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ANALYSIS OF THE DEMAND FOR MONEY AND THE VELOCITY OF MONEY IN THE DIGITAL ECONOMY ERA: A CASE STUDY IN INDONESIA

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Abstract

In the digital economy era, efficiency and effectiveness are required in carrying out all life activities, including transaction activities. The urge to payment innovates systems as an effort to meet the needs of the community has led to several new non-cash-based payment instruments, such as paperless-based payment transactions. The existence of non-cash transactions shifts the role of cash in society. This study aims to examine the effect of paperless-based non-cash payments represented by credit cards, debit cards, and electronic money on the demand and velocity of money in Indonesia. Using monthly data sourced from Bank Indonesia and the Central Statistics Agency for the period 2010M1-2019M11. The right analysis used to see the effect of payment system innovation on-demand and velocity of money circulation is the Error Correction Model. The findings in the literature state that there is a significant effect of paperless-based payments as a form of payment system innovation on the demand and velocity of money circulation in Indonesia. The strong influence between the demand for money and the velocity of money with paperless-based non-cash transactions in Indonesia in the long term indicates that policymakers need to be careful in making decisions. The long-term relationship explains that the central bank can influence people's transaction behavior. Given that currency in circulation forms a significant part of a central bank's balance sheet, the shrinking demand for currency will have important implications on the central bank's seigniorage income, its independence, and its ability to conduct monetary policy. Thus, it is important to check and understand the trend of money demand and the velocity of money so that it can provide long-term profits.

Keywords: Money Demand, Velocity of Money, Electronic Money, ECM

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INTRODUCTION

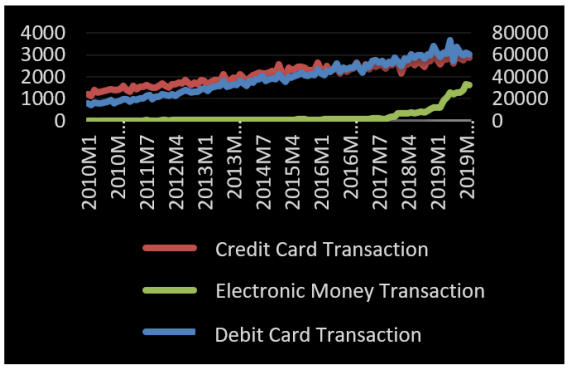
The rapid innovation in the digital era cannot be separated from the influence of increasingly sophisticated technology. With technology, several innovations such as the creation of new financial and payment systems continue to occur. Today, the issue of financial technology has received a lot of attention from financial literacy in the last few decades. (Afifah, 2017) explained that there were three types of innovations in the financial sector that occurred, including innovations on the product and process sides, as well as innovations in the payment system. Of the three innovations, innovation in the payment system is growing rapidly at this time.

The rapid development of financial innovation, especially in the payment system, has encouraged banks to carry out some innovations to produce a new non-cash-based financial and payment system. Paperless-based payment instruments (such as electronic fund transfers) and card-based payment instruments such as credit cards, debit cards, and electronic money cards are quite popular among people in various countries, including Indonesia. This is evidenced by the ease of access and ways to obtain non-cash payment instruments at various banks and non-bank issuing institutions, as well as the increasing number of merchants who accept non-cash payments, and the increasing number of non-cash payment instruments circulating in the community.

Based on Bank Indonesia data as of July 2020, it is known that the number of non-cash payment instruments circulating in the community reached more than 190 million for APMK and more than 359 million for electronic money (Huljannah & Satria, 2021). This figure shows the enthusiasm of the public in using new non-cash-based payment instruments in their daily activities. Not only that, the popularity of non-cash payment systems, especially those that occur in paperless payment instruments such as credit cards, debit cards, and electronic money, can also be seen from the development of the total nominal transactions, this fact can be seen in Graph 1.

In the past ten years, the growth of paperless-based non-cash payment transactions has continued to increase, the positive trend of each card-based payment instrument indicates that nowadays people are increasingly accustomed to using paperless-based new payment instruments, there is a change in people's behavior in transactions. namely from cash payments to non-cash payments.

Graph 1
Development of the Value of Non-Cash Payment Transactions in Indonesia (Credit Card Transactions, Debit Cards, Electronic Money)



Sources: Bank Indonesia (2019)

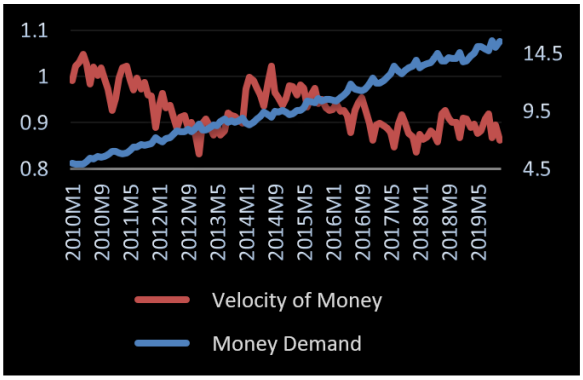
The amount of public interest in using non-cash payment instruments gives an unfavorable sentiment towards the demand for cash and the velocity of money. (Rahayu & Nugroho, 2020) The more sophisticated the payment system, the more people use

electronic money, this has an impact on the lack of use of cash and checks in the community. Supported (Alih et al., 2018) in the literature mentions new payment technologies make individuals switch from holding cash to paperless-based payment instruments which create long-term instability in the demand for money in Malaysia.

In line with research (Qin, 2017) stated that electronic money has an impact on the money supply by increasing Mo and M1. Electronic money harms cash issues. On the other hand, electronic money has a positive effect on M1 and electronic money will also affect the control power of the central bank. Regarding the findings of non-cash payments affecting the demand for money, reinforced by (Al-Laham et al., 2009) As the literature suggest, given that the amount of money in circulation is a significant part of the central bank`s balance sheet, the shrinking demand for currency will have important implications one the central bank`s seigniorage income, its independence, and its ability to conduct monetary policy.

From some of the literature, it can be concluded that rapid financial innovation not only has an impact on the demand for cash but also affects the stability of a country's monetary condition. The increasing interest of the public to switch to using non-cash transactions will make the transaction process faster and easier, this changes people's behavior to hold a little money. This change disrupts the stability of demand and velocity of money circulation, so it is important for the central bank as the monetary authority to control the development of non-cash payment transactions, to prevent risks posed by payment system innovations in the monetary sphere. The demand and velocity of money are some of the important indicators in the monetary amount to be predicted so that the central bank can achieve operational targets and final targets that are right on target. The existence of payment system innovations such as the creation of paperless-based payments is believed to have implications for the stability of these two indicators of monetary magnitude.

Graph 2
Development of Demand and Velocity of Money in Indonesia



Source: Author's Data Process (2020)

Graph 2 shows the movement of money demand and money velocity in Indonesia in the last decade. It can be interpreted; the velocity of money is the amount of money moving from one person to another or the amount of money turnover that occurs. It can be seen that the demand for money (M1) in this decade has continued to increase, this is evidenced by a positive graph trend. However, something different is seen in the movement of the velocity of money in Indonesia which is not constant. There is a tendency to decrease the velocity of money circulation in the 2010-2019 period, meaning that the movement of the velocity of money is not in line with the development of payment system innovations that occur in Indonesia.

The negative direction between money velocity and payment system innovation is also supported by research (Lubianti, 2005), The velocity of money circulation is influenced by institutional factors such as the payment methods commonly used by the community, the level of monetization, and the use of other payment instruments. The lower velocity of money and tends to be more stable, indicates that a country's economy is advancing, such as the widespread use of paperless-based payment instruments, and the improving level of community monetization. The alleged influence of innovation in the financial sector on the demand and velocity of money in Indonesia makes this issue interesting to study. Based on the description above, the main focus that will be seen in this literature is 1) how payment system innovations can affect the demand for Indonesian currency and the velocity of money circulation in Indonesia and 2) how the influence of payment system innovations on the short-term dynamics of money demand and velocity. circulation of money in Indonesia.

By analyzing the effect of payment innovation on the demand and velocity of money circulation, it is hoped that it can be used as a source of material for academic studies regarding policy determination by the monetary authority to anticipate the impact of the development of the payment system innovations in the monetary sphere.

From some previously found literature, there has been no research that uses the interest rate variable in analyzing the factors that will affect the demand for money and the velocity of money circulation. This research will also analyze the effect of payment system innovation on the short-term dynamics of money demand and the velocity of money. This is what researchers will try to do as an update from previous research.

RESEARCH METHODS

This study attempts to examine the impact of financial innovation on the demand and velocity of money in Indonesia, using the control variables, namely the interest rate and real gross domestic product. The interest rate is used as a control variable because the sensitivity of interest rates directly affects people's desire to hold cash or to save. Real gross domestic income is used because of its sensitivity in terms of the people's consumption ability which will affect the demand for money.

Money demand is represented by M1, while the velocity of money circulation is represented by the ratio between narrow money and nominal gross domestic product in the period 2010M1 to 2019M11. Payment system innovations are represented by debit cards, credit cards, and electronic money using monthly data from Bank Indonesia and the Central Statistics Agency. To know the long-term impact and short-term dynamics regarding the demand for money and the velocity of money circulation, the most suitable analytical model to use is the Error Correction Model.

In estimating the error correction model, the data stationarity test was carried out for each variable in the study, cointegration test, ECM test, and classical assumption test. The advantage of using this model is that the model can provide a broader meaning than the use of economic model estimates as the effect of changes in the independent variable on the dependent variable in the short and long term. (Anis et al., 2019). Based on research (Huljannah &

Satria, 2021) then the model used in this study:

$M_t = f(CD_t, DC_t, EM_t, R_t, GDP_t)$ (1.1)

$V_t = f(CD_t, DC_t, EM_t, R_t, GDP_t)$ (1.2)

M_t : Money Demand
V_t : Velocity of Money
CD_t : Credit card transaction
DC_t : Debit card transaction
EM_t : Electronic money transactions
R_t : Interest rate
GDP_t : Real gross domestic product

Equations (1.1) and (1.2) formulated into the error correction model equation:

$$\Delta M_t = \gamma_0 + \gamma_1(ECT) + \beta_0 + \beta_1 \Delta CD_t + \beta_2 CD_{t-1} + \beta_3 \Delta DC_t + \beta_4 DC_{t-1} + \beta_5 \Delta EM_t + \beta_6 EM_{t-1} + \beta_7 \Delta R_t + \beta_8 R_{t-1} + \beta_9 \Delta GDP_t + \beta_{10} GDP_{t-1} + \varepsilon_t \quad (1.3)$$

$$\Delta V_t = \gamma_0 + \gamma_1(ECT) + \beta_0 + \beta_1 \Delta CD_t + \beta_2 CD_{t-1} + \beta_3 \Delta DC_t + \beta_4 DC_{t-1} + \beta_5 \Delta EM_t + \beta_6 EM_{t-1} + \beta_7 \Delta R_t + \beta_8 R_{t-1} + \beta_9 \Delta GDP_t + \beta_{10} GDP_{t-1} + \varepsilon_t$$

ΔM_t : The difference of the money demand variable from period t to t-1
ΔV_t : The difference between the variable velocity of money from period t to t-1
CD_t : Credit card transaction
DC_t : Debit card transaction
EM_t : Electronic money transaction
R_t : Interest rates
GDP_t : Real gross domestic product
ECT : *Error correction term.*

RESEARCH RESULTS AND DISCUSSION

Stationarity Test Results

From the test results, it was found that most of the variables in the study were in a stationary position at the first difference level, and all variables were stationary at the second difference level. The stationarity of each variable can be determined by comparing the ADF Test Statistics values.

Table 1

Stationarity Test Results

Var.	Unit Root Test	ADF Test Stat.	Critical Values 5%	
Money Demand	2nd	-11.00105	-3.452764	*
Velocity of Money	1st	-2.709744	-1.943882	*
	2nd	-8.696819	-3.452764	*
Credit Card Transaction	1st	-9.320795	-3.452358	*
	2nd	-9.654554	-3.453601	*
Electronic money transactions	1st	-10.59067	-3.449020	*
	2nd	-7.749335	-3.452764	*
Interest Rate	1st	-7.058875	-3.448681	*
	2nd	-16.75287	-3.449020	*
Real gross domestic product	Level	-3.499936	-3.452358	*
	1st	-6.024376	-3.452358	*
	2nd	-10.78592	-3.452358	*

** Stationer*

Source: Author's Results, 2020

Cointegration Test Results

A cointegration test is a very important thing to do before formulating and predicting a dynamic model such as an error correction model. In this study, the cointegration test using the Engle-Granger model was carried out to observe the equilibrium over a long period between the variables being studied. At the level of the residual value in the research model, it must be stationary to be said to be cointegrated.

Table 2
Engle-Granger Cointegration Test Results

Money Demand Cointegration Test				
Var.	**Unit Root Test**	**ADF Test Stat.**	**Critical Values 5%**	
ECT	Level	-8.757788	-3.448348	*
The velocity of Money Cointegration Test				
Var.	**Unit Root Test**	**ADF Test Stat.**	**Critical Values 5%**	
ECT	Level	-7.404436	-3.448348	*

**Stationer*

Source: Author's Results, 2020

From the results of data processing, it is known that the residuals level (ECT) is in a stationary position, by comparing the ADF Test Statistics value with a critical value at the 5 percent real level so that it can be said that the data is cointegrated and there is a long period balance between the variables used in the analysis. The finding of a long-term relationship between variables in the observation made can be explained from the following estimation results:

Table 3
Long Term Equation Estimation

Long-Term Demand for Money in Indonesia					
No	**Var.**	**Coeff.**	**t-Stat**	**Prob.**	
1	Credit Card	0.462404	9.235531	0.0000	*
2	Debit Card	0.009136	1.557151	0.1222	-
3	Electronic Money	-0.061410	-0.954460	0.3419	-
4	Interest Rate	-0.020121	-6.163580	0.0000	*
5	Gross Domestic Product	0.797458	6.467443	0.0000	*
6	C		-5.072677		
Long-Term Velocity of Money in Indonesia					
No	**Var.**	**Coeff.**	**t-Stat**	**Prob.**	
1	Credit Card	-0.210915	-3.621747	0.0004	*
2	Debit Card	-0.022102	-3.238831	0.0016	*
3	Electronic Money	-0.019655	-0.262642	0.7933	*
4	Interest Rate	0.027398	7.215520	0.0000	*
5	Gross Domestic Product	0.743077	5.181197	0.0000	*
6	C		-5.502124		

**Stationer*

Source: Author's Results, 2020

In the estimation test on the payment system innovation variable in Indonesia on the demand for money and the velocity of money, it is known that from the five independent variables tested in the long term, there are at least three variables that have a significant effect on money demand and four variables that have a significant effect on the velocity of money circulation in Indonesia. The variables that significantly affect the demand for money are non-cash transactions using credit cards (CD), interest rates (R), and gross domestic product (GDP). Debit card and electronic money transactions in Indonesia over a long period are not strong enough to influence the demand for money.

So, the equation model for the demand for money in Indonesia in the long run is as follows:

M= - 5.0725 + 0.4624CD + 0.0091DC - 0.0614EM - 0.0201R + 0.7975GDP

From the long-term estimation equation, non-cash transactions using credit cards have a significant positive effect on the demand for money in Indonesia. With a coefficient value of 0.4624, it shows that when there is an expansion in the use of credit cards, the demand for money will increase by 46.24 percent, and vice versa, when there is a decrease in the use of credit cards, it will reduce the demand for money in Indonesia. Meanwhile, different things were found in the use of debit cards and electronic money, transactions from the two payment instruments did not have a significant effect on the demand for money in Indonesia.

On the other hand, one of the important factors in the economy that has a significant influence on the demand for money is policy interest rates and real gross domestic product. However, these two variables have different impacts in influencing the demand for money over a long period in Indonesia. With a coefficient value of -0.0201, it means that when the benchmark interest rate increases, this will make the demand for money in Indonesia decrease by 2.01 percent. Different things happened when the Central Bank cut interest rates, a decrease in interest rates had an effect on increasing public demand for money (M1) by 2.01 percent.

The resulting relationship of gross domestic product to the demand for money is in contrast to the interest rate on the demand for money. Where a gross domestic product has a significant positive effect on the demand for money. With a coefficient value of 0.7975, it means that when the real GDP of the Indonesian state increases, this will make the demand for money in Indonesia increase by 79.75 percent, and vice versa. Next is the analysis of the velocity of money in Indonesia in the long term. From the estimation results above, the following equation model is obtained:

V = - 5.5021 - 0.2109CD - 0.0221DC - 0.0197EM + 0.0274R + 0.7431GDP

From the equation, it is known that non-cash transactions using cards (card-based payment instruments) significantly affect the velocity of money circulation, but not for transactions using electronic money. From the estimation equation, we can see that in the long term card-based payments have a significant negative impact on the velocity of money in Indonesia. With a coefficient value of -0.2109, it shows that when there is an expansion in the use of credit cards, this will reduce the velocity of money circulation by 21.09 percent. Vice versa, when there is a decrease in the use of credit cards will accelerate the velocity of money in Indonesia. On the one hand, policy interest rates and real gross domestic product, which are also important indicators of the economy, have a significant positive influence on the velocity of money circulation in Indonesia in the long term. Of course, this indicates that the velocity of money circulation and the demand for money in Indonesia are dependent on interest rates and economic conditions.

So, it can be concluded that in the long term the majority of paperless-based non-cash transactions are not too dominant in influencing the demand for money, but different results can be found in the velocity of money circulation. Where in the long term, the majority of payment system innovations have a significant impact on the stability of the circulation of money. The influence was caused by the shock of card-based payments. The high existence of

paperless-based payments on the velocity of money in Indonesia proves that the rapid pace of payment innovation cannot be ignored in determining the level of demand for money and the stability of the velocity of money circulation. This can be used as the main policy instrument for the monetary authority in controlling the money supply and velocity of circulation as well as what is happening within Indonesia.

Result of Error Correction Model Equation Analysis

The co-integration of each variable in the study indicates the existence of a relationship between the variables in the study for a long period. So, it is necessary to analyze the error correction model to see the disequilibrium in the short-term dynamics. Based on the estimated data, the error correction term coefficient is a significant negative for money demand (M) and money velocity (V). The estimation of the error correction model below explains the short-term dynamics of the variables in the study which have strong implications in influencing the demand and velocity of money. The coefficients of R2 in the research model are 41.68 and 40.14 percent, respectively, indicating that the variables in the model used in this study are quite good.

Table 4
Error Correction Model (ECM) Estimated

Short-term Money Demand in Indonesia					
No	**Var.**	**Coeff.**	**t-Stat**	**Prob.**	
1	Credit Card	0.210845	4.781236	0.0000	*
2	Debit Card	0.037206	3.259834	0.0015	*
3	Electronic Money	-0.043757	-1.061629	0.2907	-
4	Interest Rate	0.009831	0.894385	0.3731	-
5	Gross Domestic Product	0.189439	0.189439	0.3581	-
6	ECT (-1)	-0.504635	-6.159585	0.0000	*
7	C		0.004916		
8	R-squared		0.416828		
Short-term Velocity of Money in Indonesia					
No	**Var.**	**Coeff.**	**t-Stat**	**Prob.**	
1	Credit Card	-0.148792	-2.579311	0.0112	*
2	Debit Card	-0.026962	-1.733948	0.0857	-
3	Electronic Money	-0.018327	-0.325180	0.7457	-
4	Interest Rate	-0.013797	-0.920904	0.3591	-
5	Gross Domestic Product	1.029551	3.620763	0.0004	*
6	ECT (-1)	-0.617408	-7.076696	0.0000	*
7	C		-0.002893		
8	R-squared		0.401455		

**Stationer*

Source: Author's Results, 2020

The results of the error correction model test can be seen in Table 4, where to find out the relationship between payment system innovation on the demand for money and the velocity of money circulation, it can be seen by comparing the probability value of each variable to a significance level of 5 percent. Based on the table of estimation results above, it is known that the short-term dynamics of money demand in Indonesia are dominantly influenced by card-based payment instruments. The equation model for the short-term dynamics of money demand in Indonesia is as follows:

$$\Delta M = 0.0049 + 0.2108\Delta CD + 0.0372\Delta DC - 0.0438\Delta EM + 0.0098\Delta R + 0.1894\Delta GDP - 0.5046ECT(-1)$$

Through the above equation, we can see that some variables are positively related to the demand for money while some other variables are negatively related. The variable that has the most dominant influence on the velocity of money in Indonesia based on the equation is credit card transactions, while the one with the weakest influence is policy interest rates. This shows that the use of credit cards when transacting has a higher ability to influence the demand for money in Indonesia. This means that credit card transactions can be used as the main consideration for the monetary authorities in controlling the demand for money in Indonesia.

This equation explains that the credit card transaction variable has strong implications for the short-term dynamics of money demand in Indonesia. This means that when there is an expansion in the use of credit cards during transactions, there will be an increase in demand for money. When there is an increase of 1 percent in credit card transactions, it will increase the demand for money by 0.2108 or 21.08 percent in the value of the demand for money. This value shows that the demand for money is very elastic because the value of changes in the demand for money is higher than changes in the use of credit cards.

Furthermore, for the estimation results of the error correction model of the velocity of money in Indonesia, based on the table above, the equation for the short-term dynamics of the velocity of money can be formed through the ECM equation as follows:

$$\Delta V = - 0.0029 - 0.1488\Delta CD - 0.0270\Delta DC - 0.0183\Delta EM - 0.0138\Delta R + 1.0296\Delta GDP - 0.6174ECT(-1)$$

In contrast to the demand for money, based on this equation, it can be seen that the existence of innovation in the payment system predominantly shows a negative effect on the velocity of money circulation in Indonesia. When there is an increase in the use of paperless-based non-cash payment instruments in Indonesia, it will cause a decrease in the velocity of money circulation. The variable that has the strongest influence on the velocity of money circulation in Indonesia based on the above equation is credit card transactions.

The existence of the use of credit cards in the community can change the stability of the circulation of money in Indonesia. This means that credit card transactions can be used as the main consideration for monetary authorities in controlling the velocity of money circulation in Indonesia. From the estimation results above, it is known that credit card transactions in Indonesia in the short term can reduce the stability of the circulation of money. When there is an increase in credit card transactions, the velocity of money will decrease. A coefficient of -0.1488 indicates an increase of 1 percent in credit card transactions will reduce the velocity of money by 14.88 percent in the value of the velocity of money.

Estimation of short-term dynamics with the error correction model produces an error correction term coefficient. This coefficient is useful for seeing how the regressand response is in each period that has a state that deviates from the equilibrium condition. According to (AT Basuki, 2016), the error correction term coefficient which is in the form of absolute value explains how quickly it will take to reach the equilibrium value. It is known that the value formed from the coefficient of error correction term in each of the processed data is 0.504635 and 0.617408 which means the difference between the demand for money and the velocity of

money circulation with the balance value of 0.504635 and 0.617408 so that within 1 year it will be adjusted. From the above equation obtained from modeling estimates, it can be concluded that when a shock occurs in demand and the velocity of money circulation, whether it comes from technological influences such as payment system innovations, or interest rates and economic conditions in the short-term dynamics have a significant influence on demand. money and velocity of money in Indonesia.

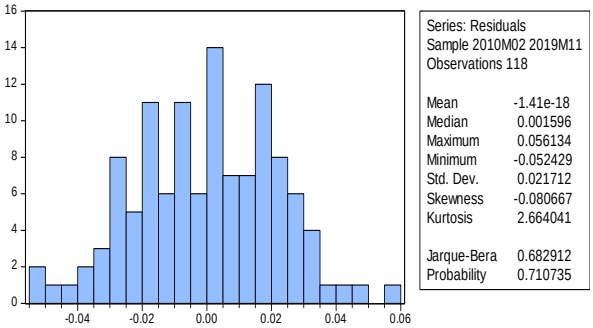
Classic Assumption Test Results

After regressing on the equations in the study, previously it was necessary to carry out tests aimed at finding out whether there were problems that occurred in the regression or vice versa, namely there were no problems with the regression results.

Normality Test Results

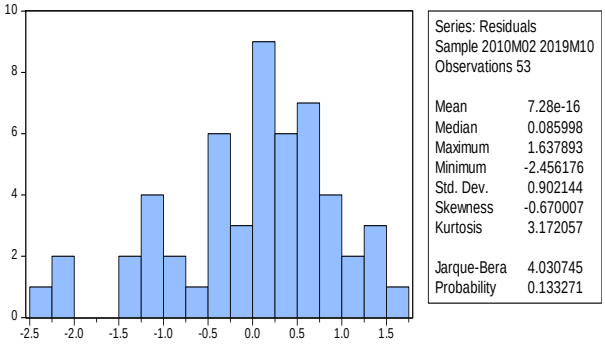
The first step in the classical assumption is to test whether the residual value that has been standardized in the model is normally distributed or not. If the residual value is mostly close to the average value it is called a normal distribution. Furthermore, due to the extreme values in the data taken, this can result in the non-fulfillment of normality.

Figure 1
Money Demand Normality Test Results



Source: Author's Results, 2020

Figure 2
The velocity of Money Normality Test Results



Source: Author's Results, 2020

Testing of the residuals was carried out using the Jarque-Bera Test. It is known that the residuals in each study are normally distributed, this is evidenced by looking at the probability value of the calculated Jarque-Bera which has a value greater than the 5 percent significance level.

Multicollinearity Test Results

Table 5
Money Demand Multicollinearity Test Results

No	Var.	Centered VIF
1	Credit Card	3.147784
2	Debit Card	1.219914
3	Electronic Money	2.749172
4	Interest Rate	1.028773
5	Gross Domestic Product	1.030025
6	ECT (-1)	1.342365
7	C	NA

Source: Author's Results, 2020

Table 6
Velocity of Money Multicollinearity Test Results

No	Var.	Centered VIF
1	Credit Card	2.905063
2	Debit Card	1.221164
3	Electronic Money	2.772059
4	Interest Rate	1.030828
5	Gross Domestic Product	1.065995
6	ECT (-1)	1.115784
7	C	NA

Source: Author's Results, 2020

The results of the multicollinearity assumption using Variance Inflation Factors, in Table 5 and Table 6, show that each variable has a VIF value whose results are below 10, indicating that there is no linear relationship between the independent variables in the study.

Heteroscedasticity Test Results

The assumption of heteroscedasticity with the Glejser method aims to see the pattern of the relationship between residuals and predictive values in the model in this study. The pattern of this relationship is not only limited to a linear relationship but allows other different relationship patterns.

Table 7
Heteroscedasticity Test Results

Heteroscedasticity Test: Glejser Money Demand			
F-stat	0.266602	Prob. F (6,111)	0.9514
Obs*R-squared	1.676332	Prob. Chi-Squared (6)	0.9469
Scaled explained SS	1.405574	Prob. Chi-Squared (6)	0.9655
Heteroscedasticity Test: Glacier Velocity of Money			
F-statistic	1.873568	Prob. F (6,111)	0.0916
Obs*R-squared	10.85137	Prob. Chi-Squared (6)	0.0931
Scaled explained SS	14.64421	Prob. Chi-Squared (6)	0.0232

Source: Author's Results, 2020

The heteroscedasticity test shows the value of each F count probability 0.9514 and 0.0916 which is greater than the 5 percent alpha level, this proves that there is no heteroscedasticity problem in the research model.

Autocorrelation Test Results

Autocorrelation is one of the basic assumptions that are useful for finding out whether there is a correlation between the residuals of one observation with other residuals. Autocorrelation testing using the LM test in this study requires a lag determined by comparing the smallest trial-error method from the absolute value of the Akaike and Schwarz standards.

Table 8
Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test Money Demand			
F-stat	1.794830	Prob. F (2,109)	0.1710
Obs*R-squared	3.762157	Prob. Chi-Squared (2)	0.1524
Breusch-Godfrey Serial Correlation LM Test Velocity of Money			
F-statistic	0.042915	Prob. F (2,109)	0.9580
Obs*R-squared	0.092845	Prob. Chi-Squared (2)	0.9546

Source: Author's Results, 2020

It was found that the residuals in this observation did not have an autocorrelation problem. This is evidenced by the value of Prob. The calculated F is 0.1710 and 0.9580 is greater than the 5 percent significance level.

The Effect of Payment System Innovations on Money Demand and the Velocity of Money Circulation in Indonesia

Based on the estimation results of ECM in the long term, payment system innovation has a dominant influence on the velocity of money circulation in Indonesia. This is evidenced by the strong influence of several variables that represent payment system innovations in this study, including card-based payments, and electronic money transactions. Based on the results of the

ECM test, non-cash transactions using cards (card-based payment instruments) have a significant negative impact on the velocity of money circulation, but these two types of card-based transactions have different relationships with money demand in Indonesia. Where in the long term, card-based transactions have a strong positive effect on money demand.

This is indicated by the probability value, which is less than 5 percent significance. Where when there is an increase in the use of credit card transactions, the demand for money in Indonesia will increase. The results of this study are supported by research (Alih et al., 2018) stated, credit cards in the long term can increase the demand for money in the case of Malaysia. However, apart from the results of the research above, there are also some contradictory arguments against the results of this study, (Jiang & Shao, 2019), the expansion of credit cards affects the cash credit sector. The new payment instrument (credit card) causes cash to drop to another payment instrument at the point of sale.

The development of new payment instruments has the potential to affect the demand for government currency. Given that currency in circulation constitutes a significant part of a central bank's balance sheet, the shrinking demand for currency will have important implications on the central bank's seigniorage income, its independence, and its ability to conduct monetary policy. In tune with (Aliha et al., 2019) emphasized that in the long term credit cards harm money demand, this means that the use of credit cards can reduce the amount of cash circulating in the community so that it will have an impact on the slower circulation of money in society. Apart from the pros and cons of arguments regarding the impact of credit cards, from some of the above literature descriptions, it can be concluded that on the one hand the presence of credit cards that offer efficiency and effectiveness in transactions, can reduce the opportunity cost of people to hold money in their daily lives. The opportunity cost consists of the transaction fee and the cost of waiting when the user wants to make a transaction. This is what attracts people to switch to using credit cards in Indonesia, thus making the role of cash start to be replaced.

The high popularity of using credit cards in Indonesia makes the velocity of transactions higher, this encourages a high rate of money circulation but suppresses the demand for cash. However, the actual use of credit cards does not reduce people's interest in cash, they just postpone it. Credit card users will eventually settle their credit bills and have to use cash to pay for them, perhaps by writing a check in their bank account or paying with their debit card. That's why the existence of a credit card will ultimately affect the increase in money supply and the velocity of money will be faster.

In line with the results of the ECM test, it can be seen that non-cash transactions using debit cards have a significant negative impact on the velocity of money circulation, but different types of card-based transactions show a different relationship to the demand for money in Indonesia. Based on the results of the ECM test with a large probability of a significance level of 5 percent, it indicates that in the long term the use of debit cards in transactions makes the velocity of money decrease when an increase of 1 percent in debit card transactions will reduce the velocity of money by 2.21 percent.

The positive relationship between debit card use and demand for money is in line with what was stated (Aliha et al., 2019)

in his research, that over a long period debit cards have a positive relationship with the demand for money in Malaysia. So that when credit card users increase this will be followed by an increase in demand for money in the community. However, apart from the results of the research above, several contradictory arguments were also found against the results of this study, as mentioned by (Dunne & Kasekende, 2018) in his research that debit/ATM cards have the potential to increase efficiency and reduce transaction costs, because the cash that will be carried to the wallet is replaced by this innovation, causing a decrease in public demand for cash. This finding is strengthened by research (Afifah, 2017) This also shows that the use of debit cards in the long term will have an impact on the money supply. The use of card payments encourages a reduction in cash held by the public, and the use of debit cards can also reduce transaction costs and become more efficient in the payment process.

The skeptical results of the impact of debit card use on money demand can be explained by the findings (David et al., 2016) in his research which states that the use of debit cards has an ambiguous impact on the certainty of the amount of money demanded. The fact that there are two services offered by debit cards, namely cash withdrawal and payment services, has a contrasting effect on cash holding and use. On the one hand, the cash withdrawal service allows card users to withdraw cash at an ATM at a lower cost. The lower the cash withdrawal fees charged by banks to debit users, the higher the use of cash, this will have an impact on the greater public interest in using cash in transactions.

On the other hand, debit card payment services avoid the cost of ownership and use of cash, which in turn tends to reduce public interest in cash. The mixed impact of credit card transactions creates uncertainty in the use and demand for cash. From several literature discussions that examine the effect of debit card transactions on money demand, it can be concluded that based on the results of the study there is a negative effect of debit card transactions on the velocity of money circulation in the long term, indicating that in recent periods there has been a tendency for people in Indonesia to take advantage of credit card payment services. The high number of paperless-based payment transactions makes the money supply in the community decrease so that the habit of using cash in transactions is getting less and less, this is what creates a negative relationship between debit transactions and the velocity of money in Indonesia over a long period.

The Effect of Payment System Innovations on the Short-Term Dynamics of Money Demand and the Velocity of Money Circulation in Indonesia.

We can see the short-term dynamics of the existence of payment system innovations on the demand and velocity of money circulation in Indonesia through the results of the ECM test. Where in the short term, the variables that represent payment system innovation have different effects on the demand for money and the velocity of money circulation. However, unfortunately, payment system innovation is dominantly unable to have a significant effect on the movement of money velocity in Indonesia, this shows a contradiction with conditions that occur in the long term. It is known that in a short period only credit card transaction variables have enough power to disrupt the stability of the velocity of money circulation in Indonesia.

An increase in the value of credit card transactions will cause an increase in the demand for money (M1) in Indonesia, but it will affect the velocity of money circulation. An increase of 1 percent in credit card transactions will cause a decrease of 14.87 percent in the velocity of money in Indonesia. The negative relationship between credit card transactions and the velocity of money occurs over a long period. There are consistent results from the two time periods in the study, which conclude that the use of credit cards has a strong potential to change the demand for money and the velocity of money in Indonesia. As is the case with debit card transactions, these different types of card-based payment instruments provide a surprising response in the short term. A significant relationship between debit card transactions and the velocity of money only occurs in the long term, whereas in a short period debit card transactions do not have enough power to influence the movement of the velocity of money. Other variables in this study, such as electronic money, do not have a significant impact on the demand and velocity of currency circulation in Indonesia in the short or long term.

Regarding the findings that state the weak influence of financial innovation on the demand for money and the velocity of money in the short term, this research is also corroborated by research (Alih et al., 2018) where he also got the results that in the short term some of the financial innovation variables chose a positive relationship and some were negative, meaning that there were no convincing results regarding the effect of financial variables in the short term. And there is no evidence of short-term causality running from the financial innovation variable to the demand for money.

From the description of the test results in this study, it can be concluded that digital technology and the rapid evolution that occurs in the financial sector, as well as the development of payment institutional infrastructure, can be said to be the main factors that change the function and circulation of money and currency circulation. The transformation in the payment system changes the role of cash into digital form, this offers benefits that make people change their habits in transactions. The existence of different results in two time periods, namely in the long term and short term, proves that in the digital era, the existence of payment system innovations changes the demand and circulation of money.

Money demand is not static and can be changed according to the innovations made by the payment infrastructure elements. The specification of the amount demanded money depends on when the money remains in the channel of the payment system and when the money is moved along the channel. This study captures a reasonable correlation between the demand for money and the velocity of money circulation with the level of economic digitization and the development of payment system infrastructure. It can be seen that in the short-term payment system innovation does not greatly affect the demand for money and the velocity of money, but over time the more rapid payment system innovation makes the role of cash fade and begin to be replaced by various types of alternative payment instruments in the economy.

Certainty and stability in demand and the circulation of money are very important in creating the effect of the monetary policy. Therefore, it is important to consider the effect of payment system innovations on the demand and velocity of money in choosing the right instrument for conducting monetary policy.

CONCLUSION

The relationship of financial innovation with the money supply is indeed familiar in the financial literature, but how financial innovation affects the demand for money as well as the performance and movement of the velocity of money is very important to be explored more deeply, this study looks at the relationship through the money demand variable. which is represented by M1 and the velocity of money which is measured by the comparison between the ratio of nominal GDP to the money supply (M1).

Answering the research questions, some of the findings that can be observed in this study are (1) In the long term payment system innovation significantly affects the demand and velocity of money circulation. The positive relationship between innovations in the payment system and the demand for money, explains that currently, paperless-based payments such as card-based payments and electronic money are increasingly popular in the community, this is what makes the demand for money (M1) increase in Indonesia.

It is different from the velocity of money circulation, the existence of innovations in the payment system makes the velocity of money decrease. The negative relationship between the velocity of money and financial innovation in the short term captures the shock to the velocity of money due to innovation, where the velocity of money decreases as a result of the increase in people's shift to alternative payment instruments in Indonesia (2) Short-term dynamics of money demand and velocity of circulation Money does not show a significant influence on financial innovation in Indonesia, where this innovation in payment instruments does not cause the demand for money to change drastically and does not cause fluctuations in the circulation of money. In short periods interest rates and economic conditions of a country greatly affect the velocity of money circulation in Indonesia.

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