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The Stability of Money Demand Function: Evidence from South Africa

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ABSTRACT

The main purpose of this paper is to assess whether the Money Demand Function is stable in South Africa by employing the Johansen co-integration and the Vector Error Correction Model. The results indicate unstable money demand function among its determinant including real income, interest rate, stock price, and real exchange rate. More importantly, the M3 has a significant long-run relationship among its determinant except the interest rate. Furthermore, the short term dynamics show that unidirectional causality runs from determinants to the broader money except interest rate and exchange rate. This paper provides crucial evidence for policy-makers to consider the importance of the stock market activity to avoid misspecification of the money demand function.

Keywords: Money Demand, Johansen, Vector Error Correction Model, Stock Price
JEL Classifications: E5, E41

1. INTRODUCTION

Many macroeconomists acknowledged the importance of behavior of money demand function when formulating an efficient monetary policy. The stability of the money demand function among its determinant including income and interest rate is a crucial component for the success of monetary intermediate targeting or direct approaches. This paper shows new evidence about the stability and relationship of the money demand function among its determinants in South Africa by including stock market activity in the function using the Johansen co-integration and Vector Error Correction Model (VECM).

The literature over the past two decades indicates that financial reforms and switching between monetary policies have increased uncertainty about the stability of the money demand function (Kumar et al., 2013; Maki and Kitasaka, 2006; Nchor and Adamec, 2016). South Africa has experienced several different financial reforms and monetary regimes since the 1960s. A liquid asset ratio, cash reserve-based system, monetary targets regime, and inflation targeting were the main systems that the South Africa Reserve Bank (SARB) adopted (Table 1) (Aron and Muellbauer, 2002; 2007).

In 2000, SARB implemented an inflation targeting system. The inflation targeting policy is that the central bank (SARB) forecasts the future rate of inflation and compares it with a predetermined inflation rate (3-6% in the case of SA). The approach proposed that the monetary policy is being directly forward-looked that employing inflation forecasting for guidance. The inflation rate is directly affected by policy instruments (interest rate, for example). Hence, it is argued that monetary aggregates have no role under this approach (Baltensperger et al., 2001). However, Baltensperger et al. (2001) investigated the nexus between broader money (M3) and inflation where they proposed that monetary aggregates are still effective in the process of forecasting and targeting inflation. The fact is that M3 provides useful information about the movements of the price. Besides, stable monetary

Table 1: Summary of monetary policy regimes in South Africa

Duration	Monetary policy adopted
1960-1980	Liquid asset ratio based system
1980-1985	Cost of the cash reserve
Mid 1985-1999	Monetary targeting
2000-current	Inflation targeting

Source: (Aron and Muellbauer, 2007)

aggregates is a useful instrument to stabilize the inflation rate (Kumar et al., 2013; Nell, 2003).

The above argument emphasizes that stable money demand function is powerful under inflation targeting regime but the question is whether the money demand function is stable in South Africa?. In the South African context, a few papers examined the relationship between money demand and its determinant. The results show stable money demand before implementing the inflation targeting regime (Tavlas, 1989) (Hurn and Muscatelli, 1992) (Jonsson, 2001)(Bahmani-Oskooee and Gelan, 2009)[1]. However, most of the empirical literature conducted after the regime indicates that stable money demand function (M3) does not exist (Nell, 2003) (Tlelima and Turner, 2004) (Kapingura, 2014). The core variables were income and interest rate, but stock price and other financial variables are omitted.

Earlier studies such as Friedman (1988) carried out empirical literature analyzing the nexus between stock market activity and money demand function in the US using data from 1961 to 1986. Friedman proposed stock market affects money demand in different channels: (1) Through income effect (positive): An increase of stock price reveals a rise of wealth that can result in higher money demand. (2) Substitution effect (negative) an increase in the price of assets reveals that the investment market is more attractive than holding money where the people tend to invest and as a result, it reduces the demand for money. Finally, Friedman concluded that the impact of the stock market on money demand function is ambiguous (Baharumshah et al., 2009).

Following the seminal work of Friedman (1988), empirical literature highlighted inserting stock price in the money demand function improves the functional form. Kia (2006), Baharumshah et al., (2009) and others showed that the stock price is an important determinant in both developed and developing countries. Furthermore, the omission of such an important variable could result in instability in the money demand function. In this regard, whereas the previous literature on South Africa neglected (to our knowledge) the impact of the stock price on monetary aggregate, our study includes this crucial variable in the model.

This study aims to address the stability and determinant of the money demand function by including the stock market activity. Our objective is to shed light on the co-integration analysis of broader money, real income, stock price index and real exchange rate by using the most recent data. We examine broader money rather than M0, M1 or M2 because M3 is an important indicator of inflation targeting which South Africa is adopting currently.

In brief, we find that real income has a positive and significant relationship on M3. In contrast, both interest rates and exchange rates are negatively related to broader money. Additionally, the stock price has a significant positive influence on the money demand function. For the period of investigation, the short term dynamics show all determinant have unidirectional causality except interest rate and exchange rate. The rest of the paper is planned as follows: Section 2 provides a review of existing literature. The methodology is discussed in section 3. Section 4 provides results and discussions. Finally, policy recommendation is found in Section 5.

2. LITERATURE REVIEW

Keynes (1936) developed the liquidity preference theory in order to analyze the money demand function. Keynes started with the question of why money is held by people. Three motives are underlined (1) transaction motive (2) precautionary motive (3) speculative motive. Keynes asserted the reason that people hold cash balance is to fill up the gap between receipts and payment as same as for precautionary propose. Keynes determined that both of the first two motives are a function of income (Nchor and Adamec, 2016). Subsequently, some other researchers followed Keynes's proposal whereby the income is determinant of money demand, this researches including Adekunle (1968) and Sowa (1993).

Baumol, 1952 and Tobin, 1956 latter argued the interest rate is one of the crucial explanatory variables that affect all money demand motives. Besides, interest estimates the opportunity cost of holding money. For instance, if the interest rate increases, the opportunity cost of holding money will rise. Hence, people desire to decrease their holding quantities of money (Mishkin, 2007; Nchor and Adamec, 2016).

After these different theories are carried out, the literature turns to investigate money demand function empirically. Baharumshah et al., 2009; Bahmani-Oskooee and Bohl, 2000; Bahmani-Oskooee and Shabsigh, 1996; Bahmani-Oskooee* and Rehman, 2005; Bhaskara and Singh, 2006; Cheong, 2007; Dreger and Wolters, 2010; Hamdi et al., 2015; Hamori and Hamori, 2008; Kjosevski, 2013; Knell and Stix, 2005; Mall, 2013; Samreth, 2008 are consider both determinant of demand function and its stability. In the African continent, a sufficient number of empirical evidence ware published in particular (Darrat, 1986; Kapingura, 2014; Kumar et al., 2013; Nchor and Adamec, 2016; Tlelima and Turner, 2004). Table 2 indicates how the elasticity of income and interest rate differ across countries in Africa.

1 Bahmani-Oskooee used M2 instead of M3 and they found that M2 demand function is stable using a data between 1971Q1 and 2001Q3.

Table 2: Summary of income and interest rate elasticity in Africa

Author	Country	Monetary aggregates: Period	Methodology	Income	Interest rate	Stability
Nchor and Adamec (2016)	Ghana	M1; 1990-2014	ECM	2.43 (0.574)***	–0.81 (0.66)***	Stable
Kapingura (2014)	South Africa	M3; 1995Q1-2012Q4	JML &VECM	5.013(1.090)	0.073(0.024)	Not stable
Kumar et al. (2013)	Nigeria	M1; 1960-2008	ECM	0.90 (4.52)***	–0.19 ((3.16) ***	Stable
Herve and Shen, (2011)	Côte d'ivoire	M1; 1980-2007	JML	5.31 (6.16)**	–0.19 (0.24)**	Not stable
Akinlo, (2006)	Nigeria	M2; 1970Q1-2004Q4	JML	1.09 (43.8)***	–0.09(1.91)*	Stable
Nell (2003)	South Africa	M3; 1965-1997	JML	1.27 (6.5)***	–0.006 (-2.6)***	Not stable
Darrat (1986)	Kenya	M1; 1969Q1-1978Q4	OLS	1.843 (8.91)*	–0.169(3.40)*	Stable

***, ** and * represents 1%, 5% and 10% significant of level respectively. (…) The number in parenthesis shows t-value. OLS, ECM, ARDL, JML are ordinary least square, autoregressive distribute lag, Johansen maximum likelihood respectively

3. METHODOLOGY

3.1. Data and Model Specification

The study considers quarterly time series data from 2000Q1 through 2017Q2 (70 observations) where all data was collected from IMF International Financial Statistics (IFS) database except broader money (M3) and stock price index. The former is obtained from South Africa Reserve Bank (SARB) whereas the latter is collected from Fred economic data. All variables are in natural log form excluding interest rate.

Following (Sriram, 2000) and base on the Friedman (1988) seminal, the broader money demand function is specified as:

$$\frac{M3}{P} = f\left(Scale,\ OC\right) \tag{1}$$

Where the demand for real broader money (*M*3/*P*) is a function of scale variable represent economic activity and opportunity cost which stands for the cost of holding money. We extend equation (1) into the econometric equation.

$$LRM3_t = \Omega_0 + \Omega_1 LY_t + \Omega_2 R_t + \Omega_3 LSP_t + \Omega_4 LEX_t + \varepsilon_t \tag{2}$$

Where LRM3[2] is a log of real demand for broader money. LY is the proxy of the scale variable. In fact, the appropriate scale variable has been strongly debated in the existing literature (Kjosevski, 2013). Some authors emphasize that using GDP as a proxy of scale variable could cause an overload of the level of the transaction in the economy. Consequently, following Kjosevski (2013), Payne (2003), Pelipas (2006) and others, the industrial production index (IPI, 2010=100) is used as a scale variable in this paper. Following Nell (2003), the (R) in the equation represents government bonds rate to estimate opportunity cost for holding money. LSP is the log of the stock price index[3] (2015=100). Finally, LEX is the real exchange rate (domestic/foreign) which is used to capture the cost of holding domestic money against foreign currency. Besides, the expectation of parameters is $\Omega_1>0$; $\Omega_2<0$. However, the expected sign of Ω_3 and Ω_4 are ambiguous. The former is discussed in the introduction section and the latter is due to different possible effects of the real exchange rate. For instance, if the real exchange rate depreciates, the domestic residents benefiting from increasing the value of the foreign asset, therefore, if the wealth follows and goes up the demand for money increases. On the other hand, if further depreciation expected, it leads to a decline in money demand (Bahmani-Oskooee and Malixi, 1991) (Kia, 2006) (Tang, 2007)

3.2. Johansen Co-integration Specification

It has been reported in the literature that most macroeconomic data have unit root and conventional thinking was to convert data into stationary before testing (Johansen, 1991; Ramachandran, 2004). However, Engle and Granger (1987) first proposed that if such a linear combination between two or more non-stationary variables is stationary, the variables are co-integrated. Afterward, (Johansen, 1991) and (Johansen and Juselius, 1990) developed a useful model to test long-run co-integration to analyze multivariate time series. In order to investigate the existence of co-integration among variables, first, we consider Vector Autoregressive model (VAR) with a vector variable Y_t is (n×1), A_0 is (n×1) constant matrix term, A_i is (n×n) matrices coefficient and ε_{1t} is vector of error term.

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \varepsilon_{1t} \tag{3}$$

$$\Delta Y_t = A_0 + \Pi Y_{t-k} + \sum_{i=1}^{k-1} A_i Y_{t-i} + \varepsilon_t \tag{4}$$

The vector variable ΔY_t and Y_{t-i} have a unit root. Therefore, the rank Π (r) matrix determines the long-run relationship. If rank = 0, the VAR with k[th] lags will proceed and there is no cointegration among variables in the long run. Despite that, if 0 <r<n, express into r×n matrix in such that rank with cointegration determined by

$$\Pi = \alpha\beta' \tag{5}$$

Where α is a strength parameter that measures the quality of co-integration and β' vector of co-integration. Hence, β' Y_t is stationary at I(0). Equation (5) implies that there is a long run linear combination among variables where r < n.

3.3. Vector Error Correction (VECM) Specification

Subsequently, the second step after confirming the existence of linear combination among variables is to employ Vector Error Correction (VECM) to conduct the long-run coefficients, Error correction model that indicates the speed of adjustments towards long-run equilibrium and granger causality test. The VECM model is specified as the following:

2 South Africa reserve bank (SARB) defines M3 as "M2 plus all long term deposit with monetary banking institutions".

3 Johannesburg stock exchange (JSE) provides the index and it contains all share prices of 150 companies listed in the market.

$$LRM3_t = \varphi_{11t} + \sum_{i=1}^{k} \tau_{12i}\, \Delta LM3_{t-i} + \sum_{i=1}^{k} \tau_{13i}\, \Delta LY_{t-i} + \sum_{i=1}^{k} \tau_{14i}\, \Delta R_{t-i} + \sum_{i=1}^{k} \tau_{15i}\, \Delta LSP_{t-i} + \sum_{i=1}^{k} \tau_{16i}\, \Delta LEX_{t-i} - \psi_{11} ECM_{1,t-1} + \varepsilon_{1t} \quad (6)$$

$$LY_t = \varphi_{21t} + \sum_{i=1}^{k} \tau_{22i}\, \Delta LM3_{t-i} + \sum_{i=1}^{k} \tau_{23i}\, \Delta LY_{t-i} + \sum_{i=1}^{k} \tau_{24i}\, \Delta R_{t-i} + \sum_{i=1}^{k} \tau_{25i}\, \Delta LSP_{t-i} + \sum_{i=1}^{k} \tau_{26i}\, \Delta LEX_{t-i} - \psi_{21} ECM_{2,t-1} + \varepsilon_{2t} \quad (7)$$

$$LR_t = \varphi_{31t} + \sum_{i=1}^{k} \tau_{32i}\, \Delta LM3_{t-i} + \sum_{i=1}^{k} \tau_{33i}\, \Delta LY_{t-i} + \sum_{i=1}^{k} \tau_{34i}\, \Delta R_{t-i} + \sum_{i=1}^{k} \tau_{35i}\, \Delta LSP_{t-i} + \sum_{i=1}^{k} \tau_{36i}\, \Delta LEX_{t-i} - \psi_{31} ECM_{3,t-1} + \varepsilon_{3t} \quad (8)$$

$$LSP_t = \varphi_{41t} + \sum_{i=1}^{k} \tau_{42i}\, \Delta LM3_{t-i} + \sum_{i=1}^{k} \tau_{43i}\, \Delta LY_{t-i} + \sum_{i=1}^{k} \tau_{44i}\, \Delta R_{t-i} + \sum_{i=1}^{k} \tau_{45i}\, \Delta LSP_{t-i} + \sum_{i=1}^{k} \tau_{46i}\, \Delta LEX_{t-i} - \psi_{41} ECM_{4,t-1} + \varepsilon_{1t} \quad (9)$$

$$LEX_t = \varphi_{51t} + \sum_{i=1}^{k} \tau_{52i}\, \Delta LM3_{t-i} + \sum_{i=1}^{k} \tau_{53i}\, \Delta LY_{t-i} + \sum_{i=1}^{k} \tau_{54i}\, \Delta R_{t-i} + \sum_{i=1}^{k} \tau_{55i}\, \Delta LSP_{t-i} + \sum_{i=1}^{k} \tau_{56i}\, \Delta LEX_{t-i} - \psi_{51} ECM_{5,t-1} + \varepsilon_{5t} \quad (10)$$

Where $\varphi_{11}\ldots\varphi_{51}$ is a constant term, $\tau_{12i}\ldots\ \tau_{56i}$ represent long-run elasticity, Δ is designed to shows the operator of the first difference, $\psi_{11}\ldots\psi_{51}$ reveals the parameter of the error correction model (ECM) which is specified as

$$ECM_{1,t-1} = LRM3_{t-1} - \rho_0 - \rho_1 LY - \rho_2 R - \rho_3 LSP - \rho_4 LEX \quad (11)$$

ρ_0 is constant of long term, $\rho_1,\ldots, \rho_4$ is long term elasticity and finally k is the optimal lag length chosen by using Akaike Information Criterion (AIC) conducted from VAR lag selection (Wang and Wang 2017).

The third step is to calculate the Granger causality test in order to investigate the direction of the relationship among variables. The VECM Granger causality is estimated. The granger causality hypothesis should be detailed as:

H_0: $\rho_{11k}=0, \rho_{12k}=0, \rho_{13k}=0, \rho_{14k}=\rho_{15k}=0$ (the lagged variable does not cause to LRM3).

H_A: $\rho_{11k}\neq 0$, $\rho_{12k}\neq 0$, $\rho_{13k}\neq 0$, $\rho_{14k}\neq\rho_{15k}\neq 0$ (the lagged variable does cause to LRM).

By computing the Wald test, if the $P < 0.10$ we reject the null hypothesis and conclude that the lagged value does granger cause to the dependent variable and vice-versa (Bah and Azam, 2017, p. 8).

3.4. Test Stability of the Model and Robustness Check

In this study, we performed cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals square (CUSUMSQ) developed by Brown et al. (1975) to test the stability of parameters in the long run. Subsequently, it is used to test the robustness of the model is to obtain the co-integration among variables. The study applied several diagnostic tests including the Breusch–Godfrey LM test and ARCH heteroskedasticity test to test the existence of autocorrelation and heteroskedasticity respectively.

4. RESULTS AND DISCUSSIONS

This section reports our empirical findings, including the results of the unit root test, co-integration test, long-run elasticity, granger causality, robustness, and stability check.

4.1. Unit Root Test

Our aim in this paper is to investigate broader money demand function (M3) in South Africa using Johansen Maximum Likelihood (JML) co-integration test and Vector Error Correction Model (VECM). Conducting the unit root test is necessary to check the validity of the JML assumption which assumes all variables are stationary at first deference I(1). An augmented Dickey-Fuller test (ADF) is employed. The null hypothesis of ADF shows the existence of a unit root. A maximum of 4 lags was chosen using the Schwartz information criterion (SIC).

Table 3 presents the results of the test. The result reveals that all variables are non-stationary at the level and therefore, they are stationary at the first difference I(1).

4.2. Lag Order Selection

Since all variables are stationary at the first difference I(1), it is reasonable to proceed and obtain the number of appropriate lags for the JML test by formulating the VAR lag order selection method. Consider that we have quarterly short term observation data (only 70), we selected a maximum of 6 lags. Base on the

Table 3: ADF unit root test

	Level		First difference		Conclusion
	Constant	Constant with trend	Constant	Constant with trend	
LM3	–2.00	–1.75	–9.03***	9.26***	I(1)
LY	–2.32	–2.60	–4.06***	–3.62***	I(1)
R	–2.18	–2.95	–4.08***	–7.36***	I(1)
LSP	–0.91	–2.43	–6.01***	–5.97***	I(1)
LEX	–0.94	–1.56	–7.37***	–7.34***	I(1)

***, ** and * denotes significant at 1%, 5% and 10% significance level, respectively. The optimum lag length selected based on Schwarz Info Criterion

Table 4: VAR Lag order selection

Lag	LR	FPE	AIC	SC	HQ
1	NA	2.04e-10	–8.13	–7.28*	–7.80
2	58.31	1.53e-10	–8.42	–6.74	–7.76
3	39.40	1.54e-10	–8.45	–5.92	–7.45
4	65.97	8.02e-11	–9.17	–5.80	–7.84
5	47.24*	5.83e-11*	–9.60*	–5.38	–7.93*
6	16.18	9.46e-11	–9.29	–4.23	–7.30

*Indicates lag order selected by the criterion (each test at 5% level). LR: Sequential modified LR test statistic. FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criteria results presented in Table 4, LR, FPE, AIC and HQ suggested 5 lags. Hence, 5 lags are included in the model. Another important diagnostic before investigating co-integration is to ensure that no significant lag was left. Correlogram of residuals is taken into the account where no significant lag left.

4.3. Johansen Co-integration Test

Subsequently, equation (3) - (5) is employed to test the number of co-integration equations in the model. As Panel A in Table 5 reveals the results of the JML test where both trace and maximum eigen value statistics confirm that at least two co-integration equations exist in the model. However, we tasted only one co-integration equation since our interest is only to assess the relationship of broader money (M3) among its determinants. Panel B in Table 5 shows Normalised long-run elasticity. The result indicates that signs of income and interest rate are consistent with the prediction of theoretical signs. Moreover, the result shows that the stock market price has positively and significantly related to M3. The positive relationship reflects income effect is large than the substitution effect of stock market activity. The positive elasticity of stock price consistent with (Baharumshah et al., 2009). On the other hand, the depreciation of the exchange rate causes a decrease of M3 which possibly comes from the expectation of the people that the domestic money depreciation can be deeper in the future and thereby holding it causes loss of its value. Kapingura (2014) found that elasticity of exchange rate is - 0.945 in South Africa, which is greater than our elasticity.

4.4. Short-run Dynamics

Afterwards, the short term relationship was tested. The VECM is required in order to check the validity and convergence of the long term relationship. To determine the existence of a short term relationship at least one of the ECM coefficients should be significant. The results presented Panel A in Table 6 indicate that The error correct model (ECM) is negative as expected and significant. Therefore, the ECM emphasized the existence of the long-run co-integration among variables. Additionally, the ECM shows the departure of the dependent variable from the independent variable is corrected 94% each period. In other words, the disequilibrium of long-run relationship is corrected 94% each period where the convergence to the long-run equilibrium takes approximately a quarter and 2 months.

Table 5: Johansen Maximum Likelihood result of the RM3 demand function

Panel A: JML trace statistics and maximum Eigen value results

Null	Alternative	Trace statistics	95% Critical value	λmax Statistics	95% Critical value
r=0[a]	r=1	97.42*	69.82	34.29*	33.88
r≤3	r=2	63.14*	47.86	28.08*	27.58
r≤2	r=3	35.06*	29.80	18.14	21.13
r≤2	r=4	16.92*	15.49	8.67	14.26
r≤1	r=5	8.25*	3.84	8.25*	3.84

Panel B: Normalized co-integration coefficients
LRM3=0.95LY–0.012R+0.45 LSP–0.40LEX
(0.48) (0.02) (0.07) (1.33)
[–1.96] [–0.49] [-6.50] [-5.65]

([a]) Indicate the rank of the co-integration equation. (*) Shows the significance of t-statistics at 5%. Trace and maximum Eigen-value statistics are obtained including intercept with no trend. P-values is base on (Mackinnon et al., 1999). (…) The number in parentheses represents standard error and […] the number in brackets indicates t-statistics

The short term dynamics also explained the causality between variable which is when a variable past behaviour predicts the future value of another variable. The granger causality is tested to detect this dynamic behaviour within VECM. The results as illustrated in Table 6 indicate the presence of this dynamic behaviour and it is directions are are ΔLY→ΔLRM3, ΔLSP→ΔLRM3, ΔLSP→ΔLY, ΔLSP→ΔLR, ΔLSP→ΔLEX. In other words, results in Table 6 Panel A show significant unidirectional causality runs from real income and stock price to the broad money. The result reveals interest rate and the real exchange rate does not granger causes broader money. In contrast, the results highlight that there is no causality running from RM3 to determinant variables.

4.5. Robustness Check and Stability Test

In Panel B of Table 6, we turn to check several diagnostic checks including model stability, autocorrelation, and heteroskedasticity test. First, the Breusch–Godfrey LM test is calculated to capture the existence of serial correlation in the residuals. The x^2 is reported in Table 6 Panel B. The P-value of the χ^2 is 0.07 which is >0.05 level of conventional significance. This implies that the model is fit and free from serial correlation problems. Next, we turn to estimate ARCH Heteroskedasticity. The same procedure has been followed where it is concluded that heteroscedasticity is not present.

Finally, the cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals square (CUSUMSQ) are estimated to test the model stability. The results are presented in Figure 1. The results show that the two tests lead to different conclusions. The former indicates a stable long-run relationship, whereas the latter shows a deviation of the money demand function. Therefore, to ensure the existence of a structural break, the Chow test is calculated. The results of the Chow test indicate that there is structural break 2010q2 through 2011Q1 where F-statistics rejected. The result of the Chow test is not reported in order to save some space.

Table 6: Panel A: Granger causality test results

	Dependent variable					
	ΔLRM3	ΔLY	ΔR	ΔLSP	ΔLEX	ECM
ΔLRM3	-	1.89	0.60	1.13	2.17	–0.95***
ΔLY	19.75***	-	0.62	4.21	4.86	0.054
ΔR	2.83	3.91	-	3.33	3.22	–0.11
ΔLSP	15.15***	20.60***	10.57*	-	10.81*	-0.07
ΔLEX	10.08*	2.61	3.10	5.32	-	–0.29

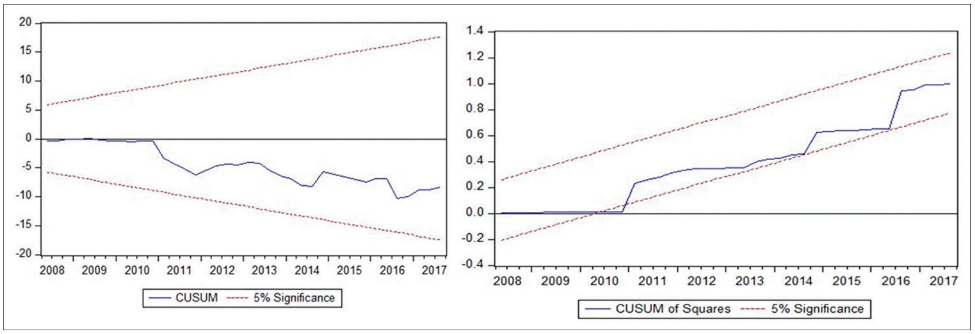
*** and ** denotes significant at 1% and 5% significance level, respectively

Panel B: Robustness check

Test	Value
R-square	0.71
Autocorrelation LM test	5.27[a]
ARCH heteroskedasticity test	0.64[a]

***and *indicates the level of significance 1% and 5% respectively. ([a]) Represents χ^2 value

Figure 1: Cumulative sum of recursive residuals and cumulative sum of recursive residuals square for stability test



5. CONCLUSION

The importance of money demand stability has been underlined to attain long term objectives of monetary policy. The previous research has shown that financial reforms and changing monetary policies could affect the stability of money demand function. Furthermore, the current literature in South Africa indicates that money demand is unstable since SARB adopted the inflation target policy in 2000.

The purpose of this paper was to investigate the stability of money demand function in South Africa. The paper included a new variable (our best knowledge) in the money demand function in South Africa. The stock market activity is included following by Friedman's (1988) seminal work. The long-run co-integration of real broader money (RM3), income, interest rate, stock price, and real exchange rate is confirmed by the Johansen co-integration model test. The VECM supported the existence of a long-run relationship. CUSUM and CUSUMSQ are also tested to investigate the stability of the money demand function. The money demand function is found unstable according to CUSUMSQ. And, Chow test confirmed the existence of a structural break in 2010Q2.

For the policy-makers, the results suggest the importance of stock price and foreign activity to generate long term effective money demand function. Although the money demand function still unstable when the two variables are included, however, the exclusion of them could delay the recovery of the stability. Furthermore, both variables showed their influence in the long run. Another important point is that income elasticity is approximately unitary which suggests to the policy-makers should allow the money supply to grow the same rate with income growth to avoid mismatching between money demand and money supply. Finally, the study suggests further research on money demand stability by taking a structural break into the account.

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