ANALYSIS OF THE CORRELATION OF THE NON-CASH PAYMENT SYSTEM AND THE MONEY SUPPLY ON THE INFLATION IN INDONESIA

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ABSTRACT

The payment system has progressed from time to time along with advances in technology which has brought non-cash payment systems to be used more and more frequently. The ease of transactions using digital money has impacted the financial condition of a country. The study aims to identify and analyze the correlation between non-cash payment systems and inflation or financial and economic stability in Indonesia. This research uses a quantitative method with secondary data from several sources, including the Bank Indonesia and the Badan Pusat Statistik from January 2020 until December 2022. It was analyzed with the VECM Estimation Model. The results showed that money supply has a positive and significant effect on a dependent variable, inflation. Meanwhile, the e-money unit does not affect inflation. The researcher is expected to give an idea that e-money can help to improve economic growth in Indonesia.

Keywords: Cashless Payment, E-Money, Money Supply, Inflation, and VECM.

INTRODUCTION

The monetary authority's policy in controlling monetary form amounts can take any form, such as money supply, base money, or bank credit and/or interest rates to obtain macroeconomic stability. Monetary policy in Indonesia has a financial institution that has a role and is responsible for regulating and supervising other financial institutions, namely the central bank, Bank Indonesia, which is also regulated in Article 23D of the 1945 Constitution. Economic stability is a condition reflected in improving macroeconomic fundamentals. In order to support more optimal macroeconomic stability and create a strong and anticipatory monetary policy framework, it is necessary to have the right monetary policy in order to achieve the stability target in the long term. The primary goal of monetary policy is to preserve and uphold the stability of the value of the rupiah, a key aspect of which is evident in maintaining a low and consistent inflation rate. (Russiadi, 2018). In Indonesia, it can be said that the economy is not stable, this of course can be caused by several things, one of which is high inflation, high inflation is often caused by the global crisis, mismanagement,

lack of production, and changes in the economic system. Another factor that affects inflation is the increase in the money supply.

The money supply is a fairly significant element of the state of the economy and has close links with the public and the central bank. The money supply must have a balanced role. Bank Indonesia as the central bank will determine the money supply which is determined by the average price level factor in the economy (Ferdiansyah, 2016). The quantity of demand for money circulating in the community is determined by the price level of available goods and services. When the price level rises, the higher the quantity of money demanded and vice versa. A continuous increase in prices over a certain period of time is called inflation.

Table 1. Inflation Target and Actual Inflation in Indonesia 2012 – 2022

Year	Inflation Target	Actual Inflation (%,yoy)
2012	4,5+1%	4,3
2013	4.5+1%	8,38
2014	4.5+1%	8,36
2015	4±1%	3,35
2016	4±1%	3,02
2017	4±1%	3,61
2018	3,5±1%	3,13
2019	3,5±1%	2,72
2020	3±1%	1,68
2021	3±1%	1,87
2022	3±1%	5,51

Source: Bank Indonesia

The inflation target is the specific inflation rate that Bank Indonesia aims to achieve in coordination and cooperation with the government. In the Cooperation Agreement between Bank Indonesia and the Ministry of Finance, the proposed inflation target is discussed together in a coordination meeting at the ministry and agency levels in the TPIP and then determined by the Government for a certain period of time through a Minister of Finance Regulation. (Bank Indonesia, 2022). The inflation target is usually set in a target band and not a single number.

The payment system has progressed from time to time along with advances in technology which has brought non-cash payment systems to be used more and more frequently. Apart from being driven by the public's need for more practical transactions, central banks worldwide are also encouraging non-cash transactions on the grounds that they want a payment system that is relatively more secure, effective, and efficient because the transaction system is easier, cheaper and faster so that it can affect productivity. Better country economy (Lintangsari et al., 2018). The flexibility distinguished electronic money from any conventional form of payment. (Merlonghi, 2010). Innovations in electronic payment instruments, and card-based systems have developed into more convenient and functional forms. Bank Indonesia plays a role in the non-cash payment system, with an interest in ensuring that the non-cash payment system in the community operates securely, efficiently, and dependably.

In supporting plans to improve and enhance the payment system in Indonesia, support for innovation is being offered to boost the digital economy and finance growth. Among the innovations gaining traction and widespread adoption is digital payment services. This innovation was carried out to reduce the use of cash by the public. As a result, the development of non-cash from year to year has increased. Bank Indonesia recognizes the advantages of this payment method as a means to promote economic efficiency, expedite inclusion, and advance MSMEs.

LITERATURE STUDY

Money Supply Theories

The Quantity Theory of Money (Irving Fisher)

In principle, the quantity theory of money is a hypothesis about the main cause of the value of money or the price level. This theory concludes that changes in the value of money or price levels are primarily the result of changes in the money supply.

$$M.V = P.T \tag{1}$$
$$P = \frac{M.V}{T} \tag{2}$$

where:
M   = Money Supply
V   = Velocity of circulation
P   = Average Price Level
T   = Volume of transactions of goods and services

Theory of Cambridge (Marshall – Pigou)

Cambidge's theory says that the use of wealth holders in the form of money is because money has a liquid nature so it can be easily exchanged for other goods. People hold money because it simplifies transactions and various economic they engage in.

Keynesian Theory

Keynes's theory of demand for money is a theory that originates from Cambridge's theory, but Keynes did put forward something that was completely different from the classical tradition of monetary theory.

In Keynes's analysis, society asks or holds for 3 purposes :
1) The demand for money for transactions
   Keynes still accepts the opinion of the Cambridge class, that people keep money in order to fulfill and smooth out the transactions made, and the public's desire for money for this purpose is shaped by both the national income and the level of interest.
2) Precautionary demand for money
   Keynes also distinguished the demand for money for the purpose of making irregular payments or those outside the normal transaction plan, because of the liquid nature of money, that is, it is easy to exchange for other goods.

3) Demand for money for speculation

Demand for money for speculation is affected by the motive of holding money for speculative purposes, especially for the purpose of obtaining profits that can be achieved when the money holder anticipates future events or developments accurately.

E-Money

The advantages derived from using e-money itself have the benefits needed in this increasingly advanced era. People will use a product if the product can be developed can provide benefits and is practical in everyday life. So therefore-money increasingly accepted by the general public because it has provided enormous benefits and conveniences. Benefits and ease of use of electronic money can affect a person's interest in using electronic money. (Meileny & Wise, 2020). The existence of e-money can increase people's purchasing power because it is safe and easy to use, so there is no need to carry a lot of cash as explained above.

The increasing use of e-money can also have an impact on the economy due to a reduced money supply so that inflation can be overcome. Indonesia's sustained economic growth is inseparable from the strategic role of the payment system in supporting economic activity (Bank Indonesia, 2012). Electronic money according to Bank Indonesia Regulation No.20/6/PBI/2018 regarding electronic money is a payment instrument that meets the following criteria:

1) Published materials produced on the monetary payments made to the publisher in advance.
2) The value of money is saved digitally in a chip or server medium.
3) Electronic money value is managed by the issuer not a classified as deposit according to the banking laws and regulations.

The Card-based payment instruments (APMK) instrument is account-based, so banks choose a different transaction settlement method for each bank (according to the operational scale of its network). Non-cash transactions have changed the role of cash transactions, especially in large trade, financial transactions with large amounts, and retail payments due to the rise of payment numbers using transfer methods between bank accounts and the increasing use of cards such as debit, credit ATMs, e-money in transactions (Lahdenpera, 2001). Apart from being easier to make transactions, the demand for money issued by central banks also reduced in effect of non-cash transactions. This situation affects the one of central bank's duties implementation in controlling monetary policy (Costa Storti & De Grauwe, 2001).

Electronic money can't be called a phenomenon of information. Instead, it serves as a means to record the transfer of ownership rights over real monetary units. Likewise, the usage of payment instruments and the arrangement of digital payment systems offer identical information. Bank accounts are solely used when depositing and withdrawing funds from the system, in the system performing electronic money transactions (Vlasov, A.V., 2017).

RESEARCH METHODOLOGY

The independent variable is another variable that has an impact on other variables you want to know. In this study, the non-cash payment system and the money supply in Indonesia. The dependent variable is the research parameter that is measured to assess the extent of the effect

or influence resulting from other variables or variables that are affected by the independent variables. This study is about the stability of the financial system in Indonesia.

The type of data in this study is a type of secondary data. Secondary data is data obtained indirectly and becomes supporting data in a study. This research uses quarterly data from 2020-2022. Sources of data taken are from the website bi.go.id and also BPS (Central Statistics Agency) which can be accessed at www.bps.go.id.

Table 2. Data Collection

Variable	Indicator	Unit
Inflation (INF)	The indicator is seen from inflation data on the official website www.bps.go.id	Percentage
E-Money (EM)	The indicator is seen from nominal data electronic money monthly within a certain period on the official website www.bi.go.id	Million Units
Money Supply (MS)	The indicator is seen from the money supply on the official website www.bps.go.id	Billion Rupiah

Data Analysis Method

The initial step before conducting Vector Error Correction Model (VECM) testing involves examining the stationarity of each variable, whether dependent or independent, to obtain VECM estimates. In conducting VECM analysis, there is an assumption that must be fulfilled, namely that all independent variables must be stationary in the same order. Based on this, if a dataset is non-stationary at the level order I(0), stationarity can be achieved through first-order differencing (I(1)) or second-order differencing (I(2)). The unit root test can be explained by the following model:

$$\Delta Yt = a0 + Yt - 1 \Sigma \beta \Delta Yt - 1 + 1 + et \qquad (3)$$

Note:
Y = Dependent variables
$\Delta Yt = Yt – Yt\text{-}1$
t = time

Data Estimation Model

Stationary Test

The stationarity of data is necessary as it can affect the results of VECM estimation tests. Regression equations using non-stationary variables may lead to what is known as a spurious regression (Winarno, 2015).

Optimal Lags

A lag length that is too large may result in an increased degree of freedom, making the model less effective in explaining relationships (Prakoso, 2009). The determination of the optimal lag length will be conducted using available information criteria, such as Akaike's Information Criterion (AIC), Schwarz Criterion (SC), and Hannan Quinn (HQ). In this

research, the lag selected for the model is the one with the smallest values for AIC, SC, and HQ, as indicated by asterisks (*) in the output generated by E-Views.

Cointegration Test

Variables that are stationary at the first difference level or I(1) tend to have cointegration among them (W. W. Winarno, 2017). However, if no cointegration is found in the tested data, then the VECM modeling cannot proceed and may be transformed into a different VAR.

Granger Causality

To investigate causality relationships in a study, the Granger Causality test can be utilized. By using this test, there are several possibilities regarding the type of causality produced, such as:
1. One-way relationship from Yt to Xt.
2. One-way relationship from Xt to Yt.
3. Two-way relationships mutually influencing each other.
4. No mutual influence relationship.

Partial Regression Coefficient t-test

The t-test is used to establish whether the independent variables in the regression model partially have a significant effect on the dependent variable. The t-test can also be done using a significance level of 0.05 (a = 5%) as follows :
1. When the probability (significance) > 0.05 (α), then H0 is accepted, indicating that the independent variable partially (individually) does not significantly affect the dependent variable.
2. When the probability (significance) < 0.05 (α), then H0 is rejected, meaning that the independent variable partially (individually) has an impact on the dependent variable significantly.

Regression Coefficient Test (F-test)

1. If F-count > F-table means H0 is rejected.
2. If F-count < F-table means H0 is accepted.

The analysis is based on comparing the significance value of F with a significance value of 0.05. H0 is rejected and H1 is accepted when the significance value of F is less than 0.05. It suggests that the dependent variable is significantly impacted by independent factors.

When the probability (significance) < 0.05 (α), then H0 is rejected, meaning that the independent variable partially (individually) has an impact on the dependent variable significantly.

Coefficient of Determination (R2)

When the adjusted R2 is close to 0, it signifies that the independent variable has a minimal contribution to explaining the variation in the dependent variable. Contrarily, when the adjusted R2 is close to one, the greater the contribution to the dependent variable.

RESULTS AND DISCUSSION

The type of data used in this study is secondary data in the form of time series data monthly from January 2020 to December 2022 The purpose of this research is to assess whether the independent variables have a correlation on the dependent variable.

Table 3. Stationary Test

Variable	Unit Root Test					
	Level			1st Difference		
	Phillip-Perron t-Stat	Critical values 5%	Prob.	Phillip-Perron t-Stat	Critical values 5%	Prob.
E-Money	2.424327	-2.948404	0.9999	-4.630641	-2.951125	0.0007
Money Supply	0.163358	-2.948404	0.9661	-8.321104	-2.951125	0.0000
Inflation	0.184077	-2.948404	0.9676	-5.438188	-2.951125	0.0001

Based on the table above on stationary test, the first difference level reveals that the variables Inflation, M2, and E-money have probability values of 0.00. At a confidence level of $\alpha= 5\%$, it is known that all variables have probability values less than 5% (0.05). Therefore, it is concluded that all variables are stationary at the first difference level. VECM estimation can be conducted using first difference data.

Table 4. Lag Optimal Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-601.3435	NA*	5.09e+12*	37.77147	37.90888*	37.81701*
1	-594.6593	11.69731	5.90e+12	37.91621	38.46586	38.09840
Lag	LogL	LR	FPE	AIC	SC	HQ
2	-584.5131	15.85346	5.59e+12	37.84457	38.80646	38.16341
3	-573.3064	15.40912	5.09e+12	37.70665*	39.08078	38.16214

Based on the determined criteria, it is known that the smallest values of Final Prediction Error (FPE), Akaike's Information Criterion (AIC), Schwarz Criterion (SC), and Hannan Quinn (HQ) are found at the lag 1. Therefore, the optimal lag selected is lag 1.
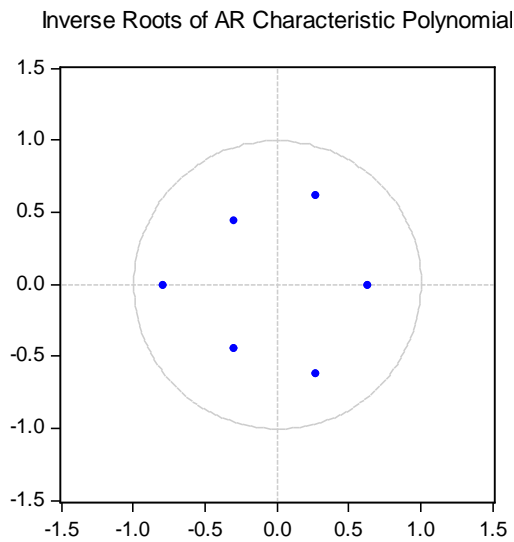
Inverse Roots of AR Characteristic Polynomial

Figure 1. Inverse AR Roots

Based on the figure above, it is known that all values are within the circle, thus indicating that the testing of IRF and FEVD in the model is stable.

Table 5. Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.544573	43.03309	29.79707	0.0009
At most 1 *	0.281597	17.07791	15.49471	0.0287
At most 2 *	0.170381	6.164023	3.841466	0.0130

Based on the table above, it is noted that the probability value at a level none is 0.00, At most 1 is 0.00, and At most 2 is 0.01, which is less than 0.05. Therefore, it is concluded that there is a long-term relationship among the variables E-Money, Money Supply, and Inflation.

After obtaining results from the cointegration test indicating the presence of a cointegrating relationship, this study proceeds with the estimation of the Vector Error Correction Model (VECM) to examine the long-term and short-term relationships among the variables. Estimation results of VECM will provide insights into the long-term and short-term relationships among the E-Money, Money Supply (as independent variables), and Inflation (as dependent variables). The VECM estimation can be written as:

$$D \ (INFLATION) = 0.010414995421(EMONEY(-1) + 1.80152694033e\text{-}05M2(-1) \ - $$
$$0.117657986665INFLATION(-1) - 1.4075607184) \ + $$
$$0.000121540910274D(EMONEY(-1) + 1.45403725504e\text{-}06D(M2$$
$$(-1) - 0. \ 48226173693 \ (INFLATION(-1) - 0. \ 00452157952197 \qquad (4)$$

Table 6. Granger Causality

Variable	Obs	F-Statistic	Prob.	Description
E-Money and Money Supply	35	3.67043	0.0644	
				There is no causality between two variables (E-Money and Money Supply)
Money Supply and E-Money		1.57533	0.2185	
Variable	Obs	F-Statistic	Prob.	Description
E-Money and Inflation	35	3.37050	0.0757	
				There is no causality between two variables (E-Money and Inflation)
Inflation and E-Money		0.06218	0.8047	
Money Supply and Inflation	35	7.40853	0.0104	There is one-way relationship between Money Supply to Inflation
				There is no causality between Inflation to Money Supply
Inflation and Money Supply		1.45073	0.2372	

Table 7. Long Term VECM Test

Variable	Coefficient	t-Statistic
EMONEY(-1)	0.010415	1.36377
M2(-1)	-1.80E-05	5.47041
Short Term VECM Test		
Variable	Coefficient	t-Statistic
CointEq1	-0.117658	-1.96600
D(EMONEY(-1))	0.000122	0.10146
D(M2(-1))	1.45E-06	2.19806
D(INFLATION(-1))	-0.482262	-3.23256
C	-0.004522	-0.06212

Based on the short-term VECM estimation test, the variable that is significant with a confidence level of 5% is Inflation. This means that variable Inflation in lag 1 has a negative influence in the amount of -0.482, if there is an increase of 1 percent in a specific variable in the previous year, it will result in a decrease of -0.482262 percent in the variable Inflation in the current year.

The t-test results of this discussion are:
- The variable E-Money Unit has a t-statistic of 1.36377 < 2.034515. For the short term, the E-Money has a t-statistic of 0.10146 < 2.034515, meaning that E-Money does not significantly affect Inflation. In conclusion, it can be stated that E-Money does not significant impact on Inflation in the long term and also short term.
- In the long term, the variable M2 or Money Supply has a t-statistic of 5.47041 > 2.034515. Therefore, it is concluded that the M2 or Money Supply has a significant

influence on Inflation in the long term. In the short term, the M2 has a t-statistic 2.19806 > 2.034515, meaning that the Money Supply significantly affects Inflation. In conclusion, it can be stated the Money Supply or M2 has a significant impact on Inflation in the long term and short term.

The results of the F-test, based on the F-value (2;33) at a 0.05 significance level and Table 4.8, indicate that the calculated F-value is 5.324499, which is greater than the critical F-value of 3.28. Additionally, the probability value for the F-statistic is 0.000 < 0.05. Therefore, it can be stated that e-money and money supply collectively have a significant impact on inflation.

The coefficient of determination explains the effect of the independent variable on the dependent variable, essentially representing the fraction of the independent variable's impact on the dependent variable. The dependent variable (Y) can bind the independent variable (X) to 35.08%. 64.92% is explained by other variable variations outside the model. Adjusted R-squared value is always smaller than R-squared.

DISCUSSION

Based on the results in the long term, the variable E-Money has a negative and significant on Inflation. Zunaitin et al. (2017) state that e-money in society is still not used as much as cash due to a significant number of people who are unfamiliar with and do not use e-money. According to this study, the e-money variable has a less significant impact on inflation rates compared to cash, which is more well-known in previous theories. This finding is further supported by the study of Narayan & Sahminan (2018), indicating that fintech, including e-money, has not significantly influenced inflation policy. Transactions with e-money are deemed practical and fast, increasing the velocity of money circulation. This finding aligns with the study by Priyatama and Apriansah (2010), stating that although the spread of e-money in Indonesia is slow, it has an impact on the velocity of money circulation based on the money balance approach. Nevertheless, e-money has not played a significant role in the Indonesian economy to date. Therefore, it can be concluded that the transaction volume of e-money does not have a significant impact on the inflation rate.

Based on the results in the long term, the variable Money Supply has a positive and significant on Inflation. The findings from this study show that the indicators of the money supply growth are more accurate calculations, it will help to curb the inflation and stabilize the value of the domestic currency. (Doan Van, 2019). If the amount of money circulating in society is greater than the amount of money needed, then the price level will increase and inflation will occur.

CONCLUSION

Based on the results of the analysis and discussion of the data, the conclusions can be drawn from research. The findings of the study reveal that the dependent variable, Inflation can be explained by independent variables namely E-Money, Money Supply, While the rest of the percentage can be explained by factors outside the model. Variables E-Money Value does not impact inflation in the short and long term. Also, The Money Supply variable has a significant influence on inflation in the long-term.

The Suggestions from the author to the future researchers, they can add other variables and longer periods that can affect the dependent variable. Also from the research results, it is found that approximately 64.92 percent is explained by variables or factors other than the five factors in the model. Therefore, it is advisable to add other independent variables that have not been investigated in this study and are relevant to their impact on Inflation

REFERENCE

Aprilianto, F. (2022). The impact of a cashless payment system on inflation. *Jurnal Ekonomi Pembangunan, 21*(2), 124–136.

Badan Pusat Statistik. (2020-2022). Inflasi (Umum). https://www.bps.go.id/indicator/3/1/1/inflasi-umum-.html

Badan Pusat Statistik. (n.d.). Uang beredar (Milyar Rupiah). https://www.bps.go.id/indicator/13/123/2/uang-beredar.html

Bank Indonesia. (n.d.). Statistik sistem pembayaran. https://www.bi.go.id/id/statistik/ekonomi-keuangan/ssp/uang-elektronik-transaksi.aspx

Chiu, J., & Wong, T. N. (2014). E-money: Efficiency, stability and optimal policy (No. 2014-16). *Bank of Canada Working Paper*.

Doan Van, D. (2020). Money supply and inflation impact on economic growth. *Journal of Financial Economic Policy, 12*(1), 121–136.

Fung, B., Molico, M., & Stuber, G. (2014). Electronic money and payments: Recent developments and issues.

Khatimah, H., & Halim, F. (2013). The intention to use e-money transaction in Indonesia: Conceptual framework.

Kumari, N., & Khanna, J. (2017). Cashless payment: A behavioral change to economic growth. *Qualitative and Quantitative Research Review, 2*(2).

Lintangsari, N. N., Hidayati, N., Purnamasari, Y., Carolina, H., & Ramadhan, W. F. (2018). Analisis pengaruh instrumen pembayaran non-tunai terhadap stabilitas sistem keuangan di Indonesia. *Jurnal Dinamika Ekonomi Pembangunan, 1*(1), 47–62.

Puspita, D. S., Saraswati, B. D., & Pertiwi, A. T. (2023, February). The effect of e-money on inflation in Indonesia: An application of the quantity theory of money. In *Proceeding Medan International Conference on Economic and Business* (Vol. 1).

Ramadhani, Z. F., & Oktora, S. I. (2019). Determinan transaksi non-tunai di Indonesia dengan pendekatan error correction mechanism (ECM) model. *Indonesian Journal of Statistics and Its Applications, 3*(1), 62–77.

Silaen, M. F., Manurung, S., & Nainggolan, C. D. (2021). Effect analysis of benefit perception, ease perception, security and risk perception of merchant interest in using Quick Response Indonesia Standard (QRIS). *International Journal of Science, Technology & Management, 2*(5), 1574–1581.

Sukirno, S. (2011). *Makroekonomi teori pengantar* (Edisi Ketiga). Jakarta: PT Rajagrafindo Persada.

Tee, H. H., & Ong, H. B. (2016). Cashless payment and economic growth. *Financial Innovation, 2*, 1–9.

Thirupathi, M., Vinayagamoorthi, G., & Mathiraj, S. P. (2019). Effect of cashless payment methods: A case study perspective analysis. *International Journal of Scientific & Technology Research, 8*(8), 394–397.

Titalessy, P. B. (2020). Cashless payments and its impact on inflation. *Advances in Social Sciences Research Journal, 7*(9), 524–532.

Vichyanond, J. (2021). Electronic money in Indonesia and Thailand. *ASEAN+ 3 Macroeconomic Research Office.*

Wulandari, D., Soseco, T., & Narmaditya, B. S. (2016). Analysis of the use of electronic money in efforts to support the less-cash society. *International Finance and Banking, 3*(1), 1–10.