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Testing for Fisher's Hypothesis in Nigeria (1970-2012)

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Abstract
This paper has examined the causal link between interest rates and inflation in Nigeria using quarterly data on Nigeria for the periods of 1970 – 2012. Maximum likelihood method of co-integration, suggested by Johansen (1988, 1991) and Granger causality in ADL models with p and q lags suggested by Koop (2005) are implemented to determine the number of co-integrating vectors and verify the nature and direction of causality between interest rates and inflation in Nigeria respectively. The co-integration results show that the null hypothesis of no significant long-run stable relationship between interest and inflation rates cannot be rejected for Nigeria and that Fisher hypothesis which supports the view that nominal interest rates consist of two components of the "real" rate of interest (to which investments respond) plus a premium based on expected change in the price level, is violated for Nigeria in the long-run. The ADL models were used to investigate the causal link between interest rates and inflation in the short-run. The results indicate non existence of a significant causal link from interest rates to inflation in the short run, suggesting that interest rates may be considered exogenous in inflation modeling in Nigeria. Furthermore, the results identified existence of a significant causal link from inflation to interest rates in the short-run. In effect, Fisher's hypothesis that nominal interest rates consist of two components of the "real" rate of interest plus a premium based on expected change in the price level is verified for Nigeria in the short-run. This finding supports that, in the short-run, market participants incorporate a predictable portion of the inflation rate into the nominal interest rate in Nigeria.
Keywords: *co-integration, Causality, Inflation, Nominal Interest Rate.*

1. Introduction

Interest rates directly affect the credit market (loans) because higher interest rates make borrowing more costly. By changing interest rates, the monetary authority tries to achieve maximum employment, stable prices and a good level of economic growth. As interest rates drop, consumer spending increases and this in turn stimulates economic growth. Contrary to popular belief, excessive economic growth can in fact be very harmful. At one extreme, an economy that is growing too fast can experience hyperinflation, resulting in the problems of great decline in time value of money (TVM). At the other extreme, an economy with no inflation has essentially stagnated. The right level of economic growth, and thus inflation, is somewhere in the middle. It's the monetary authority's responsibility to maintain that delicate balance. A tightening, or rate increase, attempts to head off future inflation. An easing, or rate decrease, aims to spur on economic growth. Interest rates and price changes are very important variables in any macroeconomy that are often monitored by economists and policy makers (Ekrem & Aykut, 2006). Although the definitions of interest rates differ to include real interest rates, nominal interest rates, deposit rates, and money market rates, many studies try to define the interaction between interest rates and the inflation (Dilek, Elcin & Oya, 2012). While few of the studies are predicated on the proposition that interest rates cause inflation (see: Ekrem & Aykut, 2006, Kandil, 2005, Mansour & Ruhollah, 2007), majority of the studies investigated the Fisher effect hypothesis (see: Nernard & Santos, 2012, Johnson, 2006, Nwafor, Nwakanma & Thompson, 2007, Santos & Chris, 2013, Berument & Jelassi, 2002, Fahmmy & kandil, 2002). This study is intended to add to the few studies predicated on the proposition that interest rates cause inflation.

The basic reason for adopting price stability as the primary object of monetary policy is to create a stable and non-inflationary environment for resource allocation and stabilize price expectations. The essence of this cannot be over emphasized as maintaining low inflation is seen as a necessary part of an effective anti- poverty strategy (Ekrem & Aykut, 2006). For many years money has been a central issue in monetary policy decisions. However, with the growing instability of money demand functions, particularly in developing economies, targeting monetary aggregates becomes less and less fashionable. In response, monetary authorities move from targeting the money supply towards controlling nominal interest rates at the money market (Brzoza-Brzezina, 1999).

Nigeria as a developing economy has been characterized by persistent inflation and interest rates innovations in response to varying economic policies and policy reversals tended towards achieving internal and external equilibrium (balances) for the domestic economy. These range from protectionism and excessive government control of economic activity to movement towards free market economy. All these were tended towards sustained economic growth and development and a healthy internal and external balance in the medium term. Internal balance means the level of economic activity consistent with the satisfactory control of inflation (Williamson, 1982), while external balance means balance of payments equilibrium or sustainable current

account deficit financed on a lasting basis by expected capital inflow (Komolafe, 1996). Nigeria has experienced high and unpredictable inflation and interest rates over the past 43 years as scheduled below.

Table 1: Schedule of Interest and Inflation rates at 5 years intervals for the period under Review.

1970	1975	1980	1985	1990	1995	2000	2005	2010	2012
7(13.75)	6.3(34)	8.4(10)	9.4(7.4)	25(7.4)	20.2(73)	21.2(6.9)	17.9(17.9	17.9(13.7)	16.5(12)

Note: The figures in bracket are the average inflation rates for the respective years.

The primary objective of most of the world's central banks these days is to keep inflation low, and the range of inflation rates banks find acceptable appears to be around 2.5 percent to 3.5 percent (David, 2003). Various stabilization policies aimed at reducing inflation rates to an acceptable level over the past four decades appear not to be yielding the much desired results. It is on the strength of the above observation that this study intends to investigate the short term and long-run causal relationship between nominal interest rates and the rate of inflation dynamics for Nigeria, over the period of 1970 – 2012 using quarterly data. In effect, this study hypothesizes that the rate of interest is the cause of inflation in Nigeria. The study employs money deposit banks lending interest rates and inflation rates for the period under review in investigation of the hypothesis.The remaining part of this paper is structured as follows: In section 2, brief review of related literature is presented; section 3 presents Data and Econometric methodology; section 4, empirical results and section 5, the concluding remarks.

2. Review of Related Literature

2.1 Theoretical Underpinning

Interest rate – Inflation relation is predicated on the Irving Fisher proposition. Fisher (1930) in his work, "The Theory of Interest" amongst others, observed that interest rates and inflation level trend in the same direction, and that inflation causes interest rates. According to fisher, nominal interest rates consist of two components - the "real" rate of interest, to which real saving and investment respond, and a premium based on expected change in the price level (William & Denis, 1969). Fama (1975) observed that in line with Fisher's initial work, the findings to a large extent indicate no significant link between interest rates observed at a point in time and rates of inflation subsequently observed but rather a greater proportion of the findings revealed significant correlations between current interest rates and past rates of inflation in support of Fisher's hypothesis.

For other studies that their findings indicate support for Fisher's proposition, see Weil (1970), Durand (1942), Sargent (1969), Yobe & Karnosky (1969), Feldstein & Eckstein (1970), Tuttle & Wilbur (1971), Million (2003), Gibson (1970) amongst others. Other studies documented no significant relationship between interest rates and inflation rates in support of the classical doctrines, that interest rates is determined by "real" factors of productivity and thrift which impinge on the market for loanable funds, while the price level is determined primarily by money supply, as prescribed by the quantity-of-money theory of price (Sargent, 1971). Such studies include Barsky (1987), Huizinga & Mishkin (1986), Ghazali (2003), Meiselman (1963) and Ball (1965). Further divergent view on the relationship between Inflation and interest is that expressed by Keynes (1930). He used United States, England and other country data to illustrate that over a long time horizon, interest rates are highly correlated with the aggregate level of commodity prices. This finding which Keynes denotes as Gibson paradox, is an economic observation made by J. M. Keynes during the period of the gold standard that there is a correlation between interest rates and the general price level. Keynes' finding, which he discusses in "A Treatise on Money" (1930), is a paradox, because it contradicts the view generally expressed by economists at the time, which states that interest rates were correlated to the rate of inflation.

We can apply the existing macroeconomic theories to study the relationship between interest rate and inflation rate. To this effect, the transmission mechanisms exploring the causal relationship from inflation to interest rates, according to macroeconomic literature, suggests that any increase in the price level, brings about a decrease in the real money supply. In Keynesian framework of analysis, decrease in real money balance means disequilibrium in the economic system. To maintain same level of consumption and liquidity, consumers offer bonds for sale thus increasing the supply of bonds. The benchmark result is a drop in the price of bonds and higher interest rate. In effect, there is a positive causal relationship from inflation rate to nominal interest rate. Then on the other hand, the transmission mechanisms exploring the causal link from interest rates to inflation can be decomposed into cost- push and demand- pull channels. For the cost-push channel, an increase in interest rates results in increase in the user cost of capital (William, 1979), this results in higher production costs which is transferred to the consumers through higher prices. By extension, demand for loanable funds will decline, resulting in drop in investment and output and hence shifting the supply curve to the left to fix higher consumer prices. In the same vein, an increase in interest rates causes inflation through increase in the volume of money supply. In the endogenous money models which money supply is a function of interest rate, the money supply is increased when interest rate goes up (Asgharpur, Kohnehshahri & Karami, 2007). Now if individuals perceive the increase in real money supply as increase in their wealth, this will cause increase in consumption expenditure

(Smal & de Jager, 2001), leading to increase in demand beyond supply at least in the short run. The excess demand leads to increase in the prices of goods and services.

2.2 Empirical Review

A Plethora of empirical studies have examined the relationship between interest rates and inflation and thus have revealed wide ranging economic policy implications. Although many studies have been conducted in investigation of the relationship between interest rates and inflation, consensus is yet be established as to the nature of the link between nominal interest rates and the rate of inflation.

Al-Khazali (1999) used vector auto-regression (VAR), integration, and cointegration models to investigate the causal relations, dynamic interaction, and a common trend between interest rates and inflation in nine countries in the Pacific-Basin. The results suggest that for all countries, short and long term interest rates and the spread between the long-term interest rates and inflation are non-stationary I (1) processes. The nominal interest rates and inflation are not co-integrated. In addition to this study's inability to find a unidirectional causality between inflation and interest rates, when the VAR model is used, it also fails to find a consistent positive response either of inflation to shocks in interest rates or of interest rates to shocks in inflation in most of the countries studied. The VAR model yielded results consistent with the co integration tests' results, which suggest that nominal interest rates are poor predictors for future inflation in the Pacific-Basin countries.

Booth & Ciner (1999) examines the long-run bivariate relationship between the short-term Eurocurrency interest rate and the inflation rate for nine European countries and the US using cointegration methods. Result reveals that in the majority of cases, there is a one-to-one relationship between Eurocurrency rates and rationally expected inflation. Likewise, the 1-month Eurocurrency rate contains information about the future path of the inflation rate. This finding supports the belief that market participants incorporate a predictable portion of the inflation rate into the nominal interest rate.

In the same vein, Alimi & Ofonyelu (2013) investigate the relationship between expected inflation and nominal interest rates in Nigeria and the extent to which the Fisher effect hypothesis holds, for the period 1970-2011. They made attempt to advance the field by testing the traditional closed-economy Fisher hypothesis and an augmented Fisher hypothesis by incorporating the foreign interest rate and nominal effective exchange rate variables in the context of a small open developing economy, like Nigeria. They employed Johansen cointegration approach, error correction model and the Toda and Yamamoto (1995) causality testing methods and the results found: (i) that money market interest rates and expected inflation move together in the long run but not on one-to-one basis. This indicates that full Fisher hypothesis does not hold but there is a strong Fisher effect in the case of Nigeria over the period under study (ii) consistency with the international Fisher hypothesis, these domestic variables have a long run relationship with the international variables (iii) that in the closed-economy context, the causality run strictly from expected inflation to nominal interest rates as suggested by the Fisher hypothesis and there is no "reverse causation." But in the open economy context, the expected inflation and international variables contain the information that predict the nominal interest rate (iv) finally that only about 22 percent of the disequilibrium between long term and short term interest rate is corrected within the year.

Still on Nigeria, Alimi & Awomuse (2012) using Johansen cointegration approach and error correction model, investigate the relationship between expected inflation and nominal interest rates in Nigeria and the extent to which the Fisher effect hypothesis holds, for the period of 1970 – 2009. They asserted that real interest rate is obtained by subtracting the expected inflation rate from the nominal interest rate, and for the Fisher hypothesis to hold, the resultant ex ante real interest rate should be stationary. The empirical results tend to suggest that: (i) the real interest rates are stationary. (ii) the nominal interest rates and expected inflation move together in the long run but not on one-to-one basis. This indicates that full Fisher hypothesis does not hold but there is a very strong Fisher effect in the case of Nigeria over the period under study (iii) causality run strictly from expected inflation to nominal interest rates as suggested by the Fisher hypothesis and there is no "reverse causation" (iv) only about 16 percent of the disequilibrium between long term and short term interest rate is corrected with the year. They observed that the policy implication, based on the partial Fisher effect in Nigeria, is that the level of actual inflation should become the central target variable of the monetary policy.

Nezhad & Zarea (2007) with regards to the importance of the rates of interest and inflation in economy investigated the Granger causality relationship between the rates of interest and inflation in Iran's economy. They employed Toda and Yamamoto's Granger test of causality as well as ARDL approach to test the hypothesis that the rate of interest is the Granger cause of the rate of inflation using Iran's data for the period of 1959-2002. The results show that in Iran's economy, the rate of (official and non-official) interest is the cause of inflation and not vice versa. This has been confirmed by both of these approaches and can be taken into consideration in Islamic banking.

Berument & Jelassi (2002) tested for Fisher hypothesis using sample data from 26 countries by assessing the long run relationship between nominal interest rates and inflation rates taking into consideration the short run

dynamics of interest rates. The empirical evidence supports the hypothesis that there is a one-to-one relationship between the interest rate and inflation for more than half of the countries under study.

Gul & Ekinci (2006) empirically analyzed the relationship between nominal interest rates and inflation using high-frequency data of nominal interest rates and inflation of Turkey. With time-series techniques, the study provides evidence that a long-run relationship exists between nominal interest rates and inflation in the case of Turkey. However, the results further indicate that causal relationship occur only in one direction from interest rates to inflation for the economy under consideration.

Malliaris, Mullady & Malliaris (1991) investigate the theoretical foundation of Fisher's equation which expresses the nominal interest rates as the sum of real interest rates and the expected inflation. To emphasize Fisher's (1930) original formulation and Sargent's (1973) recent suggestion that nominal interest rates and inflation are simultaneously determined rather than having the causation go from inflation to interest rate, they developed a two-equation continuous time stochastic model to build a more solid theoretical foundation of Fisher's equation. With the assumption that the nominal interest rate and the rate inflation follow Itô process, they derive an Itô equation that allows them to express and compute the expected real interest rate and its volatility. These two equations generalized the traditional Fisher equation and an illustration using US long data from 1865 – 1972 shows the usefulness of their results.

3. Methodology

In this section we try to empirically assess the causal relationship between interest rates and inflation putting Nigerian macroeconomic environment in perspective. The time-series data set used for this analysis covers the quarterly data on Nigeria for the 1970Q1-2012Q4 periods and sourced from IMF-IFS On-Line, 2013.The study is set to ascertain the existence of such a relationship by implementing the following three-step procedure: 1. Determine the order of integration for the two variables of interest using tests developed by Dickey and Fuller (1979) and Philips and Perron (1988). 2. If both variables exhibit the same order of integration, a maximum likelihood method of co-integration, suggested by Johansen (1988, 1991 & 1995), will be applied in order to determine the number of co-integrating vectors. In the event of one or more co-integrating vectors being identified, then an error correction model is specified to correct any evidence of short-run disequilibrium within any quarter. 3. To verify whether causality runs from interest rates to inflation or vice versa, Granger causality in an ADL model with p and q lags suggested by Koop (2005) is implemented.

3.1 Model Specification

Fisher effect hypothesis mainly states that there is a positive and significant relationship between interest rates and inflation with the effect flowing from inflation to interest rates. However, this is not the only theoretically possible relationship between interest rates and inflation. At the other extreme are some studies which documented no significant relationship between interest rates and inflation rates in support of the classical doctrines. Instances of such studies include Ghazali (2003), Meiselman (1963) and Ball (1965). Further evidence of inconsistencies trailing Fisher's hypothesis is the scenario which Keynes (1930) referred to as "Gibson Paradox", which suggests that over a long time horizon, interest rates are highly correlated with the aggregate level of commodity prices, rather than rate of price changes (inflation), a view contra to Fisher effect. In the light of the above, this study investigates the nature of the causal relationship between interest rates dynamics and inflation rates in Nigeria for the periods 1970 – 2012, using bi-variate (ADL) models based on co–integration analysis and the error correction modeling (ECM) strategy. This enables the study to evaluate the nature of causal link between interest rates and inflation in both long and short-run frameworks.

The basic model expressing inflation (x) as function interest rates (y) is of the form:

$$Xt = f(Yt) \quad (1)$$

The functional notation linearized would yield:

$$X_t = \alpha_0 + \alpha_1 Y_t + e_t \quad (2)$$

All variables are expressed in percentages as fetched from IFS-IMF On-Line for Nigeria over the period of 1970 – 2012.To investigate the causal relationship between interest rates dynamics and inflation rates in Nigeria for the periods under review, we implement simple ADL models with p and q lags suggested by Koop (2005), using multiple equation model as follows:

$$Xt = \alpha + \gamma_1 X_{t-1} + \ldots + \gamma_p X_{t-p} + \beta_1 Y_{t-1} \ldots \beta_q Y_{t-q} + e_{1t} \quad (3)$$

$$Yt = \alpha + \beta_2 Y_{t-1} + \ldots + \beta_q Y_{t-q} + \gamma_2 X_{t-1} \ldots \gamma_p X_{t-p} + e_{2t} \quad (4)$$

This multiple modeling approach has become very necessary since in many cases, it is not obvious which way causality could run. In the same vein, Sargent (1971) explained that it is inadequate to hypothesize a one-way influence running from inflation to interest rates or vice versa in explaining Gibson Paradox, but instead within the context of bi-variate models, it is necessary to view interest rate and inflation as being mutually determined, hence should exhibit bi-directional relationship.

The decision rules to guide the interpretation of the results of testing the null hypothesis that $\beta_1 =,\ldots,=\beta_q = 0$ and

$\gamma_2 =,\ldots,=\gamma_p = 0$ are as follows:

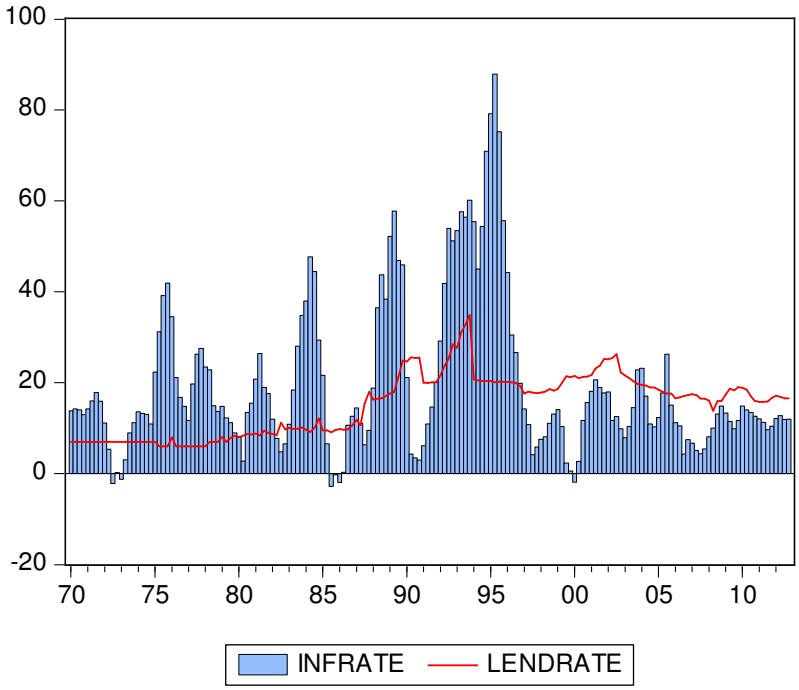
1. Using the 5% significance level for equation 3, if all or any of the P-values for the coefficients $\beta_1 ,\ldots, \beta_q$ were less than 0.05, we reject the null hypothesis of no causality and conclude that inflation (X) granger cause interest rates (Y).
2. Using the same level of significance for equation 4, if all or any of the P-values for the coefficients $\gamma_2 ,\ldots, \gamma_p$ is less than 0.05, we reject the null hypothesis of no causality and conclude that interest rates (Y) granger cause inflation (X).
3. If none of the P-vaues is less than 0.05, then we would conclude that Granger causality is absent.
4. If $\beta_1 =\ldots=\beta_q \neq 0$ and $\gamma_2 =\ldots=\gamma_p \neq 0$ suggest that significant bi-directional causal links between interest rates and inflation are identified.

4. Empirical Results

4.1 Summary Statistic of Employed Variables

This is intended to provide the preliminary test on the observed economic variables to enable us express opinion on the nature of innovations in each of the employed data series through visual observations. The data on LENDRATE and INFRATE for the period of 1970Q1– 2012Q4 for Nigeria are presented in figure 1 expressing developments in interest and inflation rates within the period under review.

Figure 1: Developments in Interestrates and Inflation



From visial observation of developments in interest rates and inflation as in figure 1 above, it appears that interest rates and inflation may not be cointegrated as they show no evidence of the duo trending together in the same direction over a reasonable period of time. Also a critical look at the figure, suggests that developments in interest rates indicate much more stabilty (may be due to the constant regulations by the financial authorities) than inflation rates which are seen to exhibit a very high level of volatility excepting for early 70s and about 2008 to the end of the period under review.

4.2 Unit Root Tests

An implicit assumptions that underlie regression analysis involving time series data is that such a data series is stationary (Gujarati, 1995). In this context, testing for stationary or otherwise of the employed data sets becomes of essence in this analysis.

Table2: Unit Root Test Results

		ADF		PP		Conclusion
Variables	Level/First Diff.	Intercept	Trend/Intercept	Intercept	Trend/Intercept	
lendrate	Level	-1.784	-1.944	-1.798	-1.999	1(1)
	First Diff.	-13.122	-13.109	-13.122	-13.109	1(0)
infrate	Level	-3.504	-3.507	-3.288	-3.293	1(0)
	First Diff.	-5.996	-5.981	-6.918	-6.885	1(0)

Notes: (i) Unit root tests performed using Eview 6.0
(ii) 95% critical value ADF/PP statistic (with intercept) = -2.878
(iii) 95% critical value ADF/PP statistic (with trend & intercept) =3.437

The results of *ADF* and *PP* as presented in tables 2 above show that at 95% level of significance, only INFRATE is found to be stationary at level, while the LENDRATE assumed stationary in its first difference. This suggests that all the employed variables for estimation of the equations are quiet suitable for purposes intended after one period lag.

4.3 Tests for Co-integration

With the manifestation of unit root 1(1) by variables of interest, which is a precondition for the existence of a stable linear steady-state relationship, we employ Johansen and Juselius Trace and maximum eigenvalue tests for co-integrating vectors between the explained and the explanatory variables in equation 2 with a view to determining the number of co-integrating equations. The concept of co-integration was first instigated by Granger (1981) and modified by Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990), amongst others. Johansen and Juselius (1990) Trace test procedure is based on the comparison of *Ho (r = o)* against the alternative H_1 *(r ≠ o)*, where r indicates the number of co integrating vectors. The co integration test provides an analytical statistical framework for ascertaining the long run relationship between economic variables and the result of the trace test depends on the lag length of the vector error correction model (Maylene and Agbola, n.d.)

Table 3: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob**
None	0.061	14.351	15.494	0.074
At most 1	0.022	3.768	3.8414	0.052

Notes: (i) Cointegration tests performed using Eview 6.0
(ii) Trace test indicates no cointegration at the 0.05 level
(iii) * denotes rejection of the hypothesis at the 0.05 level

Table 4: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob**
None	0.061	10.581	14.264	0.176
At most 1	0.022	3.768	3.8414	0.052

Notes: (i) Cointegration tests performed using Eview 6.0
(ii) Trace test indicates no cointegration at the 0.05 level
(iii) * denotes rejection of the hypothesis at the 0.05 level

The results of the co integration test (Trace) and (maximum Eigenvalue) interest rates and inflation for Nigeria suggest that the null hypothesis of no co integration *Ho (r= o)* cannot be rejected for the economy, as they indicate no co integrating equation between the variables of the model. This suggests that for Nigeria, there is no long run steady-state relationship between interest rates and inflation in the expressed equation 2. The model yielded results consistent with the features of summary statistic in figure 1 which suggests that, in the long-run, nominal interest rates are poor predictors for future inflation in Nigeria. While these results are in conformity with the finding of Al-Kahazali, (1999) for the 9 pacific-basin; they contradict the results of Alimi & Ofonyelu, (2013, Alimi & Awomuse, (2012) for Nigeria, Gul & Ekinci (2006) for Turkey and Berument and Jelassi (2002) for 26 countries.

4.4 VAR Test for Short –Run Granger Causality

With the evidence of no co-integration, we evaluate equation 3 for only short-run granger none causalities since the results of the co-integration test on Nigeria data identified no co integrating vectors between the explained

and explanatory variables. The results of the ADL models estimations to investigate the extent to which interest rates cause inflation in the short run are as presented in tables 3 &4 below:

Table 4: Vector Autoregressive Estimates (Equation 3)

Regressors	Parameter Estimate	T-Ratio	P-Values
Intercept	1.206	1.063	0.257
$infrate_{-1}$	1.415	21.468	0.000
$infrate_{-2}$	-0.533	-8.062	0.000
$lendrate_{-1}$	**0.147**	**0.547**	**0.584**
$lendrate_{-2}$	**-0.075**	**-0.283**	**0.776**

Notes: $R^2 = 0.901$, Adj. $R^2 = 0.899$, DW. Statistic = 2.04

For equation 3 (VAR), the Results of the estimation as shown in table 4 indicate that $\beta_1 = \beta_2 = 0$. The values of the parameter estimates (coefficients) of β_1, and β_2 are 0.147 (0.584) and -0.075 (0.776) respectively with the figures in brackets indicating their respective P-Values. These results indicate that the value of the coefficient of β_1 and β_2 of 0.0147 and -0.075 are both not statistically different from zero even at 10% level of significance judging from their respective P-Values. These results suggest non existence of a significant causal link from interest rates to inflation in the short run, indicating that interest rates may be considered exogenous in inflation modeling in Nigeria. In effect, the null hypothesis that, $\beta_1 = \beta_2 = 0$ cannot be rejected for Nigeria in the short run.

Table 5: Vector Autoregressive Estimates (Equation 4)

Regressors	Parameter Estimate	T-Ratio	P-Values
Intercept	0.492	1.599	0.111
$lendrate_{-1}$	0.009	0.514	0.607
$lendrate_{-2}$	-0.003	-0.165	0.868
$infrate_{-1}$	**0.963**	**12.367**	**0.000**
$infrate_{-2}$	**-0.000**	**-0.007**	**0.994**

Notes: Notes: $R^2 = 0.944$, Adj. $R^2 = 0.943$, DW. Statistic = 2.00

For equation 4, the Results of the estimation as shown in table 5 above indicate that $\gamma_1 = \gamma_2 \neq 0$. The values of the parameter estimates of γ_1 and γ_2 for $infrate_{-1}$ and $infrate_{-2}$ respectively are 0.963 (0.000) and -0.000 (0.994) respectively with the figures in brackets indicating their respective P-Values. These results indicate that the value of the coefficient of γ_1 of 0.963 is statistically different from zero even at 1% level of significance. This suggests that the null hypothesis that, $\gamma_1 = \gamma_2 = 0$ is violated. The results suggest the existence of a significant causal link from inflation to interest rates in the short-run. In effect, for Nigeria, Fisher's hypothesis that nominal interest rates consist of two components of the "real" rate of interest plus a premium based on expected change in the price level is verified in the short-run.

5. Concluding Remarks.

This paper has examined the causal link between interest rates and inflation in Nigeria using quarterly data on Nigeria for the periods of 1970 – 2012. Maximum likelihood method of co-integration, suggested by Johansen (1988, 1991) and Granger causality in an ADL model with p and q lags suggested by Koop (2005) are implemented to determine the number of co-integrating vectors and verify the nature and direction of causality between interest rates and inflation in Nigeria respectively. The co-integration results show that the null hypothesis of no significant long-run stable relationship between interest and inflation rates cannot be rejected for Nigeria and that Fisher hypothesis which supports the view that nominal interest rates consist of two components of the "real" rate of interest (to which investments respond) plus a premium based on expected change in the price level, is violated for Nigeria in the long-run. This finding supports the belief that market participants incorporate a predictable portion of the inflation rate into the nominal interest rate. The ARDL models were used to investigate the causal link between interest rates and inflation in the short-run. The results indicate non existence of a significant causal link from interest rates to inflation in the short run, suggesting that interest rates may be considered exogenous in inflation modeling in Nigeria. Furthermore, the results identified existence of a significant causal link from inflation to interest rates in the short-run. In effect, Fisher's hypothesis that nominal interest rates consist of two components of the "real" rate of interest plus a premium based on expected change in the price level is verified for Nigeria in the short-run.

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