

ANALYSIS OF FACTORS IMPACTING ON MONEY DEMAND IN VIETNAM

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Abstract. *The article analyzes and develops the demand function model in Vietnam based on the application of the VECM error correction model. Variables used are industrial production value (OI), Inflation Expectancy Index (INF), treasury bill (BR) and VND/USD exchange rate (EX). The model tests in the study show that the relationship between the variables in M1, M2 money demand functions in the study time is consistent with the theory of money demand, which is likely to explain the practice in Vietnam. In particular, the results of the study allow analysis and forecast of monetary policy in monetary policy operation of the State Bank of Vietnam.*

Key words: *money demand, inflation, exchange rate, industrial production value, interest rate, means of payment, money volume, monetary policy, State Bank of Vietnam.*

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1. Introduction

Money demand model in the economy can be either linear or non-linear. The models are applied in empirical research such as Partial Adjustment Model (PAM), BSM-Buffer Stock Model, Error Correction Model (ECM), Auto-Regression Distributed Ladder (ARDL) model. In general, in the above models, ECM has more advantages in linear estimation of money demand. ECM is a time series model that contains a combination of short-term and long-term factors that can explain both short-term and long-term effects. The error correction factor from the model provides information relating to the correction of the balance of these effects. The concept of co-integration and its application in the ECM developed by Granger in his 1981 and 1983 studies [6]. This view is extended in Granger's study (1987) [5], Nelson & Plosser (1982) [9] when it is said that, most of the macroeconomic ranges are non-stop.

The VECM self-regression model is one of the models commonly used in forecasting and analyzing macro variables. The VECM error correction model was developed from the VAR model but is in the form of an error correction model (ECM). The fundamental difference between VECM and ECM is that the error correction component of VECM has the form of an integrated copper vectors that express co-integration of variables, long-term behavioral constraints of endogenous variables while this allows fluctuations to a certain degree. Thanks to the co-integration theory of variables, VECM can be estimated with non-stop but co-integrated chains without fake regression. Thanks to its special structure, VECM can contain information about both short-term and long-term adjustments to changes in endogenous variables through forecasting and estimation.

2. Description of data of factors impacting money demand in Vietnam

The usual volume of money chosen in the world's money demand studies is usually M1 and M2. According to the monetary measurement used in Vietnam, M1 includes cash that the central bank issues in circulation, non-term deposits and cash deposits. M2 is defined as the total means of payment, including M1 and term deposits. M2 is often used in banking annual reports as well as studies on monetary policies. Due to the characteristics of liquidity and the

opportunity cost of holding money, M1 and M2 money demands are two main study subjects for monetary policy development in Vietnam.

The timeframe for the quantitative M1 money demand study for long term in Vietnam is from January 1995 to December 2012. The quantitative study year has been since 1995 for two reasons [13]:

Firstly, among the selected independent variables, there are the exchange rate variables. In September 1994, the State Bank of Vietnam established an interbank foreign currency market, which functions as an executive and "end trader" in organized foreign currency. This change has contributed to improving the effectiveness of Vietnam's exchange rate policy. The exchange rate reflects more accurately the real value of Vietnam dong;

Secondly, since 1995, Vietnam has allowed the companies to deposit into banks and use dollars in unlimited amounts. The phenomenon of dollarization and the volatility of the Dollar affect the demand for domestic currency.

In studying M1 money demand function, in addition to other variables, the variables that have the greatest effect on the money demand are income (represented by the OI value), Inflation Expectancy Index INF and EX exchange rate. The choice of these variables is based on the most basic function of money as a medium of exchange and storage.

Under the theory of liquidity preference, money demand and income are closely related. Money demand is a part of demand for money, which occurs when money is used to facilitate the trading of goods. The higher the demand for money is along with the nominal income: the higher the income is, the higher the value of the purchased goods is, the higher the value of the transaction is. Therefore, in the study of money demand function, the effect of income on money demand is expected to be positive.

In the study of money demand in Vietnam, income is represented by the value of industrial production value (OI) for reasons: Firstly, the value chain of industrial production is variable with gross domestic product GDP, secondly, collection of data on industrial production value chain OI in our country is conducted regularly on a monthly basis, while GDP is usually updated on a yearly or quarterly basis.

For the opportunity cost variable, the study chose the INF Inflation Expectancy Index. The common consequence of known inflation is the rise in prices of commodities in the market, which also means that the value of the currency is reduced when compared to the value of other assets and commodities. With the money-for-money mechanism, rising inflation makes people wish to hold more money to pay for the same amount of goods they need. However, when dealing with speculative motives, the value of money is reduced due to inflation, causing people to worry about the value of money in the future and transfer their cash reserves to other assets with the same function such as gold or foreign currency, leading to a reduction in demand for money. Vietnam is now a developing country, demand for basic commodities has been relatively stable, while the financial market is gradually developing, boosting the demand for speculative profits with other assets besides people's money. In such an economic context, the impact factor of inflation on money demand in the study is expected to be negative.

In addition to the INF, the exchange rate (EX) also has a large effect on the M1 money demand function as an opportunity cost variable. Exchange rate changes can affect the real value of the domestic currency when compared to foreign currencies. In the financial market of Vietnam, the US dollar is one of the most important currencies used to convert and store, even used as a scale when converting VND to other currencies, therefore, the change in exchange rates also affects M1 money demand: As the exchange rate between the VND and USD increases, this

means that the VND devaluates, consumers tend to shift to store US dollars instead of the domestic currency, leading to reduction of the demand for money. This is also the reason that the factor of exchange rate impact on demand for money in the study is expected to be negative. The general function of the money demand M1 used in the study is as follows:

$$\ln M1_t = \alpha_0 + \alpha_1 \ln OI + \alpha_2 \ln INF + \alpha_3 \ln EX_t + \varepsilon_t \quad (1)$$

In which, M1 is the volume of liquid money in circulation;

OI is the value of industrial production;

INF is inflation expectancy index;

EX is the USD exchange rate;

α_0 is blocking factor value;

ε_t is tolerance of the model.

For the study of the M2 demand function, the variables chosen have a small variation: the BR treasury bond interest rate variable is used as the opportunity cost variable rather than the inflation expectancy index variable. Just like demand for any kind of commodity, the demand for money also depends on the price, and the price of the money in this case is the interest that the individual can receive from the bond, as it measures the opportunity cost of keeping money. When interest rates rise, the opportunity cost of keeping money decreases, therefore, the demand for money increases. According to Keynes's preferred liquidity theory: The benefits of bond holdings will reduce the need for asset holdings, speculative demand, or Keynesian asset money demand that are inversely related to change of interest rate. The sign of the effect factor of interest on the M2 money demand function is expected to be negative to fit the theory.

Today, when studying the M2 demand function (total means of payment), researchers often use treasury bill interest rates because they are figures associated with central bank activity as central banks regulate the money amount in open market operations (OMO). Annually, the amount of money traded on open market operations is huge, therefore, treasury bill interest rates can represent opportunity costs for a large amount of demand. In addition, it should be noted that when commercial banks decide on deposit interest rates and lending interest rates, they must be based on Treasury bill interest rates, therefore, treasury bill interest rates are the basis for all types of other interest rates. The study uses interest rate data for treasury bill to model Vietnam's M2 money demand function.

Overall function of M2 money demand is as follows:

$$\ln M2_t = \alpha_0 + \alpha_1 \ln OI + \alpha_2 \ln BR + \alpha_3 \ln EX_t + \varepsilon_t \quad (2)$$

In which, M1 is money amount with liquid in circulation;

OI is the value of industrial production;

BR is treasury bill interest rate;

EX is the USD exchange rate;

α_0 is blocking factor value;

ε_t is tolerance of the model.

The data used in the article is a series of monetary data M1, M2, BR taken from the International Monetary Fund's statistics [14]. Industrial production value OI, inflation are derived from statistical data of the General Statistics Office [15]; Treasury bill interest rates and exchange rates are taken from the SBV Annual Report [16].

3. Study results

3.1. Modeling M1 money demand function for long term

Analyse stopping of time series. In order to verify the severity of the data, the author uses the ADF test. With the data collected to estimate the demand for money in Vietnam, we have the results of the ADF test in Table 1. The results show that all series of logistic logs in bifurcal difference are stopped.

Verify co-Integration. Because the variables used in the logarithmic estimation are non-paused, the probability of co- integrating vectors between time series using the Johansen and Juselius (1990) methods should be tested. This is the most commonly used co-integrated evaluation technique used in applying the maximum rationality principle to determine the existence of co- integrated vectors between non-stop time series. This method will show the number of co-integrated vectors and allow researchers to test various hypotheses related to vector elements. If the test indicates that there is at least one co-integrated vector, then there are long-term relationships between the variables. The results of the test show that both the Johansen and Juselius (1990) tests that examined the vector of the trace and the maximall eigenvalue test rejected that the hypothesis H0 does not have a co-integrated vector and claims to have at least one co-integrated vector. Thus, there exists a long-term relationship between the selected variables of the long-term money demand model.

Based on the co-integrated estimation result, the author has the following money demand function:

$$\text{LnM1} = 26,57410 + 2,2454 \text{ LnOI} - 0,7986 \text{ INF} - 1,7055 \text{ LnEX} \quad (3)$$

(0,24383)	(0,15061)	(0,91690)
[-9,20868]	[5,30244]	[1,86012]

In particular, the value in round brackets is the standard error and the value in square brackets is the statistical value t. The function (3) is marked by factors that perfectly match the theory of demand for money. Change in output has a direct impact on money demand. Inflation expectancy index and exchange rate have a negative impact on the demand for money of the public.

The factor reflecting the elasticity of the demand for money with respect to the representative variable is the value of industrial production. The OI shows that for every 1% increase in income, the demand for money changes by 2,2454%. This is in line with the reality of Vietnam's financial market which is still at a low stage of development, people do not have many things called as money to carry out transaction functions.

The factor of effect of the inflation expectancy index on the demand for money is -0,7986, indicating that if people expect inflation to rise by 1%, the demand for domestic currency will decrease by 0,7986%. This is not a high rate and this suggests that the inflation expectancy index has little impact on the need to hold M1 money in Vietnam. This is in line with the reality in recent years, when the Government of Vietnam basically still controls inflation very well. Therefore, inflation impact is negligible on the behavior of people's money holdings.

The factor of influence of the exchange rate in the money demand function shows that when the local currency depreciates by 1%, people will reduce their demand for holdings by 5,8075%. This is in line with the reality of the highly dollarized economy in Vietnam, where people can use almost the same amount of foreign and domestic currencies in their transactions.

The value of the blocking factor of 26,4741 shows that, in addition to the above factors, there are other factors that have a positive impact on the demand of money holdings of the public that have not been included in the model due to data limitations. Therefore, in order to determine the money demand function in line with reality, to ensure the accuracy of the forecast, the State Bank of Vietnam needs to well perform the statistical factors affecting the money demand and this is also a major constraint of the statistics industry in Vietnam concerned and proposed for reform by scientists in the current period.

In addition, the factors of the matrix α measure the short-term rate of change of the variables in the system of equations of endogenous variables of the VAR model. The first factor of the matrix is -0,00264, indicating that the long-run equilibrium adjustment rate of the endogenous variable $\ln m_1$ in the first equation of the VAR system is 0,264%. The negative factor indicates that if the amount of money lagged, in excess of the demand of more than 1%, in this period, it would reduce by 0,264% of the amount of money held.

M1 money demand with error correction EC, economic event and seasonal variables.

The EC error correction is computed from the co-integrated vector and has the form:

$$EC = \ln M1 - (26,57410 + 2,2454 \ln OI - 0,7986 \ln I - 1,7055 \ln EX) \quad (4)$$

The EC is included in the ECM equation to ensure long-term relations are satisfied. The delay of the variables is determined by subtracting the delay applied in the co-integrated tests. The co-integration test of this study is conducted at a delay of 16 so that the delay in the short-term correction function is 15.

Dummy economic shock and seasonal variables. The author adds three dummy variables for 1998 (D1998), 2000 (D2000) and 2008 (D2008). The dummy D1998 variable was introduced to look at the effects of the Southeast Asian monetary and financial crisis on money demand. The dummy variable D2000 was introduced to look at the effect of the stock market on money demand and the D2008 dummy variable introduced to look at the impact of the world economic crisis on the demand for money in Vietnam. In addition, due to seasonally adjusted seasonal data, the author add seasonal dummy variables (SD) to consider seasonal effects on money demand.

Since all variables in the model are stopped, the model is estimated using the OLS method and has the following results:

Table1. Results of M1 money demand with error correction EC, economic event and seasonal variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.121925	0.018774	6.494259	0.0000
D1998	0.005555	0.012867	0.431738	0.6667
D2000	0.019551	0.013071	1.495774	0.1373
D2008	-0.021971	0.012562	-1.749055	0.0828
SA1	-0.045624	0.021005	-2.172091	0.0318
SA2	-0.117460	0.025379	-4.628273	0.0000
SA3	-0.094042	0.023756	-3.958627	0.0001
SA4	-0.078329	0.021860	-3.583271	0.0005
SA5	-0.095921	0.023720	-4.043858	0.0001
SA6	-0.075409	0.022772	-3.311503	0.0012
SA7	-0.094139	0.022280	-4.225222	0.0000

SA8	-0.082031	0.021407	-3.831944	0.0002
SA9	-0.053409	0.022534	-2.370150	0.0193
SA10	-0.053408	0.024119	-2.214302	0.0286
SA11	-0.068466	0.019964	-3.429407	0.0008
EC	0.009419	0.012115	0.777401	0.4384
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R-squared	0.705347	Mean dependent var	0.017354	
Adjusted R-squared	0.527130	S.D. dependent var	0.048506	
Prob(F-statistic)	0.000000			

(Source: Estimated results from Eview 9.0)

The results of estimating the M1 money demand model with the EC error correction, the economic and seasonal variables can explain the public money holdings at 70,53%. Exchange rate variables are more statistically significant than inflation expectancy index variables and industrial output variables. This suggests that in the short term, the rate of decline in the population reduces demand for the domestic currency and the demand for foreign currency increases, as they believe exchange rates will increase in the future. In addition, this also shows that over time, Vietnam has a large import demand.

The EC estimation coefficient for the short-term money demand function has a positive sign and has a 0,9% explanatory value for the model, indicating that each pair of positive correlations is between the amount of excess money held in the previous period and demand for money holding in this period. That is, the increase in the amount of excess money held in the previous period will increase the demand of money holding in this period. This is in line with past developments in Vietnam as the government implements tightening monetary policy to control inflation and macroeconomic stability in the context of high capital demand.

The dummy variables included in the M1 money demand function are not statistically significant; however, the sign of the coefficient of rescale indicates the actual interpretation. In the context of the global economic crisis in 2008 strongly impacting on the economy of Vietnam, the high inflation of nearly 20% has forced the State Bank of Vietnam to tighten money supply, raise interest rates, reduce demand for money.

Seasonal variables from SAD1 to SAD11 are statistically significant at 5%, indicating that short-term demand is influenced by seasonality. Seasonally adjusted coefficients by absolute value show that February of the year has the greatest variation. This is quite true for Vietnam because it is a time that often coincides with the Lunar New Year when the demand for goods increases, therefore, the demand for money increases sharply.

Verify the stability of the M1 money demand function. Verify the stability of the estimated money demand function, the author uses the CUSUM, CUSUM-squares and the recomputation function of the money demand function.

The CUSUM results show that the cumulative sum of the recursive residuals is in the plus and minus 5% statistically significant. In addition, the CUSUM-squares test at a significance level of 5% also shows that the demand for money is stable during the 1995-2012 study. Thus, the variables have been corrected well for the model, resulting in high stability.

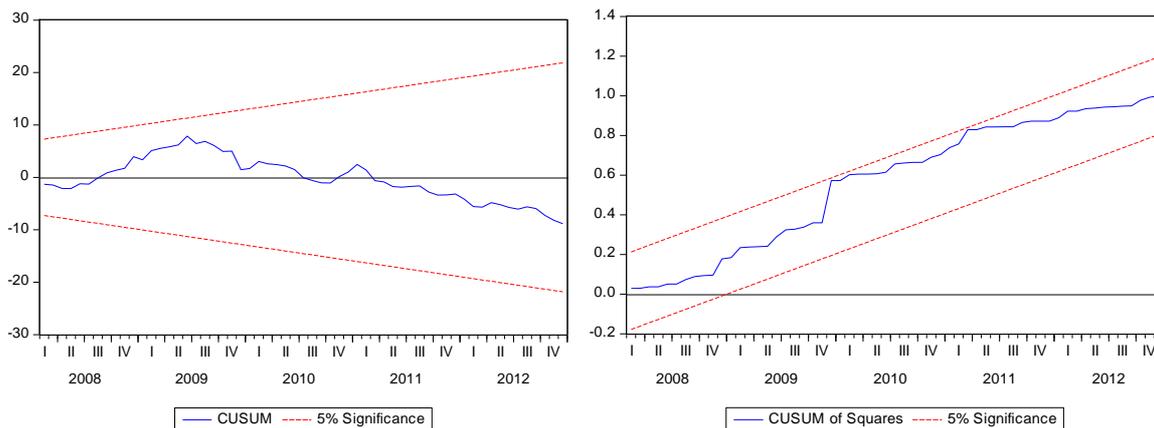


Fig 1: CUSUM and CUSUM squares tests for M1

In addition, the results of the estimation of the stability of the estimated coefficients of the short-term money demand function also show that, during the study period, the estimated coefficients of the short-term money demand function are stable.

Thus, the M1 money demand function in the study period is perfectly consistent with the theory and is capable of realistic interpretation. The tests show that the M1 money demand function is relatively stable and can be used for demand analysis and forecasting. However, the State Bank of Vietnam regulates the amount of money in circulation that usually uses M2 money demand, therefore, the researcher will next estimate the M2 money demand in Vietnam.

3.2. Modeling the M2 money demand function for long term

Similar to the analysis in M1, the stopping time series analysis is applied to M2 and results in the first-order differential logarithm series of stops.

The co-integration test was performed in the same way as in the estimation of the M1 demand function and was performed by Johansen and Jesulius (1990). The test results show that coexistence exists between the variables selected in the M2 money demand function.

Based on the co-integrated estimates of the author's long-term M2 money demand function, the following long-term M2 money demand functions are:

$$\text{LnM2} = - 8,032421 + 1,4211 \text{ LnOI} - 0,6285 \text{ lnBR} + 2,9352 \text{ LnEX} \quad (5)$$

(0,14658)	(0,13339)	(0,72859)
[-9,69531]	[4,71173]	[-4,02861]

In particular, the value in round brackets is the standard error and the value in square brackets is the statistical value t. The coefficient in the demand function shows that in the long term, the fluctuations in income and exchange rates have the effect of increasing the demand for money M2, while the fluctuation of interest rates reduces demand for money M2.

Although the sign of the coefficient of exchange rate influence on money demand shows that the relationship between two variables is unlikely to be statistically significant, the Vietnamese market can see the change of 1% of the exchange rate led to an increase of 2,9352% of the total amount of M2 money. This reflects the realities of Vietnam's economy over time as the recession, crisis and consequent macroeconomic instability lead to a loss of confidence in the local currency when the domestic currency is impaired.

The coefficient reflects the elasticity of the demand for money with the Treasury bill rate as analyzed with the sign that is perfectly consistent with the theory. When interest rates rise by 1% lead to M2 demand down 0,6285%. Of three estimated coefficients that reflect the elasticity of money demand, the Treasury bill yields the lowest, less than 1%. This shows that money demand in Vietnam is less elastic with interest rates.

M2 money demand model with EC error correction, dummy economic event and seasonal variables. EC error correction section. The EC error correction is computed from the co-integrated vector and has the form:

$$EC = \text{LnM2} - (-8,032421 + 1,4211 \text{ LnOI} - 0,6285 \text{ lnBR} + 2,9352 \text{ LnEX}) \quad (6)$$

In addition to adding the EC correction value to the ECM equation for regression, the addition of season variables to the monthly variation and dummy variables in 1998 (D1998), 2000 (D2000) and 2008 (D2008) to represent the economic events that occurred during the study period are assumed to affect the fluctuation of the demand for money. The co-integration test of this study was done at delay 13 so that the short-term correction function was 12.

Because all variables in the model are stopped, the model is estimated using the OLS method and has the following results

Table 2. Results of M2 money demand with error correction EC, economic event and seasonal variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.060898	0.014365	4.239251	0.0000
D1998	0.004713	0.009962	0.473075	0.6371
D2000	-0.006258	0.011534	-0.542557	0.5885
D2008	-0.007428	0.013438	-0.552738	0.5815
SA1	-0.032059	0.013183	-2.431868	0.0166
SA2	-0.041708	0.014883	-2.802328	0.0060
SA3	-0.051904	0.013807	-3.759372	0.0003
SA4	-0.056209	0.013383	-4.199983	0.0001
SA5	-0.036039	0.013662	-2.637904	0.0095
SA6	-0.037375	0.013077	-2.858087	0.0051
SA7	-0.047033	0.013065	-3.599989	0.0005
SA8	-0.050323	0.012516	-4.020620	0.0001
SA9	-0.041652	0.013496	-3.086354	0.0025
SA10	-0.045115	0.014561	-3.098377	0.0024
SA11	-0.040576	0.012814	-3.166510	0.0020
EC	0.011839	0.012732	0.929859	0.3544
R-squared	0.551253	Mean dependent var		0.021650
Adjusted R-squared	0.305418	S.D. dependent var		0.028826
Prob(F-statistic)	0.000088			

(Source: Estimated results from Eview 9.0)

The results of estimating the M1 money demand model with the EC error correction, the economic and seasonal variables can explain the public money holdings at 55,13%. Exchange

rate variables are more statistically significant than inflation expectancy index variables and industrial output variables in model M2. Similarly, it can be seen from the large demand pattern of foreign currencies in our country due to two factors that tastes to increase foreign currency purchases when the domestic currency devalues and the trend of large importing foreign currencies in our country during the study period.

The EC estimation coefficient for the short-term money demand function has a positive sign and has a 1,1% explanatory value for the model, indicating that each pair of positive correlations is between the amount of excess money held in the previous period and demand for money holding in this period. Through both M1 and M2, it can be seen that an increase in the amount of excess money held in the previous period will increase demand for money holdings not only of money but also of term deposits. It is considered that in the period when the government is implementing tight policies to control inflation and stabilize the macro economy in the context of high capital-intensive economy which is the characteristic of capital-saving tastes. In Vietnamese life, this result is perfectly appropriate.

The dummy seasonal variables included in the M2 money demand function are not statistically significant; however, the sign of the estimated coefficient gives a meaningful explanation. The Asian economic crisis in 1997-1998 had a positive effect on M2, suggesting that the Asian economic crisis had more impact on the trend of Vietnam's term deposits. This is also in line with the financial situation of our country in 1998 when people do not have many assets near the money to use for the purpose of hoarding and depositing money into the bank for the purpose of securing the property remains relatively common.

Seasonal variables from SAD1 to SAD11 are statistically significant at the 5% level, which suggests that seasonal factors have a significant effect on the change in demand for money. The seasonally adjusted coefficient of absolute value shows that the volatility of M2 is relatively constant between months of the year, unlike M1, which suggests that term deposits are relatively stable in the year, only slightly decreased in January when people tend to withdraw money to prepare for the Lunar New Year which usually takes place in February each year.

Verify the stability of the M2 money demand function. Verify the stability of the estimated money demand function, the author uses the CUSUM, CUSUM-squares and the recomputation function of the money demand function.

The CUSUM results show that the cumulative sum of the recursive residuals is in the plus and the 5% statistically significant and the CUSUM squares result in a 5% level showing the demand is stable during 1995-2012. From two tests, it can be seen that the economic fluctuations no longer affect the stability of the model showing the well-adjusted dummy variables, the obtained models have high stability.

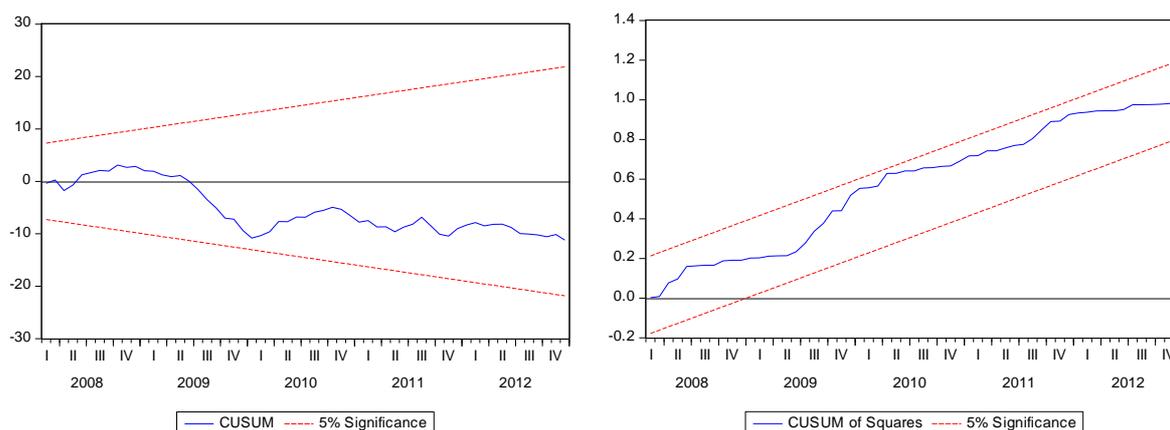


Fig 2: CUSUM and CUSUM squares tests for M2

In addition, the results of the estimation of the stability of the estimated coefficients of the short-term money demand function also show that, during the study period, the estimated coefficients of the short-term money demand function are stable.

The results of the M2 regression with the EC error correction, dummy variables and economic and seasonal variables are a significantly higher regression model for explaining the variation in total M2 Study paragraph. The model is highly stable and regressive with most of the phenomena that may affect the M2 money demand beyond the economic variables chosen at the beginning.

4. Conclusion

According to the results of the VECM study, the values of industrial production (OI) and the exchange rate (EX) have a strong impact on the change of long-term money demand, while the value of inflation Expectancy index (INF) and Treasury Bill (BR) interest rates have little impact on long-term money demand in Vietnam during the study period. The M1 and M2 models are run with the EC error correction, economic and seasonal variables giving rise to a significantly higher regression model for explaining the money demand variables during the study period. Most economic variables and effects from seasonal factors can be explained by the model.

The model results are consistent with our economic theory and economic situation in the past, so that the model can be used to forecast future demand for money. In addition, the central bank can use the M1 and M2 regression results in the monetary policy development process, in which the M2 function can be used in the intermediate objective, by the M2 model for measurement, forecasting and control.

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