

Dynamics of Inflation and Unemployment in a Vector Error Correction Model

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Abstract
We examined the dynamics of inflation and unemployment in Nigeria using the vector error correction methodology over a period of twenty seven years. The study finds evidence of stagflation in the Nigerian economy over the period of study. In fact, the Nigerian economy is managing a shocking rate of inflation together with a severe recession as the unemployment rate has risen astronomically. Consequently, the Nigerian economy is at a cross road. Based on these findings, it is recommended that the *CBN* maintains a stance of gradual reduction of the benchmark inflation rate to a single digit as the excessive contraction of the monetary policy rate seems to have become counterproductive in recent times. Single digit inflation rate can be achieved if the *CBN* could increase *GDP* growth above money supply and increase lending to the real sector of the economy.
Keywords: *Inflation targeting, unemployment, monetary policy, stagflation, Nigeria, Phillips curve, NAIRU*

1. Research Problem

Two major objectives of macroeconomic policies are to achieve full employment level and to stabilize prices through low inflation. These goals are pursued in order to avoid the cost of unemployment and inflation. Therefore, akin to every other economy of the world, monetary policy in Nigeria is first and foremost geared toward ensuring the stability of prices in the economy. Inflation has been a major problem in Nigeria and so, its incidence is no longer news. The *Central Bank of Nigeria (CBN),* the institution tasked with the conduct and implementation of monetary policy, is an inflation-targeting central bank (CBN, 2006). While this may be the case, developments in the labour market, particularly the level of unemployment in the economy remains imperative to the conduct and performance of monetary policy in Nigeria. Every year in Nigeria, millions of students are graduated from all levels of education. This yearly turn-out most often increase the country's labour force. However, not everyone that constitutes the labour force is able to secure employment at least in the immediate period and this in turn brings in unemployment in the system. High unemployment rate is one of the main challenges facing the Nigerian economy. Unemployment is an impediment to economic growth and development in every country. Apart from the fact that unemployment represents a vast waste of the country's surplus labour and hence, manpower resources, it generates welfare loss in terms of lower output and hence national income.

The relationship between unemployment and inflation has been the subject of controversial debate, stimulating an empirical divide between macroeconomists. Indeed, following Phillips' (1958) findings, the relationship between inflation and unemployment became a focal point for macroeconomic policy analysis. Most of the focus has been directed at establishing whether or not a negative relationship exists in the short run and what this may imply for policy. Friedman (1968) invented the *natural rate of unemployment (NAIRU)* which led to the view that in the long run, the Phillips curve is absolutely vertical, that is, the unemployment rate is independent of inflation and monetary policy. Thus, the nature of the short-run relationship and whether or not it represents a usable policy trade-off (Lucas, 1972) again dominated the discussion on macroeconomic policy analysis. In view of these, the study is set out to examine the relationship between inflation and unemployment in Nigeria. The paper is structured as follows; section two provides a situational analysis of unemployment and inflation in Nigeria. A succinct empirical literature is reviewed in section three. The theoretical framework and model specification are discussed in section four. Section five is devoted to a discussion of the methodology and estimation technique. The vector error correction results are analyzed in section six. Section seven concludes.

2. Unemployment and Inflation in Nigeria: Situational Analysis

The current unemployment rate in Nigeria is double digit. From 5.3 percent in December 2006, the unemployment rate in Nigeria averaged 14.6 percent reaching an all time high of 23.9 percent in December 2011 (CIA World Fact Book, 2012). In fact, the Nigeria's unemployment rate increased to 23.9 percent in 2011 from

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21.1 percent in 2010 (NBS, 2012). According to Sanusi (2012), the nation's unemployment rate has doubled in the last five years to hit the red-button zone. Sanusi added that

> …*"there is a serious problem when a country's economy is growing at seven percent and yet could not provide jobs for its citizens. It is like a broken record; a country that produces oil, yet imports refined fuel, a country that is in the tomato belt and yet imports tomatoes*" (Sanusi, (2012).

Labour surplus abounds in Nigeria. Unfortunately, the *Dutch disease* has affected the absorptive capacity of the Nigerian labour market and this has fuelled the unemployment syndrome in the country. Graduate unemployment has become significant in the last decade due largely to upsurge in the output from tertiary education and inelastic labour absorptive capacity of the Nigerian labour market. In 2011, a situational analysis of the Nigerian unemployment problem reveals that of the total unemployed persons, 43.7 percent were university graduates, 23.8 percent were polytechnic graduates and 15.5 percent were college undergraduates (CBN, 2012b). While the unemployment rate has been on the increase over time, the large pool of underemployed estimated at 13.9 million (CIA World Fact Book, 2012) has resulted in rigidities in the Nigerian labour market and in the wage structure of the country. In effect, the high unemployment rate have contributed to wage stickiness in the country and because wages do not change as much in response to fluctuations in economic activity, this has caused the declining sensitivity of inflation to changes in the domestic output and unemployment rate in the country. From the trend analysis, it is obvious that the unemployment rate in Nigeria is worrisome to a greater extent. Nigeria's unemployment rate is getting shocking and it has calamitous consequences for the country's growth.

The current monetary policy stance of the *CBN* is contractionary. This has been adopted since January 2011 when the *Monetary Policy Rate (MPR)* was raised by 275 basis points. Inflation rose considerably by 0.77 percent to 12.47 percent in November 2012 from the 11.7 percent recorded in October, 2012 (CBN, 2012a). As at December 2012, the Nigeria's headline inflation rate stood at 12.3 percent. The increase was as the result of a rise in the consumer price index by 0.86 percent to 140.25 points in November from 139.1 points in October (Sanusi, 2012). The rise in the consumer price index by 0.86 percent can also be traced to the negative externality effect of the floods and limited food supply to the markets. In other words, the significant increase in the inflation rate as remarked in a double digit rate is an undeviating consequence of higher food[2] prices and upward trend in food inflation is due to lagged effect of the floods. Indeed, the monthly composite *CPI* was higher by 0.60 percent in November 2012 when compared to the month of October 2012. Similarly, the food index was higher by 11.6 percent in August 2012 from the 11.1 percent recorded in the September 2012 and increased by 0.7 percent on monthly basis. The wide-ranging inflation index captured by the *"all items less farm produce*" also rose by 70 percent in November to record a 13.1 and 0.4 percent increase on yearly and monthly bases respectively (CBN, 2012b; NBS, 2012; CBN, 2012). The trend analysis show an upward trajectory of inflation over the last four months of 2012, a reversal from the downward trend recorded between July and September of the same fiscal year. Meanwhile, the *GDP* of Nigeria represents only 0.39 percent of the world economy while per capita *GDP* in Nigeria when adjusted by purchasing power parity *(PPP)* is equivalent to 12 percent of the world's average.

3. Literature Review

Immense number of studies validated the inverse relation between inflation and unemployment. Some of these studies include, Laurence (1996), (1997), Akerlof, Dickens and Perry (2000), Anthonio (2003), Neugart and Hassler (2003), Mankiw (2004), Bagsic (2004), Bhattarrai (2004), Gambetti (2004), Bhattarai (2004), Dumlao (2005), Antonio (2006), Dua (2006), Lim et al. (2009), Tsung-wu (2009), Chengsi and Joel (2009), Sicat (2009) and Esguerra (2010), However, studies like Sekine (2001), Leigh (2004), Kamada (2004), Gambetti (2004), Kitov (2006a), Kitov (2006b), Kitov (2006c), Feyzioğlu and Willard (2006), Caporale and Gil-Alana (2006),

[2]The increase in food inflation reflects the impact of the recent floods on food production which reached a peak between late October and early November, affecting several states across the country to varying degrees. The delayed movement of food products to markets across the country coupled with its attendant costs contributed to the rise in the index. This development exacerbated an already flawed food distribution network that relies primarily on weak road network.

Lundborg and Sacklen (2006), Kitov (2007a), Kitov (2007b), Kitov et al.(2007a), Kitov et al. (2007b), De Veirman (2007) and Pascalau (2007) find no trade-off between inflation and unemployment.

4. Theoretical Framework and Model Specification

4.1. Framework

The relationship between unemployment and inflation has conventionally been modelled within the trade-off framework of monetary policy. The transmission mechanisms of the inflation-unemployment trade-off effects of monetary policy can be schematically explained as:

$$\text{Money Supply}\uparrow\rightarrow\text{Aggregate Demand}\uparrow\rightarrow \text{Production}\uparrow\rightarrow\text{Unemployment}\downarrow\rightarrow\text{Inflation}\uparrow \quad \textbf{(3.1)}$$

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The crux of the transmission mechanisms is that an expansionary (contractionary) monetary policy leads to higher (lower) aggregate demand. These in turn increase (decrease) the level of production, lower (increase) unemployment and hence increases (lowers) inflation. In the case of an expansionary monetary policy, the *CBN* increases the quantity of money in circulation. Amplified money supply induces decline in interest rates, making available to economic agents fewer incentives to save and as a replacement for savings; consumers would have a preference to increase consumption. Moreover, lower cost of borrowing encourages investors to undertake colossal investment projects. Jointly, amplified consumption and investment expenditures leads to increased aggregate demand. The increase in aggregate demand causes an increase in the productive capacity of the economy with a positive externality effect for employment, that is, increase in production spawns higher demand for workers which reduces unemployment in the country. However, as the economy approaches full employment equilibrium, the increase in aggregate demand and employment put an upward pressure on prices and wages which in the long run, lead to higher inflation and vice-versa. Chatterjee (2002) explains the trade-off in terms of policy regimes such as the central bank independence. Accordingly, a contractionary monetary shock raises unemployment and leads to a delayed and gradual fall in inflation. Given that nominal wages are slow to adjustment, real wages will rise whenever the central bank contracts money supply and this in turn make firms to lay off workers and hence, there is a short-run trade-off. Theoretically therefore, it follows that changes in monetary policy pushes both variables of inflation and unemployment in opposite directions (Mankiw, 2000). This provides the rationale for government intervention since the proposition of the trade-off is that the government has a choice between high inflation-low unemployment and low inflation-high unemployment by means of appropriate policy measures.

4.2. The VECM Model

To observe the relationship between inflation rate and unemployment in Nigeria, we adopt the vector error correction model *(VECM).* The offshoot of the *VECM* is the *VAR* model. In this view, the specification of the z^{th} endogenous vector follows a p^{th} order autoregressive *VAR* process which is given as:

$$Z_t = \beta + \Im_1 Z_{t-1} + \Im_2 Z_{t-2} + \ldots + \Im_p Z_{t-p} + e_t \quad \textbf{(3.3)}$$

The perturbation arising from the model is *iid* with the distribution function $e_t \sim N[0,\Omega]$. Z_t is the $[n\times 1]$ vector of endogenous variables at time *t.* There are pn^2 parameters in the $\Im$ matrices. Employing the lag operator *L,* equation (3.3) is re-specified as:

$$\Im[L]Z_t = \beta + e_t \quad \textbf{(3.4)}$$

Where $\Im[L] = \Im_0 L^0 - \Im_1 L^1 - \ldots - \Im_p L^p$

The roots of $[\Im(L)]$ the lie outside the unit circle and the degree of stationarity is determined on the basis that $[\Im_0 = 1]$. The restriction that $[\Im_0 = 1]$ implies that there are no current endogenous variables in the *VAR* model. By methodology, equations in the *VAR* model are related through the off-diagonal elements in the error covariance matrix Ω which is consistently estimated as:

$$\Omega = \frac{1}{T}\left(\sum_{t=1}^{T} e_t e_t^{'}\right) \quad \textbf{(3.5)}$$

Where $\sum = E[e_t e_t^{'}] = D^{-1} G \Omega G' D^{-1}$

e_t is the $[n\times 1]$ vector of *OLS* residuals

In view of policy inference, the impulse response functions and the variance decomposition are the useful tools for evaluating the effectiveness of policy shock in *VAR* estimation. In consideration that *Z* is k-dimensional vector series generated by

$$Z_t = B_1 Z_{t-1} + \ldots + B_p Z_{t-p} + e_t \tag{3.6}$$

$$= \theta(S) e_t = \sum_{i=0}^{\infty} \theta_i e_{t-1}$$

$$I = \left[I - B_1 S - B_2 S - \ldots - B_p S^p \right] \theta(S)$$

Where $\theta_{jk,i}$ is the moving average *(MA)* coefficient that measures the impulse-response, that is, it captures the response of variable j to a unit impulse in k variable that previously occurred at the i^{th} period. Given that the matrix $\sum$ is non-diagonal, that is, positive definite matrix, it is impossible to shock one variable with other variables fixed. This indeed necessitated a transformation, the Cholseky decomposition (Sims, 1980). Thus, if *P* represents a lower triangular matrix, equation (3.6) can be rewritten as:

$$Z_t = \sum_{i=0}^{\infty} \varnothing_i \varepsilon_{t-1} \tag{3.7}$$

$$\left[\varnothing_i = \theta_i P, \varepsilon_t = P^{-1} e_t, E(\varepsilon_t \varepsilon_t^{'}) = I, \sum = PP^{'} \right]$$

The co-integration of the *VAR* model is often represented by vector error correction model *(VECM)*. The general *VECM* process is specified as:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{j=1}^{p-1} \Gamma_J \Delta Y_{t-j} + \varepsilon_t \tag{3.8}$$

Where Π and Γ are $(n \times n)$ matrices of unknown parameters and is independently, identically distributed white noise errors with zero mean and non-singular covariance matrix. The sum on the right hand side of equation (3.8) represents the short term dynamics of the *VECM* process. Using the variables of interest to the present study, the *VECM* can be specified thus:

$$\begin{aligned} Ln(U_t) &= \phi_0 + \sum_{i=1}^{p} \Delta \phi_i Ln(W_t) + \sum_{i=1}^{p} \Delta \delta_i Ln(I_t) + \theta_1 ECM_{(t-1)} + e_{1t} \\ Ln(I_t) &= \vartheta_0 + \sum_{i=1}^{p} \Delta \vartheta_i Ln(Z_t) + \sum_{i=1}^{p} \Delta \varpi_i Ln(U_t) + \theta_2 ECM_{(t-1)} + e_{2t} \end{aligned} \tag{3.9}$$

Where U_t is unemployment level in Nigeria, I_t is the current inflation rate in Nigeria, W_t is a vector of regressors that affects unemployment and these variables include, lagged unemployment rate U_{t-1}, national income Y_t^N, capacity utilization C_t^U and labour force participation rate L_t^R. Z_t is another vector of regressors that determines the inflation rate in Nigeria. These variables include the growth rate of money supply M_t^S, lagged inflation rate I_{t-1}^E is the adaptive expectation measure of inflation, the *Naira-US$* exchange rate E_t^R, fiscal deficit as a ratio of *GDP* D_t^F and nominal interest rate R_t^R. $ECT_{(t-1)}'s$ are the lagged stationary residuals from the co-integration equations, $e's$ are the stochastic regression residuals.

5. Methodology and Estimation

5.1. Engle-Granger Test

Non stationarity has been the major setback in time series data at level during estimation. Following the Engle-Granger (1987) methodology of taking first difference, the problem posed by unit root which is spurious inference is eliminated. So, to test for non-stationarity, the study utilized the *PP and the ADF*[3] tests and the test equation that was estimated is of the following form:

$$\Delta Q_t = \alpha_{11} + \alpha_{22} + \alpha_{33} Q_{t-1} + \alpha_{44} t + \sum_{i=1}^{M} \alpha_i \Delta Q_{t-i} + e_{3t} \qquad \textbf{(3.10)}$$

Where Q is the time series variable, M is the number of lags, $e's$ are the stochastic white noise residual terms. The augmented lagged difference of the time series variable guarantees stationary errors.

5.2. Johansen Maximum Likelihood (JML) Test

The study adopts a multivariate co-integration technique of Johansen, *Johansen Maximum Likelihood (JML)* method in testing the co-integration between inflation and unemployment. Thus, the co-integration test examines the long-run equilibrium relationship between variables. The justification for choosing the *JML* is that it has the facility for simultaneously estimating more than one co-integration relationships. The *JML* methodology uses the trace statistic and the maximum eigenvalue statistic which are given as:

$$LR_{trace}(r) = -T \sum_{j=r+1}^{n} Log(1-\lambda_j) \qquad \textbf{(3.11)}$$

$$LR_{\max}(r) = -TLog(1-\lambda_{r+1}) \qquad \textbf{(3.12)}$$

The hypothesis tested upholds the fact that the number of linearly independent co-integrating relations of the variables is equal to the rank of Π which is denoted by r . Accordingly, the hypothesis that is tested in the study is formulated as:

$$H(rank): rk(\Pi) = r \ \ vs. \ \ H(rank): rk(\Pi) > r \qquad \textbf{(3.13)}$$

$$H(rank): rk(\Pi) = r \ \ vs. \ H(r+1): rk(\Pi) = r+1 \qquad \textbf{(3.14)}$$

The hypotheses tests in equation (3.13) are the trace tests while those of equation (3.14) are the maximum eigenvalue tests. Given that $H(r)$ is true, the matrix Π in the *VECM* can be formally specified as a product with a further definition of the co-integrating restrictions:

$$\Pi = \delta\phi' \qquad \textbf{(3.15)}$$

Where δ and ϕ are matrices of full rank r, that is, rank $\Pi = r$. Thus, Π is the impact matrix, δ is the vector of adjustment coefficients, ϕ is the vector of co-integrating relations. In effect, the null hypothesis can be re-written as $H(r): \Pi = \delta\phi'$ such that $rk(\delta) = rk(\phi) = r$. Thus, if by replacement, $rk(\Pi) = r > r^*$, it then implies that there exits $(n \times r)$ matrices $[\delta : \delta_1]$ and $[\phi : \phi_1]$ of rank r such that $\Pi = \delta\phi' + \delta_1\phi_1'$

5.3. VECM Estimation

The co-integration of the *VAR* model is often represented by vector error correction model *(VECM)*. Error-correction mechanism *(ECM)* is used to bear out the short run dynamics between the explained and the explanatory variables in a model. Even when the long run relationship exists among variables, there may be short term disequilibrium. Hence, error correction equation is used to remove this divergence from long run equilibrium. If a linear combination of the variables in a model exists, that is, stationary the variables are found to be co-integrated. Given that the error correction representation is a function of the co-integrating relations, the co-integrating relations between the variables of the *VECM* model are determined at foremost and then estimate the *VECM* for possible short-run dynamics between the variables of the model. Impulse response functions (*IRF)* estimates based on *ECM* are consistent. Thus, the computation of an impulse response function for a co-integrated *VECM* system takes the stages: determination of the co-integration rank by estimating the *ECM* model, converting the *ECM* back to *VAR* model and using the resulting *VAR* model to perform the *IRF*. The *VECM* has the advantage of identifying the system errors which are interpreted as linear combinations of exogenous shocks rather than identifying the autoregressive coefficients [Sims (1981), (1986), Mugume (2009),

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[3]The null hypothesis of *ADF* is that the variables have unit root, that is, the variables are non stationary and the alternative is that variables are stationary. The null hypothesis of the *PP* test is that the variables are non- The non stationary and the alternative is that variables are stationary. The t-statistics of test equations (trend and intercept) are used for validating or for rejecting the null hypothesis. If t-statistics of the PP and the ADF test are greater than their critical values at mostly the 5% or 1% level of significance, the null hypothesis is rejected in favour of the alternative that the series do not have unit root and are indeed stationary. If series are non-stationary at level, the methodology holds that such series be tested at first difference to make them stationary (Amemiya, 1985; Greene, 2002).

Bernanke (1986) and Shapiro and Watson (1988)]. The annual data utilized in this study were sourced mainly from the *International Financial Statistics (IFS)* of the International Monetary Fund (IMF). The data spans over the sample period, 1986 through to 2012.

6. Empirical Results

Stationarity tests results are reported in Appendix **1.**The *ADF and PP* test statistics exceeds the critical values given by -3.536 (-3.968) and -4.352 (-4.586) at the five percent (one percent) levels respectively. As made evident by the results, none of the variables in the study was stationary at level. As it were, the variables in the study are all first-difference stationary. The multivariate co-integration test results are given in Appendix **2**. The results shows that shows that the trace and the max eigen statistics exceeds the critical values at the five percent (one percent) statistical levels of significance respectively. In effect, inflation and unemployment are co-integrated and their linear combination is stationary thereby portraying long-run relationship. Intuitively, any short-run dis-equilibrating force settles at equilibrium level. Optimal lag length of 2 was utilized in the *VAR* estimation that precedes the Johansen's co-integration test (Appendix **3**). Having established the stationarity and co-integration of the variables in the study, we proceeded to estimate the vector error correction model *(VECM)*.

The *VECM* estimates for inflation and unemployment are shown in Appendix **4.** The coefficients of inflation and unemployment rates do not conformed to theoretical expectations in their respective equations. Both coefficients of inflation and unemployment level are positive. Should unemployment rate increase by one percent, inflation rate will increase by 1.08 percent; this finding does not conform to the postulations of the short run Phillips curve. On the other hand, if inflation increases by one percent, unemployment will also increase by 1.02 percent. Therefore, if inflation were to steadily increase over a number of years, workers would eventually expect nominal wages to reflect this. This also does not conform to theoretical postulation of the short run Phillips curve. The failure of these variables to report the inverse sign expectation show evidence of stagflation in the Nigerian economy, an indication that the Phillips curve relation do not exist in Nigeria. The adaptive expectation variable passes the significance test at the one percent level and its coefficient is positive just as theoretically expected. This indeed suggests that when economic agents bases their expectations on a weighted average of previous inflation rates, their expectations becomes backward looking so that past errors are built into future forecasts. When inflation is increasing, workers systematically underestimate the inflation rate. When inflation is decreasing, they systematically overestimate it. As expected, the growth rate of broad money, interest rate and exchange rate are highly significant in explaining current inflation rate.

The results show that a ten percent increase in the growth rate of money supply and interest rate will lead to 17.3 percent increase and 5.08 increase in inflation rate. The result reveals that growth rate of *GDP*, growth rate of money supply, one-year lag of inflation rate and interest rate exert positive influence on inflation rate just as expected. The positive inflation rate effects of interest rate can be explained thus: At higher cost of borrowing, prospective investors are discouraged and this induces investment crowd out effect, deterred investment level will causes increase in price level and hence resulting in inflationary pressure on the overall economy. Fiscal deficit and Naira-US dollar exchange rate exerted negative and significant effects on inflation rate in Nigeria. The negative sign of exchange rate indicates that as exchange rate depreciates, inflation will continue to rise. In effect, a ten percent depreciation of the naira in relation to the US dollar will engender 10.3 percent increase. Capacity utilization and national income are significant determents of current unemployment in Nigeria. Specifically, the results show that a ten percent increase in the capacity utilization and the growth rate of *GDP* leads to 10.6 percent increase and 13.2 percent decrease in the level of unemployment in Nigeria. The *F-statistics* for both equations of inflation and unemployment are highly significant. These imply that the general vector error correction model adequately explains the systematic variations in inflation and unemployment rates in Nigeria. The *B-G* statistic shows the absence of serial correlation in both the inflation and unemployment equations. The adjustment coefficients of for the estimated equations for inflation and unemployment are -0.928 and -0.753 respectively. These negative coefficients are statistically significant. This means that adjustment is rapid in the inflation equation than in the unemployment equation. Thus, while over 92 percent of the total adjustment in the inflation rate is covered within a year, 75 percent of the total adjustment in unemployment level is covered annually in Nigeria.

7. Conclusion

We examined the relationship between inflation and unemployment for the Nigerian economy over a period of twenty seven years. The empirical finding in the study is that the relationship between inflation and unemployment is positive. Effectively, rising unemployment has resulted in increasing inflation since 1986 and vice versa. In particular, our analyses have shown that there is stagflation in the Nigeria economy. This invalidates the Phillips curve thesis in Nigeria. Possible factors responsible for the stagflation in Nigeria include adoption of inflation targeting (CBN, 2006) which facilitates inflation expectations; international competition as induced by the globalization of markets; and the existence of labour surplus in Nigerian economy which has resulted in rigidities in the labour market and in the wage structure of the country. Another major finding is that, while inflation is significant in explaining the level of unemployment in Nigeria, unemployment rate is not significant in explaining inflation. The policy implication of these findings is that higher unemployment will not result in large swings in inflation rate and if the inflation rate is above target, bringing it down to the desired level would entail greater employment variability. Against the scenery of inflationary threats, we recommend that the *CBN* maintains a stance of gradual reduction of the benchmark inflation rate to a single digit as the excessive contraction of the monetary policy rate seems to have become counterproductive in recent times. Single digit inflation rate can be achieved if the *CBN* could increase *GDP* growth above money supply and increase lending to the real sector of the economy. Our view is that the overdependence on interest rate by the *CBN* as a major tool for adjustment is precarious. Thus, the *CBN* will have to moderate its current policy stance to allow interest rates decline and control the growth of money in order to boost economic growth. Also, the government should create adequate manufacturing industries especially when seventy percent of the country's labour force is already engaged in agriculture.

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APPENDICES

Appendix 1: Unit Root Test Results

Block A: Augmented Dickey-Fuller Stationary Test Results @ 5 (1) Percent			
Variables	*ADF Test Statistic*	*Critical Values(CV)*	*Statistical Inference*
U_t	-5.899	-3.536(-3.968)	Difference Stationary
E_t^R	-7.645	-3.536(-3.968)	Difference Stationary
Y_t^N	-6.588	-3.536(-3.968)	Difference Stationary
R_t^R	-6.666	-3.536(-3.968)	Difference Stationary
C_t^U	-8.276	-3.536(-3.968)	Difference Stationary
L_t^R	-5.525	-3.536(-3.968)	Difference Stationary
I_t	-5.655	-3.536(-3.968)	Difference Stationary
M_t^S	-6.649	-3.536(-3.968)	Difference Stationary
D_t^F	-9.553	-3.536(-3.968)	Difference Stationary
Block B: Phillips-Peron Stationary Test Results @ 5 (1) Percent			
Variables	*PP Test Statistic*	*Critical Values(CV)*	*Statistical Inference*
U_t	-5.952	-4.352(-4.586)	Difference Stationary
E_t^R	-17.859	-4.352(-4.586)	Difference Stationary
Y_t^N	-9.582	-4.352(-4.586)	Difference Stationary
R_t^R	-5.642	-4.352(-4.586)	Difference Stationary
C_t^U	-11.276	-4.352(-4.586)	Difference Stationary
L_t^R	-13.522	-4.352(-4.586)	Difference Stationary
I_t	-15.352	-4.352(-4.586)	Difference Stationary
M_t^S	-9.956	-4.352(-4.586)	Difference Stationary
D_t^F	-27.956	-4.352(-4.586)	Difference Stationary
Note: Test equations include a constant and a trend			

Appendix 2: Johansen Co-integration Test Results

Hypothesized No. of CE	*Eigenvalue*	*Trace*	*Max-eigen*	*5% (1%) CV*	*Statistical Inference*
None**	0.327	52.559	48.259	27.25(39.23)	Co-integrated*
At most 1	0.595	49.462	33.239	23.22(25.64)	Co-integrated*
At most 2	0.769	35.255	23.225	18.42(23.26)	Co-integrated*
* denotes that Trace and Max-eigenvalue tests indicate one co-integrating equation @ both 1% and 5% levels					

Appendix 3: Lag length Selection

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	525.6	NA	3.25	-11.36	-11.23	-14.33
1	629.2	7.362*	2.65*	-11.22	-12.23	-11.23*
2	876.5	6.538*	2.36*	-11.76*	-11.95*	-12.25*
3	335.9	12.267*	2.29	-23.23	-11.26	-12.23
4	753.6	6.239	3.55	-14.82	-15.54	-12.26
5	589.5	9.263*	5.52	-15.63	-15.23*	-12.25*

** indicates lag order selected by the criterion, LR: sequential modified LR test statistic, FPE: Final Prediction Error, AIC: Akaike Information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion*

Appendix 4: Error Correction Results

Variables	*VECM Estimates*	
	$\Delta Ln(U_t)$	$\Delta Ln(I_t)$
$Constant$	1.257 (5.522)***	-1.328 (-13.262)***
$\Delta Ln(E^R_{t-1})$		-1.035 (-2.293)***
$\Delta Ln(Y^N_t)$	-1.322 (-2.356)***	
$\Delta Ln(R^R_{t-1})$		0.508 (5.437)***
$\Delta Ln(U_t)$		1.085 (1.437)
$\Delta Ln(D^F_{t-1})$		1.238 (3.536)***
$\Delta Ln(U_{t-1})$	0.026 (3.592)***	
$\Delta Ln(C^U_t)$	1.063 (3.897)***	
$\Delta Ln(L^R_t)$	0.526 (1.300)	
$\Delta Ln(I_{t-1})$		2.295 (-11.762)***
$\Delta Ln(I_t)$	1.029 (9.562)***	
$\Delta Ln(M^S_t)$		1.732 (-6.559)***
$\Delta Ln(M^S_{t-2})$		1.983 (2.576)**
$ECM_{(t-1)}$	-0.753 (-5.537)***	-0.928 (-2.956)***
Statistical Fitness of Estimates		
R^2, *Adjusted* R^2, *F-statistic*	0.773,0.695, 59.238	0.699,0.655, 25.228
SSR/SEE	0.035/1.006	0.055/1.009
Diagnostic Checkings		
Jacque-Berra/Ramsey-Reset	0.009/0.0226	0.223/0.0209
$LM_{(SC)}$ *Breusch Godfrey*	0.062	0.362
ARCH/White Test Statistic	0.262/0.255	0.262/0.338

*Note: ***, ** denotes statistical significance at the 1% and 5% levels. Figures in ( ) are t values*