

Measuring the Money Demand Function Stability in Bahrain

Dr. Mohamed Sayed Abou El-Seoud

Associate professor in Economics, College of Business Administration, University of Bahrain

*Corresponding Author: Dr. Mohamed Sayed Abou El-Seoud; Email: msayed@uob.edu.bh

Abstract: The study aims at analyzing the behavior of the real narrow money demand function (M1) for Bahrain based on annual data for the period (1991-2013), by adopting Cointegration, Error Correction Model and Granger Causality techniques. The main findings show that the demand function for real money is stable in the long run; in addition, there is a cointegration between real money demand, real income and inflation rate during the study period. The study concludes that Central Bank of Bahrain could effectively use the supply of money as an instrument of monetary policy in order to achieve price stability and promote economic growth.

Keywords: Bahrain; money demand; monetary policy; econometrics; cointegration, causality

INTRODUCTION

The study of money demand determinants and stability is an important issue in both developed and developing countries when the policy makers decide to choose the suitable monetary policy tool/s in order to achieve the macroeconomic objectives such as: economic growth, price stability, low level of unemployment,...etc. In addition it is important to investigate and test the stability of money demand since its instability is a major determinant of liquidity preference.

According to Bahrain Vision 2020, Kingdom of Bahrain aims at maintaining price stability and promoting economic growth as an important policy goal. Therefore, if the money demand function is stable over the long term, money supply changes could affect prices and income. It could enable the monetary policy to control the price level changes through adjustments made to the money supply. The money supply as an intermediate target for monetary policy purposes, should meet a stable relationship with the ultimate target.

The contemporary economics literature has numerous theoretical and empirical studies that evaluate the determinants and the satiability of money demand function. These studies adopt one or more of the following approaches: the first approach views money as a store or the balance of precaution, and it tries to focus on the variables that could affect the inventory composition, while the second approach includes the empirical studies that try to explain the demand for money since the eighties of the last century as a result of the spread and evolution of financial innovations. The third approach depends on the theoretical considerations in justifying the introduction of scale

variables like consumption expenditure rather than income in the demand functions for money. The fourth approach adopts McKinnon hypothesis to include the monetary variables in the money demand function as a result of the international financial markets intervention[1]. The fifth approach uses cointegration technique that associated with the Error Correction Model (ECM) for testing the relationship between non-stationary time series variables of the demand for money[2].

The current study adopts the fifth approach in analyzing the properties of the demand for money in Bahrain during the period (1991-2013) to identify its main determinates, and testing the stability of money demand function in both short and long terms. The main contribution of this study is twofold; first, this is the first attempts to estimate and analyze the demand for real money function in the Bahrain economy, where to our knowledge there has been no theoretical or empirical test on the money demand function in the Bahrain economy. Second the study deals with most of the proxies that could capture the effects of opportunity cost of holding money in Bahrain economy. Third, how could developing country such as Bahrain deal with the existence of stable/unstable money demand function in the economy.

The structure of this paper is organized as follows; section two introduces the specification of money demand model and data. Section three shows the study methodology. Section four illustrates the empirical results, and finally the conclusion of this study and the main policy implementations is shown in section five.

MODEL SPECIFICATION AND DATA

According to the Cagan [3] the real money demand is related to real income and real interest rate, where real income represents the demand for money that arises from the exchange or the volume of transactions, while the interest rate represents the opportunity cost for holding money. Traditionally in developing countries that have incomplete financial markets, they replace the inflation rate to the interest rate [4].

The money demand function takes the simplest formula as follows:

$$(M/P)^d = f(Y, R) \text{ ----- (1)}$$

Where :
 (M/P)^d : Real money demand
 (Y) : Real income or real wealth
 (R) : Real interest rate

Cambridge and Keynes approaches assume that there is a positive relationship between the demand for money and real income, where the demand for money increases due to the increasing in the transactions volume represented by the real income variable. In addition they assume there is an inverse relationship between the demand for money and the interest rate or inflation rate (P^e). In the other side Friedman[5] states that in the long run there is a stable relationship between the demand for real money and both of the level of real income or real wealth, and the opportunity cost for holding money represented by the expected rate of inflation or interest rates.

Rewriting the Equation (1) in logarithmic linear form as follows:

$$\text{Ln } (M/P)^d = B_0 + B_1 \text{Ln } Y_t + B_2 \text{Ln } R_t + e_t \text{ --- (2)}$$

Some empirical studies estimated the demand for money by adding additional variables such as [6, 7] who add the real exchange rate as explanatory variable, while [8] adds the short and long run interest rates as one of the explanatory variables, in addition [9] add dummy variable in the function to show a privacy performance of the economy into consideration during the study period.

Accordingly, the money demand function of Bahrain economy includes, Real Gross Domestic Product (y) as a scale variable that used to measure the transactions relating to economic activity, consumer price index as a proxy of interest rate variable (where the nominal interest rate is institutionally determined; it doesn't fully capture the opportunity cost of holding money, Furthermore, the administrative nominal interest rates are not often adjusted for changes in inflation and consequently the real interest rate became negative), In addition to dummy variable to show the performance of Bahrain economy during the period that witnessed the decline in economic growth rates and the

real demand for money; therefore, we can rewrite the demand for money as follow:

$$m_t = a_0 + a_1 y_t + a_2 \Pi_t + a_3 D + \delta \text{ ----- (3)}$$

Where:
 m_t : logarithm value for real narrow money demand(M1)
 y_t : logarithm value of real GDP
 Π_t : logarithm value of consumer price index
 D : Dummy variable; and
 δ : Error terms

Data of all certain variables has been taken from Central Bank of Bahrain (CBB), National accounts statistics (various issues), and Economic statistical bulletin (various issues). Some of the missing observations for the period (1993-1999) have been taken from the World Bank International Financial Statistics database (various issue)[10]. The concept of the demand for money in this study is the narrow money (M1). All the data are in real terms of a Bahrain Dinar.

METHODOLOGY

Most macroeconomic time series exhibit substantial co-movement, and thus estimating the previous model using OLS frequently suffers from the problem of nonstationary regressors and spurious regressions, which do not reflect the long run relationship but common time trends[11]. Therefore, in order to investigate the long run effects of the model, we should first test whether the proposed variables in the equation (1) are stationary or not. This step is carried out using Augmented Dickey Fuller (ADF) test [12]. ADF test is being conducted to indicate that variables under study have unit roots in the level data based on the following equations:

$$\Delta X = \beta X_{t-1} + \sum_{i=1}^p \mu_i \Delta X_{t-i} + \epsilon_t \text{ -----(4)}$$

$$\Delta X = \alpha_0 + \beta X_{t-1} + \sum_{i=1}^p \mu_i \Delta X_{t-i} + \epsilon_t \text{ ----- (5)}$$

$$\Delta X = \alpha_0 + \beta X_{t-1} + \delta t + \sum_{i=1}^p \mu_i \Delta X_{t-i} + \epsilon_t \text{ -----(6)}$$

Where X is log of the variables series, p is the maximum lag, and ε is the stationary random error. The first equation is a test of pure random walk since there is no time trend and intercept. The hypothesis test is to test if β = 0 or not. Equation (6) is being tested in the begging. In case of rejecting the null, we should go back to test equation (5) and (4), which are more restricted. In the presence of unit roots, the variables needed to be differenced one year or more in order for the series to be stationary. The choice of optimum

P lag was determined on the basis of minimizing the Schwarz information criterion to ensure serially uncorrelated residuals.

The next step is to test for the presence of cointegration among the explanatory variables by using the Johansen cointegration test for the study variables[13]. To estimate the cointegration rank and vector, the following λ_{trace} and λ_{max} statistics test are being used where:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^n \ln(1 - \lambda_i) \text{ ----- (7)}$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda_{r+1}) \text{ -----(8)}$$

For λ_{trace} statistics, the null hypothesis is that the number of cointegrating vectors is less than or equal to r, against $r = 1, 2, 3, 4, \dots$, while in case of λ_{mas} statistics, the null hypothesis is that the number of cointegrating vectors is less than or equal to r, against $r = r + 1$.

Having identified the cointegration vector using Johansen, we proceed to investigate the dynamics of the money demand process by employing ECM. If the results show that the coefficient of the Error Term for the estimated money demand equation is both statistically significant and negative. Thus, it will rightly act to correct any deviations from long run equilibrium. Specifically, if actual equilibrium value is too high, the Error Correction Term will reduce it while if it is too low, the Error Correction Term will raise it.

EMPIRICAL RESULTS

The Augmented Dickey Fuller (ADF) tests are applied to study the unit roots of the variables. For a given variable and null order, two values are reported in each cell. The first value is the ADF statistics and the second value in the parenthesis is the longest significant lag with significant t-value. Four lags are allowed in each variable’s ADF regression. All regressions include constant term and time trend. Table (1) shows the results of the ADF unit root tests for levels and first differences of the study variables. The t-values on the level obtained from ADF test are less than the

critical values and therefore we accept the null hypothesis of a unit root of the study variables at 5% significant level. Thus the study variables are non-stationary time series at their levels. In addition table (1) shows that the same test applied to the first differences of the variables. The results show that the calculated t-values are greater than the critical values at 5% significant level, this means rejection the null hypothesis that the series have unit roots in their first differences, which means that the variables are stationary at their first differences, and so the variables are integrated of order one I(1)

Table-1: Unit root test results

Variables	Level	1 st differences
m_t	-2.346(3)	-2.2(1)
y_t	-1.941(1)	-2.6(0)
II_t	-1.678(1)	-2.28(3)

*Critical values of ADF test for sig. (-4.047) at 1%, (-3.464) at 5%, (-3.158) at 10%. For 1st differences, (-2.727) at 1%, (-1.964) at 5%, (-1.627) at 10%.

Having established that variables are integrated of same order, we proceed to test for presence of cointegration between the variables under study. We employ Johansen cointegration test. It may be noted here that we are interested to check for the presence of cointegrating relationship between the study variables, however, number of cointegrating vectors is not of our interest. Table (2) presents the results of the null hypothesis that there is no cointegration against the alternative that there exists cointegration. Starting with the null hypothesis that cointegration does not exist among the study variables; the trace statistic value is shown to be greater than the critical values at both 5% and 1% levels. Hence, we reject the null hypothesis of no cointegration in favor of existence of cointegration for all the series at both 5% and 1% levels. The maximum Eigen statistic value indicates that 2 cointegration equations at 5% level of significance; thus, both the trace and maximum Eigen t-value test statistics indicate that there is a long run equilibrium relationship between real money demand, economic growth, expected rate of inflation and dummy variable in Bahrain during the study period.

Table-2: Johansen Panel cointegration (Trace and Maximum Eigen Value Test)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	5% critical value	1% critical value
None	0.667396	17.024	15.197	10.310
At most one	0.132376	12.751	3.962	6.936
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	5% critical value	1% critical value
None	0.667396	15.652	14.036	17.936
At most one	0.132376	11.195	3.962	6.936

Source: Researcher’s estimation using SPSS

*The critical values in the table are copied from Walter Enders, Applied Economic Time Series, Wiley Series in Probability and Statistics, 1995, page 420.

Accordingly, we can analyze the long run cointegration equation of real money demand with its

independent variables with VECM, as it is shown in table (3).

Table-3: Regression results

Variables	Coefficients	T-stat
constant	-3.32	
y_t	0.985	4.63*
Π_t	-1.63	-2.848*
Dummy	-0.256	-2.403*
R	0.978	
R ²	0.973	
Adj. R ²	0.968	
F- stat.	12.8	
D.W	2.03	

*At 0.05 significant level

It is clear from the above table the compatibility of the parameters of independent variables with the economic theory, where the real demand for money has positive relation with the real income or GDP and negative relation with the inflation rate. Moreover the periods (1997-2000) and (2008-2012) that witnessed a decline in the growth rate has negative effect on the growth of the demand for money. The estimated elasticity of demand for real income is (0.985) and for the inflation rate is (-1.63). R² shows the explanatory

variables are responsible for (97%) of the changes that occur in the real demand for money

The economic research is often looking for a clear relationship such as (y) Granger cause (m) not in the other way. Therefore the Granger causality test based on VECM is applied to variables after first differencing, with the purpose of testing whether (m) causes the (y) or vice versa. The results are presented in Table (4)

Table-4: Result of Granger causality tests

Null hypothesis	Obs.	F-statistic	Short-run Results	ECT(-1) t-statistic	Long-run Results
(y) does not cause (m) - (m) does not cause (y)	23	y: 0.8160 m: 3.9144**	y ← m	y: 0.0201* m:0.950	m ← y

Source: Researcher's estimation using SPSS

***, ** and * indicates significance at 1%, 5% and 10% respectively.

The number in parentheses is the lag length. The optimal lag length is determined based on Schwarz Information
“→ ” indicates the direction of Granger causality

Table (4) shows that in the short run, there is a unidirectional causality exists from real money demand to the economic growth. This means that real money demand Granger causes the economic growth. This result indicates that real money demand could accelerate the economic growth in the short run. While in the long run there is a unidirectional causality exists from the economic growth to real money demand; this means that the economic growth Granger causes real money demand; therefore the economic growth could stimulate the growth of real money demand in the long run.

CONCLUSION AND RECOMMENDATIONS

The current study aimed at analyzing the demand for money function (M1) in Bahrain as one of the basic indicators of monetary policy, where the stability of money demand is essential for the effective management to face of the fluctuations that come from the real sector of the economy. The results suggest that the real income or RGDP, price level, and dummy variable are the key determinants of money demand

(M1) in the Bahrain economy, where there is a cointegrating relationship between real narrow money demand and other independent variables. The estimated income elasticity of money demand is around unity while the inflation rate elasticity is negative and significant. Thus, there is no evidence that the money demand function for Kingdom of Bahrain has become unstable due to financial sector liberalization and reforms. Hence, and following Poole's analysis, we conclude that the money supply is the appropriate monetary policy instrument to be targeted by the Central Bank of Bahrain and failure to utilize the money supply as an instrument of monetary policy may result in fluctuations in the level of output.

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