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Digital Economy Dynamics: How E-Money, Debit Cards, Inflation, and Exchange Rates Shape Money Demand Stability in Indonesia

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Abstract

In the current era, technological advances are developing rapidly, one of which is e-banking through a non-cash payment system that uses APMK (Payment Tools Using Cards) in Indonesia. This study aims to analyze the effect of electronic money, debit cards, inflation, and exchange rates on the stability of money demand in Indonesia and the causal relationship between each variable. This research uses the ARDL (Autoregressive Distributed Lag) model for the period January 2009 - November 2023. The findings show that electronic money has a negative effect on the demand for money in the short term, while in the long term, electronic money has a positive effect on money demand. Debit cards and exchange rates have a positive effect on the demand for money only in the short term. However, inflation has no effect on the demand for money in either the short or long run. There is a two-way causality between the exchange rate and the demand for money, while there is a one-way relationship from debit cards to money demand, from debit cards to electronic money, and from debit cards to exchange rates. The implication of the research is that Bank Indonesia must continue to monitor the use of electronic payment instruments, including debit cards, and estimate their impact on the stability of cash demand and overall monetary policy. Bank Indonesia must also continue to pay attention to price stability when making monetary policy decisions.

Introduction

All community activities are influenced, measured, and largely determined by money because money has become an institution in society. The amount of money circulating in Indonesia can increase or decrease due to these developments [1]. The role of money is very important in the economy because it is a crucial medium, especially in M2, which includes currency, current accounts, savings, and deposits. Various theoretical and empirical studies find that individuals reduce their demand for cash as a result of financial innovation [2–4]. Theoretically, a fully floating exchange rate system would work better with perfect international capital mobility. The more perfect the international capital mobility, the more money will circulate [5]. The circulation of money in society can also be observed through the demand and supply of credit [6]. Bank Indonesia's main objective is to ensure price stability, which is greatly influenced by exchange rate stability.

The increase in the prices of goods and services is not commensurate with the increase in the level of public consumption, raising the amount of money circulating in society over a certain period. This can cause problems in the economy, known as inflation [7,8]. In 2014, inflation rose due to public consumption of imported finished goods such as electronics and clothing, as well as increased imports of raw materials by Indonesian business actors [9,10]. Due to the Covid-19 outbreak, the inflation rate in 2020 was the lowest in history. It was difficult for the selling

prices of business goods to increase during the Covid-19 pandemic, which caused weak purchasing power or public demand [11].

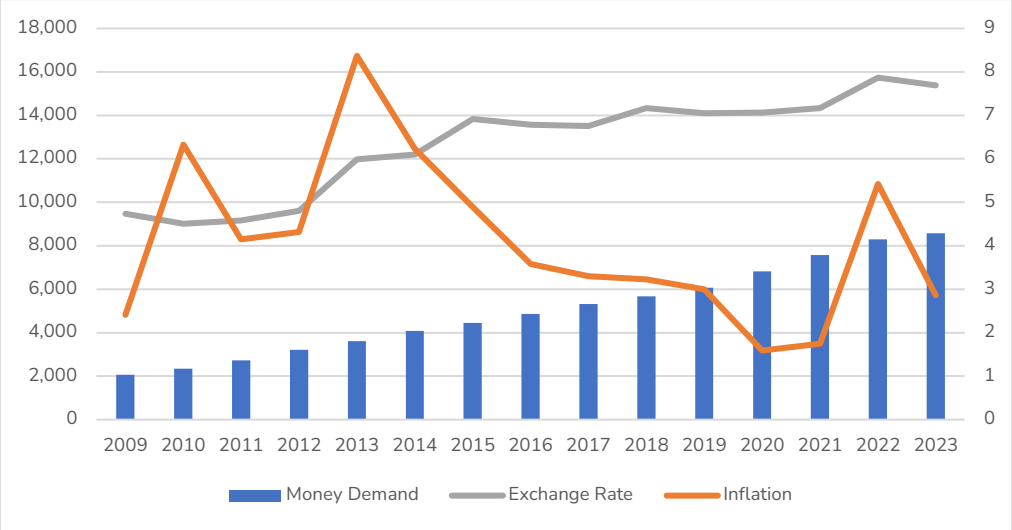


Figure 1. Money supply, inflation, and exchange rates in Indonesia, November 2009 – November 2023. Note: Data were retrieved from Bank Indonesia and the Ministry of Trade of the Republic of Indonesia.

The graph in Figure 1 presents the trends in money demand, inflation, and exchange rates in Indonesia from November 2009 to November 2023. It shows that money demand (represented by the blue bars) has steadily increased over the years, indicating a growing need for liquidity in the economy. Inflation (orange line) fluctuated, reaching a peak around 2014-2015 before declining and stabilizing after 2019, with a significant drop in 2020. However, inflation spiked again in 2022, reflecting economic pressures, possibly due to global disruptions like the pandemic or supply chain issues. The exchange rate (grey line) remained relatively stable with gradual increases, showing moderate fluctuations. Overall, the data reflects the interaction between money demand, inflation, and exchange rate movements over time.

The increasing demand for money in Indonesia can cause inflation. Price increases that exceed expectations of changes in price levels can also cause inflation. In a study by Awang [12], it was stated that the amount of money in circulation is related to economic inflation. According to Milton Friedman's quantity theory of money [13], it is crucial to keep the amount of money in circulation stable to avoid negative impacts on the economy. Keynes argued that in classical theory, money is only needed for transactions. However, in the economy, money for speculation is more important than money as a means of transaction. Based on Keynes' theory of money, which emphasizes the function of money as a store of value rather than just as a means of exchange, this theory later became known as the "liquidity preference theory," dividing the reasons for people's demand for money into three purposes: transactions, speculation, and precautionary [14–16].

In making monetary policy decisions, the stability of money demand is crucial for the central bank. In the context of monetary policy responses to non-cash payments, it is important to explain how non-cash payments affect the demand for money [17,18]. The economy relies on payment systems, particularly to ensure the efficiency of payment processes in society and the business world. These systems also play a vital role in implementing monetary policy and maintaining financial system stability [19–21]. A failure to generate stable demand for money can stem from a lack of awareness regarding the importance of financial innovation. In the current era, technological advancements are rapidly evolving, one of which is e-banking through a non-cash payment system using APMK in Indonesia. Card Payment Instruments (APMK) include credit cards, automated teller machine (ATM) cards, and debit cards. Non-cash payment

systems utilizing Card Payment Instruments (APMK) consist of various types of cards, such as ATM or Debit Cards, Credit Cards, demand deposits, checks, notes, E-money, direct debit, and credit transfers via infrastructure such as ATMs, EDC, Internet, and mobile banking. This type of payment system innovation is also referred to as a non-cash payment system [22–24]. Cashless payment systems in developing countries have only gained popularity in the last decade and are rapidly increasing.

Electronic money circulating in Indonesia continues to increase as more people in the country transact with electronic money. E-money is considered quite practical, allowing transactions to be carried out easily and quickly [25–27]. The highest e-money transactions began to rise in November 2019, reaching IDR 39 billion, compared to IDR 13 billion in November 2018. Meanwhile, debit card transactions increased in November 2014 to IDR 376 billion, up from IDR 322 billion in November 2013 [28]. This indicates that e-money and debit card transactions increase every year, as does the demand for money. This suggests that while using a non-cash payment system could reduce the demand for money, it has no significant effect. Conversely, debit card payment capabilities reduce the need for cash by lowering the costs of owning and using cash. Given these diverse impacts, questions arise regarding the ultimate effect of debit cards on a person's possession and use of cash [29]. With the current existence of non-cash payments, it becomes easier for people to make various types of digital payments. According to Keynes, the introduction of new models in the payment system, such as non-cash transactions like APMK, e-money in the form of chips and server-based systems, and digital banking, can impact the demand for physical money and reduce people's desire to hold cash [30,31].

The relationship between inflation and money demand in Indonesia is generally explained by modern and classical monetary theory, as well as Keynesian theory, which supports the supply-demand concept and interprets inflation as being caused by high demand and low supply [32–34]. An increase in price is positively correlated with an increase in quantity demanded, and vice versa. The relationship between electronic money and money demand in Indonesia is that electronic payments can greatly affect the circulation of money in the country. As a result, people are increasingly using non-cash payment systems such as electronic money to make more transactions. This can accelerate money circulation and increase the money supply [35].

The relationship between debit cards and money demand in Indonesia is based on the quantity theory of money, which assumes that money velocity is constant. However, this is not true. The increasing velocity of money indicates that non-cash payment methods are becoming increasingly important in replacing cash in economic activities, as these methods are not included in the determining factors for the amount of money in circulation [36,37]. More and more debit cards and bank account transfers are being used for payments, replacing cash, especially in large transactions [38]. The relationship between the exchange rate and the stability of money demand is crucial for encouraging sustainable economic growth; thus, the stability of the Rupiah is very important. Inflation in Indonesia, caused by the decline in the Rupiah exchange rate, results from a shortage of US Dollars, which causes the Rupiah to trade at a lower price. These factors can lead to domestic inflation due to their relationship with an increase in the money supply [39].

Many previous studies in Indonesia discuss topics related to electronic money, debit cards, inflation, and exchange rates as independent variables. For instance, research conducted by Wijaya [40] and Ambarwati et al. [41] uses Indonesian growth as the dependent variable. Previous studies by Nursari et al. [42], Yusuf & Kristiyanto [43], and Amalia & Santoso [44] found that electronic money influences economic growth. However, studies conducted by Rosanti & Maulida [45] and Ismanda [46] found that the debit card and electronic money variables had no effect on inflation. Research by Nafiah & Aulia [47], Darmawan [48], and Zunaitin [49] examines the relationships between electronic money, debit cards, and exchange rates concerning inflation.

In contrast, this study will focus on electronic money, debit cards, inflation, and exchange rates as they relate to the amount of money in circulation, which will serve as the dependent variable. This study employs a different regression model from previous research, specifically the ARDL (Autoregressive Distributed Lag) model, along with Granger causality analysis to assess the relationships among the variables. Additionally, this study distinguishes itself by utilizing data covering the period from January 2009 to November 2023, thereby providing a more comprehensive understanding of the evolving dynamics in Indonesia's financial landscape.

This study aims to analyze the influence of electronic money, debit cards, inflation, and exchange rates on the stability of money demand in Indonesia, as well as the causal relationships among these variables. By exploring how these factors interact, the research seeks to understand the broader implications for monetary policy and economic stability. A better understanding of these dynamics can shed light on how they may reduce public demand for money and the overall amount of money in circulation. Given the increasing prevalence of digital payment methods, these issues are particularly compelling and relevant to policymakers and financial institutions. The findings of this study could provide valuable insights for designing effective monetary strategies that accommodate the evolving landscape of financial transactions in Indonesia.

Materials and Methods

The Scope of Research

This research analyzes the impact of electronic money, debit cards, inflation, and exchange rates on the stability of money demand in Indonesia. The ARDL (Autoregressive Distributed Lag) model is employed to examine both the long-term and short-term effects of these variables on money demand stability.

Data Types and Sources

The data used in this research is secondary and sourced from official state institutions, such as Bank Indonesia, which provides data on money in circulation, electronic money, debit cards, and inflation. Additionally, exchange rate data is obtained from the Ministry of Trade. Since electronic money data from Bank Indonesia is available starting from January 2009, this research uses monthly time series data from January 2009 to November 2023, covering a total of 179 months. The operational definitions of the variables in this study are presented in Table 1.

Table 1. Variables and Operational Definitions

Variable Name	Symbol	Unit	Data Source
Money Supply	JUB	Billion Rupiah	Bank Indonesia
Electronic Money	EM	Billion Rupiah	Bank Indonesia
Debit Card	KD	Billion Rupiah	Bank Indonesia
Inflation	INF	Percent	Bank Indonesia
Exchange Rate	NT	Rupiah against the US Dollar, expressed in Rupiah	Ministry of Trade of the Republic of Indonesia

Data Analysis Method

The ARDL (Autoregressive Distributed Lag) model combines the AR (Auto Regressive) and DL (Distributed Lag) models. The DL model is a regression that incorporates both current and past (lagged) values of the independent variables, while the AR model uses past values of the dependent variable. The ARDL model integrates both past independent and dependent variables. Its purpose is to identify short-term dynamics or estimate long-term relationships and Error Correction Models (ECM) in the presence of cointegration [50,51]. The ARDL model applied in this research is presented in Equation 1 as follows:

$$\Delta LJUB_t = \alpha_0 + \sum_{i=0}^{p} \alpha_{1i}\ \Delta LJUB_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\ \Delta LEM_{t-1} + \sum_{i=1}^{q2} \alpha_{3i}\ \Delta LKD_{t-1} + \sum_{i=1}^{q3} \alpha_{4i}\ \Delta INF_{t-1} + \sum_{i=1}^{q4} \alpha_{5i}\ \Delta LNT_{t-1} + \theta_1 LJUB_{t-1} + \theta_2 LEM_{t-1} + \theta_3 LKD_{t-1} + \theta_4 INF_{t-1} + \theta_5 LNT_{t-1} + \theta_6 ECT_{t-1} + e_t \quad (1)$$

The ECM derived from Equation 1 is shown in Equation 2 as follows:

$$\Delta LJUB_t = \alpha_0 + \sum_{i=0}^{p} \alpha_{1i}\ \Delta LJUB_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\ \Delta LEM_{t-1} + \sum_{i=1}^{q2} \alpha_{3i}\ \Delta LKD_{t-1} + \sum_{i=1}^{q3} \alpha_{4i}\ \Delta INF_{t-1} + \sum_{i=1}^{q4} \alpha_{5i}\ \Delta LNT_{t-1} + \theta_1 ECT_{t-1} + e_t \quad (2)$$

Where $LJUB$ represents the money supply, LEM stands for electronic money, LKD denotes debit cards, INF refers to inflation, and LNT indicates the exchange rate. α_0 is a constant, while α_{1i}, α_{2i}, α_{3i}, α_{4i}, α_{5i} represent the short-term dynamic relationships. Δ indicates the first difference. The parameters θ_1, θ_2, θ_3, θ_4, θ_5, θ_6 capture the long-term dynamic relationships. ECT_{t-1} is the error correction variable, which represents the residual from the previous period, and the variable is the error term. In this research, the data has been transformed using a natural logarithm (L) transformation. This transformation was necessary because the model without data transformation exhibited unstable variable movements; the transformation aims to stabilize the variable movements obtained in the analysis.

Based on the ARDL analysis model equation, the steps for testing the ARDL estimation model include the stationarity test (unit root test), optimal lag determination test, bound cointegration test, Granger causality test, ARDL model estimation, CUSUM test, and CUSUMQ test.

Results and Discussion

Descriptive Statistics

The descriptive statistics presented in Table 2 indicate that the money supply (LJUB) variable has the highest maximum value of 15.964, while inflation (INF) variable has the lowest maximum value of 9.1700. The LJUB variable also has the highest mean at 15.299. The level of deviation for each variable is calculated using the standard deviation, yielding values of 0.4441 for the LJUB variable, 2.7584 for the LEM variable, 0.5017 for the LKD variable, 1.9012 for the INF variable and 0.1927 for the LNT variable.

Table 2. Descriptive statistics.

Statistics	LJUB	LEM	LKD	INF	LNT
Mean	15.299	7.7812	12.879	4.3094	9.4159
Median	15.369	7.3575	13.048	3.8300	9.4979
Maximum	15.964	12.040	13.513	9.1700	9.7030
Minimum	14.444	3.0754	11.799	1.3200	9.0488
Std. Dev.	0.4442	2.7585	0.5017	1.9013	0.1927
Observations	179	179	179	179	179

Stationarity Test

Table 3 presents the stationarity test results using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods, with the intercept test conducted. According to these results, the LJUB and INF variables are stationary at level in both the ADF and PP tests, while the LEM and LNT variables are stationary at the first difference in both tests. The LKD variable is stationary at level in the ADF test but at the first difference in the PP test. Therefore, all stationarity requirements are satisfied, enabling the use of the ARDL analysis method.

Table 3. Results of the ADF and PP stationarity tests.

Variable	ADF		PP	
	Level	First Difference	Level	First Difference
LJUB	0.0499**	0.0000*	0.0180**	0.0000*
LEM	0.8683	0.0000*	0.8355	0.0000*
LKD	0.0180**	0.0000*	0.4237	0.0000*
INF	0.0160**	0.0000*	0.0219**	0.0000*
LNT	0.8862	0.0000*	0.8946	0.0000*

Note: * and ** indicate significance at the 1% and 5% confidence levels, respectively.

Optimum Lag Determination Test

The magnitude of the lag that significantly influences or responds is referred to as the optimal lag. The results of the lag length test are determined by the highest number of stars recommended for each criterion [34]. Using the smallest Akaike Information Criterion (AIC) from the various existing model combinations, the lag size for the LJUB variable and the regressors—LEM, LKD, INF, and LNT—are considered. Table 4 presents the smallest AIC value in the ARDL model, which is (6, 6, 6, 6, 6), with a maximum lag set at 6.

Table 4. Results of optimum lag determination test.

Model	LogL	AIC	BIC	HQ	Adj R-sg	Specification
1	560.82	-6.0904	-5.4707	-5.8389	0.9994	ARDL(6, 6, 6, 6, 6)

Cointegration Bound Test

Table 5 presents the results of the cointegration test conducted using the Bounds test approach. The F-statistic value of 8.6643 exceeds the I(0) Bound value at the significance levels of 10%, 5%, 2.5%, and 1%. This indicates that the model being tested can have cointegrated variables, signifying a balance between short-term and long-term outcomes.

Table 5. Results of ARDL bounds test.

Test Statistic	Value	Sig.	I(0)	I(1)
F-statistic	8.6643*	10%	1.90	3.01
k	4	5%	2.26	3.48
		2.5%	2.62	3.90
		1%	3.07	4.44

Note: * indicate significance at the 1% level.

Long-Term ARDL Estimation

Based on Table 6, in the long term, only LEM has a positive and significant influence on LJUB. The coefficient value of LEM is 0.1315, indicating a positive effect on LJUB; an increase in the nominal transaction of LEM leads to a decrease in LJUB. The corresponding probability value is 0.0764, which is below the significance level of 10%, confirming that LEM significantly influences LJUB.

Table 6. Results of long-term ARDL estimation on JUB.

Variable	Coefficient	Std. Error	t-Stat.	Prob.
LEM	0.1315	0.0736	1.7853	0.0764***
LKD	0.4684	0.4701	0.9965	0.3207
INF	0.0952	0.0625	1.5226	0.1301
LNT	0.7426	0.6312	1.1764	0.2414

Note: *** indicate significance at the 10% level.

Short-Term ECM Estimation

Table 7 shows that the variable CointEq(-1), representing the error correction term from the previous period, has a significant negative impact. The coefficient for CointEq(-1) is 0.0172, indicating a speed of adjustment of approximately 58.14 months, or 4 years and 10 months. This confirms that the ARDL model used in this research is appropriate and demonstrates the existence of cointegration between variables.

The coefficient for D(LEM) is -0.0078, indicating a negative effect on LJUB; a decrease in the nominal transaction of D(LEM) leads to an increase in LJUB. The associated probability value of 0.0767 is below the 10% significance level, concluding that D(LEM) has a significant negative effect on LJUB.

The coefficient for D(LKD) is 0.0905, suggesting a positive effect on LJUB; an increase in the nominal D(LKD) transaction results in a decrease in LJUB. The probability value of 0.0000 is well below the 10% significance level, indicating that D(LKD) significantly influences LJUB.

Finally, the coefficient for D(LNT) is 0.2109, implying a positive relationship with LJUB; an increase (or decrease) in D(LNT) leads to an increase (or decrease) in LJUB. The probability value of 0.0000, also below the 10% significance level, confirms that D(LNT) significantly affects LJUB.

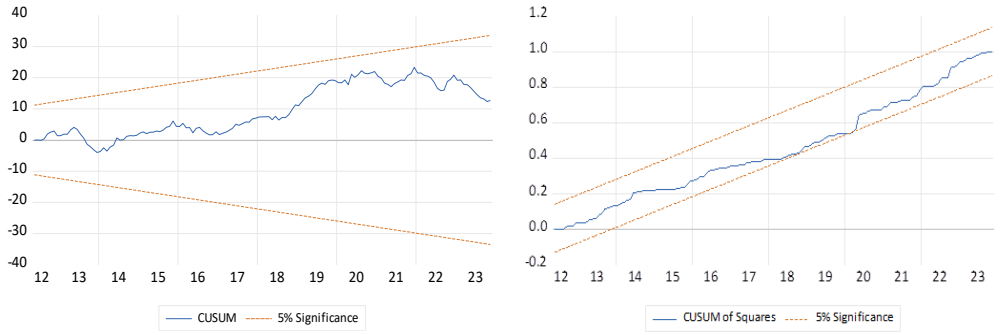
Table 7. Results of short-term ECM estimation on JUB.

Variable	Coefficient	Std. Error	t-Stat.	Prob.
D(LJUB(-1))	-0.3495	0.0808	-4.3267	0.0000*
D(LJUB(-2))	-0.0975	0.0820	-1.1885	0.2367
D(LJUB(-3))	0.0822	0.0833	0.9859	0.3259
D(LJUB(-4))	-0.1477	0.0826	-1.7879	0.0760***
D(LJUB(-5))	-0.2492	0.0789	-3.1592	0.0019*
D(LEM)	-0.0078	0.0044	-1.7834	0.0767***
D(LEM(-1))	0.0050	0.0044	1.1380	0.2571
D(LEM(-2))	-0.0044	0.0045	-0.9839	0.3269
D(LEM(-3))	-0.0023	0.0045	-0.5069	0.6130
D(LEM(-4))	-0.0037	0.0043	-0.8638	0.3892
D(LEM(-5))	0.0007	0.0044	0.1711	0.8644
D(LKD)	0.0905	0.0138	6.5672	0.0000*
D(LKD(-1))	0.0193	0.0185	1.0410	0.2997
D(LKD(-2))	-0.0067	0.0192	-0.3477	0.7286
D(LKD(-3))	-0.0531	0.0188	-2.8277	0.0054*
D(LKD(-4))	-0.0257	0.0177	-1.4569	0.1474
D(LKD(-5))	-0.0039	0.0149	-0.2629	0.7930
D(INF)	-0.0017	0.0016	-1.0136	0.3125
D(INF(-1))	0.0006	0.0017	0.3489	0.7277
D(INF(-2))	0.0009	0.0018	0.5582	0.5776
D(INF(-3))	-0.0004	0.0018	-0.2479	0.8045
D(INF(-4))	0.0003	0.0017	0.1775	0.8594
D(INF(-5))	0.0003	0.0016	0.2001	0.8417
D(LNT)	0.2109	0.0361	5.8385	0.0000*
D(LNT(-1))	0.1458	0.0402	3.6313	0.0004*
D(LNT(-2))	-0.0092	0.0406	-0.2261	0.8215
D(LNT(-3))	0.0214	0.0392	0.5469	0.5853
D(LNT(-4))	0.0064	0.0395	0.1614	0.8720
D(LNT(-5))	0.0367	0.0386	0.9502	0.3437
CointEq(-1)	0.0172	0.0023	6.6759	0.0000*

Note: * and *** indicate significance at the 1% and 10% levels, respectively.

CUSUM and CUSUMQ Test

Figure 2 shows the results of the CUSUM and CUSUMQ tests, indicating that the LJUB equation neither crosses the critical value line nor deviates from the 5% confidence interval. Therefore, it can be concluded that the employed equation is stable.



(a) (b)

Figure 2. Results of the (a) CUSUM and (b) CUSUM of squares.

Granger Causality Test Results

According to the Granger causality test results shown in Table 8, there is a two-way relationship between the LNT and LJUB variables, with probabilities of 0.0684 and 0.0138, respectively. Meanwhile, the LKD and LJUB variables have a one-way relationship with a probability of 0.0063. Similarly, the LKD and LEM variables exhibit a one-way relationship with a probability of 0.0059, and the LKD and LNT variables have a one-way relationship with a probability of 0.0016.

Table 8. Results of Granger causality test.

Null Hypothesis:	F-Stat.	Prob.
LEM does not Granger Cause LJUB	0.5146	0.7967
LJUB does not Granger Cause LEM	1.7568	0.1112
LKD does not Granger Cause LJUB	3.1311	0.0063*
LJUB does not Granger Cause LKD	1.3596	0.2341
INF does not Granger Cause LJUB	0.4726	0.8279
LJUB does not Granger Cause INF	0.8505	0.5330
LNT does not Granger Cause LJUB	2.0017	0.0684***
LJUB does not Granger Cause LNT	2.7656	0.0138**
LKD does not Granger Cause LEM	3.1587	0.0059*
LEM does not Granger Cause LKD	1.5535	0.1642
INF does not Granger Cause LEM	0.7482	0.6117
LEM does not Granger Cause INF	1.2951	0.2624
LNT does not Granger Cause LEM	0.8957	0.4996
LEM does not Granger Cause LNT	1.0772	0.3784
INF does not Granger Cause LKD	0.1038	0.9959
LKD does not Granger Cause INF	0.9391	0.4687
LNT does not Granger Cause LKD	0.9155	0.4853
LKD does not Granger Cause LNT	3.7606	0.0016*
LNT does not Granger Cause INF	1.7328	0.1166
INF does not Granger Cause LNT	1.1817	0.3187

Note: *, **, and *** indicate significance at the 1%, 5%, and 10% levels, respectively.

Discussion

The findings of this research indicate that the use of electronic money has both positive and negative impacts on the demand for money, in both the long and short term. In the long term, the positive effect arises because e-money users spend by purchasing goods or services, leading to an increase in the money supply as e-money usage grows. Over time, as e-money usage and the number of users increase, this growth does not reduce the demand for money.

Supporting studies confirm these findings. For example, research shows that as e-money transactions increase monthly and yearly in the long term, the demand for money (M1) in Indonesia is significantly affected [52]. Another study by Nursari et al. [42] indicates that electronic money positively influences the money supply in the long term. However, Hwang & Wen [53] finds cointegration among variables in the constructed function, with the electronic payment variable negatively correlated with money demand. In the long run, a 1% increase in the electronic payment variable decreases M1 demand by about 0.01%.

Debit cards do not affect long-term demand for money but have a positive effect in the short term. This relationship arises because debit card usage for transactions remains steady, as people spend according to their nominal income deposited on debit cards without considering the cash in circulation. Supporting research by Panjaitan & Sitorus [54] suggests that debit cards facilitate money transactions in both the long and short term. Non-cash transactions significantly increase the money supply, meaning that higher non-cash transaction usage increases the money supply in the community [55]. Conversely, David et al. [56] finds that while card withdrawals reduce cash holdings and increase cash usage, debit card payments significantly reduce cash holdings, making debit cards a perfect substitute for cash.

In both the long and short term, inflation does not affect money demand. This occurs because people do not adjust to price changes in the long term, so price fluctuations over time do not significantly alter money demand. Supporting this result, research from Helmy & Pratama [57] concludes that inflation does not impact money demand in either the long or short term. However, this contrasts with findings from Fatmawati & Yuliana [55], which indicate that non-cash transactions positively affect the money supply, with inflation strengthening the relationship between non-cash transactions and the money supply. Other studies suggest that inflation theoretically has a positive effect on the money supply, with regression results showing that changes in inflation positively affect the money supply [58]. Nevertheless, in Timor-Leste, inflation has a significant negative impact on the money supply, where decreasing inflation leads to an increase in money circulation [59].

In the long run, the exchange rate does not affect money demand, but in the short term, it positively influences demand. A positive short-term relationship occurs when the rupiah exchange rate nominally rises against the US dollar, causing imported goods to become more expensive. This nominal increase in the exchange rate also drives demand for money to purchase these imported goods. Supporting research by Abilawa & Siddiq [60] states that when the exchange rate rises, inflation and interest rates increase money demand. Observations show that the exchange rate is strongly influenced by global economic shocks, which enter through inflation and impact government policies on prices and income, both of which contribute to increased domestic money demand. In contrast, Ranangga et al., [61] finds that the short-term exchange rate variable has a positive but insignificant relationship with money demand (M1), while in the long term, the exchange rate has a positive and significant effect on M1 demand. Additionally, the exchange rate variable in the M2 equation positively impacts demand in the long term [62].

Granger causality results show a two-way relationship between the exchange rate and the money supply, meaning changes in one can influence the other. This indicates that shifts in the exchange rate can affect money demand, while changes in the money supply may impact the exchange rate by influencing inflation or interest rates. Additionally, there is a one-way causality between debit cards and the money supply, electronic money, and the exchange rate. This suggests that debit card usage influences these variables but is not affected by them in return. These findings highlight the importance of monitoring debit card transactions, as they play a growing role in modern monetary dynamics, impacting liquidity and consumer spending, and contributing to shifts in the monetary system.

Conclusions

The conclusion that can be drawn is that in the long term, the demand for money is significantly and positively affected by electronic money. However, debit cards, inflation, and exchange rates do not have a significant impact. In the short term, the demand for money is positively influenced by exchange rates and debit cards but negatively affected by electronic money. Inflation, however, does not influence the demand for money.

The causality test reveals a two-way relationship between the exchange rate and the money supply. Meanwhile, there is a one-way relationship between debit cards and the money supply, debit cards and electronic money, and debit cards and the exchange rate.

Based on these findings, it is recommended that Bank Indonesia continue to monitor the use of electronic payment instruments, including debit cards, and evaluate their impact on the stability of cash demand and overall monetary policy. Bank Indonesia should also maintain a strong focus on price stability when formulating monetary policy and ensure that inflation remains within its target range to uphold the stability of money demand.

One limitation of this research is that data on electronic money and debit cards for December 2023 had not been published by Bank Indonesia at the time of this study. Future research should revisit the long-term analysis in subsequent periods and compare the findings with those from other countries.

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