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The Effect of Non-Cash Payment Instruments and Interest Rates on the Velocity of Money in Indonesia

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ABSTRAK

Kemajuan teknologi digital di sektor keuangan telah menyebabkan perubahan dalam kebiasaan masyarakat dalam bertransaksi, dari yang sebelumnya mengandalkan uang tunai kini mulai beralih ke sistem pembayaran non-tunai. Penelitian ini bertujuan untuk menganalisis bagaimana pengaruh e-money, kartu ATM/Debet, *SMS/Mobile Banking*, serta tingkat suku bunga terhadap *velocity of money* di Indonesia selama periode 2013 triwulan pertama hingga 2024 triwulan keempat. Metode analisis yang digunakan adalah *Error Correction Model* (ECM), dengan data yang diperoleh dari Bank Indonesia dan Badan Pusat Statistik. Temuan dalam penelitian ini mengungkapkan bahwa e-money berpengaruh negatif dan signifikan terhadap *velocity of money*, baik dalam jangka pendek maupun panjang. Sementara itu, kartu ATM/Debet dan suku bunga tidak menunjukkan pengaruh signifikan dalam jangka pendek, namun keduanya memiliki pengaruh positif dan signifikan dalam jangka panjang. Adapun *SMS/Mobile Banking* menunjukkan pengaruh negatif dan signifikan dalam jangka pendek, tetapi tidak berpengaruh signifikan terhadap *velocity of money* dalam jangka panjang.

ABSTRACT

The development of digital technology in the financial sector has driven a shift in people's behavior in conducting transactions, from initially paying using cash to shifting to using non-cash payments. This study aims to determine the effect of e-money, ATM/Debit cards, SMS/Mobile Banking, and interest rate on the Velocity of Money in Indonesia in the period 2013Q1 to 2024Q4. The method used is the Error Correction Model (ECM). This study uses data sourced from Bank Indonesia and Badan Pusat Statistik. The results show that e-money has a negative and significant effect on the Velocity of Money, both in the short and long term. Meanwhile, ATM/Debit cards and interest rate show no significant effect in the short term, but have a positive and significant effect in the long term. SMS/Mobile Banking has a negative and significant effect in the short term, but show no significant effect on the Velocity of Money in the long term.

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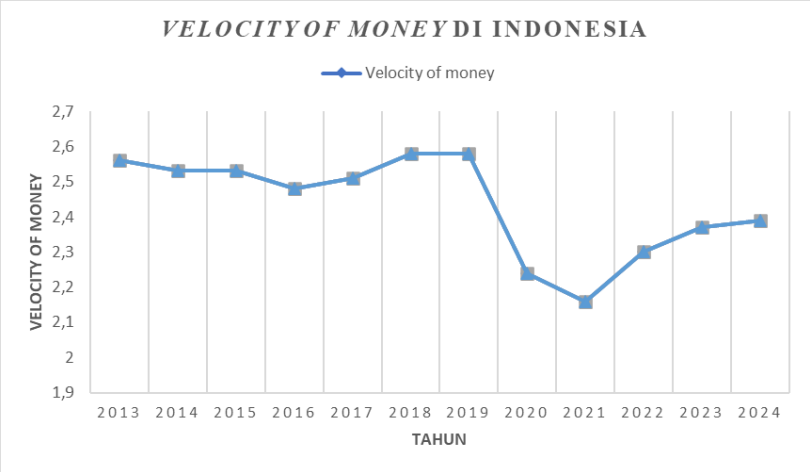
1. INTRODUCTION

Velocity of money is a crucial factor that should not be overlooked, especially for central banks, which rely on monetary indicators as a reference for operational control and the achievement of the ultimate goals of economic policy [1]. Velocity of money is a concept introduced by Irving Fisher in the quantity theory of money, which relates the amount of money in circulation to nominal GDP. The velocity of money (V) refers to the average unit of currency used to transact all goods and services produced in an economy. Irving Fisher also argued that institutional and technological factors in the economy influence velocity [2].

Figure 1. Velocity of Money in Indonesia 2013-2024



Based on the figure above, it can be seen that the velocity of money in Indonesia decreased during 2020 and 2021. This is thought to have been caused by the Indonesian economy, which was under considerable pressure at that time due to the COVID-19 pandemic. Furthermore, reduced mobility due to the implementation of large-scale social restrictions (PSBB) also contributed to this situation.

With the development of the times, technology and information have also advanced in people's lives, providing convenience in various daily activities. This progress is not only utilized in the world of education, but also plays a vital role in the economic sector, where information technology is used to increase efficiency and convenience in various transactions and business activities [3]. This rapid technological advancement has transformed the payment system. Currently, economic transaction activities no longer rely solely on cash, but have shifted to the use of non-cash instruments that are more efficient and economically profitable [4].

On August 14, 2014, Bank Indonesia, as the monetary authority, launched the National Non-Cash Movement (GNNT) with the aim of building an effective and efficient payment system. This GNNT initiative is expected to encourage the creation of a community ecosystem that conducts transactions without using cash [5]. This technological advancement in today's payment system is demonstrated by the presence of various payment instruments such as e-money, ATM/Debit cards, and SMS/Mobile Banking.

While Fisher's quantity theory of money posits that technological aspects can influence velocity slowly, or that velocity is usually constant in the short term. Keynes's liquidity preference theory posits that the velocity of money is not constant but is influenced by interest rates, which tend to fluctuate significantly. This theory rejects the notion that the velocity of money circulation is constant, as public expectations of normal interest rates can change, thus influencing the demand for money and ultimately contributing to changes in the velocity of money circulation[2]. Interest rates are one of the instruments used by Bank Indonesia to achieve monetary policy targets [6].

This study was conducted to analyze the influence of non-cash payment instruments and interest rates on the velocity of money in Indonesia. Increasing the use of non-cash payment instruments for transactions can displace cash and facilitate transactions, thus affecting the velocity of money in the economy . However, according to Fisher, institutions and technology in an economy tend to influence acceleration gradually, so that in the short term, the velocity of money is usually constant. Keynes, on the other hand, stated that the velocity of money is not constant due to the influence of interest rate [2], and interest rates are one of the instruments in monetary policy set by the central bank [7].

2. METHOD

This study uses a quantitative approach based on relevant theories and supporting data. The data used is secondary and obtained from official sources, namely the websites of Bank Indonesia Badan Pusat Statistik. The type of data used is time series data covering the period from the first quarter of 2013 to the fourth quarter of 2024. To analyze the data, this study applies the Error Correction Model (ECM) method. The dependent variable in this study is the velocity of money, which is calculated from the ratio of nominal GDP to the money supply (M2). Meanwhile, the independent variables consist of e-money, ATM/Debit cards, SMS/Mobile Banking, and interest rates. A summary of the data sources for each variable in this study is presented in the following table:

Table 1. Data and Data Sources

Variable	Period	Unit	Data Source
E-Money	Quarterly	Billion Rupiah	Bank Indonesia
ATM/Debit Card	Quarterly	Thousand Transactions	Bank Indonesia
SMS/Mobile Banking	Quarterly	Thousand Transactions	Bank Indonesia
Interest Rate (BI *Rate* & BI7DRR)	Quarterly	Percent	Bank Indonesia
Velocity of Money	Quarterly		Bank Indonesia and Badan Pusat Statistik

3. RESULT AND DISCUSSION

3.1 Level Stationery Test

Table 2. Results of the Level Stationarity Test

Variable	ADF t-statistik value	MacKinnon's Critical Value			Prob	Information
		1%	5%	10%		
VOM	-2.374591	-3.592462	-2.931404	-2.603944	0.1547	Not Stationary
LOGEM	-1.480969	-3.577723	-2.925169	-2.600658	0.5344	Not Stationary
LOGKAD	-2.871417	-3.577723	-2.925169	-2.600658	0.0564	Stationary
LOGSMB	0.315935	-3.581152	-2.926622	-2.601424	0.9767	Not Stationary
SB	-1.794746	-3.581152	-2.926622	-2.601424	0.3784	Not Stationary

The results of the stationarity test at the level show that several variables are not yet stationary, so further testing is required at the first difference level.

Table 3. Results of the First Difference Level Stationarity Test

Variable	ADF t-statistik value	MacKinnon's Critical Value			Prob	Information
		1%	5%	10%		
VOM	-2.730858	-3.592462	-2.931404	-2.603944	0.0772	Stationary
LOGEM	-7.108921	-3.581152	-2.926622	-2.601424	0.0000	Stationary
LOGKAD	-8.219582	-3.581152	-2.926622	-2.601424	0.0000	Stationary
LOGSMB	-5.228287	-3.581152	-2.926622	-2.601424	0.0001	Stationary
SB	-4.351803	-3.581152	-2.926622	-2.601424	0.0011	Stationary

Based on the results of the stationarity test at the first difference level, all variables exhibited stationary properties. Therefore, all variables met the prerequisites for the stationarity test, allowing the analysis to proceed to the next testing stage.

3.2 Cointegration Test

Table 4. Cointegration Test Results

Variable	Coefficient	Std. Eror	t-Statistic	Prob.	Adjusted R^2
C	-0.503941	0.554409	-0.908970	0.3684	0.607372
LOGEM	-0.024729	0.009802	-2.522867	0.0154	
LOGKAD	0.103010	0.042349	2.432398	0.0192	
LOGSMB	-0.013075	0.008202	-1.594002	0.1183	
SB	0.009495	0.003329	2.852282	0.0066	

An equation is obtained as follows:

$VOM_t = -0.503941 – 0.024729LOGEM_t + 0.103010LOGKAD_t – 0.013075LOGSMB_t + 0.009495SB_t$

The residual values are obtained from the regression equation used in the cointegration test. Next, the residuals are tested using the Augmented Dickey-Fuller (ADF) method to determine whether they are stationary at the level. If the ADF statistic value is greater than the critical value, it can be concluded that there is a cointegration relationship between the variables studied. The results of the ADF test are presented in the following table.

Table 5. Results of Cointegration Test with EG Using the ADF Method at Level Level

Variable	ADF t-statistik value	MacKinnon's Critical Value			Prob.	Information
		1%	5%	10%		
Residual	-2.614708	-3.592462	-2.931404	-2.603944	0.0979	Stasionary

Referring to the table above, the results of the cointegration test using the Engle-Granger approach through the Augmented Dickey-Fuller (ADF) method show that the ADF statistical value of -2.614708 is greater than the MacKinnon critical value at the 10% significance level. Furthermore, the probability value obtained is also smaller than α = 10% or 0.1. Thus, the residuals are stationary at the level, thus concluding that there is a cointegration relationship between the analyzed variables.

3.3 ECM Estimation Results

Table 6. ECM Estimation Results

Variable	Coefficient	Std. Eror	t-Statistic	Prob.	Adjusted R^2
C	0.007529	0.004260	1.767125	0.0847	0.263599
D(LOGEM)	-0.058388	0.022938	-2.545480	0.0148	
D(LOGKAD)	0.071874	0.054987	1.307095	0.1985	
D(LOGSMB)	-0.071622	0.032465	-2.206118	0.0330	
D(SB)	0.003161	0.006537	0.483589	0.6313	
ECT	-0.381654	0.143056	-2.667861	0.0109	

Based on the table above, the ECT coefficient value is -0.381654 with a probability value of 0.0109 < α = 5% (0.05). The ECT coefficient in this study has a negative sign and is statistically significant, indicating that the applied Error Correction Model (ECM) is valid. The regression results from the ECM approach based on the Engle-Granger method shown in the table can be restated as follows:

$\Delta VOM_t = 0.007529 - 0.058388\Delta LOGEM_t + 0.071874\Delta LOGKAD_t - 0.071622\Delta LOGSMB_t + 0.003161\Delta SB_t - 0.381654ECT_t$

3.2 Discussion

Based on the test results, it was found that e-money has a negative and significant effect on the velocity of money, both in the short and long term. This is suspected to occur because people still view e-money as an alternative payment method, not as a primary means of transaction. Furthermore, the type of e-money transactions with the largest nominal value each year actually comes from top-up activities, not from spending transactions. This may indicate that even though people top up, the funds are not

always used immediately for transactions. The results of this study align with the results of research conducted by (Margaretha & Wahyudi, 2025) [8], which found that e-money has a negative and significant effect on the velocity of money.

Based on the test results, it was found that ATM/Debit cards had no significant effect on the velocity of money in the short term, but had a positive and significant effect in the long term. This finding aligns with Irving Fisher's view that the more people use non-cash payment instruments for transactions, the lower the need for cash. This condition results in a smaller amount of money needed for transactions, thus accelerating the velocity of money [2].

Based on the test results, it was found that SMS/Mobile Banking had a negative and significant impact on the velocity of money in Indonesia in the short term, but no significant impact in the long term. This is likely due to limited digital infrastructure, such as limited internet access and uneven technology [9]. This may indicate that SMS/Mobile Banking can not fully replace cash for transactions, as cash usage does not rely on internet access for transactions.

Based on the test results, it was found that interest rates had no significant effect on the velocity of money in Indonesia in the short term. However, in the long term, this variable showed a positive and significant effect. This finding aligns with Keynes's theory of liquidity preference, which states a positive relationship between interest rates and the velocity of money. The results of this study align with the results of research conducted by (Sasikarani, et al., 2022) [10]

4. CONCLUSION

Based on the results of data analysis regarding the influence of e-money, ATM/Debit cards, SMS/Mobile Banking, and interest rates on the Velocity of Money in Indonesia, it can be concluded that:

1. E-money shows a negative and significant effect on the velocity of money, both in the short and long term.
2. ATM/Debit cards shows no significant effect on the velocity of money in the short term, but in the long term shows a positive and significant effect.
3. SMS/Mobile Banking has a negative and significant effect on the velocity of money in the short term, while in the long term it shows no significant effect.
4. Interest rates shows no significant effect on the velocity of money in the short term, but in the long term shows a positive and significant effect.

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