Research Article

The Effect of Non-Cash Payments on the Money Supply in Indonesia During the Covid-19 Pandemic Period

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ABSTRACT

The development of non-cash payments is predicted to have an effect on real money demand, not only in Indonesia. The use of electronic money in Indonesia itself continues to increase especially in the covid-19 pandemic and it supported by technological developments. The purpose of this study was to analyse the effect of non-cash payments on real money demand in Indonesia. The method used is Vector Error Correction Model (VECM) using secondary data from Januari 2019 to December 2022. The independent variable is the amount of money circulated by Bank Indonesia, and the independent variables used are the value of debit / ATM card transactions, credit cards, and e -money. The results indicate that in the long run debit cards and e-money have a significant negative effect on money supply, while credit cards have positive effect on money supply but it's not significican. While in the short term, all variables debit cards, credit cards and e-money are not significant on money supply.

Keywords: Covid-19, Non cash payment, Transaction, Vector Error Correction Model

Introduction

Money is very important for everyday life. The Covid-19 pandemic brought massive changes to different levels of society (Danay et al., 2021). With all the things that have happened in the digital world, no one predicted that a Pandemic hitting humanity in 2020 would even speed up digitalization (Argabioso & Orencia, 2023). Every time people do business or trade something, they exchange money in the process. Money is what people use to buy things and show how valuable they are. In the past, people could only use physical money like bills and coins for payment transactions. But now there are more ways to pay without using cash. Peoples don't have to use physical money to pay anymore. Now peoples can also use electronic payment.

The surge of infected cases of Corona Virus (COVID-19) has brought a massive impact on

the food industry (Rosa & Separa, 2022). Community lockdowns, social distance, stay-at-home orders, and many other techniques to flatten the COVID-19 having big impact for the use of e-money.

Table 1. ATM/Debit Card transaction Volume 2019-2022

Year	Volume
2019	7.026.962,69
2020	6.658.532,535
2021	7.241.115,283
2022	7.558.017,712

Source : Bank Indonesia

In the table shown above (Table 1), we can observe that there has been a fluctuating change in the usage of debit cards over the last 5 years. The amount of people using debit cards is likely to go up. The highest number of times debit cards were used was in 2022, with 7.558018. In 2020, the number of peoples that used their debit cards less compared to 2019. The volume of debit card use decreased from 7. 026963 in 2019 to 6. 658532 in 2020 This is happening because of the covid-19 pandemic, which is affecting the economic activities. But it has also caused an increase in the number of credit card transactions in Indonesia in the next periods because more people are using debit cards to make payments to avoid physical contact.

Table 2. Credit Card transaction Volume 2019-2022

Year	Volume
2019	349.212
2020	274.682
2021	281.901
2022	342.766

Source : Bank Indonesia

In the table 2 above, it shows that the volume of credit card transactions has been changing over the past 5 years and mostly increasing. In 2019, there were a lot of credit card transactions, specifically 349,212 of them. In 2020, less people are using debit cards because of the covid-19 pandemic that affecting to the economics society. In 2019, there were 349,212 debit card transactions, but in 2020 there were only 274,682. In 2021, there were more transactions than the previous year, with a total of 281. 901 This number continued to increase in 2022, reaching a total of 342. 766.

Table 3. E-money transaction Volume 2019-2022

Year	Volume
2019	7.053.582,922
2020	15.043.475,26
2021	8.264.160,256
2022	12.330.359,6

Source : Bank Indonesia

In the table above (Table 3), we can see that there has been a change in how much people use electronic money (E-money) in the past 5 years. Even though the numbers are changing, the total number of users will probably go up. In 2020, more and more people used electronic money (E-money) for transactions. The total volume of transactions was 15. 043475 This

increase happened because people wanted to be cautious of Covid-19 and avoid direct contact with others. So, lots of people are using electronic money (E-money) more frequently. In 2021, the use of electronic money decreased by 8. 264160 This happened because the government relaxed the quarantine policies and there were other factors like unstable economic activities after the covid-19 pandemic. In the upcoming year, 2022, there was a rise in the amount of transactions happening, with a total of 12,330,359. 6 This shows that people are starting to accept payment systems that use electronic money.

The Covid-19 Virus has created many issues in different parts of the Indonesian economy and made it less efficient. This happened because the government implemented a policy called PSBB that restrict people's economic activities. One of the important things that should be worried during the Covid-19 pandemic is how much money is being used. The increase in the amount of money can lead to inflation. However, if the amount of money is significantly reduced, it will cause deflation. Therefore, the researcher wanted to analyze the relationship between several variables that represent the non-cash payment to money supply during the Covid-19 pandemic.

Theoretical Framework and Hypotheses
1. The money supply

The money supply is the total amount of money that belongs to all people in a society (Ongan & Gocer, 2023). There are two ways to explain the money supply: a narrow way called M1 and a broader way called M2. M1 is the total amount of money that people have in their pockets or in their bank accounts that they can take out whenever they want. M2 is a type of money that includes M1 and some other stuff like savings accounts, fixed-term deposits, and investments that will be ready within a year.

M1 = C + D

Where M1 = money supply in the narrow sense C = (Currency) money, paper money and metal money D = (Demand deposit) giral/ cheque.

In simple terms, M2 is a measure of the money supply. It includes the money that is already in circulation, called M1, and money that is stored in time deposits.

M2 = M1 + TD

Where M2 = money supply in the broadest sense TD = Time Deposit.

2. Theory of transaction equation by Irving Fisher

In every transaction, there are always people who buy things and people who sell things. The buyer needs to pay the equal amount of money that the seller will receive. This also applies to the whole economy. During a certain time period, the total value of the things people buy must be the same as the total value of the things being sold. The value of the items being sold is determined by multiplying the transaction volume (T) with the average price of the goods (P). On the contrary, the total value of goods traded should match the amount of money in society multiplied by how often money changes hands. Fisher believes that money demand arises because peoples need money for making transactions. (Dimand, 2000) The amount of Vt is determined by how transactions are made by people over a period of time. As an improvement on the previous theory, Irving Fisher said that there are three things that determine the value of money: the amount of money in existence (M), how quickly the money is used (V), and the amount of goods traded (T). Fisher's formula,Transaction Equation is:

$$Mv = vt \text{ or } V = \frac{Mv}{T}$$

3. Cambridge equation of exchange by Cambridge

Cambridge's approach was created as a different way of understanding how money and income are related compared to the quantity theory. This idea focuses on the need for money and how it affects the price level. The Cambridge economist is interested in studying how individuals choose to hold their money, rather than focusing on market balance. Additionally,

they also analyze the demand for money in institutions. How well off people are in society can impact how much money they want. In this method, money is not just used to buy things, but also to save. Economists like A.C. Pigou and Alfred Marshall formulated this approach through the equation (Humphrey, 2012) :

Md = k x PY

where Md = money demand; P = price level; Y = income level; and k = Constanta.

4. Keynesian Theory

John Maynard Keynes studied the theory of money demand in greater detail using different ways. If an economist from the classical school looks at how people want to use money by assuming that money doesn't have any special effects. Keynes highlighted how important interest rates are. Keynes came up with three reasons why people want money (Ostapenko & Buglevsky, 2022):
1. The transactions motive.
2. The precautionary motive.
3. The Speculative motive (Liquidity Preference).

5. The Relationship between Non-Cash Payments and Money Supply

According to Irving Fisher, if people start using methods other than cash to pay for things, there will be less cash used in transactions. As a result, money will circulate more quickly. Using cards to make transactions will cause more money to be spent, which means there will be more money in circulation. From the information given, we can see that electronic transactions can affect the amount of money or money supply.

6. Covid-19 Pandemic as a driving force for Behaviour Change in Transaction Payment in Indonesia

The global impact of COVID-19 can be felt by individuals across the globe. This pandemic caused many changes in every aspect of life, and one of those changes is the increase in online shopping and selling. Even though before the pandemic, buying and selling online was already growing. Due to the pandemic,

peoples are making online purchases more frequently. According to the Indonesian Ministry of Communication and Information, online buying and selling increased by 30% during the pandemic. Many people also started using telemedicine services. Purchases of foods and necessary things are even made online during the pandemic.

Online shopping is changing how people pay for things. The number of people using e-money in Indonesia went up from 156 million to 206 million after the Covid-19 case was confirmed in March 2020 (www.bi.go.id, 2020). Since the start of the pandemic a year ago, in April 2021, the use of electronic money has increased by approximately 135 percent, reaching a total of 483 million (www.bi.go.id, 2021).

Methods

This study uses time-series data in a monthly form January 2019 to December 2022. The data used in this research are money supply (M1) data, debit card transaction volume, credit card transaction volume and e-money transaction volume. The data was gathered from Bank Indonesia (www.bi.go.id). In this study, the Vector Error Correction Model (VECM) method will be used to analyze long-term and short-term relationships between variables that can influence research results and variables that are influenced by the research using time series data.

In the first part of our study, we will check if the variables have a unit root. We will use the Augmented Dickey Fuller unit root test to see if variables have non-stationary characteristics. Second, the lag examination is used to find the best lag length for the upcoming analysis. It helps determine the estimated parameters for the VECM model. Third, Causality test is conducted to determine whether there is a relationship between endogenous variables (depedent) so that it can be treated as an exogenous variable (independent). Causality test using Granger's casuality method. Predictive power of information that has been obtained in theory and previous research can show the existence of a causal relationship between variables. Fourth, If the variables have the same order of integration, then we can use the cointegration test to check if they are related. To test

the connection between two variables, we use the Johansen test (Johansen, 1988). Fifth, VECM analysis considers the fluctuation of data around long-term trends so that the vecm model is used to analyze the correction in the dependent variable due to imbalance in several variables ((Ekananda, 2015). Sixth, Impulse Response Function (IRF) aims to isolate a shock to be more specific, which means that a variable can be influenced by a particular shock or shock. Seventh, Forecast Error Variance Decompotion (FEVD), is a device that can describe the relative importance of independent variables in the vecm model due to shock and explain how strong the role of certain variables terhadep other variables (Lütkepohl, 2005).

Result and Discussion
1. Unit Root Test
Stationary data is data that does not change much and tends to stay close to its average value. If the time series data is not stationer, then the results of the regression will be wrong or not accurate (Gujarati & Econometrics, 2004). This can be seen when $R2$ is high but the value of Durbin Watson (DW) is low, which makes the results unreliable. This test uses the Augmented Dickey Fuller (ADF) test. The testing process with ADF is conducted with a predetermined significance level of 5% (Y. Wang et al., 2022).

Table 4. Uni Root Test Result

Variable	Level		1st Difference		Level Stasioner
	t-stat	p-Value	t-stat	p-Value	
Debit/ATM	3.783479	0.0050	-11.10097	0.00	Level
Kredit	-1.854643	0.3110	-8.432921	0.00	1st
E-money	-4.122387	0.0061	-6.477074	0.00	1st
M1	0.968754	0.9714	-9.495659	0.00	1st

Source : Eviews 12 Calculation Result

The ADF method found that out of the four variables tested, only Debit Card/ATM was stationary at the level. Meanwhile, the other three variables are stationary at first difference, namely the Credit Card, E-money and M1 variables. So the stationary level used in this research is the first difference.

2. Determination of Optimal Lag
Determining the appropriate lag length can be done by comparing different criteria like the Likelihood Ratio (LR), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Final Prediction Error (FPE), and Hannan Quinn Information Criterion (HQ) (Shabir et al., 2022). Lag testing using EViews 10 can be identified by looking at the asterisks on each criterion.

Table 5. Lag Length Test Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	323.1792	NA	4.20e-12	-14.84554	-14.68171*	-14.78513*
1	339.9897	29.71170*	4.06e-12*	-14.88324*	-14.06408	-14.58116
2	354.0304	22.20389	4.54e-12	-14.79211	-13.31762	-14.24837
3	371.0005	23.67910	4.57e-12	-14.83723	-12.70741	-14.05182

Source : Eviews 12 Calculation Result

In this research model, lag 1 is the best choice because it is significant, as indicated by the asterisk in the Likelihood Ratio (LR), Akaike Information Criterion (AIC), and Final Prediction Error (FPE) in Table 5

3. Granger Causality Test
The Granger Causality Test helps us understand the connection between different variables (Kongkuah et al., 2022). The results we found could mean three things: First, both x and

y affect each other. Second, only one variable affects the other. Third, there may be no connection between the two variables. Here are the outcomes of the Granger causality test:

Table 6. Granger Causality Test Result

Hipotesis:	Obs	F-Statistic	Prob.
LOGCD does not Granger Cause LOGM1	47	2.78863	0.102
LOGM1 does not Granger Cause LOGCD		7.187	0.0103
LOGCC does not Granger Cause LOGM1	47	0.45891	0.5017
LOGM1 does not Granger Cause LOGCC		0.99219	0.3247
LOGEMNY does not Granger Cause LOGM1	47	0.29161	0.5919
LOGM1 does not Granger Cause LOGEMNY		0.57839	0.451
LOGCC does not Granger Cause LOGCD	47	0.40836	0.5261
LOGCD does not Granger Cause LOGCC		4.80E-05	0.9945
LOGEMNY does not Granger Cause LOGCD	47	0.03899	0.8444
LOGCD does not Granger Cause LOGEMNY		0.00256	0.9599
LOGEMNY does not Granger Cause LOGCC	47	2.9414	0.0934
LOGCC does not Granger Cause LOGEMNY		0.92547	0.3413

Source : Eviews 12 Calculation Result

The test results above indicate that the Debit Card and M1 variables have a one-way causal relationship. This means that the Debit Card does not affect M1, but M1 does affect the Debit Card.

4. Johansen Cointegration Test

Table 7. Johansen Cointegration Test Result

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.644114	133.8900	47.85613	0.0000
At most 1 *	0.553775	87.39858	29.79707	0.0000
At most 2 *	0.516884	51.08664	15.49471	0.0000
At most 3 *	0.334861	18.34919	3.841465	0.0000

Source : Eviews 12 Calculation Result

The results of the Johansen cointegration test indicate that the model in this research contains cointegration (Mukhtarov et al., 2022). Based on the Max-Eigenvalue Statistics probability value, there are 4 cointegrations that have values below 5% or Trace and Max-Eigenvalue Statistics values > 0.05. The results of the cointegration test identify that the variables in this model are connected, it's mean that long-term estimates can be carried out(S. Wang et al., 2018). Then the model used in this research will be Vector Error Correction Model (VECM).

5. Vector Error Correction Model (VECM)

Table 6. VECM Test Result

Variable	Long-Term		Short-Term	
	coefisient	t-statistic	coefisient	t-statistic
D(M1(-1))	1.000000		-0.342534	[-2.06064]
D(KARTUDEBIT(-1))	-2.065577	[-3.00943]	-0.036182	[-0.39215]
D(KARTUKREDIT(-1))	0.071884	[0.22909]	-0.010987	[-0.14476]
D(EMONEY(-1))	-0.534186	[-4.46499]	0.010194	[0.47096]

Source : Eviews 12 Calculation Result

a. Debit/ATM Card Relationship to M1

Based on the VECM results, in the long term Debit Cards/ATM have a significant negative influence on the money supply (M1) with the coefficient value of -2.065577. Meanwhile, in the short term, Debit Card/ATM have a negative effect with the coefficient value of -0.036182, but this effect is not significant. Therefore, the first hypothesis (H1) is accepted.

b. Credit Card Relationship to M1

Based on the VECM results, in the long term, credit cards have a positive influence on the money supply (M1) with a coefficient of -0.071884, but this influence is not

significant. Meanwhile, in the short term, credit cards have a negative effect with a coefficient of -0.010987, but this effect is not significant. Therefore, the second hypothesis (H2) is rejected.

c. E-money relationship to M1

Based on the VECM results, in the long term E-money has a significant negative influence on the money supply (M1) with a coefficient of -0.534186. Meanwhile, in the short term, E-money has a positive effect with a coefficient of 0.010194, but this effect is not significant. Therefore, the second hypothesis (H3) is accepted.

6. Impulse Response Function (IRF)
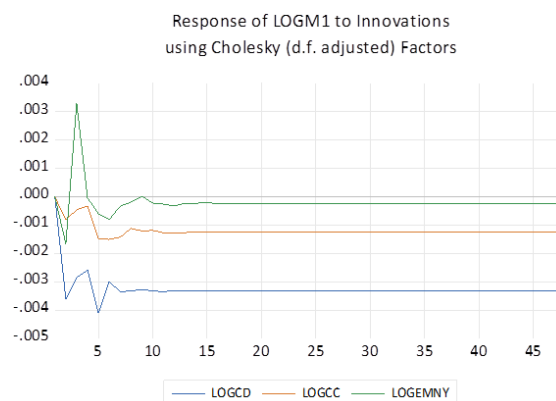
Graph 1. IRF Test Result
Source : Eviews 12 Calculation Result

The results of IRF analysis in graph 1 shows the response of money supply (M1) due to the shock in the volume of Debit Card, Credit Card and E-money payments during Covid-19 pandemic, namely from 2019 to 2022.

1. The blue line on the graph represents how money supply (M1) changes when there is a sudden increase or decrease in the use of debit card payments. In the first 10 months of the period, the money supply (M1) fluctuated a lot. It went up and down because there was a shock to the debit card payment system. This happened because at the beginning of the Covid-19 pandemic, there was a panic buying situation. People were using their ATMs and debit cards to go shopping. Moreover, from the 11th month to the 48th month, the fluctuations start to go down.

This means that the money supply (M1) is not changing as drastically as before. So it can be concluded that it takes approximately one year for the circulation of money to return to normal after encountering issues with debit card payments.

2. The orange line on the graph represents how money supply (M1) changes when there is a sudden increase or decrease in the use of credit card payments. In the first 10 months of the period, the money supply (M1) fluctuated a lot. It went up and down because there was a shock to the credit card payment system. This happened because at the beginning of the Covid-19 pandemic, there was a panic buying situation. People were using their credit cards to go shopping. Moreover, from the 11th month to the 48th

month, the fluctuations start to go down. This means that the money supply (M1) is not changing as drastically as before. So it can be concluded that it takes approximately one year for the circulation of money to return to normal after encountering issues with credit card payments.

3. The green line on the graph represents how the money supply (M1) changes when there is a sudden change in the use of e-money. At the beginning of the period, namely the first month to the 15th month, the response to the money supply (M1) was still very fluctuating since there is shock to the e-money payment variable, this was because at the beginning of the Covid-19 period there was a panic buying phenomenon which was accompanied by reduced physical contact. As a measure to prevent the transmission of Covid-19, people tend to use e-money for shopping. Furthermore, starting from the 16th month to the 48th month, fluctuations begin to decrease, meaning that the money supply (M1) is no longer as volatile as in the previous period. So, we can conclude that when a shock occurs in e-money payments, it will take around one and a half years for the money supply to return to its equilibrium point.

7. Forecast Error Variance Decomposition (FEVD)

Table 7. FEVD Test Result

Period	S.E.	LOGM1	LOGCD	LOGCC	LOGEMNY
1	0.013173	100.0000	0.000000	0.000000	0.000000
2	0.016010	93.60056	5.072037	0.254954	1.072446
3	0.018400	89.47725	6.236921	0.254056	4.031774
4	0.020405	89.82130	6.667942	0.232291	3.278464
5	0.022648	87.97414	8.679301	0.615082	2.731480
6	0.024546	87.80724	8.864043	0.897324	2.431393
7	0.026476	87.61390	9.220985	1.059738	2.105374
8	0.028154	87.49980	9.540391	1.093749	1.866060
9	0.029728	87.40946	9.771952	1.144910	1.673680
10	0.031204	87.29436	9.999002	1.182655	1.523983
11	0.032652	87.18831	10.18309	1.230649	1.397950
12	0.034031	87.11620	10.31413	1.274096	1.295576
13	0.035364	87.05418	10.43514	1.306779	1.203897
14	0.036639	87.01042	10.53429	1.330109	1.125183
15	0.037871	86.96392	10.62789	1.352039	1.056152
16	0.039063	86.92359	10.70887	1.371378	0.996162
17	0.040223	86.88687	10.78033	1.389826	0.942974
18	0.041350	86.85486	10.84336	1.406144	0.895636
19	0.042447	86.82670	10.89989	1.420551	0.852861
20	0.043516	86.80150	10.95099	1.433238	0.814266
21	0.044560	86.77813	10.99782	1.444840	0.779212
22	0.045579	86.75689	11.04032	1.455469	0.747326
23	0.046576	86.73732	11.07926	1.465287	0.718139
24	0.047553	86.71947	11.11492	1.474279	0.691330
25	0.048509	86.70303	11.14782	1.482553	0.666596
26	0.049447	86.68784	11.17826	1.490179	0.643722
27	0.050368	86.67372	11.20652	1.497262	0.622504
28	0.051272	86.66058	11.23279	1.503855	0.602775
29	0.052161	86.64832	11.25729	1.510009	0.584379
30	0.053034	86.63688	11.28018	1.515759	0.567185
31	0.053894	86.62616	11.30162	1.521143	0.551077

Period	S.E.	LOGM1	LOGCD	LOGCC	LOGEMNY
32	0.054740	86.61610	11.32175	1.526194	0.535957
33	0.055573	86.60663	11.34068	1.530946	0.521738
34	0.056394	86.59771	11.35852	1.535424	0.508340
35	0.057203	86.58930	11.37536	1.539651	0.495696
36	0.058000	86.58134	11.39127	1.543647	0.483741
37	0.058787	86.57381	11.40634	1.547430	0.472423
38	0.059564	86.56666	11.42063	1.551017	0.461691
39	0.060330	86.55988	11.43419	1.554423	0.451501
40	0.061087	86.55343	11.44709	1.557661	0.441813
41	0.061835	86.54729	11.45937	1.560743	0.432590
42	0.062573	86.54144	11.47107	1.563681	0.423801
43	0.063304	86.53586	11.48224	1.566484	0.415414
44	0.064025	86.53053	11.49290	1.569161	0.407404
45	0.064739	86.52543	11.50310	1.571721	0.399745
46	0.065445	86.52055	11.51286	1.574171	0.392415
47	0.066143	86.51588	11.52221	1.576519	0.385392
48	0.066834	86.51140	11.53118	1.578769	0.378659

Source : Eviews 12 Calculation Result

From the results of FEVD analysis in Table 7, it can be seen that in the first period, the money supply variable was strongly influenced by the shock of the money supply variable itself (100%) while in the same period the shock of the volume of debit card, credit card and e-money payments still had no effect.

Furthermore, from period 1 to period 48, the proportion of money supply shock to the money supply itself is still large, with a contribution of 86.51%. However, the impact of the money supply on itself becomes smaller over time. The shock contribution of debit card, credit card and e-money increased throughout the period. Starting from the 22nd period, the shock of debit card has even contributed more than 11% to the money supply while the shock of credit card contributed about 1.4% to the money supply. The increase in the value of the contribution continues to increase until the end of the 48th period. While the variable contribution of e-money payment volume to the money supply had increased in the initial period from the 3rd period of 4.0% to the 7th period of 2.1% but decreased from the 8th period with a value of 1.8%. The decrease in contributions continued until the end of the 48th period. From the test results above, it can be concluded that the shock of debit cards has a greater effect on the money supply than the shock of credit cards and e-money.

Conclusion

1. The Debit Card/ATM variable shows a significant negative influence on the money supply (M1) in the long term, but is not significant in the short term. The Credit Card variable has a positive and insignificant influence on the money supply (M1) in the long term, while in the short term the Credit Card variable has a negative and insignificant influence. The E-money variable shows a significant negative influence on the money supply (M1) in the long term, but is not significant in the short term.

2. Based on the results of impulse response calculations, the response of the money supply (M1) to the shock of debit card payments at the beginning of the period, namely the first month to the 10th month, was still very fluctuating, then in the 11th to 45th months fluctuations began to decrease, which means that the money supply (M1) was more stable than the previous period. The response of the money supply (M1) to the shock in the volume of credit card payments in the first month to the 11th month is still very fluctuating, then from the 12th to the 48th fluctuations begin to decrease meaning that the money supply (M1) is more stable than the previous period. The response of the money supply (M1) to the shock of the e-money

payment volume was very fluctuating in the first month to the 15th month, then from the 16th to the 48th month fluctuations began to decrease meaning that the money supply (M1) was more stable than in the previous period. The fluctuation in the money supply to the shock of non-cash payment variables (debit cards, credit cards & e-money) at the beginning of the covid-19 period was caused by several things such as panic buying phenomena and physical contact restrictions so that people tend to use non-cash payment instruments to shop. This is in accordance with Keynes's theory of the demand for money for the purpose of transactions.

3. Based on the variance decomposition test, it can be concluded that the shock of debit card has a greater effect on the money supply than the shock of credit cards and e-money.

Acknowledgement

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