Revisiting Money Demand Function for GCC Countries and Testing its Stability

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Abstract

A money demand's stability is necessary condition in choosing the appropriate monetary policy. The present study has investigated the most important determinants of money demand by using a period of 1980-2014 for a panel of Gulf Cooperation Council (GCC) countries and has also tested its stability. A unit root analysis has confirmed the mix order of integration. In the long run relationships, income and exchange rate have positive influences on money demand and inflation and interest rates are showing the negative influences. In the short run analysis, income is observed as sole determinant of money demand. Further, estimated model holds stability. Therefore, the present study suggests money supply as a policy instrument.

Key Words: Money Demand, Monetary Policy, Cointegration, Stability

JEL Codes: E41, E52, C22, C62

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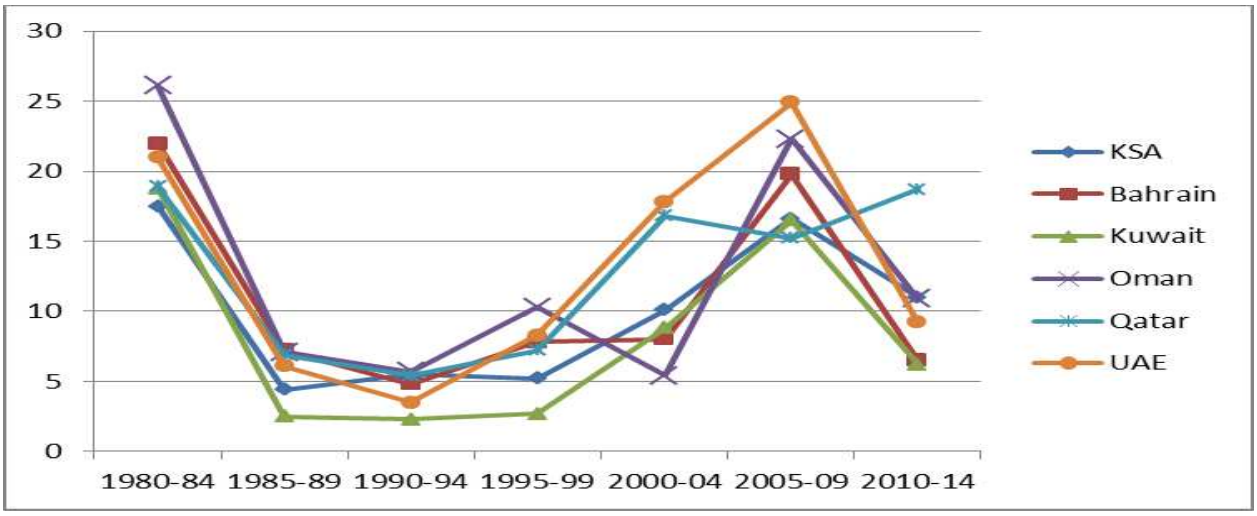
1. Introduction

Major determinants of money demand plays vital role in enacting and deciding most relevant monetary policy instrument by competent authority i.e. the central bank of any country (Goldfeld, 1994). Following it, Poole (1970) argued in the favour of money supply as policy instrument in case of a stable Money Demand Function (MDF). Further, Financial reforms, financial innovations and financial crises are becoming the major reason of MDF instability. Financial market development and financial liberalization have changed the shape of money demand and its velocity. Alike, financial crises also likened to have a great impact. For example, East Asian financial crises of 1997-98 and global financial crises of 2007-08 poured such effects on the stability of MDF in most of the world economies. So the GCC countries are no more exception to it. On the other hand, there are many unknown structural breaks in any economy in the wake of development of financial market and financial liberalization. Therefore, there is a dire need to capture the impact of such financial fluctuations (structural breaks) in the estimation of MDF for any economy and to suggest the right monetary policy instrument to meet macroeconomic policy objectives.

Every economy has its own determinants that may cater to shape the MDF, for example, economic growth targets, exchange rate devaluation and inflation and bank rates targeting. These versatile determinants change the requirement of money demand, significantly. Many other factors other than aforementioned cannot be ignored while noting impact on the MDF as per economy. In case of GCC, financial market of GCC countries has a significant share in their GDP and it is also sharply rising. The financial market is not only adaptable to modern requirements of the present age (financial market development) but also faces some structural shocks from external world as well. Aside with the discussion of demand side conditions of money, the governments of GCC countries have also their own policy objectives to monitor the supply side conditions of money to meet the challenges rising from local problem such as output gap due to high unemployment. The all international and local circumstances are changing the demand and supply conditions of money demand and are motivating researchers and policy makers to find a true MDF for any economy to suggest the right instrument and magnitude of monetary policy.

In the discussion of money supply variability in GCC countries, Figure 1 shows the money supply (M2) average percentage carrying five years' growth rates for GCC countries and is depicting very high volatility in money supply throughout the selected period. The figure shows that the period in which money growth rates remain very high i.e. period of 1980-84 counts as first phase of financial market development in all GCC countries and it significantly acts to spur money demand and to money supply, resultantly. A highest rate has been observed for Bahrain that is 22% and even least rate is very high, that is 17.5% for KSA. Afterwards, the growth rate suddenly falls in 1985-89 and remains stable for the 1990-94, afterwards. But, it shoots up again in 1995-99 except with a slight downturn in KSA. After 1995-99, the growth rates keep on rising at a greater pace except with a significant fall in growth rate of Oman and highest growth rate for UAE i.e. about 18% in a period of 2000-04. In the period 2005-09, all countries' growth rates show positive trends except a minute fall in case of Qatar and highest rate for UAE that is about 25%. This period, significantly, calls into mind the memories of financial crises in the world that hits GCC countries as well. GCC countries, in response, are trying to stabilize the economies through floating more money supply, deliberately. After this financial crises period, the growth rates tend to fall again in

all countries except with a rise in Qatar. The graph shows a high variability in the money supply growth rates that are seems to be affected by the requisites of money demand and government's policy objectives. Therefore, the present study is highly motivated to quantify the major determinants of money demand in GCC countries.



To deal with most important determinants of money demand and to verify the stability of MDF in GCC countries, the present study uses panel unit root test and Pooled Mean Group (PMG) estimators by utilizing the annual data of a period1980-2014. In this long time spam, structural breaks are likely to exist due to some local and/or international events. Further, GCC countries are still adopting the policy of financial market development to diversify their economies from oil-dependence. That can also be responsible for structural breaks in the MDF and may create biasness in estimation of long run parameters of MDF if not taken care. Therefore, the present study is aimed at capturing such breaks and is incorporating these effects in MDF to ensure the reliability of estimations. It is targeted to find separate breaks for each country and their incorporation in long run regression. This is necessary and being justified on a fact that financial reforms/ financial crises are not bound to happen at a single point of time.

2. Review of Panel Studies

There has been a vast literature on the MDF and its stability. The whole literature can be differentiated into two dimensions. First group is concerned with the estimation of money demand but not dealing with the stability issue, for example Valadkhani and Alauddin (2003), Mark and Sul (2003), Akinkunmi (2004), Dreger et al. (2007), Carrera (2012) and Hamdi et al. (2015). Valadkhani and Alauddin (2003) investigate the M2 as money demand for 8 developing countries in a period 1979-1999. A positive influence of income has been observed on money demand and interest rate spread, inflation rate and US interest rate have the negative influences. Mark and Sul (2003) investigate the MDF for nineteen- OECD countries for a period 1957-1996 by applying Dynamic Ordinary Least Square (DOLS). They find a positive income elastic influence on money demand and a negative interest rate semi-elasticity less than one has been observed. Akinkunmi (2004) investigates the MDF for 36 developing economies and has compared the dynamic panel results with the country-specific results. In the both kind of analysis, he finds a positive influence of income and a negative influence of interest and inflation rates on money demand. Dreger et al. (2007) investigate the MDF for ten European economies by using the quarterly data of a period

1995-2004. They employ the panel dynamic estimate technique after doing the integration analysis and cointegration analysis to compare US dollar exchange rate and Euro exchange rate with the ordinary determinants like interest rate and income in the MDF. They find a positive income elastic influence on money demand and a negative interest rate elasticity less than one. Further, they find a negative and significant dollar exchange rate elasticity but Euro exchange rate elasticity has remained insignificant. Therefore, they conclude dollar exchange rate as a more appropriate determinant of MDF of Euro region. Carrera (2012) estimates the MDF for fifteen Latin American states by using data of a time period 1948-2003. He applies individual country analysis and also panel group FMOLS on the group of all countries. In case of individual country analysis, he finds the positive influence of income and negative influence of interest rate on money demand in most of the countries in analysis. For the panel results, he finds about a unitary positive income elasticity and a very low negative interest rate elasticity. Hamdi et al. (2015) investigate the MDF for GCC countries for a period 1980-2011. They find a positive income elasticity less than one, negative interest rate elasticity less than one and find insignificant behavior of exchange rate in MDF.

The second group of studies focus the stability of MDF along with the discussion of its determinants, for example, Narayan et al. (2009), Bahmani-Oskooee and Rehman (2005), Setzer and Wolff (2013) and Bahmani-Oskooee and Gelan (2009). Narayan et al. (2009) investigate the MDF for five South Asian economies by using a time period 1974-2002 by individual country analysis and panel data analysis. After doing the integration analysis and confirming the cointegration, they find a positive an income elastic behavior in case of India, Pakistan, Sri Lanka and Nepal but inelastic in case of Bangladesh. A positive elasticity of real exchange rate has been found in all cases with minute magnitudes. In the short run, interest rate has negative and inelastic influence in case of Bangladesh and India. A positive inelasticity of inflation has been found in all cases except India. In case of panel results, income, real exchange rate and inflation have positively determined the money demand and interest rate has a negative impact. Further, the money demand functions of Bangladesh, India and Sri Lanka have been found stable and that proves unstable for rest of countries. Bahmani-Oskooee and Rehman (2005) estimate the stability of MDF for Asian developing economies by using quarterly data of a period 1973-2000 by applying the cointegration on determinants of M1 and M2.They apply the stability tests in the individual country analysis. They find that M1 and M2 proxies of money demand remain cointegrated with its determinants but show an unstable behavior with most of the countries in their analysis. Bahmani-Oskooee and Gelan (2009) repeat these analyses for 21 African economies by using quarterly data of a period 1971-2004. After confirming the cointegration, they test the stability tests on the estimated results for each country separately and conclude the stable MDF for all countries. Setzer and Wolff (2013) investigate the MDF for Euro area by using quarterly data of 2003-08. After doing integration analysis and confirming the cointegration in the model, they find a positive income elasticity greater than one, negative interest rate elasticity less than one and stable parameters of MDF.

Further, some of the studies also care for structural breaks in MDF while investigating the stability. Rao et al. (2009) estimate the MDF by using GMM estimates for a time period 1970-2007 for eleven Asian economies. They find a positive inelastic impact of income on money demand, negative interest rate elastic, negative inflation elastic and negative exchange rate elastic impacts on money demand. Further, they find a stable money demand function with insignificant structural breaks for Asian economies. Kumar et al. (2013) investigate MDF for eleven OECD countries by applying panel cointegration test and structural break test analysis. They find elastic income

elasticity and negative interest rate inelasticity. Further, with sub sample of break periods, they find that after structural break income parameter decreases and interest rate parameter increases. They also claim that MDF has been found stable after considering the structural breaks.

In the conclusion of the literature review, some of the studies have followed the methodology of finding structural breaks and also include these breaks in the cointegration of MDF to check the stability of the money. The studies which do not use the structural break tests, couldn't remain very clear in the conclusion to the policy recommendation. There is no single study to investigate stability of MDF in case of GCC countries though Hamdi et al. (2015) has investigated the MDF only and also do not care of structural breaks in analysis and also do not apply any stability test to ensure this issue. Therefore, the present study is going to fill this gap by finding the major drivers of money demand and it is also aiming at to find and to include the effect of most significant structural breaks in long run analysis.

3. Data, Model and Econometric Strategy

Following the empirical literature, the present study signifies the following function to estimate the MDF:

$$LMD_{it} = f(LY_{it}, R_{it}, P_{it}, ER_{it}, D_{it}) \quad (1)$$

where,
LMD_{it} = Logarithm of Money Demand (proxied by M2)
LY_{it} = Logarithm of Real GDP proxy for national income
R_{it} = Real Rate of interest
P_{it} = Inflation rate
ER_{it} = Exchange Rate
D_{it} = Dummies to capture the possible breaks in the cointegration

The annual data on all variables for a period 1980-2014 has been collected from World Development Indicators (WDI).

Im et al. (2003) Test
The first step is to estimate any time series or panel data estimation i.e. to test the stationarity of the series. As, non-stationarity can produce biased estimations. Im et al. (2003) test has been adopted the following equation to deal with this issue and to control the effect of heterogeneity:

$$\Delta Z_{it} = \beta_i + \rho Z_{it-1} + \sum_{k=1}^{n} \eta_{ik} \Delta Z_{it-k} + \lambda_{it} + \sigma_i + u_{it} \quad (2)$$

Here, Z will take the single variable for unit root test and the null hypothesis ($\rho_i = 0$) is of a unit root problem in series.

Bai and Perron Multiple Breakpoint Tests

In the long time series and panel data, there can be some unknown structural breaks. These can be responsible for the misleading results. Therefore, the consideration of these breaks in analysis is

very important for the true estimations. Bai and Perron (2003) develop the test to find the most significant breaks with n possible breaks in T time period.

$$z_t = \alpha_i' x_t + u_t \quad (3)$$

Where regimes *i=1, 2, ...,n+1*.

z_t contains matrix of LMD_t variable. x_t comprises of vector containing LY_t, R_t, ER_t and P_t. u_t is standard error.

Bai and Perron test propose the three option to estimate the break points, the present study focus on the Global maximizer tests. The test uses sums of square of residuals from the long run relationship.

$$\text{Sum } (\alpha/\text{T}) = \sum_{\text{i}=0}^{\text{n}} (\sum_{t-T_i}^{T_{i+1}-1} z_t - x_t^{'} \alpha_i) \quad (4)$$

The global break test chooses the breaks with minimum sum of square across n break partitions.

Mean Group (MG) and Pooled Mean Group (PMG)
The standard Fixed effects and random effects are not enough and may give the spurious results due to the possible endogeneity in the model. Then, the dynamic relationship can be estimated through MG and PMG estimators to avoid the endogeneity problem in the model.

Pesaran et al. (1999) extends the PMG estimators by averaging and pooling. In the cross sections, PMG allows the deviation in the intercept and other parameters. PMG estimators are the re-parameterization of ARDL model. Therefore, these are efficient even in case of mix order of integration. The ARDL (p, q) model for the estimation of PMG estimators is as follows:

$$\text{z}_{\text{it}} = \delta_i + \sum_{i=1}^{q} \alpha_i z_{i,t-1} + \sum_{i=0}^{p} \theta_i x_{i,t-1} + \varepsilon_{it} \quad (5)$$

The model can be estimated z and x approach to their steady-state points:

$$\text{z}^* = \beta_0 + \beta_1 x^* \quad (6)$$

The long run estimation can be:

$$\text{z}^* = \frac{\delta_i}{1-\sum \alpha_i} + \frac{\sum \theta_i}{1-\sum \alpha_i} x^* \quad (7)$$

The equation can be written as:

$$\text{z}^* = \beta_0 + \beta_1 x_{it} \quad (8)$$

The standard error can be estimated as:

$$\zeta_{it} = z + z^{*} \tag{9}$$

It can be written as:

$$\zeta_{it} = z_{it} - \beta_0 - \beta_1 x_{it} \tag{10}$$

The estimates of β_0 and β_1 could be find from:

$$\mathrm{z_{it}} = \delta_i + \sum_{i=1}^{q} \alpha_i z_{i,t-1} + \sum_{i=0}^{p} \theta_i x_{i,t-1} + \varepsilon_{it} \tag{11}$$

Then estimates are:

$$\beta_0 = \frac{\delta_i}{1 - \sum \alpha_i} \tag{12}$$

and $$\beta_1 = \frac{\sum \theta_i}{1 - \sum \alpha_i} \tag{13}$$

Now, the ECM can be found from the following ARDL framework:

$$\Delta \mathrm{z_{it}} = \delta_i + \sum_{i=1}^{q-1} \alpha_i \Delta z_{i,t-1} + \sum_{i=0}^{p-1} \theta_i \Delta x_{i,t-1} + \kappa_1 z_{i,t-1} + \kappa_2 x_{i,t-1} + \psi_{it} \tag{14}$$

Where, κ_1 is:

$$\kappa_1 = -(1 - \sum_{i=1}^{q} \theta_i) \tag{15}$$

κ_2 is:

$$\kappa_2 = \sum_{i=1}^{p} \theta_i \tag{16}$$

Long run estimates are as follows:

$$\beta_0 = \frac{1}{\kappa_1} \tag{17}$$

And

$$\beta_1 = -\frac{\kappa_2}{\kappa_1} \tag{18}$$

Now, to capture the short run results, ECM is as follows:

$$\Delta \mathrm{z_{it}} = \delta_i + \sum_{i=1}^{q-1} \alpha_i \Delta z_{i,t-1} + \sum_{i=0}^{p-1} \theta_i \Delta x_{i,t-1} + \kappa_1 (z_{i,t-1} - \frac{1}{\kappa_1} - \frac{\kappa_2}{\kappa_1} x_{i,t-1}) + \psi_{it}$$

(19)

$$\Delta z_{it} = \delta_i + \sum_{i=1}^{q-1} \alpha_i \Delta z_{i,t-1} + \sum_{i=0}^{p-1} \theta_i \Delta x_{i,t-1} + o_i (z_{i,t-1} - \hat{\beta}_0 - \hat{\beta}_1 x_{i,t-1}) + \psi_{it} \quad (20)$$

$z_{i,t-1} - \hat{\beta}_0 - \hat{\beta}_1 x_{i,t-1}$ is defined as lagged error term, then:

$$\Delta z_{it} = \delta_i + \sum_{i=1}^{q-1} \alpha_i \Delta z_{i,t-1} + \sum_{i=0}^{p-1} \theta_i \Delta x_{i,t-1} + o_i \omega_{i,t-1} + \psi_{it} \quad (21)$$

o_i is a coefficient of adjustment.

In the case of MG estimators, ECM is run for each country separately and δ_i, o_i and β_i are calculated. Averages of δ_i, o_i and β_i are utilized to estimate MG parameters. That requires a long time for each cross section. Therefore, MG estimators are not very efficient for a relatively small time series observations. In case of PMG estimators, maximum likelihood estimators are used for the homogeneity restriction. Therefore, long run coefficients remain same and PMG remains efficient even for small time series observations in a panel.

Hausman Test

To compare the efficiency and consistency of estimators calculated by MG and PMG, Hausman test is utilized. This test follows the χ^2-distribution. The test-statistic (H) is as follows:

$$H = (\hat{\beta}_{MG} - \hat{\beta}_{PMG})' \vartheta^{-1} (\hat{\beta}_{MG} - \hat{\beta}_{PMG}) \quad (22)$$

Where,

$$\vartheta = Variance(\hat{\beta}_{MG}) - Variance(\hat{\beta}_{PMG}) \quad (23)$$

4. Results and Interpretations

Table (1) presents the Im et al. (2003) results on our selected variables in the MDF. The results show that money demand and income have unit root at level and are stationary at their first differences. Inflation rate is found stationary both at level and its first difference. Interest rate is non-stationary at level when we test it with only intercept and it is stationary when we test it with intercept and trend. Exchange rate is stationary when we test it with intercept only but non-stationary with both intercept and trend in analysis. Unit root test analysis gives a mix order of integration but we can go forward with these results as we are using the MG/PMG estimators that are the parameterization of ARDL model.

Table 1
IPS Test

Variables	Intercept	Intercept and Trend
LMD_{it}	9.2388 (0.9999)	1.8475 (0.9677)
ΔLMD_{it}	-3.7126 (0.0001)***	-4.7636 (0.0000)***
LY_{it}	6.4631 (0.9999)	-0.7885 (0.2152)
ΔLY_{it}	-6.3600 (0.0000)***	-6.6054 (0.0000)***
P_{it}	-4.2376 (0.0000)***	-3.4309 (0.0003)***
ΔP_{it}	-9.0112 (0.0000)***	-7.8541 (0.0000)***
R_{it}	-0.3484 (0.3638)	-3.3346 (0.0004)***
ΔR_{it}	-8.4423 (0.0000)***	-7.5770 (0.0000)***
ER_{it}	-1.7851 (0.0371)**	-0.5862 (0.2795)
ΔER_{it}	-8.1099 (0.0000)***	-7.5109 (0.0000)***

Note: Δ is first difference. () contain the p-values of test statistic. *** shows rejection of null hypothesis at 1% level and ** shows at 5% level.

In the GCC countries, many financial reforms have been taken to improve the efficiency of financial markets and there are also some financial crises in the global market. Then, GCC countries are no more exception to it, in this volatile world. In the long time span of 1980-2014, there can be many structural breaks due to financial reforms and financial crises. But, these breaks are not happening at the same time in the all GCC countries. Because, each country's economy has its own unique features and monetary policies. Therefore, it is very pertinent to test the structural breaks in the individual country data set. The present study wants to incorporate the information of such breaks to avoid any biasness in the regression analysis. But to save degree of freedom in the regression analysis, the present study captures only one most significant unknown

structural break for each GCC country separately. Known breaks are not used in analysis due to a reason to capture most significant break that can affect our model most significantly. That can also be known break like world financial crises. Table (2) shows the results of Bai and Perron structural beak test with 0.15 trimming and at 5% level of significance. We have found most significant breaks in 1986, 2003, 1994, 2007 and 2001 for Saudi Arabia, Bahrain, Kuwait, Oman, Qatar and UAE respectively. The structural break of Oman is only matching with world financial crises and rest of countries have different most significant break at a single point of time. These breaks point may disturb the parameters of money demand function. Therefore, we use a dummy variable in the regression analysis to incorporate the impact of these breaks in the MDF.

Table 2
Bai and Perron Structural Breaks test

Sr. No.	Country	Structural Break
1	**Kingdom of Saudi Arabia**	1986
2	**Bahrain**	2003
3	**Kuwait**	1994
4	**Oman**	2007
5	**Qatar**	2001
6	**United Arab Emirate**	1991

In table (3), the regression results based on PMG estimators are presented. Analyses have been done with and without dummy variable in the regression to check the impact of structural breaks on the parameters of regression. For this purpose, both MG and PMG estimators have been calculated at first and Hausman test has been employed to verify the efficiency and consistency of coefficients. The test statistic of Hausman test has remained very low and its p-value has been observed very high. Therefore, PMG estimators are more reliable to elaborate and to present here.

Table 3
Results of PMG estimators

Variables	Model 1 Without Dummy	Model 2 With Dummy
Long-run coefficients		
LY_{it}	1.2079 (0.000)***	1.1439 (0.000)***
R_{it}	-0.0054 (0.0856)*	-0.0061 (0.0764)*
P_{it}	-0.0041 (0.131)	-0.0041 (0.087)*
ER_{it}	0.4317 (0.012)**	0.3863 (0.018)**
Dummy	--	0.226 (0.000)***

Error-correction term		
ECT	-0.2765 (0.001)***	-0.3079 (0.001)***
Short-run coefficients		
LY_{it}	0.3056 (0.000)***	0.2957 (0.000)***
R_{it}	-0.0034 (0.457)	-0.0028 (0.533)
P_{it}	0.0002 (0.862)	0.0010 (0.260)
ER_{it}	-2.1345 (0.288)	-2.0977 (0.297)
Intercept	-0.9369 (0.002)***	-0.8589 (0.001)***
Hausman Test	0.4600 (0.4983)	0.4400 (0.5070)

Note: Parenthesis contains the p-values test statistic. ***,** and * shows the level of significance at 1%, 5% and 10% respectively.

Table (3) represents only the results of PMG estimators with and without dummy variable. The coefficient of dummy variable has remained positive and significant. This shows an intercept shift in money demand model after the break period of each country in the analysis. Further in the long run analysis, income has a positively significant effect on money demand with income elasticity more than one in both model 1 & 2. High elasticity indicates that in the time of economic growth, money will be demand more than income growth rate. Interest rate has a negative but weakly significant effect on money demand. A negative interest and positive income effects are align with the standard theory of money demand. The coefficient of exchange rate has been observed positive and significant. It is aligned with the wealth effect hypothesis. This states that a depreciation of local currency motivates the people to demand more local currency due to increment in value of foreign asset's holding in terms of the local currency. In model 1, the impact of inflation remains negative and insignificant. But, inflation rate has a negatively significant effect at 10% level of significance in the model 2. An increase in inflation reduces the value of local currency and people increase the other asset in their portfolio to save their purchasing power. Further, the present study checks the CUSUM and CUSUM square tests to ensure the stability of MDF with incorporation of the dummy variable in the function.The figures (1a & 1b) are showing that MDF is stable. In the short run analysis, the most of regressors are showing insignificant behavior except income variable. Income is positively and significantly impacting on money demand in the both models. But income elasticity is found less than one.

Figure 1a

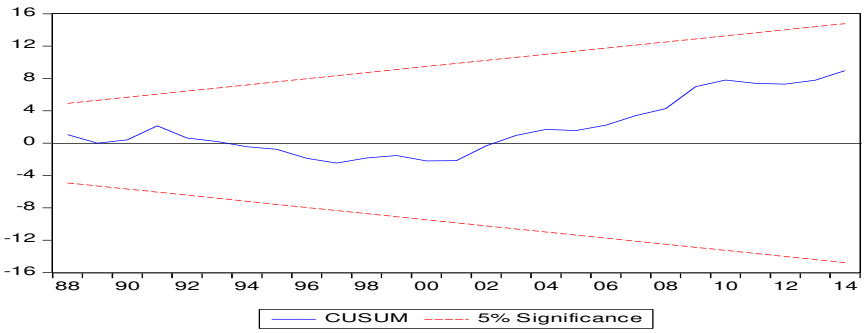
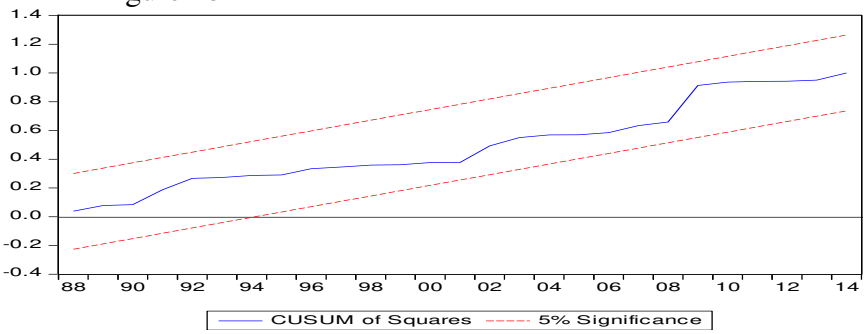


Figure 1b



5. Conclusion

The stability of MDF is prerequisite for the monetary policy in any country. The present study has investigated the most important determinants of money demand and also tests its stability by using a period of1980-2014 for GCC countries. A mix order of integration has been found in the unit root analysis. The long run results indicate that income has a positive effect on money demand with elasticity greater than unity. Exchange rate is positively determining the money demand. Inflation and interest rates have the negative effects on money demand with very small coefficients. In the short analysis, income is only determinant of money demand with elasticity less than unity. Lastly, MDF has been proved stable. Therefore, the present study suggests money supply as a valid monetary policy instrument for GCC countries.

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