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Analysis of the Impact of Electronic Money Usage as a Payment Tool on Economic Growth

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Abstract: This research is conducted for the journal with the aim of analyzing the effects of electronic payment systems based on credit cards, debit cards, and electronic money, as well as macroeconomic variables such as the money supply (M1), price levels, and exchange rates on real gross domestic product (GDP) as a proxy for economic growth. The estimations in this journal use the Vector Error Correction Model (VECM) with monthly time series data for the period from 2012 to 2023. The results indicate that transactions using debit cards and electronic money have a significant positive effect on economic growth in Indonesia in the long term.

Keyword: Electronic Money, Payment Tool, Economic Growth

INTRODUCTION

For several decades, the payment system in Indonesia has advanced thanks to technology, especially with the implementation of the National Payment Gateway by Bank Indonesia in 2017. Electronic payments, such as credit cards, debit cards, and e-money, have become popular among consumers and businesses, facilitating transactions like purchases, money transfers, and bill payments. While cash is still in use, more people are shifting to modern payment methods that are considered faster and safer. The growth of e-finance has also been rapid, with transaction volume and value reaching 205 trillion rupiah by the end of 2020, and a surge in transactions up to 30 times compared to 2017. In November 2018, the value of e-money transactions increased by 216.46% compared to the previous year. Additionally, payment infrastructure, such as card readers, has significantly improved. This development, driven by technology and a productive age demographic, is expected to enhance Indonesia's economic growth.

The rapid advancement of information technology, particularly in electronic finance (e-finance), has transformed the financial system and influenced monetary policy as well as the credibility of the central bank in managing interest rates. This technology changes the behavior of economic actors, making transactions more practical, faster, and cheaper, which affects output and prices. E-finance disruption allows for better interaction among economic agents, promoting low interest rates and credit growth, while also impacting financial stability. Currently, many daily activities, such as ride-hailing, shopping, and education, have transitioned to digitalization. This transformation simplifies the buying and selling process

through e-commerce, providing practical advantages for both sellers and buyers, and creating job opportunities for entrepreneurs without the need for physical store capital. The rapid development of the economy and information technology has significant implications for the monetary policy mechanisms in Indonesia. Technology in the financial system, especially in payment systems, accelerates economic growth and presents new challenges in policy regulation. Technological innovations enhance efficiency across various sectors, such as education and transportation, facilitating daily activities. These advancements positively impact the economy, making it a primary support for national progress. Additionally, individuals experience the benefits of technology in every aspect of their lives.

Technological advancements have spurred various innovations in the development of financial and banking systems, which in turn can affect economic activities. The emergence of various technological innovations in finance has transformed payment systems through adaptations as technology continues to evolve. A study by Puatwoe & Piabuo (2017) found a significant positive impact of financial development on economic growth.According to (Fadlillah, 2018), the use of non-cash payment methods will impact the decrease in money demand within society. This is because people tend to save more money in banks rather than withdrawing cash. According to theory, if the demand for money decreases, bank interest rates will also decline. Lower interest rates are expected to stimulate the economy by increasing consumer spending and real investment, thereby driving economic growth. The growing use of e-commerce as a medium for buying and selling has led to the digitization of payment methods that were traditionally cash-based, allowing for cashless transactions. This shift occurs as transactions in e-commerce have moved toward digital payments, often referred to as e-payment, using digital currency or electronic money (e-money). The rise of e-commerce in society has also led to an increase in transactions using e-money, prompting financial technology companies to expand rapidly to meet the high demand for digital payment tools. One way to enhance the financial sector is by improving the payment system. A study by the European Central Bank by (Hasan et al., 2013) found that migrating to a more efficient payment system can stimulate the economy, consumption, and trade overall. Over time, the use of cash transactions has created many problems and weaknesses. Innovations in payment systems are ways to address these issues and improve the shortcomings of cash payment methods. Therefore, cashless payments were developed as a form of advanced innovation in a more efficient financial system.

Research shows that increased use of non-cash payment methods can enhance economic growth (Slozko and Pelo, 2014). A study by (Zandi et al., 2013) also explains that an increase in electronic payments can boost economic growth by 0.08% in developing countries. Consequently, Bank Indonesia continues to strive to enhance non-cash payment transactions through the development of Card-Based Payment Tools and the implementation of the National Cashless Movement (GNNT) to continually increase the value of non-cash transactions in Indonesia. This effort aims to reduce the circulation of cash in society, thereby lowering the costs of cash production and creating a safer and more efficient payment system. As a result, non-cash transactions continue to rise each year in Indonesia. Electronic money (e-money) is a payment tool that stores value electronically in media such as chips or servers. E-money, as a financial technology product, facilitates transactions by eliminating the need to carry cash, especially for small, frequently made transactions like food and transportation. Users can send and receive money digitally through apps like Ovo, Gopay, and Dana, which are increasingly accessible due to the widespread ownership of mobile devices. However, the use of e-money also carries risks, such as potential loss of funds and digital crimes, including hacking and fraud. Therefore, education on e-money usage is crucial to ensure users' financial security.

The development of e-money in Indonesia has also been driven by other factors, particularly the Covid-19 pandemic that emerged in March 2020. The pandemic limited public

activities and triggered economic slowdowns, but it also accelerated digital transformation. Activities that were once conventional shifted to digital platforms, including e-commerce and online education. Payments are now often made cashless through QR codes and bank transfers, enhancing convenience and reducing the risk of virus transmission. The rise of practical digital payment tools has changed lifestyle habits, especially among Generation Z, making them more consumer-oriented. Dependency on gadgets in the digital age highlights the importance of self-control to prevent hedonistic behavior. While excessive consumption can be harmful, it also has positive effects for businesses and the national economy by increasing consumer purchasing power and driving economic growth in Indonesia.

On August 14, 2014, Agus Martowardojo, then Governor of Bank Indonesia, launched the National Cashless Movement (GNNT) to raise awareness about the use of non-cash payments that are easier, safer, and more efficient. Electronic money is now divided into two types: financial transactions through bank networks and payments with cards, such as ATM, debit, and credit cards, known as Payment Cards (APMK).This is done to align with the economic development that has entered the era of Industry 4.0, where almost all business and banking transactions use digital technology via internet-connected devices (Internet of Things). This rapid technological advancement has given rise to a new community known as the "cashless society," where people have become highly dependent on electronic means of payment rather than cash. This community is no longer accustomed to using cash as a payment method but instead utilizes electronic media such as credit cards or other payment cards.

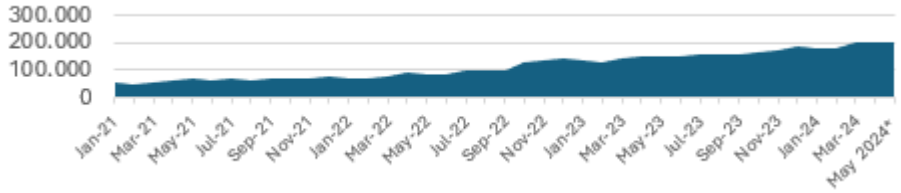

Figure 1. Electronic Money (Rp Billion)
Source : Bank Indonesia Data

The development of the payment system, in line with the modernization of society and the transformation of information technology, has led to a reduction in cash usage and an increase in the use of electronic money. Government policies to encourage cashless transactions through a cashless society approach have contributed to the growth in the number and value of electronic money transactions in Indonesia. Data from Bank Indonesia shows that in 2022, the volume of electronic money transactions increased by 50 percent to IDR 12,330 trillion, compared to IDR 8,264 trillion in the previous year. The amount of circulating electronic money also rose by 50 percent, from 786,454 units to 1,177,797 units.

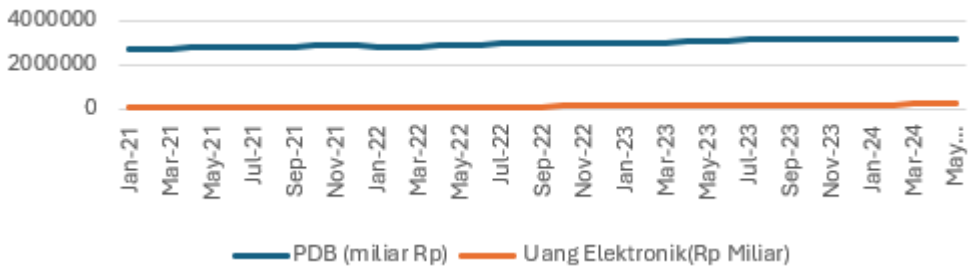

Figure 2. Electronic Payments in Relation to GRDP
Source: BPS Data and Bank Indonesia Data

The increase in public income drives the use of electronic money, as people tend to avoid cash transactions to reduce risks. Those who are starting to use or are already accustomed to

cashless payments are often motivated by convenience and ease, frequently without considering the associated costs. The emergence of cashless payment systems facilitates transactions, whether for small or large amounts, thereby aiding in financial management. However, despite their practicality, users often struggle to control their spending wisely, which requires discipline in financial management.

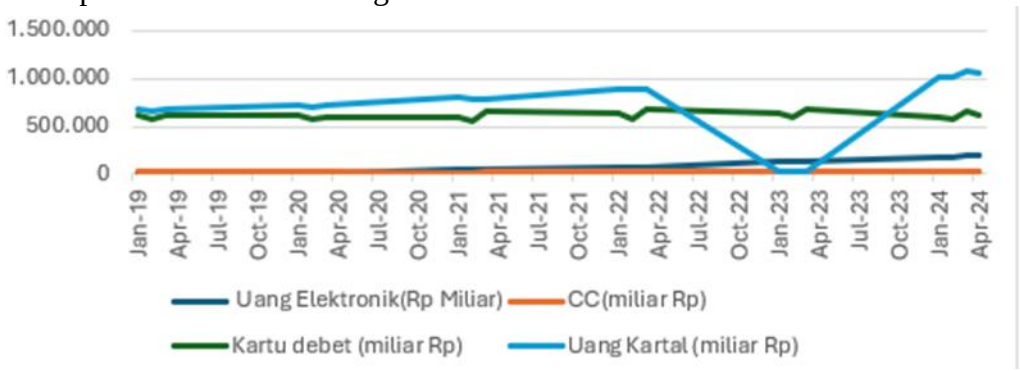

Figure 3. Use of Money as a Payment Instrument
Source : Bank Indonesia

After the community became familiar with cashless transactions, payments through bank transfers increasingly replaced the role of cash in large-value trades. On the other hand, payments using cards such as ATM cards, debit cards, credit cards, and e-money began to take over the role of cash in retail transactions (Lahdenpera, 2001). Due to the widespread use of cashless payment methods, there are differing views on the effectiveness of monetary policy implemented by central banks. Some researchers argue that the use of electronic money will have no significant impact (Goodhart, 2000), (Friedman, 2000), (Woodford, 2000). Conversely, the use of cashless payment methods has implications for the demand for money issued by the central bank, which can affect the effectiveness of the central bank in implementing monetary policy (Costa and Grauwe, 2001). (Friedman, 1999) also stated that central banks merely indicate monetary conditions without being able to create monetary stability.

There are several types of money, one of which is primary money (M0), which represents the obligation of Bank Indonesia to commercial banks in the form of cash and giro, as well as to third parties in the form of cash. The money supply includes the monetary system's obligations in the form of cash, giro, and quasi-money such as savings. E-money, classified as a prepaid product, allows for the storage of money in electronic devices to be used as a payment medium without needing to be charged at the time of the transaction. According to the Monetary and Financial Statistics Manual (MFSM) 2000, e-money can be categorized as transferable deposits, which can be used for direct payments. Although the issuance of e-money does not change the money supply (M2), it causes a shift from quasi-money to M1 in the form of float, depending on the deposits made through cash deposits or charges to bank accounts.

Moreover, individuals undoubtedly feel the significant impact of technological advancements, allowing them to enjoy these benefits in all aspects of life from the moment they wake up until they go to bed again. Technological progress has spurred various innovations in the development of financial and banking systems, which can subsequently impact economic activities. The emergence of various technological innovations in finance has transformed the payment system through adjustments due to the growing technological advancements. A study conducted by (Puatwoe & Piabuo, 2017) found a positive and significant influence of financial development on economic growth. Improvements in information and telecommunications technology, particularly in recent years, have provided opportunities for electronic payment systems as alternatives, thereby reducing reliance on cash as the primary payment channel (Oyelami and Yinusa, 2013). This indicates that electronic

payment systems as alternatives to manual payments can be quickly adopted, increasing the trend in the use of debit cards, credit cards, and electronic money. Enhanced security and relatively lower transaction costs associated with electronic money are fundamental reasons explaining the increased demand for money at the household level. Both factors will lead to an increase in the velocity of money or the acceleration of money circulation (Cassoni and Ramada, 2013).

The increase in electronic payment transactions also has a negative impact on the demand for cash. As the use of electronic transactions rises, it will enhance money circulation while decreasing the demand for cash. Moreover, the use of debit and credit cards significantly influences the demand for real money in Indonesia in the long term. In the short term, however, debit cards have a significant impact on the demand for real money (Wasiaturrahma, Wahyuningtyas, and Ajija, 2019). Interbank transactions based on technology also contribute to economic growth and productivity. The development of financial transactions using electronic cards drives overall economic development, consumption, and trade (Tee and Ong, 2016). A study conducted by Oyewole found that only debit ATMs contribute positively to economic growth, while other electronic payment channels have a negative contribution to economic growth (Oyewole et al., 2013). Similarly, other literature has found that the use of electronic payments does not have significant results in the long term (Tshukudu, 2018). The differing results from these studies represent an important step in the discussion of electronic payments in the economy, and how the transition from cash to electronic payments impacts economic growth. The authors aim to gather evidence to inform this debate by conducting economic studies in Indonesia.

Several studies on the impact of electronic money (e-money) on monetary policy conducted in various countries state that an increase in money as a substitute for cash can lead to changes in the velocity of money, affecting the effectiveness of monetary policy in countries that use money aggregates as a monetary policy target. It has been noted that the exclusion of e-money can influence short-term interest rates but will not affect the effectiveness of monetary policy. However, changes in the circulation of e-money will have implications for monetary policy in the long term. According to the quantity theory of money, changes in money circulation will impact inflation. Some have developed simulation models to assess the impact of e-money on the effectiveness of monetary policy through interest rate channels. The results indicate that e-money can reduce the effectiveness of monetary policy. High interest rates will affect the portfolios of e-money holders or issuers, who are likely to hold more e-money due to higher investment returns. In this regard, tightening monetary instruments is accompanied by an increase in the availability of money supply due to the high volume of electronic money (e-money). Mundell stated that the growth of e-money will be moderate in the medium term.

Therefore, the use of cashless payments needs to be encouraged and enhanced in Indonesia to create a cashless society, as the presence of cashless payment instruments can increase efficiency and stimulate economic consumption, thereby promoting economic growth (Zandi et al., 2013). However, while Indonesia's gross domestic product (GDP) has increased year after year, its growth rate has slowed, indicating a deceleration in growth. In terms of monetary policy, innovations in cashless payment instruments can complicate the use of quantity targets in monetary control. However, according to (Woodford, 2000) and (Khalaf, 2018), the expansion of cashless payment usage will reduce the central bank's role in cash issuance but will not threaten its role in managing monetary policy.

Tumpal Manik, in his article "Analysis of the Impact of Electronic Money Digital Transactions on Cashless Society and Electronic Money Infrastructure as a Moderating Variable," states that the circulation of electronic money over the past five years (2015–2019) shows positive growth each year. This illustrates that digitization in the financial and banking sectors continues to increase and can be considered a driving factor for Indonesia's economic

growth. To realize economic and financial digital transactions, acceleration is being undertaken in the payment system through policies implemented by Bank Indonesia. Against the backdrop of differing views among researchers, this remains an important and vital topic in macroeconomics in the era of electronic money. We will attempt to provide additional literature on how the use of cashless payment instruments affects the effectiveness of monetary policy, particularly regarding economic growth in a country, using Indonesia as a case study.

METHOD

This journal uses a descriptive quantitative research approach with the Vector Error Correction Model (VECM) method. The researcher employs this approach and method to obtain estimates of impulse response, variance decomposition, short-term relationships, and long-term relationships among variables. The data is processed and estimated using Eviews software. The research variables are the objects of observation in the study, which are divided into two categories: dependent variables, which are influenced by independent variables. In this study, the dependent variable is real GDP. The independent variables include electronic money, credit cards, debit cards, the money supply (M1), exchange rates, and inflation. The data used in this journal research is secondary data in the form of time series, consisting of macroeconomic and banking data. The data is obtained from monthly publications published by the Central Statistics Agency (BPS), the Ministry of Trade, and Bank Indonesia (BI). The time period covered in this study is from 2012:1 to 2023:12, resulting in a total sample size of 141. The data obtained from several sources (BPS, World Bank, and BI) is then processed and analyzed. The data is presented in the form of monthly time series, and the variables in this study are transformed into natural logarithms.

The type of data used in this research is time series. The data is secondary, sourced from the official websites of Bank Indonesia, the Central Statistics Agency, and the World Bank. The time series data used spans monthly data from 2012 to 2024. Operational definitions provide explanations about the variables used in the analytical model, clarifying the variables involved in the study. Some of these variables include: first, Gross Domestic Product at constant prices (real GDP); second, Payment Instruments Using Cards (APMK); third, electronic money (e-money); and fourth, the inflation rate. This study uses the Consumer Price Index (CPI) based on average price changes in households, with a base year of 2010. The variables are divided into dependent variables, which are influenced, and independent variables, which influence. The dependent variable in this study is economic growth represented by real GDP based on the base year 2010, while the independent variables include nominal transactions of electronic money, exchange rates, inflation, credit card usage, and the money supply. The data analysis method used in this study is descriptive quantitative, with the analytical tool being the Vector Autoregression (VAR) model. If the data is stationary at the level, then the VAR model can be used. Conversely, if the data is not stationary at the level but is stationary at the difference level, the next step is to conduct a cointegration test to determine whether there is a long-term relationship among the data. If cointegration is proven, then the model that can be used is the Vector Error Correction Model (VECM).

RESULTS AND DISCUSSION

StationarityTest/UnitRootTest

Before conducting the time series data test, the initial step is to check whether the data is stationary or not. The test used in this research is the unit root test with the Augmented Dickey-Fuller (ADF) approach at a significance level of 5%. If the statistical value is smaller than the critical value of MacKinnon, it can be concluded that the data is stationary. The stationarity testing is conducted at the level, first difference, and second difference. The requirement for

using VAR is that the data is stationary at the level; if it is not stationary at the level and there is cointegration, the test used will be VECM.

Table 1. Stationarity Test with the Augmented Dickey-Fuller Test

Null Hypothesis: Unit root (individual unit root process)
Series: BI_RATE, CC, EM, INFLASI, KRT_DEBET_DAN_ATM, KURS, PDB
Date: 08/15/24 Time: 14:21
Sample: 1 149
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 12
Total number of observations: 1005
Cross-sections included: 7

Method	Statistic	Prob.**
ADF - Fisher Chi-square	16.3993	0.2896
ADF - Choi Z-stat	-0.23546	0.4069

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
BI_RATE	0.3915	2	13	146
CC	0.2957	1	13	147
EM	0.9808	0	13	148
INFLASI	0.7100	4	13	144
KRT_DEBET_D...	0.0357	12	13	136
KURS	0.1425	0	13	148
PDB	0.6691	12	13	136

Source: Data processed (2023)

Based on the results of the ADF stationarity test with a critical value of 5%, it was found that all variables are non-stationary at the level. Therefore, the stationarity test continued at the first difference level. At the first difference level, all variables are stationary except for the GDP variable, which requires further testing at the second difference level. The results at the second difference level show that all variables are stationary, allowing for the next tests to be conducted.

Lag Test

VAR Lag Order Selection Criteria
Endogenous variables: PDB EM CC KRT_DEBET_DAN_ATMUANG_KARTAL KURS...
Exogenous variables: C
Date: 08/20/24 Time: 14:02
Sample: 1 149
Included observations: 141

Lag	LogL	LR	FPE	AIC	SC	HQ
0	295.5718	NA	3.94e-11	-4.093217	-3.946825	-4.033729
1	1308.126	1910.208	4.57e-17*	-17.76065*	-16.58951*	-17.28474*
2	1344.255	64.57196	5.51e-17	-17.57809	-15.38220	-16.68576
3	1393.441	83.02271	5.56e-17	-17.58072	-14.36009	-16.27197
4	1452.809	94.31547	4.92e-17	-17.72779	-13.48241	-16.00262
5	1485.605	48.84476	6.43e-17	-17.49794	-12.22782	-15.35635
6	1517.810	44.76668	8.67e-17	-17.25971	-10.96484	-14.70169
7	1579.142	79.16621	7.92e-17	-17.43463	-10.11502	-14.46019
8	1638.634	70.88490*	7.67e-17	-17.58347	-9.239102	-14.19260

* indicates lag order selected bythe criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarzinformation criterion
HQ: Hannan-Quinn information criterion

Table 2. Determination of Optimal Lag

Source: Data processed (2023)

The determination of the optimal lag length in this study uses several criteria, namely the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC). To identify the most suitable optimal lag length for this study, we look for the highest number of asterisks (*) at each lag for the criteria. Based on the table above, it indicates that almost all criteria at lag 2 have the most asterisks, thus the optimal lag used in this study is lag 2.

VAR Stability Test

Table 3. VAR Stability Test

Roots of Characteristic Polynomial
Endogenous variables: D(EM) D(CC) D(KRT_DEBET_DAN_ATM) D(INFLASI) D(KURS) D(UANG_KARTAL)
Exogenous variables: C
Lag specification: 1 2
Date: 08/23/24 Time: 16:25

Root	Modulus
-0.180895 - 0.590513i	0.617599
-0.180895 + 0.590513i	0.617599
-0.357666 - 0.446107i	0.571784
-0.357666 + 0.446107i	0.571784
0.217017 - 0.374048i	0.432445
0.217017 + 0.374048i	0.432445
0.039086 - 0.416263i	0.418094
0.039086 + 0.416263i	0.418094
-0.374204 - 0.152119i	0.403941
-0.374204 + 0.152119i	0.403941
-0.254442	0.254442
0.202307	0.202307

No root lies outside the unit circle.
VAR satisfies the stability condition.

Before conducting further analysis, a VAR stability test is needed to ensure that the VAR model is stable. Based on the results of the test above, the data has a modulus value of less than one, indicating that the data in this study is stable at its optimal lag.

Johansen Cointegration Test

Table 4. Johansen Cointegration Test

Date: 08/15/24 Time: 14:23
Sample (adjusted): 6 149
Included observations: 144 after adjustments
Trend assumption: Linear deterministic trend
Series: BI_RATE CC EM INFLASI KRT_DEBET_DAN_ATM KURS PDB
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.339556	144.8258	125.6154	0.0020
At most 1	0.216989	85.08846	95.75366	0.2157
At most 2	0.114173	49.86491	69.81889	0.6436
At most 3	0.081745	32.40734	47.85613	0.5897
At most 4	0.076570	20.12698	29.79707	0.4143
At most 5	0.036095	8.655941	15.49471	0.3982
At most 6	0.023078	3.362154	3.841465	0.0667

Trace test indicates 1 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 *	0.339556	59.73739	46.23142	0.0011
At most 1	0.216989	35.22354	40.07757	0.1593
At most 2	0.114173	17.45757	33.87687	0.9030
At most 3	0.081745	12.28036	27.58434	0.9208
At most 4	0.076570	11.47104	21.13162	0.6003
At most 5	0.036095	5.293786	14.26460	0.7044
At most 6	0.023078	3.362154	3.841465	0.0667

Max-eigenvalue test indicates 1 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 Cointegrating Coefficients (normalized by b'*S11*b=I):

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS
2.154272	-9.643254	-1.752584	-0.358468	-9.244933	-2.354960
-7.146590	12.28810	1.122025	-0.746215	-8.002554	23.22986
2.962522	-5.483006	0.636600	1.296162	0.517930	1.248997
-0.429139	-2.545659	0.040865	-0.157347	-8.931649	21.50744
-6.998795	2.548111	-0.677831	0.486560	-13.15382	5.696153
-0.613949	4.856101	-0.747791	-0.167722	-4.351952	5.333495
2.669237	-0.518658	0.006350	-0.201566	-9.636103	-3.351967

Unrestricted Adjustment Coefficients (alpha):

D(BI_RATE)	-0.009894	0.007095	-0.008471	-0.004813	0.009289
D(CC)	0.018796	0.004282	0.007322	-0.000581	0.002526
D(EM)	0.025334	-0.015583	-0.006828	0.000677	0.007915
D(INFLASI)	0.173109	-0.001455	-0.168982	0.004751	-0.117181
D(KRT_DEB...	0.021557	0.017994	0.002275	-0.001641	0.001465
D(KURS)	0.000640	-0.000248	0.001636	-0.005750	-0.000487
D(PDB)	-0.001971	0.003177	0.001193	-0.000485	-0.001058

1 Cointegrating Equation(s): Log likelihood 1412.936

Normalized cointegrating coefficients (standard error in parentheses)

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS
1.000000	-4.476341	-0.813539	-0.166399	-4.291443	-1.093158
	(0.70471)	(0.14314)	(0.09623)	(1.22993)	(1.54551)

Adjustment coefficients (standard error in parentheses)

D(BI_RATE)	-0.021315
	(0.01119)
D(CC)	0.040492
	(0.01256)
D(EM)	0.054576
	(0.02906)
D(INFLASI)	0.372924
	(0.15284)
D(KRT_DEB...	0.046440
	(0.01061)
D(KURS)	0.001379
	(0.00420)
D(PDB)	-0.004247
	(0.00213)

2 Cointegrating Equation(s): Log likelihood 1430.548

Normalized cointegrating coefficients (standard error in parentheses)

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS	PDB
1.000000	0.000000	0.252470	0.273318	4.494658	-4.595968	-2.578456
		(0.10594)	(0.08254)	(1.02648)	(1.40952)	(2.93442)
0.000000	1.000000	0.238143	0.098231	1.962786	-0.782516	-5.909883
		(0.04550)	(0.03545)	(0.44088)	(0.60541)	(1.26037)

Adjustment coefficients (standard error in parentheses)

D(BI_RATE)	-0.072020	0.182596
	(0.03846)	(0.08049)
D(CC)	0.009888	-0.128634
	(0.04342)	(0.09087)
D(EM)	0.165939	-0.435783
	(0.10008)	(0.20944)
D(INFLASI)	0.383323	-1.687215
	(0.52957)	(1.10822)
D(KRT_DEB...	-0.082156	0.013232
	(0.03454)	(0.07228)
D(KURS)	0.003149	-0.009216
	(0.01453)	(0.03042)
D(PDB)	-0.026948	0.058043
	(0.00705)	(0.01475)

6 Cointegrating Equation(s): Log likelihood 1453.799

Normalized cointegrating coefficients (standard error in parentheses)

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS	PDB
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	-3.068677
						(1.25918)
0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	-2.379951
						(0.66218)
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	-31.80539
						(4.46130)
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	15.84159
						(2.45905)
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	1.481982
						(0.80818)
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.537572
						(0.38512)

Adjustment coefficients (standard error in parentheses)

D(BI_RATE)	-0.157221	0.242521	0.016871	-0.006676	-0.028780	0.102293
	(0.05315)	(0.08773)	(0.01194)	(0.00811)	(0.10219)	(0.16284)
D(CC)	0.020034	-0.207402	-0.018045	0.002485	-0.190579	0.015147
	(0.06088)	(0.10048)	(0.01368)	(0.00929)	(0.11706)	(0.18652)
D(EM)	0.089823	-0.378305	-0.071814	-0.002615	-0.224630	-0.368783
	(0.14280)	(0.23568)	(0.03208)	(0.02179)	(0.27455)	(0.43746)
D(INFLASI)	0.733543	-1.330369	-0.293089	-0.328814	0.054793	-1.502276
	(0.72721)	(1.20018)	(0.16338)	(0.11096)	(1.39813)	(2.22778)
D(KRT_DEB...	-0.083393	-0.003777	-0.015286	-0.016805	-0.335574	0.329453
	(0.04925)	(0.08127)	(0.01106)	(0.00751)	(0.09468)	(0.15086)
D(KURS)	0.013836	-0.004512	-0.000306	0.002735	0.054421	-0.131348
	(0.01991)	(0.03286)	(0.00447)	(0.00304)	(0.03828)	(0.06099)
D(PDB)	-0.015409	0.046933	0.008954	-0.000448	0.014453	0.060054
	(0.00993)	(0.01638)	(0.00223)	(0.00151)	(0.01908)	(0.03041)

5 Cointegrating Equation(s): Log likelihood 1451.153

Normalized cointegrating coefficients (standard error in parentheses)

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS	PDB
1.000000	0.000000	0.000000	0.000000	0.000000	-11.52274	-9.262976
					(11.2282)	(11.4885)
0.000000	1.000000	0.000000	0.000000	0.000000	-8.726496	-7.071070
					(7.79374)	(7.97441)
0.000000	0.000000	1.000000	0.000000	0.000000	34.03112	-13.51121
					(19.5219)	(19.9745)
0.000000	0.000000	0.000000	1.000000	0.000000	-26.83269	1.417086
					(19.5216)	(19.9742)
0.000000	0.000000	0.000000	0.000000	1.000000	1.261227	2.159983
					(2.69108)	(2.75346)

Adjustment coefficients (standard error in parentheses)

D(BI_RATE)	-0.160059	0.264962	0.013416	-0.007451	-0.048890
	(0.05327)	(0.08465)	(0.01139)	(0.00810)	(0.10025)
D(CC)	0.014151	-0.160866	-0.025211	0.000877	-0.232283
	(0.06153)	(0.09778)	(0.01316)	(0.00935)	(0.11580)
D(EM)	0.090025	-0.379898	-0.071568	-0.002560	-0.223203
	(0.14257)	(0.22656)	(0.03048)	(0.02167)	(0.26831)
D(INFLASI)	0.700798	-1.071372	-0.332971	-0.337760	-0.177315
	(0.72796)	(1.15683)	(0.15566)	(0.11067)	(1.37003)
D(KRT_DEB...	-0.084967	0.008669	-0.017203	-0.017235	-0.346729
	(0.04923)	(0.07823)	(0.01053)	(0.00748)	(0.09265)
D(KURS)	0.013871	-0.004791	-0.000263	0.002744	0.054671
	(0.01988)	(0.03159)	(0.00425)	(0.00302)	(0.03741)
D(PDB)	-0.015802	0.050040	0.008476	-0.000556	0.011668
	(0.00993)	(0.01578)	(0.00212)	(0.00151)	(0.01869)

3 Cointegrating Equation(s): Log likelihood 1439.277

Normalized cointegrating coefficients (standard error in parentheses)

BI_RATE	CC	EM	INFLASI	KRT_DEBET...	KURS	PDB
1.000000	0.000000	0.000000	0.056642	4.924949	-6.831123	1.455094
			(0.11333)	(1.49605)	(2.10316)	(2.76743)
0.000000	1.000000	0.000000	-0.106148	2.368659	-2.890830	-2.105230
			(0.07961)	(1.05093)	(1.47741)	(1.94405)
0.000000	0.000000	1.000000	0.858223	-1.704322	8.853145	-15.97634
			(0.29830)	(3.93796)	(5.53603)	(7.28455)

Adjustment coefficients (standard error in parentheses)

D(BI_RATE)	-0.097115	0.229043	0.019908
	(0.04089)	(0.08429)	(0.01108)
D(CC)	0.031579	-0.168780	-0.023476
	(0.04639)	(0.09563)	(0.01257)
D(EM)	0.145710	-0.398343	-0.066231
	(0.10756)	(0.22172)	(0.02915)
D(INFLASI)	-0.117290	-0.760686	-0.412595
	(0.55540)	(1.14491)	(0.15050)
D(KRT_DEB...	-0.075416	0.000758	-0.016143
	(0.03712)	(0.07652)	(0.01006)
D(KURS)	0.007997	-0.018188	-0.000358
	(0.01559)	(0.03213)	(0.00422)
D(PDB)	-0.023413	0.051501	0.007779
	(0.00753)	(0.01553)	(0.00204)

Table 5. Determination of Optimal Lag

Dependent Variable: PDB
Method: ARDL
Date: 08/15/24 Time: 14:33
Sample (adjusted): 5 149
Included observations: 145 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): BI_RATE CC EM INFLASI KRT_DEBET_DAN_ATM KURS
Fixed regressors: C
Number of models evaluated: 62500
Selected Model: ARDL(4, 2, 4, 1, 0, 0, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
PDB(-1)	0.738345	0.069837	10.57235	0.0000
PDB(-2)	0.156621	0.089062	1.758547	0.0811
PDB(-3)	0.065000	0.091540	0.710069	0.4790
PDB(-4)	-0.342912	0.067304	-5.094990	0.0000
BI_RATE	-0.007300	0.015262	-0.478328	0.6333
BI_RATE(-1)	0.023332	0.018432	1.265889	0.2079
BI_RATE(-2)	-0.028252	0.014963	-1.888158	0.0614
CC	0.009170	0.013666	0.670984	0.5035
CC(-1)	0.032871	0.013943	2.357609	0.0200
CC(-2)	-0.046115	0.012787	-3.606297	0.0004
CC(-3)	-0.029649	0.013001	-2.280417	0.0243
CC(-4)	0.086790	0.011525	7.530804	0.0000
EM	-0.002753	0.005806	-0.474189	0.6362
EM(-1)	0.013192	0.005732	2.301550	0.0230
INFLASI	-0.000405	0.000943	-0.429177	0.6685
KRT_DEBET_DAN_ATM	0.053729	0.013897	3.866115	0.0002
KURS	0.094452	0.037994	2.485938	0.0143
KURS(-1)	-0.189191	0.049468	-3.824501	0.0002
KURS(-2)	0.035595	0.050395	0.706331	0.4813
KURS(-3)	0.028916	0.050553	0.572006	0.5684
KURS(-4)	0.072930	0.040110	1.818272	0.0715
C	9.439851	1.419800	6.648720	0.0000

R-squared	0.995551	Mean dependent var	35.46056
Adjusted R-squared	0.994792	S.D. dependent var	0.141494
S.E. of regression	0.010211	Akaike info criterion	-6.191767
Sum squared resid	0.012825	Schwarz criterion	-5.740125
Log likelihood	470.9031	Hannan-Quinn criter.	-6.008250
F-statistic	1310.779	Durbin-Watson stat	1.926304
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

VECM Test

Through the VECM test, the long-term and short-term relationships between the dependent variable, which is economic growth, and the independent variables, including electronic money, debit/ATM card usage, exchange rates, inflation, and credit card usage, can be determined. In this study, the significance among variables is measured based on significance levels of 1%, 5%, and 10% by comparing the t-statistic and the t-table. The t-table value is obtained by looking at the degree of freedom (df), where several parameters need to be known, including the number of research variables (k) and the number of observations (n), using the formula df=n-k. In this study, the degree of freedom is calculated as 149-7=142. The t-table results are then compared with the t-statistic values obtained in the research. The t-table results for significance levels of 1%, 5%, and 10% at df 34 are as follows:

Value T Table

Actual Rate	T Table Value
1 %	2.61090
5 %	1.97681
10 %	1.65566

Short-Term Relationship

Short-Term		
Variable	Coefficient	T Statistic
CointEq1	-0.0134	-0.6115
Log (EMoney(1))	0.0019	0.2944
Log (CC(-1))	**0.0422**	**2.6952**
Log(Debit Card /ATM(-1))	0.0096	0.4839
Log(MoneyCash(-1))	0.0035	1.4484
Log(Inflasi(-1))	-0.0009	-0.6520
Log(Kurs(-1))	-0.0488	-1.1771

Based on the VECM estimation results in the short term, it shows that the variables of electronic money, debit/ATM card usage, cash usage, inflation, and exchange rates do not significantly impact economic growth. This means that when these variables increase by one percent, they do not affect GDP in the short term. The only variable that significantly impacts GDP is credit card usage; specifically, a one percent increase in credit card usage will directly influence GDP by 0.04%, assuming other variables remain constant (ceteris paribus).

Long-Term		
Variable	Coefficient	T Statistic
Log (EMoney(1))	**-0.0912**	**-1.6314**
Log (CC(-1))	**0.5879**	**4.2534**
Log(Debit Card /ATM(-1))	**-1.6009**	**-6.2999**
Log(Money Cash(-1))	0.0097	0.4948
Log(Inflasi(-1))	**-0.1029**	**-7.4948**
Log(Kurs(-1))	**-0.7153**	**1.7470**

The results of the long-term VECM model estimation indicate that the variables e-money, labor force, inflation, and foreign direct investment (FDI) have various impacts on Gross Domestic Product (GDP). First, the e-money variable has a negative and significant effect on GDP at a 1% significance level, with a coefficient of 0.0912. This means that if e-money increases by 1%, GDP will decrease by 0.0912%, assuming other variables remain constant. Second, credit card usage shows a positive and significant effect on GDP at the same level, with a coefficient of 0.5879. This indicates that a 1% increase in credit card usage will result in a 0.5879% rise in GDP, with other variables unchanged. Next, the use of debit cards or ATMs has a negative and significant contribution to GDP at the 1% level, with a coefficient of -1.6009. This means that if debit/ATM usage increases by 1%, GDP will decline by 1.60%, assuming other variables remain unchanged. Inflation also has a negative effect on GDP, with a coefficient of 0.11. This suggests that a 1% decrease in inflation will increase GDP by 0.11%, holding other variables constant. Additionally, the exchange rate has a negative impact on GDP, with a coefficient of 0.72. This indicates that a 1% decrease in inflation will lead to a 0.72% increase in GDP, assuming other variables remain the same. Finally, the use of cash shows a positive effect on GDP at the 1% significance level, with a coefficient of 0.01. This means that if inflation rises by 1%, GDP will increase by 0.01%, assuming other variables are constant.

Variance Decomposition Analysis (VD)

The results of the variance decomposition test are conducted to determine the extent of a variable's contribution to other variables. In this study, the results of the variance decomposition test shown in Table 6 below illustrate the contributions of e-money, credit card usage, cash usage, exchange rates, and inflation to GDP.

Table 6. Results of the Variance Decomposition Test

Period	Log (PDB)	Log (EMoney)	Log (CC)	Log (Debit/ATM Card Usage)	Log (Cash/Currency)	Log (Inflation)	Log (Exchange Rate)
1	100	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	85.6420	0.7705	11.8191	0.0000	0.1888	0.0002	1.5791
3	85.8610	0.7725	10.6257	0.05911	0.9203	0.0227	1.7383
4	85.7173	0.6868	9.2862	0.7701	0.9614	0.8498	1.7280
5	83.2630	0.6807	11.7298	0.9116	0.9050	1.0342	1.4754
6	84.1101	0.6255	10.6642	1.0831	0.8567	1.0794	1.5807
7	84.2188	0.7001	10.2807	1.0153	0.8280	1.0613	1.8955
8	84.9331	0.6343	9.8960	0.9080	0.8166	1.0986	1.7131
9	85.3247	0.5978	9.4230	1.0486	0.7588	1.0703	1.7753
10	85.4200	0.6203	9.2867	1.0165	0.7587	1.0264	1.8712

Based on the table of the VD test results above, it shows that the largest contribution to the GDP variable is from the GDP itself, which accounts for 100% in the first period. This then decreased by 14.35% in the second period to 85.64%, and continued to decline until the fifth period, reaching 83.26%. In the sixth period, the variance contribution of GDP responded positively again, but tended to stagnate until the tenth period, with a GDP contribution of 85.42%. In the first period, e-money did not contribute to GDP; however, in the second period, its contribution was 0.77%, which then tended to decrease until the sixth period. In subsequent periods, e-money showed a significant positive response of 0.70%, but in the eighth period, it again showed a decline. By the seventh period, it began to rise again, but remained relatively stable at around 0.6%. The credit card variable also had a negative response to GDP, but its usage remained relatively stable in the range of 9% to 11%. For the debit/ATM card variable, there was no response to GDP growth from the beginning until the second period; however, starting from the third period, it showed a positive response to GDP. Thus, it can be concluded that the use of debit/ATM cards can enhance GDP growth. The variable of cash usage showed no response to GDP in the early periods, but in the second period, it indicated an increase in GDP of 0.18%, which continued to provide a positive response, increasing GDP growth by 0.74% until the fifth period. However, from the sixth period onwards, it showed a negative response on GDP growth, reaching -0.75%. For the inflation and exchange rate variables, there was initially no response to GDP growth, but in subsequent periods, up to the tenth period, they provided a positive response, thereby increasing GDP growth.

Analysis of the Impact of Electronic Money on Economic Growth

The results of this study indicate that the electronic money variable has a negative and significant impact on economic growth in the short term. As the volume of e-money transactions increases, economic growth tends to decrease. However, in the long term, it can have a positive effect on economic growth. This finding aligns with Keynesian economic theory, which posits that an increase in consumer spending will raise national income, reduce inflation, and indirectly strengthen the value of the rupiah against foreign currencies. Indirectly, this will affect the prices of goods, thereby boosting economic growth. The ease of using electronic money and minimizing transaction costs will encourage higher consumption among electronic money users, ultimately enhancing economic growth. This is somewhat at odds with

research by (Tee & Ong, 2016), which found that transactions using electronic money promote economic growth. The rise in electronic money payments is driven by advancements in information and digital technology. Another study by (Mashabi & Wasiaturrahma, 2021) supports these findings, showing that electronic money transactions positively influence economic growth. The use of electronic money increases the demand for money (M2), leading to enhanced economic growth. (Kartika & Nugroho, 2015) also demonstrated in their research across five ASEAN countries that electronic money transactions positively affect economic growth, attributing this to a positive trend in electronic usage driven by public awareness and government support.

In the short term, the electronic money variable significantly negatively impacts economic growth because its use in developing countries is not yet fully realized due to certain barriers. This is supported by the study conducted by (Tee & Ong, 2016) in five European Union countries, which explains that cashless payments do not directly impact economic growth in the short term. However, over time, innovations in electronic payment methods will become more widespread, and more banking institutions will provide electronic payment alternatives. According to this research, while a type of cashless payment may influence other cashless payment types in the short term, the impact of cashless payments on enhancing economic growth can only be observed in the long term. In this study, it is evident that, in the short term, the variable that significantly affects economic growth is credit cards. In contrast, in the long term, the electronic money variable has a significant influence on the economy.

Analysis of the Impact of Exchange Rates on Economic Growth

This study shows that the exchange rate variable has a negative impact on economic growth in the short term, meaning that every increase in the exchange rate leads to a decrease in economic growth. This negative effect arises because when the exchange rate increases, it indicates that the value of the rupiah is weakening or depreciating, making domestic goods more expensive compared to foreign goods. The depreciation of the exchange rate will lead to higher prices for imported commodities, thereby affecting production costs and resulting in increased output prices. This is consistent with the research conducted by (Karahan, 2020), which found that the exchange rate negatively impacts economic growth. This negative relationship is due to the fact that an increase in the exchange rate causes a contraction in economic activities. Another study by (Wiriani, 2020) also indicates that exchange rates influence economic growth. The negative impact arises from the depreciation of the exchange rate, which leads to higher prices for raw materials, consequently reducing economic growth.

Analysis of the Impact of Inflation on Economic Growth

This study shows a negative and significant impact of inflation on economic growth, both in the long and short term. This means that when inflation increases, economic growth tends to decline. When inflation or prices rise, consumers tend to reduce their consumption, which leads to a decrease in aggregate consumption. This decline in aggregate consumption hinders economic growth. This finding aligns with the study by (Andreas & Hernando, 1997), which indicates that inflation negatively affects economic growth. An increase in the inflation rate causes consumption to decrease due to falling incomes. Inflation also impacts the level of investment and reduces efficiency in the use of productive factors. Similar research has proven that inflation has a negative and significant effect on economic growth. This research highlights the impact of fuel price increases in 2018, which led to rising prices of other goods and services, subsequently reducing consumers' purchasing power. The decline in purchasing power results in losses for producers, ultimately lowering the level of economic growth.

The Impact of Credit Card Usage on Economic Growth

In the short term, the volume of credit card transactions has a positive and significant effect on economic growth, as indicated by the probability value of the credit card transaction volume variable being 2.69 > 0.05%. Credit card usage represents a new trend or lifestyle, particularly among urban populations. The funds available through credit cards come from bank loans, leading consumers to use other cashless payment methods. However, there are certain requirements to obtain a credit card, which means that individuals must carefully consider whether to use it in the short term. In the long term, an increase in the volume of credit card transactions signifies that the flow of money will be faster, which also indicates that consumption among the public is rising. As consumption increases, along with more efficient transaction costs, this will enhance profits for producers, potentially driving higher production to meet consumer needs and demands. Additionally, producers may expand their businesses. Such conditions will boost output in the real sector, leading to further economic growth. Therefore, it can be said that in the long term, cashless transactions using credit cards will positively influence the industrial production index as a proxy for economic growth.

The Impact of Money Supply on Economic Growth

The results of the study explain that the money supply variable has a positive effect on economic growth in Indonesia. This finding supports the hypothesis that the money supply influences economic growth. The evidence shows that as the money supply increases, it can enhance economic growth. This is related to the fact that an increase in the money supply leads people to allocate part of their funds for consumption, prompting producers to manufacture more goods, which in turn increases the demand for production factors. This will affect per capita income and subsequently boost economic growth. Similar results were found in the study by (Tiwa & colleagues, 2016), where the money supply was shown to influence economic growth. This is linked to the idea that an increase in the money supply leads to higher investments, which then impacts economic growth.

CONCLUSION

Based on the research conducted, we can conclude the impacts of electronic money, credit card usage, exchange rates, inflation, and money supply on economic growth in Indonesia from 2012 to 2024. The study shows that there is a positive and significant long-term relationship between electronic money and economic growth. However, in the short term, electronic money transactions do not have an impact on economic growth. In the long term, the credit card usage variable positively affects economic growth, while debit card usage has a negative impact. In the short term, credit cards significantly influence economic growth, whereas debit cards do not affect it. In the short term, the exchange rate variable does not impact economic growth, but in the long term, it has a negative effect on economic growth. Meanwhile, the inflation variable does not exert an influence in the short term, but in the long term, it has a negative impact on economic growth.

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