Dollarization, Inflation and Interest Rate in Nigeria

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This paper investigates the relationship among dollarization, inflation and interest rate in Nigeria for the period 1986-2015Q1. It adopts inter-temporal model of money-in-utility (MIU) with an estimation technique of structural vector autoregression (SVAR). Empirical evidence shows that dollarization index has been on the increase in Nigeria since 1994, despite stable and low inflation and interest rate. Results of the cointegration show long run equilibrium among dollarisation, inflation and interest rate. The Granger causality test reveals that there is a unidirectional relationship from dollarization to inflation in Nigeria. This suggests that policies that aim to reduce inflation in Nigeria must include measures that specifically address the issue of dollarization.

JEL Classification: E44, D9, E5

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1.0 Introduction

Since the 1980s, the U.S dollar has increasingly been usurping the legal role of the naira as the medium of exchange within the Nigerian markets for foreign exchange, savings and commodities. In addition, there is an economic law that explains why the U.S dollars and other financial convertible currencies of the west can thus encroach quite vicariously in the domestic turf of the naira in Nigeria. It is called the dollarization theorem. Dollarization in Nigeria is a situation which occurs where the residents use foreign currency (US dollar) along with their own domestic currency.

However, dollarization is not only applicable to the use of the United States dollar, but also to the use of any other country's foreign currency as the accepted means of exchange. The Euro, the South African Rand, the Russian Rubble, and both the New Zealand and Australian dollars are other foreign currencies widely accepted outside of their issuing country of origin (Ghalayini, 2011). Various countries, specifically emerging countries and Nigeria inclusive, have already embraced dollarization to some extent due to

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the volatility of the purchasing power of their domestic currencies. Generally, the loss of the domestic currency's external value and appeal as a store of value prompt dollarization and the national currency for the three classic uses as a medium of exchange, a unit of account, and a store of value.[3]

In the view of Berg and Borensztein (2000), dollarization also reduces the risk of a currency crisis and, in turn, a country's risk premia, with a consequent lowering of interest rates. However, the cost of dollarization could be the loss of seigniorage revenue, the loss of monetary policy independence, and the loss of the exchange rate instruments. Seigniorage revenues are the profits generated when monetary authorities issue currencies. The rate and manner in which foreign denominated currency transactions are taking place in the Nigerian economy is unbecoming (Egom, 2006). Goods and services are now being priced in U.S. dollars in the lobby of luxury hotels, shopping moor of supermarkets, night clubs, party halls and expensive boutiques in the some big cities and federal capital city like Abuja in Nigeria. Even multinational firms especially oil and gas companies now pay their workers in dollars. The country seems to encourage this act as the practice is seen to confer high social class and in every corner of the country, people even hail personalities that spend dollars at parties. The implication of these acts is high inflationary rate for the country (Yinusa and Akinlo, 2008). It is in this light that this paper examines the relationship that exists among dollarization, inflation and interest rate in Nigeria. The paper is as follows section 2 examines the literature review and shows the trend analysis of the variables, section 3 provides the research methodology, section 4 states the empirical results while the last section gives the conclusion and policy recommendations.

2.0 Literature Review

Most of the studies on dollarization were carried out abroad majorly in the Latin America because it started there. For instance, Elsalvador, Honduras, Panama, Peru had episodes of dollarization in 1800-1969, 1912-1950, 1903-

[3]The type of dollarization practiced in Nigeria is an unofficial one. Recently, while in Washington DC at the just concluded October 2013 IMF/World Bank Group Annual meetings, the Central Bank of Nigeria (CBN) Governor, Sanusi Lamido Sanusi, decried that Nigeria as a country has not officially adopted the dollar as a legal tender. However, it is still used as a means of exchange in the payment for goods and services to the extent that Nigerians want foreign transfer payment in dollars rather than in Nigerian Naira.

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present, 1887-1914 respectively and those transition countries whose hyper-inflationary episodes have induced a flight to dollars (Schuler 2005). To the best of our understanding, studies that have examined the relationship on dollarization, inflation and interest rate are scanty, especially in Nigeria. Some studies have examined the links between dollarization and inflation, Armas and Grippa (2005) argued that inflation targeting remains an appropriate approach to the complex phenomenon of a dual currency economy like Peru. Antinolfi *et al.* (2007) concluded that inflation beyond threshold level affects the financial intermediation through dollarization. In another dimension, evidence from the literature also shows that studies have been conducted to examine the importance of dollarization on monetary policy. Patricia and Alicia (2007) concluded that partial dollarization is not useful in fighting inflation and actually affect management and practice of monetary policy. Ghalayini (2011) had the conclusion that dollarization in Lebanon is no more explained by inflation, and that changes in Consumer Price Index (CPI) is granger caused by dollarization.

In a study by Lucas (2009), the paper looked at distribution cost and benefits of dollarization in Ecuador and Elsavador and concluded that distribution costs and benefits are conditional upon the level of inflation prior to dollarization. On a contrary note, Edwards and Magendzo (2001) examined the nexus among dollarization, inflation and growth with the conclusion that inflation has been significantly lower in dollarized nations than in non-dollarized ones and also argued that economy has not been growing well in dollarized nations. Noko (2011) examined the monetary experiences of dollarization in Zimbabwe. He found that dollarization led to low- inflation, clarity in price, emergence of financial institution and fiscal discipline in Zimbabwe during the period.

Available literature on dollarization in Nigeria looked at dollarization and exchange rate volatility in one hand and in sub-Saharan African countries on the other hand. Yinusa (2007) concluded that relationship between exchange rate volatility and dollarization are bi-directional. He however argued that causality from dollarization to exchange rate volatility in Nigeria appears stronger and dominates using granger causality test of VAR approach for the period of 1986(1) to 2003(4). Again, Yinusa (2009), in another paper, examined the effects of macroeconomic fluctuations on deposit dollarization in 18 sub-Saharan African countries for the period 1980-2004. With a standard money demand model, he found inflation, exchange rate volatility,

expected exchange rate, interest rate, political risk factor, and change in US monetary policy to determine dollarization. Finally, the survey of the literature review indicates that no empirical work was found on relationship among dollarization, interest rate and inflation rate in Nigeria, though several studies have looked at the link between dollarization, exchange rate and monetary policy. In conclusion, studies on dollarization in Nigeria remain scanty.

2.1 Trend Analysis and Overview of Dollarization, Inflation and Interest rate in Nigeria

Fig.1 shows that dollarization fell from 0.17 in 1986 to 0.01 in 1993, 0.16 in 2011 after which it began to rise to almost 0.36 and remained positive till 2015. The upward trend of dollarization implies the growth of dollarization in Nigeria. However, both inflation and interest rate though fluctuating were higher than dollarization over the sample period. The question is whether the inflation rate or the interest rate is responsible for the increase in dollarization or dollarization can help to explain the high inflation and interest rate in Nigeria? This paper tends to provide answers to these questions.

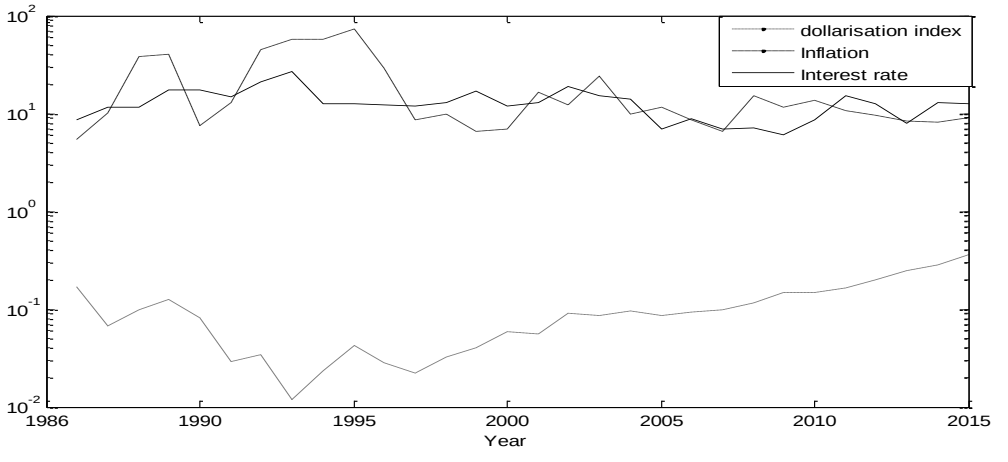

Fig.1. the evolution of dollarization, inflation and interest rate in Nigeria over the sample period.

At this juncture, a brief history of dollarization in Nigeria is discussed. The technical devaluation of the domestic currency in Nigeria, brought about by the introduction of Structural Adjustment Programme (SAP) in 1986, to alter the domestic prices in favour of export did not materialize. There was unfavourable term of trade as most export produce from the country were raw materials and unfinished products. The devaluation made export cheaper and

import dearer such that the loss of revenue coupled with increase in domestic prices of few available goods in the mid-1990s led to the emergence of dollarization. Equally, the government did not only then support and encourage dollarization by allowing residents to open bank accounts denominated in dollars called domiciliary account, but also allowed existence of dollarization such that contracts, foreign and domestic debts were valued and quoted in dollars. In many cases, even till today monetary compensations are made to athletes and footballers in dollar denominations. In fact, many big super-markets in big cities, in Nigeria, quote the prices of their products in dollars and many big estate agents and valuers only accept dollars as rents for houses in some reserved areas of Lagos, Abuja, Port Harcourt and other highly industrialized cities in Nigeria (Yinusa and Akinlo 2008).

It was also learnt that the salaries of some top government officials and some expatriates are paid in dollars. Economic theory postulates that economies grappling with high inflation are likely to suffer from dollarization as residents move to safeguard the value of their wealth by keeping foreign denominated accounts. Nigeria for the past 15 years suffers from more than one-digit inflation of about 21% on the average (see Table 1). This is on a high side compared to one digit inflation on average in some developed countries. The immediacy of a domestic currency crashing is also a prominent factor that aids dollarization of an economy. Much of the naira suffered immensely in the era of the Structural Adjustment Programme (SAP) in 1986 because of dwindling foreign reserves and the Austerity Measure.

Some analysts opined that the ease in which dollar account is operated with the growing informal and unofficial parallel foreign exchange operators aids dollarization. These unofficial parallel foreign exchange operators are present and operated freely alongside with the official foreign exchange operators in the airports without any sanctions and punishment from the government. The free environment to buy and sell dollar promote the proliferation of dollar transactions in the system. In Nigeria, an acceptance to part with $500 and being a holder of a current account, you have a dollar account. There are banks that even require just $200 to run a dollar account. The obsession for dollar account in Nigeria is the fact that it confers status of affluence as even people who have no business with foreign exchange transactions now operate dollar account (Omoragbon, 2009).

3.0 Research Methodology

3.1 Data Sources

In this paper, annual data was used in the analysis. Dollarization index (DOL) is measured as the ratio of foreign currency deposits that is domiciliary accounts (FCD) to broad money (M2) following Viseth, (2001) and Yinusa, (2007). In addition, domestic[4]money in circulation was subtracted from M2 so as not to under-estimate the relative weight of foreign currency deposits in the banking system (Yinusa, 2007). Inflation (INF) is measured as the annual percentage change in the Consumer Price Index (CPI) while treasury bill rates is used as a measure of interest rate (INT) of holding money and an alternative wealth allocation to money holdings. It is also used to capture the intention and monetary policies of the monetary authority in Nigeria over the sample period. All the data were sourced from Central Bank of Nigeria Statistical Bulletin (2011) from the period of 1986 to the first quarter of 2015. The choice of the sample period is due to the significance of dollarization in Nigeria brought about by the introduction of Structural Adjustment Programme (SAP) in 1986**.**All the variables are expressed in log form.

3.2 Theoretical Framework

Many theoretical models have been used in the treatment of dollarization in the literature. Among which was Friedman (1956) demand for money. The defect of the model is its inability to distinguish between domestic and foreign money. Another model is the portfolio balance model (Miles, 1978) where agents choose optimally between monetary and non-monetary assets. The flaw in the model is the inclusion of non-monetary assets with little or no relevance to a monetary model like dollarization. Later, the two-period portfolio model (Cuddington, 1983) and classical optimization model (Thomas, 1985) were propounded. The lack of dynamism to account for inter-temporal decisions of agents renders them irrelevant for recent studies. Recent models of dollarization usually apply the money-in-utility (MIU, Sidrauski, 1967) model of the agent's dynamic optimization. Many prior studies on dollarisation that have adopted the MIU model are (Selcuk, 1997; Friedman and Verbetsky, 1997; Mulligan and Nijsse, 2001; Cuddington *et al.*, 2002 and Selcuk, 2003)

[4]In some studies, currency substitution, which is also the habit of the residents of a country to hold foreign currency in addition to their domestic currency as a store of value, as an additional medium of exchange and unit of account, is used interchangeably with dollarization.

The MIU model accounts for substitutability between real domestic balances and foreign balances with the ultimate goal of consumption (utility) maximization, which is the major reason behind holding of foreign currencies by economic agents.[5] This theoretical assumption is relevant in Nigeria and adopted in this study since previous study by Yinusa and Akinlo (2008) have documented high domestic inflation as a driver of dollarization in Nigeria. Following Imrohoroglu (1994) and Cazoneri and Diba (1993), the MIU model, which is more relevant in recent times is adopted and presented in this paper. The model assumes an infinitely lived identical agents (households and firms) represented by N and each agent takes decisions at the beginning of every period of how much to consume and how much of domestic and foreign currency to hold optimally. Individual agent maximizes the expected discounted utility-function (EDU) described as :

$$EDU = \sum_{t=0}^{\infty} \beta^t U(c_{t,} m_t m_t^*) \quad (1)$$

where $\beta \in (0,1)$ is the discount factor, $c_t = \frac{C_t}{NP_t}$ is the real per capita consumption with P_t denoted by domestic price, $m_{t,} = \frac{M_t}{NP_t}$ is domestic real money balance while $m_t^* = \frac{M_t^*}{NP_t^*}$ signifies foreign real balances. The agents' budget constraint is then given by:

$$\frac{C_t}{NP_t} + \frac{M_t}{NP_t} + \frac{M_t^*}{NP_t^*} + \frac{CD_t}{NP_t} + \frac{CD_t^*}{NP_t^*} \leq \frac{M_{t-1}}{NP_t} + \frac{M_{t-1}^*}{NP_t^*} + (1 + i_t)\frac{CD_{t-1}}{NP_t} + (1 + i_t^*)\frac{CD_{t-1}^*}{NP_t^*} + \frac{Y_t}{NP_t} \quad (2)$$

Where $\frac{CD_t}{NP_t}$ and $\frac{CD_t^*}{NP_t^*}$are domestic certificate of deposit and foreign certificate of deposit of individual with nominal interest rate $i_t$and i_t^*. Each agent earns an endowment $\frac{Y_t}{NP_t}$. In real per capita terms, the budget constraint then becomes:

$$c_t + m_t + m_t^* + cd_t + cd_t^* \leq m_{t-1}\frac{P_{t-1}}{P_t} + m_{t-1}^*\frac{P_{t-1}^*}{P_t^*} + (1 + i_t)\frac{P_{t-1}}{P_t}cd_{t-1} + (1 + i_t^*)\frac{P_{t-1}^*}{P_t^*}cd_{t-1}^* + y_t \quad (3)$$

[5]Uribe (1997) estimated the same model of money-in-utility. The slight difference is his inclusion of knowledge to the model. In the MUI model, money is included in the utility function and treated as a good. The theory of utility function was developed in the modern times by Von Neumann and Morgenstern in 1944.

Eq(3) implies that expenditure for new consumption, new money (domestic and foreign), and new certificate of deposits (domestic and foreign) have to be covered by earnings from money holding (domestic and foreign), certificate of deposit holding (domestic and foreign) and endowment. The first order condition from Lagrangian formulation in time t expressed in terms of $t+1$ becomes:

$$U'(c_t) = \beta(1+i_{t+1})\frac{P_t}{P_{t+1}}U'(c_{t+1}) \tag{4}$$

$$U'(c_t) = \beta(1+i^*_{t+1})\frac{P^*_t}{P^*_{t+1}}U'(c_{t+1}) \tag{5}$$

$$U'(c_t) = U'(m_t) + \beta(1+i_{t+1})\frac{P_t}{P_{t+1}}U'(c_{t+1}) \tag{6}$$

$$U'(c_t) = U'(m^*_t) + \beta(1+i^*_{t+1})\frac{P^*_t}{P^*_{t+1}}U'(c_{t+1}) \tag{7}$$

In Eq. (6) and (7) $U'(c_t)$ are the utility lost by giving up one unit of real money balances in the current period while $\beta(1+i_{t+1})\frac{P_t}{P_{t+1}}U'(c_{t+1})$ and $\beta(1+i^*_{t+1})\frac{P^*_t}{P^*_{t+1}}U'(c_{t+1})$ are the next period gain in utility of holding one unit of real money balances plus the discounted utility in domestic and foreign currencies. Following the Constant Relatively Risk Aversion (CRRA), non-separable utility function in consumption and money becomes:

$$U(c_t\Phi_t) = \frac{(c^\tau\Phi_t^{1-\tau})^{1-\sigma}-1}{1-\sigma} \tag{8}$$

The parameter $\sigma > 0$ is the coefficient of the relative risk aversion and $\frac{1}{\sigma}$ is the elasticity of intertemporal substitution between domestic and foreign balances to maximize utility while τ is the transaction requirement of money. The agent is risk averse by holding foreign currency along with domestic currency in order to prevent reduction in utility due to loss in the value of domestic currency. Following Imrohoroglu (1994), the Constant Elasticity of Substitution (CES) can be written in terms of domestic and foreign money balances as:

$$\Phi_t(m_t, m^*_t) = [(1-\pi)m_t^{-\rho} + \pi(m^*_t)^{-\rho}]^{-\frac{1}{\rho}} \tag{9}$$

The elasticity of currency substitution (ECS) between domestic and foreign balances in eq. (9) is $\frac{1}{1+\rho}$. This expression can also be derived from the rate of currency substitution (RCS) given by:

$RCS = -(\frac{m_t}{m_t^*})^{1+\rho}$, cross multiplying gives $\frac{m_t^*}{m_t} = |RCS|^{\frac{1}{1+\rho}}$, taking logs of both sides indicates $log\frac{m_t^*}{m_t} = \frac{1}{1+\rho} log|RCS|$, applying logarithm derivative gives $\frac{\partial log\, m_t^*/m_t}{\partial \log|CS|} = \frac{1}{1+\rho}$. The expression $\frac{\partial log\, m_t^*/m_t}{\partial \log|RCS|}$, denotes CES. The elasticity of currency substitution represents the optimal substitution between real domestic and real foreign money balances which signify dollarization and is a function of the domestic inflation and interest rate.

3.3 Empirical Model

[6]In the empirical analysis, the SVAR model is adopted in this paper to account for structural changes in the [7]Nigerian economy. As put forward by Sims (1981, 1986), Bernanke (1986) and Shapiro and [8]Watson (1988) could be represented by:

$$Ay_t = A_1^* y_{t-1} + \ ... + A_\rho^* y_{t-\rho} + B\epsilon_t \qquad (10)$$

Where A_i^* $(i = 1, ..., \rho)$ are $(k \times k)$ structural matrices, matrix A specifies the instantaneous relations between the variables of interest and ϵ_t is a vector of

[6] Both the Engle and Granger single cointegration equation and the multivariate Johansen cointegration test were carried out to establish the long run relationship among our variables. The stability test which shows stable model is also done for robustness check and the multivariate Johansen cointegration test are not presented due to space constraint, only the Engle and Granger cointegration test is presented at the Appendix.

[7] The stability test to ascertain the reliability of the SVAR model was also carried out and it is available upon request.

[8] The SVAR is suitable for our analysis because it accounts for structural breaks that may arise due to different macroeconomics and financial reforms implemented and regime switch in Nigeria. Apart from the change from military rule to democratic rule in 1999, there was equally a recapitalization exercise in the financial sectors in 2005. The 2008 global melt down is another factor. All these structural changes necessitate the use of SVAR model.

length k. The [9]reduce form of the SVAR can be obtained by pre-multiplying with A^{-1} as:

$$y_t = \pi_1 y_{t-1} + \ ... + \pi_\rho y_{t-\rho} + u_t \tag{11}$$

Where $\pi_1 = A_1 A^{-1}$, $\pi_\rho = A_\rho A^{-1}$and $u_t = A^{-1} B \epsilon_t$, which is unobserved structural innovation. According to Sims (1980) the purpose of SVAR is to obtain non-recursive orthogonalization of the error term for impulse response analysis as against the difficulty of drawing any conclusion from the large number of coefficients estimate in a VAR system. This orthogonalization requires the researcher to impose enough restrictions to identify the orthogonal (structural) components of the error term. From equation (11) where the error term is $u_t = A^{-1} B \epsilon_t$ and following Amisano and Giannini (1997) the class of SVAR model to be estimated can be written as:

$$A u_t = B \epsilon_t \tag{12}$$

The model in equation (12) is called AB-model since it combines the restrictions for $A$and B. The restrictions on matrices A and B can be written in matrix form for 3 variable case as:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} u_t = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \epsilon_t \tag{13}$$

where A is a triangular 3×3 matrix and B is also a diagonal 3×3 matrix. Equation (13) then becomes:

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ u_3 \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \tag{14}$$

The vector ordering of our variables can be expressed as:

$$y_t = [DOL, INF, INT]' \tag{15}$$

[9]The matlab codes of Amisano and Giannini (1997) of a 3 variable case and the restrictions used are available upon request.

Our variable ordering is guided by theory and intuition. We expect inflation to lead to dollarization and then affect interest rate. Our variables ordering can be expressed with the matrices in eq. (15) as:

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} u_1^{DOL} \\ u_2^{INF} \\ u_3^{INT} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \begin{bmatrix} \varepsilon_1^{DOL} \\ \varepsilon_2^{INF} \\ \varepsilon_3^{INT} \end{bmatrix} \quad (16a)$$

$$\begin{bmatrix} 1 & 0 & 0 \\ -0.02 & 1 & 0 \\ 0.16 & -0.07 & 1 \end{bmatrix} \begin{bmatrix} u_1^{DOL} \\ u_2^{INF} \\ u_3^{INT} \end{bmatrix} = \begin{bmatrix} 0.45 & 0 & 0 \\ 0 & 0.59 & 0 \\ 0 & 0 & 0.29 \end{bmatrix} \begin{bmatrix} \varepsilon_1^{DOL} \\ \varepsilon_2^{INF} \\ \varepsilon_3^{INT} \end{bmatrix} \quad (16b)$$

Eq. (16) can be explicitly expressed as:

$$u_1^{DOL} = b_{11} e_1^{DOL} \quad (17)$$

$$u_2^{INF} = -a_{21} u_1^{DOL} + b_{22} e_2^{INF} \quad (18)$$

$$u_3^{INT} = -a_{31} u_1^{DOL} - a_{32} u_2^{INF} + b_{33} e_3^{INT} \quad (19)$$

Eq. (17), (18) and (19) are structural shocks showing the relationship among our variables from the estimated SVAR model in eq. (16b). $b_{11}$with the value of 0.45 shows that the response of dollarisation to its own shock is positive with 0.45%, while a_{21} with a negative value of -0.02 shows that the response of dollarisation to inflation shock is negative by 0.02%. However, the responses of dollarisation and inflation to interest shock are 0.16% and -0.07% respectively.

The linear restrictions on matrix A and B, can further be explicitly written as:

$$Vec(A) = s_A.\gamma_A + d_A \quad (20)$$

$$Vec(B) = s_B.\gamma_B + d_B \quad (21)$$

Where $Vec(A)$ is a transformation of matrix A to a column vector, s_A is a suitable matrix with $0-1$ elements, γ_A contains all unrestricted elements of A and d_A is a vector of normalizing constant. The same applies to $Vec\,(B)$. Therefore, in order for matrix A and B to identified, $2k^2 - \frac{k(k+1)}{2} = k(3k - 1)/2$ restrictions are required. In the case of our analysis of 3-variable case where our k is 3, 12 restrictions are required for just-identified model. The restrictions and the output are presented in the appendix.

4.0 Empirical Analysis

The descriptive statistics showing the mean, median, kurtosis, deviations and other distributions is presented in Table 1. The essence of the description of data is to provide information and the distribution about the variables of interest. One can observe the closeness of the mean, median and kurtosis of our data, which satisfies the normality and smooth distribution.

Table 1: Descriptive Statistics

	INF	DOL	INT
Mean	21.08077	0.079132	13.14423
Median	11.85000	0.084555	12.50000
Maximum	72.80000	0.360300	26.90000
Minimum	5.400000	0.011900	6.130000
Std. Dev.	18.82683	0.046891	4.816754
Skewness	1.406106	0.419458	0.800950
Kurtosis	3.784619	2.157307	3.835163
Jarque-Bera	9.234514	1.531739	3.535545
Probability	0.009880	0.464930	0.170713
Sum	548.1000	2.057440	341.7500
Sum Sq.Dev.	8861.240	0.054970	580.0280
Observations	30	30	30

In order to ensure the stationarity of our data, the Augmented Dickey Fuller (Dickey and Fuller, 1979) (ADF) is used to determine the order of integration of the variables. This is necessary to ensure the stationarity properties of the variables to avoid spurious result. The unit-root results, presented in Table 2, show that all the variables are I(1).

Table 2: Unit root test (without break)

Intercept			Trend and Intercept		
Variables	Levels	First diff	Variables	Level	First diff.
INF	-2.3014	-4.4377	INF	-2.4008	-4.3808
DOL	-1.8131	-6.9601	DOL	-3.0501	-7.3803
INT	-2.7355	-5.5656	INT	-3.3413	-5.3967

ADF critical values at levels for both the intercept at levels and first difference are -3.7241(1%), -2.9862(5%),-2.6326(10%) and -3.7379(1%),-2.9919(5%),-2.6355(10%) while that of the trend and intercept at level and first difference are -4.3743(1%), -3.6032(5%) -3.2380(10%).and-4.3943(1%), -3.6122(5%) and -3.2431(10%).

4.1 Structural Breaks

In order to account for structural breaks in the data, the Bai-Perron (2003a) and (2003b) multiple breakpoint test was first adopted to identify the breakpoints endogenously. Afterwards, the Zivot-Andrews (ZA) (Zivot and Andrews, 1992) structural breakpoint model that incorporates unit root test is carried out. The essence of this test is to be sure if our data are truly non-stationary in the presence of structural breaks. Perron (1989) discovered that structural breaks in stationary data can induce unit root. As a result, the unit root test with breaks was performed and presented in Table 3. Our results confirm that our series are all I(1). The Zivot and Andrews (1992) is of the form:

$$y_t = \mu + \beta t + \delta y_{t-1} + \alpha DU_t + \theta DT_t + \sum_{i=1}^{k} \eta_i \Delta y_{t-i} + \varepsilon_t \qquad (22)$$

Where

$$DU_t = \begin{Bmatrix} 1, if\ t > TB \\ 0, otherwise \end{Bmatrix}$$

and

$$DT_t = \begin{Bmatrix} t - TB\ if\ t > TB \\ 0, otherwise \end{Bmatrix}$$

DU and DT are dummy variables that show a break in mean and slope, respectively. TB is the date of the endogenously determined break[10]. The unit root null hypothesis that $\delta = 1$ is considered while the alternative hypothesis of no unit root is otherwise.

The unit root test with breaks using Zivot and Andrews 1992, in Table 3, shows two breakpoints in inflation (INF) in the first quarter of 1992 and 1996,

[10]The multiple structural breaks of Bai and Perron (2003a) and (2003b) would first determine the minimum segment length in the data. Given this constraint, it would then search for the optimal partition of all possible segments of data to obtain global minimizers of the sum of squared residuals. By this way, they obtain the location of breaks, and minimizing their objective function for any possible number of breaks.
The break points in the series are consistent with the timing of economic and financial crises in Nigeria. 1991 and 1992 were years of massive strike, nationwide stay-at-home protest and high commodity prices. In 1996, inflation was at its peak because of the military administration, 2002 represents the period of influx of dollars (foreign currency) due to windfall oil export and finally, 2009 represent the global financial crises. The details of the structural breaks are not presented due to space constraint.

while three break points were detected for dollarization (DOL) in the first quarter of 1991, 2002 and second quarter of 2009. No structural break was detected for interest rate (INT). All the output of the structural breaks for all the series are presented at the appendix. Next, we select the optimal lag length in the SVAR system. The Akaike Information Criteria (AIC), Schwartz Bayesian Information Criterion (BIC), and Hannan-Quinn Criterion (HQC) are used in the determination of the optimal lag length. The lag length of 1 is found to be optimal, minimal and robust. This is presented in Table 4.

Table 3: Unit root test (with breaks): Zivot and Andrews (1992) unit root test

PARAMETERS	INF	INF	DOL	DOL	DOL
TB	1992:Q1	1996:Q1	1991:Q2	2002:Q1	2009:Q2
δ	0.4719(2.31)	0.2592(1.74)	0.0799(0.37)	0.4804 (2.77)	0.618 (4.66)
θ	-2.413(-0.7)	-4.695(-2.6)	0.0155(2.01)	0.0060(1.46)	0.018 (0.51)
α	0.6868(0.04)	46.95(4.63)	-0.059(-2.2)	0.0009(0.004)	-0.015(-0.3)
β	1.339(0.38)	4.8347(3.06)	-0.009(-1.2)	0.0007(0.41)	0.0022(2.80)
k	1	1	1	1	1

Note: Critical values at 1% and 5% significance level are -5.57 and -5.08 respectively (Zivot and Andrews, 1992). K is the lag length used in the test for each series, t statistics of the related coefficient are given in parenthesis. The t-statistics of δ i.e. δy_{t-1} for each model are in parenthesis and they are greater than the ZA critical values, which implies our series are all I (1).

Table 4. Lag Length Selection Criteria

Lags	Loglikelihood	AIC	BIC	HQC
1	-35.9838*	4.1725*	4.7649*	4.3215*
2	-26.8697	4.1626	5.1993	4.4233
3	-15.5508	3.9609	5.4420	4.3334

*represents the optimal lag

5.0 Discussion of Results

After ensuring the stationarity of our variables, accounting for the structural breaks, testing for cointegration and the selection of the optimal lag length of 1, we present the causality test in table 4. The result shows that causality is from dollarization to inflation rate at 5% significant level. The implication of this is that, the use of dollars as a medium of exchange is responsible for high inflation rate in Nigeria. It can also be observed that inflation and interest did not granger cause dollarization. This implies that there are other drivers of

dollarization in Nigeria. We further found causality to run from inflation rate to interest rate at 10% significant level.

Afterwards, we proceed to estimate the SVAR model following Amisano and Giannini (1997) structural innovation. We carry out the impulse responses of the SVAR model and the dynamic results are presented in fig.2. The responses of dollarisation to inflation shock and interest rate shock are found to be negative throughout the period of study. The negative response of dollarisation to inflation shock implies that as the inflation increases, that is as the purchasing power of domestic currency falls due to inflation, people hold more dollars. This result support previous studies by Grippa (2005), Antinolfi et al (2001) and Ghalayini (2011). This implies that people hold dollars in Nigeria to hedge against the inflationary increase that erode purchasing power.

Similarly, the negative response of dollarisation to interest rate suggests that as interest rate increases dollarisation decreases. As interest rate on domestic financial assets increases, the incentive to keep a domiciliary account falls. In the other way round, as people keep more of their domestic currencies in dollars the interest rate on the fewer available loanable fund decreases. The explanation is that people have perceived investment in dollarisation as a profitable alternative and as such demand for loanable funds fall and interest rate falls. This is not good for the investment climate of a developing country like Nigeria. From the fig. 2 also, the response of inflation to dollarization shock is negative over the period of study. This result indicates that as dollarisation increases, the purchasing power falls that is inflation increases. Lastly, the response of interest rate to dollarisation shock is also negative over the period of study. This implies that as dollarisation increases, interest rate falls. The demand for dollars implies lower demand for the domestic currency, fall in the interest rate and ultimately fall in domestic investment.

Table 4: Granger causality test for Inflation, Dollarization and Interest rate

Dependent Variable	F- Value		
	INF	DOL	INT
INF	-	6.101(0.02**)	0.119 (0.73)
DOL	1.811 (0.193)	-	0.766(0.39)
INT	3.609 (0.07***)	0.268(0.61)	-

** and *** indicate 5% and 10% significance level.

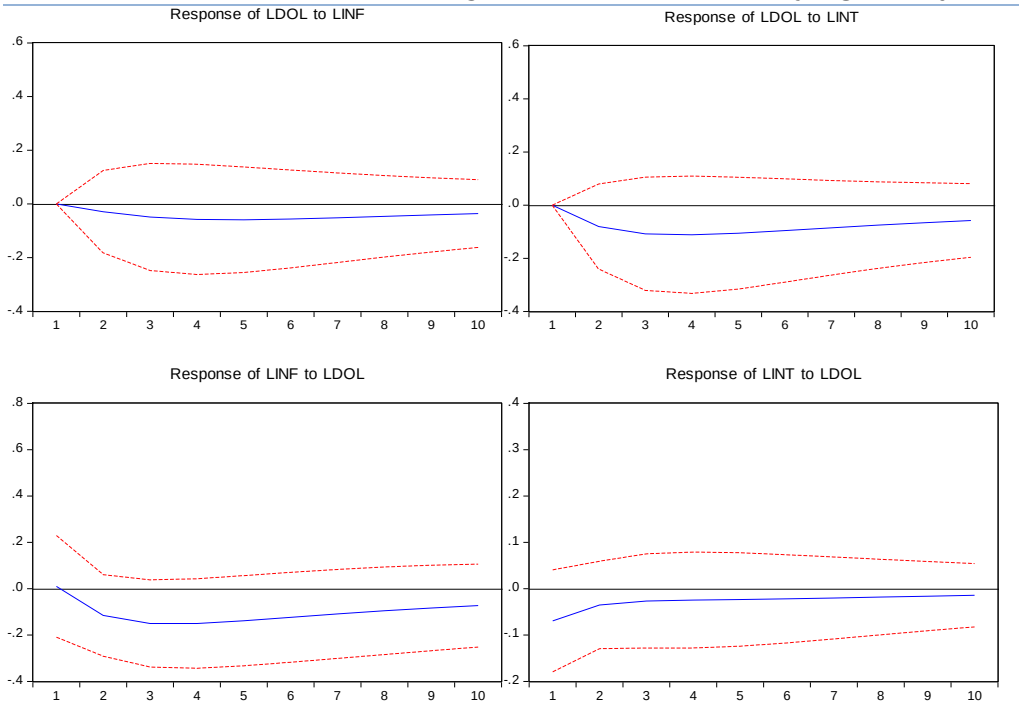

Fig.2 IndividualSVAR Impulse response of Inflation Dollarization and Interest rate

Note: The broken lines indicate 95% interval while the unbroken lines are the SVAR impulse response.

6.0 Conclusion and Policy Recommendation

In conclusion, this paper investigates the structural relationship among dollarization and inflation and interest rate, given the paucity of literature on dollarization issues in Nigeria. Based on our granger causality analysis, we find that dollarization causes inflation rate in Nigeria. Also, inflation and interest rates are not responsible for dollarization in Nigeria. We also find dollarisation to negatively affect both inflation and interest rate. It is important to consider policy implications of the increase of dollarization for emerging market economies like Nigeria. The first policy consideration is the implications of the level of dollarization for monetary policy management in general and financial system stability in particular. The second consideration is that indeed, dollarization complicates monetary policy management and renders it ineffective. This is because monetary aggregates becomes unpredictable and more sensitive to expected exchange rate depreciation. 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. Dollarisation also erodes the purchasing power of the domestic currency.

Therefore, we recommend that there should be an effective and efficient monetary authority in Nigeria to keep the dollarization index low which would invariably keep the inflation rate low as well. An economy with a well-developed financial market can offer a set of alternative financial instruments dominated in domestic currency and reduce the role of foreign currency as an inflation hedge. Finally, the monetary authority should place a restriction on the flow of dollar within the financial system and make it available only to agents with genuine foreign transactions.

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APPENDIX

1. Engle and Granger single equation cointegration

Dependent	tau-statistic	Prob.	z-statistic	Prob.
INF	-4.471601	0.0256**	-22.06975	0.0215**
DOL	-6.911799	0.0002*	-24.73903	0.0074*
INT	-5.765175	0.0019*	-29.17414	0.0008*

MacKinnon (1996) p-values. ** and * signify 5% and 1% level of significance.