



## Asymmetric Effects of Financial Innovation and Exchange Rate Changes on Money Demand in Nigeria

Nekenneri Jerome Jaimu<sup>1</sup> and Shehu El-Rasheed (Ph.D)<sup>2</sup>

<sup>1</sup>Department of Cooperative Economics and Management, Adamawa State Polytechnic, Yola, Adamawa State, Nigeria.

<sup>2</sup>Department of Economics and Development Studies, Federal University of Kashere, Gombe State, Nigeria.

### Abstract

*Nonlinearities in both long-term and short-term relationships can help explain the abrupt changes in the conventional relationships of the demand for money and its determinants. This paper examines the asymmetric relationship between financial innovation, exchange rate changes and money demand in Nigeria. The Nonlinear Autoregressive Distributed Lag (NARDL) model was employed using quarterly data from 2010Q1 to 2022Q4. The findings reveal that the demand for money is stable. Furthermore, an asymmetric relationship between financial innovation and the demand for money exists with negative changes to financial innovation being more pronounced than positive changes. Exchange rate and the demand for money also have an asymmetric relationship with negative changes having more impact than positive changes triggered by expectations effect. The policy implication for these findings is that the government and financial institutions should focus on expanding access to digital financial services, especially in rural areas so as to curtail the resurgence in demand for cash due to incomplete adoption and negative shocks in financial innovation. Another implication is that the monetary authorities should aim to maintain exchange rate stability to prevent excessive volatility that could disrupt money demand.*

### Keywords:

Financial innovation  
Demand for money  
Exchange rate changes  
NARDL

**JEL Classification:** E41, E42.

### Corresponding author

Nekenneri Jerome Jaimu  
[jeromejaimu@gmail.com](mailto:jeromejaimu@gmail.com)  
Tel:+2347039838958

### 1. Introduction

The demand for money is crucial in macroeconomic analysis, especially for effective monetary policy (CBN, 2017). A stable money demand function is essential for conducting meaningful monetary policy. Globalization and digitalization have renewed

interest in the stability of money demand, which affects liquidity preferences (Kumar et al., 2013). Digitalization is reshaping the financial sector, leading to innovations such as digital payments (Demirguc-Kunt et al., 2022). These innovations, driven by technological advancements and declining

costs, have gained momentum, especially during the COVID-19 pandemic, which accelerated the adoption of digital payments globally. The World Bank's Global Findex survey (2021) shows that 64% of adults worldwide made or received a digital payment in 2021, with significant growth in developing economies like Nigeria, where the percentage

rose from 30% in 2017 to 34% in 2021. Monetary aggregates in Nigeria have shown an upward trend likewise financial innovation with major increases around 2019Q4, as illustrated in Figure 1. This could increase economic activity but also risk inflation if demand exceeds productive capacity.

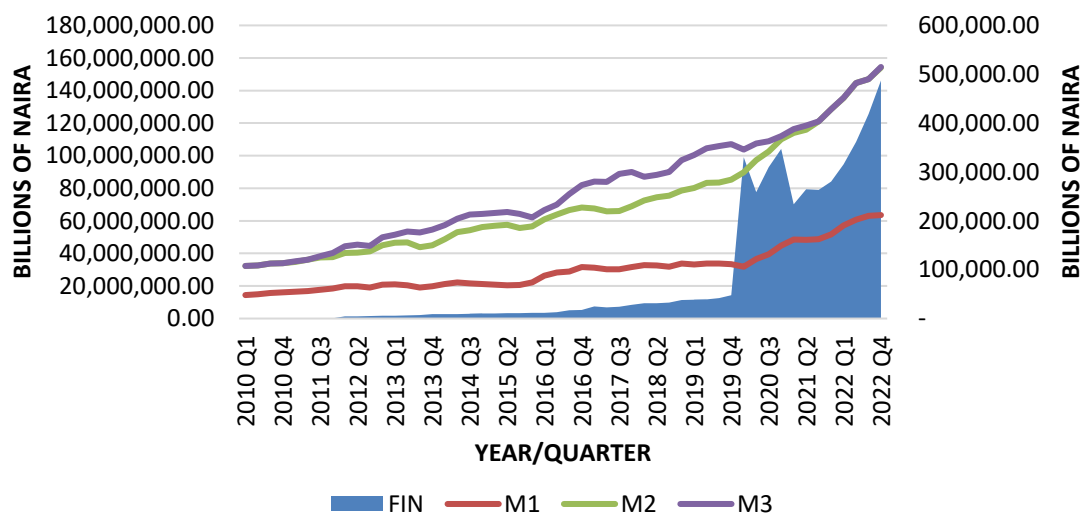


Figure 1: Trend of Monetary Aggregates and Financial Innovation  
Source: Researcher's computation using data from CBN (2024)

In addition to financial innovation, exchange rates impact money demand through wealth and substitution effects (Elhassan, 2021). In spite of various reforms, the Naira has largely remained unstable with its value depreciating over the years. It has been highly volatile, depreciating from ₦150 per U.S. dollar in 2010 to ₦1,320.64 in 2024. These persistent fluctuations pose a significant challenge in maintaining stability in both money demand and price levels (Abdullah et al., 2022). Consequently, this can constrain the effectiveness of its monetary policy. Existing studies on financial innovation, exchange rate changes, and money demand in Nigeria mostly assume a linear relationship (Nakorji & Asuzu, 2019; Ujunwa et al., 2022). However, asymmetric responses in money demand can arise from changes in exchange rates and financial innovation (Bahmani-

Oskooee et al., 2020; Escribano & Rodriguez, 2023; Ogbaro et al., 2023). This study examines the asymmetric effects of financial innovation and exchange rate changes on money demand using a nonlinear approach, focusing on broad money (M3) and direct proxies for financial innovation, which previous studies have not captured. The paper is structured as follows: section two reviews literature, section three outlines the methodology, section four presents the results and discussion, and section five offers conclusions and recommendations.

## 2. Literature review

The 1970s and 1980s were marked by instability in the demand for money function, often attributed to financial innovation and currency substitution (Copelman, 1996). Several studies have explored the inclusion of

financial innovation and exchange rates in models analysing the demand for money. Various studies indicate that financial innovations lead to an increase in the demand for money. Mumtaz and Smith (2020), studying 30 countries, showed that mobile and internet technologies are positively associated with money demand. Djaballah (2020) examined mobile money and ATMs as proxies for financial innovation in Maghreb countries, finding that mobile money positively impacted both narrow and broad money, while ATMs affected only narrow money. Adil et al. (2020) found a strong positive relationship between financial innovation and money demand in India, both in the short and long run, while Chowdhury and Karim (2020) found a similar positive effect in Bangladesh using the ARDL technique. In contrast, some studies show a negative relationship between financial innovation and money demand. Dunne and Kasekende (2018) found a negative impact of financial innovation on money demand in 34 Sub-Saharan African countries. Mlambo and Msosa (2020) observed that financial technology negatively influenced money demand in selected African countries. Chaudhari et al. (2019) found an inverse relationship between payment system innovations and currency demand in India, attributing this to a dominant income effect. Bangura et al. (2022), in Sierra Leone, also found a negative relationship between financial innovation and real money balances. In Nigeria, research on financial innovation and money demand has produced mixed results. Tule and Oduh (2016), Nakorji and Asuzu (2019), and Ujunwa et al. (2022) found positive relationships between financial innovation and money demand. However, Jonah et al. (2021), Ovat et al. (2023), and Oghenekvewe and Ezi (2023) identified mixed effects, with both positive and negative outcomes from disaggregated financial innovations.

The literature suggests mixed and inconclusive effects of financial innovation on money demand. However, most studies focus on the symmetric relationship between

financial innovation and money demand. Few have examined the asymmetric effects. Ogbaro et al. (2023) studied the asymmetric relationship in Nigeria and found that positive shocks to financial innovation had significant effects, while negative shocks were insignificant.

Regarding exchange rate changes, Bahmani-Oskooee and Bahmani (2015) argued that inconsistencies in the literature might stem from the assumption of linear short-run adjustments. Evidence from cross-country studies shows that exchange rate changes can have asymmetric effects in both the long and short runs (Hannan & Ishaq, 2021; Adabor & Buabeng, 2022). However, some studies only found asymmetry in either the long run or the short run (Bahmani-Oskooee et al., 2018, Bahmani-Oskooee & Gelan, 2019), while others found no evidence of asymmetry (Sana et al., 2020; Sakarombe et al., 2021; Durmaz & Jie, 2023).

In Nigeria, there is limited research on the asymmetric effects of exchange rate changes on money demand. Aworinde and Akintoye (2019) found that exchange rate changes have asymmetric effects on money demand in both the long and short runs. However, Bahmani-Oskooee and Gelan (2019) found no evidence of such asymmetry in Nigeria.

### **3. Methodology**

This study utilized quarterly data from 2010Q1 to 2022Q4. Data on Real GDP and financial innovation were collected from the Central Bank of Nigeria (CBN) and Nigerian Bureau of Statistics (NBS), whereas data on broad money (M3), Consumer Price Index and Exchange Rate were collected from the IMF's International Financial Statistics (IFS).

#### *3.1 Theoretical Framework*

The Keynesian Liquidity Preference Theory was used as the theory underpinning the study. The Theory developed by Keynes (1936), encompasses three key motives for holding money: transactions, precautionary, and speculative. The transactions motive is stable and linked to income levels, while the

precautionary motive is influenced by future uncertainty, with minor impacts from interest rates and income. However, the most significant aspect is the speculative motive, where the demand for money is influenced by its role as an alternative asset to interest-bearing instruments. Keynes argues that the speculative demand for money is negatively impacted by the interest rate. In times of high interest rates, people prefer holding less money due to the opportunity cost of forgoing interest-bearing assets. Conversely, when interest rates are low, the demand for money increases. The Keynesian liquidity preference function expresses the demand for real money balances:

$$\frac{M^d}{P} = \theta(r, y) \quad 1$$

with  $\theta_1 < 0$  and  $\theta_2 > 0$ , where  $\theta_i$  denotes partial derivative of  $\theta$  with respect to its  $i^{th}$  argument. That is, the demand for real money balances is negatively related to the nominal interest rate ( $r$ ), and positively related to real income ( $y$ ).

### 3.2 Model Specification

This study adapted Ogbaro et al. (2023) by treating the exchange rate variable as an asymmetric variable. This is because it has been established in literature that exchange rate changes have an asymmetric effect on money demand (Bahmani-Oskooee & Bahmani, 2015). By including financial innovation and exchange rate, the econometric

model of the log-linear money demand function is given as:

$$\begin{aligned} \ln MD_t = & \alpha_0 + \beta_1 \ln GDP_t + \beta_2 \ln INF_t \\ & + \beta_3 \ln FI_t + \beta_4 \ln EXC_t + \mu_t \end{aligned} \quad 2$$

Where  $\ln MD_t$  = log of real money demand,  $\alpha_0$  = constant parameter,  $\beta_i$  = coefficient of the explanatory variables  $i = 1, 2, \dots, 4$ .  $U_t$  = stochastic disturbance term,  $\ln GDP$  = log of real gross domestic product,  $\ln INF_t$  = inflation,  $\ln FI_t$  = log of financial innovation,  $\ln EXC_t$  = log of exchange rate,  $t$  = time subscript.  $\beta_1$  and  $\beta_2$  are expected to be positive and negative respectively whereas,  $\beta_3$  and  $\beta_4$  can both be either positive or negative. For the coefficient  $\beta_3$ , a negative sign indicates institutional and technological advancement whereas a positive sign indicates increasing monetization of the economy and financial deepening. The coefficient  $\beta_4$  may have a positive or negative relationship with money demand, indicating either a currency substitution effect or a wealth effect.  $\beta_5$  can also be positive or negative.

Following Shin et al. (2014) exchange rate and financial innovation shall be decomposed into two-time series variables each. This new series includes positive changes, which shall be denoted by  $\Delta \ln EXC_j^+$  and  $\Delta \ln FI_j^+$  and negative changes to be denoted by  $\Delta \ln EXC_j^-$ ,  $\Delta \ln FI_j^-$  for exchange rate and financial innovation respectively. They are constructed as positive and negative partial sums as follows:

$$\ln EXC_t^+ = \sum_{j=1}^t \Delta \ln EXC_j^+ = \sum_{j=1}^t \max(\Delta \ln EXC_j, 0) \quad 3$$

$$\ln EXC_t^- = \sum_{j=1}^t \Delta \ln EXC_j^- = \sum_{j=1}^t \min(\Delta \ln EXC_j, 0) \quad 4$$

$$\ln FI_t^+ = \sum_{j=1}^t \Delta \ln FI_j^+ = \sum_{j=1}^t \max(\Delta \ln FI_j, 0) \quad 5$$

$$\ln FI_t^- = \sum_{j=1}^t \Delta \ln FI_j^- = \sum_{j=1}^t \min(\Delta \ln FI_j, 0) \quad 6$$

$\Delta \text{LnFI}$  and  $\Delta \text{LnEXC}$  in equations (2) are then replaced with  $\Delta \text{LnFI}_{t-i}^+$ ,  $\Delta \text{LnFI}_{t-i}^-$  and  $\Delta \text{LnEXC}_{t-i}^+$ ,  $\Delta \text{LnEXC}_{t-i}^-$  respectively as in equation (3.7). The introduction of partial sums makes equation (3.7) NARDL model, able to test whether financial innovation and exchange rate affects money demand asymmetrically either in the short-run, the long-run, or both. The NARDL model has some advantages over other non-linear models. First, compared to other nonlinear error-correction models, NARDL estimates

the Error Correction Model (ECM) in a single step. This feature enhances the model's performance in small samples, especially in terms of the power of cointegration tests. Second, the NARDL modelling approach demonstrates a unique capability to efficiently estimate both long- and short-run asymmetries simultaneously in a simple manner thereby demonstrating its flexibility. Additionally, the technique offers a straightforward way to test for symmetry restrictions in both the long and short run (Shin et al., 2014).

$$\begin{aligned} \text{LnMD}_t = & \alpha + \sum_{i=1}^{n1} b_i \Delta \text{LnMD}_{t-i} + \sum_{i=0}^{n2} c_i \Delta \text{LnGDP}_{t-i} + \sum_{i=0}^{n3} d_i \Delta \text{LnINF}_{t-i} + \sum_{i=0}^{n4} e_i \Delta \text{LnFI}_{t-i}^+ \\ & + \sum_{i=0}^{n5} f_i \Delta \text{LnFI}_{t-i}^- + \sum_{i=0}^{n6} g_i \Delta \text{LnEXC}_{t-i}^+ + \sum_{i=0}^{n7} h_i \Delta \text{LnEXC}_{t-i}^- + \theta_0 \text{LnMD}_{t-i} \\ & + \theta_1 \text{LnGDP}_{t-i} + \theta_2 \text{LnINF}_{t-i} + \theta_3 \text{LnFI}_{t-i}^+ + \theta_4 \text{LnFI}_{t-i}^- + \theta_5 \text{LnEXC}_{t-i}^+ \\ & + \theta_6 \text{LnEXC}_{t-i}^- + \mu_t \end{aligned} \quad 7$$

#### 4. Results and discussion

##### 4.1 Unit root test

In order to avoid the issue of spurious regression, this study employed the Augmented Dickey Fuller (ADF) Test in comparison with the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test. The ADF and

KPSS results are presented in table 1. Panel A of the table shows the results of the ADF test. Gross domestic product (LNGDP) was stationary at level with an intercept at 1% level of significance whereas all other variables were stationary at first difference under intercept at 1% level of significance.

**Table 1:** ADF and KPSS Unit Root Tests

Panel A: Augmented Dickey Fuller (ADF) Test				
Variables	Level		First Difference	
	Intercept	Intercept/Trend	Intercept	Intercept/Trend
LNMD	-2.684*	-2.794	-3.765***	-3.909***
LNGDP	-3.883***	-2.353	-2.474	-2.431
INF	-1.793	-2.740	-3.687***	-3.823***
LNFI	-2.186	-2.750	-7.563***	-7.795***
LNEXC	0.062	-2.200	-5.913***	-5.896***
Panel B: Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test				
LNMD	0.632***	0.119***	0.237***	0.071***
LNGDP	0.875	0.277	0.224***	0.218**
INF	0.418***	0.098***	0.251***	0.071***
LNFI	0.911	0.119	0.212***	0.099***
LNEXC	0.923	0.104*	0.126***	0.089***

Source: Author's Computation

Note: Critical values of ADF with intercept and intercept and trend at the 1%, 5% and 10% are -3.574, -2.934, -2.560; -4.161, -3.506, -3.183 respectively. For KPSS, the critical values for intercept are 0.734, 0.463, 0.347 whereas for intercept and trend are 0.216, 0.146, 0.1119 at 1%, 5% and 10% respectively. \*\*\*, \*\*, \* denotes levels of significance at 1%, 5% and 10% respectively. This gives us a mixture of I(0) and I(1) in the order of integration. In Panel B, the KPSS results show that money demand and inflation were stationary at level under intercept and trend and intercept respectively at 1% level of significance. Gross domestic product, financial innovation and exchange rate were stationary at first difference under intercept and intercept and trend at 1% level of significance. This also shows a mixture in the order of integration in the variables hence

making it appropriate for the NARDL framework to be utilized.

#### 4.2 Brock-Dechert-Scheinkman (BDS) Test

An essential step prior to the estimation of the NARDL model involves subjecting the variables to the non-linearity test developed by Brock et al. (1996), commonly known as the BDS (Brock–Dechert–Scheinkman) test. The result of the BDS test shown in table 2, reveals that the null hypothesis of independent and identical distribution is rejected at a 1% significance level, thus signifying the non-linear characteristics of data under different dimensions. This validates the reliability of evaluating the asymmetric relationship between financial innovation and exchange rate changes on money demand using the NARDL approach.

**Table 2. BDS Test**

Dimension	BDS Statistic				
	LNMD	LNGDP	INF	LNFI	LNEXC
2	0.182***	0.076***	0.124***	0.190***	0.190***
3	0.308***	0.125***	0.182***	0.318***	0.317***
4	0.387***	0.174***	0.211***	0.406***	0.402***
5	0.435***	0.250***	0.239***	0.467***	0.462***
6	0.460***	0.278***	0.253***	0.513***	0.504***

Source: Author's Computation

Note: \*\*\*, \*\*, \* denotes levels of significance at 1%, 5% and 10% respectively.

#### 4.3. NARDL Model Analysis

In order to examine the asymmetric effects of financial innovation and exchange rate changes on the demand for money in Nigeria,

the NARDL was utilized. The structure of the model chosen with the aid of the SIC is 4,0,3,3,1.

**Table 3: NARDL Bounds Test**

Model	K	F-Stat.	Significance Level	Critical Values	
				I(0)	I(1 )
LNMD	6	9.358 ***	1%	3.656	5.331
			5%	2.726	4.057
			10%	2.309	3.507

Source: Author's Computation

From the result presented in table 3, the F statistics (9.358) is greater than the lower and

upper bounds critical values at 1%. Therefore, the null hypothesis of no cointegration is

rejected. This shows that there is an asymmetric cointegration among the variables hence a long-run relationship between financial innovation, exchange rate changes and money demand in Nigeria exists. The result is in line with the findings of Ogbaro et al. (2023).

#### 4.4. NARDL Long Run Analysis

Table 4 shows the long run results of the NARDL model. The result shows that income (LNGDP) which is the scale variable measuring the level of economic activity in the economy has a positive relationship with money demand and it is statistically

significant at 1%. This means that a percentage increase in income will increase the demand for money by 0.51%. This is consistent with the findings of Ujunwa et al. (2022) but contrary to studies such as Ovat et al. (2023), who found income elasticity to be above unity. Inflation has a negative effect on the demand for money and it is statistically significant at 1%. A unit increase in the rate of inflation will decrease the demand for money by 6.5%. It is expected that as inflation erodes the purchasing power of money, people will reduce the demand for holding money. Folarin and Asongu (2019) also had a similar finding.

**Table 4:** NARDL Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	0.512	0.175	2.936	0.005
INF	-0.065	0.007	-8.928	0.000
LNFI <sup>+</sup>	0.193	0.031	6.182	0.000
LNFI <sup>-</sup>	0.255	0.120	2.121	0.040
LNEXC <sup>+</sup>	0.104	0.113	0.920	0.363
LNEXC <sup>-</sup>	21.482	9.388	2.288	0.027

Source: Author's Computation

Positive changes in financial innovation has a positive relationship with the demand for money and it is statistically significant at 1%. A percentage increase in positive changes in financial innovation increases the demand for money by an average of 0.19 %. The result is in line with Ogbaro et al. (2023) who also found a positive relationship between positive changes in financial innovation and money demand in Nigeria. This indicates that financial innovation has not yet fully translated into a reduced demand for cash, possibly due to the limited reach of these innovations in rural areas and the entrenched preference for cash in daily transactions most especially in the informal sector. Nigeria remains a largely cash-based economy especially in the informal sector despite the surge in digital transactions. Thus, positive changes in financial innovation in the long run

bring about increased monetization and financial deepening in the Nigerian economy. Negative changes in financial innovation is also positively related to money demand and statistically significant at 5%. A percentage increase in the negative changes in financial innovation will increase the demand for money by an average of 0.26 %. This means that as issues such as cyber fraud, technical glitches, and failed transactions among others exacerbate, people will prefer to hold money since they don't have confidence in the efficiency of the innovations. Positive changes in exchange rate (depreciation of the Naira) is not statistically significant. However, Negative changes in the exchange rate (appreciation of the Naira) is positively related to the demand for money and statistically significant at 5%. A percentage increase in the negative changes in exchange rate will

increase the demand for money by an average of 21.48%. This means that as the value of the Naira appreciates, people will have more confidence in the currency and would want to hold it. This can be in expectation of further appreciation of the Naira. Thus, the wealth effect is dominant in Nigeria when there's a decline in the exchange rate.

#### 4.5. NARDL Short Run Analysis

Table 5 presents the short-run NARDL model results. The lagged differences of money demand are positive and significant in the first, second, and third lags. Inflation has an immediate negative effect on money demand, with a 1% increase in inflation leading to a 6.6% decrease in money demand. However, the second lag of inflation has a positive and significant effect, reducing the impact to 3.1%. This reflects that as inflation rises, people hold more cash in anticipation of further price increases. This finding is

consistent with Akinlo (2024). The immediate impact of both positive and negative changes in financial innovation have a positive short-run impact on money demand, with negative changes having a larger effect. The first lag of positive changes in financial innovation has a negative effect, while the second lag also shows a negative impact. This suggests that while innovations reduce the demand for cash in the short run, their reach may be limited due to the digital divide. The first and second lags of negative changes in financial innovation have a positive impact on money demand. Positive changes in the exchange rate (Naira depreciation) increase money demand by 0.25%, while negative changes (Naira appreciation) is not statistically significant. The error correction term (ECT) is significant, indicating that 47.8% of short-run disequilibrium adjusts back to the long run each quarter.

**Table 5. NARDL Short Run Coefficients**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNMD(-1))	0.379	0.086	4.364	0.000
D(LNMD(-2))	0.213	0.094	2.259	0.031
D(LNMD(-3))	0.244	0.052	4.667	0.000
D(INF)	-0.066	0.003	-18.646	0.000
D(INF(-1))	0.009	0.006	1.392	0.174
D(INF(-2))	0.031	0.007	4.499	0.000
D(LNFI <sup>+</sup> )	0.040	0.010	4.057	0.000
D(LNFI)	0.195	0.060	3.227	0.003
D(LNFI <sup>+</sup> (-1))	-0.082	0.011	-7.138	0.000
D(LNFI(-1))	0.116	0.059	1.946	0.061
D(LNFI <sup>+</sup> (-2))	-0.052	0.011	-4.823	0.000
D(LNFI(-2))	0.287	0.063	4.543	0.000
D(LNEXC <sup>+</sup> )	0.249	0.070	4.196	0.000
D(LNEXC <sup>-</sup> )	-4.034	3.365	-1.199	0.239
C	2.871	0.318	9.034	0.000
ECT (-1)	-0.478	0.053	-8.979	0.000

Source: Researcher's Computation

#### 4.6. Asymmetric Analysis

To ascertain if there are asymmetric effects of financial innovation and exchange rate changes on the demand for money in Nigeria,

the coefficient symmetry test was used. The null hypothesis states that coefficients are symmetric. The results of the coefficient symmetry test are presented in table 6. The test

statistics for financial innovation indicate that we fail to reject the null hypothesis of coefficient symmetry in the long run. This suggests that positive and negative changes in financial innovation have symmetric effects on money demand in the long run. In the short run, the probability value is significant at 1% thus rejecting the null of coefficient symmetry. Therefore, it can be concluded that financial innovation has asymmetric effects on

money demand in the short run. In considering both the long run and short run jointly, the null hypothesis is also rejected hence the conclusion that financial innovation has asymmetric effects on the demand for money. Exchange rate on the other hand has asymmetric effects on money demand in the long run and jointly as the null hypothesis was rejected at 5% in both instances. However, it has no asymmetric effects in the short run.

**Table 6. Coefficients Symmetry Test**

Variable	Test Statistic (P-Value)
<b>LONG RUN</b>	
LNFI	0.439 (0.513)
LNEXC	5.515 (0.027) **
<b>SHORT RUN</b>	
LNFI	15.364 (0.001) ***
LNEXC	0.973 (0.333)
<b>JOINT (LONG RUN AND SHORT RUN)</b>	
LNFI	7.703 (0.002) ***
LNEXC	4.946 (0.015) **

Source: Author's Computation

#### 4.7. NARDL Diagnostic Tests

Table 7 presents some diagnostic tests carried out to determine the adequacy of the estimated model. Results reveal that there is no serial correlation, non-normality or heteroskedasticity

in the residuals. The Ramsey RESET test also confirms the correct functional form of the model. This shows that the model is adequate and can be relied upon to make inferences for effective policy making.

**Table 7. Diagnostics Tests**

Diagnostics	Test Statistic
Breusch-Godfrey LM	4.626 (0.676)
Breusch-Pagan-Godfrey	22.512 (0.371)
Jarque-Bera	0.815 (0.665)
Ramsey RESET	0.747 (0.396)
CUSUM(CUSUMSQ)	Stable (Stable)

Source: Author's Computation

#### 5. Conclusion and Policy implications

The demand for money has long been recognized as a critical component in effective

monetary policy formulation, and its stability is a key concern for policymakers. Therefore, examining the dynamics of money demand in

the context of increasing financial innovation and volatile exchange rates in Nigeria is crucial. Most of the studies assumed a linear relationship between financial innovation, exchange rate changes and the demand for money. This study examines the asymmetric effects of financial innovation and exchange rate changes on the demand for money in Nigeria from 2010Q1 to 2022Q4, using the Nonlinear Autoregressive Distributed Lag (NARDL) model. The result shows that financial innovation and exchange rate changes were found to exert asymmetric effects on money demand. However, negative changes in financial innovation was found to influence the demand for money much more than positive changes implying that financial innovation in Nigeria has not yet fully displaced the reliance on cash. Likewise, negative changes in exchange rate (appreciation of the Naira) was also found to have more impact on the demand for money than positive changes. Furthermore, based on the findings of the study, the demand for money was found to be stable within the study period. The policy implication for these findings is that the government and financial institutions should focus on expanding access to digital financial services, especially in rural areas so as to curtail the resurgence in demand for cash due to incomplete adoption and negative shocks in financial innovation. Another implication is that the monetary authorities should aim to maintain exchange rate stability to prevent excessive volatility that could disrupt money demand.

## References

- Abdullah, H., El-Rasheed, S., & Hammad Ahmad Khan, H. (2022). Asymmetric impact of exchange rate changes on money demand in Malaysia. *Contemporary Economics*, 16(3), 317-328.
- Adabor, O., & Buabeng, E. (2022). Asymmetrical effect of exchange rate changes on money demand: Empirical evidence from Ghana. *Journal of Science and Technology (Ghana)*, 40(2), 131-147.
- Adil, M.H., Hatekar, N., & Sahoo, P. (2020). The impact of financial innovation on the money demand function – An empirical verification in India. *The Journal of Applied Economic Research*, 14(1), 28–61.
- Akinlo, A. E. (2024). Asymmetric effects of expected oil wealth on the demand for money in Nigeria. *The Review of Finance and Banking*, 16(1), 105-119.
- Aworinde, O. B., & Akintoye, I. R. (2019). Do exchange rate changes have symmetric or asymmetric effects on money demand in Nigeria? *African Finance Journal*, 21(1), 50-66.
- Bahmani-Oskooee, M., & Gelan, A. (2019). Asymmetric effects of exchange rate changes on the demand for money in Africa. *Applied Economics*, 51(31), 3365-3375.
- Bahmani-Oskooee, M., & Bahmani, S. (2015). Nonlinear ARDL approach and the demand for money in Iran. *Economics Bulletin*, 35(1), 381-391.
- Bahmani-Oskooee, M., Miteza, I., & Tanku, A. (2020). Exchange rate changes and money demand in Albania: a nonlinear ARDL analysis. *Economic Change and Restructuring*, 53, 619-633.
- Bahmani-Oskooee, M., Xi, D., & Bahmani, S. (2018). More evidence on the asymmetric effects of exchange rate changes on the demand for money: evidence from Asian. *Applied Economics Letters*, 26(6), 485-495.
- Bangura, M., Kargbo, I., & Pessima, S. (2022). Financial innovation in Sierra Leone: is the money demand still stable? *Modern Economy*, 13, 284-299.
- Central Bank of Nigeria (2017). Monetary policy at a glance. Central Bank of Nigeria. <https://www.cbn.gov.ng/out/2017/ccd/monetarypolicyataglance.pdf>
- Central Bank of Nigeria (2024). Quarterly statistical bulletin.
- Chaudhari, D. R., Dhal, S., & Adki, S. M. (2019). Payment systems innovation and currency demand in India: Some applied

- perspectives. *Reserve Bank of India Occasional Papers*, 40(2), 33-63.
- Chowdhury, M. I., & Karim, S. R. (2020). Financial innovations and its impact on money demand in Bangladesh: an error correction model (ECM) approach. *International Review of Business Research Papers*, 16(1).
- Copelman, M. (1996). Financial innovation and the speed of adjustment of money demand: Evidence from Bolivia, Israel, and Venezuela. *Discussion Paper Series*, 567. Federal Reserve System.
- Demirgüç-Kunt, A., Leora K., Dorothe S., & Saniya, A. (2022). The global finindex database 2021: financial inclusion, digital payments, and resilience in the age of COVID-19. *World Bank*. <https://doi.org/10.1596/978-1-4648-1897-4>
- Djaballah, M. (2020). The relationship between the financial innovation and the money supply: Empirical study on the Maghreb countries. *Economics and Business*, 34(1), 168-178.
- Dunne, J. P., & Kasekende, E. (2018). Financial innovation and money demand: Evidence from Sub-Saharan Africa. *South African Journal of Economics*, 86(4), 428-448.
- Durmaz, N., & Jie, T. (2023). Money demand in Mexico: a nonlinear ARDL approach. *Economics and Business Letters*, 13(1).
- Elhassan, T. (2021). Asymmetric impact of exchange rate fluctuations on money demand in Sudan. *Asian Economic and Financial Review*, 11(5), 406-417.
- Escribano, Á., & Rodriguez, J. A. (2023). Monetary trends in the UK and the USA from 1874 to 2020: A nonlinear approach to money demand. *Economics Working Paper*, 2304-5301. Universidad Carlos III. <https://hdl.handle.net/10016/37911>
- Folarin, O. E., & Asongu, S. A. (2019). Financial liberalization and long-run stability of money demand in Nigeria. *Journal of Policy Modeling*, 41(5), 963-980.
- Hannan, A., & Ishaq, T. (2021). The impact of symmetric and asymmetric exchange rate fluctuations on demand for money in Pakistan. *Journal of the Asia Pacific Economy*, 28(1), 261-283.
- Jonah, J. N., Egbe, I. S., & Richard, E. B. (2021). Financial innovation and demand for money in Nigeria. *International Journal of Business Management and Finance Research*, 4(1), 41-54.
- Keynes, J. M. (1936). *General theory of employment, interest and money*. Atlantic Publishers.
- Kumar, S., Webber, D.J., & Fargher, S. (2013). Money demand stability: A case study of Nigeria. *Journal of Policy Modelling* 35, 978–991.
- Mlambo, C., & Msosa, S. K. (2020). The effect of financial technology on money demand: evidence from selected African states. *International Journal of Economics and Business Administration*, 8(1), 366-373.
- Mumtaz, M. Z., & Smith, Z. A. (2020). Empirical examination of the role of fintech in monetary policy. *Pacific Economic Review*, 25(5), 620-640.
- Nakorji, M., & Asuzu, O.C. (2019). Money demand in the conduct of monetary policy in Nigeria. *Economic and Financial Review*, 57(1).
- Ogbaro, E. O., Olaniyi, C. O., Shadrach, O., & Eseyin, B. C. O. A nonlinear approach to the analysis of the financial innovation-money demand nexus in Nigeria. *Journal of Environmental Science and Economics*, 63-69. <https://doi.org/10.56556/jescae.v2i4.7077>
- Oghenekvewe, E., & Ezi, C.T. (2023). The impact of financial innovation on the demand for Money in Nigeria. *EPRA International Journal of Economics, Business and Management Studies*, 10(8), 135-141.
- Ovat, O.O., Abang. S.O., Okoi, O.B. & Ndem, B.E. (2023). Financial innovation and the demand for money in Nigeria: further empirical insights. *Universal Journal of Accounting and Finance*, 11(2), 39 – 52.

- Sakarombe, U., Makoni-Marimbe, R., & Badze, L. K. (2021). Asymmetrical effects of real exchange rate volatility during covid-19 pandemic on the demand for money in Zimbabwe. *Tanzanian Economic Review*, 11(2).
- Sana, S., Malik, S., Sheikh, M. R., & Akhtar, M. H. (2020). Money demand balances and exchange rate policy in Pakistan: An ARDL and Non-ARDL analysis. *Journal of Business and Social Review in Emerging Economies*, 6(4), 1391-1399.
- Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. *Festschrift in honour of Peter Schmidt: Econometric Methods and Applications*, 281-314.
- Tule, M. K., & Oduh, M. O. (2016). Financial innovations and the future of monetary policy in Nigeria. *Economics of Innovation and New Technology*, 26(5), 453-476.
- Ujunwa, A., Onah, E., Ujunwa, A.I., Okoyeuzu, C.R. & Kalu, E.U. (2022). Financial innovation and the stability of money demand in Nigeria. *African Development Review*, 34, 215–231.
- World Bank. (2021). *Global Findex Database 2021: Measuring Financial Inclusion and the Fintech Revolution*. World Bank. <https://www.worldbank.org/en/publication/globalfindex/Report>