International Journal of Development and Economic Sustainability

Vol. 1 No. 2, pp 1-12, June 2013

Published by European Centre for Research Training and Development UK (www.ea-journals.org)

INFLATION EXPECTATIONS AND INTEREST RATE VARIATION IN NIGERIA: AN ECONOMETRIC ASSESSMENT OF THE EVIDENCE

David UMORU[1] (Ph.D)
Department of Economics, Banking & Finance, Faculty of Social & Management Sciences,
Benson Idahosa University, Benin City, Nigeria
, Mobile: +2348033888414]

Adaobi S. OSEME
Department of General Studies, (Economics Unit),
Delta State Polytechnic, Ogwashi-Uku, Delta State, Nigeria

Abstract: *This study examines and empirically estimates the relationship between inflationary expectations and the variations in interest rate in Nigeria using the Generalized Method of Moment (GMM) estimator. In line with the study objective, we hypothesize that interest rate variations have no significant impact on inflation expectations in Nigeria. The results of empirical study indicate that the effect of interest rate variation on expected inflation in Nigeria is negative and significant. The conclusion is that variation in prime lending is a determining factor of inflation expectations in Nigeria. Accordingly, the central monetary authority, that is, the Central Bank of Nigeria (CBN) should persistently vary the prime lending rate in order to check inflation expectations in the country. As part of the CBN's statutory duties, there is need for the CBN to embark on the implementation of policies that reduce adverse inflationary trends in the economy and this it does by raising the cost of borrowing to commercial banks and thereby curtailing the capacity of commercial banks to expand credit.*

Keywords: Expected inflation, interest rate variation, dynamic model, short-run, long-run

BACKGROUND

Stability of the price level is the key mandate of the Central Bank of Nigeria (CBN). Hence, most of the forecasts of the Nigerian economy are based on the outlook for inflation. Over the past five years, inflation rates have varied dramatically, reaching a peak of around 13 percent in 2012. Changes in the inflation rate often may result in changes in inflationary expectations. The "nominal interest rates[2]" is unadjusted for inflation. When inflation and inflationary expectations both change, nominal interest rate tend to adjust. The real interest rate is estimated by excluding

[1] Corresponding author

[2] Usually, the CBN benchmark interest rate is the overnight rate at which it makes loans to the commercial banks under their jurisdiction. So, increasing the benchmark interest rate, the CBN is able to make an impact on interest rates of commercial banks, inflation level of the country and the prevailing exchange rate.

inflation expectations from the nominal interest rate (Keynes, 1936; Calvo and Végh, 1999; Fisher et al. 2000). Thus, a key general relationship is nominal interest rate is equal to real interest rate plus inflationary expectations. The motivation for this paper derived from the fact that variability in interest rate play essential role in macroeconomic stability. Nominal loan payments will rise with inflation and interest rates (Ohale and Onyema, 2002). Real interest rates play an important role in the economy because real interest rates affect the demand for goods and services through borrowing costs. Changes in real interest rates affect the public's demand for goods and services mainly by altering borrowing costs, the availability of bank loans, the wealth of households, and foreign exchange rates (Catáo and Terrones, 2001). If the inflation rate is zero, then nominal interest rates should equal real interest rates. Most economies experience some inflation. Failure to anticipate future inflation when lending, especially on long-term securities or loans, can be costly either in terms of lost interest or discounted value, or both (Alesina and Arazen, 1991; CBN, 2000; Orubu, 2009; Mordi, 2009).

In the wake of bank crisis, banks became hesitant to hand out new loans, resulting in a credit squeeze. This induced the *CBN* to implement expansionary monetary policy actions. However, in 2010, inflationary pressures increased and forced the CBN to raise the interest rate. The higher rate and the fact that banks remain risk averse, continues to restrain private credit. Overall credit to the private sector increased by 3.60 per cent while credit to state and local governments grew by 14.23 per cent or 28.46 per cent as at 2012. The Federal Government remained a net creditor to the banking system despite the 5.1 per cent rise in credit to government (net). Credit to the domestic economy grew by 2.3 per cent at end-June 2011, driven largely by the expansion in net claims on the Federal Government. Instruments of short-term maturity remained a dominant feature of the credit and deposit portfolios of commercial banks. Meanwhile, increasing food prices as well as increase in public spending keeps inflation in double-digits. In 2010, inflation averaged 14 percent and 15 percent in 2011. The growth of credit was 14 percent in 2010. The empirical question is do changes in interest rate affect inflation expectations in Nigeria? In line with the research question, the authors empirically estimate the relationship between inflationary expectations and the variations in interest rate in Nigeria. In line with the study objective, we hypothesize that interest rate variations have no significant impact on inflation expectations in Nigeria. The paper is structured into seven sections for ease of analysis. Preceding section one is the section devoted to the trend analysis of the Nigerian inflation and interest rate. The theoretical framework, model and methodology are discussed thereafter. The results are analyzed and the paper is concluded in the last section.

STYLIZED FACTS OF THE NIGERIAN INFLATION AND INTEREST RATES VARIATIONS

The monetary policy of the *CBN* is faced with complex choices, as whatever policy action taken must be weighed against the possible trade-off(s) and implications for the wider economy (Sanusi, 2012). Thus, the *Monetary Policy Committee (MPC)* has observed the uncertainty of the inflation environment in the country. The Nigerian inflation has maintained its upward trend and is expected to remain within that region over the six month forecast period in May, 2012. During 2008 and 2009 when oil prices declined sharply, the domestic currency came under

severe pressure; the CBN was able to defend the Naira because the nation had buffers, having accumulated substantial foreign exchange reserves when oil prices were high. For example, reserve money exceeded the benchmark for the first half of 2011 by 16.6 per cent (CBN, 2012). In recent times, such luxury does not exist, as the excess crude account has largely been dwindled (Sanusi, 2012). Inflation rate in Nigeria is double-digit. At 10.8 per cent in December 2011, core inflation was marginally lower than the 10.9 per cent in December 2010 and 11.2 per cent in December 2009. According to *MPC* (2012), the inflation outlook in the short-term is impacted by a host of factors which include, the anticipated fiscal injections in relation to the country's budget, the recent partial deregulation of pump price of *PMS,* and latest tariff regimes on certain food imports and increase the inflationary pressure already in place on the supply-side. The growth of broad money supply (M_2) was sluggish up to May, 2011, accelerated thereafter to 5.66, 9.50 and 15.40 per cent in June, September, and December 2011, respectively. When annualised, M_2 grew by 11.32, 12.67, and 15.40 per cent in June, September and December, respectively, which hovered around the indicative growth benchmark of 13.75 per cent for 2011. Thus, M_2 growth of 15.4 per cent in 2011 was higher than the 6.9 per cent growth in 2010. The significant increase in credit to the private sector to finance its activities was a major factor underlying growth in monetary aggregates in 2011. In Nigeria, M_2 grew by 1.35 per cent in June 2012 over the level at end-December 2011, translating to annualized 2.70 per cent growth. In 2012, growth in monetary aggregates was modest relative to the benchmark for the first half of 2011. Relative to the level at end-December 2010, M_2 rose by 5.7 per cent in 2011. Similarly, narrow money supply (M_1) grew by 1.3 per cent at end-June 2011, compared to a decline of 2.0 per cent in the corresponding period of 2010. The moderate growth in money supply reflected the efforts to contain inflationary pressures. Banks' average prime and maximum lending rates fell significantly and the spread between banks' average term deposit and maximum lending rates widened to 17.60 percentage points from 15.50 percentage points in the first half of 2010. With the year-on-year inflation rate at 10.2 per cent at end-June 2011, all the deposit rates were negative in real terms. At N8, 521.4 billion, aggregate institutional savings at end-June 2011 increased by 42.9 per cent over the level in the corresponding half year of 2010.

EARLIER STUDIES

The literature on the relationship between inflation expectations and interest rate variation is vast. Truu (1975), Strydom and Steenkamp (1976), Saini (1982), Evans (1985), Dornbusch et al. (1991), Dornbusch et al. (1993), Rudiger and Fischer (1993), Mahdavi and Zhou (1994), Adam (1995), Mark De Broeck et al.(1997), Kevin (1998), Durevall et al (1998), Atish and Steven (1998), Gunnar (1999), Njuguna and Dick (1999), Gunnar (1999), Moll (1999), Senhadji et al. (2000), Khan and Abdelhak (2001) and Fedderke and Schaling (2005),. There is no empirical consensus. This is a cursor to the fact that the relationship between changes in inflationary expectations and interest rate disparity tend to be complicated.

THEORETICAL FRAMEWORK, MODEL AND METHODOLOGY

Framework

Theoretically, there are two inflation expectations theories; the rational expectations and the adaptive expectations. The model of adaptive expectations postulates that the expected inflation rate can be explained as a weighted average of past inflation rates which implies that:

$$\Pi^*_t = \phi\Pi_{t-1} + \phi(1-\phi)\Pi_{t-2} +$$

(3.1)

$$\phi(1-\phi)^2\Pi_{t-3} + ...\phi(1-\phi)^{n-1}\Pi_{t-n} + \upsilon_t$$

The adjusted parameters ϕ and $(1-\phi)$ serve as weights of inflation rate and they corresponds to a geometric series with declining elements. The weights express the influence of past rates of inflation on the formation of currently expected inflation rate. Rational expectations theory holds that expected inflation is equals to the previous period's inflation, or that expected inflation is equal to the actual inflation. That is:

$$\Pi^e = \Pi_{t-1} \equiv \Pi^e = \Pi$$

(3.2)

Where Π is the actual inflation rate, Π^e is expected inflation and Π_{t-1} is previous year inflation. In other words expectation of future inflation is related to observations of the past. When forming inflation expectations, economic agents recognize the relevant information set (Ljungqvist and Sargent, 2000; Jerome, 2004). So, the amount of information available to actors in the economy at the end of period *t-1* is given in equation (3.4):

$$E(\Pi_t \left| Information_{t-1}) = \Pi^*_t \right.$$

(3.3)

However,

$$\Pi_t - \Pi^*_t = \Pi_t - E(\Pi_t - \left| Information_{t-1}) = Error \right.$$

(3.4)

Given that $E(Error) = 0$, it thus implies that agents' expectations may be individually wrong, but may be correct on the average. In other words, although the future is not fully predictable, agents' expectations are assumed not to be systematically biased and hence use is made of all relevant information in forming expectations of economic variables. The study adopts the model of rational expectations theory. The author is motivated to adopt the model of rational expectations theory because it defines expectations based on rational behaviour of economic agents in derive optimal future forecast that uses all available information. Therefore, it assumed that forecast outcomes do not differ systematically from the actual market equilibrium results. In effect, rational inflation expectations do not differ predictably differs from actual inflation. In effect, with rational expectations, economic agents do not commit systematic errors when predicting the future, and deviations from perfect foresight are only random. In an economic model, this is typically modelled by assuming that the expected value of a variable is equal to the expected value predicted by the model.

A core assertion of rational expectations[3] theory is that actors will seek to "head off" central bank decisions by acting in ways that fulfil predictions of higher inflation (Cukierman et al. 1992, Calvo and Végh, 1999). This means that central banks must establish their credibility in fighting inflation, or economic actors will make bets that the central bank will expand the money supply rapidly enough to prevent recession, even at the expense of exacerbating inflation. Thus, if a central bank has a reputation as being "soft" on inflation, when it announces a new policy of fighting inflation with restrictive monetary growth economic agents will not believe that the policy will persist; their inflationary expectations will remain high, and so will inflation (Gbosi, 2005; 2007; Nenbee, and Dubon, 2009). On the other hand, if the central bank has a reputation of being "tough" on inflation, then such a policy announcement will be believed and inflationary expectations will come down rapidly, thus allowing inflation itself to come down rapidly with minimal economic disruption.

Empirical Model

In this paper, we specified the following dynamic *ADL (1, 1)* regression model for inflation rate I_t in terms of interest rate R_t as follows:

$$I_t = \beta + \phi I_{t-1} + \delta R_t + \upsilon_t \quad \textbf{(3.5)}$$

Using lag operator, the equation becomes re-specified as follows:

$$\phi(L) I_t = \beta + \pi(L) R_t + \upsilon_t \quad \textbf{(3.6)}$$

$$\text{where } \phi(L) = 1 - \phi(L),\ \pi(L) = \delta_1 + \delta_2 L$$

Equation (3.6) can be solved for I_t as a function of R_t and υ_t as follows:

$$\begin{aligned} I_t &= \phi(1)\beta^{-1} + \phi(L)^{-1}\pi(L) R_t + \phi(L)^{-1}\upsilon_t \quad \textbf{(3.7)} \\ &= \gamma + \varpi_\pi(L) R_t + \varpi(L)\upsilon_t \end{aligned}$$

$$\gamma = \phi(1)\beta^{-1}$$

$$\varpi_\pi(L) = \phi(L)^{-1}\pi(L), \varpi(L) = \phi(L)^{-1}$$

Since interest rate R_t is truly exogenous to the model, we have two sources of shocks. Thus, the short-run dynamic multipliers with respect to R_t and υ_t are given by:

$$\frac{\partial I_{t+s}}{\partial R_t} = \frac{\partial I_t}{\partial R_{t-s}} = \varpi_\pi{}'s, \quad \frac{\partial I_{t+s}}{\partial \upsilon_t} = \frac{\partial I_t}{\partial \upsilon_{t-s}} = \varpi' s \quad \textbf{(3.8)}$$

[3] Rational expectations theories were developed in response to perceived flaws in theories based on adaptive expectations.

In the steady state or long-run equilibrium, all variables are constant. Accordingly, the long-run multipliers are derivable as:

$$\begin{aligned} I_t^* &= \gamma + \varpi_\pi(L) R_t^* \\ &= \gamma + \varpi_\pi(1) R_t^* \\ R_t^* &= \frac{a}{1-\vartheta} \\ \varpi_\pi(1) &= \phi(1)^{-1}\pi(1) \\ &= \frac{\delta_1 + \delta_2}{1-\phi} \end{aligned} \quad \textbf{(3.9)}$$

The long-run impact of a change in interest rate on inflation can now be obtained as:

$$\frac{\partial I_t^*}{\partial R_t^*} = \varpi_\pi(1) = \frac{\delta_1 + \delta_2}{1-\phi} = \sum_{S=0}^{\infty} \frac{\partial I_{t+s}}{\partial R_t} \quad \textbf{(3.10)}$$

For the dynamic model to be stationary, $|\phi| < 1$ and the model assumption holds that inflation and interest rate are non-contemporaneous in that the value of a variable in the current time period is influenced by its value in the previous time period. This difference is known as the lag. This is essentially the foundation of autoregressive models. Extending this model one step further gives the vector autoregressive model which applies when the dependent variable in the system not only depends on its own lags, but also on the lags of another explanatory variable.

METHODOLOGY

The unit root and co-integration test are performed on each of the variable in the study. According to Granger (1981, 1988), if a pair of variable series are co-integrated, the bi-variate co-integrating system must possess a causal order in at least one direction. If the evidence is such that interest rate variability is linked to inflationary expectation, it can also be shown that the change in the exchange rate either lags or leads movements in stock prices. The regression of inflation expectation and interest rate is analyzed in order to examine the relationship between the two variables. In this paper, we employed the *Generalized Method of Moments (GMM)* estimator. The *GMM* then minimizes a certain norm of the sample averages of the moment conditions (Greene, 2002). Given that the available data consists of T *iid* observations on $Y_t, t = 1, 2, 3, ..., T$, where each observation Y_t is an *n*-dimensional variable, it then implies that the data are generated from a process defined up to an unknown parameter $\Gamma \in \Phi$. The objective of the estimation is to find the *true* value of this parameter Γ_0, or at least an estimate. The *GMM* application is based on the existence of a vector-valued function $g(Y, \Gamma)$ such that:

$$M(\Gamma_0) \equiv E\left[g(Y_t, \Gamma_0 \right] = 0 \quad \textbf{(3.11)}$$

Where E denotes expectation, and Y_t is a set of generic observations, which are all assumed to be *iid.* Identification requires the function $M(\Gamma)$ not be equal to zero for otherwise parameter Γ will not be identified.

EMPIRICAL RESULTS

The unit root results are as reported in Appendix A1. Each of the variables was tested for a unit root using the *ADF* and the *PP* test. The results show that none of the variables of expected inflation and interest rate are stationary at level in view of their low test statistics of -1.386, -1.093, -2.456 and -3.552 respectively. The results indicate that only the first differenced series of expected inflation rate and interest rate are stationary s at the five percent level. The Johansen co-integration test results are displayed in Appendix A2. The results show one co-integrating relation between expected inflation rate and interest rate. In particular, the *trace and maximum eigenvalue* statistics are 25.9395 and respectively. These values exceed the five percent and one percent critical values. Evidently, both variables of expected inflation and interest rate share a long-run relationship. The *GMM* estimates are given in Appendix A3. The error correction coefficient indicates that 63 percent of the total deviation from equilibrium is adjusted within one year. Based on the *t-ratios*, all the variables are significant. The *F-statistic* (35.233) is highly significant even at the level of 1 percent, which implies that interest rate and one-year lag of inflation rate adequately explains the variation in inflation rate. All the estimated coefficients conformed to theoretically expected signs. As expected, lagged inflation rate is highly significant and the coefficient is positive. The lag expected inflation is significant and positive thereby portraying the fact that expectations of inflation in the previous period play important role in the determination of current inflation rate.

The *GMM* estimates indicate statistical significance of the changes in interest rate variable with a negative coefficient. The negative coefficient of the rate of interest indicates that as the prime lending rate rises, expected inflation falls. Specifically, the short-run estimates reveal that one percent positive change in the prime lending rate induces 1.66 percentage negative (decline) changes in expected inflation rate in Nigeria. The result shows that 85 percent of the variations in expected inflation rate are due to the changes in the interest rate and the one-year lag of inflation. The long-run coefficients are robust and statistically significant. The results show that the long run impact of interest rate on expected inflation is negative and this conformed to economic theory. As it were, if interest rate should rise by one percent, inflation expectations fall by 1.5 percent. The The *LM* statistic of 1.0662 with a probability value of 0.4552 shows there is absence of serial correlation and as such the estimates can be relied upon for meaningful inference. *ARCH* test shows an insignificant F-statistic of 0.2662 with p-value of 0.5356 respectively (Appendix A3). This is a pointer to the fact that there is completely no presence of *ARCH* heteroskedatsicity in the estimates as given by the data series. The estimated model is stable and stationary as shown by the *CUSUM and CUSUMSQ* plots given that the roots of the autoregressive model have a modulus less than one and lie inside the unit circle (Figure 1).

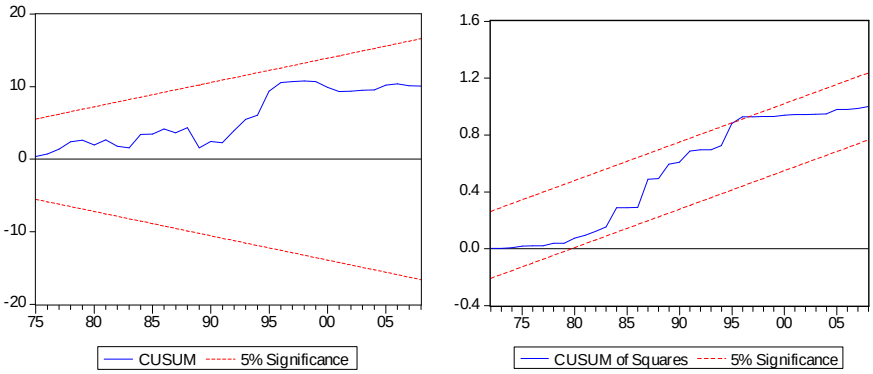

Figure 1: Stability Test Results

CONCLUSION AND CONTRIBUTION

This paper sought to investigate the relationship between inflationary expectation and interest rate in Nigeria. The results of empirical study indicate that the effect interest rate variation on expected inflation in Nigeria is negative and significant. The upshot is that variation in prime lending is a determining factor of inflation expectations in Nigeria. Thus, the Central Bank of Nigeria (CBN) should persistently vary the prime lending rate in order to check inflation expectations in the country. As part of the CBN's statutory duties, there is need for the *CBN* to embark on the implementation of policies that reduce adverse inflationary trends in the economy and this it does by raising the cost of borrowing to commercial banks and thereby curtailing the capacity of commercial banks to expand credit. By increasing the cost of borrowing to commercial banks, the prime rate of lending to the public is also increased and by so doing, the cash position of these banks is minimized thereby reducing inflationary expectations in the country. The study made heroic contributions to knowledge as regards tested parameters. The current study advocated that an inflation premium added to interest rates allows for expectations about future inflation. An inflation premium is often built into nominal interest rates to protect against the loss of purchasing power of the Naira. One may hypothesize that current inflationary expectations are based on the history of past actual rates of inflation. A formal model that may help in understanding the development of these expectations is that of the *Adaptive* expectations model. This model is based on the notion that economic agents slowly adapt to a changing inflationary circumstance. This may have been the case in the late 1960's. During the 1960's, the inflation rate in Nigeria was relatively low in the neighbourhood of three to five percent. Essentially, during this period of time, inflation was not considered to be a major macroeconomic evil. Accordingly, in the Nigerian situation when actual inflation became double-digits, forecasts of future inflation based on obsolete historical information consistently lagged behind an accelerating actual rate of inflation. In the early to mid 1980s the actual rate of inflation was de-accelerating (disinflation). During this period, economic agent's expected rates of inflation were greater than what actually occurred. What this means is that these economic agents were dawdling to adapt thus putting upward pressure on ex-post real interest rates.

REFERENCES

Adam, C., (1995). "Fiscal adjustment, financial liberalization, and the dynamics of inflation: Some evidence from Zambia," *World Development*, Elsevier, vol. 23(5), pages 735-750, May.

Alesina, A. and Arazen, A. (1991), Why is Stabilization Delayed? *American Economic Review*, 81:1170 – 118

Amemiya, T. (1985), *Advanced econometrics*. Cambridge, Massachusetts: Harvard University Press.

Atish G. and P. Steven, (1998). "Warning: Inflation May Be Harmful to Your Growth," IMF Staff Papers, Palgrave Macmillan, vol. 45(4), pages 672-710, December.

Blanchard, O. (1997), *Macroeconomics*, Prentice-Hall, Upper Saddle River, New Jersey

Calvo, G. and Végh, C. (1999), *Inflation stabilization and BOP Crisis in Developing countries.* In: John Taylor and Michael Woodford, eds. *Handbook of Macroeconomics*, North Holland.

Catáo, L. and Terrones, M. (2001), Fiscal Deficits and Inflations: A New Look at the Emerging Market Evidence. IMF Working Paper, WP/01/74.

CBN (2000), *The Changing Structure of the Nigerian Economy and Implications for Development.* Lagos: Realm Communications.

Cobham, D. (1981), On the Causation of Inflation: Some Comments. The Manchester School of Economics and Social Studies, No. 2: 348-354

Cukierman, A., S. Edwards, and G. Tabellini (1992), Seignorage and Political Instability. *The American Economic Review*, 82: 537 - 555. *International Journal of Economic Development Research and Investment Vol. 3, No 1, April 2012* 21

Davidson, R., J. G. MacKinnon (1993), *Estimation and Inference in Econometrics*. Oxford University Press.

Dick D. and N. S. Njuguna, (1998). "A Dynamic Model of Inflation for Kenya 1974 - 1996," Working Papers in Economics 7, University of Gothenburg, Department of Economics.

Dornbusch, R. and S. Fischer (1991). "Moderate inflation," Policy Research Working Paper Series 807, The World Bank.

Dornbusch, R. and S. Fischer (1993). "Moderate Inflation," World Bank Economic Review, World Bank Group, vol. 7(1), pages 1-44, January.

Dornbusch, R. and S. Fischer, (1993). "Moderate Inflation," NBER Working Papers 3896, National Bureau of Economic Research, Inc.

Evans, P., (1985). "Do Large Deficits Produce High Interest Rates?," *American Economic Review, American Economic Association*, vol. 75(1), pages 68-87, March.

Fedderke J. W. and E. Schaling, (2005). "Modelling Inflation In South Africa: A Multivariate Co-integration Analysis," *South African Journal of Economics, Economic Society of South Africa*, vol. 73(1), pages 79-92, 03.

Gunnar J., (1999). "The Relative Merits and Implications of Inflation Targeting for South Africa," IMF Working Papers 99/116, International Monetary Fund.

Gbosi, A. N. (2005), *Macroeconomic Management in Nigeria.* Port Harcourt: Sherbrooke Associates Publishers.

Gbosi, A. N. (2007), *The Nigerian Economy and Current Economic Reforms.* Ibadan: Olorunnishola Publishers

Gunnar J., (1999). "Inflation, Money Demand, and Purchasing Power Parity in South Africa," IMF Working Papers 99/122, International Monetary Fund.

Greene, W. H. (2002), *Econometric analysis* (5th ed.). Prentice Hall. [[Special:BookSources/0-13-066198-9|0-13-066198-9]].

Jerome, A. (2004), A Survey of Macroeconomic Models for Policy Analysis and Forecasting in South Africa". A Paper Presented at 9th Annual Econometrics Modeling for South Africa, University of Cape Town, June 30-July, 2.

Khan M. S. and S. S. Abdelhak, (2001). "Threshold Effects in the Relationship Between Inflation and Growth," IMF Staff Papers, Palgrave Macmillan, vol. 48(1), pages 1.

Kevin R., (1998). "Post Stabilization Inflation Dynamics in Slovenia," IMF Working Papers 98/27, International Monetary Fund.

Keynes, J. M. (1936), *The General Theory of Employment, Interest and Money.* New York: Harcourt Brace Company.

Ljungqvist, L. and Sargent, T. (2000), *Recursive Macroeconomic Theory.* Cambridge: The MIT Press.

Mahdavi, S. and S. Zhou, (1994). "Purchasing power parity in high-inflation countries: further evidence," *Journal of Macroeconomics,* Elsevier, vol. 16(3), pages 403-422.

Moll P. G., (1999). "Money, Interest Rates, Income and Inflation in South Africa," *South African Journal of Economics, Economic Society of South Africa*, vol. 67(1), pages 15-30, 03.

Mordi, C. N. O. (2009), Overview of Monetary Policy Framework in Nigeria. In *CBN Bullion* 33(1): 1-10.

Nenbee, S. G. and P. B. Dubon (2009), Output-Inflation Relationship in Nigeria: Lessons from the Petroleum Sub-sector, 1980-2007". *Journal of Economics, Management Studies and Policy* (JEMSAP), 2(1) 17-32.

Njuguna S. N. and D. Dick, (1999). "A Dynamic Model of Inflation for Kenya, 1974-1996," IMF Working Papers 99/97, International Monetary Fund.

Ohale, L. and Onyema, J. I. (2002), *Fundamentals of Macroeconomics.* Owerri: Springfield Publishers.

Orubu, C. O. (2009), Inflation in Nigeria: Concept, Measurement and Control". In CBN: Bullion, 33(1): 19- 30.

Rose, P. S. (1994), *Money and Capital Markets*, Irwin, Burr Ridge, Illinois. *Selected Interest Rates* (H.15 Release), Federal Reserve Board of Governors web site. http://www.federalreserve.gov/releases

Saini, K. G., (1982). "The monetarist explanation of inflation: The experience of six Asian countries,"

World Development, Elsevier, vol. 10(10), pages 871-884, October.

Senhadji A. S. and M. S. Khan, (2000). "Threshold Effects in the Relationship Between inflation and Growth," IMF Working Papers 00/110, International Monetary Fund.

Strydom P. D. F and L. Steenkamp (1976). "Inflation in South Africa II: Aggregate Demand and Price Expectations," *South African Journal of Economics, Economic Society of South Africa,* vol. 44(4), pages 266-277, December.

Stiglitz, J. E., and C E.Walsh (2002), *Principles of Macroeconomics*. W.W. Norton & Company, New York. See Chapter 4. Survey of Professional Forecasters, Federal Reserve Bank of Philadelphia

Truu M. L., (1975). "Inflation in the South African Economy," *South African Journal of Economics,*

Economic Society of South Africa, vol. 43(4), pg 272-286, December.

Corresponding email: udavidson2000@yahoo.com

APPENDICES

Appendix A1: Unit Root Test Results

Series	**ADF**	**Critical Value @ 5%**	**Remark***
I	-1.386	-2.539	$I(1)$
R	-1.093	-2.539	$I(1)$
ΔI	-9.378	-3.278	$I(1)$
ΔR	-8.645	-3.256	$I(1)$
Series	**PP**	**Critical Value @ 5%**	**Remark**
I	-3.456	-4.792	$I(1)$
R	-3.552	-4.792	$I(1)$
ΔI	-10.256	-5.735	$I(1)$
ΔR	-21.358	-5.735	$I(1)$
*Series are all first-difference stationary			

Appendix A2: Johansen's Co-integration Test Results

No. of CE	**Eigenvalue**	**Trace**	**Max-eigen**	**1% (5%) CV**
None**	0.8965	93.54	65.69	65.25 (59.59)
At most 1	0.8676	83.55	58.93	56.33 (53.55)
At most 2	0.7935	63.88	55.82	49.38 (38.53)
At most 3	0.6736	55.23	43.59	37.98 (33.75)
At most 4	0.5586	47.35	38.25	28.36 (23.95)
At most 5	0.5379	35.45	32.45	25.59 (22. 26)
*Trace and Max-eigenvalues indicate 1 co-integrating equation @ 1% & 5% levels				

Appendix A3: Generalized Method of Moment Estimates

Regressand: ΔI	
Panel A: Short-Run Estimates	
Regressor(s)	*Coefficient (t-statistics)*
β	*-1.025** (2.688)*
ΔI_{t-1}	*0.556*** (11.382)*
ΔR_t	*-1.362*** (-3.359)*
ECM_{t-1}	*-0.635*** (-5.605)*
Panel B: Long-Run Estimates	
γ	*-0.224** (2.593)*
R_t^*	*-1.526* (-3.082)*
Instruments $I_{t-1}, R_{t-1}, M_t, E_t, E_{t-1}$	
Goodness-of-fit Measures	
R^2 *, Adjusted* R^2*, F-statistic*	*0.853,0.725, 35.233*
Sum of Squared Residuals	*0.0066*
Standard Error of Regression	*1.0222*
Diagnostic Statistical Checking	
Jacque-Berra	*1.6682 [0.0028]*
Ramsey-Reset	*1.0255 [0.155]*
$LM_{(SC)}$ *Breusch Godfrey*	*1.0662 [0.6382]*
ARCH Test Statistic	*0.2662 [0.5356]*
White Test Statistic	*0.2446 [0.2259]*
Note: ***, ** denotes statistical significance at the 1% and 5% levels Figures in ( ) and [ ] are the t and probability values of significance respectively	