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Empirical Evidence on the Long-Run Money Demand Function in the Gulf Cooperation Council Countries

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ABSTRACT

The broad aim of this paper is to estimate the money demand function for the case of six Gulf Cooperation Council countries. By applying panel cointegration tests, the empirical results reveal strong evidence of cointegration between the variables of the model for individual countries as well as for the panel. Moreover, the results support the existence of a stable money function in the long-run estimation. The Granger non-causality test due to Toda and Yamamoto (1995) procedure shows evidence of a bidirectional causal relationship between money demand and income for panel estimation. At an individual level, the results change from one country to another one.

Keywords: Money Demand, Gulf Cooperation Council, Panel Cointegration, Toda–Yamamoto
JEL Classifications: C22, C23, E52, E41, F41

1. INTRODUCTION

Since the pioneering work by Friedman (1956), the money demand function has received a great deal of attention by scholars, policymakers and governors. This is mainly due to the role of money in economy, notably in the implementation of monetary policy. Since a long time, central bankers have used money demand to control inflation through the appropriate and adjustment of the money supply (Hayo, 1999). Money demand function provides information about the portfolio distribution (Duca and VanHoose, 2004) and it plays an important role in creating an efficient and effective monetary policy strategy (Friedman, 1959; Friedman and Schwartz, 1982; Laidler, 1977; Laidler, 1982). The monetary policies can be suitable to give a clear indication about inflation in medium and long-term. Kaldor (1982) showed that money supply is considered of being a causal in the process of inflation. However, Valadkhani (2006) showed the importance of not focusing on a single policy instrument and neglect other information and variables such interest rate. Hence, interest rate and monetary aggregates are both important to select an effective monetary policy action. Further studies that have examined the wealth variable as other variable that influence money demand such as (Boone and van den Noord, 2008; de Bondt, 2009; Dreger and Wolters, 2010). Kumar et al., (2010) analyzed the level and stability of money demand in Nigeria between 1960 and 2008. The study showed that Nigeria could efficiently use the demand of money as an instrument of monetary policy.

Recently, there has been a great resurgence of interest in the issue of the role of money demand function in conducting effective monetary policy. One symptom of this phenomenon is the huge academic research on the topic investigating the demand of money at both single country level and panel or groups of countries. Hence, the aim of this study is to investigate the importance of money demand in conducting a sound monetary policy in the Gulf Cooperation Council (GCC) countries. We are interested in GCC area for different reasons. First, during the past decade GCC countries have been witnessing an unprecedented economic performance thanks to the windfall of oil revenues. The growth was on par with other emerging markets with an average rates exceeding 5-6% and much faster than advanced economies. Second, GCC governments have adopted development strategies that prioritize the modernization of their financial systems within a large economic diversification plan (Hamdi et al., 2014). Third, the region as a whole has become a hub of finance, notably center of Islamic finance and Islamic insurance, and the preferred destination of international financial companies (Hamdi and Sbia, 2014).

Fourth, these countries have fixed their national currencies in the past to the US dollar and they are planning to move toward a single currency in the few coming months. The GCC regional bank was already implemented in Riyadh and it started executing the required first step for the formation of monetary union. In addition, those countries have started a custom union and a common market grants national treatment to all GCC firms and citizens in any other GCC country, which by doing so, they have removed all barriers to cross country investment and services trade which in an effort moving closer and closer towards an economic union for those counties.

We are also interested in examine the GCC states because these countries share similar socio-economic, historical, geographical and ethnical characteristics. Finally, there is a very limited number of empirical studies that investigate monetary policy in GCC in general and money demand in particular[1]. Therefore, this aim tries to fill the gap by introducing new methodology with fresh long data series. In fact, for panel aggregated level, this paper employs three different techniques to estimate the panel cointegration: "group-mean" panel fully modified ordinary least squares estimator (FMOLS) of Phillips and Hansen (1990); Kao and Chiang (2000); and Pedroni (1999; 2000); the dynamic ordinary least squares (DOLS) estimator of Stock and Watson (1993) and finally the pooled mean group estimators (PMGE). For country level estimations, we test for cointegration using FMOLS and DOLS and the canonical cointegrating regression (CCR) proposed by Park (1992). For robustness check, we tested for causality between the variables using Toda and Yamamoto (1995) procedure. To the best of our knowledge, this technique has never been used for either one of these countries or for the any country of the Middle East and North African countries. The advantage of using the Toda and Yamamoto procedure is that it improves the power of Granger-causality test (Rimbaldi and Doran, 1996). Moreover, this procedure makes parameter inference valid even when vector autoregressive (VAR) system is not cointegrated (Hamdi, 2013). Our empirical results suggest a stable long-run money demand for GCC countries. Moreover, we find a bidirectional relationship running between money demand proxied by M2 and income.

The remainder of the paper is organized as follows: Section 2 provides a brief review of literature, Section 3 gives data description and methodology, Section 4 presents the results and finally Section 5 concludes.

2. LITERATURE REVIEW

Literature on money demand function is rich and huge. Researchers investigated this topic at both country level case study and panel of countries. For example, at single country level, Ghartey (1998) investigated the demand for money in Ghana using the Engle and Granger (1987) and Johansen's (1988) co-integration and error-correction modeling approach. The results showed that money demand in Ghana is stable. Cheong (2003) examined the impact of financial liberalization on demand of money stability in Korea. Unlike the previous studies, he demonstrated that the stability of money demand function has not been affected by the set of financial measures over the sample period. However, the author suggested that results should be taken carefully as they depend heavily on statistical properties of the model and the suitable interpretation. He concluded that the ECM model is interpreted solely as backward-looking and is also invariant to shifts in regime and various policy reforms. Lee and Chien (2008) showed that money demand in China has a significant effect on the economic and financial stability, while Baharumshah et al. (2009) and Wu (2009) demonstrate that a stability of money demand function would exist as long as there is proper accounting in use. Recently, Jawadi and Sousa (2013) estimated money demand equations for the euro area, the US and the UK using a quantile regression framework and a smooth-transition regression. The two approaches provided different findings. The quantile regression approach revealed that the income and the interest rate semi-elasticities are meaningfully different from the OLS estimates and the reaction of money demand to inflation tends to be greater when real money holdings are particularly low. The smooth transition model revealed also two motivating results. First, it captured soundly the nonlinear dynamics of the money demand function. Second, it showed that the elasticity of money demand with respect to inflation rate, interest rate, gross domestic product (GDP) and exchange rate diverges not only according to the regime considered, but also across the countries chosen in the sample.

For a panel or group of countries, Simmons (1992) explored demand for narrow money (M1) using an error-correction model for a sample of five African countries including the Democratic Republic of the Congo, Ivory Coast, Mauritius, Morocco and Tunisia. The empirical results exposed that the domestic interest rate has a significant impact on the demand for M1 in the long run in the case of Ivory Coast, Mauritius and Morocco. Further, in the short-run the influence of expected inflation on M1 was also significant for all countries except Morocco. On the same path, Fielding (1994) built a money demand function for Cameroon, Ivory Coast, Kenya and Nigeria, using quarterly data. He discovered that money demand in these countries is determined by the volatility of inflation and interest rates in addition to the usual variables such as income, inflation and interest rate. In addition, Ewing and Payne (1999) showed the influence of income and interest rates in formatting a long run stable demand for money in Austria, Australia, Finland, Italy, US, and UK. Freshly, Bahmani-Oskooees and Rehman (2005), analyzed the stability of money demand for a group of Asian emerging market countries (India, Indonesia, Malaysia, Pakistan, the Philippines, Singapore, and Thailand), and their results showed that in many of those countries real M1 or M2 monetary aggregates are cointegrated with their factors and could be unstable. Similarly, Bahmani-Oskooee and Gelan (2009) addressed the stability of the M2 demand for money in 21 African countries using quarterly data over the period 1971Q1-2004Q3. The authors designed a standard money demand function and estimated using a bounds testing approach to co-integration and error-correction modeling. The use of the CUSUM and CUSUMSQ tests to the residuals of error-correction models showed that in almost all 21 countries, M2 demand for money is stable. This could be justified integration of the error correction term when testing the stability in the long-run.

1 To the best of our knowledge, there exist only two papers on money demand in the GCC: Darrat and Al-Sowaidi (2009) have conducted the first study while Basher and Fachin (2012) have written the second paper.

In comparison to a large number of empirical works on the demand for money for other countries and group of countries, there are only a handful of empirical studies on GCC countries. At single country level, Darrat and Mutawa (1996) have used the cointegration and error-correction model to measure the money demand in the United Arab Emirates. The result of the study confirmed the support of the use of M1 as an intermediate target for monetary policy in the United Arab Emirates. Khatib-Kswani and Towaijari (1999) have studies money demand in Saudi Arabia. They regressed the log of real M1 on the log of non-oil GDP, local interest rate, expected inflation rate and real exchange rate during the instable period of 1977-1997. They used the residuals to estimate an error correction model. The result showed that influence of the interest rate is low and statistically insignificant and the researchers explained that due to Islamic values and cultural in Saudi Arabia.

In panel framework, Harb (2004) found that cointegration between money and non-oil GDP for the period of 1979-2000. The study has used Pedroni's (1999) panel cointegration method. The study found significant negative the semi elasticity of money demand in connection to interest rate. The other study by Lee et al. (2008) estimated money demand function for six selected countries of the GCC for the same period of Harb (2004) using likelihood-based cointegration tests in heterogeneous panels. The study findings were at least two cointegrated correlation in the four-dimensional vector error-correction model for the variables of the real money balance, the real scale variable, the nominal interest rate, and the exchange rate.

Basher and Fachin (2012) estimated the long-run demand for broad money at the GCC area level and at single country level over the 1980-2009 period using times series and panel techniques. First results confirmed the stability of money demand in the long-run both nationally and regionally. Further, the estimated income and interest elasticities in Qatar, Saudi Arabia and the UAE offered an authentication for the Baumol–Tobin version of the inventory analysis of the transactions demand for money. However, income elasticities in the other GCC economies reflected portfolio demand more strongly than transaction demand with lower interest rate (semi-) elasticities. They discussed how the movements in income velocity could resolve the varying elasticities documented across the six countries.

3. DATA AND METHODOLOGY

3.1. Data

We follow the pioneering works on money demand function (Arango and Nadiri, 1981; Laidler, 1985; Hoffman and Rasche, 1991; Miller, 1991; Baba et al., 1992; Stock and Watson, 1993; Mehra, 1993; Ball, 2001; Mark and Sul, 2003; Dickey et al., 1991; Miller, 1991; Mehra, 1993; Bahmani-Oskooee and Shabsigh, 1996; Valadkhani and Alauddin, 2003; Harb, 2004; among others) in which a basic representation of the long-run money demand can be described as follows:

$$\frac{M^d}{P} = f\left(\underset{(+)}{Y_P}, \underset{(-)}{r_s}\right) \quad (1)$$

Where $\frac{M^d}{P}$ represents real money proxied by M2, where nominal money stocks M^d are deflated by the CPIs ($P_{i,t}$);

($Y_{i,t}$) is the scale variable proxied by the country's income,
($r_{i,t}$) is a domestic interest rate[2] which represents the opportunity cost of holding money.

Our sample covers the six GCC countries i.e. Bahrain, Kuwait, Oman, Qatar, Arabia and UAE and data used is quarterly and covers the period 1980Q1-2011Q4. Data was obtained from different sources such as the International Financial Statistics, the World Bank (2012) as well as the Arab Monetary Fund statistical book. We use non-oil GDP (Y) as a scale variable for the four most oil producing countries: Kuwait, Qatar, Arabia and UAE and GDP for Oman and Bahrain.

Empirical papers mainly rely on equation (1), but in many cases researchers employ an augmented money demand function by adding some variables (Foresti and Napolitano, 2012). In our case, as GCC countries are open economies, therefore we will add to equation (1) a foreign opportunity cost of holding domestic money in the GCC countries proxied by two indicators which are the UK 3 months treasury-bill rate and the US Libor rate. Moreover, unlike Darrat and Al-Sowaidy (2009) our money demand equation includes the exchange rate variable. Exchange rate is the amount of the local currency per one unit of SDR (Harb, 2004). In fact, as the GCC currencies are highly linked to the US economy through the fixed exchange rate (peg), therefore, any depreciation or depreciation of the US dollar would impact automatically the local currencies of GCC countries. The inclusion of exchange rate variable in the standard function of money demand is first suggested by Mundell (1963) and later by the works of Bahmani-Oskooee (1996), Bahmani-Oskooee and Techaratanachai (2001), Harb (2004), Bahmani-Oskooee and Tanku (2006).

According to what cited above, the money demand function could be expressed as follows

$$\frac{M^d}{P} = f\left(\underset{(+)}{Y_P}, \underset{(-)}{r_s}, \underset{(-)}{E_s}\, \underset{(-)}{Tbill_s}\ \underset{(-)}{Libor_s}\right) \quad (2)$$

Where E is the exchange rate variable. Tbill and Libor are the UK 3-months treasury-bill rate and the US Libor rate.

The volatility of E leads to volatility of the domestic currency against foreign currency (or SDR).

The estimation of the semi-logarithmic linear specification of long-run money demand takes the following form. In empirical analyses, is typically preferred.

$$\ln\frac{M^d}{P} = \alpha_0 + \alpha_1 \ln y_{i,t} + \alpha_2 r_{s,i} + \varepsilon_t \quad (3)$$

α_i refers to specific effects in a country, α_1 is the income elasticity, and α_2 is the interest rate semi-elasticity; for i = 1, 2.,, N; t = 1, 2., T;

2 Given the lack of data in GCC countries, we followed Harb (2004) and we proxied interest rates by average time deposit rates.

where N = 6 and T = 124 which gives us 6*31 = 744 observations. ε represents the error term.

The augmented money demand function is expressed as follows:

$$\ln \frac{M^d}{P} = \alpha_0 + \alpha_1 \ln y_{i,t} + \alpha_2 r_{s,i} + \alpha_3 \ln E_{t,i} + \alpha_4 Tbill_{i,t} + \alpha_5 Libor_{i,t} + \varepsilon_t \quad (4)$$

Economic theory reveals that scale variable should have a positive effect on money holdings. Therefore, the income elasticity coefficient α_i is expected to be positive. Regarding the opportunity cost, it should have a negative impact on money demand; thus α_2 is expected to be negative. For the elasticity coefficient on the exchange rate variable $\alpha_3$it can be either positive or negative (Arango and Nadiri, 1981). In fact, a depreciation of exchange rate is associated with an increase in income which in turn would rise of domestic money. In this case, the coefficient of exchange rate is positive. However, an appreciation in exchange rate is associated with a decrease in domestic money demand (currency substitution. In this case, we could expect a negative sign of the coefficient of exchange rate.

3.2. Methodology

Our empirical study is divided in three steps. The first step is to test whether the variables contain a panel unit root to confirm the stationarity of M2, NOG (or GDP), Drate, Tbill, and Xrate. This is done by performing five type of panel unit root tests which are: Levin et al. (LLC, 2002), Im et al. (IPS, 2003), the augmented dickey-fuller (F-ADF), Phillips and Perron (PP, 1988) and finally Breitung (2000). The second step is to check for panel cointegration tests using Kao (1999) and Pedroni (2004) to establish a cointegrating long-term equilibrium relationship between money demand and its determinants. Finally, the third step, we test for panel cointegration by using three different techniques: FMOLS of Phillips and Hansen (1990); Kao and Chiang (2000); and Pedroni (2004) DOLS estimator of Stock and Watson (1993) and CCR proposed by Park (1992).

4. EMPIRICAL RESULTS

4.1. Panel Unit Roots and Panel Cointegration Tests

The properties of the five variables' time series are verified through the use of four types of panel unit root tests for balanced GCC panel data. These tests are the LLC, Breitung, IPS and F-ADF panel unit root tests. The two former tests assume that there is a common unit root process across cross-sections while the alternative hypothesis does not have a unit root. However, the two later tests assume that there are individual unit root processes across the cross-sections, while the alternative hypothesis of some cross sections does not contain a unit root.

The results of the LLC, Breitung, IPS and F-ADF panel unit root tests for each of the variable are displayed in Table 1. We conducted each test for the level and first difference of each variable. The results show that the series are likely to contain a panel unit root in their levels. However, when applying each variable at first difference of the panel unit root test, all tests reject the null hypothesis at the 1% level of significance indicating that they are integrated at order one,i.e., I(1).

Following Basher and Fachin (2012), as Libor is identical for all GCC countries; therefore we can test the statistionarity of the variable using the ADF and PP unit root tests. The results are displayed in Table 2 and they show that we cannot reject the null hypothesis of unit roots for Libor in level forms. However, the null hypothesis is rejected when the ADF and PP tests are applied to the first differences indicating that Libor is integrated of order one, I(1).

After checking the integration of our six variables at order one, I(1), the Pedroni, Kao and Fisher tests for balanced (GCC) panel date are used in order to verify the presence of a long-run relation between the variables in our dataset. The test results of Pedroni displayed in Table 3.

The Table 3 reveals the rejections of the null of no cointegration for six of the seven tests at 5% level of significance Therefore; one may conclude that a long-run money demand exists for the considered panel, as all its variables are cointegrated.

4.2. Long-Run Demand of Money

In this section, we proceed to generate individual long-run estimates for equation (2) of demand of money in GCC countries. However, as foreign opportunity costs are roughly identical to domestic opportunity cost, we use the domestic interest only to avoid multicollinearity. We conduct the procedurally "group-mean" panel FMOLS developed by Pedroni (1999; 2000) since the basic OLS estimator is a biased and unreliable estimator when applied to cointegrated panels. We also employ the DOLS estimator of Stock and Watson (1993) for aggregated and desagregated panel and the CCR proposed by Park (1992) for the desagregated panel.

4.2.1. Cointegration

FMOLS was firstly designed by the work of Phillips and Hansen (1990); and later by Pedroni, (1995); and, Phillips and Moon (1999) to provide optimal estimates of co-integration regressions. The method modifies least squares to account for serial correlation effects and for the endogeneity in the regressors that result from the existence of a cointegrating relationship (Phillips, 1995). FMLOS not only generates consistent estimates of the parameters in relatively small samples, but also controls for potential endogeneity of the regressors and serial correlation.

Therefore, FMOLS dominates OLS and ML estimation even in small samples in the presence of cointegration (Phillips, 1992). In order to check the robustness of our results, we therefore re-estimate the GCC money demand function applying DOLS estimator of Stock and Watson (1993) and the PMGE introduced by Pesaran et al., (1999). We compare FMOLS estimates with DOLS and PMGE for the group panel and them we conduct CCR estimations for individual countries level.

The results of the three-cointegration techniques for the bloc of six countries are displayed in Table 4. All the three estimators correct the standard pooled OLS for serial correlation and endogeneity of regressors that are normally present in long-run relationship.

Table 1: Panel unit root test

Variable	LLC		BREITUNG		IPS		F-ADF		F-PP		Order of integration
	Level	1st difference	Level	1st difference	Level	1st difference	Level	1st difference	Level	1st difference	
lnM2	2.195	−7.201***	0.092	−1.493*	−1.889**	−8.012***	50.205***	150.24***	182.57***	194.567***	I (1)
lnY	−1.993	−4.433***	−2.481***	−2.035**	−2.683***	−7.558***	37.725***	77.868**	35.928***	123.659***	I (1)
Drate	−0.171	−4.925***	−2.622***	−4.527***	−1.880**	−4.260***	18.973**	37.920***	14.204	145.512***	I (1)
Tbill	−1.679	−4.803***	−2.241**	−2.892***	−5.477***	−7.334***	47.194***	68.674***	17.288*	263.397***	I (1)
Ln Xrate	−0.715	−8.001***	−3.990***	−1.878**	−1.314*	−6.302***	12.965	56.387***	8.6788	292.061***	I (1)

All tests examine the null hypothesis of non-stationary. The tests are: Levin et al., 2002 (LLC); Breitung, 2000; Im et al., 2003 (IPS); ADF Fisher (ADF); Phillips and Perron Fisher (PP) due to Maddala and Wu, 1999. ***Statistical significance at the 1% level. The optimal lag length is selected automatically using the Schwarz information criteria. Probabilities for the ADF (Fisher Chi-square) and PP (Fisher Chi-square) tests are computed using an asymptotic χ^2 distribution. All other tests assume asymptotic normality

Table 2: Unit root test

Variable	ADF		PP	
	Level	First	Level	First
Libor	−1.5775	−10.1552***	−2.2236	−10.1646***

***Statistical significance at the 1% level, ADF: Augmented dickey–fuller, PP: Phillips and Perron Fisher

Table 3: Results of the balanced panel cointegration tests for GCC countries

Test	Statistic	P
Panel v-statistic weighted statistic	2.926981	0.0017
Panel rho-statistic weighted statistic	−3.529681	0.0002
Panel PP-statistic weighted statistic	−3.186576	0.0007
Panel ADF-statistic weighted statistic	−2.227194	0.9731
Group rho-statistic	−2.664054	0.0039
Group PP-statistic	−2.943584	0.0016
Group ADF-statistic	−2.587459	0.0048

GCC: Gulf cooperation council, ADF: Augmented dickey–fuller

Kao test	
ADF	1.978329* (0.0239)

Johansen Fisher panel cointegration test

Null hypothesis	Max-Eigen	Trace
r=0	70.74 (0.000)***	70.16 (0000)***
r<1	12.02 (0.284)	18.95 (0.240)
r<2	8.197 (0.609)	12.05 (0.281)
r<3	7.561 (0.406)	9.475 (0.487)

The optimal lag lengths are selected using SBC. Figures in parenthesis are P values. Trace test and Max-Eigen value test indicate 1cointegrating vector at the 0.01 level. ***Rejection of the null hypothesis at 1% level of significance

Firstly, it appears that FMOLS, DOLS and PMGE outputs reveal consistent and accurate results. As it was expected, income elasticity is positive and significant at 1% level of significance in all three estimations. Moreover, the income coefficient (α_1 = 0.537, 0.496 and 0.616) is approximately in line with the Baumol–Tobin model in which the income elasticity has to be β_1 = 0.5 (Baumol, 1952); Tobin (1956). The estimated coefficient of interest rates, which represents the semi-elasticity, is negative and significant at 1% level of significance. This is also in line with standard monetary theory (Friedman, 1956) as holding physical assets produce costs. The domestic interest rate represents the opportunity cost of holding money; that interest rates fall when the money supply increases, since the lower interest rates make people more willing to hold the extra cash. However, when interest rates rise, the public would prefer holding more financial assets such as treasury bills, bonds, etc. The recent boom of energy prices was associated with low interest rates have in turn stimulated the GCC economy because affordable money make it more attractive to borrow and to invest and more attractive to spend rather than save. It is worth mentioning that during the previous decade, GCC countries have experienced a buoyant economic growth and the financial sector has witnessed a boom. New financial instruments and policy have been introduced into the GCC financial market and the region has become the hub of finance and insurance industry. Consequently, GCC households tend to adopt more and more new sophisticated interest-bearing assets rather than placing their money is saving account. The change in GCC households' behaviors has simulated money demand in these countries.

Regarding exchange rate, it appears to impact positively money demand in GCC countries but not significant. This shows that the appreciation of GCC currencies could raise money demand but it also shows that the substitution effect does not have serious consequences on GCC economies as they have pegged their currencies to US dollar, except for Kuwait. According to the results above, we can conclude that there is evidence of a cointegrating money demand among Gulf Arab countries. This fact is important since there is the project of a GCC monetary union is under implementation.

Turing now to individual country level, the estimation results are based on FMOLS, DOLS and CCR. The results are displayed in the Table 5.

The coefficients of FMOLS estimations presented in Table 4 show that the income elasticities are positive for all the countries as well as for the panel. These elasticities are ranging from 0.057 for Bahrain to a whopping 1.32 for UAE. The result of an income larger that unit is not surprising. It is even a common finding in both time series and panel data papers on money demand. Income elasticities for Bahrain, Oman and KSA are in line with the Baumol–Tobin model which predict a magnitude of 0.5 for α_1 while Kuwait, Qatar and UAE follow the quantitative theory which predict a magnitude of 1 for α_1. Results also show that all the coefficients are significant except for Oman.

Similarly, the interest semi-elasticity has the expected sign for the six countries as well for the Panel and its coefficient is ranging from −0.08 for Bahrain to −0.068 for Qatar meaning that there exist an inverse relationship between interest rate and demand for money. The sign is consistent with our postulate. However, it is not significant for Kuwait only.

Table 4: Long run money demand in GCC countries

Variable	FMOLS			DOLS			PMGE		
	ln*Y*	Dr	ln*E*	ln*Y*	Dr	ln*E*	ln*Y*	Dr	ln*E*
Panel	0.537***	−0.041**	0.359	0.496***	−0.032***	0.229	0.616***	−0.004***	0.352
GCC	*0.06411*	*0.011636*	*0.227683*	*0.069419*	*0.011154*	*0.248933*	*0.001413*	*0.003627*	*0.010596*

***Rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively. Numbers in italic are the standard deviations. FMOLS: Fully modified ordinary least squares estimator, DOLS: Dynamic ordinary least squares, PMGE: Pooled mean group estimation, GCC: Gulf Cooperation Council

Table 5: Long run money demand in GCC countries

Variables	FMOLS			DOLS			CCR		
	LnY	Dr	Ln E	LnY	Dr	Ln E	LnY	Dr	Ln E
Bahrain	0.615***	−0.050*	−0.818	0.647***	−0.033	−0.158	0.606***	−0.05	−0.844
(GDP)	*0.126*	*0.03*	*0.562*	*0.123385*	*0.032331*	*0.500457*	*0.112164*	*0.034405*	*0.551134*
Kuwait	0.968***	−0.008	−0.002	0.927***	0.002	0.021	0.832***	−0.013	0.08
	0.102306	*0.019762*	*0.099245*	*0.101759*	*0.020863*	*0.088115*	*0.085596*	*0.017951*	*0.09882*
Oman	0.577165	0.023174	1.207942	1.263***	−0.043*	−0.569	1.273***	−0.041*	−0.733
(GDP)	*0.172664*	*0.02054*	*2.797811*	*0.198265*	*0.026708*	*1.602292*	*0.180169*	*0.02372*	*1.227877*
KSA	0.597*	−0.088***	1.199***	0.721**	−0.069***	1.267*	0.782**	−0.088***	1.621*
	0.220735	*0.019212*	*0.130946*	*0.234913*	*0.014331*	*0.12454*	*0.216301*	*0.019556*	*0.135497*
UAE	1.320***	−0.023*	1.201	1.284***	0.023*	1.259	1.326***	−0.024*	1.169
	0.077236	*0.015711*	*0.13272*	*0.0859*	*0.017952*	*0.150672*	*0.076778*	*0.015785*	*0.135966*
Qatar	0.933***	−0.068*	1.462	0.934***	−0.054*	1.731	0.931***	−0.069**	1.519
	0.109416	*0.031127*	*0.057314*	*0.052956*	*0.028601*	*0.05453*	*0.050062*	*0.027251*	*0.04562*

***Rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively, Numbers in italic are the standard deviations. FMOLS: Fully modified ordinary least squares estimator, DOLS: Dynamic ordinary least squares, CCR: Canonical cointegrating regression, GCC: Gulf Cooperation Council, GDP: Gross domestic product

Consistent with the literature on currency substitution, the benchmark money demand function is extended by the real effective exchange rate (*E*). The few panel data studies including exchange rates produce ambiguous results. The coefficients take values between −1.73 (Rao et al., 2009) and +0.31 (Narayan et al., 2009). In this paper, the results show that the coefficient varies between −0.002 for Kuwait to 1.46 for Qatar.

The results of FMOLS and DOLS and CRR are in somewhat identical in our case. All the three procedure reveal on the one hand a positive relationship between output and money demand and a negative relationship between interest rates and money demand on the other hand. Regarding exchange rate, the results diverge among the countries. While it impact negatively money demand in Bahrain and KSA in FMOLS estimations, its coefficient but remains negative for Bahrain but becomes positive for KSA as well as the other countries in DOLS estimation. In CCR, Bahrain and Oman have a negative sign of exchange rate coefficients while the other countries have positive impacts.

4.2.2. Granger non-causality tests: Toda and Yamamoto procedure

In this section we will test for causality between the variables of our study by using Granger causality procedure due to Toda and Yamamoto (1995).

4.2.2.1. Granger no-causality test

Toda and Yamamoto (1995) introduce a method that is used to estimate unrestricted VAR by the use of a modified Wald test for restrictions on the parameters of the VAR (*k*) model and estimates a VAR [*k*+*dmax*], where *k* is the lag order of VAR and *dmax* is the maximal order of integration for the series in the system (Hamdi, 2013). The multivariate framework of our case study can be expressed as follows:

$$\ln\frac{M^d}{P} = \alpha_1 + \sum_{i=1}^{k+d\max} \beta_{1i} \ln\frac{M^d}{P}_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} \ln Y_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} Dr_{t-i} + \sum_{i=1}^{k+d\max} \beta_{1i} \ln E_{t-i} + \mu_{1t} \quad (5)$$

$$\ln NOG_t = \alpha_2 + \sum_{i=1}^{k+d\max} \beta_{2i} \ln\frac{M^d}{P}_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} \ln Y_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} Dr_{t-i} + \sum_{i=1}^{k+d\max} \beta_{2i} \ln E_{t-i}\mu_{2t} \quad (6)$$

$$\ln Dr_t = \alpha_3 + \sum_{i=1}^{k+d\max} \beta_{3i} \ln\frac{M^d}{P}_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} \ln Y_{t-i} + \sum_{i=1}^{k+d\max} \beta_{3i} Dr + \sum_{i=1}^{k+d\max} \beta_{3i} \ln E_{t-i} + \mu_{3t} \quad (7)$$

$$\ln E_t = \alpha_4 + \sum_{i=1}^{k+d\max} \beta_{4i} \ln\frac{M^d}{P}_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} \ln Y_{t-i} + \sum_{i=1}^{k+d\max} \beta_{4i} Dr + \sum_{i=1}^{k+d\max} \beta_{4i} \ln E_{t-i} + \mu_{4t} \quad (8)$$

Where $\ln\frac{M^d}{P}$, is the logarithm of real general stock of money, ln*Y* is the logarithm of real non-oil GDP for Kuwait, Qatar, Arabia and UAE and it is replaced by GDP for Oman and Bahrain; Dr is the domestic interest rate and finally E is the exchange rate.

The basic procedure of conducting the Toda–Yamamoto method involves two phases. The first step consists in determining the lag length (*k*) of VAR model and the maximum order of integration (*d*) of the time series variables in the system. After the selection of optimum lag length VAR (*k*) and the order of integration *dmax*, a level VAR is estimated with a total of [*k*+*dmax*] lags. The second step requests the application the standard Wald tests on the first (*k*) VAR coefficient matrix to make Granger causal inference using a chi square (χ^2) distribution 1.

4.2.2.2. Results

We already determined the order of integration of the series (*dmax*) and we showed that the series are integrated of order one. Now we determine the optimal lag length of the model using the sequential modified LR test statistic (LR), final prediction error, akaike information criterion, Schwarz information criterion, and Hannan–Quinn information criterion. The result of selecting optimal lag length of VAR indicates that lag order of VAR (k) is 2, for multitrivariate VAR.

As our series are I(1), this means that, *dmax* = 1. Further, the result of selecting optimal lag length of VAR indicates that lag order of VAR (k) is 2, for multivariate panel VAR. Therefore, we can estimate a VAR system in levels with a total of *dmax*+*k* lags for each country. The results are displayed in Table 6.

Different interesting conclusions could be drawn from Table 7. First, the panel estimation shows the existence of a bidirectional relationship between money demand proxied by M2 and income. This conclusion shows the interdependence between the two variables. A high money demand boosts non-oil GDP sector in GCC which in turn would improve the diversification of GCC economies and would lower their dependency to oil revenue and natural resources rents. During the past few years, GCC governments have undertaken huge structural reforms to diversify their economies as oil and gas are exhaustible resources. The diversification' strategy differs from country to another one. For example, while Bahrain and Qatar focused on the role of the financial sector and they have become hubs of finance in the region, UAE have focused their diversification in infrastructure to attract FDI and tourism. Oman also has become the preferred destination for luxury tourism while KSA is the preferred destination of large international manufactories. Second, the result shows also a unidirectional relationship running from domestic interest rate to money demand M2. This is in line with the quantity theory of money, which indicates the negative relationship between money demand and interest rate. This result also confirms our finding in Table 4.

Table 6: Lag length criteria for panel GCC

Lag	Log L	LR	FPE	AIC	SC
0	−2668.939	NA	1.378113	11.67222	11.70827
1	1220.622	7694.197	6.21e-08	−5.242890	−5.062677
2	1424.956	400.6386	2.73e-08*	−6.065311*	−5.740929*
3	1440.378	29.96859	2.74e-08	− 6.062787	−5.594235
4	1456.002	30.08686*	2.74e-08	− 6.061143	−5.448420

*Lag order selected by the criterion, FPE: Final prediction error, AIC: Akaike information criterion, GCC: Gulf Cooperation Council

At an individual level, the unique common result is the existence of a unidirectional relationship running from money demand to income for all the six countries. This result supports the one found in Table 5, which indicates the long run stability of money demand in all GCC countries.

Regarding the other results, they diverge from one country to another one. For example, Qatar is the only country is which it exist a bidirectional relationship between money demand and income. Moreover, there exist a double unidirectional relationship running from M2 to domestic rate and the other one running from income to domestic rate in Qatar, Bahrain and Oman. Kuwait is the only country in which exchange rate granger cause income. This is may be due to the fact that Kuwait in the only country in GCC that adopted since May 2007a peg to an undisclosed basket most likely dominated by the dollar. For UAE, there exists any other obvious granger causality between the variables beside the unique unidirectional relationship running from M2 to income. Finally, the results reveal a unidirectional relationship running from domestic rate to exchange rate in Oman only. This is may be due to rigid fixed exchange rate policy adopted by the Central Bank of Oman.

5. CONCLUSION AND RECOMMENDATIONS

In this paper, we estimated and analyzed the aggregate and individual long-run money demand functions of the six GCC

Table 7: Toda and Yamamoto Granger causality results

Direction	Panel GCC	Bahrain	Kuwait	Oman	KSA	UAE	Qatar
ln*Y*→lnM2	9.201***	0.184	0.702	0.0289	1.045	0.258	6.430***
Dr→lnM2	4.046**	0.844	0.008	0.015	2.286	0.950	0.762
E→lnM2	0.008	0.0105	1.224	0.0495	1.681	0.011	1.340
M2→ln*Y*	4.924**	4.537**	7.576***	2.855**	3.318**	2.972**	5.016**
Dr→ln*Y*	0.056	0.433	0.129	0.699	5.175**	0.131	0.685
E→ln*Y*	182	1.493	0.000***	1.340	0.021	0.007	0.415
lnM2→Dr	0.055	3.401**	0.026	76.48***	38.147	0.353	84.322***
ln*Y*→Dr	0.0765	13.714***	0.023	74.371***	0.715	0.026	17.394***
E→Dr	0.058	0.0294	0.312	0.536	1.241	0.005	3.080
lnM2→E	0.422	0.353	1.13071	1.255596	0.652	0.299	1.626
ln*Y*→E	0.0634	0.694	4.470	1.010	0.170	0.014	0.038
Dr→E	0.936	0.008	0.100	7.336***	1.416	0.118	0.068
P=*K* + *dmax*	(2)	(2)	(4)	(3)	(2)	(2)	(4)

***Rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively, GCC: Gulf Cooperation Council countries during the period 1980Q1-2011Q4. After checking for stationarity of the different variables of the model using Panel unit root test, we applied the panel FMOLS, PDOLS and PMGE method to estimate the long-run money demand function for six GCC countries. From an aggregated analysis, we found that income elasticity is around 0.5 (FMOLS−α_1 = 0.537, DOLS α_1 = 0.496 and PMGE α_1 = 0.616) which is in line with the Baumol–Tobin model in which the income elasticity has to be β_1 = 0.5 (Baumol, 1952); Tobin (1956). The estimated coefficient of interest rates, which represents the semi-elasticity, is negative and significant at 1% level of significance (FMOLS−α_2 = −0.04, DOLS α_2 = 0.03, and PMGE α_2 = 0.04). This is also in line with standard monetary theory (Friedman, 1956) as holding physical assets produce costs. The empirical literature using aggregated time series data. Panel cointegration tests provided evidence in favor of a stable long-run money demand function. Moreover, similar results were found in the disaggregated analysis (individual countries). The Granger non-causality test due to Toda and Yamamoto (1995) procedure shows evidence of a bidirectional causal relationship between money demand and income. At an individual level, the unique common results between the countries are the evidence of a unidirectional causality running from M2 to income. Finally, the overall results show that exchange rate does not affect long-run money demand functions of the six GCC countries. The purpose of this study is to demonstrate the importance of money demand in conducting a sound monetary policy because the central banker in GCC countries would needs to make sure the elasticities are stable throughout time. This is one of the several requirements of a successful monetary union. The stability of the money demand function plays a central role for the importance of money for the monetary policy; especially because the GCC countries are moving toward a single currency managed by a single central bank. The goal of having union monetary policy strategies in GCC countries would support the price stability because many of those countries have faced an increase in inflation since 2002, which was accompanied with oil price boom. In fact, inflation decreases the purchasing power of consumers in the GCC countries. This research is important in this period because the GCC countries are trying to move toward creating of a Monetary Council and a single currency.

As well, the paper would examine the influence of the variables on the money demand in those countries. The idea behind studying those countries is motivated by the location of these countries in the same region, which make it a candidate for any future trade and or monetary union. As well, these five countries broadly share similar socio-economic characteristics. However, there have been some unexpected setbacks to achieving the monetary union for those countries (Khan, 2009). Nevertheless, The International Monetary Fund (2013), in its "World Economic Outlook April 2013" stated that GCC would need to endure with reforms, which would add the pace of economic diversification and sponsorship with job creation.

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