

Substitutability of Currency in Nigeria: A non-linear approach

¹Mohammed Isa Shuaibu, ²Aliyu Rafindadi Sanusi, ³Maryam Bala Adamu¹

^{1,2}Department of Economics, Business School, Ahmadu Bello University, Zaria

³Distance Learning Centre, Ahmadu Bello University, Zaria

Abstract

The persistent rise in foreign currency demand, especially in recent years, exerts pressure on Nigeria's exchange market. This trend is often heightened by economic agents' perceived loss of purchasing power and confidence in the domestic currency, which makes them recourse to holding foreign currency that have a relatively stable value, such as the United States dollar (USD). To determine the presence of currency substitution and its effects on money demand in Nigeria, quarterly data from 1994 to 2017 was used. The non-linear Autoregressive Distributed Lag (ARDL) Model was employed in order to account for potential existence asymmetries informed by economic induced shocks overtime. The result affirms the existence of asymmetric cointegration for the variables, which implies the existence of a long run nonlinear relationship. In addition, crude oil price showed a significant effect of foreign currency demand from the stand view of domestic economic agents. The study suggests the closing of the exchange rate gap in the existing market to reduce the asymmetry expected from depreciation in domestic currency and further create buffers to manage the effect of oil price volatility, so as to check the substitutability rate of domestic currency in Nigeria.

Keywords: Currency substitution, Money Demand, Crude oil price, Non-linear ARDL

JEL Codes: C22, E44, F31, F41

Introduction

Globalization has made currency substitution/dollarization an important issue in many developing economies. This is accentuated to the fact that most countries use international currencies for exchange and transactions in their economy. Currency substitution is termed the usage of foreign currency which aid as the domestic currency unit for the major functions of money (medium of exchange, store of value and unit of account) in an economy (Heimonen 2008, Adam 2013 & Kessy 2013). Explicitly, it could be said to be the replacement of domestic currency (either partly or fully) with foreign currency. Currency substitution is also viewed as a transfer from the use of domestic to foreign currencies as a safety precaution especially periods of very high as well as volatile inflation (Calvo and Vegh, 1992). Substitution of currency is a common practice developing countries

¹ Corresponding author: maryamadamu2001@gmail.com, mobile no. 08036649782

as well as emerging economies especially the Latin America, Asia and African countries. For instance, Latin American countries such as Ecuador, El Salvador, Panama, Marshall Island among others are known to practice full dollarization (where the US dollar is an official legal tender while countries such Malawi, Bolivia, Nigeria, Cambodia, Angola, Malawi, Uruguay, Peru, and Turkey among others are of partial dollarization².

The Nigerian exchange rate arrangements have gone through various transitions dating from the 1960s with a fixed regime to a pegged regime in the 1970s to the mid-1980s and with the adoption of floating regime amidst the deregulation and Structural Adjustment Programme (SAP) of 1986. This period was characterized by the notion that residents and non-residents in the country have no restrictions on holding foreign currency in the economy. Foreign currency (especially the US dollar) was used for all the three major functions of money, notably as medium of exchange, store of value as well as for unit of account in the economy (Sanusi, 2013). Thus, currency substitution becomes prevalent in an economy that is volatile, characterised by hyperinflation that erodes the value of domestic currency. This prompt people to hold currencies of countries whose economies are perceived to be relatively stable (Meyer, 2000).

Interestingly, currency substitution most times results in a negative implication for the domestic currency and on macroeconomic policies of a country (Effiom and Samuel, 2010). For instance, the twin effect of persistent rise in inflation rate and naira depreciation caused by instability in exchange rate and misalignment of monetary policy, has predominantly made currency substitution resilient in the Nigerian economy with far reaching macroeconomic consequences (Effiom and Samuel, 2010). No doubt Nigeria as a monocultural economy which depends largely on export of crude oil proceed for its foreign exchange is susceptible to exogenous shocks from oil prices which significantly affects its reserves position hence it's currency stability. Beside, Nigeria is a member of Organization of Petroleum Exporting Countries (OPEC), and is responsive to decision of the cartel

² Intuitively, the Nigerian domestic economy uses the foreign currency which is mostly limited as a store of value. However, over time it is observed that with the current wave of dollarization, the use of foreign currencies has increasingly been taken over by the naira as a medium of exchange and at instance the unit of account function of money. This made the CBN to issue several circulars and warnings on the alarming rate at which commodities are gradually priced and exchanged in foreign currencies.

with regards to influencing international prices through productivity level which has implication on the flow of foreign exchange. Therefore, the prices of crude oil would affect monetary stability and potentially the whole economy. This is evident from the economy's over-reliance on crude oil for over 90% of its foreign exchange earnings. Therefore, any crude oil price fluctuation will tend to distort the country's accretion to external earnings.

The applicability for substitution of currency in Nigeria is not associated to the choice of fixed versus floating exchange rate regime, but more to the potential problems of short-run monetary instability that currency substitution can create (Doguwa, 2014). This is accentuated with the notion that, if the domestic demand for currency is strongly subjective by external factors (for instance, foreign interest rate, crude oil prices amongst others.), even if the monetary authorities follow consistent and favourable monetary and exchange rate policies, a considerable degree of variability may be imported from abroad. For instance, the Central Bank of Nigeria (2014) devalued the domestic currency (naira) by fixing the exchange rate at ₦168 to a dollar due to a fall in price of crude oil in the international market. In addition, the Naira had since then depreciated further to over N350 per US dollar. However, the monetary authority described the basis of the devaluation due to falling oil prices, which has consistently reduced the accretion to external reserves, thus constraining the ability of the bank to continually defend the naira and sustain the stability of the naira exchange rate. Recently, the Coronavirus (COVID-19) pandemic has made the Organization of Petroleum Exporting Countries (OPEC) to cut down on the amount of crude oil barrels to be produced by various countries. This situation has constricted the inflow of foreign exchange into the country resulting in the scarcity of the dollar currency. This has exerted more pressure on the domestic currency signaling further for devaluation of the naira. A number of studies have been identified in Nigeria on currency substitution among which include; Yinusa and Akinlo (2008), Bawa et al (2015), Kalyoncu, Isik and Jelilov (2015), Olayungbo and Ajuwon (2015), Effiom and Samuel (2010), Doguwa (2014), Aigheyis (2015) and Osemwengie, Oseme and Iseghohi (2017). These studies have argued for the prevalence of substitution of currency in Nigeria. While Kalyoncu, Isik and Jelilov (2015), Yinusa and Akinlo (2008), Effiom and Samuel (2010), and Aigheyisi (2015) have indicated that exchange rate volatility among other factors is the main determinant of currency substitution in Nigeria, Doguwa (2014) found government regime quality and exchange rate volatility as drivers of currency substitution in Nigeria. Bawa *et al.* (2015) noted the presence of ratchet effects in

currency substitution in Nigeria. However, despite these studies being explicit, they did not take into account the impact of crude oil prices which is major determinant of exchange rate movement in the foreign exchange market in Nigeria. Therefore, the current study sorts to address this gap and by incorporating the role of crude oil prices to examine the dynamics of a strong exogenous shock on currency substitution. Besides, the shocks from oil prices could be positive and negative as a result, there could be some missing information not captured by using linear models explicitly. Thus, the current study tries to address this issue by using nonlinear ARDL model to capture (if any) potential asymmetries from the model. The ARDL model was chosen because of the ability to account for heterogeneity. The paper is organized into five sections. The first section entails the introduction, second section reviews the related literature, while third section presents the theoretical framework and model specification. The fourth section explains the result and finally, the last section provides conclusion.

Literature Review

Extant studies have relied on the Portfolio balanced and Money demand models in analyzing the theoretical proposition of currency substitution. The main theoretical underpinning of these models is that the demand for foreign currency depends largely on the interest rate differentials and the risk associated with exchange rate. However, given that the currency substitution is a more dynamic process, the use of money demand and portfolio-balance approach may not be sufficient. Hence, the extension to incorporate macroeconomic and institutional components (Adam, 2013).

Studies have been conducted on currency substitution, be it country specific or cross-country studies to which the dynamics, causes and effects of currency substitution on macroeconomic variables were investigated. Some authors have opined that the determining factors of dollarization are expected exchange depreciation and exchange rate volatility (See Yinusa and Akinlo, 2008; Effiom and Samuel, 2010; and Doguwa, 2014 amongst others). Some segments of studies such as Olayungbo and Ajuwon (2015), Milenkovic and Davidovic (2013), Ghalayini (2011) and Osemwengie et al (2017) found inflation as a significant determinant of currency substitution. On the other hand, Adam (2013), Kabote et al. (2014) and Quispe-Agnoli and Whisler (2006) found that currency substitution impact positively on the economy.

In other to examine the existence of currency substitution in Argentina, Brazil and Mexico, Prock, Soydemir and Abugri (2003) relied on cointegration and Vector Error correction (VEC) model from October 1986 to June 2001. They found evidence of currency substitution in Argentina and Brazil. However, they attributed the lack of significant result for currency substitution in Mexico to its credible exchange rate and monetary policy as well as its relative financial stability. Similarly, Sharma, Kandil and Chaisrisawatsuk (2005) relied on the Morishima elasticity of substitution to ascertain the significance of the US dollar to six Asian economies as a substitute or complement to domestic monetary assets using quarterly data from 1977 to 1996. Findings reveal that there is an increasing degree of currency substitution over time in every country except for Malaysia, where capital account controls are enforced. Furthermore, there was a higher degree of currency substitution in Singapore, Korea and Japan, than in Indonesia, Malaysia and Thailand.

Heimonen (2008) and Kessy (2011) used error correction model (ECM) and cointegration in order to determine currency substitution. Heimonen (2008) evaluated the substitution of an auxiliary currency that is euros for dollars in the Estonian economy. Findings revealed evidence of substitution between the dollar and euro related balances were asymmetric in the short-run while it was symmetric in the long-run. While Kessy (2011) investigates dollarization in Tanzania and the East African Countries region with monthly series from 2001 to 2009. Evidence from the study indicates that the worth of the US dollar as a store of value is greater in Tanzania. Findings reveal that inflation rate negatively affects dollarization as the degree of foreign currency holding was persistently increasing despite inflation rate declining. Using simple regression model, Edy-Ewoh and Babatunde (2019) utilized data for the period 1972 to 2017 to examine the effects of dollarization on some selected macroeconomic variables in Nigeria. It was evident that there was no exert positive significant relationship between dollarization and the selected macroeconomic variables under the study period.

In the same vein, Adam (2013) used cointegration and ECM to investigate dollarization in Maldives using monthly data from January 1991 to December 2010. He found that unofficial dollarization remained high in the Maldives. More so, that stability of macroeconomic variables, inflows of tourism and the state of foreign exchange market are the key factors influencing the dollarization process in the long-run while openness of the country influences dollarization in the short-run. Furthermore, findings revealed negative and increased inflation volatility on

dollarization in Maldives as against other extremely dollarized economies, where dollarization increased following severe macroeconomic imbalances, high and persistent inflation rates. This was evident from the results which revealed that increased inflation volatility had a negative impact on dollarization. Corrales and Imam (2019) employed the panel regression techniques to examine the macroeconomic determinants of households deposit and loan dollarization and firms deposit and loan dollarization for lower and high income countries for the period 2001 to 2016. They found a weak relation between households and firms deposit and loan dollarization except for low income countries where inflation plays a prominent role in currency substitution. In addition, they pointed out that for both low and high income countries, some market development variables such as financial deepening, access to external debt and foreign exchange finance plays a significant role in explaining the dynamics of deposit and loan dollarization. Their study suggests that countries should minimize deposit and loan dollarization by focusing more on structural factors like financial sector development rather than macroeconomic stability which is now less of a problem to most countries.

However, some studies found exchange rate volatility as a factor driving currency substitution. Bahmani-Oskooee and Techaratanachai (2001) as well as Elkhafif (2002) used cointegration and error correction model to investigate currency substitution. While Bahmani-Oskooee and Techaratanachai (2001) established that the Thailand baht depreciated for the period 1977-1990 which resulted to currency substitution. Elkhafif (2002) applied the Granger causality test to evaluate the dynamics of currency substitution phenomenon in two Africa's emerging economies (Egypt and South Africa). Findings revealed that the elasticity of currency substitution with respect to exchange rate variable is greater in South Africa than in Egypt. The study indicated that a high currency substitution environment needs a more suitable exchange rate anchoring that would reduce the rate of substitution.

Yinusa and Akinlo (2008) examine exchange rate volatility and currency substitution in Nigeria using cointegration and ECM. They indicated the presence of currency substitution in the domestic banking system. A major factor that led to this was exchange rate volatility especially real parallel market exchange rate volatility. In addition, the study revealed that Nigeria is a moderately dollarized economy based on the findings under the study period. Effiom and Samuel (2010) used cointegration and Vector Error Correction Mechanism (VECM) to examine the vulnerability or immunity of the Nigerian economy to currency substitution

using annual time series data from 1970-2008. Findings revealed currency substitution remain a dominant feature of the Nigerian economy which also reflects inflation persistency and naira depreciation informed by exchange rate variability and monetary policy inconsistency. The Johansen cointegration test was employed by Kalyoncu, Isik and Jelilov (2015) to investigate whether the presence of currency substitution in Nigeria is as a result of currency depreciation for the period 1980-2013. They attributed the presence of currency substitution due to depreciation of the naira which resulted to a decline in holding of domestic currency in Nigeria.

Furthermore, Boamah et al (2012) investigates the degree of currency substitution and effects of foreign currency demand in four Caribbean countries for the period 1996 to 2009. Findings reveals presence of currency substitution due to exchange rate shocks with Trinidad, Tobago and Guyana having long run impact Jamaica showed short-run effects.

In order to examine the existence of currency substitution in Nigeria, Doguwa (2014) relied on Autoregressive Distributed Lag (ARDL) bound test approach with quarterly data from December 1994 to June 2014. Findings revealed that the behavior of foreign currency/naira demand deposit ratio in Nigeria has been influenced by devaluation expectations and exchange rate risk as well as some of the policies been pursued since the advent of the democratic governance regime. In the same vein, Bawa, Omotosho and Doguwa (2015) applied the bounds testing approach to cointegration with inclusion of ratchet effect to examine the persistence of currency substitution in Nigeria using monthly time series data from 1990-2013. Findings revealed persistence of currency substitution with ratchet effect in both long run and short run in Nigeria. Olayungbo and Ajuwon (2015) employed Structural Vector autoregression (SVAR) to investigate the relationship between dollarization, inflation and interest rate in Nigeria. They found out that despite low and stable inflation as well as interest rate, dollarization was still on the increase during the study period. Utilizing two stage least squares simultaneous equation technique, Aigheyisi (2015) analysed the interrelationship between currency substitution, inflation and economic growth in Nigeria for the period 1994 to 2013. Findings revealed insignificant effects of inflation and real Gross Domestic Product on currency substitution whereas currency substitution is significantly influenced by exchange rate and investment.

Furthermore, Osemwengie et al (2017) used the VAR model to investigate the impact of currency substitution on economic growth and its relationship with inflation for the period 1995 to 2013. Findings reveal the presence of currency substitution and a positive significant relationship between inflation and currency substitution in Nigeria. Yinusa (2009) adopted the Pool Ordinary Least Squares (POLS) using the fixed effect and panel least squares techniques to study the effects of macroeconomic fluctuations and deposit dollarization for a group of 18 Sub-Saharan Africa for the period 1980-2004. It was found that dollarization in Sub-Sahara Africa was informed by the interaction of inflation with capital accounts restrictions, political risk factor, changes in US monetary policy, domestic interest rate, exchange rate volatility and expected exchange rate.

Alternatively, Milenkovic and Davidovic (2013) used descriptive statistics to assess the determinants of dollarization in the Republic of Serbia for the period 2005 to 2011. They attributed presence of currency substitution to lack of confidence in the monetary authorities and the domestic currency with periods of financial instability, high inflation and the depreciation of the domestic currency. From the foregoing, it is evident that currency substitution is used interchangeably with dollarization in the literature. Indeed, currency substitution is being determined by some macroeconomic and institutional factors which have impacted on countries differently. This is evident from the literature as some studies have found high inflation to be associated with increased currency substitution while others are of the notion that even when inflation is relatively low, currency substitution increases. In addition, other studies attribute currency substitution to exchange rate depreciation. This is with the view that domestic economic agents tend to lose confidence in their currency due to its depreciation in value against the foreign currency, which makes them resort to the use of the foreign currency due to its reliability in stable value.

Methodology

Theoretical Framework and Model Specification

The portfolio balance model of Cuddington (1983) was adapted for this study. The approach emphasizes the allocation of wealth between different types of currency and other assets simultaneously. Holding of wealth by domestic investors are allowable in the form of four different assets: domestic money, domestic currency denominated non-monetary assets (which are referred to, for convenience, as domestic bonds), foreign bonds and foreign money. Thus, the

portfolio share of every asset is determined by the expected return on all assets and real income.

From the foregoing, this study relies on the specification of Cuddington's (1983) portfolio balance model drawn from the money demand specification. Following (Yinusa and Akinlo, 2008; Effiom and Samuel, 2010), the currency substitution index equation is specified as

$$\frac{FCD}{M2 - CC} = \beta_0 + \beta_1 inter_t + \beta_2 fintr_t + \beta_3 expd_t + \beta_4 rgdp_t + \beta_5 oilp_t + \beta_6 infl_t + u_t \quad (1)$$

Where *inter* is the domestic policy interest rate, *fintr* denotes foreign rate of interest plus expected exchange rate depreciation, *expd* is the expected rate of depreciation of domestic currency, *rgdp* is real income, *oilp* is crude oil price. *Infl* is inflation rate, *FCD* is foreign currency deposits in the domestic banking system, *M2* is broad money supply, *CC* is currency in circulation, $\frac{FCD}{M2 - CC}$ is also written as CSI. All data, except US treasury bills rate and crude oil prices are sourced from Central Bank of Nigeria (CBN) Statistical Bulletin- various years. Whereas treasury bills rate was sourced from the Board of Governors publication of the US Federal Reserve and crude oil prices was obtained from US Energy Information Administration.

Estimation Technique

The empirical analyses are presented in three stages; unit root test, co-integration test, and Error Correction Model (ECM). Central to the framework of analysis is the examination of the unit root characteristic of the variables in order to ascertain the stationarity of such variable. The Augmented Dickey Fuller (1979) and the Kwiatkowski-Phillips-Schmidt-Shin (1992) unit root test are used. The co-integration test entails examining the long-run relationship between the variables while the error correction is to determine the speed of adjustment on the presence of cointegration in the model. The Autoregressive Distributed Lag (ARDL) technique to co-integration was adopted for this study. The ARDL approach introduced by Pesaran, Shin & Smith (2001) is used in cases where variables are I(1) and some I(0). This suggest that the approach can be used when all the variables are I(0) or I(1) or even there is a combination of I(1) and I(0) variables. The approach also estimate both short run and long run relationships between variables in one step and simultaneously. The general form of the ARDL model is specified below;

$$CSI_t = \alpha_t + \sum_{k=1}^p \gamma_k CSI_{t-k} + \sum_{j=0}^{qi} \theta_{ij} X_{t-j} + \varepsilon_t$$

(2)

Where CSI (Currency Substitution Index),

θ_{ij} = k x 1 vector of estimating parameters

X_{t-j} = 1 x n vector of independent variables (intr (domestic Treasury bill rate), fintr (US treasury bill rate). expd (expected exchange rate depreciation), rgdp (Real Gross Domestic Product), Infl is inflation rate. Oilp (Oil prices))

$k = 1, 2, 3, \dots, n$

$i = 1, 2, 3, \dots, 6$

$j = 0, 1, 2, 3, \dots, n$

The above model is then reparameterized to derive the conditional error correction model given below as;

$$\begin{aligned} \Delta CSI_t = & \alpha_0 + \lambda_1 CSI_{t-1} + \lambda_2 inter_{t-1} + \lambda_3 fintr_{t-1} + \lambda_4 expd_{t-1} + \lambda_5 rgdp_{t-1} \\ & + \lambda_6 oilp_{t-1} + \\ & \lambda_7 infl_{t-1} + \sum_{k=1}^{p-1} \gamma_k \Delta CSI_{t-k} + \sum_{j=0}^{qi-1} \theta_{ij} \Delta X_{t-j} + \varepsilon_t \end{aligned}$$

(3)

Specifically, the non-linear ARDL approach developed by Shin, Yu & Greenwood-Nimmo (2014) was employed in this study. Shin et al (2014) decomposed the variables into partial sum components (positive and negative). This was done by changing the linear model into a nonlinear model and using Pesaran et al (2001) bounds testing approach to test asymmetric effects on the variables. The nonlinear ARDL model in which nonlinearity is introduced by creating partial sum components is represented below;

$$\begin{aligned} \Delta CSI_t = & \alpha_0 + \lambda_1 CSI_{t-1} + \lambda_2 inter_{t-1}^+ + \lambda_3 inter_{t-1}^- + \lambda_4 fintr_{t-1}^+ + \lambda_5 fintr_{t-1}^- \\ & + \lambda_6 expd_{t-1}^+ + \lambda_7 expd_{t-1}^- + \lambda_8 rgdp_{t-1}^+ + \lambda_9 rgdp_{t-1}^- + \lambda_{10} oilp_{t-1}^+ \\ & + \lambda_{11} oilp_{t-1}^- + \lambda_{12} infl_{t-1}^+ + \lambda_{13} infl_{t-1}^- + \sum_{k=1}^{p-1} \gamma_k \Delta CSI_{t-k} \\ & + \sum_{j=0}^{qi-1} (\theta_{ij}^+ \Delta X_{t-j}^+ + \theta_{ij}^- \Delta X_{t-j}^-) \\ & + \varepsilon_t \end{aligned}$$

(4)

Where the superscript on the variables are the partial sum components (positive and negative) to be used to account for the asymmetric effects in the model.

Empirical Analysis and Results

The stationarity properties of the time series data showed that some of the variables are stationary at level $I(0)$ while some are stationary at first difference $I(1)$ for the ADF and the KPSS unit root test. These results are shown in Table 1 below;

Table 1: Unit Root Test for Variables used in Estimation

<i>Variables</i>	<i>ADF</i>	<i>Remark</i>	<i>KPSS</i>	<i>Remark</i>
<i>CSI</i>	-9.583***	$I(1)$	0.165***	$I(1)$
<i>Inter</i>	-2.603*	$I(0)$	0.430***	$I(0)$
<i>Fintr</i>	-3.14**	$I(0)$	0.261**	$I(0)$
<i>Expd</i>	-2.875*	$I(0)$	0.243***	$I(0)$
<i>Rgdp</i>	-10.019***	$I(1)$	0.074***	$I(1)$
<i>OilP</i>	-8.067***	$I(1)$	0.180***	$I(0)$
<i>Infl</i>	-10.283***	$I(0)$	0.373***	$I(0)$

*, **, *** denotes rejection of the null hypothesis at 1%, 5% and 10% respectively.

Given the unit root properties of the variables, the study proceeded to establish whether or not there is a long-run cointegrating relationship among the variables by using the non-linear ARDL co-integration technique. The nonlinear ARDL approach is useful because it enables us to account for asymmetric effect (in other words capture the hidden information) from the estimation. Table 2 represents the non-linear ARDL result. From the short-run panel, only *exdp* showed evidence of asymmetric effect, with both the positive and negative partial sum having a positive effect on *CSI*. But only the positive partial sum has an insignificant effect with *CSI*. This implies that in the short run expected depreciation shock have similar effects on the currency substitution. However, the long run coefficients from panel B indicates with the absorption of the short-run shocks, the positive and negative partial sum now have a negative effect on *CSI* though the positive decomposition effect on *CSI* is not significant. This implies that the effect of expected depreciation on *CSI* is asymmetric as clearly indicated. Studies like Yinusa and Akinlo (2008) and Doguwa (2014) have also indicated that *expd* is a strong determinant of *CSI* which this study has revealed a similar finding. This asymmetric effect is intuitive because expected depreciation could be by market forces of demand and supply or government action (monetary policy). But one

key thing is the possibility of one to clear in the long run (the one induced by the market forces) while one is deemed to last longer (induced by monetary policy). More so, it is imperative to note that economic agents might suspect a possible devaluation of the domestic currency due to the incessant rise in exchange rate which will eventually increase their desire for currency substitution. The short run foreign interest rate has a negative and statistically significant effect on CSI. This implies that if the foreign interest rate is susceptible to short run shocks, it could then result to currency substitution. Domestic interest rate at one lag period has the correct sign (negative) and statistically significant. More revealing is the short run effect of crude oil prices which shows a negative and significant effect on CSI behavior. This is possible because agent can view the positive change as transitory. This implies that foreign currency demand is positively influenced by the value of crude oil price. Inflation rate has a negative and statistically significant effect on CSI in the previous period and insignificant in the present period. Indicating that the inflation rate effect is engrossed in the short-run.

Table 2: Non-linear ARDL Result

<i>Variables</i>	<i>Coefficient</i>	<i>Prob</i>
Panel A (Short run)		
D(EXPD_POS)	5.21E-05 (0.00015)	0.7294
D(EXPD_POS(-1))	0.000485 (0.00018)	0.0097*
D(EXPD_NEG)	0.000405 (0.00017)	0.0240**
D(EXPD_NEG(-1))	0.000613 (0.00016)	0.0006*
D(INTER)	-0.000923 (0.00073)	0.2131
D(INTER(-1))	-0.001476 (0.00075)	0.0546**
D(FINTR)	-0.000174 (8.10E-05)	0.0353**
D(FINTR(-1))	-0.000517 (0.00010)	0.0000*
D(INFL)	-0.000246 (0.000304)	0.4225
D(INFL(-1))	-0.000521 (0.00029)	0.0853***
D(OILP_NEG)	0.000235 (0.00019)	0.2203
D(OILP_NEG(-1))	-0.000665 (0.00020)	0.0015*
Panel B (Long run)		
C	0.0458(0.0329)	0.1683
EXPD_POS	-0.000777 (0.00065)	0.2418
EXPD_NEG	-0.001463 (0.00082)	0.0813***
INTER	0.001987 (0.00093)	0.0376**
FINTR	0.001039 (0.00057)	0.0747***
INFL	4.82E-05 (0.00033)	0.8865
OILP_POS	0.000327 (0.00016)	0.0548**
OILP_NEG	-4.96E-05(0.00025)	0.8488
RGDP	-1.23E-07 (1.30E-06)	0.9250
Panel C		
ECM (-1)	-0.553829 (0.077929)	0.0000
R-squared	0.4853	
F-statistic	4.4446	0.0000
LM	1.24	0.302

*Note: values in parenthesis are the standard errors, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

In the long run panel, the coefficient of foreign interest rate is positive and statistically significant. But the coefficient of domestic interest rate is positive and significant in the long run. This implies that in the long run with the absence of shocks, domestic interest rate and foreign interest rate moves in a similar direction. This implies that agents will view which of the currency they have confidence to invest with a relatively stable value. Rgdp here is negative though not statistically significant indicating its inaudibility in determining currency

substitution. The coefficient of the positive and negative (expd), which both have negative signs and conforms to our *apriori* expectation, signifies that only negative (expd) is statistically significant. Inflation rate has a positive sign but its effect remains statistically insignificant in the long run.

It is worth noting that Nigeria fundamentally depends on crude oil for its foreign exchange earnings. Therefore, as the price of crude oil goes up, accumulation of foreign exchange earnings increases. This is evident from our result where crude oil price has a positive sign and also significant to currency substitution. This further aggravates the substitution of currency and makes it appear more plausible in circumstances where the rising crude oil price fails to instill greater confidence in the minds of economic agents in the stability of Naira due to its high volatility nature.

In order to establish whether there is a long run equilibrium relationship (cointegration) between the CSI and the variables, the F-test was used. The F-test value is 4.4446 which is greater than the Pesaran upper and lower bound critical values implying the existence of long run relationship between the variables or the presence of cointegration. The speed of adjustment from the short-run to the long-run which is known as the error correction term indicates that the average value of the error correction term (ect) is an indication that errors in the model would take a reasonably long time period before they are fully corrected (Yinusa and Akinlo, 2008). From our result, $(ECM_{(-1)})$ is negative and statistically significant as expected, it shows around 55.4% disequilibrium error which occurred the previous quarter is corrected in the current quarter. The Lagrange Multiplier (LM) statistic distributed as χ^2 with four degrees of freedom is carried out to make there is no autocorrelation among the residuals. Its critical value is 1.24 and insignificant, implying absence of serial correlation. Finally, the R^2 which measures the goodness of fit of the model is 48.3%. This entails that about 48.3% variation in the dependent variable is been explained by the explanatory variables.

Conclusion and Recommendations

This study focused on modelling asymmetric cointegration for the existence of substitutability of currency, using an asymmetric model of nonlinear Autoregressive distributed lag model for Nigeria. A noteworthy contribution of the study is the inclusion of domestic and external economic and non-economic factors that may contribute to the pervasiveness of currency substitution in Nigeria. Findings reveal evidence of currency substitution in Nigeria. More so,

the model decomposed the exchange rate depreciation variable into partial sums (positive and negative) in order to check for asymmetric effects in the model. The study found asymmetric cointegration between the variables, which implies an asymmetric long run relationship. For instance, the estimates show that the effect of exchange rate depreciation has an asymmetric effect on CSI informed by the dynamics of occurrence of exchange rate depreciation. Therefore, the difference between the official exchange rate and parallel market rate (parallel market premium) should be contained and kept at the bearest minimum level by the monetary authority at any time period. The findings also revealed that domestic interest rate is a stronger determinant than the foreign interest rate though with both having positive effect in the long run. Oil prices also had a twin effect with negative and positive coefficients in the short run and in the long run. This implies the oil prices is also a strong determinant of currency substitution though a very volatile component. However, inflation rate was found to be insignificant both in the long run but significant in the lag period of short-run indicating its frailness in determining currency substitution for the study period.

Specifically, the finding provides important implications for monetary policies and its implementation. The monetary authorities in collaboration with the government should formulate policies that would promote the development of the domestic financial system and also, should put into effect measures that will bring back the confidence of economic agents in the domestic currency. If this is realized, it will serve as an incentive to encourage domestic agents to store their assets and also find alternatives to holding money in the domestic economy. To this end, these measures may even bring back the confidence and value of the naira as a domestic currency.

References

- Adam, A. (2013). Dollarization in a Small Open Economy: The case of Maldives. *World Review of Business Research* Vol.3 No.3 Issue.1-15.
- Aigheyisi, O.S. (2015). Currency Substitution, Inflation and Economic Growth in Nigeria: A Simultaneous Equation Analysis. *The Empirical Econometrics and Quantitative Economics Letters*, Vol.4, No.1, 33-44.
- Asteriou, D. and Hall, S.G. (2007). *Applied Econometrics: A Modern Approach*. Revised Edition. Palgrave Macmillan, 175 fifth Avenue, New York, N.Y. 10010.

- Bahmani-Oskooee, M. and Fariditavana H. Nonlinear ARDL Approach and the J-Curve
- Bahmani-Oskooee, M. and Techaratanachai, A. (2001). Currency Substitution in Thailand. *Journal of Policy Modeling*, Vol. 23, 141-145.
- Balino, T., Bennethm A. and Boresztein, E. (1999). Monetary Policy in Dollarized Economies. *IMF Occasional Paper* No. 171. Washington, D.C: The World Bank.
- Bawa, S., Omotosho, B.S and Doguwa, S.I. (2015). Ratchet Effects in Currency Substitution: An Application to Nigeria. *Central Bank of Nigeria Journal of Applied Statistics*. Vol. 6 No. 2, 19-37. *Biometrika*, 75, pp. 335-46.
- Boamah, D., Guy, K., Grosvenor, T. and Lescott, A. (2012). Currency Substitution: Evidence from the Caribbean. *Business, Finance and Economics in Emerging Economies*. 1-20.
- Calvo, G.A. and Vegh, C.A. (1992). Currency Substitution in Developing Countries: An introduction. *IMF Working Paper* No. 92/40. Washington, D.C.
- CBN (2016). *Central Bank of Nigeria Statistical Bulletin*.
- Corrales J., and Imam P. A. (2019). Financial Dollarization of Households and Firms: Does it Differ? *IMF Working Paper* No. 19/19. African Department, Washington, D.C.
- Cuddington, J.T. (1983). Currency Substitution, Capital Mobility and Money demand. *Journal of International Money and Finance*. Vol.2, 111-133.
- De Nicolo, G., Honohan, P. and Ize, A. (2005). Dollarization of the Banking System: Causes and Consequences. *Journal of Banking and Finance* 29, 1697-1727.
- Dickey, D.A., and Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Economics. *Econometrica*, 57, 1361-1401.
- Doguwa, S.I. (2014). Currency Substitution: Evidence from Nigeria. *Central Bank of Nigeria Journal of Applied Statistics*. Vol.5 No. 2, 1-23.
- Edy-Ewoh U., and Babatunde B. (2019). The Prospect of Dollarization in Nigeria: An Empirical Review. *International Journal of Business and Economics Research*. Vol. 8, No. 4, 220-231. DOI: 10.11648/j.ijber.20190804.17
- Effiom, L. and Samuel, U.P. (2010). The Currency Substitution Phenomenon: Is Nigerian Economy Immune? *Journal of Economic Theory* 4(1):9-13.
- El-khafif, M.A.T. (2002). Exchange Rate Policy and Currency Substitution: The Case of Africa's Emerging Economies. *The African Development Bank Economic Research Papers*, No. 71, 1-17.

- Engle, R. F. and Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, pages 251–276.
- Ghalayini, L. (2011). The Impact of Dollarization on the Efficiency of Monetary in Lebanon: Interaction between Dollarization and Inflation. *Middle Eastern Finance and Economics*, Issue 14, 128-139.
- Heimonen, K. (2008). Substituting a Substitute Currency: The Case of Estonia. *International Review of Economics and Finance*. Vol. 17, 66-84.
- Honig A. (2007). Dollarization, Exchange Rate Regimes and Government Quality. Department of Economics, 315 Converse Hall, Amherst College. Amherst, MA 01002-5000.
- Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society*, pages 1551–1580.
- Johansen, S. (1995). Likelihood-based inference in cointegrated vector autoregressive models. *Oxford University Press on Demand*.
- Kabote, F., Vengesayi, S., Mamimine, P.W and Mataruse, R. (2014). The Effects of Dollarization on Human Resources in the Hospitality Industry in Zimbabwe. *Journal of Business and Management*. Vol. 16, 65-71.
- Kalyoncu, H., Isik, A and Jelilov, G. (2015). Currency Substitution: Evidence from Nigeria. <https://www.researchgate.net/publication/281619767>.
- Kessy, P. (2011), Dollarization in Tanzania: Empirical Evidence and Cross-Country Experience. *Working Paper* No. 11/0251. London: International Growth Centre, London School of Economics and Political Science.
- Level Relationships”, *Journal of Applied Econometrics*, Vol. 16, pp. 289-326.
- Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., and Shin, Y. (1992). Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root. *Journal of Econometrics*. Vol. 54, pp. 159–178.
- Levy-Yeyati, E. (2006). Financial Dollarization: Evaluating the Consequences. *Economic Policy*, 21(45), 61-118.
- Meyer, S.A. (2000). Dollarization: An Introduction. Philadelphia Council of Business
- Milenkovic, I. and Davidovic, M. (2013). Determinants of Currency Substitution/ Dollarization: The case of the Republic of Serbia. *Journal of Central Banking Theory and Practice*.1, 139-155.
- Olayungbo D.O and Ajuwon, K.T. (2015). Dollarization, inflation and interest rate in Nigeria, *Central Bank of Nigeria Journal of Applied Statistics*,

- ISSN 2476-8472, The Central Bank of Nigeria, Abuja, Vol. 6, Iss. 1, pp. 241-261.
- Osemwengie P.K., Oseme S.A. & Iseghohi J.O. (2017). Currency Substitution and Economic Growth in Nigeria: Evidence from Vector Autoregressive (VAR) Method. *West African Financial and Economic Review*. Vol. 16 No 1, pp. 139-168.
- Pesaran, M. H., Shin, Y and Smith, R. J. (2001), Bounds Testing Approaches to the Analysis of Phenomenon, *Open Economies Review*, Vol. 27 (2016), Issue 1, pp. 51-70.
- Phillips, P.C.B. and Perron P. (1988). Testing for a Unit Root in Time Series Regression.
- Prock, J., Soydemir, G.A and Abugri, B.A. (2003). Currency Substitution: Evidence from Latin America. *Journal of Policy Modelling*. Vol.25, 415-430.
- Quispe-Agnoli, M. & Whisler E, (2006). Official Dollarization and the Banking System in Ecuador and El Salvador. *Economic Review*, Third Quarter, Federal Reserve Bank of Atlanta.
- Sanusi, S.L. (2013). Controlling the Dollarization of Nigeria's Economy. This day, February 20. Schmidt: *Econometric Methods and Applications*, eds. By R. Sickels and W.
- Sharma, S.C., Kandil, M. and Chaisrisawatsuk, S. (2005). Currency Substitution in Asian Countries. *Journal of Asian Economics*, Vol.16, 489-532.
- Shin, Y., Yu, B. C. and Greenwood-Nimmo M. (2014). Modelling Asymmetric Cointegration
- Yinusa, D.O. (2009), Macroeconomic Fluctuations and Deposits Dollarization in Sub-Saharan Africa: Evidence from Panel Data, *MPRA Paper* No. 16259.
- Yinusa, D.O. and Akinlo, A.E. (2008). Exchange Rate Volatility and the Extent of Currency Substitution in Nigeria. *Indian Economic Review*, New series Vol. 43, 161-181