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Impact of Macroeconomic Variables on Nigerian Unemployment using the Vector Autoregressive Approach

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ABSTRACT

Unemployment is a serious problem in almost all countries of the world both in industrially advanced as well as poor countries. During the period of recession, an economy usually experiences a relatively high unemployment rate. High unemployment signals a deficiency in the labour market, deepening poverty and spread indecent standard of living (World Bank 1994).

This study focused on the impact of selected macro-economic variables on unemployment rate in Nigeria. Vector Autoregressive (VAR) approach was used for the study which its model was found to be unstable. We also applied the Vector Error Correction Model (VECM) to calculate the Forecast Error Variance Decomposition (FEVD) and to plot the Generalized Impulse Response Function (GIRF). Finally the Granger causality test was carried out to know the variables that are informative in forecasting the unemployment rate.

The result revealed that positive shocks to Gross Domestic Product (GDP) increased unemployment rate, which is not consistent with received economic theory. Shocks to Foreign Direct Investment (FDI), Inflation Rate (INF) and Money Supply (M2) reduce unemployment as expected, while shocks to Lending Rate (LR) reduces unemployment rate contrary to received economic theory.

The FEVD showed that shocks to unemployment rate remain the predominant source of variation in the forecast of unemployment rate.

Inflation rate is linearly informative in forecasting unemployment rate in Nigeria as shown by the result of the Granger causality test.

In conclusion, it is recommended that government should look for ways of diversifying the economy including processing its crude petroleum locally and exporting refined petroleum products.

Keyword: Vector Autoregressive, Vector Error Correction Model, Forecast Error Variance Decomposition, Generalized Impulse Response Function, Foreign Direct Investment.

INTRODUCTION

Unemployment is a major problem in almost all countries of the world both in industrially advanced as well as poor countries. During the period of recession, an economy usually experiences a relatively high unemployment rate. There remains considerable theoretical debate regarding the causes, consequences and solutions for unemployment. High unemployment signal a deficiency in the labour market, deepening poverty and spread indecent standard of living (World Bank 1994).Nigeria being part of the global community has its own share of the problem of unemployment as the canker worm has been on a steady rise in the recent past.

The International Labour Organization (ILO) (2001) defines unemployment as a situation of being out of work or of needing a job and continuously searching for it in the last four weeks, or of someone unemployed(age 16 or above) but available to join the work force in the next two weeks. Unemployment rate the (Nigerian version) is the proportion of those who are looking for work but could not find work for at least 40 hours during the reference period to the total currently active (labour force) population .The category of people considered not in the labour force include those without work, who are not seeking for work and/or are not available for work as well as those below the working age. Examples of these are full time housewives, under- aged children, physically challenged and incapacitated persons and such others not employable.

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According to Njoku A. (2011) the Nigerian economy grew by 55.5 percent between 1991 and 2006, and the population grew by 36.4 percent. All things being equal, this growth rate should have resulted in a decrease in the rate of unemployment but rather, unemployment increased by 74.5 percent. Official figure from National Bureau of Statistics (NBS) show that unemployment rate in Nigeria by the end of 2011 stood at 23.9 percent. What this implies is that approximately one in every four Nigerian who is in the labour force is unemployed. The product of this unemployment rate and the active labour force in Nigeria revealed that about 16.5 million Nigerians within the active labour force are unemployed.

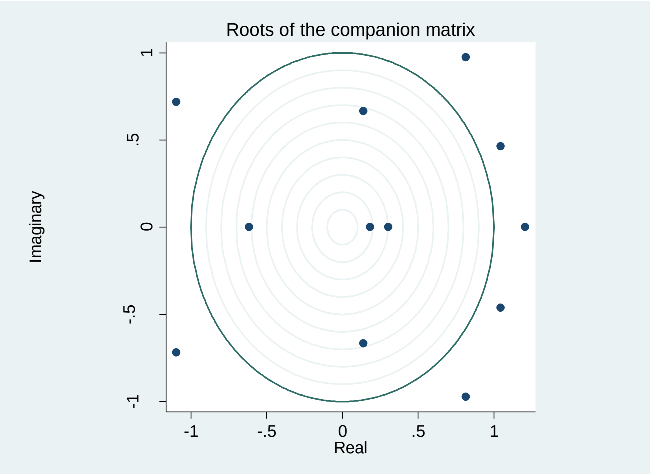


Figure1. *Model StabilityTest*

Table1. *Unit Root Test Using Augmented Dickey Fuller Test*

	At level		At first differences		
Variables	ADF at level	95% critical level	ADF at 1st differences	95% critical level	Order of integration
*ln*UN	-0.8604	-2.9862	-5.5655*	-2.9918	I(1)
*ln*GDP	-1.5768	-2.9862	-4.5589*	-2.9918	I(1)
*ln*M2	-1.2019	-3.0123	-6.9194*	-3.0124	I(1)
*ln*FDI	-2.3458	-2.9980	-8.2279*	-2.9918	I(1)
*ln*LR	-3.4808*	-3.0049	-2.1573	-3.0049	I(0)
*ln*INF	-2.6237	-2.9862	-5.2591*	-2.9980	I(1)

Cointegration Test

Table2. *Estimates of Johansen procedure and Standard statistic*

Sample (adjusted): 1987 2010

Included observations: 24 after adjustments

Trend assumption: Linear deterministic trend

Series: LNUN LNGDP LNM2 LNFDI LNLR LNINF

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesizd		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.987689	207.8030	95.75366	0.0000
At most 1 *	0.917384	102.2693	69.81889	0.0000
At most 2	0.629102	42.42409	47.85613	0.1472
At most 3	0.341735	18.62023	29.79707	0.5204
At most 4	0.299008	8.584695	15.49471	0.4052
At most 5	0.002435	0.058500	3.841466	0.8089

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

***MacKinnon-Haug-Michelis (1999) p-values*

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesizd		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.987689	105.5337	40.07757	0.0000
At most 1 *	0.917384	59.84522	33.87687	0.0000
At most 2	0.629102	23.80386	27.58434	0.1417
At most 3	0.341735	10.03553	21.13162	0.7413
At most 4	0.299008	8.526195	14.26460	0.3277
At most 5	0.002435	0.058500	3.841466	0.8089

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

Estimation of Vector Error Correction Model (VECM)

Diagnostic Checks for the VEC (2) Model:

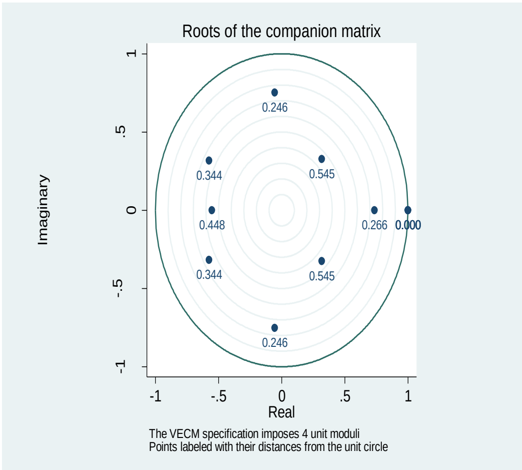
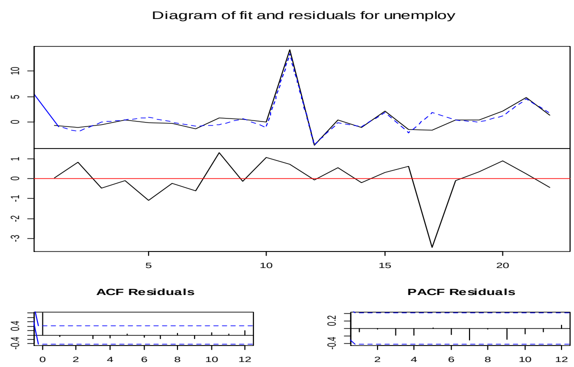


Figure2.



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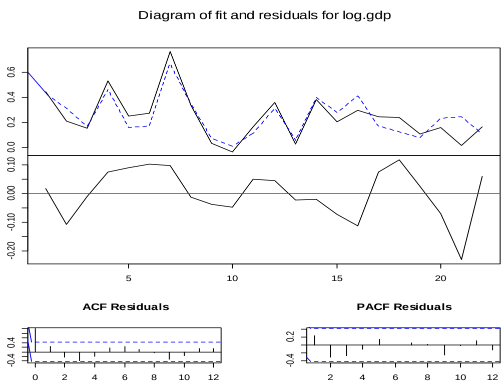


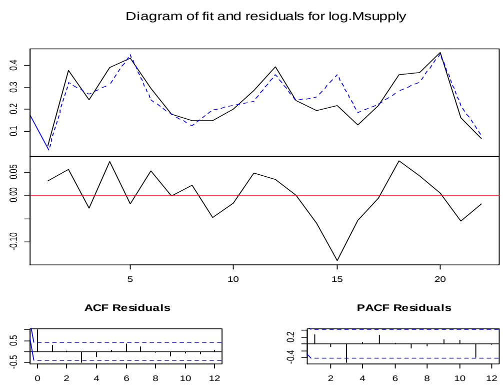
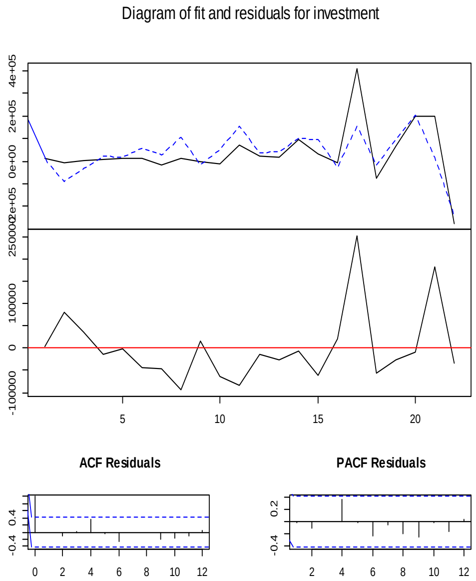


Figure4. **Figure5.**



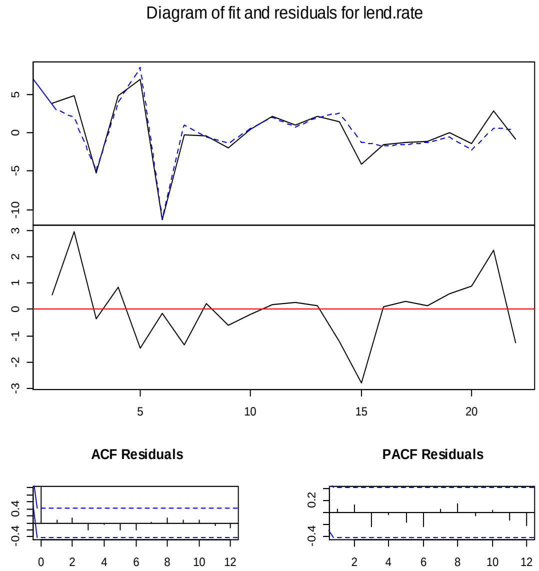


Figure6.

Figure7.

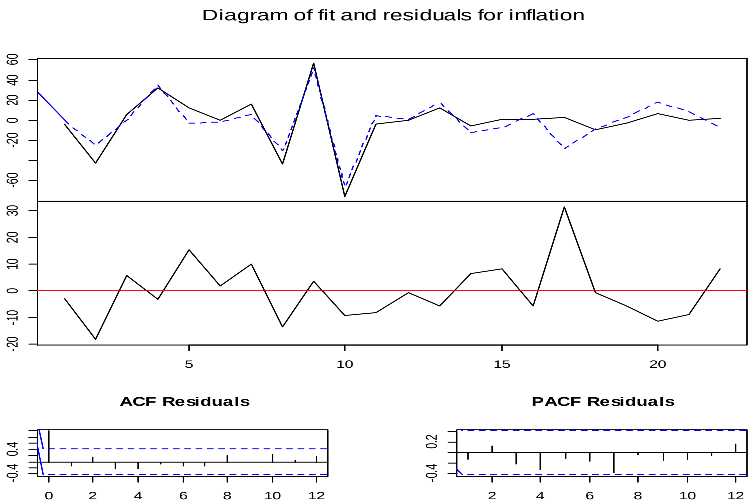
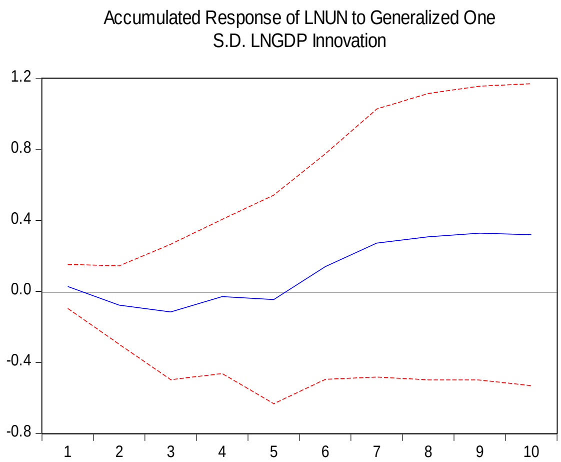


Figure8.

Impulse Response Function



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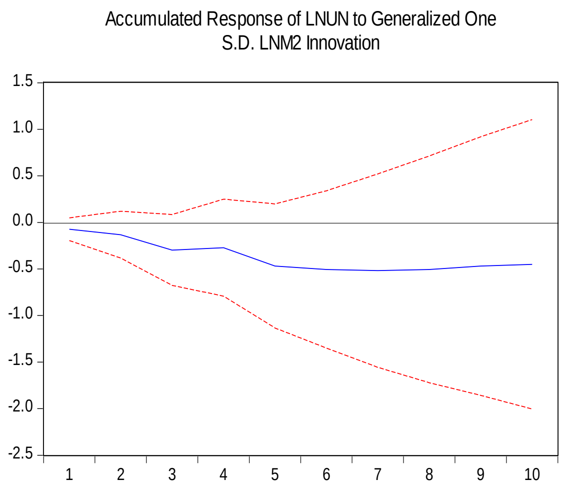

Figure10.

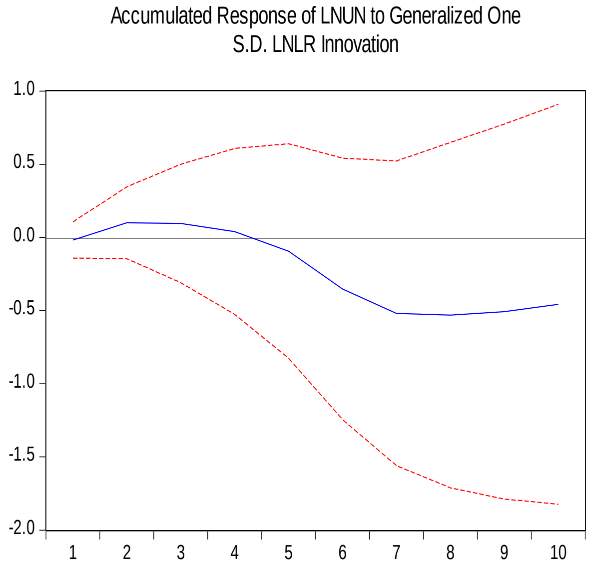

Figure11.

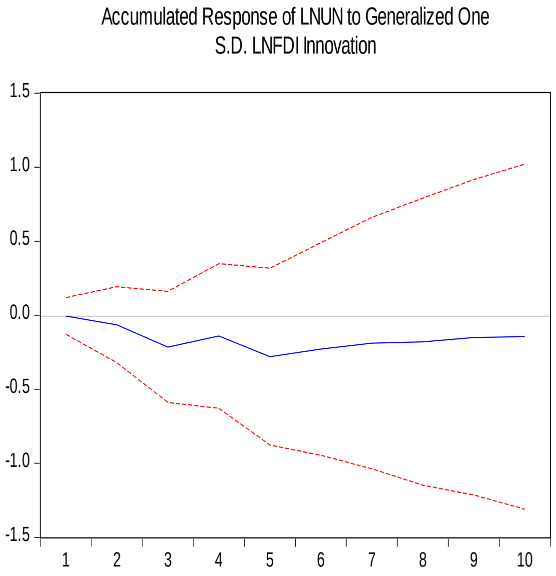

Figure12.

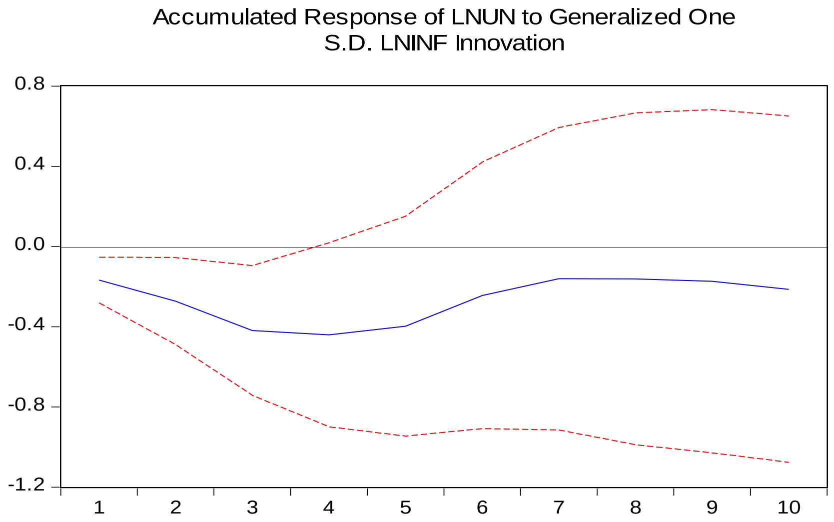

Figure13.

Table3. *Generalized Impulse standard error: Analytic*

Period	LNGDP	LNM2	LNFDI	LNLR	LNINF
1	0.028329	-0.072872	-0.005557	-0.018564	-0.167830
	(0.06183)	(0.06107)	(0.06196)	(0.06191)	(0.05704)
2	-0.077486	-0.132578	-0.065071	0.099570	-0.272556
	(0.11052)	(0.12566)	(0.12833)	(0.12274)	(0.10861)
3	-0.115941	-0.296661	-0.214515	0.095148	-0.419141
	(0.19114)	(0.18976)	(0.18739)	(0.20231)	(0.16187)
4	-0.028812	-0.272637	-0.140373	0.039862	-0.440718
	(0.21752)	(0.26028)	(0.24445)	(0.28353)	(0.22958)
5	-0.045316	-0.468617	-0.279862	-0.094252	-0.397439
	(0.29424)	(0.33320)	(0.29862)	(0.36659)	(0.27403)
6	0.139851	-0.505357	-0.228204	-0.353080	-0.243751
	(0.31801)	(0.42254)	(0.35885)	(0.44680)	(0.33250)
7	0.272430	-0.518195	-0.188852	-0.518909	-0.160925
	(0.37780)	(0.51949)	(0.42467)	(0.52057)	(0.37706)
8	0.308394	-0.504931	-0.179246	-0.531429	-0.161409
	(0.40355)	(0.60884)	(0.48476)	(0.58994)	(0.41386)
9	0.328769	-0.469282	-0.149858	-0.507347	-0.173216
	(0.41403)	(0.69435)	(0.53253)	(0.64026)	(0.42794)
10	0.319543	-0.450656	-0.144995	-0.457652	-0.213533
	(0.42589)	(0.77740)	(0.58251)	(0.68321)	(0.43175)

Table4. *Variance Decomposition of Unemployment rate*

Peroid	S.E.	LNUN	LNGDP	LNM2	LNFDI	LNLR	LNINF
1	0.303576	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.345192	81.08906	10.62934	0.020850	0.091388	8.116407	0.052957
3	0.420704	74.52544	8.942383	6.721139	3.869408	5.464350	0.477280
4	0.442584	72.07986	11.22425	6.198585	4.613987	4.993862	0.889449
5	0.495553	59.20922	9.162073	20.55570	3.680493	6.488759	0.903756
6	0.568045	45.34456	17.36777	20.36394	4.461389	11.49168	0.970667
7	0.596808	41.39573	20.47978	19.78835	4.407249	13.00983	0.919058
8	0.598039	41.22979	20.75301	19.70739	4.432457	12.95871	0.918655
9	0.599763	40.99322	20.75120	19.85419	4.407381	13.07330	0.920695
10	0.602174	40.70979	20.61553	19.94298	4.443131	13.37482	0.913748

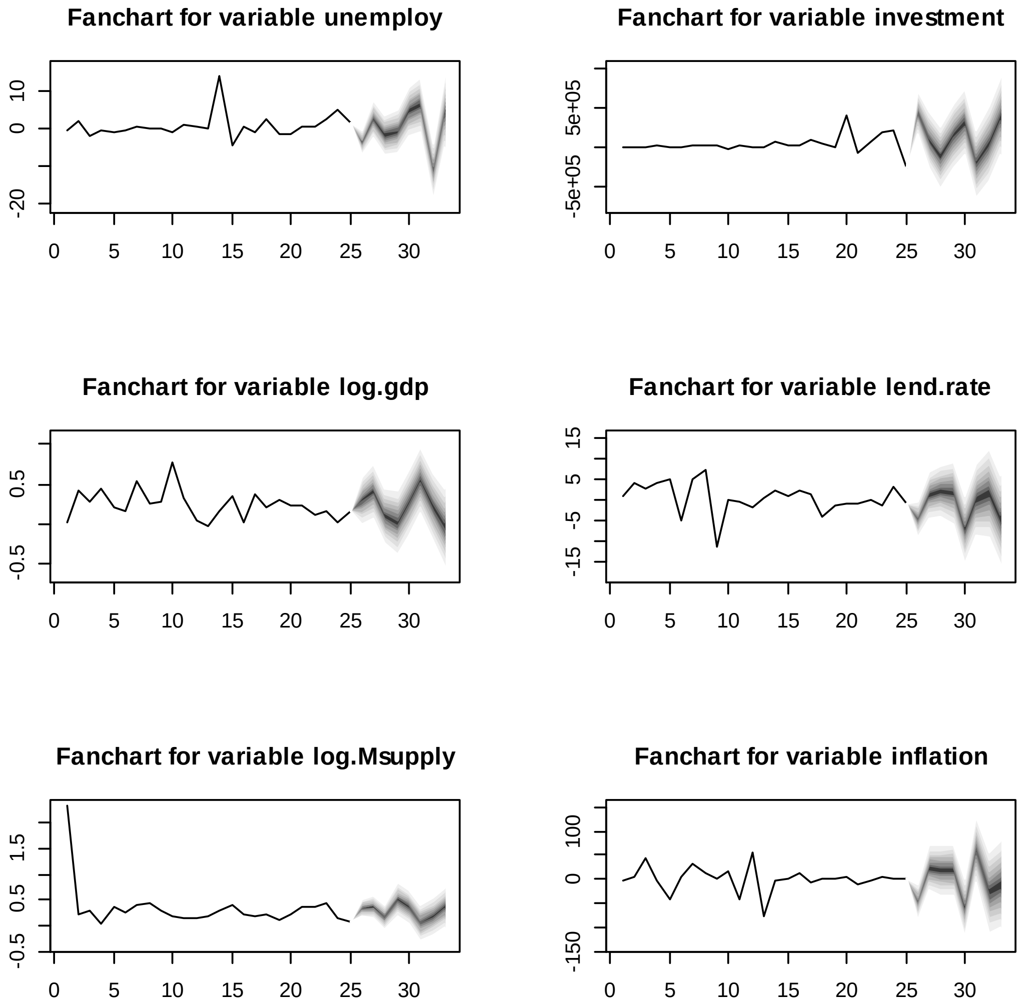

Figure14. *Forecast chart of vec(2) predicted 10 periods ahead forcast*

Between 2007 and 2011, there has been an average of about 1.8 million new entrants into the active labour market per year. The increases in particular, rise of new entrants into the labour market per year since 2007 can be attributed to increase in the number of tertiary institutions in the country since 2006. As result, over 3.2 million students gained admission into the tertiary institutions between 2006 and 2007 which should have joined the labour market by 2010 and 2011 since most courses are completed in four to five years. The above estimated number entering the labour market excludes those who joined the labour force immediately after completing their secondary school education. Secondly due to positive gender empowerment and improvement in female education, women are not only getting married much latter than before but are also becoming more insistent on financial independence and demanding more jobs than previously. The rate of unemployment in Nigeria is higher in the rural areas

(25.6 percent) than in the urban (17.1 percent). Unemployment increases susceptibility to malnutrition, illness, mental stress, loss of self-esteem, leading to depression. High unemployment can cause social problems such as crime. In some cases it leads to civil unrest leading to revolution. Concerted effort has been made by the Nigerian government especially at the federal level to reduce the scourge of unemployment in the country, but the efforts are yet to make a noticeable impact on the Nigerian labour force.

The government need to double her effort in looking for a lasting solution for bringing down the present rate of unemployment in the country to the barest minimum in order to achieve greater level of development and perhaps achieve her vision 20:20:20 . Moreover Millennium Development Goals (MDGS’) will be a mirage if the present level of unemployment is not reduced.

Based on economic theories, higher national economic output will decrease national unemployment rate. This relationship was first investigated by Arthur Malvin Okun (Okun’s law). Empirical studies done on the contributions of some major macro-economic variables to unemployment rate in Nigeria rarely capture more than three macro-economic variables: Oye et al (2011), Bakare(2012) and Njoku and Ahugba(2011).

The rest of the paper is divided into four sections. In section II, we discussed the stationarity test for the data. In section III, we described the framework of Vector Autoregressive Model. The data used are presented in section IV and finally the results are discussed in section V.

STATIONARITY TEST

Most Economic variable that exhibit strong trend are not stationary and thus not amendable to the time series analysis. The Augmented Dickey-Fuller (ADF) test will be used to test for the unit root in the macroeconomic variable considered in this paper. The actual procedure of implementing the Dickey-Fuller (DF) test involves several decisions to allow for various possibilities; the Dickey-Fuller (DF) is estimated in three different forms; three different hypothesis. If $Y_t$denote the time series of Macroeconomic variables.

Y_t is a random walk.

$$\Delta Y_t = \delta Y_{t-1} + u_t \tag{1}$$

Y_t is a random walk with drift.

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + u_t \tag{2}$$

$Y_t$is a random walk with drift around a deterministic trend

$$\Delta Y_t = \beta_1 + \beta_2 + \delta Y_{t-1} + u_t \tag{3}$$

Where t is trend variable and $\delta = (\rho - 1)$

In the case of (1), (2) and (3) above, the hypothesis is

$$H_0 : \delta = 0 \;(there\ is\ a\ unit\ root\ or\ \ Y_t\ is\ non\ stationary)$$

$$H_1 : \delta < 0 \;(Y_t\ is\ stationary)$$

It is assumed that U_t is uncorrelated. But if it is assumed that U_t are correlated. The Augmented Dickey-Fuller test is used. The expression for ADF is given as

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_t + \sum_{i=1}^{m} \alpha_i \, \Delta Y_{t-1} + \varepsilon_t \tag{4}$$

Where ε_t is a pure white noise error term and $\Delta Y_t = (Y_t - Y_{t-1})$.

After subjecting the Macroeconomic Variables under consideration to both test described above and all the series are found to be stationary at levelI(0), then unrestricted Vector Autoregressive (VAR) model can used in studying the relationship between Macroeconomic Variables. But if the series under consideration are found to be I(1) or higher order that is the series are nonstationary at level, Restricted Vector autoregression Model will be used in the modeling of the set of economic series. Hence the series have to be differenced ‘d’ times to make it stationary. A Cointegration test will be done on the set of the series to determine the number of cointegrating vectors (r) existing in the set of the variables.

FRAMEWORK OF THE VECTOR AUTOREGRESSIVE (VAR) MODELS

The term Vector Autoregressive Model is due to appearance of lagged value of the dependent variable in the right hand side of the equation and the term vector is due to the fact that we are dealing with a vector of two (or more) variable.

VAR model approach to the analysis of economic data is theoretical. This is because there has been no use of economic theory to specify explicitly, structural equations between set of variables. The VAR system rest on the general proposition that economic variables tend to move together over time and also to be auto correlated. (Johnston and Dinardo 1997).

The VAR (P) model can be expressed as follows;

$$lnY_t = m + A_1 lnY_{t-1} + A_2 lnY_{t-2} + \ldots\ldots + A_p lnY_{t-p} + \mathcal{E}_t, i = 1\ 2\ 3 \ldots\ldots T \tag{5}$$

A VAR(p) system may also be reparameterized as

$$\Delta y_t = m + \beta_1 \Delta y_{t-1} + \cdots + \beta_{p-1} \Delta y_{t-p+1} - \pi y_{t-1} + \varepsilon_t \tag{6}$$

Where $\beta y's$ are functions of $A's$ and $\pi = I - A_1 - \cdots - A_p$

Here the behavior of the vector y depends on the values of λ that solve the characteristics equation. $\left|\lambda^p I - \lambda^{p-1} A_1 - \cdots \lambda A_{p-1} - A_p\right| = 0$

Johansen Test for Cointegration

To carry out this test, a VAR(P) model is first formulated.

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \varepsilon_t \tag{7}$$

with k-variables. The order of the model must be determined in advance. Let $\boldsymbol{Z_t}$denote the vector of K(p-1) variables.

$$Z_t = (\Delta y_{t-1} + \Delta y_{t-2} + \cdots + \Delta y_{t-p+1}) \tag{8}$$

Hence Z_t contains the lags 1 to p-1 of the first differences of all K variables. Now using T available observations, a $T \times k$ matrices of least square residuals is obtained.

Let D = the residual in the regression of $\Delta y_t \ on \ Z_t$, E = the residual in the regression of $y_{t-p} \ on \ Z_t$.

The K squared canonical correlation between the columns in D and those in E is computed. The squared canonical correlation is simply the ordered characteristic roots of the matrix.

$$R^* = R_{DD}^{-1/2} R_{DE} R_{EE}^{-1} R_{ED} R_{DD}^{-1/2} \tag{9}$$

Where R_{ij} is the (Cross) Correlation Matrix between variables in the set i and set j for i and j = D, E.

The Null hypothesis that there are r^* or fewer cointegrating vectors that is

$$H_0 : r \leq r^*$$
$$H_0 : r \geq r^*$$

Is tested using the test statistic

$$TRACE\ TEST = -T \sum_{i=r+1}^{k} \ln[1 - (\boldsymbol{r}^*)^2] \tag{10}$$

The characteristic vectors corresponding to the canonical correlations are the sample estimation of the co-integrating vector β.

Vector Error Correction Model

When the variables in the VAR are integrated of order one or more, unrestricted estimation is a subject to the hazards of regression involving nonstationary variables. The VAR(P) model can be expressed as errors or vector equilibrium correction model [VECM (P-1)] formulated in differences.

$$ln\Delta y_t = m + \Pi lny_{t-1} + \cdots + \Gamma_{k-1} \Delta lny_{t-p+1} + \varepsilon_t \tag{11}$$

Where $\Delta y_t = \begin{bmatrix} ln\Delta UN_t \\ ln\Delta GDP_t \\ ln\Delta M_t \\ ln\Delta FDI_t \\ ln\Delta LR_t \\ ln\Delta INF_t \end{bmatrix}, m = \begin{bmatrix} m_1 \\ m_2 \\ m_3 \\ m_4 \\ m_5 \\ m_6 \end{bmatrix}, \Gamma_i = \begin{bmatrix} \Gamma_{11,i} & & \Gamma_{16,i} \\ \Gamma_{21,i} & & \Gamma_{26,i} \\ \Gamma_{31,i} & & \Gamma_{36,i} \\ \Gamma_{41,i} & \cdots & \Gamma_{46,i} \\ \Gamma_{51,i} & & \Gamma_{56,i} \\ \Gamma_{61,i} & & \Gamma_{66,i} \end{bmatrix}, \varepsilon_t = \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{3,t} \\ \varepsilon_{4,t} \\ \varepsilon_{5,t} \\ \varepsilon_{6,t} \end{bmatrix}$

$\pi = -(I - \pi_1 - \cdots - \pi_p)$, and $\Gamma_i = \sum_{j=i+1}^{p} \pi_j$

Assuming y_t is integrated of order one I(1) then

Δy_t is stationary, The right hand side contains both stationary and Non-stationary process. And as a result, π must have a reduced rank: only a stationary combination of Y_{t-1} can allow for stationarity of ΔY_{t-1}. Since π is a reduced rank $r \le p$, it may be written as $\pi = \alpha\beta'$:

Rank($\boldsymbol{\pi}$) = min$[rank(\boldsymbol{\alpha}), rank(\boldsymbol{\beta})\ \ ]$. Where $\boldsymbol{\beta}\,'$is the matrix of cointegrating vectors and $\boldsymbol{\alpha}$ is the associated weighting otherwise known as speed of adjustment to equilibrium. Hence (11) can be written as

$$\boldsymbol{\Delta y_t = \alpha\beta' y_{t-1} + \Gamma_1 \Delta y_{t-1} + \cdots + \Gamma_{k-1}\Delta y_{t-p+1} + \varepsilon_t} \tag{12}$$

Hence all variables in (12) are now stationary. The cointegrated VAR is estimated by the reduced rank regression of $\Delta \boldsymbol{y_t}$on $\Delta \boldsymbol{y_{t-1}}$corrected for lagged differences. The residuals from the regression of $\Delta \boldsymbol{y_t}$and $\boldsymbol{y_{t-1}}$ on $\Delta \boldsymbol{y_{t-1}}$can be written as

$$R_{0,t} = \left(\Delta \boldsymbol{y_t} \middle| \sum_{i=1}^{k-1} \Delta \boldsymbol{y_{t-1}}\right) \tag{13}$$

$$R_{1,t} = \left(\boldsymbol{y}_{t-1} \middle| \sum_{i=1}^{k-1} \Delta \boldsymbol{y_{t-1}}\right) \tag{14}$$

The above two equations can be used in (12) to produce the concentrated model.

$$R_{0,1} = \boldsymbol{\alpha\beta}' R_{1,t} + \boldsymbol{\varepsilon_t} \tag{15}$$

This gives the likelihood of

$$\mathrm{L} = \frac{1}{|\Omega|^{T/2}} exp\left(-\frac{1}{2}\sum_{t=1}^{T}\left(R_{0,1} - \boldsymbol{\alpha\beta}' R_{1,t}\right)' \Omega^{-1}\left(R_{0,1} - \boldsymbol{\alpha\beta}' R_{1,t}\right)\ \right) \tag{16}$$

The equation above is estimated by fixing $\boldsymbol{\beta}$ and estimating $\boldsymbol{\propto}$ and $\boldsymbol{\Omega}$ by OLS

regression $R_{0,t}$ on $R_{1,t}$ in (15) above. Defining the squared correlation S_{ij} as

$S_{ij} = T^{-1}\sum_{t=1}^{T} R_{1,t} R_{j,t}'$. This gives

$$\widehat{\boldsymbol{\alpha}}(\boldsymbol{\beta}) = \boldsymbol{S_{01}}\boldsymbol{\beta}\left(\boldsymbol{\beta' S_{11} \beta}\right)^{-1}$$

$$\widehat{\boldsymbol{\Omega}}(\boldsymbol{\beta}) = \boldsymbol{S_{00}} - \boldsymbol{S_{01}}\,\boldsymbol{\beta}\left(\boldsymbol{\beta' S_{11}\beta}\right)^{-1}\boldsymbol{\beta' S_{10}}$$

$$L_{max}^{-2/T}(\boldsymbol{\beta}) = |\widehat{\boldsymbol{\Omega}}(\boldsymbol{\beta})| = |\boldsymbol{S_{00}} - \boldsymbol{S_{01}}\,\boldsymbol{\beta}\left(\boldsymbol{\beta' S_{11}\beta}\right)^{-1}\boldsymbol{\beta' S_{10}}| \tag{17}$$

$$= |\boldsymbol{S_{00}}|\,\frac{|\boldsymbol{\beta}'(\boldsymbol{S_{11}} - \boldsymbol{S_{10}S_{00}^{-1}S_{01}})\boldsymbol{\beta}|}{|\boldsymbol{\beta' S_{11}\beta}|}$$

Impulse Response Function and Variance Decomposition

The VAR model can be expressed as infinite Moving Average Process MA (∞)

$$\boldsymbol{Y_t} = \sum_{i=0}^{\infty} \boldsymbol{\Gamma_i \varepsilon_{t-i}} \quad t = 1,2,\ldots,T \tag{18}$$

Where K x K coefficient matrices Γ_i can be obtained using the following recursive relations

$$\boldsymbol{\Gamma_i = A_1\Gamma_{i-1} + A_2\Gamma_{i-2} + \cdots + A_p\Gamma_{i-p}} \quad i = 1,2,3 \tag{19}$$

With $\boldsymbol{\Gamma_0} = I_m$ and $\boldsymbol{\Gamma_i} = 0\ \ for\ i < 0$. An impulse response function measures the time profile of the effect of shocks at a given point in time on the (expected) future values of variables in a dynamical system. The orthogonalized impulse response function of a unit shock to the jth equation on Y_{t+n} is given by

$$\psi_j^0(n) = \boldsymbol{\Gamma_n P e_j} \quad n = 0, 1, 2, \ldots \tag{20}$$

Where P is an mxm lower triangular matrix such that $PP' = \Omega$ and $e_j$is an mx1 selection vector with unity as its jth element and zero elsewhere. The (unscaled) generalized impulse of the effect of a shock in the jth equation of time t on Y_{t+n} is given by

$$\left(\frac{\Gamma_n \Omega e_j}{\sqrt{\delta_{jj}}}\right)\left(\frac{\delta_j}{\sqrt{\delta_{jj}}}\right); \quad n = 0, 1, 2, \ldots \tag{21}$$

By setting$\delta_j = \sqrt{\delta_{jj}}$, we obtain the scaled generalized impulse response function is given by

$$\psi_j^g(n) = \delta_{jj}^{-1/2}\boldsymbol{\Gamma}_n\boldsymbol{\Omega} e_j \quad n = 0, 1, 2, \ldots \tag{22}$$

This measures the effect of one standard error shock to the jth equation at time t on expected value of Y at time t+n.

Finally, the above generalized impulse can also be used in the derivation of the nth step ahead forecast error variance decomposition defined as the proportion of the n-step ahead forecast error variance of variable i which is accounted for by the innovations in variable j in the VAR. denoting the orthogonalized and the generalized forecast error variance decomposition by

$$\theta_{ij}^{0}(n) = \frac{\sum_{i=0}^{n}(e'\Gamma_i P e_j)^2}{\sum_{i=0}^{n}(e_i'\Gamma_i \Omega \Gamma_i' e_i)} \tag{23}$$

$$\theta_{ij}^{g}(n) = \frac{\delta_{1i}^{-1}\sum_{i=0}^{n}(e'\Gamma_i e_j)^2}{\sum_{i=0}^{n}(e_i'\Gamma_i \Omega \Gamma_i' e_i)} \tag{24}$$

Note: The orthogonalized and the generalized impulse response function , $\psi_j^0(n)$ and $\psi_j^g(n)$ differ in a number of respects. The generalized impulse response is invariant to the reordering of the variables in the VAR, but this is not the case in with the orthogonalized ones. Typically there are many alternative reparameterization that could be employed to compute the responses, and there is no clear guidance as to which one of these possible parameterization should be used (Parsaran and Shin 1997). In contrast, the orthogonalized impulse response is unique and fully takes account of the historical patterns of correlations observed amongst the different shocks. The generalized and orthogonalized impulse responses coincide if Ω is a diagonal. In case Ω is non-diagonal

$$\psi_j^g(n) \neq \psi_j^g(n) \quad \text{for } j=2\ 3\ \ldots..k \tag{25}$$

And only the two impulses are the same only if $j = 1$.

Granger Causality Test

Causality in the sense defined by Granger (1969) and Sims (1972) is inferred when lagged values of a variable, say X_t, have explanatory power in a regression of a variable Y_t on lagged values of Y_t and X_t. The basic empirical question in this study is whether the selected macroeconomic variables (X) significantly affect the unemployment rate (Y) in Nigeria. The Granger causality test will be employed to ascertain the direction of causality between the rate of unemployment(Y) and Macroeconomic variable (X) in Nigeria between 1986 and 2010.

The test procedure as described by (Granger, 1969) is illustrated below:

$$Y_t = \sum_{j=1}^{k} A_j X_{t-j} + \sum_{j=1}^{k} B_j Y_{t-j} + U_{1t} \tag{26}$$

$$X_t = \sum_{j=1}^{k} C_j X_{t-j} + \sum_{j=1}^{k} D_j Y_{t-j} + U_{2t} \tag{27}$$

Equation (26) postulates that current Y_t is related to past values of itself as well as that of X_t and vice versa for equation (26). Unidirectional causality from X_t to Y_t is indicated if the estimates coefficient on the lagged X in equation (26) are statistically different from zero as a group. (i.e. $\sum A_i \neq 0$) and the set of estimated coefficient on the lagged Y_t in equation (27) is not statistically different from 0. (i. e. $\sum D_j = 0$). The converse is the case for unidirectional causality from Y_t to X_t.

Estimate by OLS and test for the following hypothesis.

H0: $A_1 = A_2 = \ldots A_j = 0$ (X_t does not Granger Cause Y_t)

H1: any $A_i \neq 0$

Unrestricted sum of squared residuals $RSS_1 = \sum u_t^2$

Restricted sum of squared residuals $RSS_2 = \sum u_t^2$

$$F = \frac{(RSS_2 - RSS_1)/p}{RSS_1/(T-2p-1)} \tag{28}$$

Reject Ho if $F > F_{\propto}(p,\ T-2p-1)$

Feedback or bilateral causality exist when the sets of X_t and Y_t coefficient are statistically different from 0 in both regressions (Gujarati 2009)

DATA PRESENTATION

The core variable for this paper is the unemployment rate while the other macroeconomic variables are money supply (M), gross domestic product (GDP), inflation rate (INF), foreign direct investment (FDI) and lending rate (LR). All data are annual, ranging from 1985–2010 (i.e all the variables have 26 observations).

DISCUSSION OF RESULTS

It is found that all the variables are I(1) except lending rate which is I(0). Also, it is noted that there are 2 co-integrating vectors. The variance decomposition indicates that unemployment rate is not sensitive to changes in inflation rate and lending rate.

Increase in GDP over the years did not reduce unemployment in Nigeria , which is inconsistent with our theoretical expectations. Also high interest rate (lending rate) charged by Nigerian commercial banks has negative impact on unemployment in Nigeria, contrary to theoretical expectations. Innovations to foreign direct investment, money supply, and inflation rate reduce unemployment as expected but their impact is not significant.

Innovations in unemployment are mainly explained by its own variations and partly by gross domestic product and money supply. Inflation rate will be linearly informative in forecasting unemployment rate Nigeria

Effort should be made in building of refineries such that 100% percent of our crude oil is refined in Nigeria. This will create more jobs in the economy. Furthermore the issue of diversification of the economy should be given serious attention. Credit facilities should be made available to entrepreneurs in the agricultural and manufacturing sector this will encourage people to into agriculture and manufacturing.

Concerted effort should be made in providing electricity. Lack of constant power supply increased the cost of doing business in Nigeria. This has made some companies located in the country to fold up while other relocated to neighbouring countries where power supply is stable. The issue security should be addressed seriously as no investors will be unwilling to invest in an unsecured environment. A look at the Foreign Direct Investment (FDI) shows that there is a sharp drop in value of FDI during the Niger Delta crisis.

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