significantly negatively affects on interest rate and positive effect relationship with inflation [26]. A high value of money supply in the long run causes inflation and influences the interest rate [6]. Interest rate policies have a reciprocal relationship with the money supply [25]. From research findings, the hypothesis formulated is:

H7 : Money Supply affects the Interest Rate through the intervening variable of Gross Domestic Product.

From the hypothesis formulation, the framework for research as follows (see Fig. 1):

3. Research Methodology

3.1. Research variables

This research involves three variables, namely the independent variables of e-money usage (X1) and the money supply (X2), the dependent variable is interest rate (Y1), intervening variable of Gross Domestic Product (Y2).

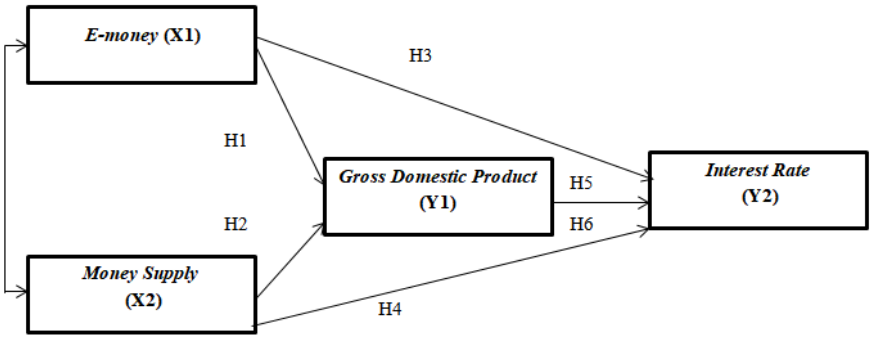

Figure 1: Research framework.

3.2. Data source and data types

This study used secondary data, collected from the Indonesian Banking website, and the Central Statistics Agency website. This research is quantitative data, including:

(1) The number of e-money transactions per month from May 2009 to March 2023.

(2) The amount of money supply per month from May 2009 to March 2023.

(3) The data on Gross Domestic Product (GDP) per month from May 2009 to March 2023.

(4) Percentage rate of interest (BI Rate) per month from May 2009 to March 2023.

Data collection was conducted through the documentation of Bank Indonesia's published data, accessible through the www.bi.go.id and www.bps.go.id. The location of the research was an of Bank Indonesia (BI).

3.3. Operational definitions of variables

3.3.1. E-money usage

E-money is the electronically stored monetary value, used for transactions or transfers [2]. The measurement of this variable uses the natural logarithm of the volume of e-money transactions per month from May 2009 to March 2023.

3.3.2. Money supply

Money supply in this research refers to the many of money and demand deposits cycle in society [13]. Measurement of this variable uses the natural logarithm of the amount of money supply per month from May 2009 to March 2023.

3.3.3. Gross domestic product

GDP in this study is the GDP at constant prices, which measures the economic growth due to changes in digital transactions at present [25]. The measurement of this variable uses the natural logarithm of the amount of Gross Domestic Product (GDP) per month from May 2009 to March 2023.

3.3.4. Interest rate

BI has enforce recent regulation for interest of rate, that is BI Repo Rate [24]. The measurement of this variable uses the natural logarithm of the percentage by BI Repo Rate per month from May 2009 to March 2023.

3.4. Data analysis method

The data analysis used in involves statistical testing with path analysis. Before conducting hypothesis testing, classical assumption tests will be performed, including tests for normality, multicollinearity, heteroskedasticity, and autocorrelation [27].

4. Research Result

4.1. Descriptive statistics

Result from descriptive statistics test (see Table 1), it shows that the lowest volume of e-money transactions occurred in August 2009, as only a small portion of the population was familiar with e-money, which was officially launched for the first time in May 2009. Meanwhile, the highest volume of e-money transactions was recorded in March 2022, with a natural logarithm value of 20.71. This increase was attributed to the post-pandemic economic recovery, which led to higher income and consumption levels among the public. Additionally, the habit of conducting online transactions during the pandemic, especially during the PPKM period, contributed to the rise in e-money transactions.

TABLE 1: Descriptive statistics test results.

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Ln_X1	167	14.47	20.71	17.6476	1.90224
Ln_X2	167	13.03	14.75	13.9163	.47032
Ln_Y1	167	13.20	13.81	13.5431	.18172
Ln_Y2	167	1.25	2.05	1.7122	.24808
Valid N (listwise)	167				

The post-pandemic economic recovery began from the middle to the end of 2021, as indicated by the money supply reaching its highest value of 14.75 in September 2021 since the period starting from May 2009. Another sign of economic improvement post-pandemic was the highest value of Gross Domestic Product (GDP) since 2009 to 2023, recorded in December 2021, reaching 13.81. On the other hand, the lower interest rate occurred in August 2020, with a natural logarithm value of 1.25. This was due to the beginning of the pandemic in March 2020, prompting some people to borrow from banks to meet their living expenses due to government-imposed social restrictions. Consequently, banks reduced the interest rate from 5% to 4%. The highest interest rate occurred at the point of 2.05, with a percentage value of 7.5% in April 2014. This period coincided with the 2014 Presidential Election, where economic instability and rising prices led Bank Indonesia to set the highest interest rate that occurred between 2009 and 2023.

4.2. The data examination of the variables

The normality test using the Normal P-Plot indicates that the research data follows a normal distribution (Figure 2). The Durbin Watson test for autocorrelation concludes that there is no autocorrelation (Table 2). The multicollinearity test using tolerance values >10 and VIF <10 shows that is no multicollinearity in the regression model (Table 3). The Heteroscedasticity test using scatterplots shows that the points on the graph are spread out, indicating the absence of heteroskedasticity (Figure 3). Thus, the classical assumption tests for the research variables have been accepted.

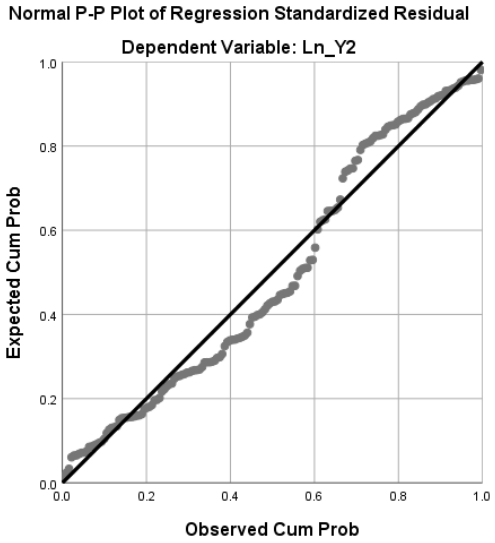

Figure 2: Normality test.

TABLE 2: Autocorrelation test.

Model Summary[b]			
Model	**R**	**Std. Error of the Estimate**	**Durbin-Watson**
1	.785[a]	.15495	.213
a. Predictors: (Constant), Ln_Y1, Ln_X1, Ln_X2			
b. Dependent Variable: Ln_Y2			

TABLE 3: Multicollinearity test.

Coefficients[a]					
Model		**t**	**Sig.**	**Collinearity Statistics**	
				Tolerance	**VIF**
1	(Constant)	7.297	.000		
	Ln_X1	-1.345	.181	.112	8.926
	Ln_X2	-3.310	.001	.112	8.926
a. Dependent Variable: Ln_Y2					

4.3. Hypothesis testing

4.4. Model fit test (F Test)

Based on the F-test results in the table 4 above, the significance value (p-value) is 0.000 ($p <$ alpha 0.05), indicating that the model fit test is significant. The significant result means formulated model research is appropriate (fit).

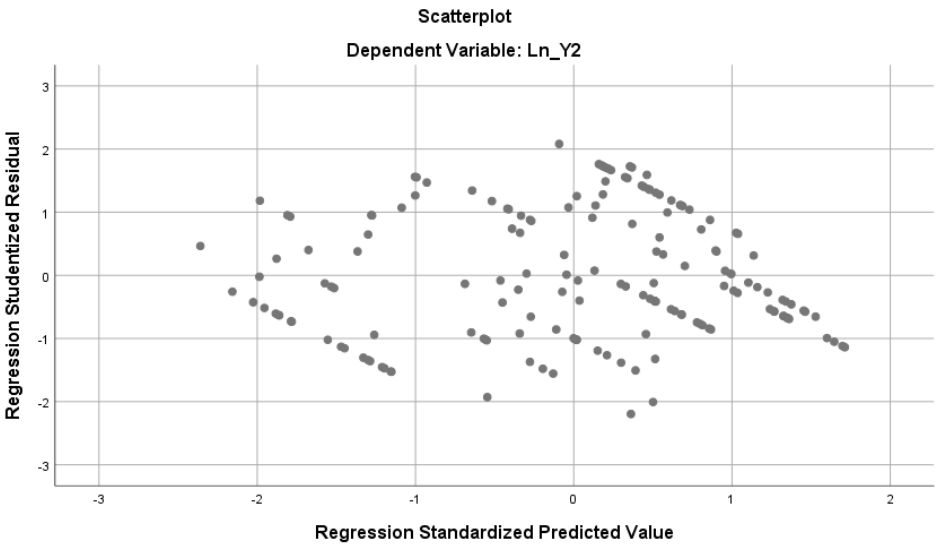

Figure 3: Heteroskedasticity test.

TABLE 4: Model Fit Test results (F Test).

Model		Sum of Squares	df	F	Sig.
1	Regression	6.303	3	87.509	.000[b]
	Residual	3.913	163		
	Total	10.216	166		

4.4.1. Coefficient of determination test

TABLE 5: Coefficient of determination test (R^2).

Model	R	R Square	Adjusted R Square
1	.785[a]	.617	.610

The value of 0.617 indicates that 61% of the variation in the Interest Rate (Y2) caused by the independent variables in this research model, namely e-money usage (X1), the money supply (X2), and Gross Domestic Product (Y1). Meanwhile, 39% of the variation in the Interest Rate (Y2) is influenced by other independent variables not included in this study (Table 5).

4.4.2. Hypothesis testing (t Test)

The t Test to examine direct influence of independent variables on dependent variable, as well as indirect effect, namely through intervening variable.

TABLE 6: t Test (direct effects).

Hypothesis	Test Variable	Standardized Coefficients	t-value	P-value
1 (X1-Y1)	E-money on GDP	0.959	43. 641	0.000
2 (X2-Y1)	Money Supply on GDP	0.979	61.049	0.000
3 (X1-Y2)	E-money on Interest Rate	-0.710	-12.953	0.000
4 (X2-Y2)	Money Supply on Interest Rate	-0.728	-13.644	0.000
5 (Y1-Y2)	GDP to Interest Rates	-0. 671	-11.621	0.000

The results of direct effects shown on the table 6, can be concluded if hypotheses 1 to 5 are all accepted. The test results indicate that e-money and the amount money supply each have a positive effect on Gross Domestic Product (GDP). Moreover, e-money and money supply variables each has a significant negative effect directly on interest rate.

TABLE 7: t Test (indirect effects).

Hypothesis	Variable Test	Standardized Coefficients (Direct Effect)	Standardized Coefficients Multiplication Results	P-value
6 (X1-Y2 through Y1)	E-money to Interest Rates through GDP	-0.710	-0.643	0.000
7 (X2-Y2 through Y1)	Money Supply to Interest Rates through GDP	-0.728	-0.657	0.000

Based on the testing results (table 7), hypothesis 6 shows that the multiplication of coefficients (-0.643) is greater than the direct coefficient (-0.710). This means if e-money have negative effect on interest rate through GDP. Furthermore, hypothesis 7 shows that the multiplication of coefficients (-0.657) is greater than the direct coefficient (-0.728). This means that money supply have negative effect on interest rate through the GDP.

TABLE 8: t Test (total effects).

Hypothesis	Variable Test	Standardized Coefficients Multiplication Results
8 (X1-Y2 through Y1)	E-money to Interest Rates through GDP	-1.353
9 (X2-Y2 through Y1)	Money Supply to Interest Rates through GDP	-1.385

From result of statistical tests (table 8), it shows that e-money can dominan influence to interest rate, rather than money supply. Therefore, it can be concluded that the GDP variable in this study is precisely an intervening variable, which mediates the relationship between the e-money variable and money supply on interest rates.

5. Discussion

From the results of the hypothesis testing, represent if increasing use of e-money can impact on increase in public consumption, as measured through Gross Domestic Product (GDP). Similarly, a high demand for money will lead to an increase in public consumption and will influence the increase in GDP. The availability of payment facilities through e-money will directly affect the decrease in the interest rate. E-money, which is cash stored electronically, raise demand for money is for speculative purposes. Keynes' theory states that this speculative motive will cause the interest rate to decrease. Meanwhile, a high demand for money will lead to an increase in public consumption and will influence the increase in GDP. Continuous increase in money demand over a long period will affect high consumption and scarcity of goods/services, leading to price increases support the research by Khatimah et al. [17]. To address this, the appropriate step taken is the determination of the appropriate interest rate. The results of this research illustrate a condition that aligns with Keynes' theory that interest rates are formed by monetary events in the money market, based on the ownership of wealth or income of individuals who always seek maximum profit. The results of the testing using the intervening variable show that e-money and the money supply have a significant negative influence on the interest rate consistent with the research by Arifin et al. [19], both directly and indirectly through the intervening variable, which is GDP.

6. Conclusion, Research Limitation, Recommendations

6.1. Conclusion

Result in this research show that the variables e-money and money supply have a significant negative influence on interest rate, both directly and indirectly through the intervening variable, which is Gross Domestic Product (GDP). This is consistent with the research by Lubis [14] that e-money has a simultaneous influence on inflation in Indonesia. Therefore, result in the study support the fact that e-money and the money supply have a significant influence, both directly and through the intervening variable, on the interest rate. Additionally, according to Pramono et al [8],monetary policies are crucial in regulating the money supply and reducing the risk of e-money developments.

6.2. Research limitations

The limitation of this research is that it only use three types of variables, that is independent, intervening, and dependent variables. Some factors, can influence varians of interest rate are not fully include in this research.

6.3. Recommendations

For future researchers, it is suggested to include other variables that may influence changes in the interest rate. This is because the coefficient of determination test results indicate that there is still a 39% chance of other variables outside this study that influence the interest rate.

For the policy makers, it is recommended to consider in formulating regulation regarding the implementation of non-cash payment methods. Also, policy-making regarding the determination of interest rates is essential to maintain the stability and economic condition of Indonesia to prevent inflation.

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