Stability of Money Supply, E-money, Interest Rate, and Inflation in Indonesia

Moh. Ridha Mahatir[1], Hasdi Aimon[2], Sri Ulfa Sentosa[3]

[1,2,3] *Universitas Negeri Padang, Padang and Indonesia*
Email: r.mahatir26@gmail.com

ABSTRACT

This study examines the stability of money supply, e-money, interest rates and inflation in Indonesia. Using the month data for the period 2009m1-2019m12, cointegration and VECM. The results showed that, in the short term money supply and inflation had a significant effect on money supply. While in the long run inflation has a significant effect on money supply . In the short term money supply has a significant effect on e-money. While in the long run money supply and inflation have a significant effect e-money . In the short term interest rates and money supply have a significant effect on interest rates. While in the long run money supply and inflation have a significant effect on interest rates. In the short term inflation and money supply have a significant effect on inflation. While in the long run money supply has a significant effect on inflation.

Keywords: *Money Supply, E-money, Interest Rate, Inflation, VECM*

1. INTRODUCTION

The increase in money demand is caused by inflation, wealth, religious holidays, monetary crisis, stock prices, foreign and domestic interest rates (Prawoto, 2010). In the long run, gross domestic product, and domestic and foreign interest rates are affect to money demand. (Sanya & A, 2014). Figure 1 shows money supply and e-money in Indonesia.
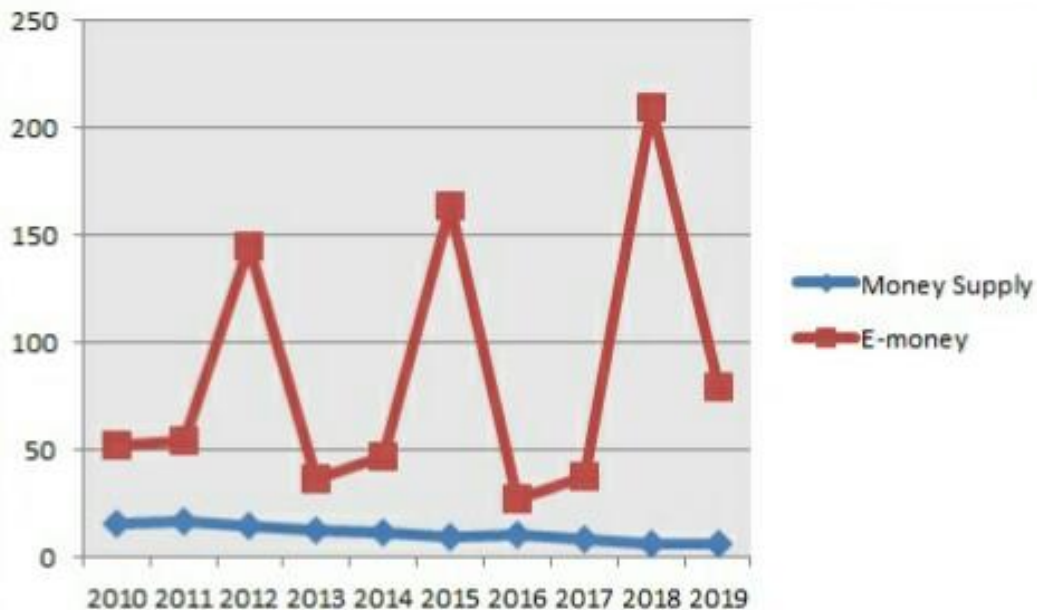

Figure 1 Money Supply and E-money in Indonesia
Source : Bank Indonesia (Authors' calculations)

Bhatta (2010) demand for money (M1 and M2) in the long run is experiencing a equlibrium with gross domestic product and interest rates. Achsani (2010) in the short and long term gross domestic product is positively related to money supply. In the short term interest rates are negatively related to money supply while in the long run they are not related.

Imimole & Uniamikogbo (2014) in the short term gross domestic product, exchange rates, and inflation affect money demand while foreign and domestic interest rates have no effect. In the long run, gross domestic product, foreign interest rates, exchange rates and inflation affect money demand, while domestic interest rates have no effect. Suliman & Dafaalla (2011) in the long run is positively related between money demand and gross domestic product and the exchange rate and inflation are negatively related to money demand.

Kiptui (2014) in the short and long term interest rates and inflation are negatively related to money demand while gross domestic product and exchange rates are positively related. Prawoto (2010) in the short term money demand is influenced by monetary crisis, wealth, inflation and religious holidays. In the long run, the demand for money is influenced by domestic and foreign interest rates, inflation and stock prices.

Nautz & Rondoerf (2010) money demand is influenced by inflation, interest rates, and stock prices. Kumar et al (2013) there is a relationship between money demand, gross domestic product and interest rates. Sanya & A (2014) Gross domestic product, domestic and foreign interest rates are related to money demand. Bedi & Herve (2011) Gross domestic product and interest rates are related to money demand.

Adi & Riti (2017) in the long run gross domestic product and inflation are positively related to money demand. While the exchange rate, foreign interest rates are negatively related to money demand. Lim & Sek (2015) in the short term the money supply, government spending, gross domestic product, imports of goods and services are not related to inflation.

In the long run the money supply, government spending, gross domestic product, imported goods and services are related to inflation.

The specific purpose of the study is to analyze and explain the stability of money supply, e-money, interest rate, and inflation in Indonesia.

2. METHODS

This research is a de facto expo study that examines the causal relationship between economic concepts based on a country's money supply, e-money, interest rate, and inflation. The data used were sourced from Bank Indonesia and Statistics Indonesia. The analysis model uses VECM, e-money study in Indonesia in the period 2009m1-2019m12. Equation:

$$MS_t = \sum_{i=0}^{n} \alpha_i\, MS_{t-i} + \sum_{i=0}^{n} \beta_j\, EM_{t-i} + \sum_{i=0}^{n} \gamma_k\, R_{t-i} + \sum_{i=0}^{n} \delta_l\, INF_{t-i} + U1_t$$

$$EM_t = \sum_{i=0}^{n} \beta_j\, EM_{t-i} + \sum_{i=0}^{n} \alpha_i\, MS_{t-i} + \sum_{i=0}^{n} \gamma_k\, R_{t-i} + \sum_{i=0}^{n} \delta_l\, INF_{t-i} + U2_t$$

$$R_t = \sum_{i=0}^{n} \gamma_k\, R_{t-i} + \sum_{i=0}^{n} \alpha_i\, MS_{t-i} + \sum_{i=0}^{n} \beta_j\, EM_{t-i} + \sum_{i=0}^{n} \delta_l\, INF_{t-i} + U3_t$$

$$INF_t = \sum_{i=0}^{n} \delta_l\, INF_{t-i} + \sum_{i=0}^{n} \alpha_i\, MS_{t-i} + \sum_{i=0}^{n} \beta_j\, EM_{t-i} + \sum_{i=0}^{n} \gamma_k\, R_{t-i} + U4_t$$

where MS is money supply, EM is e-money, R is interest rate, INF is inflation, and U is a residual term.

3. RESULTS AND DISCUSSION

3.1. Stationary Test

Unit root test is a test that aims to determine whether there is stationarity in the data where stationarity is an important thing related to research that uses time series data. Unit root tests emerged and were developed by Dickey-Fuller or commonly known as the Dickey-Fuller (DF) unit root test. And to find out whether there is a stationary unit root test is carried out using the Augmented Dickey-Fuller (ADF) test where the ADF test is used to detect whether the data is stationary or not.

Variables were test for unit root using the ADF (Augmented Dickey-Fuller) test. The

result show that, variables were stationary in levels and first difference.

Table 1. Unit root tests

Variable	ADF	
	In levels	In first difference
MS	-0.179	-2.882**
EM	5.001	-3.179**
R	-3.017**	
INF	-10.168***	

Note: ADF is the Augmented Dickey-Fuller test. ***,** and * donate rejection of unit root null hypothesis at the 1%, 5% and 10% level, respectively.

3.2. Lag Optimal

For optimal log testing, it can be seen from the interval candidates selected are the interval length according to the Akaike Information Criteria (AIC) criteria, the Schwaz Information Criterion (SIC), and the Hannan Quinn Criteria (HQC). Can be seen with the most * sign. the output above the most * sign in lag 6.

3.3. Cointegration Test

In this step you can know what model to use. Is the VAR model at the level of differentiation (if there is no cointegration) or VECM model (if there is cointegration). This study using Johanes cointegration test.

Cointegration testing shows that the trace test indicated that there were 4 cointegration. The relationship of mutual influence can be seen from the cointegration that occurs between the variables themselves. This shows that there is a long-term relationship between the variables of the level of money supply, e-money, and inflation. Co-integration of a variable shows the right signal to use VECM.

Table 2. VECM Money Supply

Variable	Coefisien	t-statistik	Decision
Long run			
Money Supply			
E-money	0.000102	0.15771	Not Significan
Interst Rate	-44366.09	-1.30677	Not Significan
Inflation	-498136.6	-7.16575	Significan
Short run			
CointEq1	-0.380858	-3.33679	Significan
Money Supply	-0.905334	-7.42509	Significan
E-money	000002.43	0.12328	Not Significan
Interst Rate	-24116.25	-0.96357	Not Significan
Inflation	-178167.0	-3.46814	Significan

Based on table 2 inflation with a t-statistic value of -7.16575 higher than t-table - 1.98 has a significant effect on money supply in the long run, whereas in the short term money supply is influenced by the money supply with a t-statistic value of -7.42509 more large than t-table - 1.98 and inflation with t-statistic value -3.46814 greater than t-table - 1.98.

Table 3. VECM E-money

Variable	Coefisien	t-statistik	Decision
Long run			
E-money			
Money Supply	9811.769	2.05682	Significan
Interst Rate	-4.35E+08	-1.27860	Not Significan
Inflation	-4.89E+09	-7.15976	Significan

Table cont…

Short run			
CointEq1	0.001723	0.30463	Not Significan
E-money	-1.109548	-11.5886	Significan
Money Supply	-20.80790	-0.35107	Not Significan
Interst Rate	-6863115.	-0.56411	Not Significan
Inflation	8262839.	0.33088	Not Significan

Based on table 3 money supply with a t-statistic value of 2.05682 higher than t-table 1.98 and inflation with a t-statistic value of -7.15976 higher than t-table - 1.98 has a significant effect on e-money in the long run, whereas in the short run e-money is influenced by money supply with a t-statistic value of -11.5886 higher than t-table - 1.98.

Table 4. VECM Interest Rate

Variable	Coefisien	t-statistik	Decision
Long run			
Interest Rate			
Money Supply	-2.25E-05	-2.09633	Significan
E-money	-2.30E-09	-0.15727	Not Significan
Inflation	11.22787	7.27578	Significan
Short run			
CointEq1	0.008534	0.40719	Not Significan
Interest Rate	-0.853899	-8.24371	Significan
Money Supply	1.33E-06	2.29110	Significan
E-money	-4.19E-10	-0.51400	Not Significan
Inflation	-0.100270	-0.47161	Not Significan

Based on table 4, the money supply with a t-statistic value of -2.09633 higher than t-table - 1.98 and inflation with a t-statistic value of 7.27578 higher than t-table 1.98 which has a significant effect on interest rates in the long run, whereas in the short term interest is influenced by interest rates with a t-statistic value of -8.24371 higher than t-table - 1.98 and money supply with a t-statistical value of 2.29110 higher than t-table 1.98.

Table 5. VECM Inflation

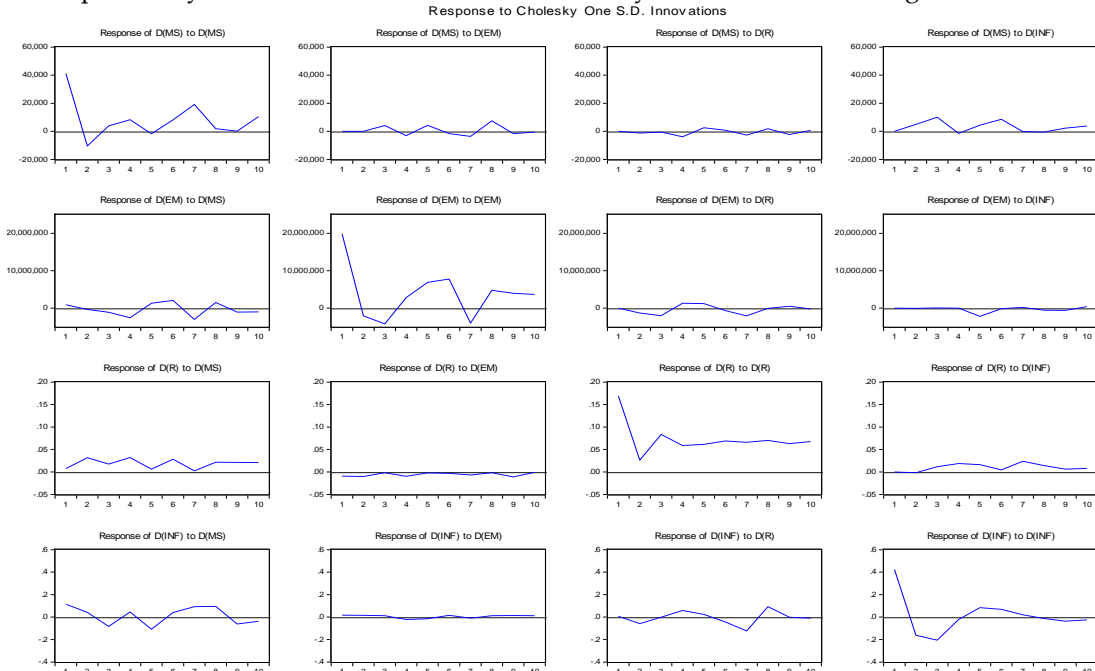| Variable	Coefisien	t-statistik	Decision
Long run			
Inflation			
Money Supply	-2.01E-06	-2.05099	Significan
E-money	-2.05E-10	-0.15713	Not Significan
Interest Rate	0.089064	1.29814	Not Significan
Short run			
CointEq1	-3.301331	-5.42679	Significan
Inflation	1.917977	3.48939	Significan
Money Supply	-4.49E-06	-3.44425	Significan
E-money	3.00E-10	0.14227	Not Significan
Interest Rate	-0.037933	-0.14166	Not Significan

Based on table 5 money supply with a t-statistic value of -2.05099 higher than t-table - 1.98 has a significant effect on inflation in the long run, whereas in the short term inflation is influenced by inflation the value of t-statistics 3.48939 higher than t-table 1.98 and money supply is the value of t-statistic -3.44425 higher than t-table - 1.98.

3.4. Variable Response Test

The Impulse Response Function tracks the effect of changing one standard deviation of one innovation of a variable on the present and future value of another variable in the VECM equation system. This method can be used to determine the response of an endogenous variable to a particular variable. Because actually the shock of a variable to one does not only affect that one variable, but also is transmitted to all other endogens through dynamic structures or lag structures in VECM.

Figure 2 Impulse Response Function between Money Supply, E-money, Interest Rate, and Inflation

In figure 2 can be seen the first Impulse Response Function (IRF) between the money supply and e-money . The results of the IRF analysis show that changes that occur in e-money are responded positively and negatively and fluctuate every year. In the ninth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing positive and negative changes that fluctuate from year to year . Second is the response of the money supply and interest rates . The results of the IRF analysis show that changes in interest rates respond positively and negatively and fluctuate each year. In the ninth year the fluctuations begin to shrink and approach the equilibrium point. Third is the response of the money supply and inflation . The results of the IRF analysis show that changes that occur in inflation respond positively every year.

In the seventh year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing a positive response from year to year. Fourth is the e-money response and the money supply . The results of the IRF analysis show that changes in the money supply are responded positively and negatively and fluctuate every year. In the eighth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing positive and negative changes that fluctuate from year to year. The fifth is e-money response and interest rates . The results of the IRF analysis show that changes in interest rates respond positively and negatively and fluctuate each year. In the ninth year the fluctuations begin to shrink and approach the equilibrium point.

Economically it can be concluded that experiencing positive and negative changes that fluctuate from year to year. The sixth is the e-money response and inflation. The results of the IRF analysis show that changes that occur in inflation are responded negatively every year. In the eighth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing negative changes that fluctuate from year to year. The seventh is

the response to interest rates and the money supply . The results of the IRF analysis show that changes that occur in the money supply are responded positively each year. In the seventh year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that there is a positive change that fluctuates from year to year. The eighth is the interest rate and e-money response . The results of the IRF analysis show that changes that occur in e-money are responded negatively if every year. In the seventh year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that there is a negative change if it fluctuates from year to year. The ninth is the response to interest rates and inflation . The results of the IRF analysis show that changes in inflation are responded positively each year.

In the sixth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that there is a positive change that fluctuates from year to year. The tenth is the response of inflation and the money supply . The results of the IRF analysis show that changes in the money supply are responded positively and

negatively and fluctuate every year. In the eighth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing positive and negative changes that fluctuate from year to year. To eleven is the response inflation and e-money .

The results of the IRF analysis show that changes that occur in e-money are responded positively and negatively and fluctuate every year. In the fifth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing a balance from year to year. To twelve is a response to inflation and interest rates . The results of the IRF analysis show that changes in interest rates respond positively and negatively and fluctuate each year. In the eighth year the fluctuations begin to shrink and approach the equilibrium point. Economically it can be concluded that experiencing a balance at the end of the year.

3.5 Variance Decomposition
Variance Decomposition (VD) provides information about how important changes in each random innovation are relative to changes in VECM.

Table 6. Variance Decomposition Money Supply

Period	S.E.	D(MS)	D(EM)	D(R)	D(INF)
1	41004.16	100.0000	0.000000	0.000000	0.000000
2	42618.86	98.61203	4.70E-05	0.072416	1.315508
3	44136.62	92.71059	0.861547	0.083455	6.344412
4	45199.97	91.73079	1.283480	0.837153	6.148582
5	45723.80	89.79513	2.114275	1.141281	6.949316
6	47258.32	87.04486	2.103063	1.093363	9.758713
7	51168.20	88.18411	2.291200	1.199340	8.325352
8	51774.77	86.25723	4.298648	1.299177	8.144942
9	51893.73	85.86359	4.367288	1.479386	8.289735
10	53082.40	85.97421	4.182057	1.430311	8.413425

Based on table 6 shows the variable money supply , where the money supply in the first period, the estimated error variance is entirely 100% explained by the variable money supply itself, which means that the probability of the money supply is influenced by itself compared to the shock that occurs from e- money,

inflation , and the money supply as well as the one that shocks or gives the biggest shock is inflation , where the variable money supply Variance Decomposition is greater when giving shocks to the money supply compared to shock given by e-money and inflation of the money supply.

Table 7. Variance Decomposition E-money

Period	S.E.	D(MS)	D(EM)	D(R)	D(INF)
1	19932404	0.198474	99.80153	0.000000	0.000000
2	20084981	0.222594	99.36391	0.412411	0.001089
3	20647647	0.487003	98.16477	1.346393	0.001830
4	21039610	1.975281	96.32783	1.695072	0.001815
5	22326217	2.099453	95.11126	1.809085	0.980207
6	23746143	2.608977	94.84329	1.676452	0.871281
7	24357932	4.025568	92.83374	2.305311	0.835382
8	24876348	4.215568	92.72555	2.211092	0.847789
9	25227523	4.267052	92.66111	2.190448	0.881389
10	25515680	4.329661	92.63856	2.146177	0.885606

Based on table 7 shows the e-money variable , where e-money in the first period, the estimated error variance is entirely 99.80 % explained by the e-money variable itself, which means that the probability level of e-money is influenced by itself compared to the shock that occurs from the amount of money circulation, interest rates, and inflation as well as those that shake or give the biggest shock is money supply Variance Decomposition is greater when giving shocks to e-money compared to shocks given by interest rates and inflation against e-money.

Table 8. Variance Decomposition Interest Rate

Period	S.E.	D(MS)	D(EM)	D(R)	D(INF)
1	0.169702	0.194278	0.287573	99.51815	0.000000
2	0.174928	3.481994	0.611705	95.89469	0.011615
3	0.195007	3.601510	0.501762	95.53326	0.363469
4	0.207353	5.588076	0.660822	92.60303	1.148076
5	0.217008	5.185639	0.613947	92.60460	1.595810
6	0.229560	6.144664	0.566164	91.82305	1.466126
7	0.240133	5.627654	0.597849	91.45686	2.317636
8	0.251551	5.863626	0.550546	91.16517	2.420656
9	0.260524	6.144241	0.688458	90.85331	2.313994
10	0.270145	6.312544	0.641661	90.81149	2.234301

Based on table 8 shows the interest rate variable , where the interest rate in the first period, the estimated error variance of all 99.52 % is explained by the interest rate variable itself, which means that the probability of the interest rate is influenced by itself compared to the shock that occurs from the money supply, e- money and inflation and that which shocks or gives the biggest shock is the money supply which is the variable money supply Variance Decomposition is greater when it gives a shock to the interest rate compared to the change/shock given by e-money and inflation to the rate interest.

Table 9. Variance Decomposition Inflation

Period	S.E.	D(MS)	D(EM)	D(R)	D(INF)
1	0.438724	6.810621	0.147303	0.022044	93.02003
2	0.473556	6.632032	0.240387	1.555219	91.57236
3	0.522724	7.966588	0.259372	1.277822	90.49622
4	0.528821	8.546648	0.404659	2.475249	88.57344
5	0.546835	11.85897	0.448050	2.498721	85.19426
6	0.554479	12.05203	0.522482	3.037948	84.38754

Table cont…					
7	0.575831	13.73978	0.513974	7.380570	78.36568
8	0.591149	15.64035	0.532242	9.426556	74.40085
9	0.595592	16.47949	0.572441	9.287349	73.66072
10	0.597471	16.76280	0.606862	9.255218	73.37512

Based on table 9 shows the inflation variable , where inflation in the first period, the estimated error variance of all 93.02 % is explained by the inflation variable itself, which means that the rate of inflation probability is influenced by itself compared to the shock that occurs from the money supply, e-money and interest rates and the one that shakes or provides the greatest shock is the money supply, where the variable money supply Variance Decomposition is greater when it gives a shock to inflation compared to the shock given by e-money and the interest rate to inflation.

4. CONCLUSIONS

This study examines stability of money supply, e-money, interest rates and inflation in Indonesia. Using the month data for the period 2009m1-2019m12, cointegration and VECM. The results showed that, in the short term money supply and inflation had a significant effect on the money supply. While in the long run inflation has a significant effect on money supply. In the short term money supply has a significant effect on e-money. While in the long run money supply and inflation have a significant effect on e-money. In the short term interest rates and money supply have a significant effect on interest rates . While in the long run money supply and inflation have a significant effect on interest rates. In the short term inflation and money supply have a significant effect on inflation. While in the long run money supply has a significant effect on inflation. Based results of these studies the need for policies to regulate stability money supply, e- money, interest rates, and inflation.

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