Do Exchange Rate Changes Have Asymmetric or Symmetric Effects on the Demand for Money in the Gambia

Kebba Bah (Corresponding author)

School of Finance, Zhongnan University of Economics and Law, Wuhan, China

University of the Gambia, Serekunda, Gambia

E-mail: kbah@utg.edu.gm or kebbabah95@gmail.com

Karamat Khan

School of Finance, Zhongnan University of Economics and Law, Wuhan, China

Arif Taufiq Nurrachman Aziez

School of Economics, Zhongnan University of Economics and Law, Wuhan, China

Ali Kishwar

School of Finance, Zhongnan University of Economics and Law, Wuhan, China

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Abstract

In trying to explain the relationship between exchange rate and demand for money researchers have applied different models. In this paper, we applied both the linear and nonlinear ARDL to check the effects of exchange rate changes on the demand for money (M1 and M2) in The Gambia. The result revealed that the demand for money is cointegrated with its determinants and have a stable short-run relationship. It also revealed that exchange rate changes have only short-run asymmetric effects on demand for money (M1 or M2) but don’t have long-run effects.

Keywords: Exchange rate, Nonlinear ARDL, M1 and M2 for money, Adjustment asymmetry, Impact asymmetry

1. Introduction

The goal of the monetary policy of every country is to make sure that the result of the monetary policy is stable prices and output growth. In other to achieve this, a stable demand for money is required. Hence the demand for money is one of the key functions in formulating an effective and appropriate monetary policy. The monetary authority should be able to control the monetary aggregate. There are a few literatures that studied the demand for money in The Gambia. Among these only one included exchange rate in their money demand function.

According to Mundell (1963), the demand for money besides income and interest rate also depends on the exchange rate. Since Mundell did not provide a clear theoretical or empirical explanation. Arango and Ishaq Nadiri (1981) argued that if the local currency depreciates, the value of foreign assets held by domestic resident's increases in domestic terms. If this is taken as an increase in wealth, then the demand for money at home might increase. This is referred to as the wealth effects of exchange rate changes. Similarly, according to M. Bahmani- Oskooee and Pourheydarian (1990), the appreciation of foreign currency could lead the public to expect further appreciation and hence hold less of domestic's currency and more foreign currency. This situation is called the expectation effect of exchange rate changes. The demand for money can increase or decrease depends due to the depreciation depending on which effect is stronger.

The literature on the demand for money is so vast. We will first start with literatures on demand for money outside the Gambia then narrow down to that on-demand for money in The Gambia. McNown and Wallace (1992) studied the demand for money (M1 and M2) of the USA and found out that there is long-run stationarity for M2 but it requires the addition of effect exchange into the money demand function. According to their finding the M1 demand for money is not stable.

Mohsen Bahmani-Oskooee and Sungwon (2002) in their studies revealed despite M2 is cointegrated with exchange rates, income and interest rate using the CUSUM and CUSUM square on the residuals of the error correction model they found it unstable for Korea. In another study by Bjørnland (2003) on demand for money in Venezuela during the financial crisis and substantial exchange rate fluctuations were able to establish a long-run relationship between real money, real income, inflation, exchange rates, and domestic interest rates. The study also revealed that both inflation and exchange rate have effects on real money demand. Ismail H Genc, Hasan Sahin, and Erol (2005) investigated whether a depreciation in the Turkish Lira leads to currency substitution. The finding revealed that currency substitution happens. Samreth (2008) uses the ARDL to estimate the demand for money in Cambodia. The results show that exchange rate changes have long-run currency substitution effects. Mohsen Bahmani-Oskooee, Martin, and Niroomand (1998) examined the determinant of M1 and M2 demand for money in Spain. Using quarterly data, they were able to find the evidence of cointegration among variables in both the M1 and M2 demand function. The study revealed that effective exchange only has effects on M2 demand for money and it is seen to be stable over time. The study by M. Bahmani-Oskooee and Bahmani (2015) on the demand for money in Iran using the non-linear ARDL was able to establish that appreciation or depreciation could affect demand for money asymmetrical. Similarly, Mouyad Al Samara, Lanouar; and Mrabet (2017) studied the demand for money function in Syria and established the evidence for the existence of stable long-run relationships. Moreover, the results show that the two additional variables, the black market exchange rate and the oil price, play a vital role in determining the money demand in Syria. Alsamara, and Mrabet (2019) in their study show that the demand for money in turkey response stronger to negative shock (appreciation) than positive shock (depreciation). Thus, individuals should expect further appreciation when Turkish lira appreciates. Mohsen Bahmani-Oskooee and Baek (2017) in their study using nonlinear ADRL on the demand for money show that exchange rate changes do have both short-run and long-run asymmetric effects on M1 demand for money. It also revealed that money demand is stable. Mohsen Bahmani-Oskooee and Saha (2016) used NARDL to study the effects of changes exchange rate on the demand for money in Japan. Their result shows that the variables are cointegrated and exchange rate has an asymmetric effect on demand for money.

In another study by Mohsen Bahmani-Oskooee, Sahar Bahmani, Ali M Kutan, and Xi (2019) on the effect of an exchange rate change on the demand for money on five Asian counties (India, Indonesia, Korea, the Philippines, and Singapore) supports the existence of short-run asymmetric effects. Dritsakis (2011) in his study of the effect of an exchange rate change on the demand for money revealed that depreciation of the domestic currency leads to a decrease in demand for money. In literature on African countries, Simmons (1992) applies the error correction model to demand money in five African Economies (Congo, Cote d'Ivoire, Mauritius, and Tunisia). The result shows that the domestic interest rate plays a significant role in the demand for money in five countries. Mohsen Bahmani-Oskooee, Ali M. Kutan, and Zhou (2006) in their paper investigating the effects of the effective exchange rate of developing countries on their demand for money. Using quarterly data, they show that short-run effects of depreciation could be in either direction but long-run effects are negative indicating that depreciation causes a decline in the demand for domestic currency. Mohsen Bahmani-Oskooee and Gelan (2019) studied the effect of the exchange rate on 18 African Countries which does not include the Gambia. Their result shows that most of the countries under studies, the exchange rate has short-run asymmetric effects, whereas in very few countries that these short-run effects translate into long-run effects.

The literatures on the effects of exchange rate changes on the demand for money in the Gambia are few and except for Nyumuah (2018), none included exchange rate in the demand function. Similarly, none of the studies use non-linear ARDL. Nyumuah (2018) study the effect of an exchange rate change on four African countries that include the Gambia. The result indicates that on the whole exchange rate and interest charges do not have significant effects on the demand for money of the countries under study. It also shows that the demand for money is unstable. Asongu Simplice, Folarin Oludele, and Biekpe (2019) study the demand for money in thirteen selected ECOWAS member states, the result of the study revealed that the demand for money is stable for ten out the thirteen selected countries which the Gambia is among. Another study by Sriram (2009) on the demand for money in the

Gambia indicates that there is a long-run relationship for the demand for real M2, but the relationship is unstable. According to their finding exogenous output shocks, financial innovations, changes in income velocity and inadequate data quality contribute to instability. In this study, we want to establish if exchange rate changes have either asymmetric or symmetric on the demand for money in the Gambia? In other to answer this question we will use both the linear ARDL and the non-linear ARDL. The remaining part of the paper as follows: Section II: the outline of the models, Section III: The results and finally Section IV: Summary and conclusion.

2. The Models and Methods

According to Mundel (1963) the demand for money besides income and interest rate depends also on exchange rate. Some other literature argued that inflation is a determinant of demand for money. Thus, the log-linear model is given as follows:

$$LnM_t = a + bLnY_t + c\pi_t + dLnX_t + er_t + \varepsilon_t \tag{1}$$

Where M denotes the real M2 or M1 monetary aggregate, Y is the real income, π is the inflation rate derived using the CPI, X is the nominal exchange. We expect the relationship between income and M2 or M1 to be positive and negative for both inflation and interest rates. In the case of the effects of the exchange rate as found by other literatures, it can either be positive or negative. Since exchange rate is the number of dalasis for a dollar, if the effect of X, d is positive then we have the wealth effect of exchange rate changes. Whereas if d is negative then speculative effects dominate, and the people will hold more dollar in steads of dalasis. Equation (1) gives the long-run coefficients, hence terms as the long-run model. To capture the short-run effects, equation (1) is converted into an error correction model. An estimate of the equation (1) only yields long-run coefficients whereas the estimate of an error correction model gives both short-run and long-run coefficients. As such, the following error-correction model is given as:

$$\begin{aligned}&\sum_{k=1}^{n1}\beta_k \Delta LnM_{t-k} + \sum_{k=1}^{n2}\lambda_k \Delta LnY_{t-k} + \sum_{k=1}^{n3}\theta_k \Delta\pi_{t-k} + \sum_{k=1}^{n4}\eta_k \Delta LnX_{t-k} + \sum_{k=1}^{n5}\phi_k \Delta r_{t-k} \\ &+\delta_0 LnM_{t-1} + \delta_1 LnY_{t-1} + \delta_2\pi_{t-1} + \delta_3 LnX_{t-1} + \delta_4 r_{t-1} + \psi_t\end{aligned} \tag{2}$$

From equation (2), the coefficients of the first difference are the short-run effects whereas the coefficients of the first lag of the level variables (δ_0 - δ_4) normalized by δ_0 are the long-run effects. According to Pesaranet.al (2001) to avoid spurious long-run coefficients, we should apply the F-test with new critical values to establish joint significant of the lagged level variables as a sign of cointegration. Model (2) can be applied to data with a different order of integration. The order integration does not need to the same but should not be greater than I(1).

Equation (2) only takes into account of symmetric effects of exogenous variables. Shin, Yu, and Greenwood-Nimmo (2014) proposed for us to decompose exchange into two-time series variables, one to represent currency appreciation and the other for currency depreciation. To that end, we first generate exchange rate changes by taking the difference of exchange, $\Delta \text{Ln} X_t$. Next, we use the concept of partial sum and construct our two measures as:

$$POS(X)_t = \sum_{i=1}^{t} \Delta LnX_i^+ = \sum_{i=1}^{t} \max\left(\Delta LnX_i^+, 0\right)$$
$$NEG(X)_t = \sum_{i=1}^{t} \Delta LnX_i^- = \sum_{i=1}^{t} \min\left(\Delta LnX_i^-, 0\right) \quad (3)$$

Where $POS(X)_t$ is the positive partial sums and $NEG(X)_t$ is the negative partial sum of the difference LnX_t. Now following Shin et al. (2014) we replace the variable LnX_t in equation (2) by our two newly constructed partial sums to give us:

$$\sum_{k=1}^{n1} b_k \Delta LnM_{t-k} + \sum_{k=1}^{n2} c_k \Delta LnY_{t-k} + \sum_{k=1}^{n3} d_k \Delta \pi_{t-k} + \sum_{k=1}^{n4} e_k \Delta POS(X)_{t-k} + \sum_{k=1}^{n5} f_k NEG(X)_{t-k}$$
$$+ \sum_{k=1}^{n6} g_k \Delta r_{t-k} + \rho_0 LnM_{t-1} + \rho_1 LnY_{t-1} + \rho_2 \pi_{t-1} + \rho_3 POS(X)_{t-1} + \rho_4 NEG(X)_{t-1} + \rho_5 r_{t-1} + \xi_t \quad (4)$$

Equation (4) according to Shin et al. (2014) is an error-correction model called the non-linear ARDL. It is non-linear due to the construction of the partial sums. Shin, Yu, and Greenwood-Nimmo (2014) were able to show that Pesaran, Shin, and Smith (2001) bound to test for cointegration could be applied to equation (4). After estimating equation (4) we can assess the existence of short-run asymmetric by comparing the coefficients of e_k's to those of f_k. We check for the long-run asymmetry by comparing the normalized estimates of ρ_0 to ρ_1. If estimates carry the same sign and size, the effects are said to be symmetric. Otherwise, they are asymmetric. Finally, the F-test is used to check the existence of cointegration.

3. The Result

Table 1. Estimates of M2 money demand

Part 1: Estimates of the Linear ARDL								
Panel A: Short-run coefficients								
Lag order								
	0	1	2	3	4	5	6	7
ΔLnM2		0.182	0.083	0.126	0.353			
		(2.06)**	0.92	1.49	(4.35)***			
ΔLnY	0.096	-0.032	-0.040	-0.044	-0.107	-0.072		
	(2.82)***	-0.935	-1.19	1.30	(− 3.17)**	(− 2.07)**		

Δr	-0.004	0.004	0.004	0.001	-0.002	0.005	0.005	
	(−2.3)**	(−2.3)**	(−2.2)**	0.38	0.14	(2.90)**	(3.13)**	
Δπ	-0.001							
	-1.45							
ΔLnX	0.24							
	(4.81)***							
Panel B: Long-run coefficients								
Cons	LnY	r	π	LnX				
1.03	0.56	-0.07	-0.17	0.16				
(6.05)***	1.65	(−3.85)**	(−3.40)**	0.47				
Panel C: Diagnostic Statistics								
F	ECM_{t-1}	LM	RESET	Norm	cusum	cusumsq	Adj.R^2	
(6.48)****	-0.11	0.31	0.32	2.77	Stable	Stable	0.67	
	(6.01)***							
Part 2: Estimates of the Linear ARDL								
Panel A: Short-run coefficients								
Lag order								
	0	1	2	3	4	5	6	7
ΔLnM2		0.018	-0.19	0.15	0.34	0.11	0.19	-0.20
		0.13	1.69	1.45	(3.00)**	0.99	1.59	(1.96)*
ΔLnY	0.109	-0.05						
	(4.61)***	(1.83)*						
Δr	-0.0003	0.015	0.023	0.013	0.013	0.009	0.009	0.007
	-0.14	(5.0)***	(7.0)***	(3.7)***	(4.7)***	(3.40)***	(5.04)***	(3.78)*
Δπ	-0.018	0.029	0.015	0.010	0.010	0.008	0.01363	0.007

							5	
	$(-6.31)^{**}$	$(4.53)^{***}$	$(2.80)^{**}$	$(2.53)^{**}$	$(3.05)^{**}$	$(3.11)^{**}$	$(4.18)^{***}$	$(3.20)^{**}$
ΔPOS(X)	-0.007	-0.006	-0.008	-0.009	-0.013	-0.009	-0.001	-0.003
	$(2.4)^{**}$	$(2.13)^{*}$	$(-2.73)^{**}$	$(-2.93)^{**}$	$(-4.39)^{**}$	$(-3.23)^{**}$	0.626	-1.60
ΔNEG(X)	0.007	0.005	0.018	0.006	0.007	0.0004	-0.013	0.003
	$(2.9)^{**}$	$(1.86)^{*}$	$(5.54)^{***}$	1.59	$(1.91)^{*}$	0.12	$(-4.37)^{***}$	0.10
Panel B: Long-run coefficients								
Cons	LnY	r	π	POS(X)	NEG(X)			
3.54	0.39	-0.048	-0.19	0.008	-0.005			
$(6.83)^{****}$	$(2.53)^{**}$	$(-1.94)^{*}$	$(-3.13)^{**}$	0.23	0.70			
Panel C: Diagnostic Statistics								
F	ECM_{t-1}	LM	RESET	Normal	Cusumsq	Wald-s	Wald-L	Adj.R^2
$(5,27)^{***}$	-0.28	4.4	4.8	0.35	Stable	$(7.8)^{**}$	1.35	0.88
	$(-6.87)^{**}$							

Table 2. Estimates of M1 money demand

Part 1: Estimates of the Linear ARDL								
Panel A: Short-run coefficients								
Lag order								
	0	1	2	3	4	5	6	7
ΔLnM1		-0.08	-0.29	-0.20	-0.22	-0.20	-0.27	
		-0.60	$(-2.02)^{**}$	-1.68	$(-2.02)^{*}$	$(-1.94)^{*}$	$(-2.83)^{**}$	

ΔLnY	0.10	-0.089	0.059	0.024	0.007	-0.07	0.07	
	$(2.49)^{**}$	$(-2.03)^{*}$	1.23	0.508	-0.136	-1.431	1.411	
Δr	-0.007	0.006	0.010	0.002	-0.001	-0.0001	0.003	0.009
	$(-2.6)^{**}$	1.69	$(-2.50)^{**}$	0.49	-0173	-0.044	1.052	$(-3.13)^{**}$
$\Delta\pi$	-0.012	0.024	0.031	0.029	0.027	0.023	0.026	0.016
	$(-3.1)^{**}$	$(3.0)^{**}$	$(4.33)^{***}$	$(3.95)^{***}$	$(4.42)^{***}$	$4.77)^{***}$	$(5.94)^{***}$	$(3.84)^{***}$
ΔLnX	0.43	0.048	0.118	-0.11	0.18	0.13		
	$(5.53)^{***}$	0.544	1.47	-1.39	$(2.21)^{**}$	1.55		
Panel B: Long-run coefficients								
Cons	LnY	r	π	LnX				
3.96	0.22	-0.015	-0.13	0.55				
$(5.95)^{**}$	1.076	-0.56	$(-2.11)^{**}$	$(2.32)^{**}$				
Panel C: Diagnostic Statistics								
F	ECM_{t-1}	LM	RESET	Normal	Cusum	Cusumsq	Adj.R^2	
$(5.8)^{***}$	-0.31	0.83	0.39	10.8	Stable	Stable	0.86	
	$(-5.9)^{***}$							
Part 2: Estimates of the non-linear ARDL								
Panel A: Short-run Coefficients								
			lag	order				
	0	1	2	3	4	5	6	7
ΔLnM1		0.21	0.18	0.28	0.58	0.66	0.36	0.29
		1.77	1.34	$(2.5)^{**}$	$(3.9)^{***}$	$(6.2)^{***}$	$(2.5)^{**}$	$(2.9)^{**}$
ΔLnY	0.240	-0.09	0.004	-0.02	-0.081	-0.057	0.102	

	$(5.5)^{***}$	$(-2.1)^{*}$	0.073	-0.342	-1.572	-1.065	$(2.0)^{*}$	
Δr	-0.004	0.012	0.022	0.012	0.015	0.017	0.018	0.018
	-1.50	$(3.4)^{**}$	$(4.9)^{***}$	$(2.9)^{**}$	$(3.4)^{**}$	$(3.8)^{***}$	$(5.3)^{***}$	$(5.2)^{***}$
$\Delta\pi$	-0.011	0.068	0.056	0.032	0.017	0.020	0.027	0.018
	$(-2.5)^{**}$	$(5.8)^{***}$	$(6.5)^{***}$	$(4.7)^{***}$	$(3.5)^{***}$	$(4.0)^{***}$	$(5.8)^{***}$	$(4.7)^{***}$
ΔPOS(X	0.017	0.009	-0.003	-0.022	-0.024	-0.025	-0.018	-0.010
	$(3.1)^{**}$	1.60	-0.53	$(-3.7)^{***}$	$(-4.3)^{***}$	$(-4.6)^{***}$	$(-4.2)^{***}$	$(-2.4)^{*}$
ΔNEG(X	0.004	-0.005	0.008	0.013	0.019	-0.0004	-0.012	-0.010
	0.72	-0.92	1.41	$(2.3)^{*}$	$(3.3)^{**}$	-0.084	$(-2.2)^{*}$	-1.87
Panel B: Long-run Coefficients								
Cons	LnY	r	π	POS(X)	NEG(X)			
4.37	0.49	0.001	-0.20	0.009	-0.013			
$(7.24)^{**}$	1.65	0.033	$(-2.4)^{*}$	0.68	-0.53			
Panel C: Diagnostic Statistics								
F	ECM_{t-1}	LM	RESET	Normal	cusumsq	Wald-S	Wald-L	Adj.R^2
$(-4.7)^{**}$	-0.48	4.5	0.032	0.43	Stable	$(15.27)^{**}$	2.65	0.90
	$(-7.2)^{***}$							

Note: *** represent sig. at 1%, ** represent sig. at 5%, * represent sig. at 10%

In this section, we estimate equation (2) the linear model and equation (4) the non-linear model using quarterly data over the period 2001q2 – 2017q4. We estimate both models using M1 and M2 measures of money demand. In order to estimate the models, we impose a maximum of eight lags on the first difference of each variable and use the Akaike's Information Criterion to obtain the optimal lags. In table 1 we have the report of both linear and non-linear ARDL estimates for M2 demand for money and in table 2 we have estimates for M1 demand for money. From table 1 part 1 panel A we can see that all the variables except inflation carry at least one significant coefficients. This signifies there is a short-run relationship between M2 demand for money and the depending variables with at least one significant coefficient. The long-run estimate is valid only if co-integration establish. The F-test in table 1 Panel C is highly significant at 1% hence support the existence of co-integration. But since the long-run coefficient of exchange is not significant, exchange rate changes do not have a long-run effect on M2 demand for money. From the diagnostic statistics, we can see that the error correction term (ECM) is negative and highly significant which what is expected. The ECM of -11% indicates that the model adjusts towards its long-run. The estimated model passes the test for no serial correlation, Ramsey's RESET indicates that the model is well specified and according to Jargue Bera test the residuals are normally distributed. Also, Cusum and Cusum square tests indicate that the model is stable.

Now we proceed to the result of the non-linear ARDL model to check if the effect of the exchange rate change is symmetric or asymmetric. From part 2 panel A, the number of significant coefficient for ΔPOS(X) and ΔNEG(X) are different indicating adjustment asymmetry. Next, we observe short-run asymmetry from the size and signs of ΔPOS(X) (dollar appreciation) and ΔNEG(X) (dollar depreciation). According to Shin (2014) we can test for impact asymmetry by checking whether the sum of the coefficients of ΔPOS(X) is different to the sum of the coefficient of ΔNEG(X). This is done by running a wald-test which is chi-square distributed with one degree of freedom. According to the diagnostic statistics the wald test for the short-run is highly significant. This supports the existence of impact asymmetry in the short-run. Next, we check if there are long-run effects and if so whether the effects are asymmetric or symmetric. From part 2 panel B we can see that there is no long-run effect since both coefficients of POS(X) and NEG(X) are not significant. This is confirmed by the wald test which is not significant. This implies that exchange rate changes do not have long-run effects on M2 demand for money. The Ramsey RESET test shows that the model is well specified and the Jargue Bera test on the residual shows that the residuals are normally distributed. Also, the result from the Cusum square test indicates the model is stable and the error-correction term indicates that the model will adjust to the long-run equilibrium.

Next, we look at table 2 which gives the results for both linear and nonlinear ARDL on M1 demand for money. From Panel A of Part 1, we can see that all the short-run variable has at least one significant coefficients which signify the existence of short-run effects. The long-run effect is only valid if co-integration is established. The F-statistic in Part 1 Panel C is highly significant revealing that the variables are co-integrated. Both the cusum and cusum square graph shows that the model is stable. Also from the diagnostics, we can see that the model is well specified, the residuals are not serially correlated but not normally distributed. The error-correction term of -31% shows that the model adjusts to its long-run equilibrium. Next, we proceed to Part 2 Panel A which contains the results of the non-linear ARDL model to check if the effect of the exchange rate change is symmetric or asymmetric. The coefficients of ΔPOS(X) and ΔNEG(X) have a different number of significant lag orders which indicates the existence of adjustment asymmetry. Next, observe short-run asymmetry from the size and signs of ΔPOS(X) (dollar appreciation) and ΔNEG(X) (dollar depreciation).

This is done by applying the wald-test. According to the diagnostic statistics, the Wald test for the short-run coefficients is highly significant indicating that there is impact asymmetry. Next, we check if there are long-run effects and if so whether the effects are asymmetric or symmetric. Again from our diagnostic statistics, we can see that there is no long-run effect since both coefficients of POS(X) and NEG(X) are not significant. The wald test for long-run coefficients is not significant. This implies the short-run effects do not translate into long effect. This implies that exchange rate changes do not have long-run effects on M1 demand for money. The Ramsey RESET test shows that the model is not miss-specified and the Jargue Bera test on the residual shows that the residuals are normally distributed. According to the Cusum square test, the model is stable. Similarly, the error-correction coefficients of -48% indicate that the model will adjust to the long-run equilibrium.

4. Summary and Conclusion

Since the main goal of monetary authorities is put in policies that will be able to overcome economic fluctuations, it deems necessary to have a clear understanding of the factors that affect the demand for money. There are few researchers who examined what happens to demand of money (M1 and M2) in the Gambia if exchanges change. We examined the demand for demand money function in the Gambia by including the exchange rate to account for currency substitution. In this study, we estimate the M1 and M2 demand for money in the Gambia using quarterly data. This study employed both the linear and nonlinear ARDL. For the nonlinear ARDL, we constructed the partial sum of the positive partial and negative changes in the exchange rate which gives the model its nonlinearity. Both models are estimated for M1 and M2 demand for money yielding similar conclusions. The findings revealed that a change in the exchange rate has both impact asymmetric and adjustment asymmetric effect for both M1 and M2. Adjustment asymmetry is evidence since dollar appreciation lasts for quite a long time then the impact of dollar depreciation. There is the presence of short-run asymmetry due to the fact that the effects of dollar appreciation are different from the effect of dollar depreciation on both M1 and M2 demand for money. This is measured by the sign of their estimated coefficients. We can see that in the short-run if the dollar appreciates Gambian's will want to hold more dollars and less of dalasis. Similarly, if the dollar depreciates the Gambian will hold more dollars and less of dalasis but this does not continue into the long-run. The result also revealed that a change in the exchange rate does not have long-run effects on demand for money in The Gambia. Since the exchange rate has only short-run effects on demand for money in the Gambia, the monetary authority can use the open market operation to counter any effect caused by a change in demand for money due to exchange rate changes.

The limitation of this study was that quarterly of GDP for the Gambia was not readily available. We generated the quarterly data of GDP for the Gambia following Bahmani-Oskooee (1998). Further studies on the demand for money in Gambia can be done by the inclusion of remittance as an independent variable. This is because since the Gambia enjoys a large inflow of remittance which is estimated to be more than 20% of GDP might affects the demand for money in the Gambia.

References

Alsamara, M., & Mrabet, Z. (2019). Asymmetric impacts of foreign exchange rate on the demand for money in Turkey: new evidence from nonlinear ARDL. *Int Econ Econ Policy, 16*. https://doi.org/10.1007/s10368-018-0421-y

Arango, S., & Ishaq Nadiri, M. (1981). Demand for money in open economies. *Journal of Monetary Economics, 7*(1), 69-83. https://doi.org/10.1016/0304-3932(81)90052-0

Bahmani-Oskooee, M., & Baek, J. (2017). Do Exchange Rate Changes Have Symmetric or Asymmetric Effects on the Demand for Money in Korea?. *Review of Economic Analysis, Rimini Centre for Economic Analysis, 9*(2), 155-168.

Bahmani-Oskooee, M., & Bahmani, S. (2015). Nonlinear ARDL approach and the demand for money in Iran. *Economics Bulletin, 35*, 381-391.

Bahmani-Oskooee, M., & Gelan, A. (2019). Asymmetric Effectsn of exchange rate changes on the demand for money in Africa. *Annals of Economics*.

Bahmani-Oskooee, M., & Pourheydarian, M. (1990). Exchnage Rate Sensitivity of the Demand for Money and Effectiveness of Fiscal Moneray Policies. *Applied Economics, 22*, 1377-1384.

Bahmani-Oskooee, M., & Saha, S. (2016). Do exchange rate changes have symmetric or asymmetric effects on stock prices?. *Global Finance Journal, 31*, 57-72. https://doi.org/10.1016/j.gfj.2016.06.005

Bahmani-Oskooee, M., & Sungwon, S. (2002). Stability of the Demand for Money in Korea. *International Economic Journal, Taylor & Francis Journals, 16*(2).

Bahmani-Oskooee, M., Bahmani, S., Kutan, A. M., & Xi, D. (2019). On the Asymmetric Effects of Exchange Rate Changes on the Demand for Money: Evidence from Emerging Economies. *Journal of Emergeing Finance, 18*(1), 22. https://doi.org/10.1177%2F0972652719831523

Bahmani-Oskooee, M., Kutan, A. M., & Zhou, S. (2006). Do Real Exchange Rates Follow a Nonlinear Mean Reverting Process in Developing Countries?. *Southern Economic Journal, 74*(4), 1049-1062.

Bahmani-Oskooee, M., Martin, M.-A. G., & Niroomand, F. (1998). Exchange rate sensitivity of the demand for money in Spain. *Applied Economics, 30*(5), 607-612. https://doi.org/10.1080/000368498325598

Bjørnland, H. C. (2003). *A stable demand for money despite financial crisis: The case of Venezuela.*

Dritsakis, P. N. (2011). Demand for Money in Hungary: An ARDL Approach. *Review of Economics & Finance*.

Ismail, H., Genc, H. S., & Erol, T. (2005). Currency Substitution in Turkey. *American Journal of Applied Sciences, 2*(5).

Nyumuah, F. S. (2018). The Impacts of Interest Rate and Exchange Rate Volatilities on the Demand for Money in Developing Economies. *International Journal of Economics and Finance, 10*(3). https://doi.org/10.5539/ijef.v10n3p56

Samara, M. Al., Lanouar, C., & Mrabet, Z. (2017). Money demand and black market exchange rate: a cointegration approach with structural break. *Afro-Asian J. of Finance and Accounting, 7*.

Samreth, S. (2008). Estimating Money Demand Function in Cambodia: ARDL Approach. *Munich Personal RePEc Archive*. Retrieved from http://mpra.ub.uni-muenchen.de/16274/

Simmons, R. (1992). An Error−correction Approach to Demand for Money in Five African Developing Countries. *Journal of Economic Studies, 19*(1). https://doi.org/10.1108/01443589210015935

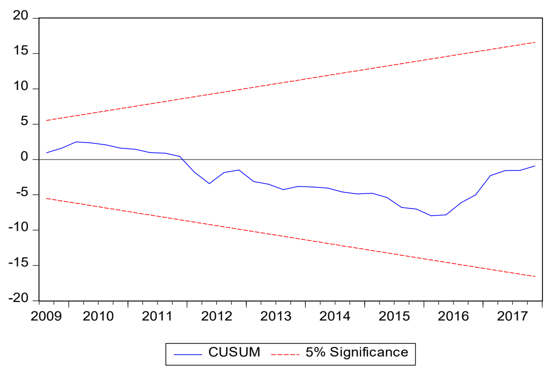
Simplice, A., Oludele, F., & Biekpe, N. (2019). The Long Run Stability of Money Demand in the Proposed West African Monetary Union. *MPRA Paper No. 92343*. Retrieved from https://mpra.ub.uni-muenchen.de/92343/

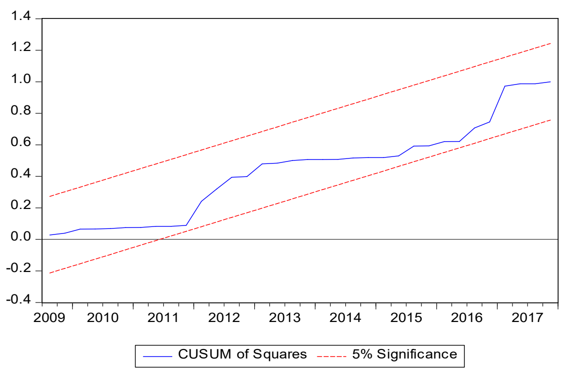
Sriram, S. S. (2009). he Gambia: Demand for Broad Money and Implications for Monetary Policy Conduct. *International Monetary Fund*.

Appendixes

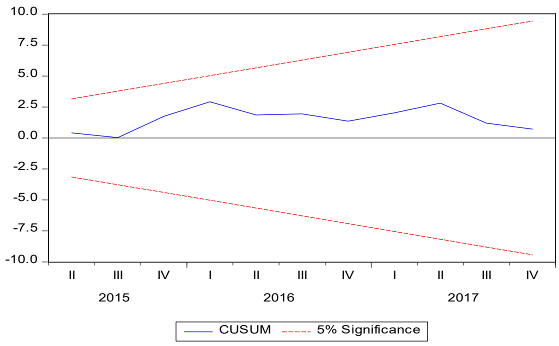
1. Diagrams

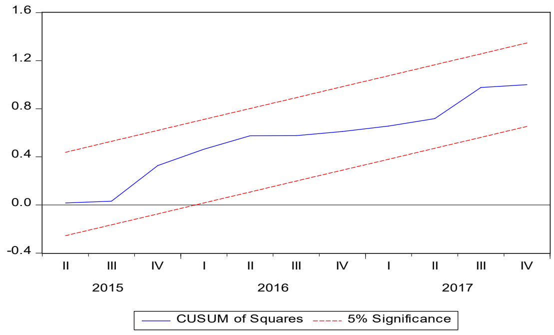
Linear –ARDL- M2



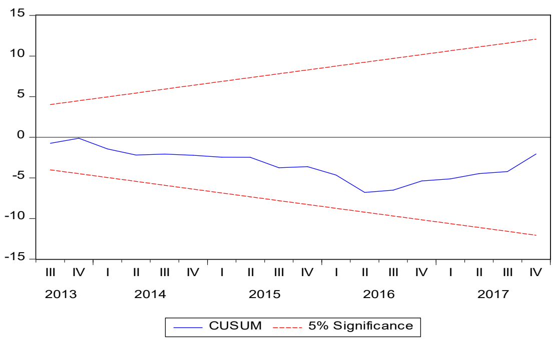


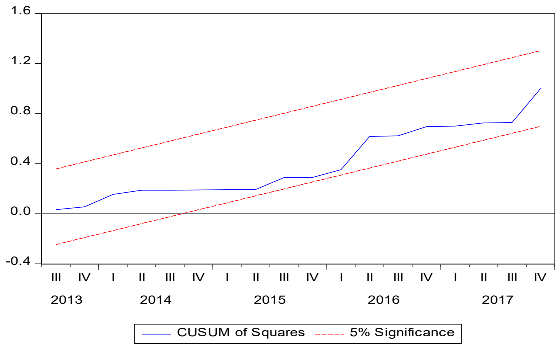
Non-linear ARDL for M2 demand for Money



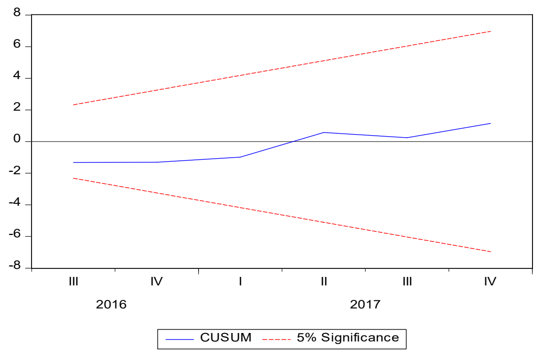


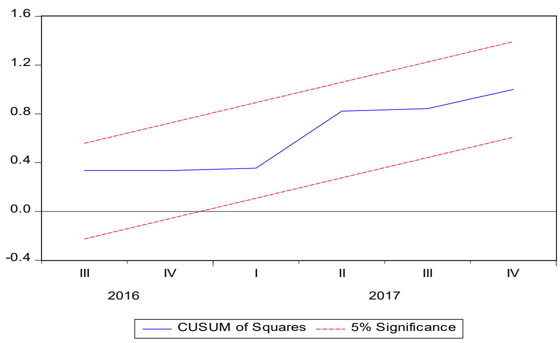
Linear ARDL for M1 demand for money





Non-Linear ARDL M1 demand for money





2. Definition of Variables

M1: Real M1 (Nominal M1 deflated by CPI) M2: Real M2 (Nominal M2 deflated by CPI) Y: quarterly real GDP (the nominal quarterly GDP of the Gambia is not available; hence data was generated following the technique of Bahmani (1998) which is deflated by CPI)

R: nominal monthly interest is use to obtained the quarterly interest rate

Π: Inflation rate is obtained by taking log difference of CPI

EX: Nominal exchange deflated by CPI

All The data except Y which is generated are obtained from the Central Bank of the Gambia website.