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EXCHANGE RATE VOLATILITY AND THE EXTENT OF CURRENCY SUBSTITUTION IN NIGERIA

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Abstract

This study tests for the existence of currency substitution and attempts to gauge its magnitude in Nigeria. The analysis was based on a multi-perspective unrestricted portfolio balance model. The stock of foreign currency deposits in Nigeria and the ratio of deposits denominated in foreign currency in the domestic banking system to deposits denominated in the domestic currency were modelled. First, the study revealed the presence of currency substitution in the domestic banking system in Nigeria. A major factor driving this process was exchange rate volatility especially real parallel market exchange rate volatility. Also, the study demonstrates that currency substitution in Nigeria was low during the period under review and as such classified Nigeria as moderately dollarized economy. Subsequently, alternative policy options for curtailing currency substitution in Nigeria were explored. The study concludes that currency substitution is an element of Nigerians' behaviour concerning wealth allocation and as such macroeconomic policies that ensure long periods of low inflation and exchange rate stability become the most powerful policy option that could help stabilize or reduce currency substitution. Also very paramount are the development of domestic financial markets with relevant infrastructural facilities and the development of new financial instruments, which will serve as alternatives to holding money in the domestic economy.

JEL: E41, F31, F400

KEY WORDS: Demand for money, Exchange Rate Volatility, Currency Substitution, Macroeconomic Aspects of International Trade and Finance, Nigeria.

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EXCHANGE RATE VOLATILITY AND THE EXTENT OF CURRENCY SUBSTITUTION IN NIGERIA

1. Introduction

The impact of increased exchange rate variability on currency substitution has been investigated in a number of empirical and theoretical studies.¹ This is particularly important for emerging market economies that switch from a fixed to a flexible exchange rate regime due to the higher degree of variability associated with flexible exchange rates. While many countries in sub-Saharan Africa have moved from to a flexible exchange rate regime with deregulation policies of 80s, it is surprising that there are very few studies that analyze the relationship between exchange rate variability and the degree of currency substitution in the continent.

The few studies include those of Olomola (1999), Oresotu and Mordi (1992) and more recently Akinlo (2003), all of which focused on the determination of the existence or otherwise of currency substitution in Nigeria. While the first two studies indicate the existence of currency substitution in Nigeria, the latter points to the contrary. Aside from the conflicting results, they do not adequately account for the forces driving this process in Nigeria. Important variables that are theoretically relevant for currency substitution (e.g. foreign rate of interest, a measure of domestic inflation and indeed, exchange rate volatility) were never included in their models. Also these studies did not quantify the extent or degree of currency substitution in Nigeria, which, in our view, is more relevant for policy purposes than its mere existence.

The purpose of this paper is to fill this gap by ascertaining the degree of currency substitution and explore the impact exchange rate variability on it using a multi-perspective unrestricted portfolio balance approach in the case of Nigeria.²

¹ Earlier studies on this issue include Mckinnon (1982), Zervoyianni (1988); Miles (1982) and Ratti and Jeong (1994) among several others.

² The advantage of the portfolio balance approach is that it distinguishes between currency substitution as measured by the coefficient on the expected change in the exchange rate, and capital mobility, as measured by

The existence of currency substitution in Nigeria has a number of implications for the stability of Naira, overall financial system development and monetary policy outcomes in particular. For concreteness it could be argued that currency substitution would serve to frustrate the authorities' efforts to measure the demand for national currencies and hence make money supply targets impossible to pursue (Imrohoroglu, 1994). Also, currency substitution will undermine the independence of the exchange rate policy and complicate monetary policy in a world where capital controls do not exist or are easily circumvented (Mizzen and Pentecost, 1996; Chang, 2000). Rather than allowing a nation to determine its own monetary policy under a floating exchange rate, currency substitution would create interdependence between nation states (D' Arista, 2001, Mizzen and Pentecost, 1996).

Indeed, the existence of currency substitution in these economies may precipitate financial crisis. This is because it may lead to short-term foreign currency liabilities that are high relative to foreign exchange reserves of the banking system. In such conditions, an increase in foreign currency deposits held in domestic banks may increase the vulnerability of the banking system through the "balance sheet effect" (Agenor, 2004).

The foregoing discussion suggests that currency substitution may have dire consequences for macroeconomic management and as such identifying its determinants is not only academically important but has policy relevance. This is because global/regional integration or common markets in developing countries would be unable to strengthen and thrive in an environment characterized by exchange rate instability. In view of this, it is important to know the extent of currency substitution in Nigeria and factors determining it.

This study will improve our understanding of the behaviour of money demand functions in an emerging market economy where more than one currency co-circulates. Aside from this, recent emerging market financial crisis and the general increase in international capital mobility have led to the need for a re-evaluation of the role of exchange rate

the coefficient on the foreign rate of interest. It can also be estimated for individual domestic money demands or as an aggregate demand for money over a specific region.

arrangements in reducing vulnerability of less developed countries to financial crisis. This becomes even more relevant for emerging market economies like Nigeria characterized by untamed fiscal deficits, inflation and the current move towards fuller capital account liberalization.

2. Model Specification

Following from standard money demand function in a flexible exchange rate environment the equation estimated is:³

$$m_t = \alpha + \beta_1 i_t + \beta_2 i_t^* + \beta_3 e_t^e + \beta_4 P_t^c + \beta_5 y_t + \beta_6 ERV_t + u_t \dots \dots \dots (1)$$

where all variables except interest rates are expressed in logarithms. e_t^e , the expected change in the exchange rate, i_t the domestic policy interest rate, m_t is domestic demand for domestic money, y_t is the home-currency value of domestic output, measured by GDP, p_t^c is the price of the domestic consumer's consumption bundle, i_t^* denotes foreign rate of interest, proxy by Federal Funds rate, u_t is the error term and ERV_t is a measure of exchange rate volatility.

Before presentation of the empirical results, it is necessary to derive an operational measure of exchange rate variability. In this paper, we extracted exchange rate volatility via a state-space representation (a form of signal to noise extraction) of the form:

$$Z_t = \sigma \varepsilon_t e^{\frac{1}{2}h_t}; \dots \dots \dots iid(0,1) \dots \dots \dots (2)$$

where,

$$h_{t+1} = \pi h_t + \mu_t \dots \dots \dots NID(0, \sigma_\mu^2) | \pi | \leq 1 \dots \dots \dots (3)$$

³ To conserve space, no theoretical discussions on the relationship between higher exchange rate variability and currency substitution are presented here. For the same reason, we do not discuss the theoretical effects of domestic interest rate, expected exchange rate, foreign rate of interest, domestic price level and output. A treatment of this issue can be found in Brandson and Henderson (1985), Cuddington (1983), Mizen and Pentecost (1996) and Ropers, (1996).

Z_t is the exchange rate. The term σ^2 is a scale factor and subsumes the effect of a constant in the regression of h_t . π , is a parameter, μ_t is a disturbance term that is uncorrelated with ε_t , ε_t is an $iid(0,1)$ are random disturbances symmetrically distributed about zero. The h_t equation is a transition equation in autoregressive form where the absolute value of π is less than unity to ensure that the process in equation (2) is stationary (Ndung'u, 2001; p.12). These equations generate the conditional volatility of exchange rate used in equation (1) for estimation purpose. However, we attempt to determine whether the most important aspect of volatility for currency substitution is for the nominal or real exchange rates. To do this, alternative measures of exchange rate volatility (i.e. real and nominal exchange rate volatilities) were estimated and included for that purpose.

3. Data and Variable Definitions

We used quarterly data spanning the period from the first quarter of 1986 to the second quarter of 2005. This covers the entire period of liberalization which also witnessed the emergence of dollarisation in the economy. Where a particular variable is of discrete form, we use a quarterly average calculated as the simple arithmetic average of the monthly end-of-period values for the three months in the current quarter and the last month of the previous quarter. We use seasonally adjusted data only in the case of the scale variable, which is the only one showing a marked seasonal pattern.

The dependent variable was measured in three ways to check the robustness of our results. First we used money supply broadly defined less domestic currency in circulation (M_2). We subtracted money in circulation from M_2 so as not to under-estimate the relative weight of foreign currency deposits in the banking system. The second measure is foreign currency deposits in domestic banking sector (FCD). This is the sum of FCD in commercial and merchant banks. The third measure is currency substitution index (CSI). This is measured as the ratio of FCD and M_2 as defined above. It is our measure of currency substitution from the store of value perspective. P^c is the consumer price index. y is

a measure of transactions in the economy and possibly accumulation of wealth. To measure this variable, we use Gross Domestic Product (GDP). i is the treasury bill rate. This is used as a measure of opportunity cost of holding money and an alternative wealth allocation to money holdings. i^* is a measure of return on foreign money proxy by Federal Funds rate plus expected exchange rate depreciation. This is measured as bilateral rate of exchange between naira and dollar. e^e is the exchange rate expectation. This is calculated as current and one-quarter-lagged values of the exchange rate between naira and dollar. We assumed that agents form their expectation adaptively and the rest use the random walk process as the predictor. Data were sourced from Statistical Bulletin, published by Central Bank of Nigeria (CBN), and International Financial statistics, published by International Monetary Fund (IMF) - various years.

4. Empirical Results

Conventionally, we first explore the stationary properties of analyzed time series using ADF- and PP-tests. For space consideration, the empirical results are not presented but they suggest that all the variables are integrated of order I (1). Consequently, we use cointegration analysis (see Johansen and Juselius, 1990).

Table 1: Johansen Cointegration Test on Variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
<i>None</i> *	0.676606	214.7271	125.6154	0.0000
≤ 1 *	0.566335	128.9319	95.75366	0.0000
≤ 2	0.325336	65.43518	69.81889	0.1064
≤ 3	0.187271	35.52606	47.85613	0.4206
≤ 4	0.157046	19.76692	29.79707	0.4387
≤ 5	0.084662	6.782892	15.49471	0.6030
≤ 6	0.000786	0.059792	3.841466	0.8068

Trace test indicates 2 cointegrating equations at the 5% significance level

** denotes rejection of the hypothesis at the 5% significance level*

***MacKinnon-Haug-Michelis (1999) p-values*

The cointegrating vectors, which are normalized with respect to the currency substitution index (CSI), together with their respective t-values, are presented in the equation below:

$$\ln CSI = 3.62 - \underset{(2.99)}{23.1459 \ln i^*} - \underset{(2.76)}{3.7214 \ln i} + \underset{(2.82)}{21.1003 \ln e^e} + \underset{(3.18)}{8.7574 \ln Y} + \underset{(2.88)}{0.02728 \ln p^c} + \underset{(2.34)}{3.5568 \ln ev}$$

The result of this normalization yield estimates of long-run elasticity. Foreign rate of interest and domestic policy rate of interest are negatively related to currency substitution index and the coefficients are statistically significant at the 1% level. Domestic inflation is positively related with currency substitution and the coefficient is statistically significant at the 1% level. This suggests that the higher the domestic inflation, the more residents in Nigeria tends to substitute or replace Naira with dollar or relatively more stable currency. GDP is positively related with currency substitution and the coefficient is statistically significant at the 1% level. This may be interpreted to mean that currency substitution provides a safe haven for holding wealth (store of value) as income rises. Real exchange rate volatility is positively related to currency substitution and significant at 1% levels indicating that the higher the real exchange rate volatility, the more residents tends to switch into holding foreign currency for store of value purposes. These results provide strong evidence that real exchange rate volatility has a positive and significant long run effect on currency substitution in Nigeria.

Since our variables are cointegrated, it therefore means that there exist long run relationships between the variables. We therefore estimate our models in error correction form.

4.1 Empirical Analysis of Currency Substitution in Nigeria from the Demand for Money Perspective

The presence of currency substitution in Nigeria was investigated using the demand for money approach as presented in equation (1). The result of the parsimonious regression equation with lagged and current period values of explanatory variables after adjusting for error correction is presented in Table 2 below. The coefficient of determination (R^2) indicates that the identified explanatory variables explain about 34 and 37 percent of the

variation in the demand for domestic currency in regressions 1 and 2, while it is upwards of 50 percent in the remaining regressions. The low value of R^2 in some of the regressions could be justified on the ground that most of the variables entered in the first difference of their lagged values. The Durbin Watson (DW) statistics are generally satisfactory. The error correction terms are marginally significant (significant at 10%) correcting between 5 and 8 percent of the errors in the model. The low value of the error correction term suggests that errors in the model take longer time than expected before they are finally corrected. It also means that distortions in macroeconomic variables take longer time than necessary before they return to the steady state. This is particularly true for Nigeria given our experiences in the past few years especially since the commencement of Structural Adjustment Programme in 1986. For example, when most important prices (e.g. commodity prices, exchange rates, etc) in Nigeria go up, they hardly come back to the steady state. The empirical evidence therefore, supports this structure of Nigerian economy.

The presence of currency substitution in Nigeria was investigated by looking at the coefficient on expected change in Naira exchange rate vis-à-vis the US Dollar ($D \log(e^e)$). It could be observed that this variable has the expected signs in all the regression equations indicating the presence of currency substitution in Nigeria, even though, they are not significant except regression (1) in Table 2. Therefore, summarizing our results, we can conclude that the results indicate the presence of currency substitution in Nigeria. The important variables accounting for this phenomenon is past (two quarter lagged) value of the Nigerian Naira/US Dollar exchange rate.

Another very important variable to note is the coefficient on nominal exchange rate volatility. The result indicates that the more volatile nominal exchange rate becomes, the less will be the demand for domestic currency. This is in line with our *a priori* expectations. Aside from the support from economic theory, the coefficient is also statistically significant

supporting the relevance of nominal exchange rate volatility in explaining currency substitution in Nigeria.

In order to ascertain which of the exchange rate volatility is more important for currency substitution in Nigeria, we included alternative specification of exchange rate volatility in our model. The procedure adopted was that, we first include them separately and later the two measures came into the same model. Our results indicate that real exchange rate volatility is more important for currency substitution in Nigeria. This flows from the insignificant coefficients on *NERV* in Table 2, regression (2), (5) and (6). However, the coefficient on *RERV* in regressions (1) is marginally significant. When the two variables are brought together in the same model, as indicated in regressions (3), (4), (5) and (6), the superiority of one over the other is hard to determine. This is because the coefficient on the two variables are not significant except for regression (3) where the coefficients on the two variables are marginally significant although with opposite signs. Nominal volatility has the correct negative sign while that of real volatility is positive. The negative sign on nominal volatility indicates that increased nominal volatility tends to make people to want to reduce their demand for domestic money and in favour of foreign currency deposits. The positive sign on real exchange rate volatility is hard to interpret.

The effect of inflation (domestic Prices) in explaining currency substitution is depicted by coefficients on the variables P^c and $P_{(-1)}^c$. It can be observed that $P_{(-1)}^c$ has negative impact on demand for domestic currency while P^c has positive effect. This indicates that current inflation will stimulate increased demand for domestic currency while past inflation (one quarter lagged) has negative impact on domestic money demand. The positive one supports linear homogeneity of deposits in Naira with respect to the price level while the negative one supports the fact that past period value of inflation can stimulate currency substitution in favour of foreign currency. This means that the higher the current

level of prices in the domestic economy, the higher will be the demand for domestic currency in Nigeria.

Also, an inspection of the results gives a significant support for the effect of foreign rate of interest on the domestic demand for Naira i.e. there exist a significant effect of returns on foreign assets on the demand for Nigerian Naira from the perspective of domestic residents. Specifically, it could be observed that demand for domestic currency is affected by past (three quarters) values of foreign rate of interest proxied by the US federal funds rate. The impact is negative as expected and significant. We can thus conclude that substitution of currency within the domestic banking system is an important pattern of residents' behaviour in Nigeria as domestic currency holdings were substituted by holdings deposits denominated in foreign currency usually the U.S. dollars.

Finally, all the domestic determinants are not significant except the lagged value of domestic money demand, which is significant in all the regressions and the coefficient on exchange rate volatility, which is marginally significant, especially regressions (1) and (3). This explains the fact that foreign factors seem to be more important in the determination of currency substitution in Nigeria (see Table 2). When real volatility is included, the picture changed. More domestic variables became significant (see regression (3) in Table 2).

The coefficient on the GDP variable points to the wealth accumulation effect. In another words, deposits are perceived to be a luxury good, i.e. as agents reach higher income levels they start to save by holding more of their funds as deposits. In terms of the poorest part of population, it implies that after attaining a certain level of income the indigent agents not only consume but also start to save. The domestic rate of interest (one period lagged) is correctly signed especially in regressions (1), (3) and (6) while others are not significant. This indicates that the higher the domestic rate of interest, the lower is the demand for domestic currency in idle form.

Table 2: Broad Money Equation - $D\log(m_2)$

Variables	Regressions					
	1	2	3	4	5	6
D log (m_2 (-4))	0.0967** (2.04)	0.7967*** (2.84)	0.7884*** (2.96)	0.7873*** (2.92)	0.8175*** (3.26)	0.7961*** (3.32)
D log (GDP)	0.0549 (0.78)	0.0354 (0.38)	0.0137 (0.16)	0.0130 (0.16)	0.0852* (1.21)	0.0681* (1.10)
D log (P^c)	1.9911* (1.36)	0.2357 (0.50)	3.2688* (1.37)	0.2753 (0.63)	0.2462 (0.59)	0.1087 (0.36)
D log (P^c (-1))	-0.2697* (-1.74)	-0.3967* (1.49)	-0.5198* (-1.37)	-0.5260* (-1.35)	-0.6274* (-1.69)	-0.4494* (-1.40)
D log (P^c (-4))	-	-0.2702 (-0.45)	-0.1865 (-0.32)	-0.1874 (-0.34)	-0.3887 (-0.72)	-
D (i (-1))	-0.0027* (-1.09)	-0.0086* (-1.11)	-0.0087* (-1.18)	-0.0088* (-1.19)	-0.0091* (-1.27)	-0.0067* (-1.14)
D (i^* (-3))	-0.0011* (-1.52)	-0.0040* (-1.12)	-0.0083* (-1.45)	-0.1428* (-1.20)	-0.0318* (-1.27)	-0.1221* (-1.55)
D log (e^e)	-2.1234* (-1.67)	-	-	-	-	-
D log (e^e (-1))	-0.0237 (-0.54)	-	-	-	-	-
D log (e^e (-2))	-	-0.0151 (-0.85)	-0.1135 (-0.08)	-0.098 (-0.55)	-0.0426 (-0.61)	-0.0936 (-0.67)
$NERV$	-	0.1437 (0.98)	-3.1135* (-1.29)	-	0.6513 (0.48)	-
$NERV$ (1)	-	-	-	-0.1236 (-0.11)	-	-1.0177 (-0.90)
$RERV$	1.6781* (1.21)	-	1.2311* (1.58)	0.0162* (1.59)	-	-
$RERV$ (-1)	-	-	-	-	-0.0194* (-2.02)	-0.0178 (-1.96)
C	0.0350 (1.64)	0.0251 (2.89)	-0.0138 (-0.89)	0.01289 (2.77)	0.1540 (2.75)	0.0222 (0.54)
$ECM1(-1)$	-0.0716* (-1.52)	-0.0866* (-1.59)	-0.0745* (-1.59)	-0.0823* (-1.66)	-0.0751* (-1.56)	-0.0590* (-1.54)
R^2	0.3410	0.3710	0.5626	0.5628	0.6116	0.5924
\bar{R}^2	0.1501	0.0391	0.1251	0.1257	0.2232	0.2528
DW	1.98	2.11	2.09	2.05	1.73	2.00

*** Significant at 1%, ** significant at 5% and * -significant at 10%.

4.3 Empirical Analysis of Currency Substitution in Nigeria from the Perspective of Demand for Foreign Deposits

To corroborate the result above, we used foreign currency deposit in the domestic banking system as the dependent variable. The result obtained is as shown in table 3 below. From Table 3, it could be observed that the coefficient of determination (R^2) ranges between 0.3700 and 0.4209 meaning that the explanatory variables explained between 48 percent and 68 percent of the variations in the demand for the stock of foreign currency deposits in Nigeria. The Durbin Watson statistics are quite satisfactory indicating non-existence of serious autocorrelation problem in the models.

The results generally indicate the significant presence of currency substitution in Nigeria. This is because, the coefficients on expected exchange rate depreciation has expected positive signs and are significant. The positive sign indicate that the higher the expected exchange rate depreciation the higher will be the demand for the stock of foreign currency by residents in Nigeria. Nominal exchange rate volatility does not perform well in the regressions. Hence, it could be deduced that nominal exchange rate may not be a significant determinant of the stock of foreign currency deposits in Nigeria (see regressions 1, 4 and 5 in Table 3). However, the superiority and relevance of real exchange rate volatility in determining the stock of foreign currency deposits in Nigeria is very conspicuous judging by the significance of the coefficients on real exchange rate volatility variable (see regressions 2, 3, 4 and 5). In addition to their significance, they are correctly signed. Therefore, we can conclude that real exchange rate volatility is a significant determinant of the stock of foreign currency deposits in Nigeria.

The result indicates that current level of inflation is not as significant as past (four quarter lagged) value of inflation in determining the stock of foreign currency deposits in Nigeria, although wrongly signed contrary to *a priori* expectation. Hence, we can conclude that residents in Nigeria are motivated to hold foreign currency deposits by past period level of inflation and not the current level.

Table 3: Foreign Currency Deposit Equation - $D\log(FCD)$

Variables	Regressions				
	1	2	3	4	5
D log (FCD (-3))	-0.7669* (-1.81)	0.1605* (1.39)	0.7538* (1.95)	0.6629* (1.83)	0.3923* (1.84)
D log (GDP)	0.5625** (2.06)	1.3734** (2.05)	0.3969* (1.93)	1.0759** (2.94)	0.0499** (3.71)
D log (P^C)	-	1.3877* (1.83)	0.8204 (0.44)	0.1057 (0.39)	0.4982 (1.25)
D log (P^C (-4))	-1.6701** (-2.39)	-	-0.1717** (-2.09)	-0.7367** (-3.06)	-1.6600** (-2.71)
D (i)	0.0295* (1.62)	-	-	-	-
D (i (-2))	-0.0579** (-1.99)	-0.0464** (-2.34)	-0.0495** (-2.55)	-0.0571** (-2.62)	-0.0725* (-2.00)
D (i^*)	0.3190** (2.09)	0.6213** (2.61)	0.3923** (2.67)	0.2232** (2.60)	0.4532** (2.39)
D i^* (-1)	-0.5432* (-1.08)	-0.1972* (-1.75)	-0.1028* (-1.96)	-0.1819* (-1.98)	-0.4102* (-2.33)
D log (e^e (-1))	-	0.1503* (1.96)	1.1398* (1.88)	1.1229* (1.97)	1.0731* (2.01)
D log (e^e (-2))	-0.1423 (-0.69)	-0.0625* (-1.91)	-0.5771* (-1.99)	-0.1579* (-1.88)	-0.9005* (-1.90)
$NERV$	-0.4812 (-0.8555)	-	-	-0.3088 (-0.77)	-
$NERV$ (1)	-	-	-	-	0.7067 (0.44)
$RERV$ (-1)	-	0.9143** (2.62)	1.3583** (2.84)	1.1079** (2.64)	1.6000** (2.59)
C	0.4943 (1.23)	0.2681 (1.54)	0.2647 (1.39)	0.5236 (1.33)	0.0185 (0.79)
Ecm2 (-1)	-0.1333* (-1.85)	-0.1019* (-1.71)	-0.1138* (-1.66)	-0.1463* (-1.94)	-0.1274* (-1.81)
R ²	0.5668	0.6326	0.6374	0.6842	0.4810
R ⁻²	0.3862	0.0205	0.3127	0.2630	0.1999
DW	1.94	2.12	2.02	2.10	2.09

*** Significant at 1%, ** significant at 5%, and * significant at 10%.

GDP is positively related to domestic demand for foreign currency deposits. The coefficient is generally significant in all the regression equations. This shows that the higher the income level of residents in Nigeria, the more they seek alternative form of holding their assets other than in domestic currency. This may probably suggest that foreign currency deposits in Nigeria are held for store of value purposes.

The result shows that past period (one quarter) value of foreign rate of interest is negatively related to demand for foreign currency in conformity with a priori expectation. The negative sign may mean that asset holders see higher foreign rate of interest as a form of expected depreciation of the foreign currency and hence, they tend to hold less of such currency. However, the positive sign on current level of foreign interest rate points to the fact that foreign interest rate has a significant positive impact on the demand for foreign currency deposits in Nigeria. This is because high foreign rate of interest tends to stimulate increased demand for assets denominated in foreign currency as asset holders try to take advantage of increased rates, *all things being equal*. This is particularly true in Nigeria where asset holders are always interested in getting safe havens for their assets, which in most cases are readily provided by stable currency denominated assets like the dollar.

To probe further into the existence of currency substitution in Nigeria, we substituted the ratio of foreign currency deposits to domestic broad money (dollarization index) as our dependent variable so that we can reinforce or refute the earlier results. The result obtained is presented in table 4. The following points are noted from the results.

Expected exchange rate lagged one quarter causes increased dollarization in Nigeria. This is supported by the values of the coefficients on one period lagged value of expected exchange rate depreciation as shown in regression (1), (2), (3) and (4). However, two quarter lagged value of the same variable has the opposite sign and marginally significant. Real exchange rate volatility is more relevant for currency substitution in Nigeria. This flows from the significance of the coefficient on RERV especially regression (4) where both real and nominal volatilities entered into the same model.

The impact of foreign rate of interest on dollarization is also mixed. For example, while changes in two quarter lagged value of foreign rate of interest may dampen dollarization in Nigeria, three quarter lagged values may aggravate it (see coefficients on

foreign rate of interest (i^*). Dollarization may be self-perpetuating. This could be so given the significance and positive signs on past values (one quarter, two quarter and three quarter lagged) of dollarization index in Nigeria (see Table 4).

Given our results, we conclude that agents are concerned with the real value of the currency substitution Index (CSI). The overall significance of the current level of GDP most probably suggests that foreign deposits are held solely for store-of- value purposes. The estimates of the i effect on dollarization index seem to be robust and significant, with the expected sign. To explain the i effect we recall that i stands for the domestic policy rate of interest. In the case of Nigeria, this could also means the cost of financing for business firms, assuming that financial intermediation goes mostly through the banking system. So if i increases, agents probably look for an alternative source of financing. In the absence of effective and efficient domestic capital markets, this involves borrowing on foreign or international financial markets, resulting in an increase in foreign currency deposits in Nigeria such funds are raised. The mechanism described here is relevant for Nigerian corporations and indeed the three tiers of government, as these made intensive use of international sources of financing as from 1986 when financial liberalization started.

Table 4: Currency Substitution Equation- $D\log(CSI)$

Variables	Regressions				
	1	2	3	4	5
D log (CSI (-1))	0.5532 * (1.49)	0.8910* (1.64)	0.1066* (1.59)	0.0962* (1.79)	0.1344* (1.86)
D log (CSI(-2))	0.4557* (1.99)	-	-	-	-
D log (CSI (-3))	0.1987 * (1.56)	0.4239 ** (2.41)	0.3718** (2.71)	0.2994* (1.79)	0.7727 * (1.69)
D log (CSI (-4))	-	-	-	-0.2024* (-1.69)	-0.1376* (-1.72)
D log (GDP)	0.6279 * (1.93)	0.5239 ** (2.44)	0.8664** (2.32)	-	-
D log (GDP (-1))	0.5716 (0.39)	0.1457 * (1.98)	0.2697* (1.84)	0.6510** (2.65)	0.7579** (2.09)
D log (GDP (-2))	-	-	0.2897** (2.07)	0.3856** (2.57)	0.5235* (1.73)
D log (PC)	0.8221 (0.69)	0.3943 (0.97)	-	1.1123* (1.57)	-
D log (PC (-1))	-	-	2.4567** (1.89)	-	3.6065* (1.17)
D log (PC (-4))	1.5722 * (1.99)	1.7393 * (1.88)	0.5785* (1.53)	1.1276* (1.70)	1.2048* (1.92)
D (i (-2))	-0.0365 * (-1.59)	-0.0468 * (-1.84)	-0.0394* (-2.36)	-0.4753* (-1.87)	-0.1428* (-1.69)
D (i^* (-2))	-0.1660 (-1.25)	-0.0075 (-1.32)	-0.0134 (-0.64)	-0.6058 (-0.98)	-0.0799 (-0.67)
D (i^* (-3))	0.1414 (0.99)	-	-	0.3284* (1.62)	0.1633* (1.70)
D log (e^e (-1))	1.2317 * (1.45)	1.3926 * (1.84)	2.8598* (1.92)	1.2819* (1.82)	-
D log (e^e (-2))	-	-	-	-	-0.4286* (-1.90)
<i>NERV</i>	0.3805 (0.91)	0.9501 * (1.87)	-	9.3094* (1.77)	-
<i>NERV</i> (-1)	-	-	-	-	5.7792 (1.42)
<i>NERV</i> (-2)	-	-	-0.3713* (-2.05)	-	-
<i>RERV</i> (-1)	-1.4694 (-1.90)	-1.7148 (-1.89)	-6.0221 (-1.32)	-1.4092** (2.98)	-6.4215 (-1.38)
ECM3 (-1)	-0.3986 * (-1.88)	-0.1184 * (-1.74)	-0.4132* (-1.95)	-.0519* (-1.65)	-0.4221* (-1.79)
C	0.0550 (0.13)	-0.4105 (-2.27)	0.2986 (2.45)	0.0247 (0.37)	0.0550 (1.03)
R ²	0.3866	0.4725	0.3965	0.5808	0.5232
R ²	0.2086	0.1710	0.2131	0.2053	0.2501
DW	2.10	1.93	1.99	1.89	2.09

*** Significant at 1%, ** significant at 5% and * -significant at 10%.

When we move to the estimates of the returns on foreign currency, there is general support for the existence of a significant effect on dollarization index from the Naira/US Dollar exchange rate. The significance of the Naira/US Dollar exchange rate probably results from the higher volatility of this rate, which has made domestic agents more aware of the opportunity cost of holding domestic currency. In short, foreign currencies are held in order to hedge against domestic inflation and unfavourable exchange rate movements.

4.4 Magnitude and Trend of Currency Substitution in Nigeria

To capture the magnitude of currency substitution in Nigeria, we adopted the IMF dollarization index as our measure of currency substitution. This was measured by taking the ratio of foreign currency deposit to monetary aggregates adjusted for local currency in circulation in Nigeria. The result of our computation is presented in Table 6 below, which presents the ratios of foreign currency deposits to broad money in Nigeria, alongside with the ratio of foreign currency deposits to broad money adjusted for local currency in circulation in Nigeria. Measured in terms of stock, a country is classified as highly dollarized if the country's dollarization index is 30 percent and above (Feige, 2002). Looking at the figures in Table 5, it could be deduced that the level of dollarization in Nigeria is generally low with currency substitution ratios of 17.03 percent and 14.55 percent as the highest in 1986 when liberalization started and 1.20 and 1.18 percent minimum during the last quarter of 1993 when Nigeria witnessed a reintroduction of economic regulation by the Abacha administration. Indeed, the commencement of financial liberalization witnessed sporadic changes in the various rates and prices in the domestic economy especially the Naira exchange rate against major currencies of the world especially the U.S dollar. The pass-through effect of this development to domestic inflation made residents to realize the huge opportunity cost of holding domestic currency in the face of high inflation. Hence, without any legal restrictions on the holding of foreign currency, foreign currency cash and deposits became ready candidates for hedging against inflation in Nigeria. For example, in 1994 alone,

there was a 91.53 percent growth rate in the currency substitution index while it increased by 81.86 percent in 1995. However, in 1996, there was a drastic fall of about 32.85 percent in the value of currency substitution in Nigeria. From 1998 onwards, the value of currency substitution has been on the increase recording as high as about 45.50 percent in 1998 and 44.20 percent in 2000 with a slight decline of about 4.79 percent in 2001 before accelerating to a record value of about 78 percent in 2005. In all, it could be observed that currency substitution index has been on the increase in Nigeria since 2001 despite all macroeconomic reforms implemented in the country. This shows the persistence of currency substitution once it starts.

Judging by the trend of figures presented in Table 5 above vis-à-vis the bench mark for classifying countries as highly dollarised or otherwise, it could be concluded that Nigeria is partially dollarised, although the magnitude is low and fluctuating since the reform began in 1986. However, the results interpreted above must be taken with caution because this index represents the lower bond of currency substitution in Nigeria: sizable amounts of foreign currency are held in form of cash and cross border deposits, which cannot be captured in this study for lack of data. Hence, the general preference of asset holders for cross border deposits motivated by pervasive lack of confidence in the domestic banking system due to widespread distress in this sector might be responsible for the low level of currency substitution index indicated by the data.

Table 5: Extent of Currency Substitution in Nigeria

Year	$CSI = \frac{FCD}{M_2}$	Percent	Growth Rate (%)	$CSI = \frac{FCD}{M_2 - CC^*}$	Percent	Growth Rate (%)
1986	0.1455	14.55	-	0.1703	17.03	-
1987	0.0638	6.38	-128.06	0.0681	6.81	-60.01
1988	0.0903	9.03	41.54	0.0993	9.92	45.67
1989	0.1127	11.27	24.81	0.1271	12.71	28.13
1990	0.0763	7.63	-32.30	0.0826	8.26	-35.01
1991	0.0281	2.81	-63.17	0.0289	2.89	-65.01
1992	0.0334	3.34	18.86	0.0346	3.46	19.72
1993	0.0118	1.18	-64.67	0.0119	1.20	-65.32
1994	0.0226	2.26	91.53	0.0232	2.32	93.33
1995	0.0411	4.11	81.86	0.0429	4.29	84.91
1996	0.0276	2.76	-32.85	0.0284	2.84	-33.80
1997	0.0217	2.17	-21.38	0.0222	2.22	-21.83
1998	0.0312	3.13	44.24	0.0323	3.23	45.50
1999	0.0389	3.89	24.28	0.0405	4.05	25.39
2000	0.0552	5.52	41.90	0.0584	5.84	44.20
2001	0.0527	5.27	-4.53	0.0556	5.56	-4.79
2002	0.06817	6.817	29.35	0.09013	9.013	62.10
2003	0.06175	6.175	-9.42	0.08651	8.651	-4.02
2004	0.07622	7.622	23.43	0.09700	9.70	12.13
2005 ⁴	0.07177	7.177	-5.84	0.17303	17.303	78.38

Source: Author's calculation based on CBN and IFS Quarterly data on Nigeria.

*Domestic currency in circulation (CC) is removed from broad money supply (M_2) so as not to underestimate CSI since foreign currency cash in Nigeria is not captured by FCD.

⁴ Second quarter figures were used for computations.

5. Policy Implication of Results

Given the current level of currency substitution in Nigeria and the identification of its determinants, it is important to consider policy implications of this development for emerging market economies like Nigeria. The first policy consideration may be to analyse the implication of this level and trend of currency substitution for monetary policy management in general and financial system stability in particular. The second may involve the implications of currency substitution for exchange rate regime choice and the need for the development of tradable domestic financial instruments and markets that serves as alternative to money holding and ensures flexible and reliable portfolio diversification

Indeed, currency substitution complicates monetary policy management and renders it ineffective. This is based on the fact that monetary aggregates becomes unpredictable and more sensitive to expected exchange rate depreciation. This result corroborates studies by Eichengreen and Hausmann (2005) and Ize and Yeyati (2003). Further, currency substitution may engender higher exchange rate pass-through to domestic prices and weakens monetary transmission. This derives from the fact that interest rates on dollars and quantity of dollar inflows are not under the control of monetary authorities. As such, the effectiveness of the interest rate channel of monetary policy transmission is weakened when most intermediation is in foreign currency. Increases in domestic interest rate may become an impotent tool for controlling credit expansion even when it is desired (Reinhart, Rogoff and Savastano, 2003).

Another implication of currency substitution revolves around the prudential issues deriving from the so-called “balance sheet effect”, when the increase in the local currency value of dollar liabilities outpaces the increase in the value of the borrower’s assets or its income flow. To the extent that dollar debtors may no longer be able to service their loans, this can trigger corporate and banking crises, exacerbate sudden stops, cause output volatility, and ultimately result in costly self-fulfilling macroeconomic crises. Yet, financial stress can also result from prolonged economic contractions caused by unadjusted real exchange rate disequilibrium (overvaluations). On the deposit side, currency substitution enhances the scope for systemic, self-fulfilling, liquidity crises, triggered by persistent deposit withdrawals

that can at some point no longer be accommodated, due to limited holdings of liquid foreign assets.

Given the above, what policy actions should developing economies whose currencies are being substituted implement to reduce the negative effects of this phenomenon? Ize and Yeyati (2005) suggest three broad strategies for dealing with incidence of currency substitution in developing countries: Surrender and accept dollarization; “market driven road to de-dollarization”; and implement policies that will fight dollarization brusquely.

Market-driven policy may involve regulatory reforms in the domestic economy so as to fully internalize the risks of dollar intermediation and provide more room for monetary policy; and more credibility should be established for the domestic currency by fighting inflation. *Ceteris paribus*, currency substitution should decline in response to good policies, in turn generating further room for policy changes. This is because de-dollarization is equivalent to improving monetary credibility.

Fighting dollarization brusquely may involve direct measures to discourage currency substitution, e.g. limits on dollar deposits or loans, taxes on dollar intermediation, forced conversion, etc. However, Forcing agents to use a currency that they distrust could lead to heavy disintermediation (de la Torre and Schmukler, 2004). In turn, the costs resulting from disintermediation are likely to undermine the political support for a frontal attack on dollarization in the absence of a crisis. Attempting to mobilize political support for this approach by scaring away the public could backfire if it leads to a run on deposits. Thus, the central bank may be forced to remove restrictions on dollarization and the economy will quickly re-dollarize with a reprisal (Savastano, 1996). Thus, monetary policy credibility and reputation should be sought first before attempting an attack on dollarization.

In a similar vein, another policy option but clearly suboptimal in reducing currency substitution could be to temporarily but significantly allow naira to appreciate or if the authorities would more strictly enforce laws that prohibit transactions to be carried out in dollars. However, we are aware of the fact that while the formal policy option is quite plausible for Nigeria, the latter may not be a feasible policy option because Nigeria have

attained a level of economic liberalization and integration with the rest of the world that it may be difficult or at best costly to impose any restriction on the use of dollars in this economy. This is because the considerable appreciation needed for a meaningful reduction in dollarization may imply a serious cost in terms of loss of competitiveness, which could easily exceed any benefits of reduced currency substitution in the long run. This may be particularly damaging for an emerging economy like Nigeria nurturing and pursuing export-led growth strategy.

Also effective but clearly undesirable measure to curb dollarization would be to reverse the process of capital account liberalisation in Nigeria and engage in direct administrative measures such as the introduction of capital controls or the prohibition of foreign currency deposits. But such measures would reverse the broadly successful liberalization and global market integration and would almost certainly provide only a short-lived solution. Indeed, it could ignite capital reversal and may eventually engender financial crisis. Capital controls and the prohibition of foreign currency deposits are unlikely to boost the demand for domestic currency assets in Nigeria (Yinusa, 2007).

Finally, for countries that are small, heavily dollarized and endowed with central banks with limited or no credibility, may find dollarization to be greatly irreversible in which case they may have to live with it. However, justifying this policy choice from a political economy point of view may be very difficult to sell because, it amounts to “surrender and accept dollarization” with all its macroeconomic and political costs.

Therefore, since currency substitution has its roots in inappropriately sequenced macroeconomic reforms (capital account liberalization) coupled with domestic macroeconomic imbalances, especially, exchange rate volatility, the most powerful tool to reduce it would be restoration of sustained confidence in the domestic currency and more broadly macroeconomic stability because obviously, liberalization process cannot be reversed. As such, macroeconomic policies that ensure long periods of low inflation and exchange rate stability become the most powerful policy option that could help stabilize or reduce currency substitution. Also very paramount are the development of domestic financial

system with relevant infrastructural facilities and the development of new financial instruments, which will serve as alternative to holding money in the domestic economy. If the financial system is developed, there will be no need for Nigeria to commit the proverbial “original sin” (i.e. borrow in foreign currencies).

6. Concluding Remarks

This study investigates the determinants of currency substitution and attempts to gauge its magnitude using the Nigeria data. Overall, the results indicate the significant presence of currency substitution and the major factors driving this process were exchange rate volatility, influence of foreign policy on the domestic economy, long period of high inflation coupled with shallow financial market development that obstructs efficient portfolio diversification. Our measure of the magnitude reveals that the currency substitution index was low but is on the increase. Therefore, the paper concludes that a long period of macroeconomic stability that restores confidence and credibility in the domestic currency and institutions, coupled with the development of domestic risk (inflation) hedging instruments and markets will be necessary to reverse the trend of currency substitution in Nigeria.

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Appendix

Definition of Variables, Notations and Sources of Data

S/No	Variable Definition/Measurement	Notations	Data Sources
1.	Demand for domestic money proxy by broad money supply (CC plus Quasi money).	m_2	Statistical Bulletin published by Central Bank of Nigeria.
2.	Domestic policy rate of interest, proxy by treasury bill rate.	i	Statistical Bulletin published by Central Bank of Nigeria.
3.	Foreign rate of interest proxy by US Federal Funds Rate (ffr) plus expected change in exchange rate.	i^*	International Financial Statistics, published by IMF.
4.	Expected change in exchange rate.	e^e	International Financial Statistics, published by IMF.
5.	Domestic Inflation rate, computed as percentage change in the consumer price index (CPI).	p^e	Statistical Bulletin published by Central Bank of Nigeria.
6.	Home currency value of domestic output measured by real Gross Domestic Product (GDP).	y	Statistical Bulletin published by Central Bank of Nigeria.
7.	Nominal exchange rate volatility extracted via a state space model.	$NERV$	International Financial Statistics, published by IMF.
8.	Real exchange rate volatility extracted via a state space model.	$RERV$	International Financial Statistics, published by IMF.
9.	Foreign currency deposits in the domestic banking system.	FCD	Statistical Bulletin published by Central Bank of Nigeria.
10.	Currency substitution/dollarization index measured as the ratio of foreign currency deposits and broad money (Fcd/M_2)	CSI / DI	Statistical Bulletin published by Central Bank of Nigeria.
11.	Error correction term	ECM	Generated from regression results.
12.	Nominal and Real Exchange Rates from which nominal and real exchange rate volatilities were extracted respectively.	Z	International Financial Statistics, published by IMF.
13	Domestic Currency in Circulation	CC	Statistical Bulletin published by Central Bank of Nigeria.