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THE CAUSALITY BETWEEN ECONOMIC GROWTH AND GOVERNMENT EXPENDITURE IN NIGERIA

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ABSTRACT

The Purpose. *The paper studies the causal relationship between economic growth and government expenditure between 1970 and 2016.*

Design/Methodology/Approach. *The study employed modern co-integration techniques, Granger causality test within an error-correction modeling framework and variance decomposition analysis.*

Findings/Implications. *The co-integration test found that a co-integration relationship exists between economic growth and government expenditure. The Granger Causality test result shows that there exist both short run and long run bidirectional relationships between the variables with causality stronger from economic growth to government expenditure than the opposite direction as proved by the variance decomposition analysis.*

Originality. *The Granger Causality test results found that both economic growth and government expenditure have a cause effect on each other, suggesting that both variables are growing substantially. Using the variance decomposition analysis result as a basis for policy formulation, the government should ensure that resources are well managed and allocated efficiently among competing needs to accelerate economic growth.*

1. INTRODUCTION

The need to unravel the direction of causality between economic growth and government expenditure has resulted to two approaches, Wagner's and Keynes' approaches, thus dividing scholars into two groups. Wagner and his supports are of the view that government expenditures are caused by economic growth, while Keynes' group opines that public expenditure is the main tool to boost economic growth. This has generated varying debates given the data sets, theories and the methodologies or techniques adopted. For instance, while (Mitchell, 2005) believes that government uses resources less efficiently, and that the various methods of financing government (taxes, borrowing, and printing money), are inimical to growth, Hsieh *et al* (1994), Loizides *et al* (2005), etc, are of the view that economic growth causes increases in government expenditure. In other to fill the empirical gaps exposed by these studies, this paper seeks to dig more the direction of causality between government expenditure and economic growth in Nigeria by deploying a more robust and sophisticated econometric technique based on co-integration and error correction modeling framework. This paper will update the data used by Omo (2006) to 2016. Giving the upsurge in government expenditure and GDP, a decade is big enough for there to be changes in the direction of relationship between the variables under study. The study will also carry out Granger causality test within an error-correction modeling framework which allows for dynamic specifications by taking into account of the distinction between a long term relationship and short term adjustment. The result from this analysis would assist policy makers in formulating budgetary adjustment plans so as to achieve specified objectives. It will also help in instilling discipline in the expenditures patterns of government.

The rest of this study is organized as follows; relevant literature review will be presented in section two. Section three showcases econometric methodology. This is followed by the presentation of the empirical findings and analysis in section four. Finally, in section five, concluding remarks are provided.

2. LITERATURE REVIEW

This study is predicated on the argument between Wagner and Keynes and their supporters on the relationship between public expenditure and economic growth. Wagner introduced a model that government expenditures are endogenous to economic development, while Keynes and his supporters argue that public expenditure is the main tool to boost the economic activities. This has led to varying opinions because such studies were done using varying measurements of different data sets, theories, methodologies or techniques.

In his paper, Landau (1983) examined the relationship between the share of government consumption expenditure in GDP and the rate of growth of real per

capita GDP for 104 countries. The results of this study suggest a negative relationship exists between the share of government consumption expenditure in GDP and the rate of growth of per capita GDP. This study also found the relationship between total investment in education and the growth rate is also positive and highly significant in the regressions for all time periods for both the full set and all subsets of countries.

Hsieh *et al* (1994) utilized a multivariate time series, paying particular emphasis to the causal pattern and the shape of impulse response function in the context of vector autoregression to examine the intertemporal interactions among the growth rate in per capita real GDP, the share of government spending, and the ratio of private investment in GDP for a group of seven countries. Their result shows that the relationship between government spending and growth can vary significantly across time as well as across the major industrialized countries that presumably belong to the same growth club. This result shows no consistent evidence that government spending can increase per capita output growth.

In order to examine if the share of total expenditure in GNP can be determined to Granger cause the rate of economic growth, or vice versa. Loizides *et al* (2005) first adopted the use of a bivariate error correction model within a Granger causality framework, as well as adding unemployment and inflation (separately) as explanatory variables, creating a simple 'trivariate' analysis for each of these two variables. These analyses of bivariate and trivariate tests using data on Greece, UK and Ireland, show that government size Granger causes economic growth in all countries of the sample in the short run and in the long run for Ireland and the UK. Also, economic growth Granger causes increases in the relative size of government in Greece, and, when inflation is included, in the UK.

Bose *et al* (2007) investigated the growth effects of government expenditure for a panel of thirty developing countries for the period of 1970–1990, with a particular focus on sectoral expenditures. Their result shows that the share of government capital expenditure in GDP is positively and significantly correlated with economic growth, but current expenditure is insignificant. The result of their sectoral analysis shows that government investment in education and total expenditures in education are the only outlays that are significantly associated with growth once the budget constraint and omitted variables are taken into consideration.

Mo (2007) estimated how government expenditures affect the growth rate of real GDP through total factor productivity, investment, and aggregate demand using cross-country data in the period 1970 to 1985. He found that except government investment, all government expenditures have negative marginal effect on productivity and GDP growth.

In his study, Cooray (2009) investigated the role of government in economic growth by extending the neoclassical production function to incorporate the size and quality dimensions of government measured by government expenditure and governance respectively. His result on a cross section of 71 economies using generalized

method of moments (GMM) indicates that both the size and quality of government are important for economic growth. As a result, they argued that investing in the capacity for enhanced governance is a priority for the improved growth performance of the countries examined.

Alexiou (2009) provided further evidence on the relationship between economic growth and government spending. He applied two different panel data methodologies (standard pool estimates, and the random coefficients estimates (GLS)) to seven transition economies in the South Eastern Europe (SEE) for the period 1995 to 2005. The evidence derived from their result indicates that governments spending on capital formation, development assistance, private investment and trade-openness have positive and significant effect on economic growth, while Population growth is found to be statistically insignificant.

Mohammadi *et al* (2012) studied the effect of governmental expenditure composition on the development of Economic Cooperation Organization countries (ECO) in the period 1995-2009. They applied dynamic panel data method & generalized method of moments (GMM) on three types of public expenditure; health, education and defense expenditures. Their findings show that health expenditure by governmental has a negative and statistically significant effect on growth, expenditures on education and defense by governmental have positive and statistically significant relationships with economic development of ECO countries.

Abu-Eideh, O. M. (2015) investigated the causal relationship between public expenditure and the GDP growth in the Palestinian territories over the period of 1994-2013. The Engle-Granger cointegration test adopted proved that a long-run relationship between public expenditure and GDP growth exists in the Palestinian case. The Granger causality tests also found that both public expenditure and GDP have a cause effect on each other.

In Nigeria, there are also mixed findings on the relationship between government expenditure and economic growth. For instance, Omo (2006) examined the tendency for public expenditure to grow relative to national income against the contending proposition that it is the changes in public expenditure that trigger those of national income using Nigeria's data over the period 1970-2003. His result from co-integration and causality techniques shows that there exists a unidirectional causality from national income to total public expenditure, while a bi-directional causality exists between non-transfer public expenditure and national income.

Omoke (2009) tested for the direction and level of causality between government expenditure and national income in Nigeria using annual data for the period 1970-2005. Their results from co-integration and Granger Causality tests show that there is no long-run relationship between government expenditure and national Income in Nigeria and that causality runs from government expenditure to national Income.

Abu *et al* (2010) studied the effect of government expenditure on economic growth in Nigeria between 1970 and 2008. Employing error correction technique,

their results reveal that government total capital expenditure, total recurrent expenditures and government expenditure on education have negative effect on economic growth, while government expenditure on transport and communication and health results to an increase in economic growth.

Loto (2011) investigated the growth effects of sectoral government expenditure in Nigeria over the period of 1980 to 2008 using co-integration analysis and Error correction technique. The result shows that in the short-run, expenditure on agriculture was found to be negatively related to economic growth. The impact of education, though also negative was not significant. The impact of expenditure on health was found to be positively related to economic growth while expenditures on national security transportation and communication were positively but statistically insignificantly related to economic growth.

Taiwo (2011) analyzed the implications of government spending on the growth of Nigeria economy over the period 1980-2009. Using Johansen co-integration, unit root test and error correction model, their result discovered that total capital expenditure, inflation rate, degree of openness and current government revenue are significant variables to improve growth in Nigeria. They therefore recommended that future expenditure on capital and recurrent should be managed along with adequate manipulation of other macroeconomic variables to ensure steady and accelerate growth.

In their paper, Obeh *et al* (2012) investigated the relationship between government expenditure in the education sector and economic growth in Nigeria using time series data from 1986 to 2011. Employing Johansen co-integration technique and error correction method, their result shows that long run relationship exists between the variables and that recurrent expenditures and gross capital formation exhibit positive impact on economic growth while capital expenditures on education and human capital development have negative and significant impact on economic growth.

With the objective to analyze the effect of public government spending on economic growth in Nigeria between 1970 and 2009, Nworji *et al* (2012) found that capital and recurrent expenditure have insignificant and negative effects on economic growth. They also observed that capital expenditure on transfers has insignificant positive effect on growth, while capital and recurrent expenditures on social and community services and recurrent expenditure on transfers have significant positive effect on economic growth.

Nasiru, I. (2012) examined the cointegration and causality analysis of Government Expenditure and Economic Growth in Nigeria employing Bounds Test approach to cointegration based on unrestricted Error Correction Model and Pair wise Granger Causality tests. When real GDP is taken as dependent variable, the results from the Bounds Test indicate that there exists no long run relationship between government expenditure and economic growth. The causality results reveal that while government capital expenditure granger causes economic growth, no causal

relationship was exists between government recurrent expenditure and economic growth in Nigeria.

Akpokerere *et al.* (2013) investigated the effect of disaggregated government expenditure on economic growth in Nigeria between 1977 and 2009. Using the multiple regression technique, they found that Government total capital expenditure, total recurrent expenditures, Government expenditure on education and power have negative and significant effect on economic growth. They also found that rising Government expenditure on transport and communication, and health result to an increase in economic growth.

Employing the ordinary least square multiple regression analysis, Granger Causality test, Johansen co-integration test and error correction mechanism to estimate time series data of 32years period (1980-2011), Okoro (2013) investigated the impact of government capital expenditure and recurrent spending on Nigerian economic growth. The result shows that there exists a long-run equilibrium relationship between government spending and economic growth in Nigeria.

Egbetunde, T. & Ismail O. Fasa, I. O. (2013) analysed the impact of public expenditure on economic growth in Nigeria during the period 1970 to 2010 making use of annual time series data. The results from the bounds testing (ARDL) approach suggested that public expenditure and economic growth variables are bound together in the long run, and that the associated equilibrium correction was also significant confirming the existence of long run relationships. The results indicate that total public spending has a negative relationship with economic growth, while recurrent expenditure has little significant positive impact on growth.

Jelilov, G. & Musa, M. (2016) examined the impact of Government Expenditure on Economic Growth in Nigeria, using time series data spanning 1981-2012. The OLS technique employed found that government expenditure has a positive and significant impact on economic growth.

Idris, M. & Bakar, R. (2017) continued the Search for a Stable Relationship between Public Sector Spending and Economic Growth in Nigeria. The result from the ARDL model employed reveals that there exists a positive and significant relationship between public spending on economic growth in Nigeria.

3. ECONOMETRIC METHODOLOGY

Following Fasano and Wang (2002), after determining that the variables of the model are co-integrated, we will estimate the Granger causality test within an error-correction modeling framework in which we shall include a mechanism of error correction model (ECM). However, we will adopt the normal Granger causality method without the error correction term where the variables are stationary and that there is no co-integration between the variables in the equation. The data on the variables are sourced from the various issues of the Central Bank of Nigeria (CBN) Statistical Bul-

letin. The models of the causality between government expenditure and economic growth when the variables used in the study are stationary series are specified empirically below:

$$GDP_t = \alpha_0 + \alpha_1 GEXP_t + \varepsilon_1 \quad (1)$$

$$GEXP_t = \beta_0 + \beta_1 GDP_t + \varepsilon_2 \quad (2)$$

GDP_t is GDP at current market cost; $GEXP$ is government expenditure; $\alpha_0, \alpha_1, \beta_0, \beta_1$ are the coefficients to be estimated and $\varepsilon_1, \varepsilon_2$ are the stochastic error terms with all the standard attributes. We decided to use total expenditure because it is mostly important in determining government deficit, debt and the overall sustainability of public finances.

3.1. Unit Root Tests

We will determine the stationarity properties of the variables using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. According to Obioma & Ozughalu (2010), the ADF approach accounts for the autocorrelation of the first differences of a series in a parametric manner by estimating additional nuisance parameters, the PP non-parametric test on the other hand generalizes the ADF procedure and takes care of the serial correlation in the error terms without adding lagged difference terms, allowing for less restrictive assumptions for the time series in question. These tests are used in order to guarantee that our inferences regarding the important issues of stationarity are not based on the choice of the testing procedure used. We will also apply the variance decomposition approach in the event of bidirectional causality to determine the strength of causal relationship between the variables.

The ADF test is estimated through the equation below;

$$\delta K_t = \alpha_1 + \alpha_2 t + dK_{t-1} + \sum_{i=1}^n \chi_i \delta K_{t-i} + \mu_t \quad (3)$$

Where, δ is difference operator; K_t is the variable to be estimated; α_1, α_2, d and χ_i are the various parameters; μ_t is a pure white noise error term. The ADF tests either $d = 0^1$ or not.

The PP test estimates the equation 4.

$$\delta d_t = b + \alpha d_{t-1} + \mu_t \quad (4)$$

μ_t is a white noise error term assumed to be stationary $I(0)$ with zero mean and constant variance. This test is done to reject the null hypothesis of a unit root ($\alpha = 1$).

3.2. Co-integration Tests

This study will adopt the Engel-Granger (EG) and the Johansen maximum-likelihood co-integration tests. The EG tests the stationarity of the residuals from the equations of interest. The variables under consideration are co-integrated if the residuals are stationary at level. However, EG assumes arbitrary normalization of the co-integrating vector and can also be extremely weak under mild cases of autocorrelation. Since the EG test is not very powerful and robust when compared with the Johansen co-integration test, it becomes necessary to complement it with the Johansen test which is a full information maximum likelihood ratio statistics with exactly known distributions. Following Obioma & Ozughalu (2010), we present the vector autoregressive (VAR) model of order p for Johansen co-integration test as follows.

$$K_t = B_1 Y_t + \dots + B_p Y_{t-p} + A X_t + et \quad (5)$$

K_t is a k -vector of non-stationary $I(1)$ variables, X_t is a d -vector of deterministic variables, while et is a vector of innovations. Equation 5 can also be rewritten as follows:

$$\delta K_t = \Pi K_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \delta K_{t-i} + A X_t + et. \quad (6)$$

Where

$$\Pi = \sum_{i=1}^p B_i - I, \Gamma_i = - \sum_{j=i+1}^p B_j \quad (7)$$

The Johansen maximum-likelihood co-integration test estimates the Π matrix from an unrestricted VAR, and also whether we can reject the restrictions implied by the reduced rank of Π . Granger's representation theorem assumes that if the coefficient matrix Π has reduced rank $r < k$, then there exists $k \times r$ matrices α and β , each with rank r such that $\Pi = \alpha\beta'$ and $\beta' Y_t$ is $I(0)$; r is the number of co-integrating relations and each column of β is the co-integrating vector. The elements of α are known as the adjustment parameters in the vector error correction model. If the variables are co-integrated, a dynamic error correction models (ECMs) that take into account the underlying co-integration properties is constructed. The ECM adds another regressor, the estimated residuals obtained from the associated co-integrating equations into the error correction model.

3.3. Error Correction Term

After determining that the variables of the model are co-integrated, we will adopt the methodology of Fasano and Wang (2002) where we will carry out the

Granger causality test within an error-correction modeling framework. The error-correction model has arisen from the long-run co-integration relationship. We specify the following error-correction model equations;

$$\delta GDP_t = \alpha_1 + \alpha_2 \delta GDP_{t-1} + \alpha_3 \delta GEXP_{t-1} + \alpha_4 ecm1(-1) + \varepsilon_1 \quad (8)$$

$$\delta GEXP_t = \beta_1 + \beta_2 \delta GEXP_{t-1} + \beta_3 \delta GDP_{t-1} + \beta_4 ecm2(-1) + \varepsilon_2 \quad (9)$$

where α and β are the coefficients, δ is the change operator, ε_1 and ε_2 are the error terms, $ecm1(-1)$ and $ecm2(-1)$ are the one-period lagged fitted values of ε_1 and ε_2 from equations 1 and 2 respectively, and they give another avenue through which the effects of causality can occur. Specifically, α_3 and α_4 show the effect of past values of δGDP_t and $\delta GEXP_t$ on δGDP_t , while β_2 and β_3 describe the effects of past values of $\delta GEXP_t$ and δGDP_t on $\delta GEXP_t$.

The Granger causality is tested through the null hypothesis that $\alpha_3 = \alpha_4 = 0$ in equation 8 and $\beta_3 = \beta_4 = 0$ in equation 9. If these hold, then there is no causality between the variables since the current value of each variable is only affected by its own lag values. In addition, a unidirectional relationship ensues if $\alpha_3 \neq 0$ and/or $\alpha_4 \neq 0$, and also $\beta_3 \neq 0$ and/or $\beta_4 \neq 0$ holds in the equations. In these cases, δGDP_t is said to be caused by $\delta GEXP_t$, while $\delta GEXP_t$ is caused by δGDP_t in equations 8 and 9 respectively. Furthermore, if both $\alpha_3 \neq 0$ and $\beta_3 \neq 0$ hold, there is a bidirectional short run causality. The statistical significance of the parameter estimates associated with the error correction terms i.e. $\alpha_4 \neq 0$ and $\beta_4 \neq 0$ show that the relationship between the variables in the estimated model is long run. In both cases, the variables are related to current and/or past effects of the other variable.

4. EMPIRICAL FINDINGS AND ANALYSIS

The empirical findings are presented in this section:

4.1. Unit root Results

As shown in Table 1., the unit root tests are carried out using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. It is observed that test statistics are greater than 1% or 5% critical values either in models 1, 2 or 3 at level. Thus, the two variables (GEXP, GDP) are found to be stationary at level, i.e. I(0).

Table 1.: Unit Root Tests

Augmented Dickey- Fuller								
Variable		(ADF) Test			Phillips-Perron (PP)			Decision
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	
LGEXP		6.88*	4.22*	11.56*	19.1*	10.54*	24.13*	1(o)
LGDP		4.19*	4.19*	3.58*	7.98*	4.16**	9.62*	1(o)
	1%	-3.62	-4.27	-2.63	-3.61	-4.21	-2.62	
CRITICAL	5%	-2.94	-3.56	-1.95	-2.94	-3.53	-1.95	
VALUES	10%	-2.61	-3.21	-1.61	-2.61	-3.19	-1.61	

Note: *The Null hypothesis is the presence of unit root. Model 1 includes a constant, model 2 includes a constant and a linear time trend while model 3 includes none in the regression as exogenous lags are selected based on Schwarz info criteria in ADF test. In the PP test, The Bandwith was chosen using Newey-West method with Bartlett Kernel spectral estimation (*), (**) and (***) indicate significance at 1%, 5% and 10% significance levels respectively.

Source: Author.

4.2. Co-integration Tests Results

Since we estimated that the variables are stationary, i.e. integrated of the same order one, 1(o), our co-integration test is therefore aimed at verifying whether a linear combination of these variables that are integrated of the same order one is stationary. If co-integration exists, then there is a long run relationship between the variables. A long run relationship between these variables under study will help us understand how they behave in the long run. Beginning with the EG test, the tests for the stationarity of the residuals (ECM₁ & ECM₂) from equations 1 and 2 in Table 2. shows that the residuals from the equations are stationary at level, that is, they are each integrated of order zero, i.e. 1(o). Thus, the EG co-integration test indicates that the variables in question are co-integrated.

Table 2.: Co-integration Tests Results of Residuals

Augmented Dickey- Fuller								
Variable		(ADF) Test			Phillips-Perron (PP)			Decision
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	
ECM ₁		-2.95**	-2.97	-2.99*	-3.03**	-3.05	3.07*	1(o)
ECM ₂		-2.99**	-2.95	-3.03*	-3.07**	-3.03	-3.11*	1(o)
	1%	-3.58	-4.18	-2.62	-3.58	-4.18	-2.62	
CRITICAL	5%	-2.93	-3.51	-1.95	-2.93	-3.51	-1.95	
VALUES	10%	-2.60	-3.19	-1.61	-2.60	-3.19	-1.61	

Note: *The Null hypothesis is the presence of unit root. Model 1 includes a constant, model 2 includes a constant and a linear time trend while model 3 includes none in the regression as exogenous lags are selected based on Schwarz info criteria in ADF test. In the PP test, The Bandwith was chosen using Newey-West method with Bartlett Kernel spectral estimation (*), (**) and (***) indicate significance at 1%, 5% and 10% significance levels respectively.

Source: Author.

The Johansen test is conducted to complement the EG test. Tables 3. and 4. present the Johansen co-integration test for equations 1 and 2. The results indicate that the models show that both max-eigenvalue and trace statistics indicate one co-integrating equation each at 5% significant level. These results reinforce the results of the EG test. We therefore conclude that there is the existence of long-run equilibrium relationships between economic growth and government expenditure in the models.

Table 3.: Model 1 (GDP and GEXP)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value 5 per cent	Trace Statistic	Critical Value 5 per cent
None *	0.58	37.94	14.26	40.15	15.49
At most 1	0.05	2.21	3.84	2.21	3.84

Note: * denotes the rejection of the hypothesis at the 5% level. Both Max-eigenvalue and trace statistics indicate 1 co-integrating equation each at 5% level.

Source: Author.

Table 4.: Model 2 (GEXP and GDP)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value 5 per cent	Trace Statistic	Critical Value 5 per cent
None *	0.58	37.94	14.26	40.15	15.49
At most 1	0.05	2.21	3.84	2.21	3.84

Notes: * denotes the rejection of the hypothesis at the 5% level. Both Max-eigenvalue and trace statistics indicate 1 co-integrating equation each at 5% level.

Source: Author.

4.3. Error Correction Results

The models are found to be co-integrated; we therefore conduct Granger causality tests within the error-correction modeling frameworks as specified in equations 8 and 9 above. We adopted a simple one-period lag length because it proved to be optimal given statistical considerations of Akaike Information Criterion (AIC) and the Schwartz Information Criterion (SIC). The error correction results presented below show that both the parameter estimates associated with lags of the explanatory variables in the two equations are significant at 5% level of significance. Also, the parameter estimates of the error correction terms are significant at 1% significant level. While the error correction term, ECM1 has the right negative sign, ECM2 is positively signed. This result however indicates that there is a short run as well as long run bidirectional causality between economic growth and government expenditure. Abu-Eideh, (2015) confirmed the same result in his investigation of the causal relationship between public expenditure and the GDP growth in the Palestinian territories over

the period of 1994 to 2013, the Engle-Granger cointegration test he adopted proved that a long-run relationship between public expenditure and GDP growth exists in the Palestinian case, while he Granger causality tests also found that both public expenditure and GDP have cause effect on each other. On the other hand, this result disagrees with the findings of Omo (2006) whose result indicates a unidirectional causality running from economic growth to government expenditure. However, Omo (2006) did not deduce a co-integration relationship between national income and government expenditure and hence did not apply Granger causality based on error correction in the estimation of same. Our findings also departed from that of Omoke (2009), who though confirmed that a short run relationship exists between the variables, but proved that such relationship was unidirectional, with causality running from government expenditure to national income.

Table 5.: Granger Causality Tests within the Error-Correction models.

Dependent Variable: D(GDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	2.832	0.522	5.421	0.000
D(GEXP(-1))	-44.999	8.101	-5.555	0.000
ECM(-1)	-1.774	0.226	-7.860	0.000
F-statistic			22.051	0.000
Durbin-Watson stat				2.024
Dependent Variable: D(GEXP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GEXP(-1))	-0.446359	0.189320	-2.357697	0.0232
D(GDP(-1))	0.029	0.010	2.924	0.006
ECM(-1)	0.310	0.101	3.073	0.004
F-statistic			6.122	0.002
Durbin-Watson stat				1.909

Source: Author.

Given that our Granger causality result indicates a bidirectional relationship between economic growth and government expenditure, it became necessary to adopt a variance decomposition approach to determine the strength of the causal relationship from either of the variables. Part A which examines the variance decomposition of gross domestic product (GDP) or GDP innovation shows that the shocks in gross domestic product in the years result in very high changes in gross domestic product without significant impacts on government expenditure in the number of periods. In part B, the innovation in GEXP which determines the effect of GEXP on GDP showed a significant impact on GDP also. However, the shock is higher when compared with the shock by GDP. Although this result cannot be said to be fully supportive of either Wagner's assertion or Keynes' proposition, it shows that GDP has stronger impact on GEXP than vice versa. The result of the variance decomposition is presented in Table 6.

Table 6.: Variance Decomposition Results

Part A: Variance Decomposition of GDP		
Number of Periods	GDP	Innovations in: GEXP
1	100	0
2	98.91	1.09
3	98.37	1.63
4	98.22	1.78
5	98.19	1.81
Part B: Variance Decomposition of GEXP		
Number of Periods	GDP	GEXP
1	2.01	97.99
2	38.91	61.09
3	91.85	8.15
4	99.08	0.92
5	98.71	1.29

Note: Variance decomposition depends on the order in which the variables enter the VAR system and its innovations are orthogonalized by Choleski decomposition method. Based on the fact that the t-statistics from the causality was higher in the direction from GDP to GEXP than the opposite case, we ordered the variables by considering GDP first and next GEXP.

Source: Author.

5. CONCLUSIONS

The objective of this empirical investigation is to determine the causal relationship between economic growth and government expenditure in the case of Nigeria by employing Granger causality test within an error-correction modeling framework based on the outcome of the modern co-integration techniques, and also variance decomposition analysis. The test for unit root using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests show that the variables are integrated of order zero, i.e. $I(0)$. Verifying whether a linear combination of these variables that are integrated of the same order one is stationary, our results from Engel-Granger (EG) and the Johansen maximum-likelihood co-integration tests show that a co-integration relationship exists between economic growth and government expenditure.

The result from the Granger Causality test based on error correction framework shows that both short and long run bidirectional relationship exist between the variables, suggesting that both variables are growing substantially. The variance decomposition analysis shows that the causality from economic growth to government expenditure was found to be stronger than the opposite direction, but such result is not strong enough to affirm the superiority of growth-expenditure relationship over expenditure-growth relationship between 1970 and 2016.

However, the implication of his result is that, the government should ensure that resources are well managed and allocated efficiently among competing needs to accelerate economic growth.

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FOOD PRICE VOLATILITY EFFECT OF EXCHANGE RATE VOLATILITY IN NIGERIA

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ABSTRACT

Purpose. *There are sufficient evidences in the literature that welfare of food producers and consumers is easily compromised due to unfavorable food price volatility dynamics. Therefore, this study investigates the volatility dynamics in food price index returns (FPIRETURNS), imported food price index returns (CIFCPIRETURNS), price of dollars at bureau de change (BDCRETURNS) and inter-bank rate (EXRETURNS).*

Design/Methodology/Approach. *In view of the increasing quest to account for volatility behavior such as non-linear and time-varying risk premium in food price series using an appropriate tool, this paper adopts exponential generalized autoregressive conditional heteroscedasticity (EGARCH) model. This is because it allows error terms to be conditional heteroscedastic, and the dynamics process generating the underlying heteroscedasticity to be asymmetric. That is, the model introduces a parameter that can reveal how conditional variance respond to both positive and negative shocks of equal magnitude (asymmetric effect).*

Findings and Implications. *The study finds leverage effect and high persistence in some of the selected models. Also, exchange rate volatility affects volatility of FPIRETURNS, but it is more pronounced on the volatility of CIFCPIRETURNS.*

Limitations. *Inadequate data especially for CIFCPIRETURNS is a huge limitation in this study.*

Originality. *However, this study has sufficient empirical evidences that instability in forex market flows into the Nigerian food market with pronounced leverage effect and persistence in food price volatility. The recommendation is, government should implement stabilization policy in the forex market as a precursor to ensuring stability in domestic food market.*

1. INTRODUCTION

Many households in low income countries have continued to wallow in poverty because of the perceived weakness and less skills in taking informed decision about their livelihood. The inconsistent pattern in policy implementation creates so much uncertainty in the economy. Food market is one place where signals about the behaviour of market participants are best examined. An average household in Nigeria spends more than 60% of household income on food (Mgbenka, Mbah, Ezeano, 2015). This is an evidence of the centrality of food in household expenditure. It implies that implementation of household budget can easily be distorted by inefficient and unstable food market dynamics, thereby resulting into changing consumption habit. Similarly, uncertainty in food market has been implicated in the rising food inflation in low income countries (Sehakar, Roy, Bhatt, 2017) and this may create more instability in the economy. Although the literature is replete with findings on predictable price changes (Assefa, Meuwissen, Lasink, 2016), there are evidences that this does not stimulate risk in food market as much as unpredictable changes in food prices. Two problems have emerged in the literature on unpredictable movement (risk) in food prices; evidences of asymmetric effects (leverage effects) in food prices suggest differential price risk (sudden change) depending on direction of price movement, and that persistence in food price volatility stimulates food price inflation and low investment. The fact that Nigerian food economy has been continually troubled by low investment in the agricultural and food sector has heightened our curiosity about the cloudy nature of food market. All these are possible precursor to food insecurity which incontrovertibly have welfare implications on the people especially the low income earners and rural poor who are dominantly peasant farmers (Pinstrup-Andersen, 2015; and Sassi, 2014). Therefore, a deep knowledge of food price volatility dynamics can have both intellectual and policy implications with a view to addressing food insecurity and its attendant challenges in Nigeria and other low income countries.

Experts have asserted that food price volatility (FPV) is a global phenomenon (FAO et al., 2011; IFPRI, 2013 and HLPE, 2011). It is the frequent and unpredictable changes to food prices over a period of time (Assefa, Meuwissen, Lansik, 2015; Serra, Zilberman, 2013; Piot-Lepetit, 2011; FAO et al., 2011; and Rabobank, 2011). These changes can affect a number of market variables directly - demand and supply, price, production, and inventory; and indirectly - welfare of producers, traders and consumers (Pindyck, 2004). The increasing impact of food price volatility on smallholder farmers and other pro poor households in the developing countries is daunting (IMF, OECD, and WFP UNCTAD, 2011; IFPRI, 2013; FAO et al., 2011; and Minot, 2014). It is a well-known fact that smallholder farmers and agribusiness folks are dominant among economic agents in Nigeria economy (Akor, 2012; and Fatuase et al., 2016) and they are predisposed to frequent food price fluctuations. Therefore,

stability in food economy is one of the key instrument to sustainably keep the welfare of the people in proper economic shape. It is in view of this goal that policy makers and economists have continually paid attention to global food price dynamics. Volatility dynamics in food market is the totality of responses to different types of news including instability in exchange rate (Ogundipe, Ojeaga, Ogundipe, 2013; Chit et al., 2010; Jozsef, 2011, and Nwoko et al., 2016). This response, in a high food importing and developing countries, has various policy implications. It can induce rising food prices (Brinkman, Hendrix, 2011; and Sol, Morales-Opazo, Garrido, Demeke, and Bardaj, 2013), and this is a constraint to access adequate food and nutrition. The effects of this in developing and low income countries include but not limited to increasing food related crises, poverty and poor consumption habit. The state of food economy, to a large extent, dictates the pace of growth in other sectors of any economy. Therefore, failure to achieve stability in food and agricultural commodity prices may; aggravate inefficiencies, cause less competitiveness, increase food prices and also prompt global food insecurity (HLPE, 2011; Gilbert, Morgan, 2010; Hajkowicz, Negra, Barnett, Clark, Harch, Keating, 2012; and Minot, 2013). Although financial experts have opined that one off spikes in price is not abnormal in trading cycle however, posited that high persistence in volatility bears high intensity of risk (Jain, Strobl, 2016) and causes inflation in food prices (Sehkar, Roy, Bhatt, 2017). Therefore, volatility persistence is of interest in analyzing food and agricultural market. Food price volatility affects both food consumers (food expenditure) and producers (food prices - income). In low and middle income countries, household expenditure put serious pressure on household income at the expense of other financial obligations. On the other hand, agriculture provides direct and indirect jobs for over 60% of Nigerian population (Nigerian Bureau of Statistics). Risk in food market therefore, becomes intolerable when it is persistent. Production and market risks in agriculture and agribusiness have been linked to weather, inadequate access to input and output market, international market dynamics, multiple contracts period spillover etc. In developing countries, policy strategies to mitigate against price volatility have produced both positive and counter-positive effects. For instance, periods of obstructive monetary policy have resulted into frequent changes in value of dollar and most often, this consistently altered food price dynamics known market fundamentals. Oyejide (1986) and Ogundipe, Ojeaga, Ogundipe (2013) robustly discuss the influence of exchange rate policies on agriculture and economy in Nigeria. Therefore, achieving price (market) stability without robust discourse on price dynamics, level price and price volatility, will be difficult.

Price volatility is characterized by both upward and downward spikes in price movement. Besides market endogenous factors, these spikes are partly linked to market response to both government fiscal expansion and contractionary measures respectively. Importers and traders at domestic market often find periods with marked and frequent changes in exchange rate as difficult periods because they are

usually unable to meet their financial obligations to creditors. It is also a period of heightened risk in the foreign exchange (forex) market. The dynamics in the forex market is largely influenced by the volume of export relative to import. Nigeria is a net exporter and importer of crude oil and fuel respectively, and the volume of what is exported and imported makes her a dominant player in the global oil market. Trading activities in the world oil market remarkably influenced Nigerian currency since 1983 culminating into both favourable and unfavourable trade balances. The consequence is the exposure to dollar denominated debt. On the other hand, Kafle (2011) opines that agricultural production in low income countries is susceptible to the subtleties in forex market. For instance, according to Olusoji et al. (2014), Nigeria spent more than five times of income from food exports on food import bills. This expenditure patterns percolates down to household level. The degree of impact on the rural households depends on the coping strategies by the households, available social safety and stabilization measures by government.

Theoretically, low output induces supply falls and thus, price also goes up. A lot of factors affect domestic production in Nigeria hence, domestic food supply is not only inelastic and low but also not sufficient to meet demand. The risk averse producers are known to be highly cautious to avoid losses due to risk. The exploitation becomes complicated where insurance literacy is still abysmally low and only very few participants are involved. In view of this, food imports augment the inadequate domestic food supply. The forex market has been implicated in the dynamics of both agricultural input and output (food) markets (Ogundipe, Ojeaga, Ogundipe, 2013). Farm and processing machines, fuel, fertilizers and farm chemicals are imported while cash crops like cocoa, rubber and cotton with little of food products are exported. In completing these transactions, the price of dollar at forex market takes centre stage. This is one of the reasons it has become essential to know the degree of dependence of food price volatility on forex market instability. Findings have shown that the consumption behavior of poor households in the low income countries is largely influenced by food price volatility (Sol et al., 2013; Coyle, 1992; Haile et al., 2014; and Bellemare et al., 2013). Besides, high food price spike can also aggravate poverty (HLPE, 2011). For instance, shortly after the 2008 episode of global financial crises, the proportion of people, particularly in the sub-Saharan Africa, living on US\$1.90 or less per day as a result of the pass through effect of price volatility increased to 47% from the previous 40% (Wilson, 2015). Even after that episode in 2008, not much is known about food price volatility in Nigeria but in the last two decades, food prices trend in similar order as exchange rate. Many countries' including Nigerian forex market have also witnessed series of instability that contribute largely to general uncertainty in the average economy. There are concerns that this instability affects food prices, food price inflation and ultimately, the welfare of the both food producers and consumers. Experts have suggested the combination of well-grounded financial measures and macroeconomic measures as pre-conditions

for global economic rebound (Ferrara et al., 2018). Therefore, it is expected that adequate understanding of the food market dynamics can help policy makers on the appropriateness of strategies to reduce uncertainty in the economy with a view to enhancing households' welfare.

According to Newberry (1989), price volatility negatively affects both consumers and producers. Therefore, importance of agriculture and food in Nigeria economy cannot be over-emphasized. Hence, both the food price and its volatility have significant effects on Nigeria economy. This accounts for the close monitoring of the food market by producers, consumers, investors, and policymakers. It has been observed that both the type of news (positive or negative) and the degree of shocks to the variance (permanent or otherwise) have varying effects on food price volatility. Therefore, a very efficient food price volatility model will accommodate the perceptions on these endogenous and other likely exogenous factors in it. However, the challenges confronting forex market in Nigeria are deep and have become the nightmare of importing traders (including importation of food and agricultural input). The major problems confronting the forex market is that of multiplicity and the gap between the official and parallel market rates. The activities of the street hawkers (black market) have been implicated in these problems by players like Nigerian Inter-Bank Market, Bureau De Change (BDC) and Financial Market Dealers Quote (FMDQ). Furthermore, the influence of exchange rate on food market has been well argued hence, forex trading activities of Bureau De Change (BDC) and Inter-bank market (EXR) are spot on. There have been series of argument for and against the position that the frequent changes in the price of dollar affect food price volatility. The forex trading activities of BDC and Inter-bank market help to ensure stability in the forex market by ensuring a convergence between official and parallel market exchange rate. It is not uncommon to hear traders lament when exchange rate spikes very frequently. The Central Bank of Nigeria continually deploys various measures to guarantee stability in forex market. Although few studies have modelled food price volatility in Nigeria, it is critical to point out that most of the authors omitted the influence of the endogenous and exogenous factors on food price volatility. Such omission, which include modelling price volatility without recourse to structural breaks (endogenous) and influence of other markets such as forex market (exogenous) in the return series, can lead to spurious conclusions.

This study attempts to analyze the response of food price volatility to both positive and negative news and the persistence of these shocks with adequate attention paid to structural breaks in the mean equations. In order to achieve these: (1) we investigate the asymmetric volatility response to both positive and negative news; (2) we assess volatility persistence in food price volatility; and (3) we examine the pass through effect of exchange rate (BDC and EXR) volatility on conditional volatility of food prices in Nigeria. The significance of this study is its contribution to the debate on food price dynamics in Nigeria. It increases available information on food price

movement to major participants in food value chain and also widens the policy options required to manage food price stability.

Other parts of the paper are structured as follows: session two reviews the related literature to the study; session three focuses on theory and methods; discussion on results of model estimation is in session four; and the conclusion is on session five.

2. LITERATURE

Globally, empirical studies have been carried out on stock and food price volatility, volatility persistence, asymmetry of distribution error and leverage effects. Persistence to food price volatility is capable of delaying the return of food prices to its mean value. According to Sehkar, Roy and Bhatt (2017), persistence food price volatility predisposes food prices to food price inflation. Poterba and Summer (1986) explains that if the variance equation gives a parameter estimate that indicates high volatility persistence, then it implies that the shocks will decay slowly. A high degree of price volatility persistence in shocks to conditional variance is an indication that the perception about low return will linger for a longer period (McAleer et al., 2007). Interpreting that in another way, it means that higher degree of shocks increases persistence in volatility and this can increase food price inflation. This corroborates the findings of Cornia, Deotti, and Sassi (2012). Fasanya and Adekoya (2017) empirically observe the volatility persistence and leverage effects in the consumer price indices (headline and core) and find that there is strong persistence in inflation volatility for both types. Several studies have confirmed persistence in food price volatility (Ajeet, Sascha, 2017; Ismail, Ihsan, Khan, Jabeen, 2016; Ojogho, Egware, 2015; Osarumwense, Waziri, 2013; Rovinaru, Rovinaru, 2013; Omojimite, Akpokodje 2010). However, the literature is not rich enough on how these dynamics reel out on rural food prices and imported food prices in Nigeria.

A number of studies have been conducted to investigate transmission effects across markets (Nwoko, Aye, Asogwa, 2016; Khiyavi et al., 2012; Rezitis, Stavropoulos, 2011; Rezitis, 2010; and Apergis, Rezitis, 2011). Alom et al. (2011) provides an insight to the spillover effect of oil on food prices while Engle and Ng (1993) give a clue on how to measure the impact of new information on volatility. Their findings buttress the asymmetric state of the impact curves. That is, there is inverse relationship between new information and volatility. The effect of exchange rate volatility on agricultural trade flow is well established in literature (Chit et al., 2010; and Jozsef, 2011), and policy makers have continually made attempts to mitigate against these subtleties in exchange rate. Vita and Abbott (2004) analyzed the impact of exchange rate volatility on US exports to other countries using the ARDL bounds testing approach to cointegration. Nwoko, Aye, and Asogwa (2016) find that oil market volatility is transmitted to food price volatility using Johansen cointegration. A modified two-stage procedure based on modified GARCH in mean has also been used to ana-

lyze volatility spillover between markets. Ezzati (2013) applied this approach to analyze the international transmission of financial volatility among six countries - US, Germany, Kuwait, Saudi Arabia, Japan and Iran.

Sun, Kim, Koo, Cho and Jin (2002) opine that exchange rate risk has significant and negative effect on wheat export worldwide. Ogundipe, Ojeaga and Ogundipe (2013) found long run relationship between exchange rate and trade balance in Nigeria. However, their findings reveal that money supply volatility, more than exchange rate volatility, affects variances in trade balance. Ott (2010) finds out that uncertainty in exchange rate influences agricultural commodity prices. Similarly, Mushtaq et al., (2011), Yu, Bessler and Fuller (2006); Campiche et al., (2007); Frank and Garcia (2010) have joined the growing list of authors who have provided empirical evidences to support that exchange rate has significant impact on food and agricultural commodity prices. According to the study of Vita and Abbott (2004), their findings reveal that the considered markets are significantly affected by exchange rate volatility. Similar studies also reveal that soybean trade flow is significantly influenced by uncertainty in foreign exchange market (Anderson and Garcia, 1989). Zheng, Kinucan and Thompson (2008) assert that low (food) prices induce increase in price volatility. Ismail, Ihsan, Khan and Jabeen, (2016) finds inverse relationship between exchange rate and returns. It has been affirmed that frequent changes in exchange rate affect agribusiness, but despite depending on food imports to meet her food demand, the debate on the effect of exchange rate volatility on food price (movement) volatility remains inconclusive. In Nigeria, this narrows down the policy options available for policy makers. In literature, only very few studies have investigated the influence exogenous factors on food price volatility. Besides, it is even rarer to find studies on food price volatility that accommodate structural breakpoints in model estimation. Evidences abound that modelling price volatility without adequate considerations to breakpoint in the series will undermine the prediction power of the model (Salisu, Fasanya, 2013; Salisu, Oloko 2015; and Fasanya, Adekoya 2017).

3. THEORY AND METHODS

The first challenge associated with measuring price volatility is how to separate predictable price changes from unpredictable price changes. The literature is replete with evidences that authors measured price volatility using standard deviations and/or coefficient of variance (Kenyon, 2001; Gilbert, Morgan, 2010; Maurice, Davis, 2011; Minot, 2013; Syampaku, Mafimisebi, 2014; Bobola et al., 2015; and Agunbiade, et al., 2015). The missing gap in the above is that past price and volatility realizations do not have role to play in the determination of the present and future price realizations. This assumption punctures the thought that farmers and other agents in food market understand and can differentiate price processes influenced by seasonal changes and ex-ante knowledge of conditional distribution of prices. This results

to the striking difference between predictable and unpredictable price changes respectively. Scholars have argued that measuring price volatility without differentiating these two features hypes the degree of risk in price process (Dehn, 2000; and Gilbert, Morgan, 2010).

In order to separate the unpredictable price changes from the predictable price changes, quite a number of authors have provided clues (Ramey, Ramey, 1995; and Moledina et al., 2004). Brown, Halow and Tinic [BHT], (1988) develop Uncertain Information Hypothesis [UIH] to describe the behavior of traders and producers in an unpredictable scenario. The high point of UIH is that flow of unpredictable information (uncertain) or surprises influences market instability, a deviation from market efficiency. Therefore, market's response to uncertain information creates some overreactions. These market reactions, over a period, create a tranquil and spiky phenomenon (Mandelbrot, 1963). It means that a period of tranquility of small returns is intermingled within the period of volatility of large returns. The spikes are evidence of risk a threat to market stability (Prakash, 2011; and Rydberg, Shephard, 2003). Although this theory establishes the influence of uncertain information in market instability but the full impact of the information is not appropriately defined.

Engle (1982) develops an Autoregressive Conditional Heteroscedasticity (ARCH) model to help in modelling price volatility and determine the magnitude of shocks caused by its own shock and independent variables included in the model. It simply captures an autoregressive moving average process for the variance process of time series to give an estimate of the conditional variance of the process per time in the sample. The ARCH model became popular because of how it characterizes changing variance (volatility). ARCH model exposes the relationship that can exist between conditional variance of residuals and the addition of all the squared residuals in the recent past, and because many parameters are required, large lag length is also required (Rydberg, Shephard, 2003). In order to achieve this, the variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables (Green, 2007).

Evidences abound that some financial time series have inbuilt unpredictable features referred to as stylized property (Cont R, 2000) and exhibition of non-constant variance (heteroscedasticity) is also a common phenomenon (Tsay, 2005). All these make some financial time series to defy the normal distribution assumptions hence, the past volatility cannot be used to predict the present of future volatility using the assumptions of Ordinary Least Square (OLS) procedure. Recent studies have shown that food prices, like financial time series, exhibit these stylized and volatile properties (Osarumwense, Waziri, 2013; Ojogho, Egbare, 2015; and Ikuemonisan, 2017).

The ARCH model became popular because of how it characterizes changing variance (volatility). GARCH model is relatively better than the ARCH model in terms of parsimony. It also captures the persistence of volatility, though it has its short-

coming. These include: its inability to capture the symmetric effect of how volatility evolves in response to positive and negative news (leverage effect); the restrictions of non-negativity imposed on the parameter to the estimated, and clumsiness in revealing persistence in stationary series. In view of these challenges, other variants of GARCH model specifically designed to include asymmetric and leverage effects of estimated parameters, the following models have evolved: TGARCH, PGARCH, GJR and EGARCH developed by Nelson (1991). The latter has reliably proved that it can address some of the challenges confronting GARCH model particularly non-negative restriction. This is achieved with logarithmic transformation in the model specification. Similarly, it also expresses leverage effect in the model as exponential. The model introduces a parameter that can reveal how conditional variance respond to both positive and negative shocks of equal magnitude (asymmetric effect). Besides, the appropriate methodological approach to estimate volatility and volatility spillover across markets is also one of the contemporary issues along this conversation.

Therefore, attempt to reject the null hypothesis for no evidence of persistence in food price volatility portends predisposition to food price inflation which can compel low income households to negatively change their feeding habit. For the purpose of policy also, ascertaining the type of news (positive and negative news) that causes volatility persistence in food prices will in the management of the markets/direction where such innovations/news emanate from. The theory of leverage effect suggests that negative news hypes price volatility. Negative news is usually part of the outcomes of policies that are not well thought-out. Above all, frequent changes in policies are hallmark of government in developing countries and these often result in structural breaks in price series. Therefore, evidences of structural breaks can add to the debate on food price volatility.

3.1. Data and Methodology

Food is central to household economy in low income countries. According to National Bureau of Statistics (2014), more than 70 percent of Nigerians live directly and indirectly on agriculture. Similarly, studies have revealed that more than 60 percent of household income is spent on food (Mgbenka, Mbah, Ezeano, 2015). It may be convenient to state that the market (supply and demand) dynamics affect the predominant rural poor farmers in low income countries as food producers and consumers. According to Olusoji et al. (2014), the evidence that domestic food supply is grossly inadequate hence the need to augment with food importation is the increasing food import bill which is fast depleting forex reserve. The importation dimension to food supply increases the possible influence of forex market. It is in view of these this study considers food prices (on the composite food prices) and forex market (Bureau De Change - BDC and Inter-bank exchange rate-EXR). Data were obtained on food price index (FPI), composite imported food consumer

price index - CIFICPI, price of dollar in Bureau De Change (BDC) and price of dollar in Inter-Bank Market (EXR) from Food and Agriculture Organization (FAO), National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN). FPI is aggregated from the retail prices of both domestic and imported food. CIFICPI is aggregated exclusively from retail prices of imported food. BDC and EXR represent the exchange rate at the Bureau De Change and Inter-Bank Market respectively. 320 and 272 observations of price of dollar (BDC) and EXR respectively were obtained from CBN while 86 and 336 observations of CIFICPI and FPI were obtained from National Bureau of Statistics (NBS) and Food and Agriculture Organization (FAO) respectively. In this study, we disaggregated the series: on the basis of start date of observation (block 1 - ≤ 1995 and block 2 > 2008); and on the basis of discarding/including structural break date in the data series.

Inadequate data was a huge constraint in this study. Since only 86 data points (2009M11 - 2016M12) of price volatility of CIFICPI returns (CIFICPIRETURNS) were available, we modelled same sample size for FPI returns (FPIRETURNS) with a view to comparing the volatility persistence in each of the disaggregated series (with or without structural breakpoint included in the Mean Equation) and the influence of exchange rate volatility on it. In all, the returns series are formed into sub-samples which are coded as: R1, R2, R3, ..., R16. The disaggregation was done for the purpose of convenience to achieve the objectives of the study. The missing values in the price of dollar at inter-bank market (EXRETURNS) were forecasted using GARCH (1,1). The report is not included in this study because of space.

3.2. Model Specification

3.2.1. Leverage Effect and Persistence in volatility

Considering the stylized facts attributes of each of the series, we proceed to model the sub-sampled returns series as follows:

We specified k- variable regression thus:

$Y_t = \alpha_0 + \alpha_2 X_2 + \dots + \alpha_k X_{kt} + \varepsilon_t$, and ε_t follows a normal distribution hence, it is written as $\varepsilon_t = v_t \sqrt{h_t}$. v_t is a white noise such that $v_t \sim N(0,1)$ given that v_t and h_t follow i.i.d hence, $v_t \sim N(0,1)$. It should be noted that h_t is an element of an information (F_{t-1}) set over the previous period of time. It implies that $E(\varepsilon_t | F_{t-1}) = (v_t \sqrt{h_t} | F_{t-1}) = E(v_t | F_{t-1}) E(\sqrt{h_t} | F_{t-1}) = 0 \sqrt{h_t} = 0$ and $Var(\varepsilon_t | F_{t-1}) = E(u_t^2 | F_{t-1}) = E(v_t \sqrt{h_t} | F_{t-1})^2 = E(v_t^2 | F_{t-1}) E(h_t | F_{t-1}) = h_t = 0$. This is particularly so because $E(v_t^2 | F_{t-1}) = 1$ and $\varepsilon_t \sim N(0, h_t)$ and $\varepsilon_t \sim N(0, h_t)$.

Bollerslev (1986) incorporated lagged terms of the conditional variance (h_t) in the ARCH model to generate infinite order of ARCH model called generalized ARCH (GARCH). At this juncture, we prefer to replace the conditional variance (h_t) with (σ_t^2). Therefore, GARCH (1,1) can be written as:

$\sigma_{it}^2 = \alpha_0 + \alpha_1 \varepsilon_{it-1}^2 + \beta_1 \sigma_{it-1}^2$. On the strength that Exponential GARCH (EGARCH) models have taken care of shortcomings GARCH model because it achieves covariance stationarity when the GARCH term is less than 1 (Shephard, 1996). EGARCH model was developed by Nelson (1991). In each case, the model adequacy is tested using the post diagnostic procedure as explained by (Tsay, 2002; Gouriéroux, Jasiak, 2010; Engle 1982; and Bollerslev, 1986).

EGARCH model consists of two equations - mean and variance equations of food price inflation rate series:

Conditional Mean Equation:

The returns series are obtained as $R_t(k) = \log P_t - \log P_{t-k} = \log \left(\frac{P_t}{P_{t-k}} \right) * 100$. The log difference provides the basis to analyze the structural behaviour of the selected series. Given that R_t , P_t and P_{t-k} represent $R_1 - R_{16}$, FPI/BDC/EXR/CIFCPI value at month (t) and FPI/BDC/EXR/CIFCPI value at the previous month (t-k) in that order, the conditional mean equation is expressed as,

$$R_{it} = \alpha_0 + \alpha_1 R_{it-q} + \varepsilon_{it} \quad (1)$$

$$R_{it} = \alpha_0 + \alpha_1 R_{it-q} + \alpha_2 D_i + \varepsilon_{it} \quad (2)$$

$$\varepsilon_t \sim (0, \sigma_t^2)$$

α_0 is a constant (average of returns over the period), α_1 and α_2 are coefficients of one period lagged return series and the dummy variable (D) respectively. The dummy variable captures the structural break in returns series. Post and pre structural break dates are coded 1 and 0 respectively.

The conditional variance of EGARCH model (1,1) model is specified as;

$$\log(\sigma_{it}^2) = \omega_i + \beta \log(\sigma_{it-1}^2) + \gamma \frac{\varepsilon_{it-1}}{\sqrt{\sigma_{it-1}^2}} + \alpha \left[\frac{|\varepsilon_{it-1}|}{\sqrt{\sigma_{it-1}^2}} - \sqrt{\frac{2}{\pi}} \right], \quad (3)$$

3.2.2. Model Selection

This is an important aspect of the study. Two-stage selection is required to select the best model for each returns series with which to estimate the spillover effect of exchange rate volatility on food price volatility. In the first step of selection, each returns series is modelled using EGARCH equation under the three distributions (Gaussian normal distribution, t-distribution and Generalized error distribution). At this stage, all returns series are modelled without recourse to structural break. Selection of the best model for each series is based on the pre-tests suggested by Engle

(1982). The major selection criteria are Akaike Info Criterion (AIC), Schwarz Criterion (SC) and Hannan-Quinn Criterion (HQC) as well as maximum Log likelihood ratio (LLR). The rule is that the most efficient model has the least AIC, SC and HQC values. Each of the selected equations is deployed to model the returns series but with the inclusion of structural breakpoint. At the second stage of model selection, the results obtained from the estimation of EGARCH models with inclusion of structural breaks in the mean equation are compared to those without structural breakpoints accordingly. At this stage of selection, we relied strongly on LLR to compare the better fit of the EGARCH models estimated with or without structural breakpoints in the mean equations for each returns series.

Therefore, from the selected models, we attempt to;

- (i) investigate the asymmetric volatility response to both positive and negative news;
- (ii) assess the volatility persistence in food price volatility; and
- (iii) examine the pass through effect of exchange rate (BDCRETURNS and EXRETURNS) volatility on conditional volatility of food prices in Nigeria.

3.2.3. Spillover between Foreign Exchange Market and Food Markets

This study adapts the EGARCH univariate approach to achieve objective 3. After accounting for both the correlation and volatility clustering properties, the conditional volatility of exchange rate R_1 - R_9 (σ_{it}^2) models earlier saved are later fed into each of EGARCH models estimated for the selected food series (R_{10} - R_{16}).

EGARCH conditional variance equation for the exchange rate spillover to food

$$\log \sigma_{it}^2 = \omega_i + \beta \log(\sigma_{it-1}^2) + \gamma \frac{\varepsilon_{it-1}}{\sqrt{\sigma_{it-1}^2}} + \alpha \left[\frac{|\varepsilon_{it-1}|}{\sqrt{\sigma_{it-1}^2}} - \sqrt{\frac{2}{\pi}} \right] + \delta_1 \sigma_{it}^2 \quad (4)$$

where ω , β , γ , and α are parameters to be estimated. These parameters are defined as follows:

$i = R_1 - R_{16}$

γ = captures leverage effect;

$\gamma < 0$ means conditional volatility of i responds to -ve shock more than +ve shock;

$\gamma > 0$ means conditional volatility of i responds to +ve shocks more than -ve shocks;

α = captures magnitude of conditional shocks on the conditional variance

β = Persistence

$H_0 = \beta_1 = 0$ (No persistence); and $H_1 = \beta_1 \neq 0$

$H_0 = \gamma = 0$ (No leverage); and $H_1 = \gamma \neq 0$

Given that R_{it} is returns of the selected series ($R_1 - R_{16}$), R_{t-k} are lagged R_{it} , ε_t

stands for error term (white noise). Therefore, ω_i , α_0 , α_1 , α , β , γ , and δ_1 are parameters to be determined in each model.

3.3. Model Estimation

3.3.1. Preliminary and Post Estimation Diagnostic Tests

We began our estimation by assessing the descriptive statistics of both the level and the returns of selected series in block 1 (FPI, BDC and EXR) and CIFICPI. This is specifically to determine the mean, standard deviation, coefficient of variation of the returns series. The Jarque-Bera test provided information on the normality status of the selected series (not included on the table because of space). The Augmented Dickey-Fuller is used to ascertain that the selected returns series are stationary. This is necessary because in financial series, the possibility of non-stationarity is high and our model requires that the series are stationary to avoid spurious estimates. We modelled EGARCH under the three distributions, Gaussian normal (N-EGARCH), t-distribution (T-EGARCH), Generalized Error Distribution (Ged-EGARCH).

Unit root test is carried out on the disaggregated series (R1 - R16). The Augmented Dickey-Fuller (ADF) test is carried out on each of the returns series without consideration for structural breaks in the series to validate or otherwise the presence of unit root in the returns series. Similar test is also conducted using breakpoint unit root test (Augmented Dickey-Fuller - ADF). This is to consider the structural breaks in the series. Decision Rule: If the test statistics is below the critical value, then accept null, but reject it if otherwise.

The Ljung-Box-Pierce (null: no serial correlation in the series) and ARCH Lagrange Multiplier, ARCH -LM, (null: no ARCH effect in the series) tests are carried out on the residuals and residual squares respectively to ascertain the autocorrelation and volatility bunching in the selected series. The approach therefore, is that a decision threshold of 5% was set for the P values to either reject the null hypothesis or otherwise by the Ljung-Box and ARCH -LM tests. For each of the model, the rejection of null hypotheses by ARCH-LM test is an evidence that the volatility of the returns can be modelled by EGARCH model.

The importance of the post estimation diagnostic test is to validate the performance of the EGARCH model. We rely on the ARCH-LM test to ensure that the EGARCH model sufficiently account for all the volatility structure in each of the selected series. ARCH-LM (null: no ARCH effect in the series), and we also follow the decision threshold of 5% for the P values to either reject or not to reject the null hypotheses. Once there is no basis to reject the null hypotheses by ARCH-LM tests, it implies that the volatility structure of the series has been efficiently modelled by the EGARCH models.

3.3.2. Maximum Log-likelihood Function

The Quasi Maximum Log Likelihood (QML) estimation was used to achieve parameter estimates for both conditional mean and variance equations. Gaussian (normal) distribution and BFGS-BOUNDS were the choice for parameter estimation because it converges for optimum quadratic Taylor expansion.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 1. presents the descriptive statistics for the returns of selected series. Based on the values of standard deviation, the BDCRETURNS (1.81) is more volatile than EXRETURNS (1.27) while FPIRETURNS (1.10) spikes higher than CIFCPIRETURNS (0.80). Using the coefficient of variation to describe the volatility of only the returns series, CPIRETURNS (38.2%) is the more volatile than CIFCPIRETURNS (5%). On exchange rate, volatility of BDCRETURNS (26.5%) rises higher than that of EXRETURNS (17.7%). However, the differentials in the size of observations, simplicity of the method and its disregard for time trend make it difficult to draw conclusion on whether or not these volatility results reflect reality about the risk in food market. Further estimation of conditional volatility is required to validate these findings. On the other hand, a random normal distribution is expected to have a symmetrical distribution of observations with bell like peak. All the returns series defy this pattern. FPIRETURNS and CIFCPIRETURNS are skewed to the right, BDCRETURNS and EXRETURNS are skewed leftwards. The kurtosis value for each of the series shows that the leptokurtic attributes of each of the returns series is well pronounced. The attributes suggest that the series deviates from normal distribution. The Jarque-Bera test confirms that each of the returns series is not normally distributed. The observed structure in each of the returns series indicates the presence of volatility. Following these outputs, the returns series are disaggregated as R1 - R16.

Table 1. Descriptive statistics of data series used in the analysis

Series	Sample period	N	Mean	Std. Dev.	Coef. Var.	Skewness	Kurtosis	Jarque-Bera	Probability
BDC	1991Mo1 - 2017Mo8	320	135.21	82.37	1.641	1.80644	7.942776	499.7857	0.0000
BDCRETURNS	1991Mo1 - 2017Mo8	319	-0.48	1.81	0.265	-0.92808	8.873882	504.3892	0.0000
CPI	1990Mo1 - 2017M12	336	139.73	43.45	3.216	0.708397	2.16525	37.8576	0.0000
CPIRETURNS	1990Mo1 - 2017M12	335	0.42	1.10	0.382	0.493037	5.483994	99.69836	0.0000

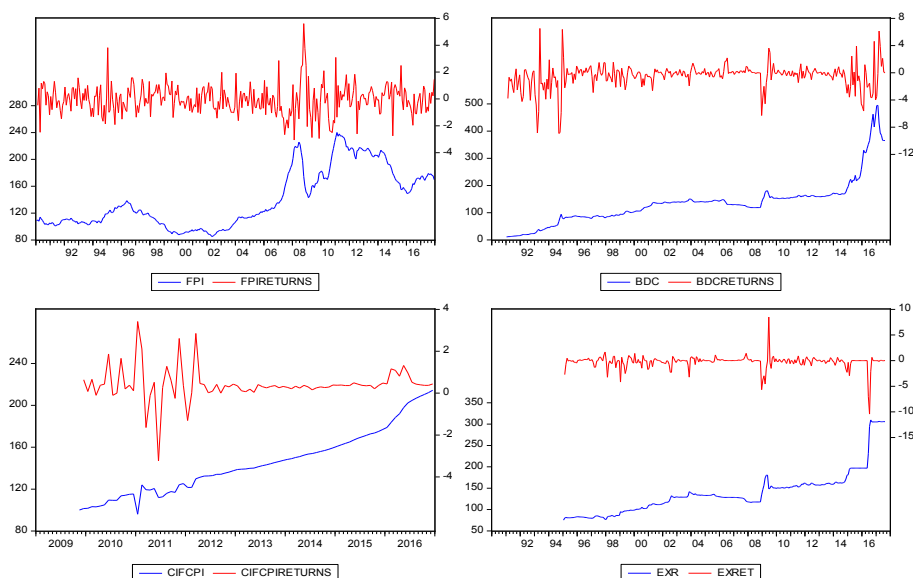
Series	Sample period	N	Mean	Std. Dev.	Coef. Var.	Skewness	Kurtosis	Jarque-Bera	Probability
CIFCPI	2009M11 - 201612	86	144.97	30.48	4.756	0.5411	2.5568	4.8997	0.0863
CIFCPIRETURNS	2009M11 - 201612	85	-0.04	0.80	0.050	0.0017	10.8844	220.1649	0.0000
EXR	1995M01 - 2017M08	272	138.347	50.64	2.732	1.6917	6.5757	247.64	0.0000
EXRRETURNS	1995M01 - 2017M08	271	-0.2244	1.27	0.177	-2.1448	29.4165	8089.339	0.000

Note: All variables are expressed in logarithmic first-difference form.

Source: Data Analysis, 2018.

Figure 1. shows the graphical representations of the structure in both the level and returns series. There is clear evidence of volatility clustering in the returns series. The FPIRETURNS and EXRETURNS peaked in 2008. A period that coincides with global financial crisis. The peak of volatility in BDCRETURNS is witnessed between 93/94. Although volatility in BDCRETURNS is also observed to be high in 2008 and 2016 but not as high as the peak period. The volatility clustering in CIFCPIRETURNS is evident in 2011. At that period, the world witnessed a mild global food crisis as part of hangover from 2008 global financial crisis. Experts linked that mild crisis to the counter effects of some restrictive policies taken by some countries to prevent pass through effects from international market to domestic markets. The spikes are the market responses to both government fiscal expansion and contractionary measures.

Figure 1.: Graphical representation of Combined Level and Returns Series (CPI,CFPI, BDC and EXR)



Source: Data Analysis, 2018.

4.2. Unit Root Test

The results of the unit root test are presented in Table 2. The stationarity of the series is a pre-requisite for estimating GARCH models. The results reveal that all the returns series are found to be stationary at level. This evidence is obtained from the P-values which indicate that the null for each of the series can be rejected in favour of the alternate hypothesis at 1% significant level.

Table 2.: Unit Root Test

Code	Variable Description (Only Returns Series are modelled)	Break Date	Period	Test of Unit Root	Test Statistics	Critical Statistics (1%)	P Value	Source of Data
R1	Block 1: Pool BDCRETURNS without including dummy for structural break in Mean Equation	1994M10	1991M01 - 2017M08	I(o)	-12.1142	-3.9917*	0.0000	CBN
R2	Block 1: Pool BDCRETURNS with dummy for structural break included in Mean Equation		1991M01 - 2017M08	I(o)	-14.2266	-4.949	0.01	
R3	Block 1: POST structural break date in BDCRETURNS		1994M11 - 2008M10	I(o)	-13.699	-4.0139	0.0000	
R4	Block 2: BDCRETURNS without structural break in the Mean Equation		2009M11 - 2016M12	I(o)	-8.9034	-4.4635	0.000	
R5	Block 2: BDCRETURNS with structural break in the Mean Equation	2015M12	2009M11 - 2016M12	I(o)	-9.5997	-4.9491	0.010	
R6	Block 1: EXRETURNS without Break Date	2016M07	1995M01 - 2017M08	I(o)	-10.6647	-3.9925	0.0000	CBN
R7	Block 1: EXRETURNS with Break Date		1995M01 - 2017M08	I(o)	-13.8220	-4.9491	0.000	
R8	Block 2: EXRETURNS without Break Date		2009M11 - 2016M12	I(o)	-6.847	-4.0696	0.000	

Code	Variable Description (Only Returns Series are modelled)	Break Date	Period	Test of Unit Root	Test Statistics	Critical Statistics (1%)	P Value	Source of Data
R ₉	Block 2: EXRETURNS with Break Date	2016M05	2009M11 - 2016M12	I(0)	-8.4043	-4.9491	0.010	FAO
R ₁₀	Block 1: Pool FPIRETURNS without including dummy for structural break in Mean Equation		1990M01 - 2017M12	I(0)	-7.246	-3.9912*	0.000	
R ₁₁	Block 1: Pool FPIRETURNS with structural break dummy included in Mean Equation	2008M10	1990M01 - 2017M12	I(0)	-8.9811	-4.9491	0.010	
*R ₁₂	Block 1: Pre structural break date in CPIRETURNS		1994M11 - 2008M10	I(0)	-3.8922	-3.4372**	0.014	
R ₁₃	Block 2: FPIRETURNS series (Without Break Date included)		2009M11 - 2016M12	I(0)	-7.8730	-4.0696	0.0000	NBS
R ₁₄	Block 2: CIFCPIRETURNS with structural Break included in the Mean Equation	2011M06	2009M11 - 2016M12	I(0)	-5.5502	-3.5144	0.0000	
R ₁₅	Block 2: CIFCPIRETURNS without including structural Break in Mean Equation		2009M11 - 2016M12	I(0)	-10.7127	-4.9491	<0.01	
R ₁₆	Block 2: FPIRETURNS series (With Break Date included)	2015M08	2009M11 - 2016M12	I(0)	-8.3072	-4.9491	<0.01	

Note: *POST structural break date in BDCRETURNS/ Pre structural date in CPIRETURNS in block 1 (both are independent of whether or not structural breakpoint is included).

Source: Data Analysis, 2018.

4.3. Ljung-Box-Pierce and ARCH Lagrange Multiplier Tests

Table 3. contains the outputs of Ljung and ARCH tests. Notably, the output of ARCH Lagrange Multiplier test null hypothesis is rejected at 1 lag but R6, R8 & R9 reject null hypotheses at lag 2 while R14 & R15 reject null hypotheses at lag 6. It implies that the presence of ARCH effect in the returns series gives the sufficient condition for the series to be modelled using EGARCH. The other necessary condition is the presence of long memory in the returns series. The Ljung-Box-Pierce test reveals the evidence of strong autocorrelation (long memory recall) in all the series except R3, R5, R6, R7, R8, R9, R11, R13 and R16, where the long memory attribute of the series is very weak. The outputs of the ARCH-LM are convincing reasons to estimate these series using EGARCH models hence, we proceeded to model selection using the selection criteria (AIC, SIC and HQC). The best model is selected from among those estimated under the three distributions: Gaussian normal (N-EGARCH), t-distribution (T-EGARCH), Generalized Error Distribution (Ged-EGARCH). The selected model is posted accordingly for each return series (R1 - R16) in Table 3.

Table 3.: Output of ARCH LM Test, Liung-Box-Pierce and Model Selection

			ARCH (1-5)			ARCH (6-12)						
	Variable Description (Only Returns Series)	Period	DF	F Stat	P-value	DF	F Stat	P-value	Q (5)	Prob	Q (10)	Prob
R1	Block 1: Pool BDCRE- TURNS without including dummy for structural break in Mean Equation	1991M01 - 2017M08	1.315	14.479	0.000	6.305	9.7322	0.000	10.851	0.054	27.195	0.000
R2	Block 1: Pool BDCRE- TURNS with dummy for struc- tural break included in Mean Equation	1991M01 - 2017M08	1.315	10.513	0.001	6.305	7.064	0.000	12.460	0.029	31.263	0.001

			ARCH (1-5)			ARCH (6-12)						
R3	Block 1: POST structural break date in BDCRE- TURNS	1994M11 - 2008M10	1.165	117.67	0.000	6.155	0.646	0.6931	8.164	0.169	13.018	0.223
R4	Block 2: BDCRE- TURNS without structural break in the Mean Equation	2009M11 - 2016M12	1.103	13.497	0.000	6.93	6.580	0.000	14.353	0.014	20.399	0.026
R5	Block 2: BDCRE- TURNS with structural break in the Mean Equation	2009M11 - 2016M12	1.82	25.7426	0.000	6.72	6.3844	0.000	3.8088	0.577	15.115	0.128
R6	Block 1: EXRE- TURNS without Break Date	1995M01 - 2017M08	2.80	3.094	0.050	6.72	1.1644	0.3349	2.362	0.797	11.552	0.242
R7	Block 1: EXRE- TURNS with Break Date	1995M01 - 2017M08	1.267	24.2324	0.000	6.257	6.3269	0.000	5.9675	0.309	12.522	0.252
R8	Block 2: EXRE- TURNS without Break Date	2009M11 - 2016M12	2.80	3.5309	0.034	6.72	1.986	0.079	4.196	0.522	6.332	0.777
R9	Block 2: EXRE- TURNS with Break Date	2009M11 - 2016M12	2.80	3.4969	0.035	6.72	1.9736	0.081	4.366	0.498	6.483	0.773
R10	Block 1: Pool FPIRE- TURNS without including dummy for structural break in Mean Equation	1990M01 - 2017M12	1.328	81.052	0.000	6.318	15.063	0.000	122.71	0.000	126.77	0.000

			ARCH (1-5)			ARCH (6-12)						
R11	Block 1: Pool FPIRE-TURNS with structural break - dummy included in Mean Equation	1990M01 - 2017M12	1.328	16.090	0.000	6.318	4.2339	0.000	7.595	0.180	9.503	0.485
R12	Block 1: Pre structural break - date in FPIRE-TURNS	1994M11 - 2008M10	1.165	49.143	0.000	6.155	10.042	0.000	60.940	0.000	64.200	0.000
R13	Block 2: FPIRE-TURNS series without Break Date included)	2009M11 - 2016M12	1.82	3.8939	0.05	6.72	0.8323	0.548	4.001	0.549	8.915	0.540
R14	Block 2: CIFCPIRE-TURNS with structural Break included in the Mean Equation	2009M11 - 2016M12	1.81	0.094	0.7896	6.71	5.2346	0.0002	28.019	0.000	44.545	0.000
R15	Block 2: CIFCPIRE-TURNS without including structural Break in Mean Equation	2009M11 - 2016M12	1.81	0.0641	0.8007	6.71	5.1019	0.0002	28.338	0.000	44.796	0.000
R16	Block 2: FPIRE-TURNS series with Break Date included.	2009M11 - 2016M12	1.82	4.9347	0.029	6.72	0.9838	0.4426	3.8900	0.565	8.3733	0.592

Source: Data Analysis, 2018.

4.4. Leverage Effect and Volatility Persistence in estimated EGARCH Models

The dynamics in both food and forex markets are reflections of the behavior of economic agents therein including the government agents who craft and implement macroeconomic-stability-driven policies. Across and along food value chains, news/innovations are generated. Either positive or negative, the news has a way of influencing movement of food price and exchange rate series (structural and leverage effects). This may prolong or reduce the persistence in volatility dynamics. Appendix I presents the outputs of EGARCH model (with and without structural breakpoints included in the mean equation) showing leverage effect and volatility persistence. The selected equations are highlighted in yellow. Among these, R₂ (Block 1: Pool BDCRETURNS with dummy for structural break included in Mean Equation), R₅ (Block 2: BDCRETURNS with structural break in the Mean Equation), R₉ (Block 2: EXRETURNS with Break Date) and R₁₂ (Block 1: POST structural break date in BDCRETURNS) have leverage effects that are statistically significant at 1%, 1%, 5% and 10% respectively. It implies negative shocks, more than the positive shocks, increase conditional volatility in R₂, R₅ and R₉. On the contrary, positive news creates more shocks to conditional volatility of R₁₂. Given the threshold of 0.5, above is high persistence while below is low persistence. Therefore, in Appendix 1, volatility persistence is high in all the selected models except in R₁₂ (Block 1: POST structural break date in BDCRETURNS). The persistence of volatility gives clue about the speed it takes for shocks to decay off. At high persistence, shocks to conditional variation decay off very slowly but reverse is the case with low persistence. It implies that a high degree of price volatility persistence in the selected series (food price and exchange rate) is an indication that the perception about low return lingers for a longer time as opined by McAleer et al. (2007). The implication is that farmers factor this risk perception by setting their prices above the mean price value. This is capable of altering price competitiveness at international market.

4.5. Exchange Rate Volatility (Forex) Spillover to Food Price Volatility

The utmost goal of any economy is to, at least, achieve balanced trade if favourable trade is not possible. This prevents household from trading-off their welfare. For a country that depends on food importation to augment her inadequate domestic food supply to achieve and sustain her household welfare, her trade policies must be well-thought-out. Stability in forex market is one outcome of these efforts. However, achieving stability in the forex market in Nigeria has been a herculean task. It is in view of this, this study investigates the instability in Nigerian forex market and its spillover effect on food prices in Nigeria. The outputs of exchange rate volatility spillover to food market are presented in Appendix II. The selected EGARCH

model for each returns series is estimated to capture the transmission from forex (BDCRETURNS and EXRETURNS) volatility to food price volatility. In block 1, there is evidence of significant transmission from R₇ (Block 1: EXRVOL with Break Date) to R₁₁ (Block 1: Pool FPIRETURNS with structural break dummy included in Mean Equation). Findings also reveal that conditional volatility of R₁₄ (Block 2: CIFCPIRETURNS with structural Break included in the Mean Equation) is affected by R₅ (Block 2: BDCVOL with structural break in the Mean Equation) and R₉ (Block 2: EXRETURNS with Break Date). The fact that the volatility in price of dollar at inter-bank market (EXRVOL) affects the conditional volatility of each of FPIRETURNS and CIFCPIRETURNS, it implies that the instability in inter-bank exchange market strongly affects food prices. Also, BDCVOL and EXRVOL strongly affect imported food prices in Nigeria. The spillover may persist as the country increases her food imports in the light of instability in international food market.

5. CONCLUSION AND RECOMMENDATION

This study reveals that negative news more than positive news increases volatilities in the selected series. There is leverage effect in the conditional volatility of R₂, R₅, R₉ but positive news hypes conditional volatility in R₁₂. The forex market (BDC and Inter-Bank Market) is strongly affected by negative news. On speed of adjustment in the volatilities of food price and exchange rate, there is evidence that it takes a long period for shock to fade away in all the selected returns series except R₁₂. Such high persistence predisposes the markets (forex and food) to a prolonged perception of low returns hence, food producers/traders set prices above the mean value to avert risk. Consequently, food price inflation increases as opined by Sehkar, Roy and Bhatt (2017). This is not a good condition for market stability. Output on Appendix II provides the evidence that exchange rate volatility significantly spillover to food price market. This influence is more pronounced on the price volatility of imported food. Therefore, policies geared towards the stability of forex market can minimize the price volatility of imported food. The presence of structural shifts in the series is an evidence of impact of inconsistent macroeconomic policies implemented to achieve macroeconomic objectives including market stability. It aligns with the findings of Salisu and Fasanya (2013), Salisu and Oloko (2015), and Fasanya and Adekoya (2017). Therefore, consistent implementation of well thought-out macroeconomic policies particularly on forex, food and agriculture will hugely mitigate against food market risk and enhance household food security. This call becomes apt because household spend an average of 60% of household income on food. Achieving stability in food market will not only enhance household long term plan but also budget discipline. Therefore, when household food security is achieved, welfare is enhanced and more members of the households can contribute to economic growth.

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APPENDIX I. OUTPUT OF EGARCH MODEL

	Variable Description	Period	EGARCH and its selected distribution	Conditional Mean Equation			Conditional Variance Equation			
				α_0	α_1	α_2	ω	α	γ	β
R1	Block 1: Pool BDCRE-TURNS without including dummy for structural break in Mean Equation	1991M01 - 2017M08	T-EGARCH	-0.065***	0.263*		-0.165**	0.339*	-0.3306*	0.877*
R2	Block 1: Pool BDCRE-TURNS with dummy for structural break included in Mean Equation	1991M01 - 2017M08	T-EGARCH	-0.7945*	0.1936*	0.7388*	-0.1796**	0.3941*	-0.3464*	0.8632*
R3	Block 1: POST structural break date in BDCRE-TURNS/ Pre structural break date in FPIRETURNS	1995M11 - 2008M10	Ged-EGARCH	0.000	0.2716*		-0.360**	0.3794*	-0.1601	0.9157*
R4	Block 2: BDCRE-TURNS without structural break in the Mean Equation	2009M11 - 2016M12	Ged-EGARCH	-0.1618*	0.0672		0.3420*	-0.4524*	-0.5664*	0.9139*
R5	Block 2: BDCRE-TURNS with structural break in the Mean Equation	2009M11 - 2016M12	Ged-EGARCH	-0.2162*	0.0202	-1.5311*	0.3202*	-0.3616*	-0.4708*	0.9072*
R6	Block 1: EXRETURNS without Break Date	1995M01 - 2017M08	Ged-EGARCH	0.0000	0.1709*		-0.4305*	0.8589*	0.0250	0.6510*
R7	Block 1: EXRETURNS with Break Date	1995M01 - 2017M08	Ged-EGARCH	0.0129*	0.2078*	-0.0092*	-0.4484*	0.7994**	0.0318	0.6501*
R8	Block 2: EXRETURNS without Break Date	2009M11 - 2016M12	Ged-EGARCH	0.0037*	0.3106*		-0.4360*	0.7534*	-0.2592	0.6046*
R9	Block 2: EXRETURNS with Break Date	2009M11 - 2016M12	Ged-EGARCH	0.0006	0.1070***	-0.0578	-1.1043*	0.5829***	-0.7414**	0.7406*
R10	Block 1: Pool FPIRETURNS without including dummy for structural break in Mean Equation	1990M01 - 2017M12	T-EGARCH	-0.0390	0.1562		-0.1405**	0.1808**	-0.0315	0.9604*
R11	Block 1: Pool FPIRETURNS with structural break dummy included in Mean Equation	1990M01 - 2017M12	T-EGARCH	-0.0443	0.1558*	0.0283	-0.1401**	0.1805**	-0.0309	0.9600*
R12	Block 1: POST structural break date in BDCRE-TURNS/ Pre structural break date in FPIRETURNS	1995M11 - 2008M10	T-EGARCH	-0.0309	0.2896*		-0.2272	0.2436	0.2569***	0.1675
R13	Block 2: FPIRETURNS series without Break Date included)	2009M11 - 2016M12	T-EGARCH	0.1562***	0.1394**		0.9390	-0.2738	0.0732	-0.6503***
R14	Block 2: CIFCPIRETURNS with structural Break included in the Mean Equation	2009M11 - 2016M12	T-EGARCH	0.1625**	0.2776*	0.0882	-0.6478*	1.6538	-0.2486	0.9377*
R15	Block 2: CIFCPIRETURNS without including structural Break in Mean Equation	2009M11 - 2016M12	T-EGARCH	0.2506*	0.2778*		-0.6524*	1.5909	-0.2324	0.9398*
R16	Block 2: FPIRETURNS series with Break Date included.	2009M11 - 2016M12	T-EGARCH	0.2857*	0.1499**	-0.6293*	0.9644	-0.2312	0.1132	-0.7238*

Note: *, **, *** mean 1%, 5% and 10% level of statistical significance respectively.

Source: Data Analysis, 2018.

APPENDIX II. OUTPUT OF EXCHANGE RATE (FOREX) VOLATILITY SPILLOVER TO FOOD PRICE VOLATILITY

Reaction	Dependent Variable	Exogenous Variable	Period	Conditional Mean Equation				Conditional Variance Equation				POST DIAGNOSTIC TEST / ARCH LM Test			
				α_0	α_1	α_2	ω	α	γ	β	δ_1	AIC	SIC	LLR	FStat
Ru1 x R2	Block 1: Pool FPIRE-TURNS with structural break dummy included in Mean Equation	Block 1: Pool BDCVOL with structural break included in Mean Equation	1995M01 - 2017M08	-0.0483	0.1707*	0.0420	-0.1978**	0.2487**	-0.0023	0.9093*	0.0004	2.9533	3.0726	-392.65	0.3767 (-0.5399) NS
Ru1 X R7	Block 1: Pool FPIRE-TURNS with structural break dummy included in Mean Equation	Block 1: EXRVOL with Break Date	1995M01 - 2017M08	-0.0398	0.1610*	0.0638	-0.0252	0.1232	0.0050	0.9717*	-0.0909***	2.9086	3.0285	-383.66	0.7072 (0.4011) NS
Ru6 X R5	Block 2: FPIRE-TURNS series (With Break Date included)	Block 2: BDCVOL with structural break in the Mean Equation	2009M11 - 2016M12	0.2856*	0.1499**	-0.6293*	0.9591	-0.2296	0.1143	-0.7242*	0.0020	2.9690	3.2276	-117.18	0.0014 (0.9704) NS
Ru6 X R9	Block 2: FPIRE-TURNS series (With Break Date included)	Block 2: EXRVOL with Break Date	2009M11 - 2016M12	0.2893*	0.1502**	-0.6418*	0.9619	-0.1890	0.1532	-0.7318*	-0.0146	2.9671	3.2258	-117.10	0.0014 (0.9703) NS
Ru4 X R5	Block 2: CIF-CPIRE-TURNS with structural Break included in the Mean Equation	Block 2: BDCVOL with structural break in the Mean Equation	2009M11 - 2016M12	0.1647**	0.2650*	0.0977	-0.4754***	1.4475	0.0574	0.8900*	-0.0747**	0.7601	1.0188	-23.31	0.1757 (0.6761) NS
Ru4 X R9	Block 2: CIF-CPIRE-TURNS with structural Break included in the Mean Equation	Block 2: EXRVOL with Break Date	2009M11 - 2016M12	0.1617**	0.2666*	0.0997	-0.3661	1.2119	-0.0315	0.9095*	-0.0881*	0.7213	0.9799	-21.66	0.6648 (0.4172) NS

Note: *, **, *** mean 1%, 5% and 10% leel of statistical significance respectively.
Source: Data Analysis, 2018.

STUDY ON THE SERVICE QUALITY E-RETAILING VARIABLES AFFECTING BRAND LOYALTY

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ABSTRACT

Purpose. *The study aims to study four attributes of the electronic retailing service quality [website design, reliability/fulfillment, security/privacy and customer service] based on the implications each one of them has towards brand loyalty [being measured through intentions to repurchase from the same brand on upcoming occasions and customer incentives to pay a price premium for the brand]. This process in two contexts, when respondents are faced with a local vs global brand.*

Design/Methodology/Approach. *Through literature review the study has used the model of mapping electronic service quality variables introduced by Wolfinbarger and Gilly (2003) in their eTail Quality model. Related to data collection we have conducted two focus groups each being prompted with local and global renown brands, respectively. Considering that the study aims to measure perceptions, and knowing that the best way to express them is through linguistic terms, which is the way humans express their feelings on daily basis, the analysis is based on fuzzy logic by using triangular fuzzy sets as means of analysis. The process through the analysis phase has followed the (i) fuzzification process, where linguistic terms have been converted to triangular fuzzy sets, (ii) fuzzy averaging to find group opinions, (iii) clarifying weak and/or strong conditions in between the importance and satisfaction degrees, lastly (iv) defuzzification process in order to convert triangular fuzzy sets in linguistic terms.*

Findings and Implications. *The analysis suggests that when customers are faced with global brands, service quality elements such as website design, customer service and reliability/fulfillment are good predictors for the creation of behavioral intents towards the brand. Whereas when customers faced with local brands, service quality elements such as security/privacy, reliability/fulfillment and website design, have high implications towards customers' behavioral intents.*

Limitations. *The study represents an innovative approach to measuring service quality variables in the apparel purchase online context. Due to its generic nature as a model the conceptual framework and methods of analysis could be tested in other industries, apart from the apparel online purchase. Furthermore, in order to enforce external validity, the study is recommended to be replicated within the same or other contexts.*

Originality. *This scientific paper presents an innovative approach to measuring on-line service quality in the apparel industry. Furthermore, the understanding of underlying factors impacting customers purchase online from local or global brands makes it unique in its nature for the context applied. The use of fuzzy logic and triangular fuzzy sets has allowed the research to use linguistic measurements (which belong to the nature of how humans' express feelings) and their conversion in fuzzy triangular sets allowing for deeper analysis in descriptive and predictive statistics without comprising the reliability of either of them.*

1. INTRODUCTION

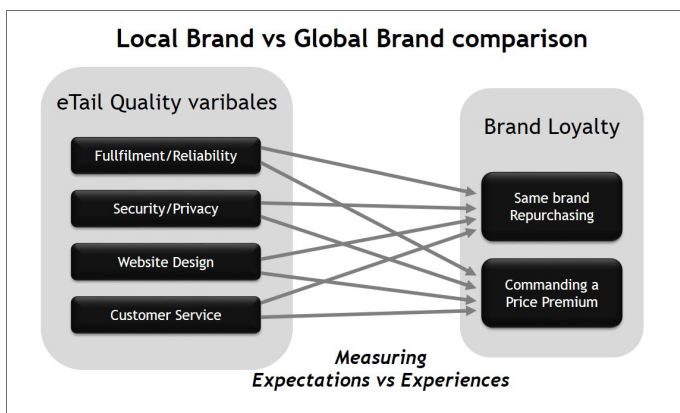
During the last 15 years, there has been immense growth on the apparel industry providers offering products online. This segment of the market has seen high growth and is still considered on having potential to grow more. With the existence of global providers there have been as well local providers offering such services. This has mainly been as a consequence of better understanding local fashion trends; feature that has caused retailers to be more efficient with their stock. Offering good service quality appears to be essential for success in the online environment. From the organizations perspective, the relevance of these issues, mostly regards to how the service quality attributes impact behavioral intents that customers develop throughout their experiences online. The importance of the online service quality on the cases when customers buy from local or global brands formalizes the ground for the objectives that this research aims to study:

- identify key service quality attributes that impact upcoming repurchasing behavioral intents;
- identify key service quality attributes that incentivize customers to pay a price premium;
- assess the relationships between the service quality attributes and behavioral intents in situations where customers are purchasing from local versus global brands.

A plausible answer to these questions is beneficial in contributing to the current academic discussion in the area; as well as for assisting practitioners operating in this field, taking into account that this relationship directly affects their profitability on the long run.

2. CONCEPTUAL FRAMEWORK

In order to answer the questions this study poses, we proceed with presenting previously conducted research on the constructs of the study, being brand awareness, brand loyalty and e-commerce service quality attributes.

Figure 1.: The Conceptual Model

Source: Authors.

A

2.1. Brand Awareness [local versus global brands] and brand loyalty and the e-commerce

In a transaction there are always risks that are encountered between the buyer and the seller, where brands are found to have a high importance benefit as risk reducers (Roselius 1971). Based on research conducted by Keller (2012), brands are regarded to reduce risk perceptions in a buying decision. According to Pan et al (2012), customers perceive the online environment to be more risky due to the non-physic existence of the stores. Consequently, in the online, they base their buying decision on brands that they know, hence the role of known brands locally or known brands at a global level. The role of local versus global brand offering similar services, could be seen from different prisms affecting customers. The self-identification or being part of owns community could be seen as main elements empowering local brands. Previous research has proved that in developed countries consumers prefer brands with strong local connections (Zhang and Khare 2009). Whereas, this relationship has been questionable in developing countries, considering their aspiration for further towards developed countries culture and life style (Chiu 2015). Global brands are considered brands that market to several countries across the world. Strong as-sociations that are leveraged by global brands are: good perceived quality, level of prestige and psychological benefits (EM Steenkamp, Batra, and Alden 2003).

Based on these determinants related to brand awareness and the benefits of local vs global brands, we assume brand awareness and country of origin to play a crucial role in the perceptions towards service quality attributes that this research aims to study. According to Oliver (1999), loyalty is described as the "commitment to rebuy or re-patronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same brand-set purchasing, despite situational

influences and marketing efforts, having the potential to cause switching behavior". Through this definition of loyalty, the main emphasis is put in the re-purchasing of the same-brand or brand-set regardless of the risks from external factors influencing the switching behavior to another brand. With regards to the online world, research has shown that an increase of 5% in customer retention, consequentially affects profit growth from 25% to 90% within the fifth year (Schefter and Reichheld 2000). This essential growth on customer retention is associated to a better service offered online which affects customers' behavioral intents to revisit the website. In this study, elements of importance are related to the behavioral loyalty, that Keller (2012) defines in terms of repeated purchases, and attitudinal attachment. Acquiring customers via the web is costly and, since the competition is just a mouse click away, customer e-loyalty appears essential in an economic as well as a competitive sense (Gustafsson et al. 2005). Thus, e-loyalty is defined as the "consumer's favorable attitude toward the e-retailer that results in repeat buying behavior" (Srinivasan, Anderson, and Ponnaolu 2002). Service quality level is confirmed to affect the behavioral intents that customers tend to develop with the brand (Zeithaml, Berry, and Parasuraman 1996). Brand loyalty has been proved to be affected by the level of brand awareness but this process is considered to be mediated by the impact that perceived quality that customers expect to receive from a global vs local brand (Roy and Chau 2011). Offering customers a good service quality online is believed to be a good predictor towards pushing customers to repurchase from the same brand and incentivize them into paying a price premium for the services.

Electronic commerce is defined as 'all electronically mediated information exchanges between an organization and its external stakeholders' (Chaffey 2007).

According to Bakos (1998), the reasons behind e-commerce's success lie upon its successful leverage of information technologies to offer a platform where there is an increased effectiveness and decrease in transaction costs consequentially leading to an increase in efficiency. According to Tassabehji and Ebrary (2003), customer's benefits that accrue when using e-commerce are: 24/7 access, ease of switching from one supplier to another through a live price comparison between the offerings and a wider variety of products being offered. In this study, the main focus would be on the comparison between two similar e-commerce platforms. ASOS is an international apparel fashion retailer founded in 1999, with coverage across Europe, Asia and USA (ASOS 2015); and on the other hand OXYS founded in 2012, which is an fashion electronic retailer and offers its products and services within Albania and Kosovo. These two were taken as an example considering the high awareness they enjoy across Tirana, Albania. One of the main characteristics they share across each other, are that they sell goods through e-commerce platforms. The impact of how one customer may judge the service quality variables and how he/she might become brand loyal towards the brand, is considered to be mediated by the brand awareness and associations that the brand offers.

2.2. Measuring Electronic Service Quality [eTail Quality]

Positioning the consumer as the focal point of the study and offering a good service quality online is a key determinant in fostering web sales and profits for the company. In addition to the quality of goods or services offered, other determinants in being successful are the website presence and a low price of goods or services offered. Studies on the online environment and the service quality offered in e-commerce platforms have been researched from different perspectives: satisfaction with the website (Alpar 1999, Blut et al. 2015) website success (Liu and Arnett 2000); intention to purchase and the intention to revisit (Loiacono, Watson, and Goodhue 2007); online experience (Novak, Hoffman, and Yung 2000) and customer loyalty (Srinivasan, Anderson, and Ponnnavolu 2002). All these studies pinpoint attributes of the service quality online, but lack the general sense of the service quality measurement, from a pre-purchase, purchase to post-purchase review of the process. An overall evaluation of the service quality online has been proposed by Wolfinbarger and Gilly (2003), called electronic retailing service quality [eTail Quality], which focuses into measuring the service quality in an e-commerce platform holistically at all stages of the customer interaction with the website. Depicting the whole process on purchasing goods online from the information search, service provided through the navigation on the website, the process of ordering the goods, potential customer service correspondence between the seller and buyer, finalized by the procedure of shipping the product to the buyer. Dimensions measuring the eTail quality are: fulfillment and reliability, website design, customer service and security/privacy. According to Parasuraman and Berry (1985), service quality measures the gap between what consumers expect from the service and what their perceptions after experiencing the service are. The gap between the two measures presents the perceived service quality. Therefore perceived quality signifies an overall attitude; judgment towards the service quality for its superiority compared to competitors (Zeithaml 1988). According to Chien and Tsai (2000), from a customer's stand point expectations and perceptions characterize the difference between the importance degree related to the expected quality and the satisfaction degree corresponding from the perceived experience. Seemingly the importance and significance of a good service quality offered in offline or online, appears to have a huge implication of the company's success.

Fulfillment/reliability as defined by Wolfinbarger and Gilly (2003) is "[a] the accurate display and description of a product so that what customers receive is what they thought they ordered, and [b] delivery of the right product within the time frame promised." So, fulfillment and reliability is a consequence of a couple of implications such as the representation of the adequate product which is shown on the website and what is going to be delivered; technology which is used in the e-commerce framework and its functionality of receiving orders correctly and forwarding these orders in time; and finally the relationship between the online retailer and the deliv-

ery services in order that the consumer receives the products that are purchased at a certain time within the deadline that was stated in the website.

Website design includes all elements relevant to the customer's experience with the website [except for customer service]. It includes dimensions as navigation, information search, order processing, appropriate personalization and product selection. According to Schaffer (2000), it is the inability to navigate a website and failure to find their way through, which represents 30% of customers who leave the website without purchasing anything. According to Pastrick (1997), elements such as fast loading, uncluttered and easy to navigate websites characterize the best dimensions for a satisfying e-commerce experience. Because, e-commerce platforms that are characterized with these elements offer the benefit for consumers to shorten their shopping time compared to the offline world. In order to characterize website design these were the guidelines: Very user friendly navigation; Huge caching ability, speed optimized website, allowing a very quick navigation within the website; Once creating a user and sharing your preferred styles, the website automatically suggests goods that you might be interested in purchasing; A one-click option to purchase a product (Rosen and Purinton 2004).

Customer service refers to the care that the online retailer has shown towards situations where customers face challenges with the framework. According to Wolfinbarger and Gilly (2003), employees' skills or technological tools that offer prompt solutions to customers facing these challenges play a crucial role at this point. Thinking of it, the customer service is regarded as the process of not allowing any problem occurrence within the system, however if challenges are faced, the efficiency and effectiveness to solve these issues is measured. With the social media frameworks people can easily share bad reviews to thousands of people within seconds. Therefore, the impact that customer service has on the whole experience and behavioral consequences towards brand loyalty is considered of immense importance. Customer service is defined in this study by Wolfinbarger and Gilly (2003) as the "responsive, helpful, willing service that responds to customer inquiries quickly."

To measure the customer service offered online these characteristics are used: The option of contact us for any issue that you face with the framework or shipping issues is available; A phone line is given, offering assistance for any questions that the consumer might have; An immediate chat option is offered, so that customers get an immediate response regarding the challenges that they are facing.

Security/privacy is related to the level of credit card payments security and privacy of users shared information. Even though privacy and security are used as an expression together, they tackle different elements within the experience online. Privacy is related to the safety level of how information is gathered from customers, how the data are stored and finally for what purposes the data will be used. Another point to make with regards to privacy is that of asking from the visitor of the platform on approving the data usage conditions (Friedman, Khan Jr, and Howe 2000). Whereas

security is related to the financial risks that consumers might face throughout their online transactions. Such as how the credit card information will be handled and the protection level of conserving that information from vulnerable acts (Wolfenbarger and Gilly 2003). According to Hoffman, Novak, and Peralta (1999) information privacy is listed as the top concern for web visitors. Based on his study, people that do not buy online appear not to be taking this decision based on functional reasons but it is mostly with regards to the frightening fact of giving personal information away. Miyazaki and Fernandez (2001), consider that privacy and security issues represent the crucial barriers for the consumers not using e-commerce activities. Moreover, potential online customers are very aware of the implications of privacy and security in an environment which contains potential threats for vulnerability acts (Culnan and Armstrong 1999).

With regards to characterizing the Security and Privacy this elements are used: Personal information is gathered only when information is given by the consumer [such as when you open your account] and through cookies, in order to have better results on the recommended products or offering the 1-click purchase option; We only share personal information related to specific transaction when the product needs to pass through one of our affiliated parties. The information shared is strictly connected only to information concerning that transaction; With regards to the security, information given from the customers' side is encrypted with advanced software named Secure Sockets Layer [SSL], offering a high level security; Only the four digits of the credit card can be seen when a customer wants to buy a product, in order to decrease the probability of vulnerability acts by third parties; And finally, all the security and privacy terms and conditions are during the whole time accessible through the website.

3. RESEARCH METHODOLOGY

The main focus of this study is on measuring the service quality offered in e-commerce platforms and the implications it has on behavioral intents to repurchase from the brand and pay a price premium for it based on the case of dealing with local or global brands. The relation between the two is studied under two conditions, being the importance degree and the satisfaction degree (Chien and Tsai 2000). In order to measure the possible implications of local vs global brand we apply the same research in two focus groups, where [i] one analyzes the implications when consumers purchase from a local brand, OXYS is taken as an example in this case and [ii] analyzes the implications when participants purchase from a global brand, ASOS will be used as the brand to study. Rihoux and Ragin (2009), discussed the need to set up sufficiently comparative cases which share similar patterns is essential for a research aiming on drawing parallels of comparison between them. In order to have a similar pool of participants in the experiment, the case selection procedure covered two phases:

First phase: A homogenous pool of participants was demanded with regards to experiences online. During this phase 70 people were contacted, in order to be presented with the research, and whether they showed interest in being part of this study. In order to be eligible as a participant in the study a person should have fulfilled the below mentioned criteria:

- Every participant needed to have at least purchased online three times during the last year;
- Every participant should be familiar with both OXYS and ASOS brand;
- Every participant needed to have spent at least 50 Euros on their online purchases throughout 2015;
- Every participant needed to have previous experience on buying apparel goods online.

From the total number of 70 cases that were contacted in Tirana [Albania], demanding a reply from the ones that fulfilled the above mentioned criteria, 19 replied to the email, admitting their interest in the study. A certain date was set when and where the experiment would take place. Furthermore, only 14 were available on that specific date and time.

Second phase: The 14 participants were assigned randomly into the two groups. A bowl of mixed papers having written a unique number in them varying from 1 to 14 was used. The participants were asked to get a paper from the bowl and tell the number. Participants having numbers from 1 to 7 were assigned to Group 1 [OXYS group] and the participants having numbers from 8-14 were assigned to Group 2 [ASOS group].

Conducting experiments seems to be the best way on finding the cause effect relations between study constructs (Christensen, Johnson, and Turner 2011). The study controls for internal validity by setting out a strict guideline for participants in order to be part of the research, which is elaborated below. During the experiment the participants are randomly assigned to the focus groups. Having on focus the measurement of linguistic terms such as importance degree and satisfaction degree, the challenge was on selecting the appropriate method of analysis. Customer perceptions are expressed in linguistic terms and expecting respondents to provide objective response in continuous data is a bit a challenge (Chien and Tsai 2000). On the other hand, fuzzy logic and fuzzy sets have appeared to be very significant methods on using linguistic terms as inputs for approximate reasoning (Zimmermann 2001). As well they have proved to be very effective in situations of uncertainty such as is the case when customer perceptions are studied (Zadeh 2002). The strong point of fuzzy logic and fuzzy sets lies upon the fact of offering a linguistic degree of vagueness as a metric which in real life situations is a common case (Bojadziev and Bojadziev 2007). Measuring customer perceptions based on fuzzy logic seems to be more objective for this particular study, thus I decide to proceed by utilizing this method.

4. THE FUZZY SETS THEORY AND FUZZY ARITHMETIC

As a theory, it has had a wide application on research fields as: computer science, decision theory, logic, management science, operations research as well as pattern recognition (Bojadziev and Bojadziev 2007). Conventional or crisp sets are seen as the primates of fuzzy sets. Zimmermann (2001), referred to crisp sets as “*a collection of elements or objects that can be finite countable, or over countable*”. The pioneer in fuzzy logic and fuzzy sets, Lotfi Zadeh (Jacoby and Kyner 1973) referred to this traditional logic as when “*the complexity of a system increases, our ability to make precise and yet significant statements about its behavior diminishes until a threshold is reached beyond which precision and significance [or relevance] become almost mutually exclusive characteristics.*”

In real life, this is rarely the case, considering that mostly an attribute can be considered as member for a certain amount to a certain group and as well there could be a possibility of being member to another group. The downfall of the crisp set theory and bivalent logic that probability theories use are that, in real life, variables might be partly members of a set or outcome (Rihoux and Ragin 2009). The theory of fuzzy sets allows partial membership to a given condition between a full nonmember denoted by 0 and a full member denoted by 1; in order to describe the gradual transitions between the two continuums. As a theory it consists of this strong point that based on the analysis, it allows an attribute or condition to be a partial member of the outcome (Zimmermann 2001). For ex. if A is the set of importance degree between the eTail Quality attributes and brand loyalty types, fuzzy set $\tilde{A}$ represents the set of ordered pairs $\tilde{A} = \{(x, \mu_A(x)) | x \in X\}$ where $\mu_A(x)$ is the membership function of x in $\tilde{A}$. This membership function can vary in between the two continuums of being a nonmember up to being a full member of the outcome that is studied (Zadeh 1965).

In this study the two conditions importance degree and satisfaction degree could be considered as vague or with a degree of vagueness and hardly conceptualized (Chien and Tsai 2000). The condition of importance degree between eTail Quality attributes and brand loyalty types; through fuzzy sets I can offer the glimpse on understanding the partial membership that the attribute might have on the outcome. The same holds for the satisfaction degree which is analyzed in this study.

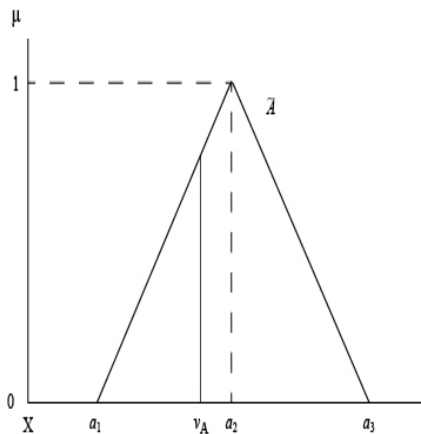
There are two major reasons why this theory applies in discovering the puzzle in this work. This range is given in linguistic terms in order not to lose its objectivity, when data is collected. The benefit of fuzzy sets is that it enjoys the possibility on using the same arithmetic calculations as conventional sets such as union, intersection and negation (Rihoux and Ragin 2009), which provide a good background on finding cause-effect relations and pattern recognition in the variables that are studied. Another reason for using this method on this study would be the lack of having a defined parameter on measuring importance degree and satisfaction degree (Chien and Tsai 2000). Linguistic terms as importance and satisfaction are not deterministic com-

pared to a linguistic term as height, which can be measured based on a certain set of scales such as meter, feet etc. The fuzziness on defining the concepts makes the conditions that are being studied to be adequate for a fuzzy sets study.

The bases of fuzzy arithmetic imply that, let the universe of discourse X be the subset of real number R where $X = \{x_1, x_2, x_3, \dots, x_n\}$. A fuzzy set $\tilde{A} = \{(x, \mu_A(x)) \mid x \in X\}$ in X is a set of ordered pairs where $\mu_A(x)$ is called the membership function where $\mu_A(x): X \rightarrow [0,1]$.

Through the various types of fuzzy number representations, this study uses the triangular fuzzy numbers which are proved to have wide applications in social sciences (Bojadziev and Bojadziev 2007). The membership degree of importance and satisfaction conditions, in terms of triangular fuzzy number Figure 1., lays between a_1 , meaning full nonmember of a set; a_2 denoting a full member of the set and a_3 denoting full nonmember of the set. The triangular fuzzy numbers are denoted by $\tilde{A} = (a_1, a_2, a_3)$. The v_A score in Figure 1., is the point that divides the bounded area of a triangular fuzzy number $\tilde{A}$ into two equal parts.

Figure 2.: A triangular fuzzy number



Source: Bojadziev and Bojadziev (2007).

Using the same method as used by Chien and Tsai (2000), which applies based on previous findings from Dubois and Prade (1985), Peter, Churchill Jr, and Brown (1993), Klir and Yuan (1995) I proceed on understanding the study and analyzing the data through four stages, being:

- (1) Firstly, since importance degree and satisfaction degree could be considered as vague terms of measurement Chien and Tsai (2000), in this study we fuzzify these two degrees, which are shown as μ_A [for the importance degree] and μ_B [for the satisfaction degree]. These two membership scores correspond

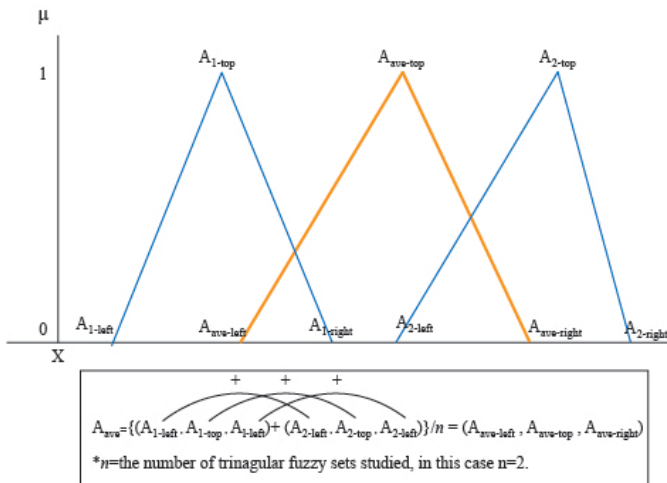
to Group 1 respondents. The same procedure is applied to Group 2 and create membership scores presented by μ_C for importance degree and μ_D for the satisfaction degree. The process of fuzzifying the importance degree and satisfaction degree is shown in equation. (1). The same procedure is applicable for μ_B , μ_C , and μ_D .

$$\mu_A(x) = \begin{cases} y_a^L(x) = \frac{x-a_1}{a_2-a_1}, & a_1 \leq x \leq a_2 \\ y_a^R(x) = \frac{x-a_3}{a_2-a_3}, & a_2 \leq x \leq a_3 \\ 0, & \text{otherwise.} \end{cases} \quad (1)$$

- (2) In order to understand the general descriptive part within the surveyed groups I use the average fuzzy number denoted by A_{ave} for the n triangular numbers, equation (2). The same is done to membership scores for B, C and D sets. Graphical presentation of the procedure is shown in Figure 2.

$$\tilde{A} = A_{ave} = \frac{\tilde{A}_1 + \tilde{A}_2 + \dots + \tilde{A}_n}{n} = \frac{(\sum_{i=1}^n a_1^{(i)}, \sum_{i=1}^n a_2^{(i)}, \sum_{i=1}^n a_3^{(i)})}{n} = (a_1, a_2, a_3) \quad (2)$$

Figure 3.: Fuzzy Averaging



Source: Chien and Tsai (2000).

- (3) Clarify weak and/or conditions for eachetail quality attribute with regards to the two types of brand loyalty equations (3) - (5). Furthermore understanding the implications that local brands vs global brand has on positioning a specific attribute as sufficient for the outcome to happen.

$$v_A = (a_1 + 2a_2 + a_3) / 4 \quad (3)$$

$$v_B = (b_1 + 2b_2 + b_3) / 4 \quad (4)$$

$$v = v_B - v_A \quad (5)$$

Through this analysis I am after to find whether the importance or satisfaction degrees are greater or smaller when compared to one another. Using the theory from Chien and Tsai (2000), In the findings section I will present which eTail Quality attribute appears to be sufficient for behavioral intentions to happen.

- (4) Defuzzifying sets which are of interest to the study. As the last step of the process I use the v scores equations (3) and (4), to defuzzify the sets, and give them the approximate linguistic term. This type of defuzzification procedure has been proved to work very well in studies where triangular fuzzy numbers are used (Zimmermann, 2001; Chien and Tsai, 2000; Bojadziev and Bojadziev, 2007), which is the case in this study.

5. ANALYSIS

This section will firstly give the descriptive information on the samples being: gender and value of online purchases during 2015 for the focus group participants. Then, the analysis deepens into interpreting linguistic terms into fuzzy sets, aggregation of group opinions and finally the mathematical analysis to see the differences between the trends in the samples and lastly generalize from the sample.

In terms of group composition, the Group 1 [OXYS] consisted of three males and four females, whereas Group 2 [ASOS] consisted of two males and five females. In terms of the value of online purchases throughout 2015, in Group1, one [or 14% of all cases] denoted spending 500€ to 1000€ during 2015, and six [or 86% of all cases] denoted spending more than 1000€ during 2015. In Group 2, two [or 29% of all cases] denoted spending between 500€ to 1000€ during 2015, and five [or 71% of all cases] proclaimed spending more than 1000€. Overall in the two groups as a percentage, 21% spent between 500€ to 1000€ during 2015; whereas 79% spent more than 1000 euro during the same year.

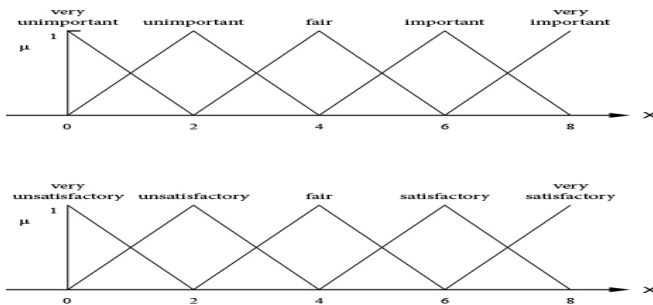
In order to analyze the linguistic results extracted during the focus groups, the linguistic terms are converted into fuzzy sets. Let the triangular fuzzy number that signifies the i^{th} consumer's linguistic importance degree of etail quality attributes having as an outcome the two brand loyalty types and be one that is the i^{th} consumer's linguistic satisfaction degree of etail quality attributes having as an outcome the two

brand loyalty types. k denotes the k^{th} etail quality attribute; j represents the j^{th} type of brand loyalty. In terms of sets the $i=1,2,3,\dots,n$; representing consumer's linguistic term, where n is the number of cases that were analyzed, $k=1,2,3,\dots,p$; where p denotes the number of etail quality attributes and $j=1,2,3,\dots,m$; where m denotes the number of brand loyalty types. In this case in hand, since there are two groups consisting each of 7 participants, each group consists of these numbers: $i=7$, $k=4$ and $j=2$; so we have seven cases, four different etail quality attributes and two types of brand loyalty.

The same numbers of $i=7$, $k=4$ and $j=2$; are relevant for $\tilde{A}_i^k$ and $\tilde{B}_i^k$ triangular fuzzy numbers. They characterize the findings for the importance degree and satisfaction degree, correspondingly, from Group 1, which is the OXYS group. The same is conducted as well for the Group 2 [ASOS], represented by $\tilde{C}_i^k$ importance degree and $\tilde{D}_i^k$ satisfaction degree of etail quality attributes having as an outcome brand loyalty types. In all cases k and j are constants [meaning $k=4$, and $j=2$], we simplify the mathematical symbols and substitute $\tilde{A}_i^k$ to $\tilde{A}_i$, $\tilde{B}_i^k$ to $\tilde{B}_i$, $\tilde{C}_i^k$ to $\tilde{C}_i$ and $\tilde{D}_i^k$ to $\tilde{D}_i$.

For the fuzzification procedure the raw information gathered from the focus groups is needed and linguistic terms are converted into fuzzy sets: $\tilde{A}_i = (a_1, a_2, a_3)$; $\tilde{B}_i = (b_1, b_2, b_3)$; $\tilde{C}_i = (c_1, c_2, c_3)$; $\tilde{D}_i = (d_1, d_2, d_3)$. Using the fuzzy importance degree is presented as the membership scores, being: very unimportant [0,0,2], unimportant [0,2,4], fair [2,4,6], important [4,6,8] and very important [6,8,8]. The coordinates next to the linguistic term represent the triangular fuzzy numbers of the importance degree.

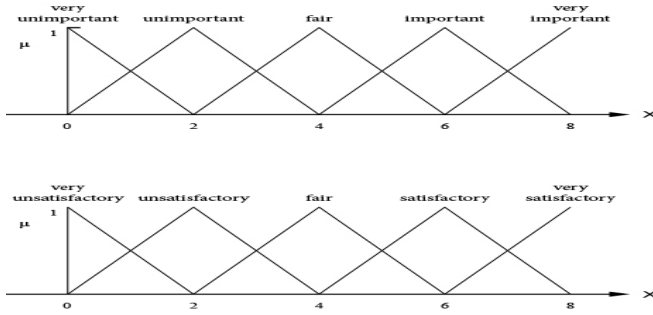
Figure 4.: The consumer's linguistic term of Importance in fuzzy set



Source: Chien and Tsai (2000).

The satisfaction degree in linguistic terms has been proposed from Chien and Tsai (2000), presented in Figure 4. the scales are: very unsatisfactory [0,0,2], unsatisfactory [0,2,4], fair [2,4,6], satisfactory [4,6,8] and very satisfactory [6,8,8]; representing the cases in Group 1 and Group 2.

Figure 5.: The consumer's linguistic term of Satisfaction in fuzzy sets



Source: Chien and Tsai (2000).

The transformation of linguistic terms from the raw data table to triangular fuzzy numbers was done through was used for $\tilde{B}$, $\tilde{C}$, and $\tilde{D}$. These equations set the membership score to understand the left [L] and right [R] of the membership function. There is a rule about the triangular fuzzy numbers that $a_1 < a_2 < a_3$, a rule which is valid as across all membership sets.

5.1. Aggregating group opinions

In order to reason from the group opinions, the study focuses on using theoretical frameworks, in order to aggregate group opinions for each condition related to the etail quality attributes and the two brand loyalty types: the latter considered as the outcome of the study. The aggregation of group opinions is conducted through equations (6) - (9). (Bojadziev and Bojadziev 2007), for each condition: for Group 1 importance degree denoted by $\tilde{A}$ and satisfaction degree denoted by $\tilde{B}$. The same rule is applied as well for Group 2, importance degree denoted by $\tilde{C}$ and satisfaction degree denoted by $\tilde{D}$. The graphical representation of the theory behind aggregating group opinions can be found at Figure 2.

$$\tilde{A} = A_{ave} = \frac{\tilde{A}_1 + \tilde{A}_2 + \dots + \tilde{A}_n}{n} = \frac{(\sum_{i=1}^n a_1^{(i)}, \sum_{i=1}^n a_2^{(i)}, \sum_{i=1}^n a_3^{(i)},)}{n} = (a_1, a_2, a_3) \quad (6)$$

$$\tilde{B} = B_{ave} = \frac{\tilde{B}_1 + \tilde{B}_2 + \dots + \tilde{B}_n}{n} = \frac{(\sum_{i=1}^n b_1^{(i)}, \sum_{i=1}^n b_2^{(i)}, \sum_{i=1}^n b_3^{(i)},)}{n} = (b_1, b_2, b_3) \quad (7)$$

$$\tilde{C} = C_{ave} = \frac{\tilde{C}_1 + \tilde{C}_2 + \dots + \tilde{C}_n}{n} = \frac{(\sum_{i=1}^n c_1^{(i)}, \sum_{i=1}^n c_2^{(i)}, \sum_{i=1}^n c_3^{(i)},)}{n} = (c_1, c_2, c_3) \quad (8)$$

$$\tilde{D} = D_{ave} = \frac{\tilde{D}_1 + \tilde{D}_2 + \dots + \tilde{D}_n}{n} = \frac{(\sum_{i=1}^n d_1^{(i)}, \sum_{i=1}^n d_2^{(i)}, \sum_{i=1}^n d_3^{(i)},)}{n} = (d_1, d_2, d_3) \quad (9)$$

After running the analysis, the results for the condition “importance degree” in Group 1 A_{ave} ; in Group 2 C_{ave} . With regards to the satisfaction degree we have B_{ave} for Group 1; and C_{ave} for Group 2.

5.2. Strong or weak eTail Quality attributes

In order to understand which eTail Quality attribute is sufficient for the outcome to happen; meaning the behavioral intents, the measurement through strong or weak attribute analysis is used. Considering that this study measurements are based on the importance and satisfaction degree, it is considered that satisfaction degree to be the outcome that signifies the relation between eTail attributes and brand loyalty types to happen. So, if the satisfaction degree for a given eTail Quality attribute is greater than the importance degree of the same attribute, I say that the attribute is strong related to the specific brand loyalty type; and the opposite.

To find out the strong or weak attribute the procedure of comparing the group opinions is used (Chen 1996). The average triangular fuzzy numbers $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$ for the importance and satisfaction degree, individually, corresponding to Group 1 responses; and $\tilde{C} = (c_1, c_2, c_3)$ and $\tilde{D} = (d_1, d_2, d_3)$ for the importance and satisfaction degree, individually, corresponding to Group 2 responses. These averages are applied to equations (10) and (11).

$$v_A = (a_1 + 2a_2 + a_3) / 4 \quad (10)$$

$$v_B = (b_1 + 2b_2 + b_3) / 4 \quad (11)$$

$$v_{Group1} = v_B - v_A \quad (12)$$

Equation (12) measures the difference in importance degree and satisfaction degree for each eTail Quality attribute affecting brand loyalty types, accordingly, within Group1. The same procedure is followed for Group2 responses.

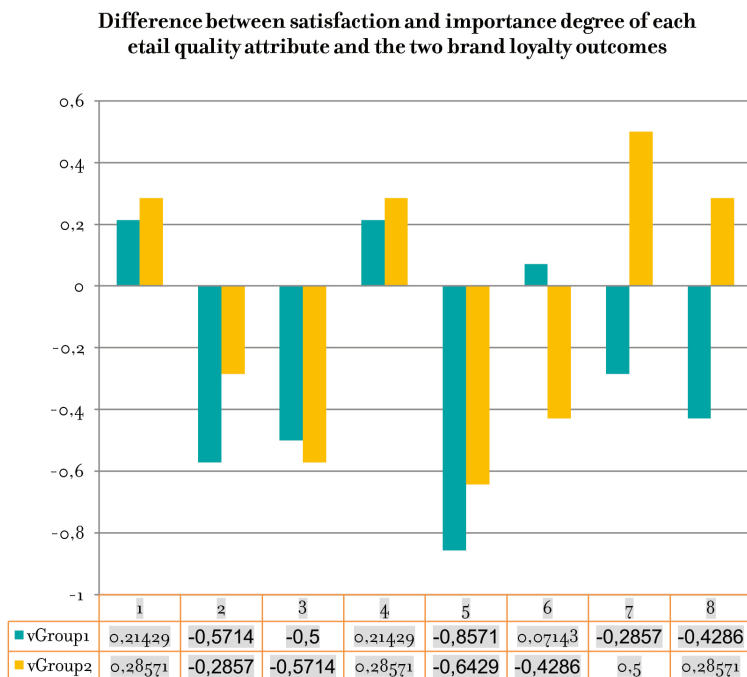
For the two groups, we get the difference scores between the importance degree and satisfaction degree symbolized as V_{Group1} and V_{Group2} , for every single eTail quality attribute related to the types of brand loyalty.

- Rule1: If $v > 0$; the satisfaction degree is greater than the importance degree, and so the eTail quality attribute is considered strong for the specific outcome to happen.
- Rule2: If $v < 0$ than the satisfaction degree is smaller than the importance degree. Once we get a score as this, we consider the attribute weak for the outcome to happen.
- Rule3: If $v = 0$, means that the attribute has been considered at the same level of importance and satisfaction for the outcome. In this study we have no such results.

Table 1.: Strong or Weak etail quality attributes for the outcome

	$vscore_A = (a1 \cdot x^2 \cdot a2 \cdot a3) / 4$	$vscore_B = (b1 \cdot x^2 \cdot b2 \cdot b3) / 4$	$vscore_{comp} = B - vA$	$vscore_C = (c1 \cdot x^2 \cdot c2 \cdot c3) / 4$	$vscore_D = (d1 \cdot x^2 \cdot d2 \cdot d3) / 4$	$vscore_{comp} = vD - vC$
importance degree of website design for paying a price premium	$(3.1+5.1+7.1)/4 = 5.14$		0.214	$(3.1+5.1+7.1)/4 = 5.14$		0.286
satisfaction degree of website design to urge you into paying a price premium		$(3.4+5.4+7.1)/4 = 5.35$			$(3.4+5.4+7.4)/4 = 5.42$	
importance degree of website design in order to repurchase	$(3.4+5.4+7.4)/4 = 5.42$		-0.57	$(4.0+6.0+7.4)/4 = 5.85$		-0.286
satisfaction degree of website design to urge you into repurchasing		$(2.9+4.9+6.9)/4 = 4.85$			$(3.7+5.7+7.1)/4 = 5.57$	
importance degree of fulfillment/reliability for paying a price premium	$(4.6+6.6+7.7)/4 = 6.35$		-0.5	$(4.3+6.3+8.0)/4 = 6.21$		-0.571
satisfaction degree of fulfillment/reliability to urge you into paying a price premium		$(4.0+6.0+7.4)/4 = 5.85$			$(3.7+5.7+7.4)/4 = 5.64$	
importance degree of fulfillment/reliability in order to repurchase	$(4.9+6.9+8.0)/4 = 6.64$		0.214	$(3.7+5.7+7.4)/4 = 5.64$		0.286
satisfaction degree of fulfillment/reliability to urge you into repurchasing		$(5.1+7.1+8.0)/4 = 6.85$			$(4.0+6.0+7.7)/4 = 5.92$	
importance degree of security/privacy for paying a price premium	$(4.6+6.6+8.0)/4 = 6.42$		-0.86	$(3.7+5.7+7.7)/4 = 5.71$		-0.643
satisfaction degree of security/privacy to urge you into paying a price premium		$(3.7+5.7+7.1)/4 = 5.57$			$(3.1+5.1+6.9)/4 = 5.07$	
importance degree of security/privacy in order to repurchase	$(4.0+6.0+7.4)/4 = 5.85$		0.071	$(4.6+6.6+7.7)/4 = 6.35$		-0.429
satisfaction degree of security/privacy to urge you into repurchasing		$(4.0+6.0+7.7)/4 = 5.92$			$(4.0+6.0+7.7)/4 = 5.92$	
importance degree of customer service for paying a price premium	$(3.1+5.1+7.1)/4 = 5.14$		-0.29	$(2.6+4.6+6.6)/4 = 4.57$		0.5
satisfaction degree of customer service to urge you into paying a price premium		$(2.9+4.9+6.9)/4 = 4.85$			$(3.1+5.1+6.9)/4 = 5.07$	
importance degree of customer service in order to repurchase	$(4.3+6.3+7.7)/4 = 6.14$		-0.43	$(4.0+6.0+7.4)/4 = 5.85$		0.286
satisfaction degree of customer service to urge you into repurchasing		$(3.7+5.7+7.7)/4 = 5.71$			$(4.3+6.3+7.7)/4 = 6.14$	

Source: Authors.

Figure 6.: Graphic for the Strong and weak etail quality attributes for the outcome

Source: Authors.

In the X-axis of the diagram, the difference between satisfaction degree and importance degree for every attribute connected to the outcome is found; attributes are written in "1,2,3,...,8". Considering that the study comprises of four eTail quality attributes and two brand loyalty outcomes, we have an overall representation of eight combinations, for each group that was studied.

5.3. Defuzzifying sets

During the defuzzification procedure we focus on the v scores that are greater than the value 0, because these scores have shown that the given attribute is sufficient for the outcome to happen. Considering that in both groups, we have found positive scores for the website design attribute towards paying a price premium and reliability/fulfillment for the outcome of repurchasing we present the average weighted scores in approximate linguistic terms.

Table 2.: Defuzzification scores

Defuzzifying membership scores into percentages of membership				
		vscores	Important	Fair
importance degree of website design for paying a price premium	OXYS Group 1	5.14286	57.14%	42.86%
		vscores	Satisfactory	Fair
satisfaction degree of website design to urge you into paying a price premium	OXYS Group 1	5.35714	67.86%	32.14%
		vscores	Importance	Fair
importance degree of website design for paying a price premium	ASOS Group 2	5.14286	57.14%	42.86%
		vscores	Satisfactory	Fair
satisfaction degree of website design to urge you into paying a price premium	ASOS Group 2	5.42857	71.43%	28.57%
		vscores	Important	Very Important
importance degree of fulfillment/reliability in order to repurchase	OXYS Group 1	6.64286	32.14%	67.86%
		vscores	Satisfactory	Very Satisfactory
satisfaction degree of fulfillment/reliability to urge you into repurchasing	OXYS Group 1	6.85714	42.86%	57.14%
		vscores	Important	Fair
importance degree of fulfillment/reliability in order to repurchase	ASOS Group 2	5.64286	82.14%	17.86%
		vscores	Satisfactory	Fair
satisfaction degree of fulfillment/reliability to urge you into repurchasing	ASOS Group 2	5.92857	96.43%	3.57%

Source: Authors.

5.3.1. Website design towards paying a price premium for the local and global brand

In order to better understand the implications of this finding, the study defuzzifies the v scores by running a quick analysis on the distance between the two closest membership scores where the given v score has fallen. The values are represented in percentages. The formula used in this study, has been proved as a decent method in defuzzifying triangular fuzzy numbers in social sciences (Chien and Tsai 2000, Bojadziev

and Bojadziev 2007). Taking vA, vB, vC and vD scores as the weighted averages for the triangular fuzzy numbers representing the importance degree and satisfaction degree for each eTail quality attribute; The vA and vB scores are extracted in the relation between website design towards paying a price premium in Group 1, for the importance degree, the vA score is 5.14286, corresponding to 57.14% into the membership score of being Important and 42.86% into being a member of the set Fair. Whereas for the satisfaction degree the v score is 5.35714 corresponding to 67.86% into being a member of the set Satisfactory and 32.14% in being a member of the set Fair.

This finding leads to understand that website design is sufficient for the outcome of paying a price premium for the local brand [OXYS] to happen. Since the satisfaction degree is greater than the importance degree.

In Group 2, for the importance degree, the vC score is 5.14286, corresponding to 57.14% into the membership score of being Important and 42.86% into being a member of the set Fair. Whereas for the satisfaction degree for the vD score is 5.42857 corresponding to a 71.43% into being a member of the set Satisfactory and 28.57% % in being a member of the set Fair.

5.3.2. Fulfillment and reliability towards repurchasing from the same brand

To better understand how the v scores are ranked, we defuzzify vA, vB, vC and vD scores for the importance degree and satisfaction degree of the fulfillment/reliability attribute towards repurchasing from the same brand, individually for the two groups. In Group 1, for the importance degree, the vA score is 6.64286, corresponding to a 67.86% into the membership score of being Important and 32.14% into being a member of the set Very Important. Whereas for the satisfaction degree presented by the vB score is 6.85714 corresponding to a 57.14% into being a member of the set Satisfactory and 42.86% in being a member of the set Very Satisfactory. In Group 2, for the importance degree, the vC score is 5.64286, corresponding to a 82.14% membership score of being Important and 17.86% into being a member of the set Fair. Whereas for the satisfaction degree the vD score is 5.92857 corresponding to a 96.43% into being a member of the set Satisfactory and 3.57% in being a member of the set Fair.

With the defuzzification procedure, the weighted average v-scores are now converted into linguistic terms. This analysis allows the study to be more objective with regards to the scales with which the data was collected.

6. CONCLUSIONS & MANAGERIAL IMPLICATIONS

There are three basic questions that the study aims to provide an answer: [i] Which are the strong eTail quality attributes that impact behavioral intents regardless of where a brand is local or global, in this case OXYS vs ASOS brands? [ii] Which

are the strong eTail Quality attributes that impact behavioral intents when consumers buy from a local brand, in this case OXYS? And [iii] Which are the strong eTail Quality attributes that impact behavioral intents when consumers buy from a global brand, in this case ASOS?

Attributes that are considered sufficiently strong towards the outcome to happen in both the groups [regardless of being local or global] have been found to be:

6.1. Website design towards paying a price premium for the OXYS & ASOS brand

Based on the cases that were studied; being aware of the brand or not being aware of the brand has not much influence in terms of paying a price premium for an e-commerce platform that offers a website design which is considered great by the user. Characteristics of a great website design are: great look, user friendly and easy to navigate, fast loading of pages and finally offering convenience. These findings can be enforced through previous literature on website design and the satisfaction from a transaction, which relates to brand loyalty intentions. (Rosen, 2004), points out that a well-designed site has a number of beneficial impacts, such as trust and confidence in the company as well as building on the image, functionality, and usefulness. Alongside these beneficial it can as well inform visitor to the company's range of products and services and reasons to come back again (Toufaily, Ricard and Perrien 2013). According to Pastrick (1997), offering e-commerce website designs which are fast, uncluttered and easy-to-navigate has statistically proven to offer pleasure and satisfaction for the website surfer. The cases that I studied, report to perceive that website design is a member of the set Satisfactory by 67.86% in Group 1 and 71.43 % in Group 2. This finding based on the theory of fuzzy sets (Zadeh 1965), appears to be sufficient for the price premium paying outcome to happen. Even though, website design has been studied redundantly from previous researches, there are still strong researches showing that it still remains one of the main dimensions of online service quality that impact loyalty (Collier and Bienstock 2015)

6.2. Fulfillment and reliability towards repurchasing from the same brand

In this study, fulfillment and reliability was defined with these elements: the company takes a special care on the product description and the compatibility with the products that will be shipped; a set timing of the dispatch and shipping process, and the opportunity to receive a new product if the product that was sent appears to be defective.

Based on the analysis that we conducted it is proved that an e-commerce platform that offers fulfillment and reliability services as mentioned above are predis-

posed on pushing customers to repurchase from the same brand either in the case of OXYS or ASOS in the future. According to Jiang and Rosenbloom (2005) the satisfaction related to the delivery timing and reliability appears to have a great influence on the overall customer satisfaction as well as the grows the return intention in order to purchase from the same brand. According to Lee and Lin (2005), the "reliability dimension is a significant predictor of overall service quality, customer satisfaction and purchase intentions in online shopping." The cases that we studied, report to perceive that fulfillment/reliability is a member of the set Very Satisfactory by 57.14 % in Group 1 and in the set Satisfactory 96.43 % with regards to Group 2.

With regards to the analysis towards the eTail Quality attributes that impact behavioral intents towards a global brand customer service appears to be sufficient for both the outcomes: paying a price premium and repurchasing in coming occasions. Customer service expresses the relationship between the customer and the company, if customers are satisfied with the service offered this link strengthens which results in greater perceptions of service quality. According to Sundharesalingam and Padmavathy (2016), for online businesses, the first ranked variable in retaining customers to increase the customer loyalty base was characterized the customer service.

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THE DYNAMISM OF EXCHANGE RATE SHOCKS: EVIDENCE FROM NIGERIA

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ABSTRACT

Purpose. *The main objective of this study is to investigate the dynamics of exchange rate shocks in Nigeria.*

Methodology. *The researcher used Error Correction Model (ECM) with annual time series data covering the period of 36 years; 1981 through 2016 as the estimation technique. The estimated co-integration test shows that the macroeconomic variables in the system do share a long run relationship with the exchange rates in the period under investigation. Accordingly, each variable in the system tends to adjust proportionally to bring in the system back to its long run equilibrium.*

Findings and Implications. *The estimation result shows that increase in productive output (gross domestic product) leads to depreciation of the exchange rate in the short run but with insignificant effect in the long run. This, hence, implies that the dwindling trend in domestic production has remained one of the major causal factors of the persistent fluctuation in exchange rate in Nigeria. The persistent rise in price level is equally found to lead to appreciation of the exchange rate simply because of over reliance on cheap and more sophisticated foreign goods and materials, in the short run but with insignificant effect in the long run. The domestic interest rate, as reveal by the estimation results, is found to be significantly impacted on the fluctuation of exchange rate in Nigeria.*

Limitations. *The main limitation of this study is in the area of data availability and model specification. The VAR model as popularized by Sims, (1980) is such that all the variables in the framework are assumed to be endogenous with the exception of exogenous variable. This problem may raise the tendency of for multicollinearity and the statistical insignificance of the regressors co-existing with high overall statistical significance of the regression model (Gujarati, 2005; Brooks, 2008).*

Originality. *To the best of my knowledge, at the time of conducting this research, many of the studies in Nigeria have employed other methods other than Vector Error Correction Model (VECM). And, we affirm that this work is original and not being considered elsewhere for publishing. Therefore, this study will contribute to existing literature on the dynamics of exchange rate shocks in Nigeria.*

1. INTRODUCTION

In the first year of the Millennium, according to Krugma, Obstfeld and Melitz (2013), Americans flocked to the Paris to enjoy French cuisine while shopping for designer clothing and other specialities. When measured in terms of dollars, prices in France were so much lower than they had been in a few years before that a shopper's saving could offset the cost of an airplane ticket from New York or Chicago. Five years later, however, the prices of French goods looked high to Americans. What are the economic implications of this widely swing of dollar prices of French goods?

The Nigerian national currency (naira) has depreciated by over 7000 per cent relative to the U.S. dollar since the introduction of Structural Adjustment Programme in Nigeria in 1986, falling from 2.0206/dollar in 1986 to over 160.7228/dollar by the fourth quarter of 2014 (Central Bank of Nigeria; 2013). Surprisingly, between the first quarter of 2013 and the fourth quarter of 2014 alone, the depreciation of naira against the dollar is about 3.20 per cent (Central Bank of Nigeria; 2013) and has since remained in this free fall range. This depreciation is noteworthy; not only because of its size, but also because of the nature of the Nigerian economy of being import-dependent and thus, the precarious situation that such a free-fall pushes the economy. Indeed, such a large and rapid fall of the naira is unprecedented in the post-Bretton Woods period. It seems the worst is yet to happen, the recent (2015-2016) fluctuations of naira against the dollar in the parallel market in Nigeria is a food for thought for all! The most recent Central Bank of Nigeria's policy of abrogating official exchange rate is a pointer in another direction. Such prolong dramatic fluctuations of one currency against another presents a puzzle for economists and policymakers alike. Traditional exchange rates theories seem finding it difficult if not impossible, to explain both the immediate and remote impacts of such meteoric shocks on the macroeconomic variables.

Exchange rates can fluctuate meteoric over time. These fluctuations, and even just moderate exchange rate movements, can have significant impacts on output and prices in an economy. But unfortunately, notwithstanding the volume of substantial evidence in the academic literature and forecasting models, fundamental factors responsible for evolution of exchange rate fluctuations and how it will affect output growth and domestic inflation, at different points in time have had only limited success. This has posed challenges for monetary authorities which are forced to set monetary policy without a clear understanding of how exchange rate movements will affect key macroeconomic fundamentals over the medium term.

From exchange rates policy perspective, it is pertinent to understand the implications of such policy on the economy as a whole because different policies are likely to have different implications on the economy and may require different policy approaches. For example, naira may be responding to an increase in Nigerians' demand for imports or a decrease in foreign exchange earnings due to persistent fall in oil prices in the recent times, which has led to depletion of foreign reserves and its inherent impacts on

the economy as a whole. In the alternative, maybe, the depreciation of the naira is attributable to general strengthening of the U.S. dollar. These possible scenarios, if either of them is the reason behind the free fall of the naira, call for different and appropriate policy to offset the free-fall of naira. With this puzzle yet unresolved, we revisit the academic literature on exchange rate to ascertain fundamental factors responsible for exchange rate shock with efforts of drawing inferences from both short-run and long-run macroeconomic models that link exchange rate with the selected macroeconomic variables in order to explain the likely effects of exchange rate shocks in Nigeria.

This work adopts a fundamental change to the methodology currently mainly used to analyse and measure transmission of exchange rate shocks to the selected macroeconomic aggregates. In many literature, attempts have been made to conduct econometric studies of the impacts of exchange rate shocks on the movements in output in Nigeria, Egwaikhde (1994); Odusola and Akinlo (2001); Ekpo (2003), Oladipo (2007), Omishakin (2009), Oyinlola and Babatunde (2009), Adijah, El-hamza and Biola (2009) Adetiloye (2009). In their studies, they made use of a number of methods to evaluate the transmission of exchange rate shocks to selected aggregates. Disappointedly, many of these earlier studies were based on single equation regression and simultaneous equation modelling approaches. However, Ogunleye, Igue and Aremu (2012) adopted non-recursive VAR to evaluate impacts of exchange rate shocks on domestic prices in Nigeria. Unfortunately, many of these approaches seem to have been unable to capture the peculiar features of the Nigerian economy; the long-run phenomenon which exchange rate shock is associated, as well as the trends and dynamics in the data. To the best of my knowledge, at the time of conducting this research, most studies have employed other methods other than Error Correction Model (ECM). This paper, thus, seeks to re-evaluate the dynamism of exchange rate shocks with evidence from Nigeria by selected macroeconomic aggregates of changes in interest rate, change in domestic prices (inflation) and change real GDP.

Against this backdrop, this paper is intended to provoke and pave ways for further studies on the subject matters as it reveals the difficulty in resolving the empirical question on the macroeconomic fundamentals responsible for exchange rate shocks in Nigeria.

2. REVIEW OF RELEVANT LITERATURE

This section presents a review of literatures to put the study in context. The review covers both theoretical and empirical findings.

2.1. Exchange Rate Shocks: Conceptual Issues

Exchange rate is the rate at which one country's currency is exchanged for the currency of another country (Dornbusch, 2004). It can also be defined as the price of one country's currency relative to other countries' currency. While, Mankiw (1997)

defines it as the price at which exchange between two countries take place. How to determine the exchange rate is issue that has taken the centre stage of monetary and international economics. Monetary policy authority in Nigeria is faced with the problems of having a stable and realistic exchange rate which is in consonance with other macroeconomic fundamentals. This is because exchange rate instability can have serious adverse consequences on prices, investments and international trade decisions. A realistic exchange rate is one that reflects the strength of foreign exchange inflow and outflow, the stock of reserves as well as ensuring equilibrium in the balance of payments that is consistent with the cost and price levels of trading partners (Ojo, 1998).

While exchange rate shocks implies the ability of a country's currency relative to another country's currency to fluctuate over time. Exchange rate shocks is a term used to describe a phenomenon that occurs when the value of one currency spikes relative to another in an extremely short period of time. Exchange rate shocks could depend on two basic policies, that is the fixed exchange rate policy and the flexible exchange rate policy. By fixed exchange rate policy (regime), we mean a situation, when the exchange rate is set and government is committed to buying and selling its currency at a fixed rate, while flexible exchange rate policy defines a situation when the exchange rate is set by market forces (demand and supply for a country's currency). Beyond directly influencing different economic channels, exchange rate shocks have policy implications which are not as easily understandable. This shock have found to have significant impact on inflation, interest rate, real gross domestic product and other fundamental macroeconomic aggregates.

The high volatility of foreign exchange rates surprises many people. Approximately forty-five years ago, economists generally believed that allowing exchange rates to be determined in the free market would not lead to large fluctuations in their values. Surprisingly, recent experience has proved them wrong. Findings have shown that exchange rates over the 1986- 2016 in Nigeria for instance, after the introduction of flexible exchange regime, have been very volatile.

In addition, we have equally seen that exchange rate analysis produces exchange rate overshooting when the money supply increases. Exchange rate overshooting is an additional reason for the exchange rates shocks in Nigeria. Because earlier models of exchange rate behaviour focused on goods markets rather than asset markets, they did not emphasize changing expectations as a source of exchange rate movements, and so these earlier models could not predict substantial fluctuations in exchange rates. The failure of earlier models to explain shocks is one reason why they are no longer so popular.

The more modern approach emphasizes that the foreign exchange market is like any other asset market in which expectations of the future matter. The foreign exchange market, like other asset markets such as the stock market, displays substantial price volatility, and foreign exchange rates are notoriously hard to forecast.

2.2. Theories/Models of Exchange Rate Shocks

In general, two models of exchange rate shocks would be discussed to form the main theoretical frameworks upon which this study hinges; they include the purchasing power parity model, and the more modern asset market theory of exchange rate.

The purchasing power parity is a simple theory of equilibrium exchange rate determination and is used mainly for cross-country composition of living standards and examining the productivity levels over time as well as determining the relative value of currencies (Vachris and Thomas, 1999 as cited by Omolara et al; 2012). This theory is based on the proposition that exchange rates would adjust to equalize the relative purchasing power of currencies. Thus, it is expected that in perfectly competitive markets, identical products would trade at equivalent prices when valued in the same currency.

The PPP theory is based on the notion that the exchange rate is dependent on the actual buying power over a basket of goods, and so changes in the nominal exchange rate should reflect changes in the prices of goods (Taylor and Taylor, 2002, as cited in Omalar et al; 2012). Thus, the PPP theory is rooted on the concept of the "law-of-one-price" which assumes that nominal exchange rates should change to compensate for price differentials across countries. In its simplest form, the law-of-one-price can be expressed as:

$$P_t = P_{tx} S_t \quad (1)$$

Where:

P_t : domestic prices for a good or basket of goods

P_t^* : foreign prices for a good or basket of goods and,

S_t : spot/ market determined exchange rate; units of domestic currency in terms of a unit of foreign currency.

If PPP holds, then equation 2.1 can be re-arranged to derive the form of absolute PPP.

The left hand side of equation 2.1 can also be referred to as the real exchange rate or the exchange rate that has been adjusted for relative price levels. It differs from absolute PPP approach as it takes into cognizance changes in prices and exchange rate. This implies that the expected changes in the exchange rates would be equivalent to the change in the ratio of the two countries' price level, given that there are no changes in fundamentals relationships. Thus the relative PPP model which establishes a relationship between the price indices of both domestic and foreign countries is given as follows:

$$St^2 - St^1 = \pi_t - \pi_t^* \quad (2)$$

$$\text{Or } \% \Delta S_t = \% \Delta P_t - \% \Delta P_t^* \quad (3)$$

Where;

π_t : domestic inflation, and the depreciation

π_t^* : foreign inflation

S_t : rate of depreciation of domestic currency

In equation 2.2, it can be seen that the percentage change in exchange rate over a given range of time will be equal to the differences in inflation of domestic economy and that of the foreign economy. Put in a slight different form, equation 2.3 reveals the differences in percentage changes in price levels in the domestic country and foreign country, also known as the changes in the relative inflation, as direct determinants in the relative changes in exchange rate between the two countries. It is thus, the calculation of the relative PPP that many economists and theorists normally anchor their empirical tests in order to establish the validity of PPP.

However, this theory has few shortcomings that makes it difficult to explain exchange rate shocks in the short run. The PPP conclusion that exchange rates are determined solely by changes in relative price levels rests on the assumption that all goods are identical in any two given countries and that transportation costs and trade barriers are very low. The assumption that goods are identical may not be too unreasonable in reality. PPP theory furthermore does not take into account that many goods and services (whose prices are included in a measure of a country's price level) are not traded across borders. Housing, land, and services such as restaurant meals, haircuts, and golf lessons are not traded goods. So even though the prices of these items might rise and lead to a higher price level relative to another country's, there would be little direct effect on the exchange rate.

We have discussed the PPP theory of the long-run behaviour of exchange rates. However, in order to understand why exchange rates exhibit such large changes (sometimes several percent) from day to day, the theory of how current exchange rates (spot exchange rates) are determined in the short run as explained by the asset market theory is reviewed.

Writing the currency exchange rate (the spot exchange rate) as E_t and the expected exchange rate for the next period as E_{t+1}^* , we can write the expected rate of appreciation of the naira as $(E_{t+1}^* - E_t) / E_t$. Our reasoning indicates that the expected return on naira deposits R^D in terms of foreign currency (dollars) can be written as the sum of the interest rate on dollar deposits plus the expected appreciation of the dollar:

$$R^D \text{ in terms of dollars} = i^D + \frac{(E_{t+1}^* - E_t)}{E_t} \quad (4)$$

Thus in terms of dollars, the relative expected return on naira deposits (that is, the difference between the expected return on naira deposits and dollar deposits) is calculated by subtracting i^F from equation 2.4 to yield equation 2.5:

$$R^D \text{ in terms of dollars} = i^D - i^F + \frac{(E_{t+1}^* - E_t)}{E_t} \quad (5)$$

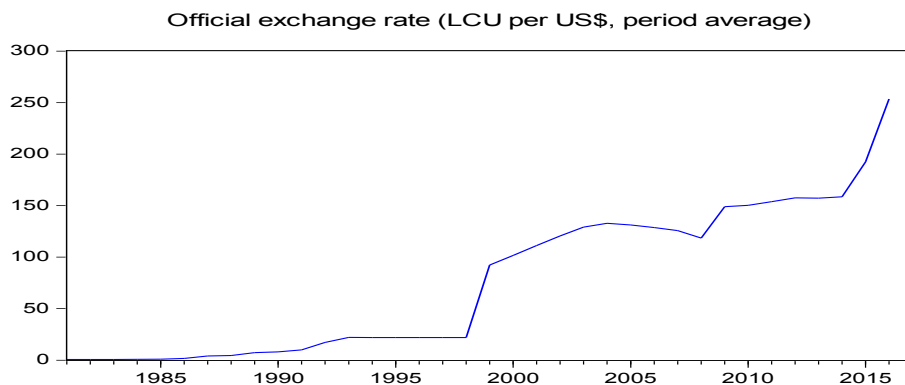
As the relative expected return on naira deposits increases, foreigners will want to hold more naira deposits and fewer foreign deposits (dollars).

2.3. Review of Empirical Literature

2.3.1. Trends in Exchange Rate Shocks in Nigeria

The naira which has served as the Nigerian currency since 197, started very strongly against the dollar for a number of years. Naira was stronger than the US dollar in the earliest period of the Nigerian political independence in 1960. This was partly supported by the strong productive capacity of the economy. Although, the Nigerian economy has always been an exporter of primary commodities even in the pre-independence period, as automated to operate by the colonialists, the economy had been able to achieve a positive balance of payments. Thus, this largely accounts for the economy maintaining the projectile of producing primary products to the rest of the world many years into independence (Sharehu 2015).

Figure 1. : Trends of Exchange Rate in Nigeria



Source: CBN 2016.

Consequently, the naira maintained a robust Naira/Dollar exchange rate for some years. This is as depicted in the chart in Figure 1. It is noteworthy that over this period the country was exclusively practising a fixed exchange rate regime. It is also crucial to know that the economy reaped surplus from oil boom in the mid-70s. However, it is imperative to know the fixed exchange rate regime was never in tandem with prevailing economic realities.

International pressure on the government to deregulate the economy in order to devalue a perceived over-valued naira heightened after a series of budget deficits as a result of global financial crisis of the early 80s. The crisis which saw the government borrowings in order to sustain the fixed exchange rate of the Naira/dollar increased monumentally for a number of years. As the oil glut ended due to weak demand in addition to debt profile used to finance the deficits in the budgets, the government gave in to pressure and relaxed the exchange rate regime to a flexible

one. The deregulation of the economy and the domestic currency devaluation came into effect precisely in 1986.

2.3.2. Empirical Literature from Developed Economies

A review of studies conducted in advanced countries includes Feyzioglu (1997) who examined the real exchange rate in Finland during the period between 1975 and 1995. He made use of Johansen Co-integration techniques and the result showed that positive terms of trade shocks, world real interest rates and productivity differential between Finland and its main trading partners contributed to the appreciation of the real exchange rate. He found out that the real exchange disequilibrium persisted for long periods and it would take about one and a half years to correct 50 per cent of such disequilibrium.

In their work, Clostermann and Schnatz (2000), equally examined the real exchange rate on the euro-dollar relationship. They assessed the major determinant factors that drive changes in real exchange rate in the European zone between 1975 and 1998. They constructed a synthetic real euro-dollar exchange rate and used co-integration techniques and the error correction model for their study. Their findings revealed that the international real interest rate differential, relative prices in the goods sector, real oil prices and government spending accounted for significant changes in the real exchange rate. They equally estimated the medium-term equilibrium exchange rate of the euro to be 1.13 dollar/euro.

In a similar vein, Lorenzen and Thygenssen (2000) carried out a study on the euro-dollar link indicated that net foreign assets, demographics, research and development spending and the relative prices of the goods sector accounted for changes in the euro. They observed that the estimated euro-dollar exchange rate ranged from 1.17dollar/euro to 1.24dollar/euro.

In a related study, Chinn (2000) investigated the behaviour of the dollar/euro exchange rate using the monetary approach to the exchange rate. Variables analysed included money stocks, industrial production, interest and inflation rates, relative price of non-tradables and synthetic euro. He used co-integrating VAR analysis to found that the real values of the euro lied between 1.15dollar/euro and 1.17dollar/euro and that euro was undervalued by about 13.0 to 15.0 per cent in January 2000, implying that it was below its equilibrium value.

2.3.3. Empirical Literature from Developing Economies

The impact of exchange rate regimes and selected macroeconomic fundamentals on dynamics of exchange rate shocks have been analysed in many empirical studies for developing countries. However, the findings of these studies differ and cannot be generalized. Impacts of exchange rate regimes; fixed or flexible; on exchange rate

fluctuation is more ambiguous. Meanwhile, most of the empirical findings confirm that the depreciations of the nominal exchange rate are related to temporary increases in domestic prices.

According to Gosh et al (1997); there are evidence that the mean inflation rate is lower in economies with a fixed exchange rate than in those with a more flexible exchange rate. Accordingly, Aghevli et al. (1991) came up similar results, but however showed that many countries with fixed exchange rate regimes have experienced a high rate of inflation consequent upon inadequate fiscal policies.

Quirk (1994) observes that the differences between the various exchange rate regimes have been reduced, once the adjustments in the case of fixed exchange rate regimes are taken into account. Similarly, he demonstrated that the stability of the exchange rate has become a "by-product" of other political options. As revealed in the literature, many developing economies have been subjected, since the mid-1980s, to frequent shocks in the terms of trade and, thus, have adopted more flexible exchange regimes to avoid the deterioration of external competitiveness. However, according to Kamin (2003) in Mexico, the real depreciation of the peso had a strong inflationary impact. In general, it seems that not only changes in the nominal exchange rate, but also the level of the effective real exchange rate are correlated with the inflation rate.

In their work, Mahamadu and Philip (2003) explore the relationship between monetary growth, exchange rates and inflation in Ghana using the Error Correction Mechanism. The empirical result confirms the existence of a long-term equilibrium relationship between inflation, the money supply, the exchange rate and real income. According to the theory, the findings show that in the long term, inflation in Ghana is positively related to the money supply and the exchange rate, while it is negatively related to real income.

Dick and Ndung'u (1998) develop an error correction model with the objective of analyzing the behavior of prices in Kenya during 1974-1996. Using the Johansen procedure, they conducted a co-integration test in the currency and exchange markets. They found that in the long term, inflation emanates from movements in the exchange rate, foreign prices and terms of trade, while the money supply and the interest rate influence inflation in the short term. These findings indicate that the exchange rate is likely to be a nominal anchor more efficient than the money supply.

T.O. Akinbobola (2012) investigates the dynamics of money supply, inflation and exchange rate in Nigeria, adopting Vector Error Correction Model (VECM). He argues that the main cause of price fluctuation in many developing economies is the exchange rate fluctuation. There are several reasons for this. In import dependent country like Nigeria, changes in exchange rate are directly reflected in the prices of the goods and services.

Odusola and Akinlo (2001) investigate the link between depreciation, inflation and naira production in Nigeria, adopting Vector Self-Regress (VAR) and its struc-

tural variant. Their findings suggest that the adoption of a flexible exchange rate system does not necessarily lead to the expansion of production, particularly in the short term. Issues such as discipline, trust and credibility on the part of the government are essential.

According to Akpan and Atan (2012), using a Generalized Method of Moments (GMM) procedure, found a statistical significant relationship between exchange rate and economic growth in Nigeria in the short-run, but in the long-run, the two variables drifted apart.

Rodrik (2008) dramatically argues differently about the reason exchange rate shocks matter for economic growth and also about the empirical relationship. In large sample of developing countries over 1950-2004 period, he discovers that economic growth over the medium term is much higher in countries with more undervalued exchange rates, and that the effect is linear and similar for both under and overvaluation of exchange rate; implying that overvaluation hurts economic growth but undervaluation spurs it. This evidence is also corroborated by the evidence from Rajan and Subramanian (2007); Dollar and Kraay (2003); Razin and Collins (1997). McCarthy (2000) used the VAR model in estimating exchange rate impact on domestic prices at the aggregate level for several developed economies. He concluded that impact of exchange rate on domestic prices was minimal for most of the countries. Impacts of exchange rate shocks on domestic prices was found to be incomplete and higher in both magnitude and speed (Campa and Goldberg, 2005).

3. RESEARCH METHODOLOGY

This section discusses explicitly the methodology and estimation related issues in line with the objectives of this study. The source of data is stated and the theoretical framework is developed also.

3.1. Source of Data and Estimation techniques

The main focus of this research work is on the dynamism of exchange rate shocks in Nigeria. The paper thus, makes use of annual time series data covering the period of 36 years; 1981 through 2016 and were obtained mainly from the World Economic Index.

In order to isolate and analyse the impact of selected variables on exchange rate shocks, ECM models are relied upon such as ARDL bound testing, impulse response functions (IRFs) and Forecast Error Variance Decomposition (FEVD). These methods are utilized in order to ascertain the trends in the macroeconomic aggregates under study as stated in the introductory section of the paper.

3.2. Model Specification

In the literature, series of factors have been adduced as the evident behind exchange rate evolution in Nigeria. Meanwhile, the focus of this study is in line with the monetary theory of exchange rate. The following econometric model based on the 4×4 matrix regression equations were formulated:

$$\ln Z_t = \emptyset_i + \sum \beta_i \ln Z_{t-1} + \varepsilon_t \quad (6)$$

where;

$\ln Z_t = (\ln EXR_t, \ln GDP_t, \ln INFR_t, \ln INTR_t)$; the vector of the log values of nominal exchange rate (EXR), nominal gross domestic product (GDP), Inflation rate (INFR) and interest rate (INTR).

$\emptyset_i$ = intercepts of the autonomous variables.

β_i = matrix of the coefficients of all the variables in the model

Z_{t-1} = vector of the lagged variables.

ε_t = vector of the white noise error term.

Going by the model above, the functional relation between the variables can be implicitly shown as below:

$$\ln EXR = F(\ln GDP, \ln INFR, \ln INTR) \quad (7)$$

where;

$\ln EXR$ = *ln of nominal exchange rate,*

$\ln RGDP$ = *ln of nominal gross domestic product,*

$\ln INFR$ = *Inflation rate and*

$\ln INTR$ = *Interest rate.*

4. ANALYSIS OF ESTIMATION RESULTS AND FINDINGS

This paper explore the co-integration and Error Correction Mechanism (ECM) method. This is due to the fact that the selected variables of interest are found to relate to dynamics exchange rate, thus the need to treat the variables symmetrically and allow feedback among them. Second, ECM analysis is superior to the orthodox VAR for capturing the long-run dynamics of exchange rate. This technique enables us to verify the stationarity as well as the order of integration of the variables used in the model. The method also enables us to establish the long-run relationship between exchange rate, gross domestic product interest rate and inflation.

4.1. Unit Root Test

Empirical findings have shown that most economic time series are strongly trended and hence non-stationary (Iyoha M.A. 2004). The Unit Root Test is conducted to verify the stationarity or otherwise of the selected macroeconomic vari-

ables. The result of the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) used in the study are shown in Table 1.

Table 1. : Unit Root test

Variable	AUGMENTED DICKEY-FULLER						Phillips-perron Statistic	
	AIC		SBC		HQ		Level	First Diff.
	Level	First Diff.a	Level	First Diff.	Level	First Diff.		
lnEXR	-1.90574	-5.0265*	-1.90574	-5.0265*	-1.90574	-5.0265*	-2.03421	-5.0265*
lnGDP	0.297192	-5.2820*	0.297192	-5.2820*	0.297192	-5.2820*	0.185485	-5.2690*
INFR	-5.6964*	-7.1276*	-5.6964*	-7.1276*	-5.6964*	-7.1276*	-5.6964*	-27.112*
INTR	-2.80487	-2.48467	-2.40276	-5.1321*	-2.40276	-2.48467	-2.3816	-6.5282*

Note: *, **, and *** represents statistical significance at 1%, 5% and 10% respectively

Source: Authors' Results from E-views 9 for Windows.

Prior to the examination of the long-run relationship between exchange rate and the selected macroeconomic fundamentals, the times series properties of the variables are first investigated using ADF and PP tests. The ADF test was based on Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQ). The three criteria chosen for the ADF and the PP revealed that exchange rate and gross domestic product are I(1) variables. While the interest rate is shown to be I(1) variable by the PP and the is supported by HQ criterion of the ADF. However, the inflation rate is found to be I(0) variable by both ADF and PP.

4.2. Selection of Optimal Lag Length of the Model

Table 2. : VAR Lag Length Selection Criteria- LHCPI

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-311.01	NA	7877.5	20.3232	20.5082	20.3835
1	-203.35	180.582	21.53846*	14.41	15.33513*	14.71156*
2	-191.81	16.3835	30.4107	14.6975	16.3628	15.2404
3	-178.58	15.3696	42.3027	14.8759	17.2813	15.66
4	-148.62	27.05456*	23.705	13.9757	17.1212	15.0011
5	-126.47	14.2916	30.0418	13.57882*	17.4645	14.8454

* indicates lag order selected by the criterion

Source: Authors' Results from E-views 9 for Windows.

Thus, the optimum lag length of 1 is chosen based on FPE, SC and HQ criteria as shown in Table 2. And the residual of the VAR is tested for autocorrelation at this lag length, the residual is found to be free of serial correlation. Hence, the lag length

of 1 is chosen as the optimum lag; this equally confirmed what is usually expected of annual data.

4.3. Analysis of Long run Effects of Gross Domestic Product, Inflation and Interest Rate on Exchange rate

To obtain the long run impact of the selected macroeconomic variables on the exchange rate, Error Correction Mechanism (ECM) which incorporates both the long run and short run effect simultaneously is estimated. The elegance of this estimation technique is that once variables are non-stationary but co-integrated, the estimates from ECM are more efficient than either the Ordinary Least Square or orthodox VAR estimates. The ECM is also devoid of endogeneity problem and the inherent spurious inferences associated with OLS estimates.

The ECM is a gauge of the speed of adjustment of the short run relation to unexpected shocks. It is measured as the effects of residual from the long run model. This long run feedback effect is indicated by significant ECM terms while the short run causality is measured by the significant coefficient on the individual variables.

To establish the presence of a long-run equilibrium relationship among the non-stationary variables, the Johansen and Juselius (1990) co-integration test using the trace and max-eigenvalue tests was conducted as shown in the Table 3. below:

Table 3.: Unrestricted Johansen's Co-integration Rank Test (Trace and Max-eigenvalue)

Hypothesized no of CE(s)	Eigenvalue	Trace Statistic	5% critical value	Prob-ratio
None *	0.49707	57.53523	54.07904	0.0238
At most 1	0.407894	34.16687	35.19275	0.0642
At most 2	0.26372	16.34852	20.26184	0.1587
At most 3	0.160287	5.939617	9.164546	0.1954
Trace test indicates 1 co-integrating equation at 5% level. *denote rejection of the hypothesis at 5% level of statistical significance.				
Hypothesized no of CE(s)	Eigenvalue	Max-Eigen	5% critical value	Prob-ratio
None*	0.49707	25.36836	24.58808	0.0214
At most 1	0.407894	17.81835	22.29962	0.1881
At most 2	0.26372	10.4089	15.8921	0.2986
At most 3	0.160287	5.939617	9.164546	0.1954
Max-Eigenvalue test indicates 1 co-integrating equation at 5% level. *denote rejection of the hypothesis at 5% level of statistical significance.				

Source: Authors' Results from E-views 9 for Windows.

According to trace and max-eigenvalue test results, the null hypothesis of no co-integration equation is strongly rejected as the trace and max-eigenvalue statistic were greater than their corresponding critical values at 5 percent significance level.

Hence, it is concluded that there exists a unique long-run equilibrium relationship between the nominal exchange rate and the selected macroeconomic fundamentals.

The co-integration test as shown in Table 4. is mainly to establish whether this ECM term; derived from the residual of long run regression; is stationary at level or not and to determine how many of such relationships exist. As confirmed from the table, there is significant long run relationship among the variables. Meanwhile, the presence of long run relationship among the variables included in the model does not automatically imply that all the variables in the model have significant effects on the dependent variable. Thus, to determine which variable actually exhibit the observed long run relationship, there is the need to estimate the long run model and then analyse the estimates.

Having established the presence of a single co-integrating vector, the estimation of long-run equilibrium relationship using the Error Correction Model is then conducted. In the first stage, we estimated the co-integration equation for the LEXR by imposing 1 normalizing restriction while in the next stage, we estimated the error correction term arising from the co-integration relation. The result of the estimated co-integrated vector normalized on LEXR is presented in Table 4.

Table 4.: Equation of the co-integrated vector normalized on LEXR

LEXR(-1) = 24.7755 - 0.9706*LGDP(-1) + 0.0488*INFR(-1) - 0.2582*INTR(-1)			
(4.7129)	(0.17921)	(0.01004)	(0.03614)
[5.25693]	[-5.41619]	[4.85823]	[-7.14422]

Source: Authors' Results from E-views 9 for Windows.

The long-run relationship between the LEXR and the selected variables showed that LGDP, INFR and INTR are highly statistically significant. In the long run estimation result above, growth of gross domestic product exerted greatest impact on growth rate of exchange rate in Nigeria. That is, a 1.0 percent increase in growth rate of gross domestic product, leads to depreciation of the exchange rate by 9.7 percent elasticity in the long-run; implies that elasticity of growth rate of exchange rate to growth rate gross domestic product is 9.7. While a 1.0 percent increase interest rate leads to 26 percent depreciation in the growth rate of exchange rate. However, 1.0 percent increase in inflation rate leads to a less than 4.8 percent appreciation in growth rate of exchange rate. Thus, result of the error correction model; that is the short-run relationship is presented in Table 5.

Table 5.: Error Correction Model

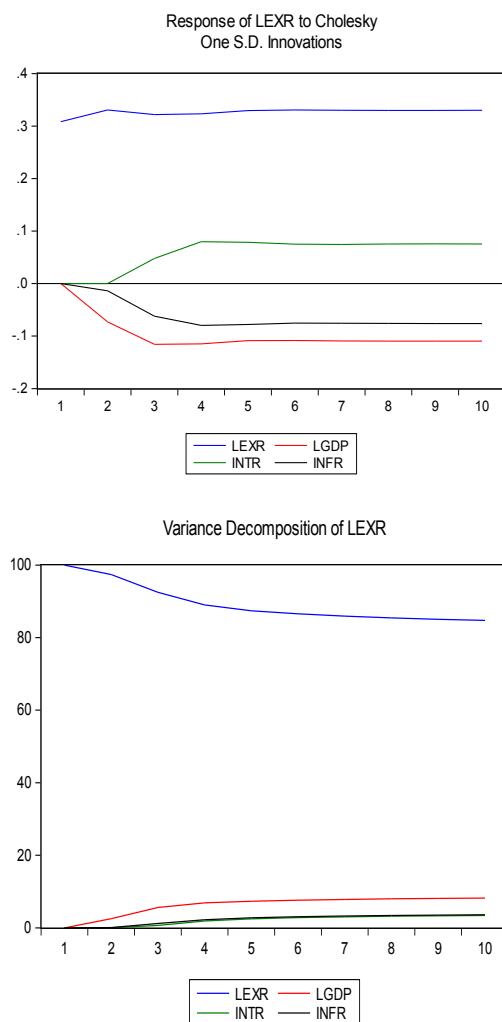
CointE1	D(LGDP(-1))	D(INFR(-1))	D(INTR(-1))
-0.044321*	-0.025039	0.000288*	-0.014401*
-0.07174	-0.35269	-0.00206	-0.02132
[-0.61782]	[-0.07099]	[0.14000]	[-0.67547]

Standard errors are in () and t-statistics in [] *denotes 5 percent level of statistical significance

Source: Authors' Results from E-views 9 for Windows.

The estimation discloses that the speed of adjustment coefficient of the LEXR had a negative sign, less than one and highly statistically significant at 5% level with -0.044 indicating that any shock in the short-run would be obviated each year by about 4.4 percent and further ascertain the existence of a long-run relationship between the variables. The adjustment process is relatively slow albeit, indicating that any short-run LEXR disequilibrium would be corrected to settle towards its long-run equilibrium value.

Figure 2.: Response of LEXR to Shocks and Variance Decomposition of LEXR



Source: Authors.

Similarly, the dynamism of exchange rate shocks error correction specification showed that the parameter estimate of the EXR and the three selected variables are statistically significant at 5 percent level of significance.

5. CONCLUSION AND POLICY RECOMMENDATION

This paper examines the dynamism of exchange rate shocks from the view point of three selected macroeconomic fundamentals of domestic prices (inflation), interest rate and nominal gross domestic products (GDP). The existing financial and economic literature such as the purchasing power parity model and the more modern asset market theory to exchange rate were relied upon to conduct the study on the relationship between exchange rate shocks and the three macroeconomic variables.

The estimation result shows that increase in productive output (gross domestic product) would lead to depreciation of the exchange rate in the short run but an insignificant effect in the long run. It hence, implies that dwindling in domestic production has remained one of the major causal factors of the persistent fluctuation in exchange rate in Nigeria. That is, real output has an inverse effect on exchange rate; thus implying that the supply side argument also holds. That is, increasing the supply of goods and services will reduce the pressure on exchange rate. This means that increase in real output can also be used to curtail spiral fluctuation in exchange rate. There are divergent opinions on whether inflation in developing countries like Nigeria, could be explained from monetarist perspective in view of the significant distortions in the supply chain of food and material resources flow in Nigeria and consequently, impacted on the exchange rate. The estimation result shows that persistent rise in price level would lead to appreciation of the exchange rate simply because of over reliance on cheap and more sophisticated foreign goods and materials, at least in the short run but. The domestic interest rate, as reveal by the estimation results, is equally found to significantly impact on the fluctuation of exchange rate in Nigeria. The above results corroborate the findings of Clostermann and Schnatz (2000) that examined the real exchange rate on the euro-dollar relationship and that of T.O. Ak-inbobola (2012) titled the dynamics of money supply, exchange rate and inflation in Nigeria. Their findings revealed that the international real interest rate differential, relative prices in the goods sector, real oil prices and government spending accounted for significant changes in the real exchange rate.

The overall conclusion is therefore to achieve exchange rate stability in Nigeria, both monetary policy and fiscal policy need to be well coordinated to prevent excessive import of goods and services as well as promoting import-substitution and export of domestic products. Though the selected variables may not be the most important factors in exchange rate determination in Nigeria, the fact that they influence exchange rate in the long run and short run, suggests that sustainable growth of gross domestic product through increased output production and diversifying the

economy from import based economic activity to export oriented will increase output supply, stability of domestic prices and optimum money supply achieved through disciplined monetary policy are sine qua-non for stable and effective exchange rate in Nigeria.

In view of our findings, the study therefore recommends that a proactive exchange rate policies that promote stability and induce non-tradable activities in the domestic economy is put in place. There is also the need for the economy to be re-structured in favour of exports and reduce importation of foreign goods. We in addition, recommend that joint efforts by public and private sectors are put together to stimulate the country's level of production, especially in the area of non-oil outputs to promote export drive and import substitution to enhance inflows of foreign exchange and consequently stabilize the value of naira against other currencies of the world.

To address the influence of pass through of exchange rate into domestic prices, there is need to combine a good mix of macroeconomic policies by the policy makers. An exchange rate policy that shows the prevailing equilibrium conditions is advocated. However, because the pass-through effect of exchange rate is high and the economy is import dependent, a once and for all adjustment of exchange rate could be inimical to the economy by resulting in high pass-through to inflation as evident from year 2016 to the current economic reality in Nigeria. The retention of an over-valued rate is a precursor to loss of external and internal balance.

Most importantly, all the necessary measures to curb inflation especially the consumer price index, must be put in place by the stakeholders. The positive correlation between domestic prices and exchange rate in both the short-run and long run models reveals the destabilizing tendencies of inflation. High volatile domestic prices could lead to distortions in the economy and disequilibrium in the foreign exchange market.

From the aforementioned, an exchange rate policy that would gradually adjust the rate towards its equilibrium position must be encouraged. The objectives would be to adopt an exchange rate that would enable the automatic adjusters in the economy correct misalignments when it occurs. Thus, this work recommends gradual depreciation of exchange rate rather than what is being experienced at present in the Nigerian foreign exchange market.

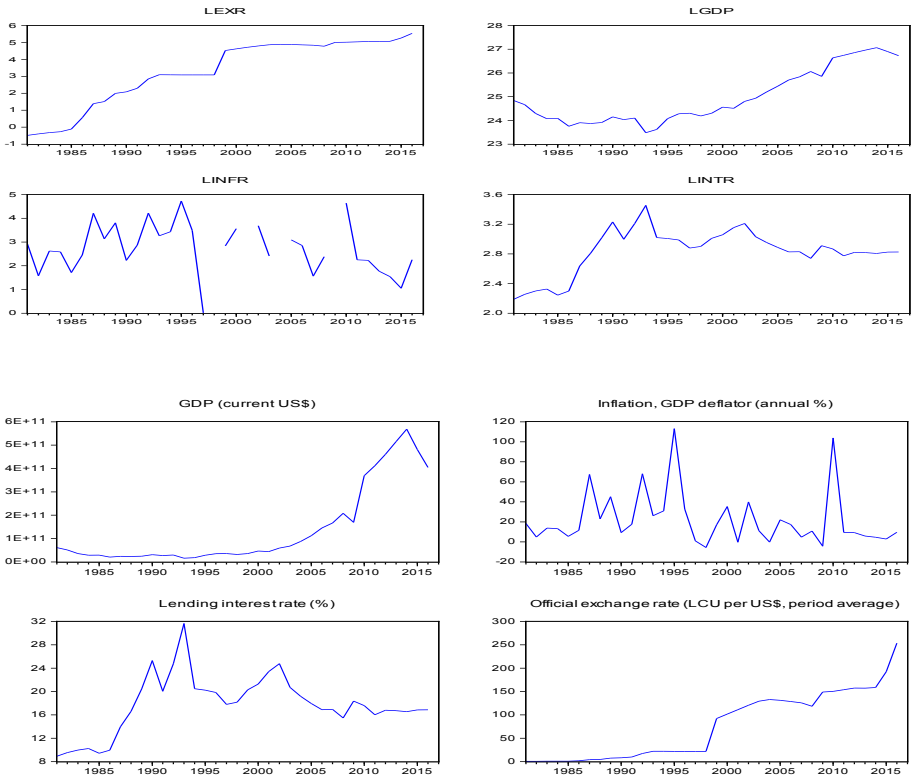
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