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Consumption Dynamics, Interest Rate Behavior and the Euler Equation: Time Series Evidence for Nigeria

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Abstract: The study investigated the Consumption-Interest rate Euler relationship for Nigeria in the periods 1980 to 2015. Applying commonly used vector autoregression (VAR) techniques on annual data obtained for the country, the study found that there exists the Consumption-Interest rate Euler relationship for Nigeria. However, our finding refutes the general assertion of theorist that the substitution effect is always larger (and more workable) in the Euler relationship than the income effect. Our results show that the consumption Euler equation for Nigeria is consumption-driven, an indication that income effect may be more workable in Nigeria thus crowding out the substitution effect. This was further supported by a uni-directional causality that runs through consumption to interest rate. We recommend, among other things, interest rate policy framework that is flexible to economic needs of the region and motivates saving-dissaving culture of the people and consumptions patterns that is financed by cashless financial products.

Keywords: Consumption, Real Interest Rate, Inflation, VAR, Nigeria

1. Introduction

The consumption behavior of an economy is often believed to have growth-inducing effect on the entire economy. In-fact, received theories of growth opined that consumption and investment are important to growth and fluctuations therein direct the real growth path an economy possesses. It is however noteworthy that growth cannot be achieved in itself without necessarily postponing consumption at a cost of declining standard of living. The level of consumption may be interpreted as the result of a decision-making process of households over the time structure of the allocation of their income. The decision between what to consume and what to postpone for future consumption are largely determine by both the household and the government subject to the reigning rate of return on income.

The effect of financial markets on the activities of household consumption and other related activities can only be captured through interest rate fluctuations. Interest rate under this cover takes the form of any return on income that will induce households to postpone current consumption for future ones. Viewed from this perspective, higher interest rates are expected to compressed current consumption for future ones even as low interest rates are expected to push-up present consumption at the expense of future ones.

However, John M. Keynes in one of his glorified postulates stated that 'the usual type of short period fluctuations in the rate of interest is not likely to have much direct influence on spending either way'. Instead, he focused on current income as the most important determining factor (Keynes, 1936).

Shortly thereafter, (and possibly in 1937, as reported by Parker, (2007)), Euler proposed a consumption-interest rate relationship that is tested and workable in many countries. Canzoneri, Cumby and Diba (2007) thus argued that the Euler equation provides a direct link between monetary policy and Consumption demand. Hansen (1996) explains why the variables in the Euler equation are so important. First, the interest rate in the equation is a potentially relevant variable for making decisions on the use of households' income; second, the responsiveness to interest rate changes of the demand for consumer credits; and, third, the importance of interest rates as a determinant of investment income (which is capable of shifting income from

consumption to real investment).

The purpose of this paper is to provide evidences of Consumption-Interest rate Euler relationship for a developing economy like Nigeria using annual time series data from 1980 to 2015. At present, studies on the validity of Euler relationship for Nigeria are scanty (if not totally unavailable). Our search for such evidence only landed us on justifications for traditional consumption functions. Thus, this work exists to fill such gaps in the literature. Following this brief introduction, the rest of the paper is structured as follows; section two examines both the theoretical and empirical background for the study; section three examines the stylized facts about consumption-interest rate relationship in Nigeria; section four examines the methodological issues adopted for the study; section five presents the findings of the study; and section six concludes the paper with some policy options.

2. Literature Review

2.1. The Theory

Economic theory indicates that the effect of real interest rates on personal consumption depends on the relative magnitudes of the substitution effect and the income effect. We saw earlier that higher interest rates are expected to compressed current consumption for future ones even as low interest rates are expected to push-up present consumption at the expense of future ones. This effect is the total interest rate effect on consumption which can be separated into two effects: the substitution effect and the income effect.

The substitution effect is the increase in current consumption as real interest rate falls after adjusting the income of the consumer so as to keep the purchasing power of the consumer as before. According to Koutsoyiannis (2001), this adjustment in income is called compensating variation. The purpose of compensating variation is to allow the consumer to remain on the same level of consumption before the interest rate change.

The former is the amount that a consumer gained from a decrease in real interest rates by consuming today rather than saving for tomorrow, so it results in an increase in consumption today. The latter is the effect that a decrease in real interest rates causes by decreasing today's consumption since the amount of lifetime income declines by the reduction in the return on savings. In general, it is argued that the substitution effect is always larger (and more workable) in the Euler relationship than the income effect.

2.2. The Household Behaviour

A representative household behaves to maximizes the following

$$\text{Max}\, E_0\left[\sum_{t=0}^{\infty}\beta^t u(c_t)\right] \quad (1)$$

$$subject\ to \sum_{i=1}^{N} q_{it}Q_{it+1} + c_t = \sum_{i=1}^{N}(q_{it} + d_{it})Q_{it} + y_t$$

where,

β: subjective discount rate, c_t: consumption at t period (real, per capita), q_{it}: price of financial asset at t period, d_{it}: dividend of financial asset at t period, Q_{it}: amount of asset holding at t period (real, per capita), Y_t: income other than return on assets at t period (real, per capita), $u(c_t)$: utility function of representative household and E_0: conditional expectation based on the information available at t period.

The household chooses today's consumption and n-types of financial assets so as to maximize the discounted value of expected utility of future consumption under the budget constraint in each period.

Solving the equation (1) using Lagrange multiplier reduces to the following first order condition (Euler equation)

$$E_t\left[\beta\frac{u'(c_{t+1})}{u'(c_t)}(1 + r_{it+1}) - 1\right]=0 \quad (2)$$

Equation (2) is the called the Euler equation. The log-linear version of the above Euler equation is

$$\Delta c_t = \mu + \quad r_t + £_t \quad (3)$$

where r_t is the real interest rate contemporaneous with Δc_t, and as before the error term $£_t$ may be correlated with r_t but is uncorrelated with lagged variables. The coefficient on the real interest rate, , is the intertemporal elasticity of substitution.

In the process of log-linearizing the first-order condition, the variance of consumption growth is subsumed in the constant term (see Campbell and Mankiw, 1989)

2.3. Empirical Literature Review

Campbell and Mankiw (1989) investigated the empirical relationship between consumption, income and interest rate in the period 1953 to 1986 using what he calls First Stage Instrumental Regression. Their result reveals fairly small values for the coefficient on the real interest rate. The empirical regularity is that expected real interest rates are not associated with expected changes in consumption. This means that the predictable movements that we observe in consumption cannot be explained as a rational response to movements in real interest rates. It also means that forward-looking consumers do not adjust their consumption growth in response to interest rates, so their intertemporal elasticity of substitution in consumption must be close to zero-that is, consumers are extremely reluctant to substitute intertemporally between consumption now and consumption tomorrow.

Hansen, (1996) examine the impact of interest rates on private consumption in Germany from 1975 to 1994 using vector error correction model. His results suggest that interest rates play only a secondary role in explaining the development of private consumption in Germany. According to the estimations and simulation studies presented by the author, the semi-interest-rate elasticity is probably about 0.2 if the income effect is taken into consideration. Accordingly, interest rates can influence only the short-run dynamics of

consumption; the long-term trend of private consumption is determined by other variables. Thus, from monetary policy point of view, the empirical results presented permit the conclusion that a change in central bank interest rates is not an appropriate instrument for stimulating or restraining the level of private consumption.

Nakagawa and Oshima (2000) investigated the relationship between real interest rate and personal consumption in Japan using quarterly data from 1970 to 1999. Applying integrated multiple regression technique, they found suggestive evidence of no clear relationship between the real interest rate and personal consumption in Japan, because the Japanese people like to save and they don't want to consume by drawing on savings or by taking consumer loans even if real interest rates go down. Their studies suggest the prevalence of income effect over substitution effect in Japan.

Cromband Fernandez-Corugedo (2004) examines the sensitivity of the level of consumption to interest rates in a standardpartial equilibrium theoretical framework with no uncertainty. Using a multi-period framework, the consumption function is derived and interest rate effects are decomposed into substitution, income and wealth effects. Drawing on parallels with the finance literature, the authors illustrates two key implications of the theory that are not typically emphasized in the literature. First, they shows that wealth effects mean that consumption is much more likely to be negatively related to interest rates than the simple two-period model might suggest. Second, they demonstrates that long-term interest rates are more important than short-term rates, that is, the sensitivity of consumption to interest rate changes depends crucially on how long these are expected to persist. The numerical calibrations provided an indication of the sensitivity of the results to key parameters.

Christensen (2012), explored how interest rate affect household consumption and saving in the United States using 200 quarterly observations from 1962 to 2012. The author employed repeated regression and optimization, taking partial derivatives on the variables in the system to determine the optimal interest rate that households are comfortable to part their income between consumption and savings. Her findings suggest that consumption tends to increase at periods of low interest rates than periods of high interest rates thereby justifying the Federal Reserve stance at keeping interest rate low in their economy and justifying the dominant effect of substitution in the consumption – interest rate Euler relationship.

Jappelli and Padula (2013) investigate the relationship between consumption growth, interest rate and financial literacy in a model in which financial sophistication improves the portfolio returns and therefore the incentive to substitute consumption temporarily. They tested the model using panel data set from Italian household survey of income and wealth from 2006 to 2010 in an appropriate instrumental variable procedure. Their model delivers an Euler equation in which consumption growth is positively correlated with financial sophistication. Their findings reveal that consumption growth is positively correlated with financial literacy through interest rate. Under appropriate assumptions, they provide of the intertemporal elasticity of substitution of between 0.2 and 0.4 and complemented the results with direct evidence on the link financial literacy and returns on savings.

Ashley Mutezo (2014) examines the relationship between household debt in which interest rate is a major component and consumption spending in South Africa for the period of 1986-2013 in order to capture the short-run and long-run dynamics using what he called ARDL-bounds testing procedure. The empirical result reveals a significant deterministic relationship between household debt and disposable income, net wealth and inflation. There was however no significant short-run relationship between debt and the interest rate variable. There is further evidence of the existence of a long-run relationship between household debt and disposable income, interest rate and inflation. The implication of the study was that the low interest rates during the period (2004-2011) and a general increase in household income had supported household consumption expenditure in South Africa thereby sustaining high household indebtedness.

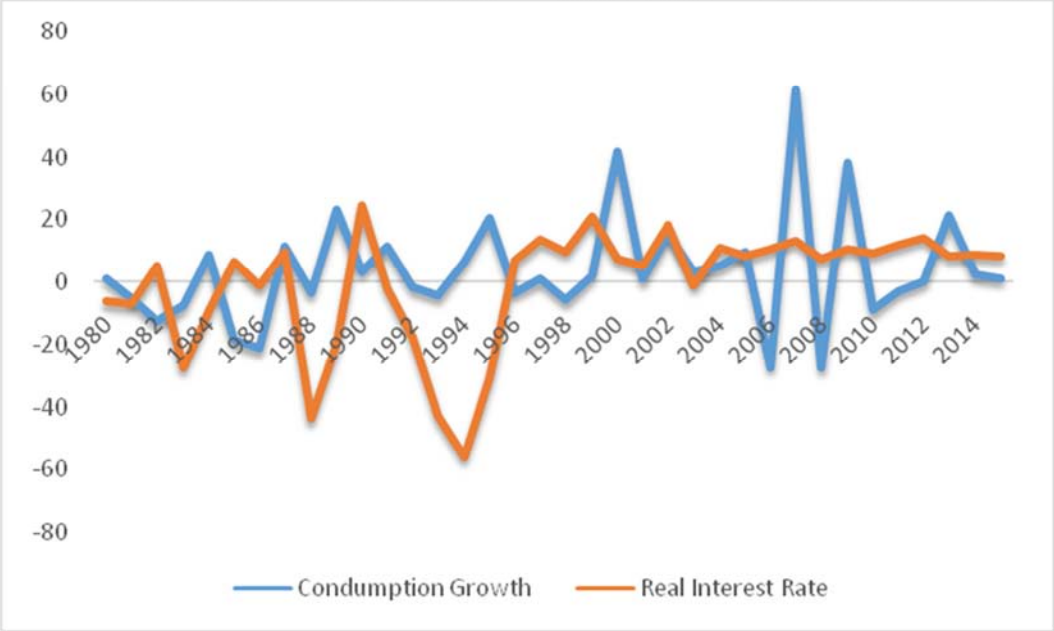
Fasoranti. (n.d) examined the determinants of consumption among rural dwellersin Akoko North West Local Government Area of Ondo State, Nigeria using both primary and secondary data. Data obtained was analysed with the aid of simple multiple regression analysis. The author found out that among other things, expected future income, deposits at banks and shares are significant determinants of consumption in the study area. He therefore concluded that to raise consumption in the study area, respondents should be enlightened on how they can invest in shares. On the other hand, consumption can be reduced in the study area if interest rates on deposits are increased.

Audu (2014) examined the determinants of consumption among rural dwellers of Bayelsa State, Nigeria. Primary data were collected through structured questionnaire that was administered randomly to 5000 selected respondents from rural communities. The data were analyzed and grouped into seven variables to test two hypotheses. The results showed that current income, expected future income, bank savings, investment in shares, pension fund returns and durable assets were significant determinants of consumption. The author therefore suggested that government should reinforce financial inclusion so as enhance savings habit in rural Nigeria especially Bayelsa State. Rural Nigeria need to invest their idle funds in equities (apparently enticed by enhancing interest rate) and key into the new pension scheme in order to maintain a steady stream of income both now and in the future.

3. Stylized Facts About Consumption and Real Interest Rate Behaviour in Nigeria (1980 - 2015)

Figure 1 presents the behaviour of consumption growth and interest rate swings in Nigeria between 1980 to 2015. As

the figure shows, both consumption growth and real interest rate were negative for most of the years. Consumption growth fell from -5.3 percent in 1981 to -21.14 percent in 1986. The years from 1988 to 1991 witnessed positive consumption growth as it grew from -3.1 percent to 11.25 percent before declining to 6.2 percent in 1994. From 1998, consumption grew from a negative of -6.01percent to 41.44 percent in 2000, before declining at a positive rate to 15.4 percent in 2002 and 9.2 percent in 2005. The next positive growth periods were recorded for 2011 as it grew from -3.1 percent to 21.1 percent in 2031 and falling at a positive rate to 1.9 percent in 2015. Within the same period, real interest rate fell from -6.6 percent in 1980 to -9.6 percent in 1984. It however grew from -43.6 percent in 1988 to 24.1 percent in 1990. Negative growth in interest rate were also noticed from 1991 to 1994 declining from -2.2 percent to -55.8 percent. From 1995 to 2002, positive growth were also noticed for real interest rate moving from -30.8 percent to 17.6 percent; even as in moved from 10.62 percent to 13 percent between 2004 and 2007 and maintaining an undulating positive rates throughout till 2015. Argued from the figure, it can be stated that the only seemingly correlation between consumption growth and interest rate existed in the early periods of investigation (say 1980 to 1988) as their fluctuations were minimal (although negative for most of the years) and between (1996 to 2005) although fluctuations in these periods were positive. We however, allow conclusive statements for our analysis.



Source: Author's Computation

Figure 1. *Consumption growth and Interest rate behaviour in Nigeria.*

4. The Model and Data

4.1. Vector Autoregressive (VAR) Model

This study employs vector autoregression VAR to estimate the properties of the variables. A VAR model treats every endogenous variable in a system as a function of the lagged values of all of the endogenous variables in the system. The vector autoregression (VAR) is used for forecasting systems of interrelated time series variables and for analyzing the dynamic impact of random disturbances on the system of variables. Mathematically, a VAR is represented as,

$$y_t = \lambda_1 y_{t-1} + \ldots\ldots + \lambda_q y_{t-q} + \beta x_t + \mu_t \qquad (4)$$

where y_t is a vector of endogenous variables, x_t is a vector of exogenous variables, $\lambda_1 \ldots \lambda_q$ and β are matrices of coefficients to be estimated, and μ_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

A VAR model is free of simultaneity bias since only the lagged values of the endogenous variables appear on the right-hand side of the equation. Estimates from VAR are consistent and efficient due partly to identical regressors and freedom from simultaneity bias.

In other to be thorough, we present our VAR model of Consumption and Interest rate but with the inclusion of inflation thus:

$$Com_t = \propto + \sum_{j=1}^{n} \delta_j Com_{t-j} + \sum_{j=1}^{n} \rho_j \, r_{t-j} + \sum_{j=1}^{n} \beta_j \, \pi_{t-j} + \varepsilon_{1t}$$

$$r_t = \propto_2 + \sum_{j=1}^{n} \rho_j \, r_{t-j} + \sum_{j=1}^{n} \delta_j \, Com_{t-j} + \sum_{j=1}^{n} \beta_j \, \pi_{t-j} \; + \varepsilon_{2t}$$

$$\pi_t \; = \propto_3 + \sum_{j=1}^{n} \beta_j \, \pi_{t-j} \; + \sum_{j=1}^{n} \rho_j \, r_{t-j} + \sum_{j=1}^{n} \delta_j Com_{t-j} + \varepsilon_{3t}$$

Where, Com_t is Consumption; r_t is real interest rate and π_t is inflation.

Data for the study were obtained from the world development indicators and the Central Bank of Nigeria. The estimation used real interest rate, the original variable specified by Euler for the period 1980 to 2015. The inclusion of inflation in the analysis is not a diversion from our focus. Inflation serves as a macroeconomic presence in the system.

4.2. Unit Root Test

We employ the traditional Augmented Dickey–Fuller (ADF) test for testing the stationarity and order of integration of the variables. The ADF test was employed because of its simplicityin testing for unit root and its suitability for large and complex set of time series data with unknown orders. The ADF estimation model is specified as follows:

$$\Delta y \; = \; ą \; + \quad t \; + \beta y_{t-1} \; + \sum_{t=1}^{n} ą_i \Delta y_{t-1} + \mu_t \qquad (5)$$

Where:
n = Number of lags required to obtain white noise
ą = Constant term
μ = Error term
t = Time trend

Due, however, to structural changes that may occur in the study period within the variables, the ADF may be insufficient in identifying integrated data. This deficiency is accommodated by the PP test developed by Perron (1997). Scholars are of the opinion that the PP test evaluates the time series properties of the variables in the presence of structural changes at unknown points in time and thus endogenises these structural breaks. The PP test is specified as:

$$\theta_\alpha^* = \; \theta_\alpha \left[\frac{\gamma_\circ}{\omega_\circ}\right]^{\frac{1}{2}} - \frac{T(\omega^\circ - \gamma^\circ)[se(\varphi)]}{2\omega_\circ^{\frac{1}{2}} s} \qquad (6)$$

Where, φ is the estimate, and θ_α is the t-ratio of φ, $se(\varphi)$ is the coefficient standard error, and s is the standard error of the regression equation. $\omega°$ and $\gamma°$ are the residual spectrum at zero frequency and consistent estimate of the error variance respectively.

Furthermore, to overcome the problem of low power and size distortion inherent in the above traditional ADF and PP test, as shown in Akpan (2011), we employed the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. The contrasting evidence of the KPSS and other duo is in the statement of the null. In the KPSS, the null hypothesis is that the variable in question is stationary. The decision criteria is to reject the null if and only if the absolute value of the calculated value exceed the critical value at the accepted level of significance (Akpan, 2011).

Thereafter, a test of causality using Pairwise Granger Causality Tests will be conducted to determine if there is any causal relationship among the variables.

5. Empirical Analysis

5.1. Staionarity Test

The unit root test, as shown in Table 1, indicates that our variables are stable for further empirical analysis for all the different test methods adopted. So our VAR model can be tested for lag selection order. This is important for, as noted by Bjørnland (2000), a large lag length relatively to the number of observations, will typically lead to poor and inefficient estimates of the parameters. On the other hand, a too short lag length, will induce spurious significance of the parameters, as unexplained information is left in the disturbance term. The lag selection test is reported in Table 2. As reported in Table 2, all the lag selection criterion shows that the number of lag to be included in the model should be of order one.

Table 1. *Unit root test results (regression with an intercept).*

Variables	ADF	PP	KPSS	Integration
CGR	-9.3535**	-9.2284**	0.3526*	1(0)
ΔCGR			0.2401**	1(1)
Ri	-3.1782*	-3.2656*	0.4454*	1(0)
ΔRi	-5.9380**	-15.5289**	0.3171**	1(1)
Infla	-1.1516	-2.9685**	0.3168**	1(0)
ΔInfla	-5.51190**	-116916**		1(1)
1% level	-3.6617	-3.6394	0.7390	Critical Values
5% level	-2.9604	-2.9511	0.4630	
10% level	-2.6192	-2.6143	0.3470	

Note: * indicates 5% significance; ** indicates 1% significance
Δ indicates the first difference
Source: Author's Computation

Table 2. *VAR Lag Order Selection Criteria.*

Lag	Log	LLR	FPE	AIC	SIC	HQ
0	-383.3993	NA	2971453	23.41814	23.55418	23.46391
1	-365.1170	32.13247*	1698979*	22.85558*	23.39976*	23.03868*
2	-359.47	488.8906	63211607	23.05908	24.01140	23.37951

Note: * indicates the lag order selected by the criterion.
Source: Author's Computation

Having selected the lag order, we were faced with the question of whether a VAR model should be used in the first place. To deal with this problem, Bjørnland (2000) asserted that more emphasis should be put into assuring that the models are dynamically well specified. That is, non-correlation, heteroscedasticity, and normality should be checked, and the order of integration. Thus, we test for the normality of our VAR residuals.

Our normality test follows the Jarque-Bera (1987) test. The basic idea behind the J-B test is that the normal distribution (with any mean or variance) has a skewness coefficient of zero, and a kurtosis coefficient of three. One caution we take into consideration when applying the J-B test was its asymptotic validity. If it is applied in small samples then there can be considerable "size distortion". That is, the actual probability of rejecting H_0 when it is true can be very different from the assumed significance level, based on the asymptotic distribution. More recent evidence suggests that the power of the J-B test can be quite low in small samples, for a number of important alternative hypotheses (see Thadewald and Buning 2004; Domanski, 2010; Giles, 2014). Hence, our inference was based on 1% level of significance. The Normality test is reported on Table 3.

Table 3. *VAR Residual Normality Test.*

Null Hypothesis: Residuals are multivariate normal

Component	Jarque-Bera	Df	Probability
1	3.1502	2	0.2070
2	7.8172	2	0.0201
3	8.0573	2	0.0178
Joint	19.0247	6	0.0041

Source: Author's Computation

Under the null hypothesis that the variable residuals are multivariate normal, against the alternative hypothesis of non-normality, the calculated value of the test less than the Jacque Bera chi-square critical value at the 1% level of significance (9.21), made it apparent that the hypothesis that all the variables are normally distributed cannot be rejected since all the probabilities are less than the Jarque Bera chi-square distribution at 1% level of significance.

5.2. Vector Autoregression Estimates

The results are provided in Table 4. As reported by Arodoye and Iyoha (2014), all coefficient estimates of VAR are elasticities. Examination of the results shows that the lagged values of real interest rate and inflation are important determinant of consumption dynamics in Nigeria. The elasticity of consumption with respect to the lagged value of real interest rate is 1.2 and statistically significant; the elasticity of consumption growth with respect to the lagged values of inflation is 1.3 and statistically significant. The elasticity of consumption growth with respect to its lagged value is 0.55 and significant statistically, signifying that consumption has a spiral link in the economy.

Table 4. *Vector Autoregression Estimates Dependent Variable: Consumption Growth.*

	CGR	RI	INFLA
CGR(-1)	-0.545962	0.073430	-0.073989
	(0.15087)	(0.16731)	(0.15719)
	[-3.61870]	[0.43888]	[-0.47068]
RI(-1)	1.213493	0.218655	0.338619
	(0.50407)	(0.55901)	(0.52520)
	[2.40737]	[0.39115]	[0.64475]
INFLA(-1)	1.301003	-0.309055	0.899373
	(0.51551)	(0.57169)	(0.53712)
	[2.52370]	[-0.54060]	[1.67444]
C	-19.93509	5.790393	2.481120
	(10.4143)	(11.5492)	(10.8508)
	[-1.91420]	[0.50137]	[0.22866]
R-squared	0.340172	0.270624	0.328396
Adj. R-squared	0.276317	0.200040	0.263402

Source: Author's output

5.3. Analysis of Impulse Response Functions

A shock to the *i*-th variable in the VAR not only directly affects the *i*-th variable itself but may also be transmitted to all of the other endogenous variables in the system through the dynamic (lag) structure of the VAR. An impulse response function traces all such effect of a one-time shock to one of the innovations on current and future values of the endogenous variables.

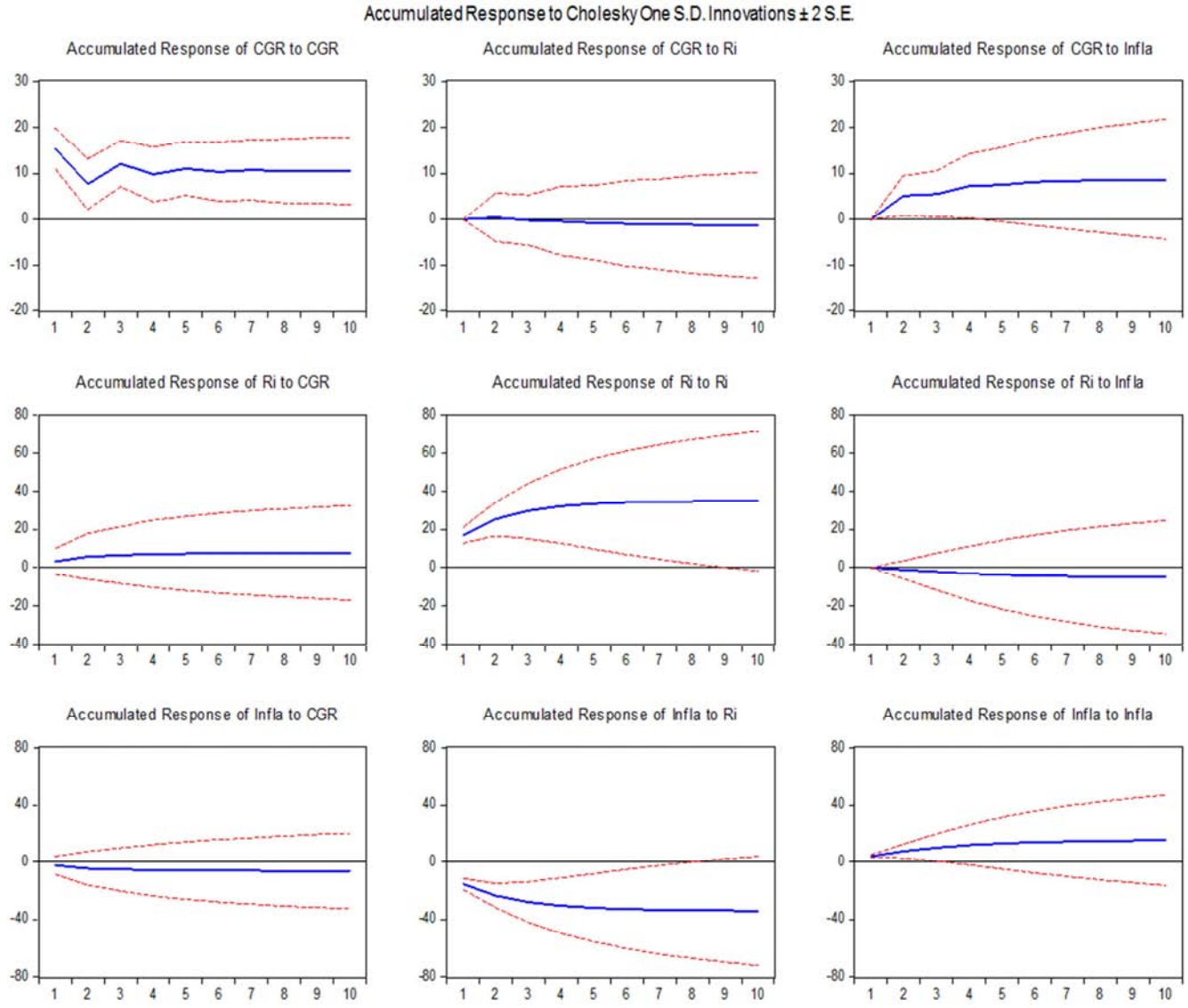
The impulse response functions (Figure 2) suggested that a one-time real interest rate shock produces negative (albeit small in magnitude) but statistically significant effects for both consumption growth and inflation which appear 1 period after the shock. The negative effect is more persistent with some marginally insignificant effects in the first period for inflation but continues to be lower than the pre-shock value from the 2^{rd} to the 10^{th} period (and more statistically significant). This effect suggests a slow and persistent pass through of Euler effect of consumption-interest rate changes for Nigeria.

Similarly, a positive shock to core inflation produces a large and statistically significant positive effect on cumulative consumption growth that rises continuously from

the pre-shock level to the 10th period level. Also, a positive shock on inflation has a large but statistically insignificant positive influence on real interest rate.

When the impulse responses to innovative shocks on consumption were investigated, we found that innovations on consumption growth has a positive but declining effect on consumption from the pre-shock level up to the fifth period, and later maintain a steady positive effects up to the tenth period (but not as high as the pre-shock level). Real interest rate also responded positively to innovations in consumption from the first period shocks to the last period, (although the magnitude of the shock is small but stable throughout). Inflation negatively response to shocks in consumption growth from the first period to the last period.

Aside from consumption growth that generated positive but declining impacts to its own variations at the outset, the other endogenous variables exhibits positive own shocks that are statistically significant at different magnitudes.



Source: Author's output

Figure 2. *Impulse Response Functions.*

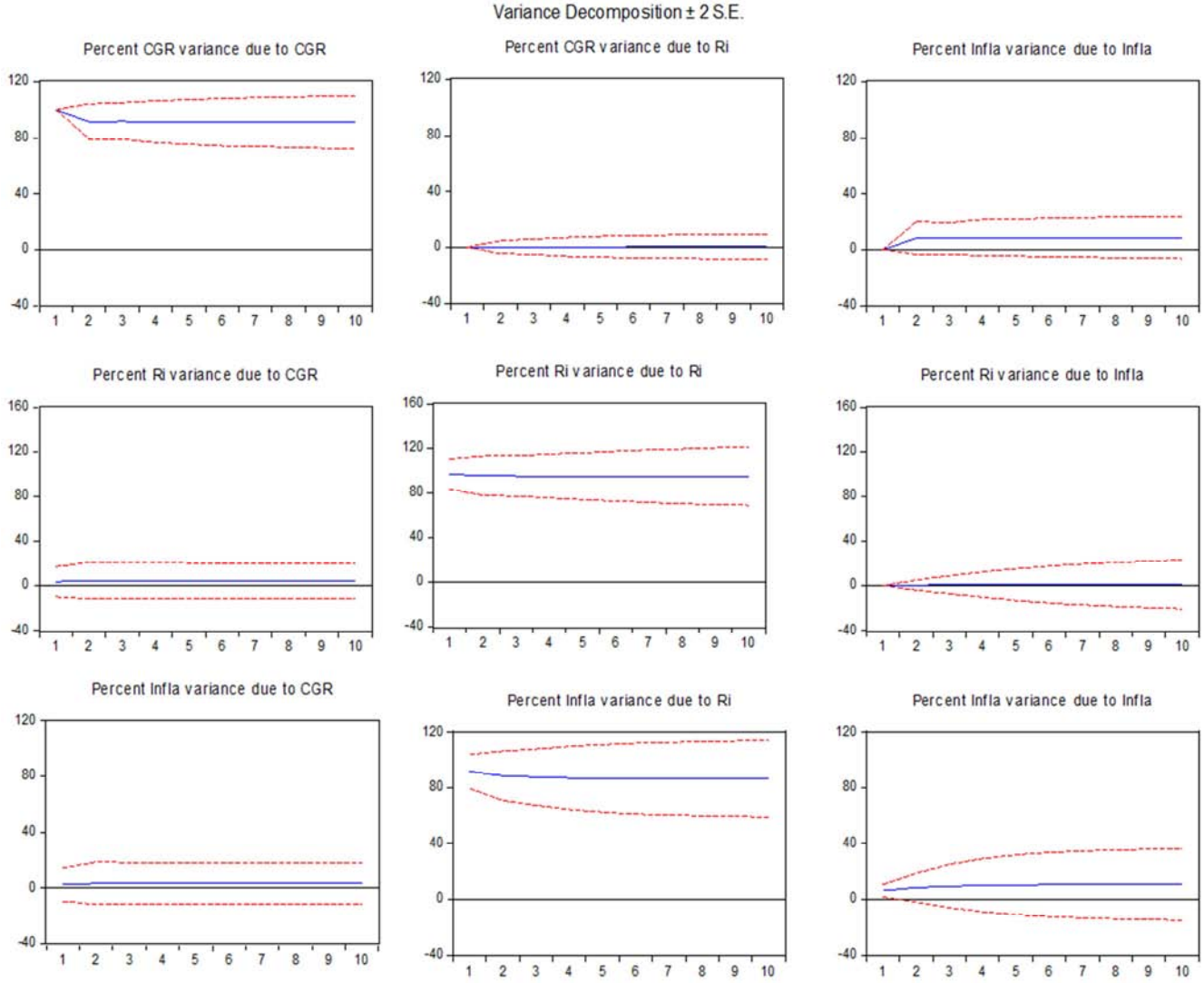
5.4. Forecast Error Variance Decomposition

The variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. It shows the proportion of forecast error variance for each variable that is attributable to its own innovation and to innovations in the other endogenous variables. The variance error decomposition is reported on Figure 3. As the figure shows, consumption growth contributes the biggest share to its own variations accounting for 100 percent in the first period. However, in the second period, it shakes off 9 percent contributions to interest rate and inflation, and maintaining over 91 percent contributions to its own shock up to the 10th period. The contributions of the other variables are quite marginal. The highest is by inflation which contributes over 8 percent from the second to the tenth period, with innovations from real interest rate accounting for only less than one percent of

variations in consumption.

A slightly different pattern is noticed for real interest rate. Whereas the largest innovations in real interest rate is attributed to its own shock (over 96 percent) in the first period, and falling to over 94 percent in the third period and maintaining same to the tenth period, consumption growth was found to cause over three percent of the variations in interest rate even in the first period. The percentage contributions increased to over four percent by the end of the tenth period. This pattern of shock-innovations may suggest that consumption Euler equation for Nigeria is consumption-driven pointing to the fact that income effect may be more workable in Nigeria thus crowding out the substitution effect. Inflation dynamics did contribute slightly above one percent to innovations in real interest rate within the period under consideration.

Similarly, the patterns of variables contributions to innovations among other endogenous variables were different for inflation. Here, innovation shocks from real interest rate are shown to be attributed for over 91 percent variations in inflation in the first period shock. This high innovation shocks grew at a declining rate to over 86 percent in the tenth period. Innovations to own shocks increased from 6 percent in the first period to almost 11 percent in the tenth period, with consumption marginally following the same chart (increasing from two to three percent from the first to the tenth period).



Source: Author's output

Figure 3. *Forecast Error Variance Decomposition.*

5.5. Causality Test

Having established the existence of consumption-interest rate Euler relationship for Nigeria, we sought to know the causality relationship between the variables. The results of the pairwise granger causality test are reported on Table 5. As the results shows, the consumption-interest rate Euler relationship for Nigeria cannot be rejected as there exist a uni-directional causality from consumption to interest rate.

Table 5. *Pairwise Granger Causality Tests.*

Null Hypothesis	Obs	F- Statistic	Prob
Ri does not Granger Cause CGR	32	0.5113	0.7280
CGR does not Granger Cause Ri		2.5514	0.0196
Infla does not Granger Cause CGR	32	0.3798	0.8207
CGR does not Granger Cause Infla		0.1752	0.9489
Infla does not Granger Cause Ri	32	0.5972	0.6683
Ri does not Granger Cause Infla		0.4048	0.8032

Source: Author's Computation

5.6. Model Stability Check

An estimated VAR is said to be stable if and only if all the inverse roots of the autoregressive polynomial have modulus less than one and lie inside the unit circle. A non-stationary VAR produces results whose standard errors are not reliable and as such may lead to misleading inferences. As reported on Table 6, we cannot reject the hypothesis that our VAR was stable and the results reliable as no roots lies outside the unit circle.

Table 6. *VAR Stability Test.*

Endogenous Variables CGR, Ri, Infla
Lag order: 1 1

Root	Modulus
0.649279	0.649279
-0.541897	0.541897
0.464684	0.464684

Source: Author's Computation

6. Conclusion and Policy Options

The study examined characteristics interaction between consumption and interest rate in Nigeria under the premised of Consumption-Interest rate Euler relationship.

The results suggest the existence of Euler's Consumption-Interest rate relationship for Nigeria. However, it appears that the general theorem of the Euler proposition in which the substitution effect is always believed to be larger (and more workable) in the Euler relationship than the income effect did not hold for Nigeria. The consumption Euler equation for Nigeria is consumption-driven pointing to the fact that income effect may be more workable in Nigeria to have crowd out the substitution effect. Consumption in Nigeria does not seem to depend on interest yielding assets and even if it does, the effects may be marginally insignificant to be noticed during the study period. Interest rate driven activities of the financial markets may thus, have entered the national income accounting framework through other channels in the economy order than through consumption. This may explain why many scholars in the region dwells much on the relationship between consumption and income. Nakagawa and Oshima (2000) had observed this similar pattern of Euler relationship in Japan due to Japanese people indifference to interest rate changes.

An interesting observation in the analysis (that may have given the region a consumption-income effect Euler relationship) are that growth rate in consumption rises in the years following and up to electioneering periods in Nigeria (see for instance the years 1999, 2003, 2007, 2011, and 2015 in Figure 1). Governments may have used large chunk of their consumption quota on electioneering campaigns and the people may only respond in their consumption trend through this transitory income effect leaving the markets with unresponsive interest rate. Such non-consumption-interest rate nexus may stifle real economic growth as income in consumer's households may not really respond to markets rates and investments.

As a policy option, we recommend a consumption-interest rate policy frame work for Nigeria. An interest rate policy framework that is flexible to economic needs of the region and motivates saving-dissaving culture of the people is strongly encouraged. We also recommend that future consumptions in the region be financed by cashless financial products. This will curtail needless transitory income spending and may make consumption respond as expected (negatively) to interest rate in the region.

References

[1] Akpan U. F. (2011). Cointegration, Causality and Wagner's Hypothesis: Time Sereis Evidence for Nigeria, 1970 – 2008, *Journal of Economic Research*, 16, 59-84.

[2] Arodoye, N. L. and Iyoha, M. A. (2014), Foreign Trade-Economic Growth Nexus: Evidence from Nigeria, *CBN Journal of Applied Statistics,* 5 (1), 121-141.

[3] Audu, N. P. (2014). Consumption Dynamics in rural Nigeria: The Experience of Bayelsa State, *Journal of Economics and Sustainable Development*, 5 (20), 59-69.

[4] Bjørnland, H. C. (2000). VAR Models in Macroeconomic Research, Statistics Norway Research Department, available online at https://www.ssb.no/a/histstat/doc/doc_200014.pdf, 17.11.2016.

[5] Campbell, J. Y. and Mankiw, N. G. (1989). Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence, In: Olivier Jean Blanchard and Stanley Fischer (Eds), *NBER Macroeconomics Annual 1989*, MIT Press, available online at http://www.nber.org/books/blan89-1, 06.08.2015.

[6] Canzoneri, M. B., Cumby R. E. and Diba, B. T. (2007). Euler Equations and Money Market Interest Rates: A Challenge for Monetary Policy Models, *Journal of Monetary Economics,* 54, 1863-1881.

[7] Christensen, L. (2012). "How Are Interest Rates Affecting Household Consumption and Savings?"All Graduate Plan B and other Reports*,* Utah State University Paper 215, available at http://digitalcommons.usu.edu/gradreports/215

[8] Cromb, R and Fernandez-Corugedo, E. (2004). Long-term interest rates, wealth and consumption, The Bank of England's working paper series no 243, available online at www.bankofengland.co.uk/wp/index.html, 02.08.2015.

[9] Domanski, C. (2010). Properties of the Jarque-Bera Test, Acta Universitatis Lodziensis Folia Oeconomica, 235, 75-86.

[10] Fasoranti M. M. *(*n.d*)* The Determinants of Consumption PatternAmong Rural Dwellers of Ondo State (CaseStudy of Akoko North West Local Government), *European Scientific Journal*, 8 (6), 72-79.

[11] Giles, D. (2014). Some things you should know about the Jarque-Bera Test, http://davegiles.blogspot.com.ng/2014/02/some-things-you-should-know-about.html, 12.09.2016.

[12] Hansen, H. (1996). The Impact of Interest Rate on Private Consumption in Germany, Economic Research Group of the Deutsche Bundesbank, Discussion Paper 3/96.

[13] Jappelli T. and Padula, M. (2013). Consumption Growth, the Interest Rate, and Financial Literacy, Centre for Studies in Economics and Finance, Working Paper No 329, University of Naples.

[14] Jarque, C. M. and A. K. Bera, 1987. A test for normality of observations and regression residuals, *International Statistical Review*, 55, 163-172.

[15] Keynes, John Maynard (1936). *The General Theory of Employment, Interest, and Money*, MacMillan, London.

[16] Koutsoyiannis, A. (2001). *Theory of Econometrics*, 2nd ed. New York, Palgrave, pp 164-168.

[17] Mutezo A. (2014) Household debt and consumption spending in South Africa: An ARDL-bounds testing approach, *Banks and Bank Systems*, 9 (4), 74-81.

[18] Nakagawa, S. and Oshima, K. (2000). Does a Decrease in the Real Interest Rate Actually Stimulate PersonalConsumption? An Empirical Study, Bank of Japan, Working Paper Series 00-2.

[19] Parker, J. A. (2007). Euler Equations, Paper Prepared for the New Palgrave Dictionary of Economics, available online at http://www.princeton.edu/~jparker, 10.09.2016.

[20] Perron, P. (1997). Further Evidence on Breaking Trend Functions in Macroeconomic Variables, *Journal of Econometrics*, 80 (2), 335-385.

[21] Thadewald, T. and Buning, H. (2004). Jarque-Bera test and its competitors for testing normality - A power comparison, School of Business and Economics, Free University of Berlin, Discussion Paper Economics 2004/9.