The Effectiveness of Monetary Policy And Money Demand Function Stability In A Developing Economy: Empirical Evidence from the State of Kuwait

Abdullah Ghazi Alazemi [1]
Rashed Dakheel Alenezi [2]
Abdullah Raja Alotaibi [3]
P.A.A.E.T
College of Business Studies

Abstract

A stable money demand function plays a vital role in the analysis of macroeconomics, especially in the planning and implementation of monetary policy. This paper aims to examine the stability and behavior of the money demand function in Kuwait during two different periods. Where the first period extent between the first quarter of the year 1980 until the fourth quarter of the year 1998, which represents the political instability in the Arabian Gulf area. The second period between the first quarter of the year 1999 until the second quarter of the year 2018, and this period represents the political stability in the State of Kuwait.

Hence, the real money balances (M1) is used by the error-correction models (ECM) technique to explain the short-run stability

[1] An associated professor in economics at The College of Business Studies.
[2] An associated professor in economics at the College of Business Studies.
[3] An assistant professor in economics at the College of Business Studies.

and behavior of M1, where ordinary least squares (OLS) technique is used to explain the stability and the behavior of M1 in long-run.

The function of demand for money for Kuwait, whether short-term or long-term, is stable between the first quarter of the year 1999 and the second quarter of 2018, as well as stability in the full data between the first quarter of 1980 and the second quarter of 2018, which means that monetary policy is effective during these periods according to the estimated results of these functions.

الملخص

دالة الطلب على النقود المستقرة تؤدي دورا حيويا في تحليل الاقتصاد الكلي ، ولا سيما في تخطيط السياسة النقدية و تنفيذها . و تهدف هذه الورقة البحثية إلى دراسة استقرار و سلوك دالة الطلب على النقود في دولة الكويت خلال فترتين زمنيتين مختلفتين ، حيث تمتد الفترة الزمنية الأولى من الربع الأول من عام 1980 إلى الربع الأخير من عام 1998 و التي تمثل النزاعات السياسية في اقليم الخليج العربي ، بينما تمتد الفترة الثانية من الربع الأول من عام 1999 إلى الربع الثاني من عام 2018 حيث تمثل فترة استقرار سياسي في دولة الكويت .

و قد تم استخدام الكتلة النقدية (M1) بواسطة تقنية نموذج تصحيح الأخطاء (ECM) لشرح سلوك و استقرار دالة الطلب على النقود في المدى

القصير ، و تم استخدام تقنية المربعات الصغرى (OLS) لفحص استقرار وسلوك دالة الطلب على النقود في المدى الطويل .

أن دالة الطلب على النقود سواء شبه اللوغاريثمية ذات الأجل القصير أو الدالة في الأجل الطويل يتميزان بالاستقرار خلال الفترة ما بين 1999 في الربع الأول إلى الربع الثاني من عام 2018 و كذلك بالاستقرار عند كامل البيانات لدولة الكويت ما بين الربع الأول من عام 1980 إلى الربع الثاني من عام 2018 مما يعني أن السياسة النقدية فعالة خلال تلك الفترات حسب النتائج التقديرية لتلك الدوال.

Introduction

The function of money demand, has rich studies and one of the most investigated macroeconomic relationships, which is meant to help the monetary authority to understand what motivates economic agents to hold money. Therefore, the monetary authority can decide which monetary targets and policies are recommended under specific economic conditions.

Since the late fifties and early sixties many economists were very concern and presented extensive studies in regard of the money demand function whether is “stable”, which is one of the most important recurring issues in the theory and application of macroeconomic policy. Many studies, such as Friedman (1959), Meltzer (1963) and Laidler (1966), have provided generally satisfactory results, in the sense that results match the general theory of money demand. However, this literature is criticized by Courchene and Shapiro (1964), who identified certain dynamic problems with it, such as difficulties with autocorrelation and the once-lagged money stock possesses a significant role. According to Miller (1991), a distinction between the long-run and short-run demand for money should be made. Chow (1966) argues that short-run money demand adjusts slowly toward long-run equilibrium. For Miller (1991, p.139), "this stock-adjustment specification has weathered significant storms and remains the centerpiece of many money demand studies." If the expectation of the existence of the long-run equilibrium is met, the last step is to use the Error Correction Mechanism (ECM) test to estimate the short-run dynamic adjustment equation which identifies how changes in the money stock responds to changes in the determinants of long-run money demand (Handa, 2000). Hence, this paper uses cointegration and ECM to investigate the equilibrium relationship between the demand for money and its explanatory variables in the State of Kuwait.

The literature underscores two major points relevant to modeling and estimating the function of the demand for money: variable selection and representation, and framework chosen. Failure to provide due consideration to these issues has tended to yield poor results. For the first point, proper specification of opportunity cost variables happens to be the most important factor in getting meaningful results. In regard of the second point, the chosen system should be free of theoretical estimation problems, and should perform well in empirical testing. The error-correction models (ECMs) have shown to meet these criteria.

The stability of money demand function states that the money supply has a potential impact on both economic activity and inflation.

A glance through the literature reveals that the investigation of money demand stability has multiple implications. First, it helps to make an adequate choice of a monetary policy instrument because the instability of money demand is a major determinant of liquidity preference (Kumar et al., 2013). Second, a stable money demand implies a stable money multiplier, ensuring a correct predication of the effects generated by money-supply shocks on the aggregate income, according to the monetarist view (Narayan, 2010). Third, and very important, the stability of money demand provides valuable information for the nexus between money and inflation.

Theoretically and empirically, the equilibrium relationship between the demand for money and its explanatory variables plays an important role in macroeconomic models.

A stable money demand function plays a vital role in the analysis of macroeconomics, especially in the planning and implementation of monetary policy. When investigating the theory of money demand, there are some important issues that need to be considered, such as the choice of the appropriate measure of money, the scale variable (income or wealth) and the opportunity cost variable (short-term or long-term interest rates). This paper estimates a stable long-run equilibrium relationship between real money demand (M1) and its explanatory variables in the State of Kuwait, using cointegration and error correction methods. The results obtained confirm the existence of such stable equilibrium relationships.

The State of Kuwait is an oil country, and its economy is affected by number of factors that led to an instability of its economy. These factors such as the crash of the Kuwaiti Stock Market in early 1980's, the Iraqi-Iranian war that continued until late of the 1980's, the Iraqi invasion of Kuwait in August of 1990 that continued for seven months, and the Iraqi threats that continued after freedom until late of 1990's .

From the brief history of the above events and incidents that Kuwait suffered from in the last three decades, one would expect that these events and incidents have negative effects on the stability of money demand function in The State of Kuwait. Therefore, we expect the demand function to be instable during the period between 1980:Q1 and 1998:Q4 where Kuwait is affected by such economic and political situations in the Arabian Gulf region, but stable after 1999:Q1 due to the economic and political stability in Kuwait.

Vital Importance of the stability

The stability of the money demand function has important implications for the way monetary policy is conducted. In particular, if the money demand function becomes unstable, velocity is more difficult to predict. Setting rigid money supply targets in order to control aggregate spending in the economy may not be an effective way to conduct monetary policy.

A stable money demand function appears to involve three key elements. (1) the function of demand for money relation should be highly predictable in a statistical sense if measured by the usual "goodness-of-fit" statistics, precision of estimate coefficients, and its ability to forecast accurately. (2), a stable money demand function has relatively few arguments. A relationship requiring knowledge of a large number of variables in order to pin it down is, in effect, not predictable. (3), the variables that appear as arguments in the money demand function should represent significant links to spending and economic activity in the real sector.

The economist Goldfeld (1973) found that the quarterly demand function for money was most stable when: (1) a "narrow transactions" definition of money was used; [4] (2) a short-term market rate of interest like

[4] However, in the United States the evidence shows that the demand for M1 became unstable in the 1980's due to financial deregulation and innovations. For example, see: Judd, John and John Scadding. "The Search for a Stable Money Demand Function: A Survey Of the Post-1973 Literature." ***Journal of Economic Literature*****. Vol. XX. (September, 1982), pp. 993-1023.**

the Treasury bill or commercial paper rate was used and the rate on savings deposits was included; (3) measured income (real GNP) was used rather than permanent income or wealth; (4) "lagged money" was included to allow for incomplete adjustment in the short-run.

The stability of the money demand function is also crucial when considering whether the central bank should target interest rates or the monetary base.

Literature Review

As early as the late fifties, the quantity theorist maintained that the demand for money is highly stable, and underlined its importance for transmission of monetary impulses into prices. However, during the 1980s, several elements, such as financial innovations and the deregulation process, put into question the concept of money demand stability which is reported in the paper of Lucas and Nicolini, (2015). Also, Friedman and Kuttner (1992), in their study report a break in the cointegration relationship around 1980 for the United States (US), a new instability literature emerged, characterized by the consideration within the money demand function of substitutes for money.

There is a different variety of money demand theories emphasizing the transactions, speculative, precautionary or utility considerations. These theories implicitly address a broad range of hypotheses. One notable aspect, however, is that they share common important elements (variables) among almost all of them (Adam, Christopher S., 1992). In general, they bring forth relationship between the quantity of money demanded and a set of few important economic variables linking money to the real sector of the economy (Judd and Scadding, 1982, p. 993). What sets apart among these theories is that although they consider similar variables to explain the demand for money, they frequently differ in the specific role assigned to each (Streken, E., 2004). Consequently one consensus that emerges from the literature is that the empirical work is motivated by a blend of theories.

Based on the general framework, this section provides a brief overview of issues in regard of the selection and representation of variables, modeling, and estimation. Sriram (1999) presents detailed account of these issues, including relevant references justifying various approaches undertaken by the researchers. The extensive literatures show that money demand has been estimated for various aggregates, their components, or certain combination of these components. As definitions of money differ across countries (Boughton, 1992, Kumah, 1989 ,and Nwaobi, 2002), measures considered, including divisia aggregates, also varied across studies.

Scale variable is used in the estimation as a measure of transactions relating to the economic activity. It is usually represented by variables expressing income, expenditure, or wealth concept (although a host of other variables is discussed in the literature). The price variable is selected to follow closely the chosen scale variable, although consumer price index is the most commonly used measure.

But the economic theory does not provide any rationale as to the correct mathematical form of the money demand function. There is consensus, however, that the log-linear form is the most appropriate functional form (Zarembka, 1968). While money and scale variables typically enter in logarithms, interest rate variables appear either in levels or in logarithms (Owoye and Onafowora, 2007).

The earlier ECMs on money demand tended to be based on the single equation co-integrating relationship between money and the chosen scale variables as developed by Engle and Granger (1987).

Those who have used co-integration techniques to test for the existence of a long-run, equilibrium M1 demand function, however, have found mixed results. For example, Miller (1991), and Hafer and Kutan (1994) do not find a long-run equilibrium relationship between real M1, real income, and a short-term nominal interest rate.

Other analysts including Hoffman and Tahiri (1994), Dickey, Jansen and Thornton (1991), and Drama and Yao (2010), on the other hand, have presented evidence favorable to the presence of a long-run relationship among these variables. [5]

Whether money demand is stable is an empirical question that provides important insight for theory and policy making. Empirical studies of money demand include Nachega (2001), Anoruo (2002), Nell (2003), Akinlo (2005), Nwafor et al. (2007), and Bahmani-Oskooee and Gelan (2009).

Early studies in this area focus on the US economy and show mixed evidence. Laumas and Mehra (1977) examine the stability of the US money demand using annual data for the period 1900-1974. Their varying parameter technique, which regresses money on income and interest rates, shows that money demand is not stable. Opposite findings are advanced by Lin and Oh (1984), who employ switch-regression techniques and document money demand stability. These results are confirmed by recent works on the post-war stability of money demand in the US. Along this line, Arize et al. (2012)

[5] Sample periods, measures of income and interest rates, tests for cointegration, and estimators of cointegrating vectors used in these studies differ. These factors outwardly appear to explain part of different results found in these studies. However, as shown in Stock and Watson (1993), the main reason for the sensitivity to the sample period and estimator used is the presence of multicollineariry between real income and interest rate in the post-World War II period. The presence of this multicollinearity has made it difficult to get reliable estimates of the long-run money demand parameters. Stock and Watson (1993), however, note that the disappearance since 1982 of the trend in interest rates has reduced the extent of this multicollinearity. This may make it possible to get more reliable estimates of the long-run money demand function over the sample period that includes more of post-1982 observations.

examine the long-run stability of money demand using the Johansen cointegration technique. Further, Miller et al. (2017) resort to nonlinear cointegration techniques and document the stability of money demand in the US.

Liu and Kool, (2018) reported in their study that the money demand stability in the EU are generally oriented on the Euro Area monetary stabilization as a whole.

Adopting a different strategy, Setzer and Wolff (2013) focus on the stability of money demand for the selected Euro Area countries, using disaggregated data. Their cointegration relationship is generated from a micro-founded money demand model, and the results show that the income and the interest rate elasticity remain stable over time. Capasso and Napolitano (2012) add another piece of evidence to the stability of money demand in the Euro Area countries.

Applying a bounds-testing approach to error-correction modelling and cointegration, Bahmani and Kutan (2010) show that money demand in the case of the CEE countries is quite stable. Further, Bahmani-Oskooee et al. (2013) introduce uncertainty and monetary volatility in the money demand equation for six CEE and four other emerging economies.

Dritsaki, Chaido, and Melina (2014), found that there exists a well determined instability for money demand and its dynamics, which is adequately captured by cointegration and error correction models. Finally, their conclusions from the estimation of the impulse response functions show that interest rate causes the largest shift in money demand as well as in industrial production.

The Goal of the study

A stable money demand function plays a vital role in the analysis of macroeconomics, especially in the planning and implementation of monetary policy.

Therefore, the goal of this study is to examine the stability and behavior of the function of the demand for money. The demand for money function (M1) is reformulated using error-correction models (ECM) techniques to explain the short-run behavior, where ordinary least squares (OLS) techniques are used to explain the stability and the behavior of M1 in long-run. Much of the recent work on Ml demand has focused on the search for a long-run money demand function. In fact, those economists, who have found a long-run cointegrating relationship between Ml and its explanatory variables (like real income and interest rates), either have not constructed error-correction models of money demand or have constructed but failed to evaluate them for parameter stability and for explaining Ml's short-run behavior. [6]

This paper makes the basic assumption that there exists a long-run equilibrium relationship between demand for real balances, real income, and an opportunity cost variable. Under this assumption, error-correction models of M1 demand are constructed.

The Plan of the Study

The study plan is divided into four parts. Part I: The estimation procedures; the general specification of the money demand function, the basic error-correction model, and the review of the Engle-Granger test for cointegration. Part II: The data and specifications. Part III: The empirical results and analyses. Part IV: Conclusion.

Part I. The Estimation Procedures

[6] **Only Hoffman and Rasche (1991) estimate the short-run error-correction model for M1, under the long-run specification that real M 1 balances depend upon real income and a short-term interest rate. One important exception is the study by Baba, Hendry and Starr (1991), where the postulated long-run M1 demand function is complicated and differs substantially from that used by others. In particular, they assume that real M1 balances depend upon real income, one-month T-bill rate, the spread between long- and short-term rates, learning-adjusted yields on Ml and M2, and a moving standard deviation of holding period yields on long-term bonds. Given this long-run specification, they estimate an error-correction model for Ml and show that the model is stable over the sample period 1960Q3 to 1988Q3 studied there. The evaluation of this money demand model is outside the scope of the present study.**

The general specification of the money demand function

The general specification begins with the following functional relationship for the long-term demand for money:

$$(M1) = f(Y^{+}, R^{-}) \quad (1)$$

where the demand for real balances (M1) is a function of the real income variable (Y) to represent the economic activity and the rate of return on money (R).

Like in theoretical models, the empirical models generally specify the money demand as a function of real balances (Laidler, 1993).[7]

Using equation (1) to derive the general form of the error-correction money demand model is given below.

$$\ln(Ml)_t = \beta_0 + \beta_1 \ln(Y)_t + \beta_2 R_t + U_t \quad (2)$$

[7] **Using the real money balance as the dependent variable will also mean that price homogeneity is explicitly imposed into the model. Additionally, there are less severe econometric problems associated with using real rather than nominal balances as the dependent variable (Boughton, 1981, and Johansen, 1992 b). And, majority of the empirical work does find evidence for the demand being for *real* balances.**

$$\Delta \ln(M1)_t = \delta_0 + \sum_{s=1}^{n1} \delta_{1s} \Delta \ln(M1)_{t-s} + \sum_{s=0}^{n2} \delta_{2s} \Delta \ln(Y)_{t-s} + \sum_{s=0}^{n3} \delta_{3s} \Delta \ln(R)_{t-s} + \sum_{s=0}^{n4} \delta_{4s} \Delta^2 \ln(p)_{t-s} + \delta_5 U_{t-1} + \epsilon_t \quad (3)$$

where M1 represents real narrow money balances; Y real income; R a short-term nominal interest rate; p the price level; U and ϵ, random disturbance terms; <u>In</u> the natural logarithm; Δ and Δ^2 the first- and the second-difference operators. Equation (2) is a long-run equilibrium M1 demand equation, which says that the long-run equilibrium demand for real Ml balances depends upon real in-come and an opportunity cost variable measured as the short-term nominal interest rate. The parameter β_1 is the long-run real income elasticity and β_2 the long-run (semi-log) opportunity cost parameter. This equation is consistent with models of the transactions demand for money formulated in Baumol (1952) and Tobin (1956).

The presence of the disturbance term U_t in (1) implies that actual real Ml balances momentarily can differ from the long-run equilibrium value determined by factors specified in (2). <u>Equation (3)</u> describes <u>the short-run behavior</u> of Ml demand and is in a <u>dynamic error-correction</u>

form, where δ_i, (i = 2,3,4) measures the short-run responses of real Ml balances to changes in income, opportunity cost and inflation variables. The parameter δ_5 that appears on the disturbance term U_{t-1} is the error-correction coefficient and measures the extent to which actual real Ml balances adjust to clear disequilibrium in the public's long-term money demand holdings. This can be seen in (4), which is obtained by solving (2) for U_{t-1} and then substituting for U_{t-1} in (3).

$$\Delta \ln(M1)_t = \delta_0 + \sum_{s=1}^{n1} \delta_{1s} \Delta \ln(M1)_{t-s} + \sum_{s=0}^{n2} \delta_{2s} \Delta \ln(Y)_{t-s} + \sum_{s=0}^{n3} \delta_{3s} \Delta \ln(R)_{t-s} + \sum_{s=0}^{n4} \delta_{4s} \Delta^2 \ln(p)_{t-s} + \delta_5 [\ln(Ml)_{t-1} - \ln(Ml)^*_{t-1}] + \epsilon_t \quad (4)$$

Where,

$$\ln(M1)^*_{t-1} = \beta_0 + \beta_1 \ln(Y)_{t-1} + \beta_2 R_{t-1} \quad (5)$$

One can view M1* as the long-term equilibrium real Ml balances, and Ml, of course, is actual real Ml balances. Thus, the term $[\ln(Ml) - \ln(Ml)^*]_{t-1}$ measures disequilibrium in the public's long-term real money balances. If the variables included in (2) are nonstationary but cointegrated, then the error-correction parameter is likely to be non-zero, i.e., $\delta_5 \neq 0$ in (4).

Another point to highlight is equation (4) can be viewed as a generalization of the conventional partial-adjustment model, because the approach considered here allows separate reaction speeds to the different determinants of money demand. The coefficients δ_{2s}, δ_{3s}, δ_{4s} and δ_5 are different, yet via the error-correction mechanism ensures that actual real M1 balances converge to equilibrium levels in the long run.

The long-run money demand equation (2) is "conventional" in the sense that real Ml demand is assumed to depend only on real income and an opportunity cost variable. In particular, inflation is assumed to have no long-run effect on money demand. In this respect, the specification used here is similar to ones estimated in Dickey, Jansen and Thornton (1991), Hoffman and Rasche (1991), and Stock and Watson (1993). However, following Friedman (1959) the potential long-run influence of inflation on Ml demand is also examined.

Even if inflation has no long-run effect on money demand, it could still influence real Ml balances in the short run because of the presence of adjustment lags. [8] Hence, the inflation variable appears in

[8] The empirical work reported in Goldfeld and Sichel (1990) and Hetzel and Mehra (1989) is consistent with the presence of an inflation effect on money demand in the short run.

the short-run money demand equation (3) and is in first differences rather than in levels. This specification reflects the assumption that inflation is non-stationary.

However, the consequences of introducing inflation in levels or dropping it altogether from (3) are also examined.

The Basic Error - Correction Model

If the disturbance term U_t is stationary, then the money demand model described above can be estimated in two alternative ways. First procedure is a two-step procedure given in Engle and Granger (1987). In the first step, the long-run money demand equation (2) is estimated by ordinary least squares and the residuals are calculated. In the second step, the short-run money demand equation (3) is estimated with U_{t-1} replaced by residuals in step one.

Second procedure is substituting (5) into (4), to get the following equation:

$$\Delta \ln(M1)_t = (\delta_0 - \delta_5 \beta_0) + \sum_{s=1}^{n1} \delta_{1s} \Delta \ln(M1)_{t-s} + \sum_{s=0}^{n2} \delta_{2s} \Delta \ln(Y)_{t-s} + \sum_{s=0}^{n3} \delta_{3s} \Delta \ln(R)_{t-s} + \sum_{s=0}^{n4} \delta_{4s} \Delta^2 \ln(\pi)_{t-s}$$

$$+ \delta_5 \ln(Ml)_{t-1} - \delta_5 \beta_1 \ln(Y)_{t-1} - \delta_5 \beta_2 R_{t-1} + \epsilon_t \quad (6)$$

Equation (6) shows that the long-run and short-run parameters of the money demand model are now together in this equation. The key parameters of equations (2) and (3) such as those pertaining to income and opportunity cost variables can be recovered from those of (6). The Ml demand equation (6) is estimated using the second procedure. [9]

The Review of Engle-Granger Procedure for Cointegration

An assumption that is necessary to yield reliable estimates of the money demand parameters is that the non-stationary variables included in (2) or in (6) are co-integrated as discussed in Engle and Granger (1987). Hence, one must first test for a co-integrating relationship between real Ml balances, real GDP and an opportunity cost variable, i.e., test whether U_t is stationary in (2).

There are several tests for co-integration have been proposed in the literature [see, for example, Engle and Granger (1987) and Stock

[9] **The money demand model was also estimated using the first procedure, which generated qualitatively similar results on parameter stability and predictive ability.**

and Watson (1991)]. The test for co-integration used here is the one proposed in Engle and Granger (1987) and consists of two steps. The first tests whether each variable in (2) is non-stationary, which is done performing unit root tests on the variables. (The presence of a single unit root in a series implies that the series is non-stationary in levels but stationary in first differences.) The second step tests for the presence of a unit root in the residuals of the level regressions estimated using the non-stationary variables. To explain further, assume that $M1_t$, Y_t and R_t are non-stationary in levels. In order to test whether these variables are cointegrated, one needs to estimate the following regressions:

$$M1_t = \beta_0 + \beta_1 Y_t + \beta_2 R_t + U_{1t} \quad (7.1)$$

$$Y_t = \beta_3 + \beta_4 M1_t + \beta_5 R_t + U_{2t} \quad (7.2)$$

$$R_t = \beta_6 + \beta_7 M1_t + \beta_8 Y_t + U_{3t} \quad (7.3)$$

If the residuals in any one of these regressions are stationary, then these variables are cointegrated.

Part II: Data and Specifications

The money demand equation (6) is estimated using quarterly data over the period 1980:Q1 to 2018:Q2 and is divided into three periods to test for stability.

The first period extent between the first quarter of the year 1980 until the fourth quarter of the year 1998, which represents the political instability in the Arabian Gulf area. The second period runs between the first quarter of the year 1999 until the second quarter of the year 2018, and this period represents the political stability in the State of Kuwait, and the third covers the whole period which runs from the first quarter of 1980 until the second quarter of 2018.

Ml is real money balances; Y real GDP; P the consumer price index; and R is the inter local bank interest rates. All data belong to the State of Kuwait are gathered form different issues of Kuwait Central Bank quarterly reports.

The opportunity cost variable in (2) is not in logarithms, whereas other variables are. This (semi-log) specification implies that the long-run opportunity cost elasticity varies positively with the level of the opportunity cost variable. This specification implies that the long-term opportunity cost elasticity is constant. Furthermore, following Hoffman and Rasche (1991), the test for cointegration is also implemented including trend in the long-run part of the model.

Part III. Empirical Results and Analyses

First: Unit Root Test Results

The unit root tests are performed by estimating simple Dickey-Fuller test, augmented Dickey-Fuller test, [10] and Phillips-Perron test. [11]

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[10] **Notes: Ml is real money balances; Y is real GNP; R is the rate of return; and P is the consumer price index. In is the natural logarithm and Δ is the first-difference operator.**

Augmented Dickey-Fuller statistics are from the regression: $X_t = a + \rho X_{t-1} + \sum_{s=1}^{k} b_s \Delta X_{t-s} + e_t$

where X_t is the pertinent variable; k the number of lagged first differences of X_t included to remove serial correlation in the residuals. t is the t-statistic. The test of the null hypothesis that ρ = 1. T is the number of observations used in the regression. k is chosen by the final prediction error criterion given in Akaike. " * " indicates significant at the 5 % level. The 5 % critical value for t is – 2.89.

[11] **Phillips-Perron tests assess the null hypothesis of a unit root in a univariate time series *y*. All tests use the model:**

$$y_t = c + \delta t + a\, y_{t-1} + e(t).$$

The null hypothesis restricts $a = 1$. Variants of the test, appropriate for series with different growth characteristics, restrict the drift and deterministic trend coefficients, c and δ, respectively, to be 0. The

Table (1): Unit Root Test Results: 1980:Q1 - 2018:Q2

Variables	Simple Dickey-Fuller test		Augmented Dickey-Fuller test		Philips-Perron test	
	Level	First Difference	Level	First Difference	Level	First Difference
$M1_t$	- 2.15	- 13.41	- 2.17	- 5.49	- 2.20	- 13.40
$M2_t$	- 1.17	- 9.52	- 1.09	- 4.24	- 1.11	- 09.54
Y_t	- 0.72	- 12.60	- 0.61	- 6.16	- 0.67	- 12.59
R_t	- 2.40	- 11.65	- 2.35	- 5.43	- 2.42	- 11.60
P_t	- 1.46	- 12.21	- 1.36	- 5.38	- 1.46	- 12.19

Table (1) reports the unit root test results for the real $M1_t$, the real Y_t, the level and the opportunity cost variable R_t, and the price level P_t. These results indicate that real money balances, real Y_t, the opportunity cost variable R_t, and the price level P_t, are nonstationary in levels, but stationary in first differences.

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tests use modified Dickey-Fuller statistics (see `adftest`) to account for serial correlations in the innovations process *e*(*t*).

Second: Cointegration Test Results

Given the unit root test results, the logarithm of real M1, the logarithm of real GNP, and the logarithm (or the level) of opportunity cost are included in the cointegration tests. The inflation rate is not included because unit root test results are ambiguous about its stationarity. [12]

Tables (2) present cointegration test results using the Engle-Granger procedure. As can be seen, these test results conclude that the real M1 is cointegrated with real income and interest rates for the semi-log specification, where the residuals represent stationary time series data because their t-test calculated value exceeds the critical value in the cointegration table of Engle and Yoo. Therefore, there exists a long-run equilibrium relationship between demand for real balances, real income, and an opportunity cost variable (see results in equations 7.1-7.3 of Table 2). [13]

[12] Is the inflation variable, when treated as nonstationary and included in the cointegration regression, statistically significant? In order to answer this question, I estimated, following Stock and Watson (1991), the dynamic version of (1) by ordinary least squares. That is, the cointegrating regression (1) was estimated including, in addition, current, past, and future values of first differences of real income, opportunity cost and inflation variables and the current value of the inflation variable. The estimated coefficient on the current value of the (level) inflation variable is small and not statistically significant. This result indicates that the inflation variable does not enter the cointegrating regression (1). (In contrast, real income and opportunity cost variables were statistically significant.).

[13] This explains why Baum and Furno (1990) and Miller (1991) conclude that real Ml is not cointegrated with real income and interest rates. These authors implement the test for cointegration by estimating the cointegration regression normalized on the Ml variable.

Hence, this requires estimating the equation (6) using variable levels that can be destroyed if the first differences of variables found through single-root tests are static.

Though, we proceed under the assumption that real Ml is cointegrated with real income and interest rates over the period studied here.

Table (2): Cointegration Test Results

Equation Number	Engle-Granger Procedure Results of The Semi-log Specification				(ε_{t-1})
(7.1)	$M1_t$	β_0	$\beta_1 Y_t$	$\beta_2 R_t$	- 22.44 *

(7.2)	Y_t	β_3	$\beta_4 M1_t$	$\beta_5 R_t$	- 29.93 *
(7.3)	R_t	β_6	$\beta_7 Y_t$	$\beta_8 Ml_t$	- 09.84 *

Notes: The table reports estimates of the long-run income and interest rate coefficients from the cointegrating regressions estimated using alternative dependent variables [equation (6)]. The right column of the table presents statistics from the augmented Dickey-Fuller (ADF) regression that is used to test for the presence of a unit root in the residuals of the relevant cointegrating regression.

"*" indicates significant at the 5 % level. The 5 % critical value for (ε_{t-1}) is = 4.22 from Table 3 in Engle and Yoo (1987).

Third: Regression Results and Analyses

The results of estimating equation (6) are reported in two tables: Table (3:A) which represents short-run ECM for the Semi-Log equation, and Table (3:B) which represents the long-run equation. All equations in these tables are used to test for stability of the money demand (M1), using Chow stability-test. Each table has the results for three periods of time. The first period runs from the year 1980 first quarter (1980:Q1) until the fourth quarter of 1998 (1998:Q4), the second period runs from the first quarter of 1999 (1999:Q1) until the second quarter of the year 2018 (2018:Q2), and the third period runs from the first quarter of 1980 until the second quarter of the year 2018. The estimated regressions have mixed results in term of estimated coefficients which some of these possess theoretically correct signs, but others don't. In general, for the political instability period most coefficients don't possess correct sings, statistically insignificant, and don't have goodness of fit, which can be seen in Table (3:A). The $R^2 = 78\ \%$, which means that 78 % of changes in independent variables are explained the change in the dependent variable (the real M1 in Kuwait). Also, the results for the long-run in the period of political stability in Table (3:B) show unsatisfactory and unstable money demand function. The DW's for the three periods are close in their values to 2, which mean that there isn't an autocorrelation problem.

The semi-log short-run equation Table (3:A) and the long-run equation in Table (3:B) their results for the political stability period are generally have goodness-of-fit and have correct coefficients signs. And, both equations indicate that the money demand functions are stable.

Moreover, the Chow test for stability was implemented for the two models (the semi-log short-run and the long-run) using equation (6) for the three periods, and the F-values for the money demand are reported in Table (4).

The estimated F-values in Table (4) say that the real money demand function for both the long-run equation and the semi-log equation is unstable during the politically instable period, whereas stable during the politically stable period for both. Also, money demand is stable in the semi-log short-run and the long-run for the pooled period.

Finally, our empirical results in regard of stability are consistent with our expectations for the money demand where we expected the money demand equation in its two forms (short-run, and long-run) to be unstable during the political instability period.

The expected stability of money demand function during the political stability period and pooled period provide the authority in Kuwait Central Bank the power to conduct effective monetary policy.

Table (3:A): A Regression Results For Money Demand Equation (6)

The Short-run (ECM) Results: (Semi-log Form)

Dependent Variable: $\Delta \ln(M1)_t$

Independent Variables	1980:Q1 – 1998:Q4 Political Instability Period	1999:Q1 – 2018:Q2 Political Stability Period	1980:Q1 – 2018:Q2 Pooled
Constant	- 4535.96 ; (- 0.39)	126750.01 ; (3.71)	4107107.11 ; (4.22)
$\Delta \ln(M1)_{t-1}$	- 292.74 ; (- 0.88)	134.44 ; (3.63)	529.92; (2.14)
$\Delta \ln(Y)_t$	125.01 ; (2.74)	137.44 ; (4.61)	520.62 ; (3.01)
ΔR_t	- 42.62 ; (- 3.66)	11.13 ; (0.36)	- 55.34 ; (- 4.61)
$\Delta^2 \ln(p)_{t-1}$	- 32.73 ; (- 1.20)	- 270 ; (- 0.56)	1195.78 ; (1.23)
$\ln(M1)_{t-1}$	354.77 ; (1.99)	- 1395 ; (- 2.96)	1229.26 ; (2.51)
$\ln(Y)_{t-1}$	19.86 ; (0.55)	- 229 ; (0.38)	8325.10 ; (1.98)
R_{t-1}	- 40.90; (- 2.41)	5.89; (0.14)	- 245.25; (- 4.65)
R^2	0.78	0.99	0.97
DW	1.94	1.95	1.99
Chow test	2.60 - unstable	1.44 - stable	1.64 - stable

Table (3:B): A Regression Results For Money Demand Equation (6)

Dependent Variable: Δ ln(M1) $_t$

Independent Variables	1980:Q1 – 1998:Q4 Political Instability Period	1999:Q1 – 2018:Q2 Political Stability Period	1980:Q1 – 2018:Q2 Pooled
Constant	620.68 ; (2.62)	1349.99 ; (3.26)	2867.13 ; (2.99)
ln(Y) $_t$	0.31 ; (1.96)	0.11 ; (10.81)	0.01 ; (5.06)
ln(R) $_t$	- 34.06 ; (- 0.31)	- 5.28 ; (- 7.22)	- 16.76 ; (- 8.27)
R^2	83	98	99
DW	1.34	1.89	1.92
Chow test	4.92 - unstable	0.84 - stable	1.52 - stable

Table 4: Stability Tests and Chow Test Results (5%)

Period	Short-run Semi-log Model	Long-run Model
1980:Q1 – 1998:Q4 Instability Political Period	2.60 Critical Value $F_{(8, 55)}$ = 2.11 Unstable	4.92 Critical Value $F_{(4, 65)}$ = 2.51 Unstable
1999:Q1 – 2018:Q2 Stability Political Period	1.44 Critical Value $F_{(8, 59)}$ = 2.10 Stable	0.84 Critical Value $F_{(4, 63)}$ = 2.51 Stable
1980:Q1 – 2018:Q2 Pooled	1.64 Critical Value $F_{(8, 100)}$ = 2.03 Stable	1.52 Critical Value $F_{(4, 143)}$ = 2.46 Stable

Part IV. Conclusion

Recent advances in time series analysis designed to deal with nonstationary data have yielded new procedures for estimating long-run and short-run econometric relationships. Several analysts have employed these techniques to study real (M1) demand for money function, and some of them have concluded there exists a long-run equilibrium relationship between real M1, real income, and an opportunity cost variable.

This study also provides evidence consistent with the existence of a stationary linear relationship among these variables. Thus, actual real Ml balances do not drift permanently away from the levels predicted by such cointegrating regressions in the long run.

The importance of a stable money demand function for monetary policy is illustrated with the standard framework of IS-LM model, in which interest rates and GDP are the endogenous variables. In this context, a stable demand function for money translates into a well-defined relationship between money, interest rates and GDP. This allows the slope and position of the LM curve to be determined once the quantity of money is known. It follows, that changes in the money supply exert a predictable effect on GDP (given knowledge of the IS curve). This implies that control of the money supply gives the Central Bank of Kuwait some measure of control over real GDP. Hence, the monetary policy is expected to be more effective under these conditions.

References

Adam, Christopher S., 1992,

"On the Dynamic Specification of Money Demand in Kenya," Journal of African Economies, Vol. 1 (August), pp. 233–70.

Akinlo, A. E., (2005),

"The stability of money demand in Nigeria: An autoregressive distributed lag approach", Journal of Policy Modeling 28, 445-452.

Anoruo, E., (2002),

"Stability of the Nigerian M2 money demand function in the SAP period," Economics Bulletin 14, 1-9.

Arize, A. C., Harris, P., Kasibhatla, K. M., Malindretos, I. N. and Scoullis, M., 2012,

"The values of the determinants and tests of stability of the money demand function of the United States", Review of Business, 32, pp. 99-104.

Baba, Yoshihisa, David F. Hendry, and Ross M. Starr, 1991,

"The Demand for M1 in the U.S.A., 1960–1988," Review of Economic Studies, Vol. 59 (January), pp. 25–61.

Bahmani-Oskooee, M. and Gelan, A., (2009),
"How stable is the demand for money in African countries," Journal of Economic Studies, 36, 216-235.

Bahmani, S. and Kutan, A. M., 2010,
"How stable is the demand for money in emerging economies?" Applied Economics, 42, 3307–3318.

Bahmani-Oskooee, M., Kutan, A. M. and Xi, D., 2013,
"The impact of economic and monetary uncertainty on the demand for money in emerging economies', Applied Economics, 45, 3278–3287.

Boughton, James M., 1992,
"International Comparisons of Money Demand," Open Economies Review, Vol. 3, No. 3, pp. 323 – 43.

Capasso, S. and Napolitano, O., 2012,
"Testing for the stability of money demand in Italy: has the Euro influenced the monetary transmission mechanism?" Applied Economics, 44, 3121–3133.

Central Bank of Kuwait, "Quarterly Data," Different issues.

Chow, Gregory,. 1966,
"On the Short-Run and Long-Run Demand for Money," Journal of Political Economy, 74. (April), pp. 111-131.

Courchene, T. J. and Shapiro, H. T., 1964,
"Money Supply and Money Demand: An Econometric Analysis for Canada," Journal of Political Economy, 4(10), 498-503.

Dickey D. A., D. Jansen, D. Thornton, 1991,
"A Primer Cointegration with an Application to Money and Income", Federal Reserve Bank of St. Louis, (March-April): 58-77.

Drama, B. H. G. and Yao, S., (2010),
"The demand for money in Cote d'Ivoire: evidence from the cointegration test", International Journal of Economics and Finance
3(1).

Dritsaki, Chaido, and Melina. (2014),
"Money Demand Stability: Some Evidence from Turkey", The IUP Journal of Bank Management, Vol. XI, No. 4.

Engle, Robert F., and C.W.J. Granger, 1987,
"Co-Integration and Error Correction: Representation, Estimation, and Testing, " Econometrica, Vol. 55 (March), pp. 251–76.

Engle, Robert F., and Byung Sam Yoo, 1987,
"Forecasting and Testing in Co-Integrated Systems," Journal of Econometrics, Vol. 35 (May), pp. 143–59.

Friedman, Milton., 1959,

“The Demand for Money: Some Theoretical and Empirical Results.” Journal of Political Economy, August 1959, 67(4), pp. 327-51.

Friedman, B. M. and Kuttner, K. N., 1992,

“Money, Income, Prices, and Interest Rates,” American Economic Review, 82, 472–492.

Goldfeld, Stephen, 1973,

"The Demand for Money Revisited," Brookings Papers on Economic Activity. (March), pp. 577-638.

Hafer, R.W., and A.M. Kutan, 1994,

“Economic Reforms and Long-Run Money Demand in China: Implications for Monetary Policy,” Southern Economic Journal, Vol. 60 (April), pp. 936–45.

Hoffman, Dennis L., and Chakib Tahiri, 1994,

“Money Demand in Morocco: Estimating Long-Run Elasticities for a Developing Country,” Oxford Bulletin of Economics and Statistics, Vol. 56 (August), pp. 305–24.

Handa, J., 2000,

“Monetary Economics.” New York, Routledge.

Judd, John P., and John L. Scadding, 1982,

“The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature,” Journal of Economic Literature, Vol. 20 (September), pp. 993–1023.

Kumah, Emmanuel O., 1989,
"Monetary Concepts and Definitions," IMF Working Paper 89/92 (Washington: International Monetary Fund).

Kumar, S. and Webber, D. J., 2013,
"Australasian money demand stability: application of structural break tests," Applied Economics, 45, 1011–1025.

Kumar, S., Webber, D. J. and Fargher, S., 2013,
"Money demand stability: A case study of Nigeria," Journal of Policy Modeling, 35, 978–991.

Ireland, P. N., 2009,
"On the welfare cost of inflation and the recent behavior of money demand," American Economic Review, 99, 1040–1052.

Laidler, David E.W., 1993,
The Demand for Money: Theories, Evidence, and Problems (New York: HarperCollins College Publishers, 4th ed.).

Laumas, G. S. and Mehra, Y. P., 1977,
"The Stability of the Demand for Money Function, 1900-1974." The Journal of Finance, 32, 911–916.

Lin, K-P. and Oh, J. S., 1984,
"Stability of the U.S. short run money demand function, 195981," The Journal of Finance, 39, 1383–1396.

Liu, J. and Kool, C. J. M., 2018,
"Money and credit overhang in the euro area,"
Economic Modelling, 68, 622–633.

Lucas, R. E. Jr. and Nicolini, J. P., 2015,
"On the stability of money demand."
Journal of Monetary Economics, 73, 48–65.

Nachega, J., (2001),
"A cointegration analysis of broad money demand in Cameroon", IMF Working Paper 01/26 (Washington DC: International Monetary Fund).

Nell, K. S., (2003),
"The stability of M3 money demand and monetary growth targets: The case of South Africa", Journal of Development Studies 39, 151-180.

Nwafor, F., Nwakanma, H., Nkansah, P. and Thompson, F., (2007),
"The quantity theory of money in a developing economy: Empirical evidence from Nigeria", African Economic and Business Review 5, 1-9.

Nwaobi, G., (2002),
"A vector error correction and non-nested modeling of money demand function in Nigeria', Economics Bulletin 3, 1-8.

Meltzer, Allan H., (1963),
"The Demand for Money: The Evidence from the Time Series," Journal of Political Economy, 71. (June), pp. 219-246.

Miller, Stephen M., 1991,
"Monetary Dynamics: An Application of Cointegration and Error Correction Modeling," Journal of Money, Credit, and Banking, Vol. 23 (May), pp. 139–54.

Miller, S. M., Martins, L. F. and Gupta, R., 2017,
"A time-varying approach of the US welfare cost of inflation," Macroeconomic Dynamics, 1-23.

Narayan, P. K., 2010,
"Modelling money demand for a panel of eight transitional economies," Applied Economics, 42, 3293–3305.

Owoye, O. and Onafowora, O. A., (2007),
"M2 targeting, money demand, and real GDP growth in Nigeria: Do rules apply?", Journal of Business and Public Affairs 1, 1-20.

Sriram, Subramanian S., 1999,
"Survey of Literature on Demand for Money: Theoretical and Empirical Work with Special Reference to Error-Correction Models," IMF Working Paper 99/64, (Washington: International Monetary Fund).