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Some Empirical Evidence on the Stability of Money Demand in Kenya

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ABSTRACT: This study examines the stability of the demand for money in Kenya owing to conflicting results derived from previous studies which have cast doubt on the relevance of monetary targeting. Bounds testing techniques are applied and an error correction model estimated. Demand for broad monetary aggregates is shown to be stable. Moreover, the real income elasticity estimates derived in the analysis are reasonably within the range expected in the Baumol-Tobin framework while the interest rate (Treasury bill rate) elasticity is in the expected range of -0.1 to -0.5. An uncertainty variable incorporated in the model is found to have positive effects on demand for broad monetary aggregates particularly M2 money demand, implying that uncertainty drives economic agents to subsequently switch to relatively liquid assets. The finding that demand for broad monetary aggregates is stable can be interpreted to mean that monetary targeting remains relevant in the Kenyan context.

Keywords: Money demand; stability; monetary policy formulation
JEL Classifications: E41; E52

1. Introduction

The demand for money in Kenya has been studied in regional studies which cover other African countries as well and also in a few studies dedicated to the Kenyan case. The findings of these studies are quite varied. An early study by Fielding (1994) estimated money demand function which included real money balances, real incomes, inflation, interest rates and rate of exchange rate depreciation. The study also included the annual moving average of interest rates and inflation. The study covered Kenya (1976Q1-1987Q2), Cameroon, Ivory Coast and Nigeria. The inclusion of interest rate and inflation variability terms significantly improved model performance. Variability terms became significant in all the four countries investigated.

Then in a recent study, Bahmani-Oskooe and Gelan (2009) investigated the stability of the M2 demand for money in 21 African countries using quarterly data over the period 1971Q1-2004Q3. The study found that in almost all 21 countries, M2 demand for money is stable. In the case of Kenya, money demand was found to be stable. The error correction term was significant and the F- test applied in bounds testing established cointegration between money supply, M_2, real income, inflation and nominal effective exchange rate. The estimated exchange rate elasticity implies that a depreciation of the domestic currency raises the demand for money signifying the wealth effect of Arango and Nadiri (1981). Depreciation increases the value of foreign assets and is perceived as increase in wealth. Inflation being a measure of opportunity cost to holding money was found negative and significant. With a slightly different focus, Adom et al. (2009) investigated the presence of currency substitution in eight African countries including Kenya, Egypt, Morocco, Nigeria, Ghana, South Africa, Tunisia and Zambia. For Kenya, Tunisia and Zambia there was no evidence of currency substitution irrespective of the anchor currencies considered. The estimated money demand model included M_2 real money balances, real income, interest rate, expected inflation and expected exchange rate depreciation. There was no evidence of currency substitution between the Kenya shilling and the South African Rand and versus dollar. Thus the study suggested that money demand in Kenya is stable.

A recent study on the Kenyan economy by Sichei and kamau (2012) analyzed demand for different monetary aggregates in Kenya for the period 1997; 4-2011; 2. The long run equation included four measures of money supply (M0, M1, M2, M3), price level (CPI), real income, treasury bill rate, deposit rate and foreign interest rate adjusted for nominal exchange rate depreciation. The income elasticity of money demand was found to be greater than unity. The coefficient on nominal 91 day Treasury bill rate was negative as expected for all monetary aggregates. The nominal deposit rate (own return on money) had a positive effect on the demand for real broad money M3 balances. Foreign interest rate adjusted with nominal exchange rate depreciation had a negative effect for the demand for real money M_2 and M_3. The study concluded that the demand for the different monetary aggregates is unstable.

Instability in money demand function results in instability in the LM curve which requires policy makers to target the rate of interest instead (Singh and Kumar, 2010). Consequently, the instability of money demand function has been widely expressed as the main reason for de-emphasizing the role of monetary aggregates in the formulation of monetary policy (Özdemir and Saygili, 2013). The breakdown of the money demand function has been attributed mainly to factors like financial innovation, deregulation of financial markets, a change in the exchange rate regime, and a sudden jump in oil prices (Bahmani-Oskooee and Barry, 2000).

Owing to the contradictory evidence presented in previous studies with some studies suggesting stable money demand while others suggest otherwise, this study re-examines the stability of the money demand function in Kenya. A clear understanding of the stability of money demand is crucial given its implications for monetary policy formulation. Currently, in Kenya, broad money, M_3 is the intermediate target variable of monetary policy. The choice of an intermediate target variable to conduct monetary policy is based on the understanding that the demand for the monetary aggregate is stable (Qayyum and Nishat, 2001).

The rest of the paper is organized as follows: section 2 discuses liberalization and developments in financial markets in Kenya, section 3 presents the methodology, section 4 discuses the empirical results while section 5 concludes the study.

2. Liberalization and Developments in Financial Markets in Kenya

The Kenyan economy has undergone major reforms since the early 80's. The country adopted structural adjustment programs with support of the IMF and the World Bank to correct macroeconomic imbalances. Following independence in 1963, Kenya fixed the value of the Kenya Shilling at Kenya shillings 7.14 per one US dollar. From 1972 however, the Government started devaluing the Kenya shilling. The devaluation of the Shilling picked pace in 1981 and continued unabated. Between 1972 and 1992 the Kenya shilling was devalued by 351 per cent. As the pressure for devaluation persisted after 1992, the Government responded by adopting a floating exchange rate regime in October 1993. Within a span of one year alone (1992-1993), the Kenya shilling depreciated by 80 per cent. Since 1993, the Kenya shilling continued to depreciate but in a more gradual manner. Exchange rates continue to respond to external and internal crises such as the 2007/2008 post-election crisis and the subsequent global financial crisis and the Euro zone crisis.

As a major step towards full liberalization of the financial sector, the government decontrolled interest rates in 1991 and liberalized the capital account in 1994. Since 1981, interest rate adjustments were carried out frequently. It can be argued that Kenya adopted a "big bang" approach to capital account liberalization as opposed to gradual opening of the capital account. In the 'Big bang' approach, controls on inflows and outflows are simultaneously removed. The capital account was liberalized in 1994, a period when trade liberalization or current account liberalization was being completed. The opening of the capital account allowed Kenyan residents with foreign currency earnings to open and operate foreign currency accounts. It allows residents to borrow abroad without limit or make outward investments equivalent to U.S$ 500,000.

In 1995, parliament passed the Bill for the repeal of the Exchange Control Act. The Act received presidential assent in June 1995, thus formalizing the liberalization process. Since then, non-residents have been formally permitted to invest in local money market instruments and repatriate their capital and income earned from such investment. As a step towards attracting foreign capital, regulations were revised in 1995 to enable foreigners to own up to 40% of any local company listed in the Nairobi Stock Exchange (NSE). This was later amended thus enhancing foreign portfolio investors' participation through the requirement that only 25% of the share capital of a listed company is to be reserved for domestic investors. The remaining 75% of the share capital was defined as a free float and is available for investment by foreign investors as well as domestic investors without any limitation whatsoever.

Another significant development in the Kenyan economy is the introduction of mobile money in April 2007, when Safaricom launched M-Pesa, a money transfer service. M-Pesa has quickly spread, and by 2013, a stock of about 18 million M-Pesa accounts had been registered in Kenya. M-shwari mobile money savings and loans were introduced in December 2012 thus deepening mobile money, mobile banking and branchless banking.

Liberalization of financial markets and subsequent developments are presumed to affect money demand and hence the need to study more recent periods to ascertain whether these effects have been substantial to warrant rethinking formulation and implementation of monetary policy.

3. Methodology and Data

Theories of money demand have revolved around portfolio balance models and transactions theories with the former emphasizing store of value function of money while the latter views money as a medium of exchange for transactions purposes. The demand for money as a financial asset is determined by the rate of return on the money itself, rate of returns on alternative assets and the total wealth proxied by real income (Civcir, 2003). Recent contribution by Özdemir and Saygili (2013) emphasize the importance of including uncertainty variables in the demand for money function. They examine the role of uncertainty captured by budget deficits, prices and stock market index. This study follows a similar approach but focuses on volatility of exchange rates, inflation, interest rates and Nairobi stock market (NSE) share price index. Thus the following money demand model is adopted:

$$\frac{M}{p} = m = m(y, Rd, Rb, \pi, EX, V) \qquad (1)$$

Where M is the monetary aggregate (M_1, M_2, M_3)

P is price level measured by the consumer Price Index

y is real GDP

R_d is the nominal deposit rate

R_b is the nominal 91-day Treasury bill rate

Π is inflation rate

EX is nominal exchange rate

V is volatility measure

The money demand, m(…) is an increasing function of the scale variable (y) and returns to financial assets included in m (Rd). m(…) is a decreasing function of uncertainty variables (V) and returns to financial assets excluded in m (Rb) and inflation (π). The vector of volatility Variables, V(…) includes variability in exchange rates (EX), inflation (π), interest rates (Rb, Rd) and stock market index (ST). Özdemir and Saygili (2013) argue that worsening macroeconomic sentiment is usually followed by outflow of short-term capital flows, rising interest rates, sudden depreciation of the currency, and fall in stock prices and eventually rising inflation rate. They concluded that a single measure of uncertainty is sufficient to capture the uncertainty in the economy since they are highly correlated with each other.

This study employs bounds testing approach for cointegration analysis based on the Autoregressive Distributed Lag model (Pesaran et al, 2001). The ARDL approach is suitable for money demand analysis since some variables are likely to be stationary while others could have unit roots. The long run cointegrating equation is defined as follows.

$$Ln(\frac{M}{P})_t = \beta_0 + \beta_1 \ln y_t + \beta_2 Rd_t + \beta_3 Rb_t + \beta_4 \pi + \beta_5 \ln EX + \beta_6 V_t + u_t \qquad (2)$$

The ARDL specification for estimation purposes is defined by:

$$\Delta \ln m_t = a_0 + \sum_{i=1}^{n} a_{1i} \Delta \ln m_{t-i} + \sum_{i=0}^{n} a_{2i} \Delta y_{t-i} + \sum_{i=0}^{n} a_{3i} \Delta Rd_{t-i} + \sum_{i=0}^{n} a_{4i} \Delta Rb_{t-i} + \sum_{i=0}^{n} a_{5i} \Delta \pi_{t-i} + \sum_{i=0}^{n} a_{6i} \Delta \ln EX_{t-i} + \sum_{i=0}^{n} a_{7i} \Delta V$$
$$+ \delta_1 \ln m_{t-1} + \delta_2 \ln y_{t-1} + \delta_3 Rd_{t-1} + \delta_4 Rb_{t-1} + \delta_5 \pi_{t-1} + \delta_6 \ln EX_{t-1} + \delta_7 V_{t-1} + e_t \quad (3)$$

Where Δ is the difference operator, *ln* signifies the logarithmic transformation of the data and e_t is a white noise normally distributed disturbance term. The ARDL equation is estimated using ordinary least squares method and zero coefficient restrictions are imposed on the lagged level variables to derive the F-test statistic. The null and alternative hypotheses to be tested are as follows:

$H_o : \delta_1 = 0, \delta_2 = 0, \delta_3 = 0, \delta_4 = 0, \delta_5 = 0, \delta_6 = 0, \delta_7 = 0$

Against the alternative hypothesis,

$H_A : \delta_1 \neq 0, \delta_2 \neq 0, \delta_3 \neq 0, \delta_4 \neq 0, \delta_5 \neq 0, \delta_6 \neq 0, \delta_7 \neq 0$

Critical values have been availed by Pesaran et al (2001) and another set for small samples by Narayan (2005). The latter is suitable and is adopted for this study. Upper bound and lower bound critical values are given for specific sample sizes by Narayan (2005). If the computed F-statistic is below the lower bound critical values, the null hypothesis of no cointegration cannot be rejected. If however the computed F-value is greater than the upper bound critical value, the null hypothesis of no cointegration can be rejected and one can conclude that the variables are cointegrated. If the computed F-value falls between the lower and upper critical values, the test yields an inconclusive result. Once cointegration is established, the long-run estimates are derived by normalizing the coefficients of the lagged level variables by the coefficient of the lagged level dependent variable i.e., $\delta_2, \delta_3, \delta_4, \delta_5, \delta_6,$ and δ_7 by $-\delta_1$.

As explained in Tang (2007) as well as Bahmani-Oskooee and Brooks (1999) and attributed to Kremers et al (1992), the F-test is considered a stage one test- the more powerful test is the significance of the lagged error correction term in the short-run model. The short run model will then be examined for stability using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ). If CUSUM statistic stays within 5% significance level then the coefficient estimates are said to be stable (Bahmani-Oskooee and Barry, 2000). The error correction model is thus defined as:

$$\Delta \ln m_t = a_0 + \sum_{i=1}^{n} a_{1i} \Delta \ln m_{t-i} + \sum_{i=0}^{n} a_{2i} \Delta y_{t-i} + \sum_{i=0}^{n} a_{3i} \Delta Rd_{t-i} + \sum_{i=0}^{n} a_{4i} \Delta Rb_{t-i} + \sum_{i=0}^{n} a_{5i} \Delta \pi_{t-i} + \sum_{i=0}^{n} a_{6i} \Delta \ln EX_{t-i}$$
$$+ a_7 \sum_{i=0}^{n} \Delta V_{t-i} + \delta_1 EC_{t-1} + e_t \quad (4)$$

Where EC_t is the error correction term obtained from the estimated long run equation.

The study covers a more recent period than previous studies and uses quarterly data over the period 2000q1-2013q4. Data on monetary variables including money demand (M1, M2, M3), deposit rates, Treasury bill rates, CPI, and Kenya Shilling-US dollar nominal exchange rates are obtained from the International Monetary Fund (IMF). Quarterly data on real gross domestic product is published by the Kenya National Bureau of Statistics (KNBS). In this study, the seasonally adjusted series is used. The independent variables included in the empirical analysis are real GDP, deposit rate, Treasury bill rate, inflation and the nominal exchange rate. The measures of volatility were obtained through GARCH (1, 1) estimation of changes in the nominal exchange rate and stock market index and also deposit rate, Treasury bill rate and inflation.

4. Empirical Results

Table 1 shows there is positive correlation between volatility of interest rates, inflation and the stock market index and the volatility of the nominal exchange rate implying that to some degree the volatility of the exchange rate is representative of volatilities of the other variables. Put differently, macroeconomic uncertainty permeates through domestic markets concomitantly causing simultaneous volatilities in exchange rates, interest rates, inflation and stock market index. As shown in the appendix, the volatility of the change in exchange rates captures better the global financial crisis of 2008-2009 (which was partly masked by the post-election crisis which affected Kenya in the first quarter of 2008) and the ongoing Eurozone crisis which began towards the end of 2009. Hence, the variables retained in the model are monetary aggregates, real GDP, deposit rate, Treasury bill rate, inflation and volatility of the change in the nominal exchange rate.

Table 1. Correlations between uncertainty measures relating to the variables EX, Rd, π, ST, and Rb

	ΔEX	Rd	π	ΔST	Rb
ΔEX	1.00				
Rd	0.23	1.00			
π	0.521	-0.119	1.00		
ΔST	0.582	-0.134	0.539	1.00	
Rb	0.328	0.245	-0.094	-0.137	1.00

The first step is to estimate an ARDL model in order to ascertain the existence of cointegrating relations between money demand and the independent variables. This is done by carrying out a bounds test. A general –to-specific approach is adopted in the estimation of the ARDL model. In this case, the estimation begins with five lags for each monetary aggregate. The Bayesian Information Criterion (BIC) is then applied to select the optimal lag length in each case. The penalty term for the number of parameters in the model is larger in BIC making it more suitable than other information criteria. By applying the Wald test of zero coefficient restrictions on the lagged level terms in the model, the calculated F- statistic is compared with the critical F-value obtained from Narayan (2005). The results are shown in table 2 (a) and (b). The bounds test confirms cointegration between m1, m2 , m3 and the regressors [y, π, Rd, Rb, EX, V) at 95 % level of significance.

After establishing the existence of long run money demand functions for m1, m2 and m3, the next step is to confirm these relations by estimating an error correction model for each monetary aggregate. The results of the ARDL model and the error correction model are reported in table 3. For the three monetary aggregates considered in this study, the error correction term is highly significant thus confirming the existence of cointegration between m1, m2, m3 and the regressors. Establishing cointegration through the error-correction term is considered the most efficient way in the bounds testing approach.

The coefficient on the error correction term which basically measures the speed of adjustment is similar for m1 and m3, at 46% and slightly higher for M1 at 50 per cent. These results show that following any disequilibrium, adjustment back to equilibrium is rather swift, taking just about two quarters. The fit of the models as indicated by the adjusted R^2 is good, in the range 0.6-0.9. The diagnostic tests indicate that the model passes the various diagnostic tests; the residual series are normally distributed, do not suffer from serial correlation and also do not suffer from heteroskedasticity.

Table 2(a). Bounds test - calculated F-values with lag selection based on BIC

Monetary aggregate	Optimal lags*	Calculated F-statistic
M1	(1, 0, 0, 0, 0, 0,0)	6.15
M2	(4, 2,0, 3, 1,1, 1)	10.47
M3	(4, 2, 0, 3, 0, 0, 1)	4.69

*lags relate to the once differenced variables- [ΔLnM, Δπ, ΔLnRd, ΔLnRb, ΔLny, ΔEX, ΔV,]

Table 2(b). Critical values of F-statistic for Bounds test (unrestricted intercept and no trend)

(n, k)	90% level (lower bound, upper bound)	95% level	99% level
(50, 6)	(2.309, 3.507)	(2.726, 4.057)	(3.656, 5.331)

Note: n represents number of observations while k is number of regressors
Source: Narayan (2005)

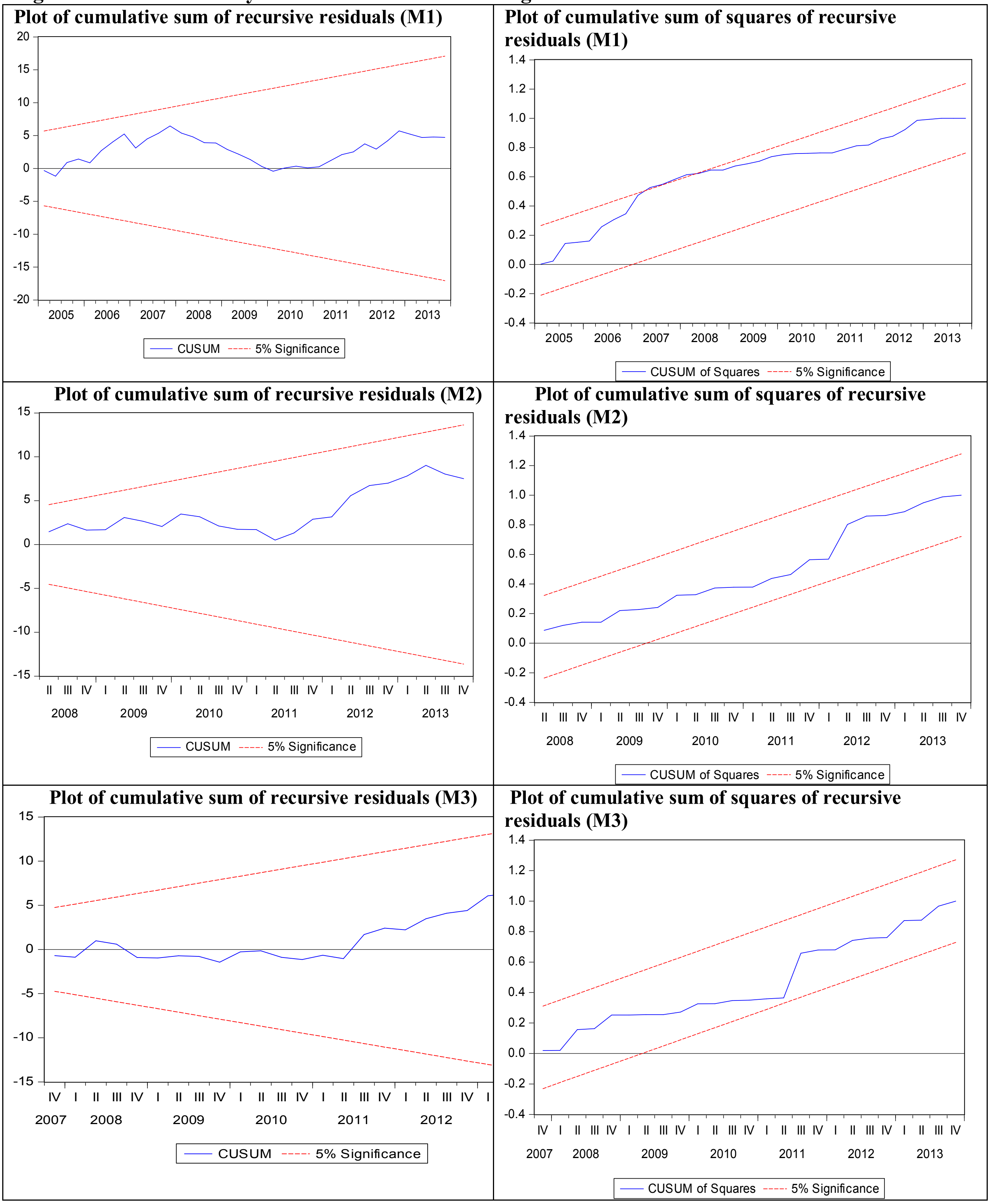
Table 3. Estimates of the money demand models for m1, m2, and m3

Dependent Variable					
ΔLNM1		ΔLNM2		ΔLNM3	
Short-run estimates		Short-run estimates		Short-run estimates	
Δ LnM1(-1)	-0.24 (-1.66)	Δ LnM2(-1)	-0.02 (-0.13)	Δ LnM3(-1)	-0.10 (-0.67)
Δ π	-0.004 (-1.72)	Δ LnM2(-2)	0.01 (0.07)	Δ LnM3(-2)	-0.05 (-0.35)
Δ LnRd	0.28 (3.62)	Δ LnM2(-3)	-0.15 (-1.23)	Δ LnM3(-3)	-0.29 (-1.86)
Δ LnRb	-0.07 (-5.29)	Δ LnM2(-4)	0.58 (4.77)	Δ LnM3(-4)	0.46 (2.79)
Δ Lny	0.85 (2.52)	Δ π	-0.01 (-11.50)	Δ π	-0.01 (-7.21)
Δ LnEX	0.03 (0.19)	Δ π (-1)	0.004 (5.16)	Δ π (-1)	0.004 (3.05)
Δ V	-0.0004 (-0.86)	Δ π (-2)	0.003(3.86)	Δ π (-2)	0.003 (3.22)
		Δ LnRd	0.05 (1.52)	Δ LnRd	0.01 (0.27)
		Δ LnRb	-0.02 (-2.80)	Δ LnRb	-0.01 (-0.66)
		Δ LnRb(-1)	0.05 (3.54)	Δ LnRb(-1)	0.04 (2.13)
		Δ LnRb(-2)	0.03(3.55)	Δ LnRb(-2)	0.02 (1.87)
		Δ LnRb(-3)	0.02 (3.14)	Δ LnRb(-3)	0.03 (2.45)
		Δ Lny	0.24 (1.92)	Δ Lny	0.37(2.09)
		Δ Lny(-1)	0.24 (1.74)	Δ LnEX	0.13 (1.34)
		Δ LnEX	0.11 (1.87)	Δ V	0.00004 (0.17)
		Δ LnEX(-1)	0.17 (2.48)	Δ V(-1)	-0.0004(-1.69)
		Δ V	0.00005 (0.30)		
		Δ V(-1)	-0.001 (-3.25)		
Long-run estimates					
C	-2.32 (-0.73)		3.09 (2.25)		-0.83 (-0.51)
π	-0.01 (-2.70)		-0.02 (-5.78)		-0.02 (-4.26)
LnRd	0.24 (3.02)		0.28 (3.94)		0.18 (1.78)
LnRb	-0.24 (-4.90)		-0.16 (-4.52)		-0.13 (-2.57)
Lny	1.04 (2.38)		0.50 (3.63)		0.77 (4.03)
V	-0.001 (-0.70)		0.002 (2.48)		0.001(1.08)
LnEX	-0.68 (-2.38)		-0.21 (-1.75)		-0.04 (-0.21)
Diagnostics					
Adj. R^2	0.55		0.91		0.80
Normality (Jargue-Bera)	0.82		0.57		0.55
Serial correlation LM test (χ^2)	0.26		1.67		4.69
Heteroskedasticity test (χ^2)	0.11		23.44		24.31
Ramsey RESET test (F-statistic)	0.32		1.95		0.86
CUSUM	Stable		Stable		Stable
CUSUMSQ	Unstable		Stable		Stable
ECM_{t-1}	-0.46 (-6.43)		-0.50 (-9.61)		-0.46 (-6.38)

Note: numbers inside parentheses are the t-values.

Figure 1 shows results derived from CUSUM and CUSUMSQ tests. The CUSUM test for M1 confirms stability of the model but CUSUMSQ test disapproves it, thus yielding mixed results for M1 model. For the broad monetary aggregates however, CUSUM and CUSUMSQ tests both confirm stability of the demands for M2 and M3. Thus demands for M2 and M3 monetary aggregates can be considered stable.

Figure 1. Test for stability of the short-run and the long-run coefficient estimates



As presented in table 3, contemporaneous short-run effects of the Treasury bill rate and inflation are consistently negative across the monetary aggregates as expected while short-run effects of the deposit rate, real income and exchange rate are consistently positive as expected.

Contemporaneous short-run effect of the uncertainty term is negative for m1 but positive for m2 and m3. However, in this study our focus is mainly on the long-run coefficients.

The long-run coefficients reveal that inflation has negative significant effects on money demand as expected across the three monetary aggregates. The coefficient estimates range from 0.01 for m1 to 0.02 for m2 and m3. The deposit rate is also highly significant; significant at 95 per cent level for m1 and m2, but at 90 per cent for m3. The coefficient on the deposit rate is 0.24 for m1, 0.28 for m2 and 0.18 for m3. The Treasury bill rate is significant across the three monetary aggregates and has a negative effect as expected. The coefficient estimates are -0.24 for m1, -0.16 for m2 and -0.13 for m3. The nominal exchange rate has negative effect on money demand across the monetary aggregates and highly significant for m1. For m2 it is significant at 90 per cent level. It is insignificant in the m3 model. It appears therefore that depreciation results in reduced demand for money in the long-run. Real income has a positive significant effect across the three monetary aggregates. The income elasticity of demand for money is 1.04 for m1, 0.5 for m2 and 0.77 for m3. Therefore, for broad monetary aggregates, income elasticity is consistent with the Baumol-Tobin framework. Moreover, coefficient restrictions imposed in the model did not reject the null hypothesis that income elasticity for m2 and m3 could be 0.5. The uncertainty variable is highly significant and positive in the m2 money demand function. It is also positive for m3 though not highly significant. The coefficient is negative and insignificant for m1. It appears therefore that uncertainty increases the demand for money implying that economic agents respond to uncertainty by switching to relatively liquid assets.

Therefore, the long-run income elasticity estimates derived in this study are lower compared to findings by Sichei and Kamau (2012) who find income elasticities greater than unity for all monetary aggregates. However some similarities emerge since they also find positive effects of deposit rates and negative effects of Treasury bill rates on demand for money. Previous studies by Bahmani-Oskooee and Gelan (2009) and Adom et al. (2009) covering the periods 1971-2004 and 1976-2005 respectively also yield different results. The latter finds income elasticity of 2.03 while Bahmani-Oskooee and Gelan (2009) find income elasticity of money demand of 0.21 when nominal effective exchange rate is included in the estimation and 1.26 when real effective exchange rate is included instead. Durevall and Ndung'u (1999) in a study of inflation in Kenya estimated a long-run money demand model and found an unrestricted estimate of real income elasticity of 0.37; by applying coefficient restrictions, 0.5 was found acceptable as predicted by the inventory-theoretic approach to money demand associated with Baumol (1952) and Tobin (1956). As pointed out by Laidler (1982), reasonable quantitative real income elasticity is in the range of 0.5 to 1.0 and -0.1 to -0.5 for interest elasticity. Furthermore, Arrau and De Gregorio (1993) have argued that high elasticity estimates (of interest rate and scale variable) provided by standard estimations are due to omitted variables.

5. Conclusions

The purpose of this study is to re-examine the stability of the money demand function in Kenya using recent data owing to the contradictory evidence presented in previous studies with some studies suggesting stable money demand while others suggest otherwise. A clear understanding of the stability of money demand is crucial given its implications for monetary policy formulation. This study employs bounds testing approach for cointegration analysis based on the Autoregressive Distributed Lag model and uses quarterly data over the period 2000q1 to 2013 q4.

The long-run estimates show that the income elasticity of the demand for money is 1.04 for narrow money, M1, but much lower for broad money, M2 and M3; 0.50 for M2 and 0.77 for M3, hence somehow close for the two broad monetary aggregates. These results are consistent with the Baumol-Tobin framework of Transactions demand for money. The deposit interest rate has positive effect on money demand being a proxy for returns on financial assets included in money. In contrast, the Treasury bill rate has negative effect on demand for money since it is considered a proxy of the return on financial assets excluded in money. The interest rate elasticities are shown to be generally within the expected range of -0.1 to -0.5. The coefficient on inflation variable which is considered a measure of the opportunity cost of holding money is found negative across the different monetary aggregates. Similarly, a depreciation of the exchange rate has negative effect on money demand implying that depreciation reduces demand for money. Macroeconomic uncertainty is shown to have positive effects on money demand particularly for m2 money demand implying that economic agents respond by switching to relatively liquid assets when faced with uncertainty.

The study confirms that the demands for the broad monetary aggregates are stable. Hence, the current arrangement in which M_3 is taken as the intermediate target variable of monetary policy could be considered appropriate.

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APPENDIX

Garch variance of change in exchange rates (V_EX), inflation (V_INF), Treasury bill rate (V_RB), deposit rate (V_Rd), and change in Stock market price index (V_ST)