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Financial Innovation, Money Demand Function and Currency Substitution in Africa

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Abstract- This paper examined the relationship among money demand function, financial innovation and currency substitution in African countries between 1980_{q1} and 2016_{q2}. Data for the study were sourced from International Financial Statistics (IFS), United Nation Statistical Bulletin, (2016) and Central Banks of various countries selected. The study employed panel ARDL as estimation technique. The result from the showed that there was long-run relationship among money demand, financial innovation and currency substitution in the selected African countries during the study period. The result further showed that income, effective exchange rate, foreign interest rate, savings deposit rate, inflation rate and dummy variables have significant impact on money balances. However, the significant value of exchange rate in the model implies the existence of currency substitution in the selected African countries during the study period. The value of dummy variable showed positive but insignificant. This shows that financial innovation has not really altered the stability of money demand function in the selected African countries. Based on these findings, the study therefore, recommends that monetary authorities in the selected countries should always ready to use active money balances as an effective instrument in designing monetary policy.

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I. Introduction

The efficacy of money demand function in the conduct of monetary policy depends on its stability. A stable money demand function is a prerequisite for the conduct and formulation of monetary policy. A stable money demand function is required for the proper understanding of monetary policy transmission mechanism. Money demand function links money and other real economic variables and it plays an important role in the decision making process of central Bank in dealing with monetary and other macro-economic policies.

In recent times, developing countries have introduces series of financial and economic reform particularly structural adjustment programme, financial deregulation, stock market deregulation, financial regulation etc. Besides these reforms, developing countries (particularly Africans countries) have equally moved from direct to indirect monetary policy instruments. The integration of these two issues has increased the volatility of monetary aggregates which might have affected their relationship with the final goals of monetary policy.

Furthermore, before economic deregulation policy in the 1980s which was adopted by most of African countries, it was assumed that money demand function was relatively stable. Thereafter, that is, during economic deregulation, it is equally assumed that new financial products (elements of financial deregulation) could caused instability in the underlying money demand relationship with important consequences for the conduct and efficacy of monetary policy. (Gurley and Shaw, 1995) and (Darrat, 2009).

Moreover, currency substitution occurs when foreign currencies are being substituted for domestic money in its three traditional roles such as medium of exchange, unit of account and store of values which may makes execution of monetary policy difficult. A large number of factors may make domestic residents substitute the domestic currency. Namely, the foreign trade transactions, the domestic transaction, the portfolio diversification and avoidance of excessive financial losses from inflationary taxation.

Financial innovation is to improve macroeconomic performance of a nation. The level to which financial sector performs in an economy is essential depends on the stage of economic growth and development. The financial innovation is closely and positively related to the real economy. However, financial innovation may impact national economy positively or negatively. Take for instance, financial development and the proliferation of financial product and deposit substitutes could cause instability in the underlying money demand relationship with important consequences for the conduct of monetary policy and financial innovation.

The remainder of the paper is structured as follows. This introductory section is follows by section two that presents empirical literature. Section three deals with methodology. Section four present results and its interpretation. Section five concludes the paper.

II. Empirical Literature

Studies have been carried out on the relationship among money demand, currency substitution and financial innovation both in developed and developing nations. However, some of these

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studies are presented here as empirical literature to guide and provide foundation for the model of this present study.

(Monday and Guevva, 2008) examined the effects of financial development on economic growth in developing countries. The study made used of structural measures of competition and industrial organization. Findings from the study revealed that financial development has marginal effects on economic development of selected countries. In the same line of study, (Pan Zar and Mosses, 2006), also studied the relationship between economic growth and financial sector development between 1993 and 2003 in some developing countries. Finding showed that financial sector development really stimulated the growth of economies of selected countries during the study period. To revalidate the previous two studies, (Zoedarmono, 2010) investigated the causal relationship between banking sector and output growth in some developing countries. The study employed dynamic panel as estimation techniques; Results from empirical analysis showed that banking sector development only had marginal impact on the output growth of selected countries. (Zewdie, 2013), studied the effects of financial innovation on the financial performance of commercial banks in Kenya. The study used both descriptive and inferential methods. Findings showed that financial innovation did not have significance impact on the bank performance in Kenya during the study periods. (Davde, 2011), investigated the relationship between financial innovation and bank performance in Nigeria. Fifteen selected commercial banks were considered. The study made used of pearson correlation co-efficient as estimation techniques; Findings showed that financial innovation actually impacted the performance of selected banks in Nigeria positively during the study period. (Antony and Antony, 2012) examined the relationship between financial innovation and economic growth in Ghana between 1963 and 2009. The study employed (ARDL) and Granger Casualty as estimation techniques. Findings showed that financial innovation only had positive impact in the short-run but did not have significant impact in the long-run.

(Bahmani and Shabsigh, 1996) examined the stability of M1 and M2 money demand function for Japan. They found that M1 money demand function was stable with and nominal exchange rate. Similarly, (Bahmani-Oskooee and Bohl, 2000) analyzed the stability of M3 money demand function for German following the monetary unification. Their results indicated that M3 money demand function in Germany was not stable for the study period. (Gil-Alana, 2004) applied co-integration using data for five major industrial countries (namely, Canada, U.S, Japan, Germany and UK), found mixed results in particular, the non hypothesis of no co-integration cannot be rejected for Japan, but there was some evidence of frictional co-integration for Germany, Canada, the US and the UK (Where however, the income elasticity is found to be negative). (Darrat, 1986) explores the demand for money in three major OPEC countries including Saudi Arabia Libya and Nigeria. Applying the Chow, Gupta and Farley and Hinich stability, the study concluded that the Money Demand Function was stable in Saudi Arabia, Libya and Nigeria during the study periods. (Oloyede, 2000) estimated the demand for narrow and broad money-in Nigeria using the Engle and Granger (1987) approach with quarterly data: from 1990 to 1998. The variables included in their model were the South African Treasury ' Bill rate (representing return on alternative assets), a six month's, Namibia ' commercial bank deposit (representing own rate of return on money), real exchange between Namibian dollar and South African rand, Namibia Treasury bill rates, real GDP, expected rate of inflation and either narrow money (M1) or broad money, (M2). All variables were in logarithms except the inflation rate. (Adebiyi, 2006) examined broad money demand, financial liberalization and currency substitution in Nigeria using Error Correction Model (ECM). His results showed that long-run demand for real balances in Nigeria depends upon real income on its own interest rate, interest rates on government securities, inflation and expected exchange rates. He finally concluded that money demand function in Nigeria was stable despite the economic reforms and financial crises. In the same line of study (Gbadepo and Adedapo, 2008) examined the impact of financial innovation on the stability of Nigerian money demand function using Johansen ECM and found that financial innovation had no significant impact on the stability of Nigerian Money demand function during the study periods. (Blevms, Vagassky and Wong, 1999) examined the effects of financial liberalization on the stability of money demand function in Peru and their implications for monetary policy. The study used quarterly data between 1979 and 1997. The study employed co-integration and error correction as estimation techniques. Findings showed that financial sector reforms and financial liberalization had marginal effects on the stability of money demand function in the selected countries.

(Kargbo, 2010) re-validated the mekinnon complementanty hypothesis to examine the relationship between financial liberalization and savings mobilization in Sierra Leone. The study made used of ARDL as estimation techniques. Findings showed that financial liberalization had positive effects on savings and rate of capital formation during the study periods. (Aiyedogbon, et al, 2013) examined the stability of money demand function in Nigeria between 1986 and 2010. The study employed co-integration and error correction as estimation techniques. The study found that the money

demand function was stable during the study period. In the same line of study, (Iyoboyi and Pedro's 2013) examined the stability of narrow money (m1) in Nigeria between 1970 and 2010. The study made used of ARDL as estimation technique. Findings from the study showed that real income, real effective exchange rate, the expected inflation rate, foreign real interest rate and short term interest rate are major determinants of the stability of narrow money in Nigeria during the study period. To further examine the relationship between money demand function and financial liberalization in Nigeria, (Sanya and Awe, 2013) studied the impact of financial liberalization on the stability of Nigerian money demand function between 1970 and 2008. The study employed multivariate co-integration as estimation technique. Findings from the study revealed that financial liberalization did not alter the stability of Nigerian money demand function during the study period. To revalidate the previous studies. (Bassey, Besong and Effiong, 2012) studied the effect of monetary policy on the money demand in Nigeria. The multiple regression was the estimation instrument used in this study. Study showed that there was an inverse relationship between interest rate, expected inflation rate, exchange rate and money demand in Nigeria during the study period. (Odhiumbo, 2009), used co-integration to study the relationship between interest rate and financial development in South Africa. The study revealed that there was no causality between interest rate and financial development in South Africa during the study period. (Behumani, Oskooee and Bary, 2000) investigated the stability of broad money (M2) in Russia. The study made used of co-integration and error correction as estimation techniques. The study found long-run co-movement among the variables used in the study but discovered that (M2) was unstable during the study period. In the same line of study (Ogun, 1986), used correlation analysis to examine the relationship between financial deepening and economic growth in selected countries in Africa. The study revealed that financial deepening has negative relationship with economic growth in the selected African countries.

(Sanjay, 1998) examined the relationship between inflation and money demand in Albania between 1993 and 1997. The study employed multiple regression as estimation techniques. Finding from the study showed that after the one time effects of the 1997 crisis are considered, the long-run determinants of inflation and money demand remained the same. And also series of financial sector reforms used in Albania have really helped to reduced inflation and enhanced the stability of money demand function during the period. (Wong jinn, 2010) investigated money demand, financial liberalization and currency substitution in Malaysia between 1978 and 2007. The study made used of johasen-juselius cointegration to carry out the analysis. Finding showed that currency substitution effect existed in the money demand function. The study equally found that there was negative relationship between financial liberalization and narrow money (m1) during the study period. (Assande, Subhas and Mahbub, 2006). Used descriptive method to investigate currency substitution in selected countries in Africa. Findings from this study showed the existence of currency substitution in Nigeria, Ghana and South Africa but not in Egypt, Kenya, Tunisia and Zambia during the study period.

From the empirical literature reviewed, the issue of money demand function has become a perennial topic in the literature. However, the study on the relationship among money demand, financial sector reforms, currency substitution and financial innovation is so scanty especially in Africa. Besides this, the available studies produced a conflict results. While some found that financial innovation and currency substitution did not affect the stability of money demand function. Some found that financial sector reforms have actually altered the money demand function stability. Based on these conflicting results, it is imperative to reinvestigate the stability of money demand function in the face of financial sectors reforms and currency substitution. This present study filled this gap by examining the relationship among demand function, financial innovation and currency substitution in Africa.

III. Section 3

Research Method

a) Model Specification

The conventional specification of the long-run money demand model that has been adopted in most emerging economies takes it root from the functional representation in equation 3.1

$$\left(m/p\right)_t = f(y,r) \quad \text{.....3.1}$$

Then, m/p represents the demand for real balances which considers scale variables, Y stands for opportunity cost variable and r and m are taken to represent monetary aggregate in nominal terms and price level is represented by p.

In line with (Adebiyi 2006, Gbadebo & Adedapo 2008, Akinlo 2006, kallon 2009 & Ogunsakin 2013), this present study therefore, augments equation 3.1 with other variables to examine the relationship among real money balances, financial innovation and currency substitution. However, the equation to be estimated is given in3.2

$$\left(m/p\right) = a_0 + a_1 Y + a_2 INF + a_3 EX + a_4 SDR + a_5 TDR + a_6 FIR + SAP + \mu$$

.....3.2

M/P = Real Money Stock

Y = Real Gross Domestic Product

INF = Domestic Infation Rate

EX = Real Effective Exchange Rate

SDR = Saving Deposit Rate

FIR = Foreing Interest Rate

TDR = Treasury Bill Rate

SAP = Captures the Financial Innovation

However, it should be noted that exchange rate performs two functions here, it is used to determine the level of currency substitution and also to know the levelof stability of money demand function. While, SAP is employed to examine the impact of financial innovation on the stability of money demand function.

b) Estimation Techniques

Estimation techniques that are employed in this study are panel Co-integration and panel Vector Autoregressive Model.

c) Sources of Data

The data for this study were sourced from the World Bank Developing Indicators Database, IMF Online Database and the United Nation Conferences on trade and Development statistics (UNCTADSTAT).

IV. Section 4

In this section, data and its analysis are presented.

a) Panel Unit Root Test

Table 4.1

Variable	Statistics	Order	T-statistics	Order of integration	T-Statistics	Order of integration
m/p	-4.6105***	1(1)	611.030***	1(1)		
Y	-2.0142***	1(0)	113.324***	1(0)	-19.4669**	1(1)
INF	-4.4914***	1(0)	529.590***	1(1)	-25.8011**	1(1)
EX	-2.1727***	1(0)	117.089***	1(0)	-21.3304**	1(0)
SDR	-4.9518***	1(1)	401.090***	1(0)	-11.2203**	1(1)
TDR	-2.3185***	1(0)	187.920***	1(1)	-2.7662**	1(0)
SAP	-2.3863***	1(1)	148.452***	1(0)	-5.7624**	1(1)
FIR	-4.3231	1(1)	613.231	1(1)	-6.3111**	1(0)

Statistical significance at 1% (***), 5% (**), 10% (*)

The panel unit root test results on table 4.1 showed that all the time series variables attained their stationarity both at level and at first difference. This shows that the variable of interest were integrated of difference orders. Therefore, we can now proceed to panel Auto-regressive Distributive Lag ARDL which allows the mixture of both stationarity at level and first difference.

b) Panel Ardl

Table 4.2: Panel ARDL Result

Variable	Coefficient	Standard Error
m/p	0.132501***	
Y	0.000700	0.083662
INF	-0.000231	0.000834
EX	0.154550	0.0634562
SDR	-0.044600	0.052341
TDR	-0.046092	0.043211
SAP	0.042321	0.34562
FIR	0.043612	0.03245
(Y)	0.037832	0.034562

Table 4.2 shows the long-run relationship between money demand function and other variables in the model.From the results, long-run coefficient of money demand function is 0.132501 and the value is significant at 1%.The implication of this result is that 1 percent increases in real income increases the demand for real money balances by 0.89 percent. However, the positive relationship between real income and money demand corroborates the transactionary demand for money which says active balance is an increase function of income $dy/dl_1 > 0$. This results conforms with findings of (Akinola 2006, Busari 2008) and (Gbadebo & Adedapo 2008), and contradicts the findings of Sanya and Awe, 2013 which showed negative relationship between income and money demands,that there is a positive relationship between money balances and

income.Inflation rate as expected displays a negative relationship with the real money balances.This implies that 1 percent increase in inflation reduces demand for real money balance by 0.00023. This result is equally in conformity with theory and some of the previous studies on money demand function. (Akinola 2006, and Ogunsakin 2013) Real effective exchange rate shows positive and significant Values. This implies that in the case of depreciation, people expectation will rise so that the domestic currency would rebound and this makes people to hold more domestic money. However, the significant value of exchange rate variable shows that there is currency substitution in the selected African countries during the study period. The other opportunity cost variables in the results behaved in the manner suggested by the theory. The coefficient of the saving deposit rate showed a negative and significant relationship with money balances. This shows that the variable behaved the way it was suggested by the theory. The foreign interest rate proxed by US Treasury bill rate displayed a positive and significant relationship with money balances. This result showed that Naira and America Dollars are substitutes in the portfolios of economic agents in the selected Africa countries. The dummy variable that captures the effects of financial innovation shows positive butinsignificant value with money balance in the selected countries. This result shows that financial reforms is one of the determinants of money balances in the selected countries during the study period but did not alter the stability of money demand function. This result corroborate the findings of (Sanya and Awe, 2009, Gbadebo & Adedapo 2008, and Adebiyi 2008) but negates the findings of (Ogunsakin 2013) which says that effects of financial liberalization on the stability of Nigerian money demand function was marginal.

c) Short-run estimation

Since long-run estimation results indicate that there was long-run relationship between money demand function and other explanatory variables, it is pertinent to estimate the dynamic short-run coefficient through ARDL.

d) Panel Error Correlation Model

The panel error correction model explains the short-run dynamics in the panel ARDL model. However, the result is shown in the table 4.6

Variable	Co-efficient	Std. Error	T-statistics	Probability
ECM (-1)	-1.097345	0.177687	-6.342133	0.000

From the result on the table 4.3, ECM shows a negative co-efficient sign which implies that any disequilibrium in the past has been adjusted in the right direction.

ECM value of -1.087345 suggests the relatively high speed of adjustment from the short-run equilibrium of money balances. More positively, it shows that about 20% deviation from the long-run money balance is corrected in the dynamic model that the system is getting adjusted towards long-run equilibrium at this speed of about 20% in addition, the ECM is equally statistically significant at 1% level, showing that long-run equilibrium can be attained. This result is in line with finding of (Mohamed and Saidu 2012) and (Bartholomew and Kargbo 2009) that showed a highly significant error correction term. This is a further proof of the existence of stability of the money demand function in the selected African countries. This result equally shows that there will be convergence (steady-state) of the system and the attainment of stable money demand function in the selected African countries.

e) WALD Test

The WALD test is one of the coefficient diagnostic test necessary to confirm the existence of co-integration in the model. However, its result is shown in table 4.4

Table 4.4: WALD Test Panel ARDL Model

	Value	Df	Probability
T-statistics	78.71234	(2.286)	0.0000
F-statistics			
Chi-square	158.3324	2	0.0000

Result on table 4.4 displays both the F-Statistics and Chi-square which are significant at 1%. Therefore, we can now reject the hypothesis of no co-integration and accept the alternative hypothesis that there is long-run relationship between money balance and explanatory variables, that is, all the explanatory variables influence the money demand function in the selected African countries during the study period.

f) Model specification criteria

This selection model is used to determine the suitability of the model for forecasting. However, its result shown on table 4.5

Table 4.5: Model Specification criteria

Model	LogL	A/C	B/C	HQ
9	-1916.920702	5.362456	9.184562	6.899233
6	-1813.324562	5.46621	9.456223	6.9334562
3	-1962.887255	5.678923	9.562334	6.9456224
4	-2346.892346	5.624562	7.845622	6.8453662
5	-2556.7894231	5.844661	8.7345661	6.845662
1	-26340.8733412	5.952311	7.634566	6.789223
8	-2442.813456	5.741321	8.7673411	6.822345
7	-2553.733441	5.456672	7.566221	6.456778
2	-22945.7455621	5.456251	8.456622	6.824562

The strength of each model is explained in the table 4.5. Based on ARIKE information criteria A/C the most suitable model 9. This is the model that generated the panel ARDL result in table 4.2. Therefore, the results as presented in the table 4.5 are valid and reliable, based on the model selection criteria.

Table 4.6: Plot of cumulative sum of recursive Residuals

Variable	Coefficients	Standard Error
SR D(y) (-1)	0.184623	0.016245
D(y) (-2)	0.0362451	0.056204
D(EX) (-1)	0.016234	0.0345623
D(INF) (-1)	-0.623456	0.0432456
D(INF) (-2)	-0.614512	0.0342341
D(FIR) (-1)	0.345621	0.024622
D(FIR) (-2)	0.433211	0.064522
D(SDR) (-1)	-0.045062	0.072312
D(SDR) (-2)	-0.62422	0.062443
D(TBR) (-1)	0.2244531	0.072456
D(TBR) (-2)	0.664562	0.082421
D(SAP) (-1)	0.456221	0.624412
D(SAP) (-2)	0.621132	0.722113
Constant	-21.03442	3.582423

From results on table 4.6, there was currency substitution in the selected African countries during the study period. Because the value of exchange rate was positive and significant. However, the value of inflation rate, income and other opportunity cost variables was positive which implies that those variable are positively related to the money demand function during the study period. This shows that these variables are major determinants of domestic money holding in the selected African countries during the study period.

Furthermore, foreign interest rate proxed by US Treasury bill rate has positive and significant relationship with money balances both in the long-run and short-run Real Effective exchange rate also has a positive and significant value on the money balance in the long run but a negative value in the short run. While the dumany variable used to capture financial innovation shows positive but significant both in short-run and long-run. The implication of this results is that financial innovation did not alter the stability of money demand function in the selected African countries. The results displayed that the model went through a structural stability test and passed. That is, there was no instability in the model since the plots of CUSUM and CUSUMSQ lies within the 5 percent critical bounds.

Additionally, considering the transmission mechanism of monetary policy to aggregate demand function, the value of the dumany variable used to capture financial innovation showed positive but insignificant relationship with monetary demand function. This implies that the financial innovation did not alter the stability of money demand function. That is, the financial innovation did not limit the extent to which credit is made available to the economies of the selected countries.

V. Summary and Conclusion

The study examined the money demand, financial innovation and currency substitution between 1980_{q1} and 2016_{q4} in selected African countries. The study employed ARDL Co-integration as estimation technique. Findings from the result showed that inflation rate, savings deposit rate, real effective exchange rate, foreign interest rate, income are determinants of money demand function in the selected African countries. Based on the significant of exchange rate both in the short and long run. The study therefore, concludes that there is a currency substitution in the selected African countries during the study period. Also the positive coefficient and insignificant value of dummy variables

shows that financial innovation is one of the determinants of money balance but did not alter the stability of money demand function during study period in the selected African countries.

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