THE ROLE OF FOREIGN DIRECT INVESTMENT IN ECONOMIC DEVELOPMENT: A STUDY OF NIGERIA

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Abstract: The study investigates the relationship between foreign direct investment flows and economic growth in Nigeria. The study became necessary because as never before, the civilian governments since 1999 have employed several strategies to ensure increased flow of FDI into Nigeria because of its perceived benefits as lauded in the theoretical literature as the panacea for economic underdevelopment. The study utilized simple OLS regression analysis and conducted various econometrics tests on our model so as to obtain the best linear unbiased estimators. The study confirmed the beneficial role of FDI in growth. However, the role of FDI on growth could be limited by human capital. The study concluded that indeed, FDI promotes economic growth, and hence the need for more infrastructural development, ensuring sound macroeconomic environment as well as ensuring human capital development is essential to boosting FDI productivity and flow into the country.

Keywords: Foreign direct investment, growth, human capital, OLS, multicollinearity, autocorrelation, heteroscedasticity, Normality test, macroeconomic, Nigeria, infrastructural development, correlation

INTRODUCTION

Foreign direct investment (FDI) is one of the standard panacea for economic underdevelopment in the economic development literature. FDI has been defined as an investment made to acquire a lasting management interest (normally 10% of voting stock) in a business enterprise operating in a country other than that of the investor (where foreign is defined according to residency and not according to nationality) (World Bank, 1996). Such investments could take the form of either greenfield investment (also called 'mortar and brick' investment) or merger and acquisition (M&A) which entails the acquisition of existing interest rather than new investment. In corporate governance, ownership of at least 10% of the ordinary shares or voting rights is the criterion for the existence of a direct investment relationship (World Bank, 1996; Obadan, 2004; Ayanwale, 2007).

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FDI has assumed a prominent place in the strategies for economic growth as it is useful in bridging the technological and resource gap of underdeveloped countries and also stems the tide of debt build-up (UNCTAD, 2005). FDI is expected to help a developing nation access part of the savings of the developed world, thereby helping to make up for the country's dearth of savings (Noorzoy, 1979). Furthermore, FDI helps fill the domestic revenue-generation gap in a developing economy, given that in most developing countries, governments do not seem to be able to generate sufficient revenue to meet their expenditure needs. FDI is said to be a vehicle for transfer of technology – both the technology embodied in goods, services, people, organizational arrangements, and those embodied in blueprints, designs, technical documents, and in the content of innumerable types of training. That FDI promotes technology transfer is advocated in the works of UNCTAD (1997), UNIDO (2002), Ikiara (2002), Caves (1996),Kim and Seo (2003), Borensztein, De Gregorio and Lee (1998).

Inspite of the debate raging in the literature on the desirability or otherwise of FDI to growth, governments in developing countries are still making concerted efforts to attract ever increasing volume and value of FDI into their countries. Infact, the African Union deliberately formed NEPAD (New Partnership for Africa's Development) with one of the key objectives of promoting FDI flows into African countries. The Federal Government of Nigeria in its medium-term-economic development document, known as National Economic Empowerment and Development Strategy (NEEDS) said "~While the government is reducing the cost of doing business in Nigeria, ~ the government will aggressively promote exports and general commercial policy to attract foreign direct investments, and it will pursue export orientation as a deliberate policy". (NPCN, 2004, pp. 54).

However, given Lipsey's (2004) conclusion that, attempts to find a consistent relation between the extent of FDI inflows and national economic growth do not produce strong and consistent relationships, and Ayanwale's (2007) conclusion that the empirical linkage between FDI and economic growth in Nigeria is yet unclear, also that recent evidence affirms that the relationship between FDI and growth may be country and period specific. There is a serious need to dig deeper in finding the relationship between FDI and economic growth in Nigeria, hence this study. This paper is divided into five parts. Part two reviews the relevant literature, part three discusses the methodology employed in this study, part four is data presentation and analysis while part five discusses the findings and implications for policy purpose.

LITERATURE REVIEW

That investment is a crucial ingredient to growth in any economy is an understatement. According to Solow (1956), output is a function of capital stock, labour, and total factor productivity. However, more recent findings have emerged from the neoclassical aggregate production function (Ram, 1985). New growth theorists, Levine and Renelt (1992) have identified the main determinants of economic growth as investment (foreign as well as domestic), population and human factor. Ordinarily improved technology, improved efficiency and improved productivity are expected to promote growth, whether the improvement comes from foreign direct investment or from domestic investment is not important. To the extent that the above is true therefore, FDI if indeed it represents new technology

and greater efficiency should promote economic growth (Ayanwale, 2007).

However there have been several empirical studies on the relationship between FDI and economic growth, and the results of these studies have been mixed. Such works include Borensztein, De Gregorio and Lee (1998) Bende–Nabende and Ford (1998) Caves (1996) all maintain that FDI promotes growth through positive externalities operating through technology transfer, human capital development and the opening up of an economy to international forces. Caves (1996) argued that the introduction of new processes brought on by the presence of FDI, managerial skills and know-how and the opening up of firms to international markets all contribute to economic growth in positive definite ways. De Gregorio (2003) in his study of Latin American countries for the period 1950 – 1985 found that whenever FDI rose by one percentage point of GDP, economic growth rose by 0.6% as against a rise of 0.2% when aggregate investment (i.e. domestic plus foreign) rose by 1 percentage point of GDP, indicating that FDI is three times more efficient than domestic investment in the growth process.

FDI was found to promote growth in host countries through its effects on trade. Researchers with this finding include Bhagwati (1978), Balasubramanyam et al (1996), Athukorala and Chand (2000). These researchers found that when a country adopts an export – promotion strategy to economic development, then FDI would have positive impact on growth. Alfaro et. al. (2004) Javorcik (2004) found that trade had positive effects on growth whenever the financial market of the host country was developed. Alfaro, Chanda, Kalemli-Ozcan and Sayek (2006) found that, holding the extent of foreign presence constant, financially well-developed economies experience growth rates that are almost twice those of the economies with poor financial markets thereby making sound financial market a necessary condition for FDI to contribute to growth.

Aitken et al (1997, 1999). Aitken et al tried to find out whether indeed the presence of FDI in a country ensures productivity and efficiency gains on the part of local firms in the form of increased growth rate. They found that in developing countries the needed forward and backward linkages to make efficiency and productivity gains impact economic growth are not there. According to Aitken et al (1997, 1999), FDI activities in some economies are "enclave" activities that do not impact the rest of the economy. They further argue that transnational corporations' (TNCs') activities meant to encourage increased productivity due to increased competition, many times simply stifle nascent domestic industries and entrepreneurship.

In another study to determine the relationship between FDI and growth, Durham (2004) could not identify any positive relationship between FDI and economic growth, he however provided evidence that the positive effects of FDI are contingent on the absorptive capability of host countries. Like Durham, many studies have found that whether FDI would positively impact economic growth in a recipient or host country or not, depends on certain conditionalities. For instance Bhagwati (1978), Balasubramanyam, Salisu and Sapsford (1996). Dauda (2007) found that whether FDI would promote economic growth through trade depends on whether a country is adopting an Import Substituting Strategy of Industrialization (ISI) or an Export Promotion Strategy (EP). These researchers contend that once a country adopts

an export – promotion strategy, then FDI would promote economic growth through trade. If a country however adopts an ISI strategy the cost of importation to keep the domestic import – substituting industries going may result in net-resource outflow from such a developing country and impair the country's growth promotion efforts.

In addition, Carkovic and Levine (2002) reached the conclusion that exogenous component of FDI does not exert a robust positive influence on economic growth and that there is no reliable cross country empirical evidence supporting the claim that FDI per se accelerates economic growth. Lipsey (2004) also concluded that "... attempts to find a consistent relation between the extent of FDI inflows and national economic growth do not produce strong and consistent relationships" (pg 371). Aitken, Hansen and Harrison (1997) and Aitken, Hansen and Lipsey (1999) insist that all the productivity gains usually attributed to the presence of FDI in a country may be a myth.

With specific reference to Nigeria, studies on the impact of FDI on growth have also come out with mixed results. Dauda (2007) found a positive relationship between FDI and economic growth in Nigeria in the era of liberal trade policy and export promotion. Ayanwale (2007) equally found that there is a positive relationship between FDI and economic growth. Prior to these recent studies, results of earlier studies have been mixed. While Oyinlola (1995), and Adelegan (2000) found that FDI in Nigeria is pro-consumption and pro-imports and hence negatively related to gross domestic investment, and hence to growth, Ayanwale and Bamire (2001) found a positive relationship between FDI and economic growth in Nigeria. In the same vein, Dutse (2008) concluded that FDI can facilitate economic growth in Nigeria through the generation of technological and efficiency spillovers to local firms thereby encouraging innovations, allowing technological enhancement and developing human capital.

Akinlo (2004) investigates the impact of FDI on economic growth in Nigeria using data for the period 1970 to 2001. His error correction model (ECM) results show that both private capital and lagged foreign capital have small and insignificant impact on economic growth. This study however established the positive and significant impact of export on growth. Financial development which he measured as M_2/GDP has significant negative impact on growth. This he attributed to capital flight. In another manner, labour force and human capital were found to have significant positive effect on growth.

In the earlier studies reviewed, researchers have found that the condition that must be in place for FDI to impact economic growth positively is that the incentive structures must be attractive. Others contended that the conditionality needed for FDI to promote economic growth is that infrastructural development must be at a given critical minimum level. Some other researchers maintain that the nature of the financial markets in the recipient economy is what determines whether the FDI will impact growth positively or not. In this study therefore we attempt to find out the relationship between FDI flows and growth in Nigeria anchoring heavily on Solow's growth theory as well as Levine and Renelt neoclassical aggregate production function.

METHODOLOGY

Solow (1956) has observed that the major determinants of output growth in any

economy are; the capital stock, labour and total factor productivity, we formulated our functional model of growth along this line. Output growth is not however determined only by the above factors, trade has also been identified as a determinant of growth (Bhagwati, 1978; Balasubramanyam et. al, 1996; Athukorala and Chand, 2000; Alfaro et. al (2004) and; Javonick, (2004)). Apart from trade, foreign direct investment has been theorized and demonstrated to be a driving force in the achievement of output growth. De Gregorio (2003), UNIDO (2002) and Ikiara (2002) among others have found the positive impact of FDI on growth, while others found the FDI impact on growth beneficial under given conditions. Debate on FDI – growth relationship is far from being resolved and we join our contribution by formulating a Solow–type model of growth as follows:

$$GDPGR = F(LPGROW, TFPG, GRCS, TRADO, FDIGR) \quad (1)$$

From (1) therefore, we formulated our econometric model.

$$GDPGR = \beta_1 + \beta_2 LPGROW + \beta_3 GRCS + \beta_4 TRADO + \beta_5 FDIGR + \beta_6 TFPG + \mu \quad (2)$$

Where:

GDPGR = is the real GDP growth rate
LPGROW = Labour productivity growth rate (%)
GRCS = Growth of real capital stock (%)
TFPG = Total factor productivity growth rate (%)
TRADO = Volume of trade/RGDP
FDIGR = FDI growth rate

The estimated regression model based on equation 2 is presented in table 2. In conducting a regression analysis, we began by making some assumptions about the appropriateness of our model for capturing the relationship between the dependent and independent variables. The most important of those assumptions we shall consider so as to obtain the best linear unbiased estimates of our parameters. The ordinary least squares (OLS) estimators (say $\hat{\beta}_2$), is said to be best linear unbiased estimator (BLUE) of (say $\hat{\beta}_2$) if; it is a linear function of a random dependent variable, and it is unbiased as expected value of ($\hat{\beta}_2$) is equal to the true value, β_2 and; it has minimum variance of all such linear unbiased estimators. According to Gauss-Markov theorem therefore, given the assumptions of the classical linear regression model, the least squares estimators in the class of all linear unbiased estimators, have minimum variance (i.e. BLUE) (Gujarati 2003, p. 79). Given that the satisfaction of the assumptions of the classical linear regression is a necessary condition for achieving BLUE, it is therefore worthwhile to test for the satisfaction of those assumptions because of the following reasons:

Under heteroscedasticity and autocorrelation, the OLS estimators, are still linear, unbiased, and asymptotically (that is in large samples) normally distributed, however, OLS estimators no longer possess minimum variance among all linear unbiased estimators. In other words, they are no longer efficient relative to other linear and unbiased estimators (they are no longer the best linear, unbiased estimators – BLUE). As a result of this, the usual t-statistics, F-statistic, R^2, and χ^2 of the affected OLS may no longer be valid. For instance, positive serial correlation in an OLS estimate will not affect the least squares slope estimates on the average (i.e. they are unbiased). However, least-squares estimates of the standard error of the regression will be biased downward (inefficiency). This will lead to erroneous conclusion that some explanatory variables significantly contributed to the explanation of the dependent variable when in the real sense they are not.

Generally, when there is autocorrelation of any kind, this will lead to the conclusion that the parameter estimates in an OLS are more precise than they actually are. There will be a tendency to reject or accept the null hypothesis when infact, they should not be rejected or accepted. A test of autocorrelation therefore is necessary in an OLS analysis so as to obtain the best linear and unbiased estimates.

Error variances of OLS is assumed constant (homoscedasticity). However, when error variances are not constant, there is heteroscedasticity. When there is heterscedasticity, OLS estimations places more weight on the observations with large error variances than those with smaller error variances. The OLS parameter estimators therefore are unbiased and consistent, but they are not efficient, therefore the consequence is similar to those of autocorrelation.

When two or more explanatory variables are highly correlated with each other, we say there is multicollinearity. Multicollinearity poses problem to the ordinary least squares' estimates. It will be possible to obtain the least squares' estimates of the regression coefficients (when there is no perfect collinearity) however, the interpretation of the OLS coefficients will be quite difficult. The difficulty arises due to the fact that the coefficient estimates of the first two highly correlated variables is interpreted as change in the dependent variable in question, 'other things remaining constant'. However, anytime a given change in one variable occurs, the corresponding observation on its highly correlated partner is likely to change in a predictably similar manner thereby making interpretation difficult (Pindyck and Rubinfeld, 1998). Another consequence of multicollinearity is that although $\hat{\beta}_5$ will remain unbiased estimators, their variances become too large and some explanatory variables become insignificant, yet the coefficient of determination are very high.

Based on the foregoing therefore, by running and interpreting the regression on model may lead to some erroneous conclusions on the relationship between the dependent and the independent variables unless other complementary tests are conducted and where the is a violation of the standard OLS assumptions a remedial action is taken. This therefore provided the justification for our complementary tests below.

Multicollinearity

The general linear model made many more assumptions other than the normality of the error term. One of the other assumptions is that there is no multicollinearity among the regressors in the model. Multicollinearity can be detected by several methods. One of these methods is the visual inspection of R^2 and significance of t-ratios. When R^2 is high and there are few significant t-ratios, we suspect the presence of multicollinearity. Another method of detecting multicollinearity that we adopted in this study is the pairwise correlations among regressors (the result based on this we presented in table 1). If the pairwise correlations among two regressors is in excess of 0.8, we suspect that multicollinearity poses serious challenge to our estimates (Gujarati, 2003). Caution must be exercised in interpreting this, high zero-order correlations are a sufficient but not a necessary condition for the presence of multicollinearity. The choice of this zero-order correlation lies in its simplicity and some identified weaknesses of other methods of detecting multicollinearity.

When multicollinearity is identified, we still face the problem of its correction. In

Table 1 Correlation matrix of variables of the model

	GDPGR	*LPGROW*	*GRCS*	*TRADO*	*TFPG*	*FDIGR*
GDPGR	1.000000	0.989139	0.643327	0.758698	0.920111	-0.360910
LPGROW	0.989139	1.000000	0.614682	0.754788	0.943982	-0.433684
GRCS	0.643327	0.614682	1.000000	0.928171	0.350990	-0.306534
TRADO	0.758698	0.754788	0.928171	1.000000	0.568728	-0.390403
TFPG	0.920111	0.943982	0.350990	0.568728	1.000000	-0.356832
FDIGR	-0.360910	-0.433684	-0.306534	-0.390403	-0.356832	1.000000

the process of correcting multicollinearity however, most (if not all) remedies may be worse than the disease. Taking a clue from the Goldberger's (1964) parody, Achen (1982) and Blanchard (1967), they observed that small sample size (micronumerosity) and lack of variability in the explanatory variables may cause problems that look like multicollinearity, and Blanchard recommended that we do nothing. A way around this therefore is the reliance on economic theory's a priori predictions in the determination of variables necessary for exclusion in a model and while we do this, be sure that we are not running into model specification bias.

Looking at the correlation matrix of table 1, we can see that labour is correlated with total factor productivity. However, labour and capital are by economic theory major subsets of total factor productivity. So, by excluding total factor productivity from the model, we are not likely to run into specification bias problem and doing so may reduce the multicollinearity. The result of the model in which total factor productivity was excluded is shown in table 3 and the significance of more independent variables is obvious. The high correlation between trade openness and growth of real capital stock cannot be easily linked a priori in economic theory and excluding either of the variables may likely lead to specification bias. We therefore present our result of the re-formulated model 3 as follows.

$$GDPGR = \beta_1 + \beta_2 LPGROW + \beta_3 GRCS + \beta_4 TRADO + \beta_5 FDIGR + \mu \quad (3)$$

Where:

GDPGR = is the real GDP growth rate
LPGROW: = Labour productivity growth rate (%)
GRCS = Growth of real capital stock (%)
TFPG = Total factor productivity growth rate (%)
TRADO = Volume of trade/RGDP
FDIGR = FDI growth rate

Data employed in this study are annual macroeconomic variables (1992-2007). Data on FDI, real GDP and trade were directly obtained and growth rates were computed from these figures. All other ratios and growth rates were directly sourced from the Economist Intelligence Unit (EIU) (2008) country Data – Annual time series.

RESULTS PRESENTATION

Table 2 below shows the result of our estimates based on equation 2 above. From the result, only labour productivity growth rate and growth rate of FDI significantly explained growth. The coefficient of determination is high though, but the result showed a symptom of multicollinearity (this we discussed earlier) because the

Table 2 OLS result of Growth Model for Nigeria.
Dependent Variable Is The Growth Rate Of GDP

Dependent Variable: GDPGR				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Constant	0.029405	0.010298	2.855348*	0.0171
LPGROW	0.009551	0.003189	2.994898*	0.0135
GRCS	0.000792	0.001020	0.777012	0.4551
TRADO	-0.018956	0.021890	-0.865978	0.4068
TFPG	6.92E-05	0.003580	0.019342	0.9849
FDIGR	0.058885	0.031325	1.879784***	0.0896
R-squared	0.988076			
Adjusted R-squared	0.982113			
Durbin-Watson stat	1.490467			
F-statistic	165.7221			
Prob(F-statistic)	0.000000			

* Means significant at 1% level
** Means significant at 5% level
*** Means significant at 10% level

coefficient of determination is very high, yet, there is only one significant variable (apart from the constant) at one percent significant level. The other variable is barely significant at 10 percent level indicating the possibility of multicollinearity (Pindyck and Rubinfeld, 1998). For the reasons earlier explained in the methodology, we therefore present results based on model 3 in table 3 below:

Table 3 OLS result of the re-formulated growth model for Nigeria.
Dependent variable is the growth rate of GDP

Dependent Variable: GDPGR				
Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
Constant	0.029285	0.007847	3.731981*	0.0033
LPGROW	0.009612	0.000511	18.81425*	0.0000
GRCS	0.000775	0.000447	1.734687	0.1107
TRADO	-0.018674	0.015556	-1.200442	0.2552
FDIGR	0.059150	0.026864	2.201836**	0.0499
R-squared	0.988075			
Adjusted R-squared	0.983739			
Durbin-Watson stat	1.494192			
F-statistic	227.8592			
Prob(F-statistic)	0.000000			

* Means significant at 1% level
** Means significant at 5% level
*** Means significant at 10% level

Result of the re-formulated growth model shows a better estimate than the earlier growth result of table 2 as one variable other than the constant is significant at 1 percent significance level while the other is significant at 5 percent level. This indicates that multicollinearity has been removed. Another striking feature of this estimate is that the coefficient of determination is almost as high as that of table 2. The independent variables have explained about 99 percent variability in the dependent variable. This is quite a good fit. The F-statistic is highly significant validating the joint contributions of all the independent variables in explaining output growth in Nigeria.

A serious look at the results showed that labour productivity growth significantly explained output growth in Nigeria. This is a validation of the Solow's theory and a confirmation of the role of human capital in productivity growth. A unit increase in labour productivity other things remaining constant, can cause output to grow by 0.009612 unit. The result also shows the positive impact of capital growth on productivity. However, this variable is not a significant factor explaining output growth in Nigeria.

Trade openness however is not a significant factor explaining output growth as trade openness actually depresses growth. Trade openness usually leads to high level of importation and lower domestic production. It also leads to net outflow of financial resources.

Foreign direct investment has significantly explained output growth. A unit rise in FDI flow can bring about 0.059150 rise in output. This study like many others (for example, Caves (1996), De Gregorio (2003), Ayanwale (2007) etc, has confirmed the significantly positive impact of FDI on output growth in Nigeria.

The reliability of the above results for policy formulation and forecast however depends on, the satisfaction of some assumptions of the general linear model. These assumptions include the normality distribution of the error term, lack of autocorrelation and the absence of heteroscedasticity among others. We therefore proceeded by testing these assumptions.

Normality test

Jarque-Bera statistic is a more formal test of normality. It is most useful in testing whether or not a given data (in our own case the residuals) approximates to the normal distribution. For a normal distribution, Kurtosis (K) is equal to 3, and skewness (S) is approximately equal to zero. Whether the above conditions hold or not, the Jarque-Bera statistic can provide answer to that. JB is given as:

$$JB = [\frac{N}{6}][S^2 + \frac{(K-3)}{4}]$$

JB statistic follows a chi-square distribution with 2 degrees of freedom. If JB> critical value of chi-square, we reject the null hypothesis of normality. In other words, if the computed probability value of the JB statistic is sufficiently low (maybe 0.05), (JB statistic is very different from zero) we reject the null hypothesis that the residuals are normally distributed. If the p-value is reasonably high, then the JB statistic is close to zero and we do not reject the normality assumption. In our own case here, the Jacque-Bera statistic is 0.50, and this indicates that the JB is sufficiently high and we must accept the null hypothesis that residuals are normally distributed.

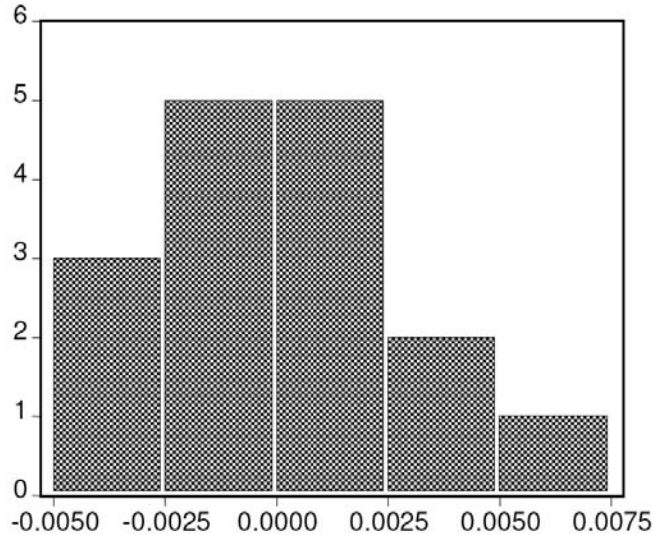

Figure 1 Histogram and the Jarque-Bera Statistic of the residuals

Autocorrelation

In this study, we also tested for autocorrelation or residual dependence over time. The test is necessary because both heteroscedasticity and autocorrelation violates the general linear model assumptions. When they are present, the usual OLS estimators, although linear and unbiased, they are no longer efficient relative to other linear and unbiased estimators (they are no longer BLUE) as the variance produced by the regression is no longer minimum among all linear unbiased estimators.

To test for autocorrelation therefore, we employed the Lagrange-Multiplier test (Breusch-Godfrey (BG) test). The procedures are as follows:

In a model; $Y_t = \beta_1 + \beta_2 X_{2t} + - - - + \mu_t$. This model is estimated and the obtained error term $\hat{\mu}_t$ is regressed on its lagged values in the form of the pth-order autoregressive, AR(p) as shown in equation 4:

$$\hat{\mu}_t = \rho_1 \hat{\mu}_{t-1} + \rho_2 \hat{\mu}_{t-2} + - - - + \rho_p \hat{\mu}_{t-p} + \varepsilon_t \quad (4)$$

Where ε_t is a white noise error term. The null hypothesis of no serial correlation of order p is tested (Ho: $\rho_1 = \rho_2 = - - - = \rho_p = 0$) as against the alternative which says at least one 'rho'is significantly different from zero (there is autocorrelation).

Breusch (1978) and Godfrey (1978) have shown that (in large samples), $(n-p)R^2 \sim \chi_p^2$. In other words, $(n-p)R^2$ follows the chi-square distribution with p degrees of freedom. If $(n-p)R^2$ exceeds the critical chi-square at the appropriate significance level, (i.e. lower probability of F-statistic) we reject the null hypothesis, otherwise, we accept the null hypothesis.

From our result of LM test in table 5 we can see that autocorrelation up to order 2 is ruled out as the probability of F-Statistic is very high (see table 5).

White's Heteroscedasticity Test

If the error term in a regression has a constant variance, we call it homoscedasticity but if variance is changing, we call it het-

Table 5 Lagrange-Multiplier result of serial correlation of order 2

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.242289	Probability	0.444219
Obs*R-squared	0.817458	Probability	0.338778

eroscedasticity. Although heteroscedasticity usually does not occur in time series studies, one cannot just ignore its possibility in a time series study, hence the test for heteroscedasticity in this study.

Ordinary least squares estimates are consistent in the presence of heteroscedasticity, but the conventional standard errors are no longer valid (Eviews User's Guide 1994-1997). White's test is a test of heteroscedasticity or specification error or both (when cross-section product terms are included). The white's heteroscedasticity test investigates the acceptability or otherwise of the null hypothesis that there is no heteroscedasticity while the Goldfeld-Quandt test involves rigorous re-ordering of observations and it is sensitivity to the choice of the number of omitted central observations. Secondly, the identification of the correct X variable with which to order the observations poses some challenges to this method. Breusch-Pagan-Godfrey Test (BPG) on its own is sensitive to normality assumption and breaks down when error terms are not normally distributed. White's test however does not rely on the normality assumption and easy to implement.

The procedure in a three-variable regression model is as follows:

Given the regression;

$$Y_i = \beta_1 + \beta_2 X_{2i} + X_{3i} + \mu_i \qquad (5)$$

The White's test involves obtaining the estimate of equation 5 and obtaining its residual $\hat{\mu}_i$, then regress $\hat{\mu}_i^2$ (in an auxiliary regression) on the original independent variables in 5, their squared values and cross products as follows:

$$\hat{\mu}_i^2 = \alpha_1 + \alpha_2 X_{2i} + \alpha_3 X_{3i} + \alpha_4 X_{2i}^2 + \alpha_5 X_{3i}^2 + \alpha_6 X_{2i} X_{3i} + V_i \qquad (6)$$

The R^2 obtained in equation 6 is then multiplied by N (number of observations). The White's test is based on the fact that when there is homoscedasticity;

$$NR^2 \sim \chi^2 \qquad (7)$$

with P degrees of freedom (where P is the number of independent variables in equation 5). If the chi-square value computed in equation 7 exceeds the critical chi-square value at the chosen level of significance, we conclude that there is heteroscedasticity, otherwise, we conclude that there is no heteroscedasticity which is to say that $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0$ which means that which $\hat{\mu}_i^2 = \alpha_1$ is a constant.

The white's test above confirms the acceptance of the null hypothesis of homoscedasticity. Based on the results conducted on the validity of the OLS estimate in table 3 therefore, we can conclude that the ordinary least square estimates are best linear and unbiased estimates (BLUE) of productivity growth in Nigeria and the model is good for predictions.

IMPLICATIONS OF FINDINGS

FDI has again been confirmed as a contributor to growth, and this study found out that

Table 6 White Heteroskedasticity result for the residual

White Heteroskedasticity Test:				
F-statistic	2.744987	Probability	0.444219	
Obs*R-squared	15.59422	Probability	0.338778	
Dependent Variable: Residual-squared				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-6.84E-05	0.000369	-0.185070	0.8835
LPGROW	-5.37E-05	6.01E-05	-0.892921	0.5360
LPGROW^2	6.08E-08	2.39E-06	0.025386	0.9838
LPGROW*GRCS	-6.42E-06	5.12E-06	-1.255013	0.4283
LPGROW*TRADO	0.000181	0.000173	1.049827	0.4845
LPGROW*FDIGR	-0.000323	0.000236	-1.365189	0.4025
GRCS	-3.36E-05	4.66E-05	-0.721783	0.6020
GRCS^2	-5.47E-07	1.60E-06	-0.342682	0.7898
GRCS*TRADO	8.77E-05	7.84E-05	1.119718	0.4641
GRCS*FDIGR	-5.12E-05	0.000164	-0.311851	0.8076
TRADO	0.000712	0.001570	0.453379	0.7290
TRADO^2	-0.001580	0.001459	-1.083223	0.4746
TRADO*FDIGR	0.003830	0.005943	0.644535	0.6355
FDIGR	0.001448	0.001258	1.151515	0.4552
FDIGR^2	-0.021046	0.013464	-1.563126	0.3623
R-squared	0.974638			
Adjusted R-squared	0.619577			
Durbin-Watson stat	2.361987			
F-statistic	2.744987			
Prob (F-statistic)	0.444219			

FDI has contributed significantly to output growth in Nigeria. The efficacy of FDI in generating the desired growth may be limited by the level of infrastructural development in Nigeria.

This study also found out that human factor is an important factor in FDI-growth debate in Nigeria. The implication of this is that if Nigeria put sufficient investment into high levels of human capital development, she can maximize the technological spillovers associated with foreign direct investment.

The import of the foregoing is that for FDI to continue to play an important role in the growth process of Nigeria and other countries, conducive environment such as infrastructural development, capital as well as human capital development must be pursued as a matter of priority in the national development goals. In addition, further efforts must be devoted to means of attracting further FDI.

Maximizing the benefits of FDI on growth requires a favourable macroeconomic and

institutional environment. In Nigeria like many other developing countries, poor macroeconomic and institutional constraints have watered down the impact of FDI on productivity and investment growth.

Improving policy and regulatory environment, tariff reforms, investor friendly tax and legal systems, removal of capital controls are essential to FDI's attraction and contributions to growth in any economy.

Lastly, investment and political stability, policy consistencies are also important in attracting and retaining foreign direct investment. There is therefore a great need to ensure political stability, corruption-free-economy, and ensure financial institutions stability and health. Provisions of investment incentives are important for maximizing the gains from FDI.

BIOGRAPHY

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