



Impact of Foreign Direct Investment on Employment and Unemployment Rate in Nigeria: Application of Vector Autoregression(VAR) Models (1960-2014)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Unemployment is one of the major problem affecting Nigeria's economy and its' society, the rate of unemployment have increased over the years. This study's aim is to investigate the impact of Foreign Direct Investment (FDI) on the employment and unemployment rate in Nigeria. The study use yearly data on employment and unemployment rate collected from CBN Statistical Bulletin, National Bureau of Statistics and World Bank Indicators for the period 1960 – 2014 to achieve its objective and all analysis were done with E-view 9.5. The study employ Vector Autoregression (VAR) to model the employment and unemployment rate in Nigeria. The findings of the study suggested that FDI had a significant and positive impact on employment, FDI Granger-cause employment, employment Granger-cause FDI, unemployment Granger-cause employment and employment also Granger-cause unemployment. Also unemployment Granger-cause FDI and FDI Granger-cause unemployment. This implied that FDI has a significant role on employment rate in Nigeria and this should not be minimized. The study therefore recommended that policies should be formulated to exploit the role of FDI on employment in Nigeria, in an attempt to reduce the unemployment rate.

Keywords: *Employment; foreign direct investment; granger-cause; unemployment; VAR.*

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1. INTRODUCTION

Foreign direct investment (FDI) can be described as a flow of capital and technology know-how from one (home) country to another (host) country. Investopedia defines FDI as an investment made by a company or entity based in one country, into a company or entity based in another country. Foreign Direct Investment (FDI) has been defined as the investment of resources in business activities outside a firm's home country [1], OECD [2], IMF [3,4], define FDI as the long term investment that reflects the objective of a lasting interest and control by a resident entity of one economy (the direct investor) in an enterprise that is resident in another economy (the direct investment enterprise). In as much as foreign direct investment (FDI) remains a topic for debate among policy makers, several countries believed that FDI is not beneficial, so the policy to reduce FDI was created. The negative effects of FDI on the economic have driven the government to intervene in free trade. Lagging far behind in technology, domestic companies are unable to compete against foreign companies. This can cause domestic companies to shut down their operation. The monopoly of foreign companies frequently occurs, causing unemployment to increase. FDI can also provide a stimulus to competition, capital formation, innovation, and savings, and through these effects, to job creation and economic growth. The widespread use of new technology in producing goods coming from FDI is said to have a negative impact on employment [5,6], stated that Foreign Direct Investment (FDI) contributes to the host country's gross capital formation, higher growth, industrial productivity and competitiveness and other spinoff benefits such as transfer of technology, managerial expertise, improvement in the quality of human resources and increased investment.

Two schools of thought exist with a strong wall of partition dividing them. On one side are the pro-foreign international schools that see FDI as adding new resources in terms of capital, technology, managerial skill and technical know-how, productivity gains, and so on, to the host economy. They regard FDI as potent enough to improve the prevailing efficiency in the productive sector, stimulate change for faster economic growth, create jobs, foster growth, and improve the distribution of income by bidding up wages in the host economics. On the other side of the wall is the opposing dependency school drawing their arrangement from Marxist dependency theory.

They doubt whether FDI which do soak up local financial resources for their own profits can bring about industrialization because foreign investors see host economics as merely serving the interest of their home countries in supplying basic needs for their companies. This school views foreign investors as "imperialistic predators" that specialize in exploiting the entire globe for the sake of corporate few as well as creating a web of political and economic dependence among nations to the detriment of the weaker ones.

The oil boom in the 1970s led to the mass migration of youths into the urban area, seeking to get work. However, following the recession experienced in the 1980s, the available data revealed that, the problem of unemployment started to manifest, precipitating the introduction of the Structural Adjustment Programme (SAP), the rapid depreciation of the naira exchange rate and the inability of most industries to import the raw materials required to sustain their output levels. A major consequence of the rapid depreciation of the naira was the sharp rise in the general price level (inflation), leading to a significant decline in the real wages. The low wages in turn fuelled a weakening purchasing power of wage earners and a decline in the aggregate demand. Consequently, industries started to accumulate unintended inventories and, as a rational economic agent, the manufacturing firms started to rationalize their market prices. With the simultaneous rapid expansion in the educational sector, new entrants into the labour market increased beyond absorptive capacity of the economy. Thus, the avowed government's objective of achieving "full employment" failed.

The main objective of this study is to examine the impact of Foreign Direct Investment (FDI) on the employment and unemployment rate in Nigeria from 1960 to 2014. Annual data on Foreign Direct Investment (FDI), (million USD) inflows, total number of unemployment and employment were analyzed by using Vector Autoregression (VAR). Theoretical framework is presented in section 2, Literatures Review in section 3. Section 4 presents the materials and methods of the study. Section 5 presents the results and discussions and finally, the conclusions and recommendations are presented in section 6.

2. THEORETICAL FRAMEWORK

Employment generation has been seen as a vehicle for alleviating poverty, increasing the

level of economic activity which ultimately translates to economic growth. The situation of employment in Africa has become critical and labour absorption capacity knotty. Employment has been defined to mean a situation whereby an individual in the labour force bracket willing to work is engaged in a satisfactory economic activity while if otherwise are said to be unemployed. There are many types of unemployment identified in the literature, ranging from frictional, seasonal and cyclical to structural unemployment [7]. Consented to the stance that the problem of unemployment among youths in Africa and Nigeria is a current and major socio-economic problem. International statistics portray industrial and service workers living in developing regions account for about two-thirds of the unemployed [8,9,10] substantiated that in the developed world most workers have jobs in the formal sector and the share of workers with wage contracts is only 15% and 46% in middle-income developing countries. This is indicative that the rate of open unemployment as observed in most developing countries especially Nigeria is a limited indicator of the employment conditions.

Unemployment is seen as a great problem to global economic development. In recent years, both developed and developing countries have witnessed this problem, though the developed countries have been curtailing the rate of their unemployment. However, in developing countries, especially in Africa, unemployment has been on a continuously accelerating rise in the economy, culminating in reduction of household income and living standards and concomitant rise in the level and incidence of poverty [11]. For instance, the unemployment in Africa was 9.7% as at 2005 [12]. This means about 10 in every hundred people fit to be in the labour market are unemployed.

In Nigeria, the record of registered unemployment is very low owing to the lack of incentives such as unemployment benefits cum job loss benefits (such as is obtainable in developed countries) to prompt individuals to report for job loss. The registration is also low because individuals have lost confidence in the government's ability to provide the required employment. Consequently, majority of unemployed find employment in the informal sector of the economy, where adverse employment conditions rather take the form of increased underemployment, casual employment or informal self-employment which are scarcely registered.

3. LITERATURE REVIEW

Employment generation has over the years been widely celebrated as a major key to socio-economic progress. Reduction in unemployment has been identified as a chief indicator of economic development in recent times. Unfortunately, the problem of unemployment has plagued Nigeria over the years and it has become highly pronounced in recent times.

Uche and Fidelis [13] investigated the unemployment problem in Nigeria and whether the problem can be solved through economic growth, exports and foreign direct investment. They employed contemporary econometric techniques of co-integration and Granger causality tests within error correction modelling framework to analyse the relationship among unemployment, economic growth, exports and foreign direct investment. VAR techniques of variance decomposition and impulse response functions was employed and it was discovered that economic growth, exports and foreign direct investment do not provide the desired solution to the problem of unemployment in Nigeria both in the short-run and long-run. Thus adequate mechanism should be put in place to ensure that economic growth, foreign direct investment and exports bring about optimum employment generation. [14] evaluated and forecasted the impact of FDI in the agricultural sector from 1980-2007, specifically its impact on agricultural output and labour in a Vector Auto Regression (VAR) environment. The results from the analysis revealed that FDI in the period under review had no significant impact on agricultural output. In addition, the findings revealed that; forecast estimates showed that the current volume of FDI would not significantly affect agricultural output but will have significant positive impact on labour (employment generation). They therefore, recommended for increase in the volume of FDI and advised government and other stakeholders to seek FDI that will improve existing or introduce new technology in the agricultural sector and enhance domestic capacity or domestic investment, even if the opportunity cost of a reduction in labour may have to be paid. This investment ranges from transfer of funds to whole package of physical capital, techniques of production, managerial and marketing expertise, products, advertising and business practices for the maximization of global profits.[15], investigated and analyzed empirically the impact of Foreign Direct Investment (FDI) on the economic growth for a panel of 32 Sub-Saharan

African countries during the period 2008-2014. Both static panel regression techniques and dynamic panel estimates were employed to assess the causal link of our regressors, namely, FDI, trade openness, domestic investment, working population size and the effects of the 2009 European debt crisis on dependent variable, Gross Domestic Product (GDP) per capita. The evidence from the statistical analysis suggests that aggregated FDI does have a positive and significant impact on economic growth and is thus consistent with the literature, especially with respect to developing countries. Based on static random effects, the inclusion of the 2009 Euro zone crisis did not diverge the results despite its negative impact on economic growth. The contribution of FDI is observed to be relatively higher than domestic investment. [16], investigated the relationship between exports, Foreign Direct Investment (FDI) and the economic growth in Malaysia. Records of annual time series data from the year 1971 till 2013 have been utilized for this purpose. Upon testing the data for stationarity, the Auto Regressive Distributed Lag (ARDL) model was applied for the purpose of empirical investigation. The empirical results indicated that the productivity factor and externality effect of exports on the non-export sector are found to be statistically, positively significant, with the exports also having a positive impact on the economic growth and FDI of the country. The results support Exports Led Growth (ELG) and FDI-Led economic Growth (FLG) in Malaysia. The finding further suggests that Malaysia should continuously pursue exports promotion and a liberal investment economic policy in order to maintain and bolster overall economic growth.

Olofin, Aiyegbusi and Adebayo [17] revisits the determinants of FDI and economic growth by testing for the roles of country's location in the determination of the inflow of FDI to Nigeria. Unlike other studies, this study finds that countries' locations do not play any significant role in determining FDI inflow to Nigeria. The study, therefore, employs fully modified ordinary least square (FMOLS) to examine the determinants of FDI in Nigeria. The FMOLS results show that FDI, manufacturing sector, tax revenue, financial development, health expenditure, net trade and human capital have a positive relationship with income growth. These results were statistically significant except for tax revenue, net trade and human capital. These results support the argument that these variables are important determinants of economic growth.

The article also finds a negative and statistically significant relationship among FDI, income growth, import and capital formation. [18] examined the sectoral impact of FDI in manufacturing, mining, oil and the telecommunications sectors on economic growth in Nigeria based on a theoretical framework founded on the standard growth accounting theory, the detailed analysis of the sectorial FDI (which is only available for over the period 1986-2009) was carried out. This involved the use of descriptive analysis, unit roots test, Johansen co-integration test, error correction mechanism, and fully modified least squares technique. The correlation analysis of aggregate FDI on sectorial GDP growth indicates that only the oil sector GDP has a significant positive correlation with aggregate FDI over the period 1981 and 2017. While the sectorial analysis revealed that only the flow of FDI into the communication sector has a positive and statistically significant impact on economic growth for the period considered. Given the positive significant growth impact for FDI in the telecommunication sector, and the negative significant growth impact of FDI in the manufacturing sector. [19], investigated the impact of foreign direct investment on economic growth in Nigeria using descriptive and regression analyses estimation techniques. The findings of the study revealed that foreign direct investment was positive and significant to economic growth of Nigeria while the domestic investment was also positive but not significant at 5% alpha level. [20] examine the impact of foreign direct investment (FDI) and other macroeconomic variables on agricultural growth in Nigeria from 1981 to 2014, using annual time series data from Central Bank of Nigeria (CBN), World Bank and the United States of America (US) Federal Reserve System. Data was analysed using trend analyses, unit root tests, co-integration tests, ordinary least squares (OLS) regression and Granger causality tests, while the hypothesis was tested with F-test. Results revealed very low FDI inflow into agriculture, not commensurate with the share of agriculture to GDP. All significance were taken at the 5% probability level, i.e. $p < 0.05$. There was positive non-significant relationship between agricultural growth and FDI in agriculture, meaning that FDI in agriculture has no direct impact on agricultural growth or the impact on agricultural growth is masked by other macroeconomic variables. Significant positive relationship exists between agricultural growth and macroeconomic instability, while interest rate differential had a significant negative relationship. There was

unidirectional causality running from FDI in agriculture, stock of gross external debts, and variability of consumers' price index to agricultural growth, while agricultural growth was significant in granger causing macroeconomic instability. [21] examined the impact of foreign portfolio investment and Foreign Direct Investment on the performance of the Nigerian Economy over a period of 1980-2017. The data used were purely secondary sourced from the central Bank of Nigeria statistical Bulletin and World Bank Development indicator. The ordinary least square (OLS) regression analysis was used. The findings revealed that the performance of the Nigerian Economy is directly related to inflow of foreign portfolio investment and foreign direct investment and it is also statistically significant at 5% level. This means that a good performance of the economy depends on the inflow of these variables, or that the variables serve as an engine of economic growth. [22] used cost of exporting and importing as well as the number of days and the number of documentation it takes to complete a trade transaction (both import and export) in the doing business indicators dataset to create an index for trade policy openness. This provides a better measure of trade openness compared with the traditional measure of trade openness which takes into the volume of trade. The study employed both static and dynamic panel estimation technique to analyse the relationship between trade policy openness and FDI inflow for 29 sub Saharan African countries. The result from the study indicates that, policy openness affect FDI inflows positively.

In light of the above reviewed literatures, the need to investigate the impact of FDI on employment and unemployment rate in Nigeria has been re-affirmed.

4. MATERIALS AND METHODOLOGY

4.1 Source of Data

Annual time series data of FDI, employment and unemployment rate in Nigeria were used in this study, the data are obtained from the Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics and World Bank Indicators for the period 1960 – 2014.

4.2 Vector Autoregression (VAR) Model

Vector Autoregression (VAR) model was created by Sims [23] when he has used multivariate

simultaneous equations models for econometric analysis. It is established based on time series analysis which described the variables' dynamic structure, and thus it is typically examine the trends of the variables [24]. VAR model is defined as a statistical model employed to examine the interdependencies between the variables in the time series analysis [25]. The model expresses each variable as a weighted average of its own lagged values plus the lagged values of the other variables. A VAR model with p lags is denoted by VAR (P) model. According to [24], there are five main steps which developed and were added respectively by [26, 27,28] to discover the causality relationship within a Vector Auto-Regression (VAR) model, which should be applied to examine any relationship between variables. The steps are unit root test, Co-integration and Granger causality, Vector-Error Correction, Variance Decompositions and Relative exogeneity, and Impulse Response Functions (IRFs).The researchers have employed the E-Views to test the hypotheses of the study. The collected data were examined throughconducting the unit root test of stationary, Cointegration (Johansen Methodology) and Granger causality, vector error correction model, variance decompositions (VDCs), relative exogeneity and lastly, impulse response functions (IRFs) by using t-test technique in the software. The hypotheses considered in this study is;

- H₀: There is no relationship between FDI and employment rate in Nigeria.
- H₁: There is a long-term relationship between FDI and Nigeria's employment and unemployment rate.
- H₂: There is a short-term relationship between FDI and Nigeria's employment and unemployment rate

4.3 The Stationary Vector Autoregression (VAR) Model Specification

The VAR model contains variables for the total FDI inflows in the Nigeria economy, Unemployment and employment rate. Therefore, the specified model's equation is written as:

$$FDI = \beta(Unemployed, employed) \quad (1)$$

Where;

FDI represents the Foreign Direct investment inflows

Unemployment is the number of unemployed people in the country

Employment is the number employed in the country

The model will test the effect of FDI on Nigeria economy based on its employed and unemployed rate

$$Y_t = B_0 + B_1X_t + B_2Z_t + \varepsilon_t \quad (2)$$

$$FDI_t = B_0 + B_1unemployed_t + B_2employed_t + \varepsilon_t \quad (3)$$

where;

Y_t is the log of endogeneous effect variables measured with Foreign direct investment (FDI)
 B_0 is the current time period of the observation of each variables based on the lag values
 B_1 and B_2 are the coefficient of the unemployed and employed people in the country
 X_t is the unemployment rate
 z_t is the employment rate
 ε_t is the error term of the model.

The coefficient of regression, β indicates how a unit change in the independent variable (foreign direct investment) affects the dependent variable (gross domestic product). Forecast variance decompositions and impulse responses were based on the Cholesky decomposition of the contemporaneous covariance matrix. The FDI variable has been assumed to be the most exogenous [29]. Therefore, the FDI variable was the first input followed by the value of the oil exports variable. [30] stated that the F test and the T test are important to determine the significance of a multiple regression equation. [31] confirmed that the F-test and T-test are always used to explain the relationship between X and Y variables. F-test gives an indication of the 'short-term' causal effects, their meaning, and strict exogeneity of the variables [32], and T-test is applicable to explain the Vector Error Correction (VEC) in VAR model [33]. The researchers intend to employ T-test technique in order to explain the VEC in the part of VAR model and to explain the granger causality test between the variables FDI, unemployment and employment rate. Therefore, the following sequential procedures will be applied:

4.4 Unit Root Test of Stationarity

Unit root test is an important step to check the Stationarity of the data included in any time

series analysis [34]. It is also used in most applications of modelling studies. It was developed by [35]. Furthermore, Augmented Dickey-Fuller (ADF) tests the presence of difference stationarity (unit root in the series) [34]. In this study, the integration order of each of the three panel level series were considered; FDI, employment, and unemployment rate.

5. THE RESULTS AND DISCUSSIONS

5.1 Descriptive Statistics

The descriptive measures on the employment, unemployment and Foreign Direct Investment (FDI) data were presented in Table 1. The result obtained shows that the mean of the series are 29.240, 465410.10 and 7.447 for employment, FDI and unemployment respectively with the median values of 23.530, 2452.80 and 4.300 in that order and the standard deviation of employment is 15.139, FDI is 1050297.00 and Unemployment is 6.959. The p-value of FDI and unemployment are 0.000, which indicated that the data are significant at 0.01, 0.05 and 0.10 significant levels. Fig. 1 presents the time plot of employment rate in Nigeria, the plot shows that there is gradual constant increase from year 1961 to 1970, a sudden rise up to 2005 and later constantly fluctuated till 2014. Fig. 2 shows the time plot of FDI in Nigeria, where slight increase was observed in year 1993-1995 and then continued till 2011 before a fall occur at 2012, it also show that FDI is not stationary. Fig. 3 presents the time plot of Unemployment rate in Nigeria, it was observed that; a breaks occurred from 1970-1978 then a slight fall and then, stability from 1982-1989, a fall was experience before another rise in year 1998, it also shows that the unemployment rate is also not stationary, this leads to the application of VAR model.

5.2 Unit Root Test on FDI, Employment and Unemployment Rate

The result of unit roots test for the FDI, Employment and Unemployment rate series are presented in the table. Based on the ADF (Augmented Dickey-Fuller) and PP (Phillips and Perron), the null hypothesis of unit roots is rejected for the FDI, employment and unemployment rates. The KPSS (Kwiatkowski-Phillips-Schmidt-Shin) test presents different result which confirms stationarity at 0.01, 0.05 and 0.1 significant level in the FDI series Since

both ADF and PP tests are among sensitive to linear time series, the KPSS non-linear unit root test was therefore applied to the FDI, employment and unemployment rate. It was discovered that employment and unemployment rates were non-stationary but FDI was stationary. It is therefore concluded that only FDI is stationary for KSS for KPSS.

Table 1. Descriptive statistics measure

| Descriptive | Employment | FDI | Unemployment |
|--------------|------------|------------|--------------|
| Mean | 29.240 | 465410.10 | 7.447 |
| Median | 23.530 | 2452.80 | 4.300 |
| Maximum | 59.800 | 3845712.00 | 27.400 |
| Minimum | 12.320 | 38.00 | 1.200 |
| Std. Dev. | 15.139 | 1050297.00 | 6.959 |
| Skewness | 0.702 | 2.26 | 1.454 |
| Kurtosis | 2.001 | 6.61 | 4.076 |
| Jarque-Bera | 6.809 | 76.81 | 22.044 |
| Probability | 0.033 | 0.00 | 0.000 |
| Sum | 1608.18 | 25597556 | 409.600 |
| Sum Sq. Dev. | 12376.59 | 5.96E+13 | 2614.737 |
| Observation | 55 | 55 | 55 |

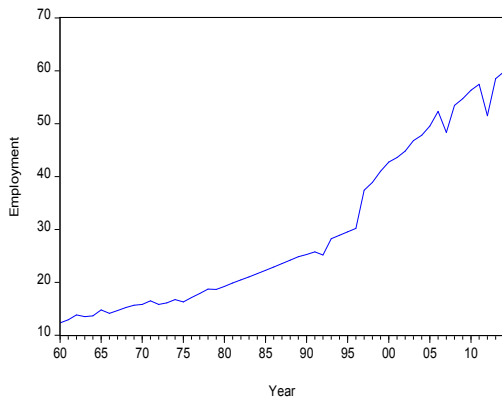


Fig. 1. Time series plot of employment rate in Nigeria, (1960-2014)

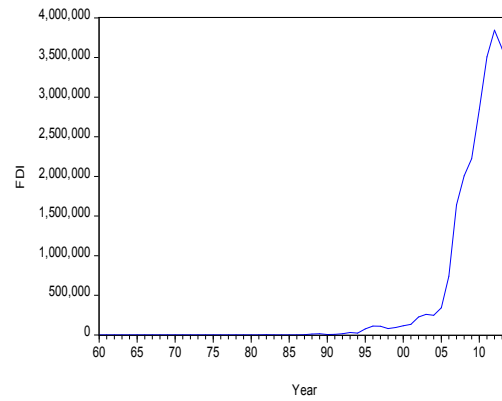


Fig. 2. Time series plot of FDI in Nigeria, (1960-2014)

Table 2. Unit root test on FDI, employment and unemployment rate

| Unit Root | | FDI | | Employment | | Unemployment | |
|-----------|-----------|--------|---------|------------|---------|--------------|---------|
| | | t-Stat | P-value | t-Stat | P-value | t-Stat | P-value |
| ADF | None | 8.0666 | 1.0000 | 4.6999 | 1.0000 | 1.7308 | 0.9786 |
| | Intercept | 7.7902 | 1.0000 | 1.9544 | 0.9998 | 0.5997 | 0.9885 |
| | with None | 7.0643 | 1.0000 | -1.1704 | 0.9062 | -0.9371 | 0.9438 |
| KPSS | None | - | - | - | - | - | - |
| | Intercept | 3.2863 | 0.0018 | 0.8298 | 0.4630 | 0.7441 | 0.4630 |
| | with None | 6.2553 | 0.0000 | 0.2198 | 0.1460 | 0.2029 | 0.1460 |
| PP | None | 1.5538 | 0.9691 | 5.1985 | 1.0000 | 1.7308 | 0.9786 |
| | Intercept | 1.0273 | 0.9964 | 1.9339 | 0.9998 | 0.5667 | 0.9875 |
| | with None | -0.254 | 0.9901 | -1.3031 | 0.8766 | -1.0301 | 0.9309 |

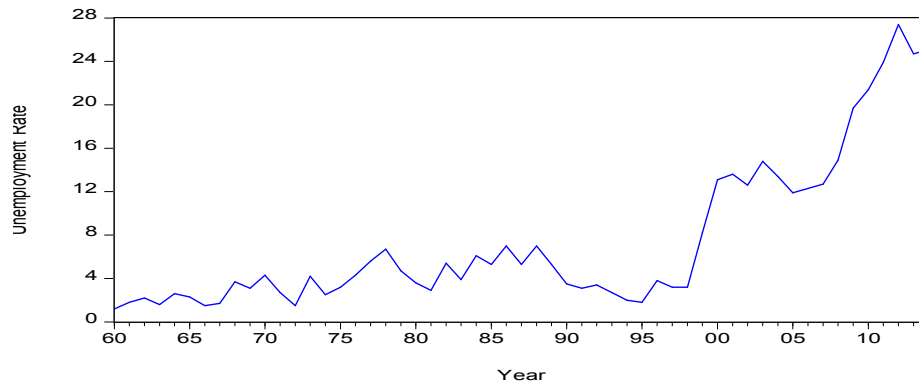


Fig. 3. Time series plot of unemployment in Nigeria, (1960-2014)

Table 3. Estimation of VAR model

| | Employment | FDI | Unemployment |
|---|--|---|---|
| Employment(-1) | 0.4265936525783347 0.1370702717931473 [3.11223] | 28922.10701321655 11013.04656888621 [2.62617] | 0.2271629311589906 0.1322715541914943 [1.71740] |
| Employment(-2) | 0.7301640912913998 0.1570435185999188 [4.64944] | -26711.32193281343 12617.81683991028 [-2.11695] | -0.132131691042157 0.1515455540371271 [-0.87189] |
| FDI(-1) | -5.517498845246419e-06 1.72075313156679e-06 [-3.20644] | 1.821493210813184 0.1382556124211994 [13.1748] | 3.201505078541723e-06 1.660510978162364e-06 [1.92802] |
| FDI(-2) | 6.443087959731628e-06 1.908266138241267e-06 [3.37641] | -0.9346685244479406 0.1533215304190443 [-6.09613] | -2.059429807683449e-06 1.841459308529599e-06 [-1.11837] |
| Unemployment(-1) | -0.1060276040723207 0.1527631385895932 [-0.69407] | 6802.724053911699 12273.9054740863 [0.55424] | 0.7584545757393559 0.1474150266142999 [5.14503] |
| Unemployment(-2) | -0.1841939076237752 0.1414033914011217 [-1.30261] | -1473.099330287282 11361.19534985011 [-0.12966] | -0.1182353482267236 0.1364529748419862 [-0.86649] |
| C | -0.9563019707414348 0.6630155006969071 [-1.44235] | -80883.12950159602 53270.63621853481 [-1.51834] | -0.5016602718923546 0.6398038727359995 [-0.78408] |
| R-squared | 0.9894012974849259 | 0.9863400313728178 | 0.9541576653194142 |
| Adj. R-squared | 0.988018858026438 | 0.9845582963344896 | 0.948178230361077 |
| Sum sq. resids | 125.0979648843495 | 807567156510.1112 | 116.4921363301081 |
| S.E. equation | 1.649097018294172 | 132498.3311223949 | 1.591363486544384 |
| F-statistic | 715.6923157901661 | 553.5840122998021 | 159.5732158586338 |
| Log likelihood | -97.96208101060259 | -696.5492459960772 | -96.07333649321916 |
| Akaike AIC | 3.960833245683117 | 26.54902815079537 | 3.889559867668648 |
| Schwarz SC | 4.221060479548491 | 26.80925538466074 | 4.149787101534022 |
| Mean dependent | 29.86679245283018 | 482971.0960377359 | 7.671698113207546 |
| S.D. dependent | 15.06597003101118 | 1066259.224125436 | 6.99058095303659 |
| Determinant resid covariance (dof adj.) | | 101656977421.1078 | |
| Determinant resid covariance | | 66463480284.13359 | |
| Log likelihood | | -885.9890661046991 | |
| Akaike information criterion | | 34.22600249451695 | |
| Schwarz criterion | | 35.00668419611307 | |

5.3 Estimation of VAR model

Table 3 above, present the estimated coefficient, standard error, and the t-statistic. For instant the coefficient for EMPLOYMENT (-1) in the UNEMPLOYMENT equation is 0.227163 and the coefficient for FDI (-2) in the FDI equation is -0.934669. The first part of the additional output presents standard OLS regression statistics for each equation. The results are computed separately for each equation using the appropriate residuals.

5.4 Auto Regression (AR) Root

Table and Fig. 4 presents the AR roots using a complex coordinate system which report the inverse root of the characteristics AR polynomial. The VAR is said to be stationary at 0.257821 to 0.928229 and falls inside the unit circle while the one with the modulus value of 1.044380 is not stationary and also fall outside the unit circle.

5.5 Granger Causality Block Exogeneity Wald Tests

The granger causality block exogenously Wald test shown in Table 5 indicated that the employment rate on the FDI with (p-value = 0.0033) is significant at 1%, 5%, and 10% respectively and unemployment with (p-value = 0.0505) is not significant. The result also shows that employment moved in one way direction for both FDI and unemployment. For FDI on employment and unemployment, it was observed that it was also a one-way direction, and employment rate is significant while unemployment rate was not significant. For

unemployment on employment and FDI, it can be seen from the result that it follows a bi-direction movement; while employment and FDI were both significant.

Table 4. AR root

| Root | Modulus |
|-----------|----------|
| 1.044380 | 1.044380 |
| 0.873130 | 0.928229 |
| 0.873130 | 0.928229 |
| -0.578427 | 0.578427 |
| 0.536508 | 0.536508 |
| 0.257821 | 0.257821 |

5.6 VAR Lag Exclusion Wald Tests

The lag exclusion tests for each lag in the VAR result in Table 6 indicted that each lag of the χ^2 (Wald) statistic joint significance of all endogenous variables shows that at lag 1, employment, FDI, unemployment and their combination were all significant at 0.01, 0.05 and 0.1 significant level, while at lag 2, employment, FDI and their joint were significant at 1%, 5% and 10% but was not significant for the unemployment at 3 degree of freedom.

5.7 Lag Order Selection Criteria

Lag Order selection criteria result is presented in Table 7, some criteria of selecting the best lag order of an unrestricted VAR was computed; it was observed that lag 5 had the best criteria with the maximum Log L of -794.0278 and minimum AIC (33.68111), followed by lag 4, lag 3, lag 2, lag 1 and lag 0 respectively.

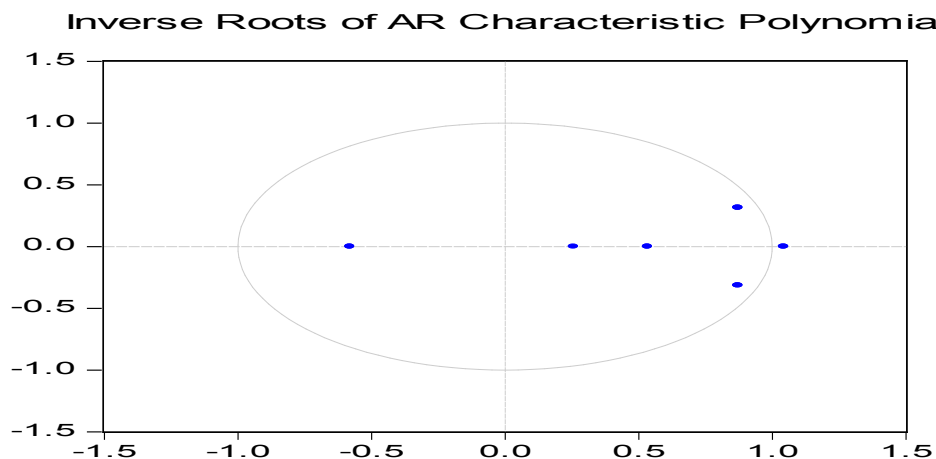


Fig. 4. Inverse roots of AR characteristics polynomial

Table 5. Granger causality block exogeneity wald tests

| Dependent variable: Employment | | | |
|---|----------|----|--------|
| Excluded | Chi-sq | df | Prob. |
| FDI | 11.40537 | 2 | 0.0033 |
| Unemployment | 5.972783 | 2 | 0.0505 |
| All | 13.93700 | 4 | 0.0075 |
| Dependent variable: FDI | | | |
| Excluded | Chi-sq | df | Prob. |
| Employment | 9.819813 | 2 | 0.0074 |
| Unemployment | 0.405919 | 2 | 0.8163 |
| All | 14.29536 | 4 | 0.0064 |
| Dependent variable: Unemployment | | | |
| Excluded | Chi-sq | df | Prob. |
| Employment | 13.02105 | 2 | 0.0015 |
| FDI | 9.813225 | 2 | 0.0074 |
| All | 21.80770 | 4 | 0.0002 |

Table 6. VAR lag exclusion wald tests

| Numbers in [] are p-values | | | | |
|-----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | Employment | FDI | Unemployment | Joint |
| Lag 1 | 39.46666 [1.38e-08] | 189.0332 [0.000000] | 30.06383 [1.34e-06] | 241.4599 [0.000000] |
| Lag 2 | 23.74776 [2.82e-05] | 41.61129 [4.85e-09] | 2.554249 [0.465567] | 66.16231 [8.57e-11] |
| D.f. | 3 | 3 | 3 | 9 |

5.8 VAR Residual Portmanteau Tests for Autocorrelations

The multivariate Box-Pierce/Ljung-Box Q-statistics for residual serial correlation up to the specified order was computed in Table 8. Both the Q-statistics and the adjusted Q-statistic (with a small sample correction) reported that lag 1 and 2 are non-available (NA) but in lag 3 and 4 they both have p-value of 0.000 which means it was significant at 1%, 5% and 10% level of significant.

5.9 VAR Residual Serial Correlation LM Test

In Table 9, it was observed that at 5% (0.05) significant level, the VAR residual serial correlation LM-test was significant at lag 1 (0.0240), lag 2(0.0002), lag 4(0.0007), lag 5(0.0159) but not significant at lag 3(0.2959) while at 1% (0.01) significant level both lag 2 and lag 4 also shows significance.

5.10 VAR Residual Normality Tests

The Table 10 presents the multivariate extensions of the Jarque-Bera residual normality

test, it compares the third and fourth moments of the residual to those from the normal distribution. For the multivariate test, factorization of the k residuals was observed to be orthogonal to each other. For the skewness; it was observed that only the second component was significant at 1%, 5%, and 10% with p-value of 0.0000 while the first and third components were not significance, for the kurtosis and Jarque-Bera; only the third component is not significant with a p-value of 0.1820 and 0.2261 respectively, it is therefore concluded that Jarque-Bera for component 1 and 2 are normally distributed.

5.11 VAR Residual Heteroskedasticity Tests: No Cross Terms

Table 11 shows that the joint test were significant at 5% (0.05) level of significant and also the individual component of each one.

5.12 Granger Causality Tests

The result presented in Table 12, shows that FDI Granger-cause employment, employment Granger-cause FDI, unemployment Granger-cause employment and employment Granger-

cause unemployment, and finally, unemployment Granger-cause FDI and FDI also Granger-cause unemployment. Fig. 5 shows the correlation plots for the variables under consideration, it was observed that the first, third, seventh, eighth and ninth plot did not cross the stationary line at any lag, while the plot of the second, fourth, fifth and sixth cut the stationary line at difference lag.

Table 7. Lag order selection criteria

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|-----|-----------|-----------|-----------|-----------|-----------|-----------|
| 0 | -1061.380 | NA | 6.21e+14 | 42.57519 | 42.68991 | 42.61887 |
| 1 | -866.5007 | 358.5773 | 3.67e+11 | 35.14003 | 35.59891 | 35.31477 |
| 2 | -839.5375 | 46.37657 | 1.79e+11 | 34.42150 | 35.22455 | 34.72731 |
| 3 | -828.2270 | 18.09689 | 1.65e+11 | 34.32908 | 35.47629 | 34.76594 |
| 4 | -803.6054 | 36.43990* | 9.04e+10* | 33.70422 | 35.19559* | 34.27214* |
| 5 | -794.0278 | 13.02555 | 9.13e+10 | 33.68111* | 35.51665 | 34.38010 |

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Table 8. VAR residual portmanteau tests for autocorrelations

| Lags | Q-Stat | Prob. | Adj Q-Stat | Prob. | df |
|------|----------|--------|------------|--------|-----|
| 1 | 4.161980 | NA* | 4.242018 | NA* | NA* |
| 2 | 21.99981 | NA* | 22.77937 | NA* | NA* |
| 3 | 28.39961 | 0.0008 | 29.56316 | 0.0005 | 9 |
| 4 | 44.76741 | 0.0004 | 47.26710 | 0.0002 | 18 |
| 5 | 56.14403 | 0.0008 | 59.82879 | 0.0003 | 27 |

*The test is valid only for lags larger than the VAR lag order
df is degrees of freedom for (approximate) chi-square distribution

Table 9. VAR residual serial correlation LM test

| Lags | LM-Stat | Prob. |
|------|----------|--------|
| 1 | 19.14697 | 0.0240 |
| 2 | 32.09519 | 0.0002 |
| 3 | 10.71286 | 0.2959 |
| 4 | 28.99212 | 0.0007 |
| 5 | 20.33954 | 0.0159 |

Table 10. VAR residual normality tests

| Component | Skewness | Chi-sq | df | Prob. |
|-----------|-------------|----------|--------|--------|
| 1 | -0.410346 | 1.487388 | 1 | 0.2226 |
| 2 | 1.513307 | 20.22921 | 1 | 0.0000 |
| 3 | 0.367446 | 1.192643 | 1 | 0.2748 |
| Joint | | 22.90924 | 3 | 0.0000 |
| Component | Kurtosis | Chi-sq | df | Prob. |
| 1 | 7.045892 | 36.14874 | 1 | 0.0000 |
| 2 | 7.562771 | 45.97503 | 1 | 0.0000 |
| 3 | 2.101867 | 1.781335 | 1 | 0.1820 |
| Joint | | 83.90511 | 3 | 0.0000 |
| Component | Jarque-Bera | df | Prob. | |
| 1 | 37.63613 | 2 | 0.0000 | |
| 2 | 66.20424 | 2 | 0.0000 | |
| 3 | 2.973978 | 2 | 0.2261 | |
| Joint | 106.8143 | 6 | 0.0000 | |

Table 11. VAR residual heteroskedasticity tests: no cross terms

| Chi-sq | df | Prob. | | | |
|-----------|-----------|----------|--------|------------|--------|
| 176.4951 | 72 | 0.0000 | | | |
| Dependent | R-squared | F(12,40) | Prob. | Chi-sq(12) | Prob. |
| res1*res1 | 0.611625 | 5.249444 | 0.0000 | 32.41614 | 0.0012 |
| res2*res2 | 0.757953 | 10.43811 | 0.0000 | 40.17152 | 0.0001 |
| res3*res3 | 0.430368 | 2.518393 | 0.0143 | 22.80948 | 0.0294 |
| res2*res1 | 0.739539 | 9.464486 | 0.0000 | 39.19556 | 0.0001 |
| res3*res1 | 0.396790 | 2.192656 | 0.0316 | 21.02985 | 0.0499 |
| res3*res2 | 0.545833 | 4.006104 | 0.0004 | 28.92913 | 0.0040 |

Table 12. Granger causality tests

| Null Hypothesis: | Obs | F-statistic | Prob. |
|--|-----|-------------|--------|
| FDI does not Granger Cause Employment | 53 | 3.67772 | 0.0327 |
| Employment does not Granger Cause FDI | | 7.18328 | 0.0019 |
| Unemployment does not Granger Cause Employment | 53 | 1.05842 | 0.3550 |
| Employment does not Granger Cause Unemployment | | 5.15769 | 0.0094 |
| Unemployment does not Granger Cause FDI | 53 | 1.92428 | 0.1571 |
| FDI does not Granger Cause Unemployment | | 3.57295 | 0.0358 |

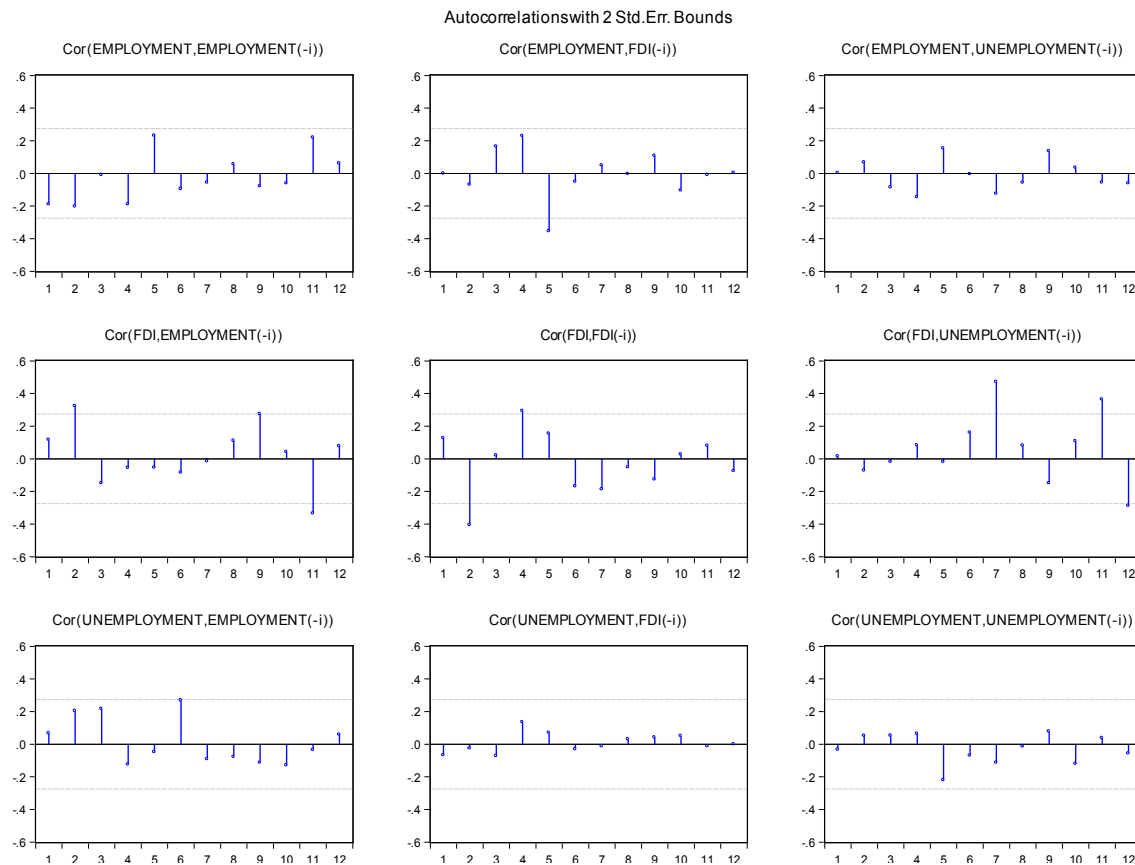


Fig. 5. Correlograms of unemployment, FDI and employment

6. CONCLUSION AND RECOMMENDATIONS

The descriptive measures for the employment, unemployment and Foreign Direct Investment (FDI) shows that the mean of the series are 29.240, 465410.10 and 7.447 and the standard deviation of Employment which is 15.139, FDI is 1050297.00 and Unemployment is 6.959, it also shows the p - value of both FDI and unemployment are 0.000 which indicated that the data are significant at 0.01, 0.05 and 0.10 significant levels, and the Jarque-Bera values shows that all the variables were Normally distributed.

VAR model estimation process like; estimation of VAR model, AR root, Pairwise Granger causality tests, Granger Causality/ block Exogeneity Wald tests, VAR lag exclusion Wald tests, Lag Order Selection Criteria, VAR Residual Portmanteau Tests for Autocorrelations, VAR Residual Portmanteau Tests for Autocorrelations, VAR Residual Normality Tests, VAR Residual Heteroskedasticity Tests, Granger Causality Tests, Impulse Response for co-integration of the variable and Variance Decomposition of the variables were applied to the time series data of employment, FDI and unemployment.

It was discovered that FDI had a significant and positive impact on employment but did not have any impact or contribution to unemployment. The variance decomposition of employment shows that at the first period, employment contribute 100%, at sixth quarter employment contribute 67.47% while FDI and unemployment contribute 20.73% and 11.80% respectively. For the variance decomposition of FDI in the second period, FDI contributed 94.13% while employment and unemployment contributed 5.71% and 0.16% respectively. Also for variance decomposition of unemployment at period ten, unemployment contributed 54% while FDI and employment contributed 24.47% and 21.54%.

The Granger causality test was significant at 1% significance level, therefore FDI Granger-cause employment, employment also Granger-cause FDI, unemployment Granger-cause employment, employment Granger-cause unemployment, and finally unemployment Granger-cause FDI and FDI Granger-cause unemployment while FDI and unemployment did not contribute anything.

Base on the result of findings, it was recommended that the monetary authorities in Nigeria should emphasize on stable exchange rate so that higher levels of foreign direct investment can be attracted, effective measures should be undertaken to develop SOC (Social-overhead Capital) and also measures should be taken to reduce brain drain phenomenon and finally, Government should be more concern with Foreign Direct Investment which could benefit Nigeria's economy because FDI creates more domestic jobs and strengthen economic growth.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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