International Journal of Economics and Finance; Vol. 6, No. 1; 2014
ISSN 1916-971XE-ISSN 1916-9728
Published by Canadian Center of Science and Education

Endogenous Structural Breaks and the Stability of the Money Demand Function in Saudi Arabia

Waheed Abdulrahman Banafea[1]

[1] Department of Economics & Budget Programs, Institute of Public Administration, Riyadh, Saudi Arabia

Correspondence: Waheed Abdulrahman Banafea, Department of Economics & Budget Programs, Institute of Public Administration, P. O. Box 204, Riyadh 11141, Saudi Arabia. E-mail: Banafeaw@ipa.edu.sa

Received: October 11, 2013 Accepted: November 12, 2013 Online Published: December 23, 2013

doi:10.5539/ijef.v6n1p155 URL: http://dx.doi.org/10.5539/ijef.v6n1p155

Abstract

In this study, an endogenous investigation of the long run relationship between the demand for money, narrow definition of money (M1), and its determinants in Saudi Arabia was conducted. A structural break date was estimated by applying the Andrews (1993) and Andrews and Ploberger (1994) methods. These tests illustrated that there is evidence of a structural break for all of the variables, namely money demand, real income and nominal short-term interest rates when they are considered together. The results of the Hansen stability test support the idea that the instability of money demand could be related to the structural breaks. Since there is evidence of a structural break, the Gregory and Hansen procedure was used to test for the cointegrating equation of money demand. This test allows for a one time structural break in the relationship among the money demand variable, real income and nominal short-term interest rates. The results of this test affirm stable money demand in Saudi Arabia. The monetary aggregate in Saudi Arabia seems to be an appropriate indicator in the formulation of monetary policy.

Keywords: endogenous structural breaks, money demand, cointegration, Saudi Arabia

1. Introduction

The relationship between money demand and its determinants is a crucial concern for policymakers, since it enables them to formulate appropriate monetary policies and increase the level of accuracy in targeting money growth. The issue of the stability of the money demand function in the long run has received extensive attention in the past. However, the results are not found to be conclusive, as some money demand studies indicate that it is unstable, while others claim it is stable.

Goldfeld (1976) claimed that money demand was unstable in the United States (US) during the 1970s, while Stock and Watson (1993) claimed that the M1 demand was unstable during the post-world war II. However, when the sample period investigated by Stock and Watson was extended to 1996 by Ball (2001), the results showed stability of M1. Furthermore, Choi and Jung (2009) found that M1 demand in the US is unstable during the period of 1959Q1 through 2000Q4. However, when Choi and Jung estimated the unknown structural break points in the money demand function and tested to see if a long run relationship existed in each sub-sample period of the structural break points, while they did find evidence of stability within each sub-sample, they did not find this evidence for the entire sample.

Some studies attribute the instability of the money demand function to structural changes arising from innovations in the financial sector and financial deregulation (Breuer & Lippert, 1996; Ericsson, Hendry, & Prestwish, 1998; Chio & Jung, 2009). Haug and Lucas (1996) illustrated that the stability of the money demand function depends on the type of cointegration tests used and the combination of money and interest rates. Gregory and Hansen (1996) found that data frequency can play an important role when testing for stability, while Cheong (2003) infers that the instability of the money demand function could be caused by a misspecification in dynamic models, error correction models (ECM), which omits important lags.

Poole (1970) shows that the instability of money demand can prevent policymakers from implementing an appropriate policy and lower the level of accuracy of targeting money growth. If stable money demand increases the ability of policymakers to prevent a money market disequilibrium, then it is worth investigating the stability of the money demand function using a variety of techniques, including a cointegration framework that accounts for structural breaks.

The purpose of this paper is to empirically evaluate the money demand function in Saudi Arabia, focusing on two primary issues. The first is to test whether or not the money demand function in Saudi Arabia is stable in the long run using the Hansen (1992) test for parameter stability. The second is to investigate the long run relationship between money demand and its determinants, real income and short-term interest rates, using the Gregory and Hansen (1996) cointegration test. The Gregory and Hansen (GH) cointegration test incorporates structural breaks. Therefore, this test allows one to empirically investigate the stationarity of the money demand function after allowing for a one time structural break in the relationship among the money demand variable, real income and nominal short-term interest rates.

What distinguishes this paper from the previous work is that this paper endogenously deals with the structural breaks. (Enders, p. 106) indicates that even if it is possible to determine the exact date of a structural break, the full effect of this structural break would not occur instantly.

The motivation for evaluating the stability of the money demand function in Saudi Arabia is that Saudi Arabia has experienced reforms in the financial sector and many severe economic crises, including the oil crisis in 1986 and the global financial crisis in 2008. The effects of these reforms and financial crises on the stability of the money demand function are rarely endogenously investigated. Consequently, these reforms and financial crises likely created structural breaks that need to be accounted for in the estimation of the long run money demand function.

2. Recent Studies on Money Demand in Saudi Arabia

There have been several empirical studies on the stability of the money demand function in Saudi Arabia (Al-Kswani & Al-Twaijari, 1999; Lee, Chang, & Chen, 2008; Bahmani, 2008; Masih & Algahtani, 2008; Abdulkheir, 2013). These studies use different econometric techniques to empirically investigate the stability of the long and short run relationship between money demand and its determinants. This section provides a brief review of some of the recent studies on the stability of the money demand function in Saudi Arabia (Table 1).

Al-Kswani and Al-Twaijari (1999) conducted a Johansen and Juselius (1990) cointegration test to examine the long run relationship between M1 demand and its determinants, real income, interest rate, expected inflation rate, and real exchange rate using annual data from the period of 1977 to 1997. The results indicate the existence of a long run relationship between M1 demand and its determinants. In addition, they examined the stability of the money demand function in the short run using an error correction model (ECM). The results of the ECM illustrate that M1 demand is stable. The long run income elasticity is 1.72 which is not closer to unity as suggested by the quantity theory of money. This finding indicates that the Saudi economy is becoming monetized.

Furthermore, Lee, Chang and Chen (2008) employed the panel cointegrated technique developed by Larsson, Lyhagen, and Lothgren (2001) to determine the panel cointegrated relationship between money demand, M1, and its determinants in six selected Gulf Cooperation Councils (GCC) using annual data from 1979 to 2000. The individual country by country trace statistics indicate that there is a long run relationship between M1 demand and its determinants, GDP, the interest rate, and the nominal exchange rate in Saudi Arabia. However, when the scale variable was changed from real GDP to private consumption, the results of the individual trace statistics show that the M1 money demand is unstable. The results of the panel test suggest that the demand for money, M1, is stable in GCC countries.

Using annual data for the period of 1971 through 2004, Bahmani (2008) examined the stability of the M2 demand for money in fourteen countries: Saudi Arabia, Qatar, Syria, Tunisia, Turkey, Kuwait, Lebanon, Libya, Morocco, Oman, Bahrain, Egypt, the United Arab Emirates, and Jordan. The Persaran (2001) cointegration test and the CUSUM and CUSUMSQ parameter instability tests were applied. The results of the cointegration and the stability tests support the idea that the demand for money, M2, in Saudi Arabia is stable in both the long and short run.

Masih and Algahtani (2008) evaluated the money demand function in Saudi Arabia using annual data for the period from 1986 to 2004. Using both the cointegration technique developed by Pesaran and Shin (2002) and the CUSUM and CUSUMSQ instability tests, the authors tested for the long and short run relationships between real M2 and M3 demand for money and their determinants. The results from the cointegration and instability tests suggest that M2 and M3 are stable.

Abdulkheir (2013) used annual data from 1987 to 2009 to evaluate the stability of the M2 demand for money in Saudi Arabia. The author applied the vector error correction model integration technique and the Johansen and

Joselius (1990) technique to test for the long and short run relationships between the M2 demand and its determinants, namely the inflation rate, real GDP, the interest rates, and real exchange rates. The results suggest that M2 demand is stable in both the long and short run.

Table 1. Recent studies on money demand

Author	Frequency of the data	Measures of money	Determinants	Unit root tests	Cointegration approaches	Stability tests
Al-Kswani & Al-Towaijari (1999)	1977–1997 (q)	M1	GDP, interest rate on the eurodollar, exchange rate, inflation rate	ADF	JJ (1990), ECM	None
Lee, Chang & Chen (2008)	1979–2000 (a)	M1	GDP or consumption, interest rate, exchange rate	Panel unit root (not mentioned)	Larsson et al. (2001)	None
Bahmani (2008)	1971–2004 (a)	M2	GDP, inflation rate, exchange rate	–	Persaran et al. (2001)	CUSUM and CUSUMSQ
Masih & Algahtani (2008)	1986–2004 (a)	M2, M3	GDP, twelve rates of interest, foreign interest rate	ADF, PP	LRSM by Pesaran and Shin (2002)	CUSUM and CUSUMSQ
Abdulkheir (2013)	1987–2009 (a)	M2	GDP, inflation rate, interest rate, real exchange rate	ADF, PP	VECM (J (1988) and JJ (1990))	None

Note: ADF, J, VECM, JJ, and PP stand for Augmented Dickey-Fuller, Johansen, Vector Error Correction Model, Johansen &Juselius, and Phillips &Perron, respectively. In addition, a and q denote annual and quarterly data.

3. The Model and the Data

This study uses annual Saudi Arabia data from 1980 to 2012 to test whether there is cointegration between money demand and its determinants, real income and interest rates. All data were obtained from the International Financial Statistics website. The monetary aggregate was deflated by the price level, CPI. The money demand specification can be written as:

$$m = \lambda_1 + \lambda_2\, y + \lambda_3\, i + \epsilon \tag{1}$$

where: m denotes the real money supply, M1. In Equation (1), y is real GDP, i is US treasury bills and ϵ is the error term. All variables are in natural logs, except the nominal interest rates. The expected signs of the coefficients in Equation (1) are positive for income elasticity and negative for interest rate semi-elasticity (e.g., $\lambda_2 > 0$, and $\lambda_3 < 0$). In addition, the properties of the error sequence (ϵ) are an integral part of the theory. If (ϵ) has a stochastic trend, then the deviation from the money market equilibrium will not be eliminated (Enders, p. 357). This theory assumes that the εt sequence is stationary.

4.Econometric Methodologies

4.1 Structural Break Tests

The Andrews (1993) and Andrews and Ploberger (1994) methods are used to check for one unknown structural break in both individual time-series and the model as a whole. These methods estimate the structural breaks endogenously; therefore, they do not require a priori knowledge of the dates of the structural breaks. Both methods are computed on the basis of the Wald test; they test the null of no structural break. The existence of a structural break implies that the linear relationship between money demand and its determinants does not hold. The Andrews test is computed as:

$$SupF = supF_{t/T} \tag{2}$$

where: Ft/T is considered to be the F-test statistic. The Andrews and Ploberger (1994) is computed as:

$$ExpF = log\ [(1/L_2 - L_1 + 1) \sum (0.5\ F_{t/T}\ (L))] \tag{3}$$

where: L_1 and L_2 denote the trimmed region [0.15T, 0.85T], respectively. According to Hansen (2000), the ExpF is considered a more powerful test than SupF that has almost a zero size distortion. Since both tests assume that all variables are stationary, the first difference data are used.

4.2 Parameter Stability Test

Hansen (1992) proposes three test statistics, namely Lc, MeanF, and SupF. All of these tests have the same null hypothesis: that there is cointegration. However, they differ in their choice of the alternative hypothesis. The SupF test is appropriate when one is looking for a shift in regime. Hansen illustrates that the SupF test is based on the Chow F-tests. It can be calculated as SupF = supFt/T, where Ft/T denotes the F-test statistic. The MeanF test is the average of the F-test statistic and is suitable when testing whether or not the specified model captures a stable relationship. Lc is appropriate if testing whether the model is correctly specified.

4.3 Unit Root Test

This paper utilizes Phillips and Perron (1988) and Zivot and Andrews (1992) to test unit roots. The Zivot and Andrews (1992) test allows for one unknown structural break in the series. According to the procedure of Zivot and Andrews, a break point is endogenously determined. Zivot and Andrews (ZA) use three models to test for a unit root.

Model (A): A mean shift

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \gamma DM_t + \sum \rho i \Delta y_{t-j} + \varepsilon_t \tag{4}$$

Model (B): A trend shift

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \theta DT_t + \sum \rho i \Delta y_{t-j} + \varepsilon_t \tag{5}$$

Model (C): Both a mean and a trend shift

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \theta DT_t + \gamma DM_t + \sum \rho i \Delta y_{t-j} + \varepsilon_t \tag{6}$$

In Equations (4) through (6), DMt is a dummy variable for a mean shift and DTt is a dummy variable for a trend shift. These dummies can be defined as DMt equals 1 if $t > b$ and 0 if $t \leq b$, while DTt equals t-b if $t > b$ and 0 if $t \leq b$, where b denotes the time at which the structural break occurs. Equation (4) detects any possible structural break in the mean and Equation (5) detects any structural break in the slope. Equation (6) detects a structural break in both the mean and the slope. The date of a structural break is determined according to the smallest t-statistics. The lag length is determined using the Akaike Information Criterion (AIC). Asymptotic distribution of the minimum t-statistics and critical values are provided by Zivot and Andrews (1992).

4.4 Cointegration Test

Gregory and Hansen's (1996) cointegration test is used to test for a long run relationship between money demand and its determinants. This test allows for an unknown regime shift in the intercept, either alone or in both the intercept and the coefficient vector. It can take on the following regression forms:

Level shift (GH1):

$$Y_t = \lambda_1 + \lambda_{11} DU_{tb} + \lambda_2 X_t + \varepsilon_t \tag{7}$$

Level shift with trend (GH2):

$$Y_t = \lambda_1 + \lambda_{11} DU_{tb} + \delta\ t + \lambda_2 X_t + \varepsilon_t \tag{8}$$

Regime shift (GH3):

$$Y_t = \lambda_1 + \lambda_{11} DU_{tb} + \lambda_2 X_t + \lambda_{22} X_t DU_{tb} + \varepsilon_t \tag{9}$$

In Equations (7) through (9), Y_t is the dependent variable, X_t is the independent variable, λ_1 and λ_2 are the intercept and the slope coefficients before the structural break, respectively, λ_{11} and λ_{22} are the intercept and the slope coefficients after the structural break, respectively. The time trend is t, where $DU_{tb} = 1$ if $t > b$ and $DU_{tb} = 0$ if $t \leq b$, while b is the date at which the structural break occurs.

Gregory and Hansen (GH) propose the $ADF^* = \inf_{t \in T} ADF(t)$, which is a modified version of the Engle and Granger (1987) cointegration test. The smallest value of this test is considered to be the break point. The null hypothesis of the GH test is that there is no cointegration with a structural break, while the alternative is that there is cointegration with a structural break. It is easy to extend these three models to include more than one explanatory variable.

5. Empirical Results

5.1 Structural Break Test Results

The results of the Quandt-Andrews and Andrews-Ploberger tests for one unknown structural break are presented in Table 2. These tests show that there is evidence of a structural break for all the variables considered together. Moreover, the results for the individual variables indicate that the real GDP and interest rates have a statistically significant break in the coefficient in 2004. The year 2004 corresponds to the high oil prices, which led to high revenues. Break dates correspond with the high oil prices between 2003 and 2004.

Table 2. Results of Quandt-Andrews and Andrews-Ploberger tests

Variables	Break date	Quandt-Andrews		Andrews-Ploberger		H_0: No structural break
		P-value	T-stat	P-value	T-stat	
When M1 is the dependent variable						
y	2004	0.002	15.364***	0.000	5.678***	Reject H_0
i	2004	0.083	7.483*	0.064	1.834*	Reject H_0
All variables	2003	0.003	17.858***	0.002	6.770***	Reject H_0

*,**,*** denotes the statistical significance at the 10, 5, and 1 percent levels, respectively. The maximum of the LM statistics is used by the Quandt-Andrews test, while the exponentially weighted average of the LM statistics is used by the Andrews-Ploberger test. The P-values are calculated using Hansen's approximations (1997) approach.

5.2 Parameter Stability Test Results

The results of Hansen test for parameter instability are presented in Table 3, together with their probabilities. The results illustrate signs of instability. The three test statistics of Lc, MeanF, and SupF indicate that the null hypothesis of cointegration, for M1 demand, is rejected at the 5 percent significance levels. According to these results, there is strong evidence that the demand for money, M1, in Saudi Arabia is unstable.

Gregory et al. (1996) indicated that Hansen's test can perform well when there is no structural break. Breuer and Lippert (1996) mentioned that tests of the stability of money demand only focus on whether the coefficient estimates are stable over time, without taking into account the structural break.

Table 3. Results of the Hansen (1992) test

Monetary aggregate	Lc	MeanF	SupF
M1	0.695 (0.039)**	8.978 (0.026)**	61.934 (0.01)**

** denotes the level of significance at 5 percent.

5.3 Phillips-Perron (PP) Unit Root Test Results

The results of the PP test are presented in Table 4. The results indicate the presence of non stationarity of all variables at levels. Thus, the null hypothesis of a unit root is not rejected. For the first difference of the series, the null hypothesis of a unit root is rejected at the 1% level for all variables. Therefore, the results show that M1, y, and i are integrated of order (1).

Table 4. Phillips-Perron (PP) Unit Root test results

Variables	PP in levels	PP in first differences
M1	2.264	-4.541***
y	2.167	-4.290***
i	-1.431	-5.102***

*** denotes the level of significance at 1 percent.

5.4 Zivot and Andrews Unit Root Test Results

The results of the Quandt-Andrews and Andrews-Ploberger tests and the Hansen test suggest that a structural break is important and needs to be taken into account when testing for a unit root. Perron (1989) shows that if researchers ignore a structural break in the data series, then they may falsely accept the null hypothesis of a unit root. Therefore, we apply the ZA unit root test, which examines a unit root in the presence of a single endogenous structural break in the data series.

The results of the ZA unit root test are presented in Tables 5 and 6, respectively. The results illustrate that M1 is not stationary in levels in the A and C models; however, it is stationary in levels in the B model. Moreover, the results of the ZA test indicate that the y is non-stationary in levels. Thus, the null hypothesis of a unit root is not rejected. The results of all the models of a ZA test suggest that the interest rate variable, i, is stationary in levels.

For the first difference of the series, the null hypothesis of a unit root is rejected at the 1% level. The results show that M1 and y are integrated of order (1), while i is integrated of order (0). Since we obtained mixed results, it is worth performing cointegration tests on the demand of M1. Testing for cointegration is still necessary and valid, despite the variables not being from the same order. Harris (1995) points out that it is common to test for cointegration when the variables are not from the same order, because unit root tests, in most cases, suffer from statistical power problems and size distortions.

The ZA break dates correspond with the oil price crash of 1986 and the low oil price beginning in late 1997 due to the East Asian economic crises. In addition, the break date of 1999 corresponds with the high oil price beginning in 1999. In 2004, the oil prices increased dramatically, which led to high revenues. The break date of 2007 refers to the oil shock of 2007–2008.

Table 5. ZA Unit Root test results in levels

Model	Variable	T- Statistic	Break date
A	M1	-1.058	2004
B	M1	-5.207***	1999
C	M1	-4.855	1998
A	y	-1.829	2007
B	y	-2.865	2007
C	y	-2.862	2007
A	i	-5.900***	1997
B	i	-5.383***	2007
C	i	-5.820***	2005

*** denotes the level of significance at 1 percent.

Table 6. ZA Unit Root test results in first differences

Model	Variable	T- Statistic	Break date
A	M1	-6.441***	1999
B	M1	-6.037***	1996
C	M1	-6.433***	1999
A	y	-6.718***	1986
B	y	-6.723***	1989
C	y	-8.081***	1993
A	i	-5.518***	2001
B	i	-5.169***	2006
C	i	-5.313**	2001

,* denotes the level of significance at 5 and 1 percent, respectively.

5.5 Gregory and Hansen Cointegration Test Results

The results of the Gregory and Hansen cointegration test are reported in Table 7. The results indicate that the ADF* statistics are significant at the 5 percent significance level in the GH3 model. Therefore, the null hypothesis of no cointegration, with a structural break for M1 demand, is rejected. The results indicate that the demand for money, M1, is stationary and has a long run relationship with its determinants.

The break date for year 2001 corresponds with the September 11 attacks.In 2005, Saudi Arabia joined the World Trade Organization (WTO).

Table 7. Gregory and Hansen cointegrationtest results

Monetary aggregate	Model	Break date	Critical value 5%	ADF*
M1	GH1	2005	-4.92	-4.741(0)
M1	GH2	2005	-5.29	-4.081(0)
M1	GH3	2001	-5.50	-5.529** (0)

** denotes significance at the 5 percent level of statistical significance, using 2-regressor critical values. Thenumbers in parentheses refer to the number of lags.

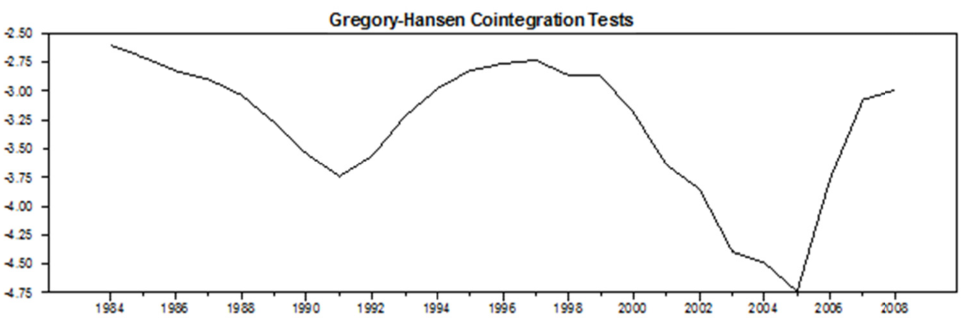

Figure 1. GH1 for money demand M1

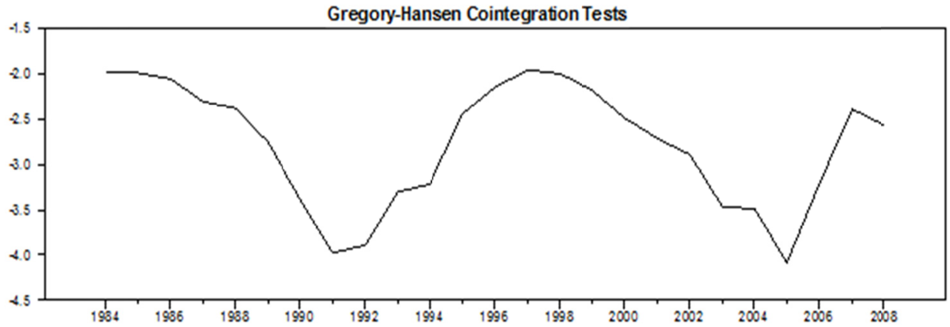

Figure 2. GH2 for money demand M1

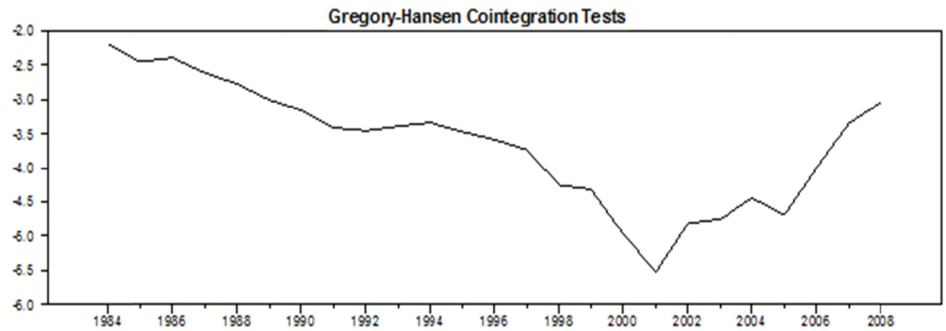

Figure 2. GH3 for money demand M1

5.6 Long Run Elasticities

The long run income elasticity and interest rate semi–elasticity are estimated using the Phillips and Hansen (1990) FMOLS procedure (Table 8). The results are consistent with theoretical expectations. More specifically, the income elasticity of 1.6 indicates that the Saudi economy is becoming monetized, which is consistent with the results of previous studies . The model illustrates that there is a positive and significant relationship between real income, y, and the demand for money, M1. This result means that for every one percent increase in real income, the M1 demand increases by 1.6 percent. In addition, the short term interest rate has a negative and significant relationship with M1 demand.

Table 8. Long Run elasticities in the fully modified OLS

Regressor	Coefficient	T-Statistics
Constant	-2.807 (0.316)***	-8.891
y	1.639 (0.154)***	10.637
i	-0.017 (0.006)***	-2.823

*** denotes a 1 percent significance level. The numbers in parentheses refer to the standard errors.

6. Summary and Conclusions

This paper aims to empirically investigate the stability of the money demand function in the long run for Saudi Arabia using annual data for the years of 1980 through 2012. The narrow definition of money, M1, is used as a proxy for money demand, the real GDP is used as a proxy for the scale variable, and the opportunity cost is proxied by the US treasury bills.

The results of the parameter stability test indicate that the money demand function is unstable in Saudi Arabia in the long run for monetary aggregate M1. These results could be related to the structural breaks, since all structural break tests indicate the existence of structural breaks in the model. However, given the specification of the model and the dataset, the results of the Gregory and Hansen (GH) cointegration test, which allows for one unknown structural break, suggest that M1 demand is stable in the long run.

Since there was evidence from the GH cointegration test that a long run relationship exists between M1 demand and its determinants for Saudi Arabia, it is possible for policymakers to conduct money targeting using M1 for the control of monetary policy.

For future research, I would suggest using econometric techniques which incorporate more than one unknown structural break in order to investigate the stability of money demand function in Saudi Arabia. In addition, the future work on this issue should depart from linear models and use nonlinear models since most of the previous research focused on linear models of money demand.

References

Abdulkheir, A. (2013). An analytical study of the demand for money in Saudi Arabia. *International Journal of Economics and Finance, 5*(4), 31. http://dx.doi.org/10.5539/ijef.v5n4p31

Alkswani, M., & Altowaijari, H. (1999). Cointegration, error correction and the demand for money in Saudi Arabia. *Economic–International, 52*(3), 229–308.

Andrews, D. (1993). Tests for parameter instability and structural change with unknown change point. *Econometrica, 61*(4), 821–856. http://dx.doi.org/10.2307/2951764

Andrews, D., & Ploberger, W. (1994). Optimal tests when a Nuisance Parameter is present only under the alternative. *Econometrica, 62*(6), 1383–1414. http://dx.doi.org/10.2307/2951753

Bahmani, S. (2008). Stability of the demand for money in the Middle East. *Emerging Markets Finance & Trade, 44*(1), 62–83. http://dx.doi.org/10.2753/REE1540-496X440104

Ball, L. (2001). Another look at long-run money demand. *Journal of Monetary Economics, 47*(1), 31–44. http://dx.doi.org/10.1016/S0304-3932(00)00043-X

Breuer, J., & Lippert, A. (1996). Breaks in money demand. *Southern Economic Journal, 63*(3), 496–506. http://dx.doi.org/10.2307/1061183

Cheong, C. (2003). Regime changes and econometric modeling of the demand for money in Korea. *Economic Modeling, 20*(3), 437–453. http://dx.doi.org/10.1016/S0264-9993(01)00093-1

Choi, K., & Jung, C. (2009). Structural changes and the US money demand function. *Applied Economics, 41*(10), 1251–1257. http://dx.doi.org/10.1080/00036840601007385

Enders, W. (2010). *Applied econometric time series*. Hoboken, NJ: John & Sons.

Ericsson, N., Hendry, D., & Prestwich, K. (1998). The demand for broad money in the United Kingdom, 1978–1993. *The Scandinavian Journal of Economics, 100*(1), 289–324. http://dx.doi.org/10.1111/1467-9442.00103

Goldfeld, S. (1976). The case of the missing money. *Brookings Papers on Economic Activity, 3*, 683–730. http://dx.doi.org/10.2307/2534372

Gregory, A., & Hansen, B. (1996). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics, 70*(1), 99–126. http://dx.doi.org/10.1016/0304-4076(69)41685-7

Gregory, A., Nason, J., & Watt, D. (1996). Testing for structural breaks in cointegrated relationships. *Journal of Econometrics, 71*(1), 321–341. http://dx.doi.org/10.1016/0304-4076(96)84508-8

Hansen, B. (1992). Tests for parameter instability in regressions with I(1) processes. *Journal of Business & Economic Statistics, 10*(3), 321–335.

Hansen, B. (2000). Testing for structural change in conditional models. *Journal of Econometrics, 97*(1), 93–115. http://dx.doi.org/10.1016/S0304-4076(99)00068-8

Harris, R. (1995). *Using cointegration analysis in econometric modeling*. Hemel Hempstead, England: Harvester Wheatsheaf, Prentice Hall.

Haug, A., & Lucas, R. (1996). Long-term money demand in Canada: In search of stability. *The review of Economics and Statistics, 78*(2), 345–348. http://dx.doi.org/10.2307/2109938

Lee, C., Chang, C., & Chen, P. (2008). Money demand function versus monetary integration: Revisiting panel cointegration among GCC countries. *Mathematics and Computers in Simulation, 79*(1), 85–93.

http://dx.doi.org/10.1016/j.matcom.2007.10.003

Masih, M., & Algahtani, I. (2008). Estimation of long-run demand for money: An application of long-run structural modeling to Saudi Arabia. *International Economics, 61*(1), 81–99.

Perron, P. (1989). The great crash, the oil-price shock, and the unit root hypothesis. *Econometric, 57*(6), 1361–1401. http://dx.doi.org/10.2307/1913712

Phillips, P., & Hansen, B. (1990). Statistical inference in instrumental variables regression with I(1) processes. *Review of Economic Studies, 57*(1), 99–125. http://dx.doi.org/10.2307/2297545

Phillips, P., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346. http://dx.doi.org/10.1093/biomet/75.2.335

Poole, W. (1970). Optimal choice of monetary policy instruments in a simple stochastic macro model. *Quarterly Journal of Economics, 84*(2), 197–216. http://dx.doi.org/10.2307/1883009

Stock, J., & Watson, M. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica, 61*(4), 783–820. http://dx.doi.org/10.2307/2951763

Zivot, E., & Andrews, D. (1992). Further evidence on the great crash, the oil–price shock, and the unit root hypothesis. *Journal of Business & Economics, 10*(3), 251–270. http://dx.doi.org/10.2307/1391541