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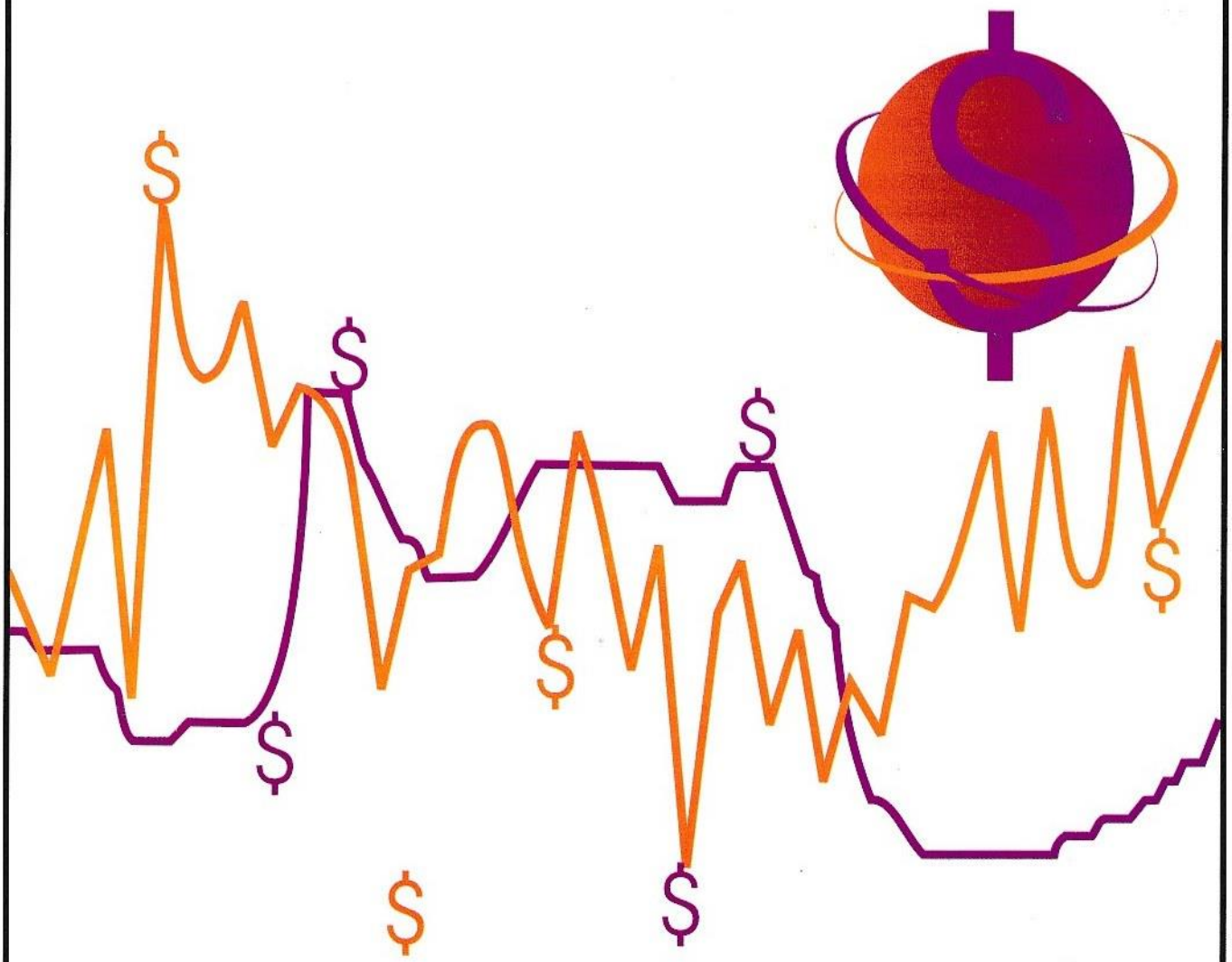

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Foreign Direct Investment and Economic Growth in Nigeria: An Analysis of the Endogenous Effects

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Abstract: This research endeavour set out to empirically investigate the relationship between foreign direct investment and economic growth in Nigeria between 1970 and 2008. The paper makes the proposition that there is endogeniety i.e., bi-directional relationship between FDI and economic growth in Nigeria. Single and simultaneous equation systems are employed to examine if there is any sort of feed-back relationship between FDI and economic growth in Nigeria. The results obtained show that FDI and economic growth are jointly determined in Nigeria and there is positive feedback from FDI to growth and from growth to FDI. The overall policy implication of the result is that policies that attract more foreign direct investments to the economy, greater openness and increased private participation will need to be pursued and reinforced to ensure that the domestic economy captures greater spillovers from FDI inflows and attains higher economic growth rates.

Keywords: Economic growth, endogeniety, FDI, Nigeria, three stage least square

INTRODUCTION

Over the last four decades, the macroeconomic performance of Nigeria can be described as being chequered. The average GDP growth rate of 3.95% achieved between 1970 and 2008 translates into a low growth rate of 1.49% in per capita income terms. This rate of growth in per capita income is insufficient to reduce in a significant way, the level of poverty which remains the primary goal of development policy in Nigeria. Ajayi (2006) notes that the savings rate in Nigeria is lower than that of most other countries and far lower than the required investments that can induce growth rates that are capable of alleviating poverty.

Recent studies have shown that Foreign Direct Investment (FDI) is what is needed to bridge that savings-investments gap that exists in Africa in general and Nigeria in particular. Prior to the 1970s, Foreign Direct Investment (FDI) was not seen as an instrument of economic development. The perception of FDI as parasitic and retarding the development of domestic industries for export promotion had engendered hostility to multi-national companies and their direct investments in many countries.

However, the consensus now is that FDI is an engine of growth as it provides the much needed capital for investment, increases competition in the host country industries and aids local firms to become more productive by adopting more efficient technologies or by investing in human and/or physical capital. Foreign direct investments contributes to growth in a substantial manner because it is more stable than other forms of capital flows (Ajayi, 2006).

While the FDI-growth linkage is still ambiguous, most macroeconomic studies nevertheless support the notion of a positive role of FDI within particular economic conditions. There are three main channels through which FDI can bring about economic growth. The first is through the release it affords from the binding constraint of domestic savings. In this case, foreign direct investment augments domestic savings in the process of capital accumulation. Second, FDI is the main conduit through which technology spillovers lead to an increase in factor productivity and efficiency in the utilization of resources, which leads to growth. Third, FDI leads to increase in exports as a result of increased capacity and competitiveness in domestic production. This linkage is often said to depend on another factor, called "absorptive capacity", which includes the level of human capital development, type of trade regimes and degree of openness (Ajayi, 2006; Borensztein *et al*., 1998).

The proposition made in this paper is that FDI facilitates economic growth on the one hand and on the other hand, economic growth attracts foreign direct investments into Nigeria. In other words, FDI and economic growth are both endogenously determined in Nigeria. Consequently, the objective of this study is to analyse the endogenous nature of the effects of FDI on

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economic growth in Nigeria, using data between 1970 to 2008. The aim is to find out if there is a bidirectional relationship between economic growth and FDi inflows into Nigeria.

This study is justified particularly for the following reasons. The study recognizes the growing evidence from cross-country studies that the relationship between FDI and economic growth is endogenous. That is, FDI engender growth and growth attracts FDI. The study does not simply assume endogeniety, but actively tests for endogeniety of FDI and economic growth in Nigeria, using appropriate econometric methodologies. The study is also significant because it differs from all other studies in scope (1970-2008). This gives the study an edge because it examines the FDI-growth relation in the near-contemporary context, taking account of past trends and recent developments in the global financial market for capital flows. Finally, the study adds to the literature by specifically examining the interactions between FDI and human capital and infrastructure with a view to examining whether FDI affects growth by itself or through an indirect interaction term.

LITERATURE REVIEW

There is a preponderance of empirical studies on the FDI-growth nexus and the determinants of FDI inflows. Early empirical works on the FDI-growth nexus modified the growth accounting method introduced by Solow (1957). This approach defined an augmented Solow model with technology, capital, labour, inward FDI and a vector of ancillary variables such as import and export volumes. Following this theory, most of the empirical works on the effects of FDI, focused on their impacts on output and productivity, with a special attention on the interaction of FDI with human capital and the level of technology (Vu and Noy, 2009).

However, recent empirical works have been influenced by Mankiw *et al.* (1992) pioneering research which adds education to the standard growth equation as a proxy for human capital. Blomstrom *et al.* (1994) and Coe *et al.* (1997) found that for FDI to have positive impacts on growth, the host country must have attained a level of development that helps it reap the benefits of higher productivity. In contrast, De Mello (1997) finds that the correlation between FDI and domestic investment is negative in developed countries.

Li and Liu (2005) found that FDI not only affects growth directly, but also indirectly through its interaction with human capital. Further, they find a negative coefficient for FDI when it is regressed with the technology gap between the source and host economy using a large sample, Borensztein *et al.* (1998) found similar results i.e. that inward FDI has positive effects on growth with the strongest impact, coming through the interaction between FDI and human capital.

De Mello (1997) found positive effects of FDI on economic growth in both developing and developed countries, but concludes that the long-run growth in host countries is determined by the spillovers of knowledge and technology from investing countries to host countries. Similarly, Balasubramanyam *et al.* (1996) found support for their hypotheses that the growth effect of FDI is positive for export promoting countries and potentially negative for import-substituting ones.

Alfaro *et al.* (2004) and Durham (2004) focused on the ways in which the FDI effect depends on the strength of the domestic financial markets of the host country. They both found that only countries with well developed banking and financial systems benefit from FDI. In addition, Durham (2004) found that only countries with strong institutional and investor-friendly legal environments are likely to benefit from FDI inflows. In another work, Hsiao and Shen (2003) add that a high level of urbanization is also conducive to a positive impact of FDI on growth.

Comparing evidence from developed and developing countries, Blonigen and Wang (2005) argued that mixing wealthy and poor countries is inappropriate in FDI studies. They note that the factors that affect FDI flows are different across the income groups. Interestingly, they find evidence of beneficial FDI only for developing countries and not for the developed ones, while they find the crowding-out effect of FDI on domestic investment to hold for the wealthy group of nations.

Recently, Vu and Noy (2009) carried out a sectoral analysis of foreign direct investment and growth in developed countries. They focused on the sector specific impacts of FDI on growth. They found that FDI has positive and no statistically discernible effects on economic growth through its interaction with labour. Moreover, they found that the effects seem to be very different across countries and economic sectors.

Carkovic and Levine (2005) argue that the positive results found in the empirical literature are due to biased estimation methodology. When they employed a different estimation techniques i.e. Arellano-Bond Generalized Moment of Methods (GMM), they found no robust relationship between FDI inflows and domestic growth.

In line with the notion that there is an endogenous relationship between FDI and economic growth, Ruxanda and Muraru (2010) investigated the relationship between FDI and economic growth in the Romanian economy, using simultaneous equation models. They obtained evidence of the bi-directional connection between FDI and economic growth, meaning that incoming FDI stimulates economic growth and in its turn, a higher GDP attracts FDI.

In a paper most similar to this work, Li and Liu (2005) investigated the relationship between FDI and economic growth based on a panel of 84 countries, using both single equation and simultaneous equation systems.

They found that FDI affects growth indirectly through its impact on human capital. This work is similar to their own in that we use both single equation and simultaneous equation systems. However, our work is different in that it is country specific (Nigeria) and involves a longer time frame (1970-2008).

The consensus in the literature seems to be that FDI increases growth through productivity and efficiency gains by local firms. The empirical evidence is not unanimous, however. Available evidence for developed countries seems to support the idea that the productivity of domestic firms is positively related to the presence of foreign firms (Globerman, 1979; Imbriani and Reganati, 1997). The results for developing countries are not so clear, with some finding positive spillovers (Blomstrom and Sjoholm, 1999; Kokko, 1994) and others such as Aitken *et al.* (1997) reporting limited evidence. Still others find no evidence of positive short-run spillover from foreign firms.

Some of the reasons adduced for these mixed results are that the envisaged forward and backward linkages may not necessarily be there (Aitken *et al.*, 1997) and that arguments of MNEs encouraging increased productivity due to competition may not be true in practice (Ayanwale, 2007). Other reasons include the fact that MNEs tend to locate in high productivity industries and, therefore, could force less productive firms to exit (Smarzynska, 2002). Caves (1996) also postulates the crowding out of domestic firms and possible contraction in total industry size and/or employment. However, crowding out is a more rare event and the benefit of FDI tends to be prevalent (Cotton and Ramachandran, 2001).

Further, the role of FDI in export promotion remains controversial and depends crucially on the motive for such investment (World Bank, 2009). The consensus in the literature appears to be that FDI spillovers depend on the host country's capacity to absorb the foreign technology and the type of investment climate (Obwona, 2004).

The review here and in the references provided, shows that the debate on the impact of FDI on economic growth is far from being conclusive. The role of FDI seems to be country specific and can be positive, negative or insignificant, depending on the economic, institutional and technological conditions in the recipient countries. Most studies on FDI and growth are cross-country evidences, while the role of FDI in economic growth can be country specific. Further, only a few of the country specific studies actually took conscious note of the endogenous nature of the relationship between FDI and growth in their analyses, thereby raising some questions on the robustness of their findings.

Finally, the relationship between FDI and growth is conditional on the macroeconomic dispensation the country in question is passing through. In fact, Zhang (2001) asserts that "the extent to which FDI contributes to growth depends on the economic and social condition or in short, the quality of the environment of the recipient country". In essence, the impact FDI has on the growth of any economy may be country and period specific and as such there is the need for country specific studies. This discovery from the literature is what provides the motivation for this study on the relationship between FDI and economic growth in Nigeria.

The FDI-growth relation in Nigeria: There are several Nigeria-specific studies on the relationship between FDI and economic growth in Nigeria. Some of the pioneering works include Aluko (1961), Brown (1962) and Obinna (1983). These authors separately reported that there is a positive linkage between FDI and economic growth in Nigeria. Edozien (1968) discussed the linkage effect of FDI on the Nigerian economy and submits that these have not been considerable and that the broad linkage effects were lower than the Chenery-Watanabe average. Oseghale and Amonkhienan (1987) found that FDI is positively associated with GDP, concluding that greater inflows of FDI will spell a better economic performance for the country.

Odozi (1995) placed special emphasis on the factors affecting FDI flows into Nigeria in both pre and post Structural Adjustment Programme (SAP) eras and found that the macro policies in place before SAP where discouraging investors. This policy environment led to the proliferation and growth of parallel markets and sustained capital flight.

Adelegan (2000) explored the Seemingly Unrelated Regression model (SUR) to examine the impact of FDI on economic growth in Nigeria and found out that FDI is pro-consumption, pro-import and negatively related to gross domestic investment. In another paper, Ekpo (1995) reported that political regime, real income per capita, inflation rate, world interest rate, credit rating and debt service were the key factors explaining the variability of FDI inflows into Nigeria. Similarly, Ayanwale and Bamire (2001) assessed the influence of FDI on firm level productivity in Nigeria and reported positive spillover of foreign firms on domestic firm productivity.

Ariyo (1998) studied the investment trend and its impact on Nigeria's economic growth over the years. He found that only private domestic investment consistently contributed to raising GDP growth rates during the period considered (1970-1995). Furthermore, there is no reliable evidence that all the investment variables included in his analysis have any perceptible influence on economic growth. He therefore suggested the need for an institutional rearrangement that recognizes and protects

the interest of major partners in the development of the economy

A common weakness that has been identified in most of these studies is that they failed to control for the fact that most of the FDI inflows to Nigeria has been concentrated on the extractive industry (to oil and natural resources sector). According to Ayanwale (2007), these works invariably assessed the impacts of FDI inflows to the extractive industry on Nigeria's economic growth.

Akinlo (2004) specifically controlled for the oil, - non-oil FDI dichotomy in Nigeria. He investigated the impact of foreign direct investment (FDI) on economic growth in Nigeria, using an error correction model (ECM). He found that both private capital and lagged foreign capital have small and not a statistically significant effect on economic growth. Further, his results support the argument that extractive FDI might not be growth enhancing as much as manufacturing FDI.

Examining the contributions of foreign capital to the prosperity or poverty of LDCs, Oyinlola (1995) conceptualized foreign capital to include foreign loans, direct foreign investments and export earnings. Using Chenery and Stout's two-gap model (Chenery and Stout, 1966), he concluded that FDI has a negative effect on economic development in Nigeria. Further, on the basis of time series data, Ekpo (1995) reported that political regime, real income per capita, rate of inflation, world interest rate, credit rating and debt service were the key factors explaining the variability of FDI into Nigeria.

Anyanwu (1998) paid particular emphasis on the determinants of FDI inflows to Nigeria. He identified change in domestic investment, change in domestic output or market size, indigenization policy and change in openness of the economy as major determinants of FDI inflows into Nigeria and that it effort must be made to raise the nation's economic growth so as to be able to attract more FDI.

Ayanwale (2007) investigated the empirical relationship between non-extractive FDI and economic growth in Nigeria and also examined the determinants of FDI inflows into the Nigeria economy. He used both single-equation and simultaneous equation models to examine the relationship. His results suggest that the determinants of FDI in Nigeria are market size, infrastructure development and stable macroeconomic policy. Openness to trade and human capital were found not to be FDI inducing. Also, he found a positive link between FDI and growth in Nigeria. Our work is similar to that of Ayanwale (2007), in that we seek to examine the determinants and impact of FDI on growth in the Nigerian economy. However, our work is improved because we consider a longer time frame (1970-2008), whereas that of Ayanwale was (1970-2002) and we use a more robust system of equation i.e. three stage least squares, 3SLS estimation methodology.

METHODOLOGY

FDI can be analytically linked to growth through a differentiated impact of FDI on productivity of both domestic labour and domestic capital, through the transmission of superior technology. The analytical structure, is therefore, in the spirit of Romer (1986). The importance of FDI can be seen as closing the capital-gap identified by Romer (1993) as the main obstacle facing developing counties trying to catch-up with advanced countries. This gap is more in knowledge or human capital, than the gap in physical capital.

In the spirit of De Mello (1997), Ramirez (2000) and Fedderke and Romm (2006), the analytical framework that links FDI to economic growth can be analyzed via an augmented Cobb-Douglas production function, as follows:

$$Y = Af\left[L, K_p, K_f, E\right] = AL^{\alpha} K_p^{\beta} E^{(1-\alpha-\beta)} \quad (1)$$

where, Y is real output, K_p is the domestic capital, K_f is foreign capital, L is labour and E refers to the externality or spill over effect ($\neq 1$) generated by the additions to the stock of FDI. α and β are the shares of domestic labour and capital respectively and A captures the efficiency of production. Here, we assume that $\alpha + \beta < 1$. For simplicity, let the externality, E be represented by a Cobb-Douglas function of the type:

$$E = \left[L, K_p, K_f^{\gamma}\right]^{\theta} \quad (2)$$

where K_f^{γ} denotes foreign owned capital. Combining Eq. (1) and (2), we obtain:

$$Y = AL^{\alpha+\theta(1-\alpha-\beta)} K_p^{\beta+\theta(1-\alpha-\beta)} K_f^{\gamma\theta(1-\alpha-\beta)} \quad (3)$$

From Eq. (2),$(\delta K_p/\delta K_f)(K_f/K_p) = -\gamma$, such that $\gamma \neq 0$ implies that domestic and foreign capital may either serve as substitutes or complements. This corresponds to the crowding-out and crowding-in effects of FDI respectively. (Fedderke and Romm, 2006). Specifically, when $\gamma = 0$, foreign direct investment crowds out domestic investment (De Mello, 1997). By contrast, θ captures the spill over effect of foreign direct investment on the productivity of capital and labour. It is therefore, possible to interpret γ as the instantaneous or marginal effect of foreign capital on output and θ as the long-run or intertemporal elasticity of substitution between domestic and foreign capital. Finally, we can generate the dynamic production function by taking the logarithms and time derivatives of Eq. (3).

$$g_y = g_A + [\alpha + \theta(1-\alpha-\beta)]g_L[\beta + \theta(1-\alpha-\beta)]g_{k_p} + [\gamma\theta(1-\alpha-\beta)]g_{k_f} \quad (4)$$

where, g_i is the growth rate of i and i stands for Y, A, L, K_p and K_f, respectively.

Model specification: Following the analytical framework presented in the previous section, we seek to econometrically estimate: the relationship between FDI inflows and economic growth in Nigeria. To ensure that the conclusions we arrive at are robust and useful for policy making, we employ two alternative estimation techniques for estimating the nature of the first relationship. Hence, we employ single-equation models and simultaneous equation models to examine the FDI-growth relationship in Nigeria. Our procedure is motivated by the notion that there might be simultaneity (bi-directional) bias between FDI and growth. That is FDI is affected by growth and at the same time, the rate of economic growth is influenced by FDI.

Single equation models:

FDI and growth: We estimate both the growth impact of FDI and the determinants of FDI by means of a vector error correction model (VECM). Our model is adapted from Ayanwale (2001), Akinlo (2004), Ekpo (1995) and Fedderke and Romm (2006). Hence, for the FDI growth relation, we specify thus:

$$YG = f(L, K_p, F, H, O, C_g, B_gF_n, D, T) \quad (5)$$

In econometric form, the model can be written thus:

$$YG = \beta_0 + \beta_1 L + \beta_2 K_p + \beta_3 F + \beta_4 H + \beta_5 O + \beta_6 C_g + \beta_7 B_g + \beta_8 F_n + \beta_9 D + \beta_{10} T + \mu \quad (6)$$

where YG is real GDP growth rate; L is labour, K_p and F are stock of private and foreign capital respectively; C_g is real government consumption, O is trade openness, H is human capital, D is the adjustment dummy, 1 for adjustment periods 1986-2001 and 0 otherwise, F_n stands for financial depth, B_g is budget balance to GDP and T, is the time trend to capture the cyclical or secular trends in output during the period under review. Reparamertrization and taking lower case letters to denote natural logarithms and Δ, to denote the difference operator provides the VECM specification:

$$\Delta y_t = \beta_0 + \beta_1 \Delta l_{t-i} + \beta_2 \Delta k_{pt-i} \beta_3 \Delta f_{t-i} + \beta_4 \Delta h_{t-i} + \beta_5 \Delta O_{t-i} + \beta_6 \Delta c_{gt-i} + \beta_7 \Delta b_{gt-i} + \beta_8 \Delta F_{nt-i} + \beta_9 D + ecm_{t-1} + \mu \quad (7)$$

where $\beta_1, \beta_2, \beta_3, \ldots \beta_9$ are interpreted as the various elasticises and ecm $_{t-1}$ is the short-run error correction coefficient.

Simultaneous equation systems: We first use a five simultaneous equation system and then we narrow down to a two-equation system to examine the relationship between FDI and growth in Nigeria. The use of the simultaneous equation estimation is motivated by the simultaneity bias between FDI and growth.

The three stage least squares (3SLS) approach: We use the three stage least squares approach (Gujarati and Porter, 2009) to estimate a system of five endogenous equations. This approach is appropriate when estimating systems of equations that are over identified (Ruxanda and Muraru, 2010; Greene, 2003) and it has been the preferred choice in empirical studies with numerous systems of equations (Ghatak and Halicioglu, 2006). The equations of the system are described as follows:

The growth equation: This is specified thus:

$$YG = c(1) + c(2)*(F) + c(3)*(M) + c(4)*(o) + c(5)*(H) \quad (8)$$

where M stands for the ratio of gross capital formation to GDP and the other nomenclatures are as earlier described.

The FDI equation: This is specified thus:

$$F = c(6) + c(7)*(Y) + c(8)*(M) + c(9)*(o) + c(10)*(H) \quad (9)$$

Capital stock equation: This is specified thus:

$$M = c(11) + c(12)*(F) + c(13)*(Y) + c(14)*(F_n) + c(15)*(S_d) \quad (10)$$

where, S_d is the level of domestic savings and other variables are as described earlier.

Openness equation: This is specified thus:

$$O = c(16) + c(17)*(Y) + (18)*(E) + c(19)*(M) + c(20)*(I) \quad (11)$$

where, E represents the real effective exchange rate and I is the average deposit rate.

The savings equation: This is specified thus:

$$Sd = c(21) + c(22)*(Y) + c(23)*(I) + c(24)*(E) + (25)*(H) \quad (12)$$

All the variables are as earlier described. For each of the equations, we use the lagged first difference of all the exogenous variables as our instruments. Ruxanda and

Table 1: Unit root tests

	AD		FPP		
Variables	Level	1st Difference	Level1st	Difference	Conclusion
BG	-3.91(0) ***	-	-3.97(0)***	-	$I(0)$
E	-0.99(1)	-5.73(0)***	0.99(0)*	-5.34(1)***	$I(1)$
F	4.98(0)***	-	4.94(1)***	-	$I(0)$
FN	-0.85(1)	-5.14(0)***	0.91(5)	6.08(3)***	$I(1)$
I	-0.67(0)	-7.76(0)***	0.69(5)***	8.10(4) ***	$I(1)$
H	-2.892(0)*	-	0.82(5)	3.24(2) ***	$I(1)$
L	0.33(0)	-4.32(0)***	0.81(5)	4.26(1) ***	$I(1)$
KP	0.89(1)	5.45(0)***	0.75(0)	6.04(0)***	$I(1)$
N	-1.85(0)	11.45(2)***	1.72(1)	-8.31(1)***	$I(1)$
O	1.52(2)	8.21(1)***	1.02(2)	-9.01(1)***	$10I(1)$
R	-1.93(9)	-6.63(8)***	1.82(5)	5.23(2) ***	$I(1)$
Y	0.21(1)	7.52(0)***	0.81(5)	-7.28(1) ***	$I(1)$
YG	-1.02(0)	4.23(0)***	-1.75(0)	-3.04(0)***	$I(1)$
YP	-0.25(2)	-3.01(0)***	1.02(1)	8.31(1)***	$I(1)$

***: significance at the 1%, **: significance at the 5%, *: indicates significance at the 10%, The values in bracket for the ADF and PP test, indicates the optimal lag length selected by the SIC within a maximum lag of 13

Muraru (2010) use a similar approach. All the variables used in the model were obtained from the World Development Indicators (WDI, 2010) and supplemented with data from the Central Bank of Nigeria whenever necessary.

The A priori expectations: In this sub-section, we focus on the expected theoretical relationship that should hold in the equations. This is achieved by examining the signs and magnitudes of the parameters to be estimated. In the FDI-growth equation (i.e., Eq. (7)), we expect the signs of the parameters β_1, β_2, β_3, β_4 and β_7 to assume positive signs. This theoretical expectation follows naturally from the analysis of production theory. β_1 represents the coefficient for labour and the higher the labour input in a production process, the higher will be the output. β_2 represents the stock of private capital, while β_3 is for foreign capital. Again, from the simple production function, the higher the capital input in a production process, the higher will be the level of output, hence, our theoretical expectation of a positive sign for these parameters are justified.

We also anticipate that the parameter β_4 will assume a positive sign. Thus is in line with theories of human capital development which postulates that the better the quality and supply of human capital the higher will be the productivity of labour. The parameter β_5 is indeterminate. This is because there is no straight rule about the effects of openness on a economy. Openness may harm or accelerate growth in an economy depending on the level of development of that economy. The effect of government consumption on an economy is not also certain. It depends on whether or not government expenditure crowds-out private consumption. If government expenditure crowds-out private consumption, then β_6 will be positive. If it does not, then it will be negative.

The sign of the parameter for financial development (β_8) is indeterminate. It depends on whether financial development reduces or increases capital flight. If it increases capital flight, it will have a positive value. If it does not, it will have a negative value (Akinlo, 2006). The coefficient for the adjustment variable, (β_9) may take a positive or negative sign, depending on the way the adjustment works. If adjustment enhances efficiency, as it should, the sign should be positive. A negative sign for the adjustment variable will imply that the SAP programme was nit growth enhancing. (β_{10}) can be positive or negative, depending on whether annual growth rate in the country increased or decreased during the period.

RESULTS ANALYSIS AND DISCUSSION

Table 1 presents the unit root tests for all the variables used in the equations. The test is conducted using two different unit root models. That is, the Augmented Dickey Fuller (ADF) model and the Philips-Perron (PP) model. The essence of using the two testing procedures is for confirmatory testing.

The Schwarz Information Criterion (SIC) is used to select the optimal lag length of the models. The tests are conducted with a maximum permissible lag length of 9 lags. Table 1 indicates that all the variables in the model are not stationary at the levels except for two variables: fiscal budgets as a ratio of GDP and foreign direct investment. After taking the first differences of all the other variables they became stationary. Interestingly, the two tests statistics (ADF) and (PP) returned results that lead to similar conclusions. These results imply that the regression results that would be obtained from the models specified in Chapter 3 would return spurious results if there is no long-run relationship among the variables in the model. Since not all the variables are stationary at levels, it necessarily means that we have to investigate the cointegration properties of the variables in the equations.

Table 2: Johansen co integration test for FDI-growth model

Null hypothesis	Alt. hypothesis	Test statistic	Critical value (5%)	p-value
Trace test				
r=0	r=<1	549.6560	197.3709	0.0001
r=1	r=<2	367.5954	159.5297	0.0000
r=2	r=<3	248.4119	125.6154	0.0000
r=3	r=<4	163.6921	95.75366	0.0000
r=4	r=<5	96.17374	69.81889	0.0001
r=5	r=<6	54.21201	47.85613	0.0113
r=6	r=<7	31.41903	29.79707	0.0322
r=7	r=<8	17.94208	15.49471	0.0210
r=8	r=<9	4.709390	3.841466	0.0300
Maximum Eigen value test				
r=0	r=1	182.0606	58.43354	0.0000
r=1	r=2	119.1835	52.36261	0.0000
r=2	r=3	84.71986	46.23142	0.0000
r=3	r=4	67.51833	40.07757	0.0000
r=4	r=5	41.96173	33.87687	0.0044
r=5	r=6	22.79297	27.58434	0.1825
r=6	r=7	13.47696	21.13162	0.4093
r=7	r=8	13.23269	14.26460	0.0723
r=8	r=9	4.709390	3.841466	0.0300

Trace test: 9 cointegration equation, maximum eigenvalue test: 5 cointegrating equations at the 5% level of significance

Table 3: Estimates of the standard and ECM FDI-growth equation

Dependant variable GDP growth rate (YG)	Standard model	ECM model
Constant	-1.660088	-0.502262
	(3.68013)	(3.5542)
t	0.1127***	5.78E-06**
	(0.2148)	(1.81E-05)
D(L)	5.53E-07**	6.00E-06**
	(6.53E-05)	(2.93E-05)
D(KP)	-1.32E-06**	-2.30E-07
	(-3.28E-05)	(1.74E-05)
D(F)	5.9923***	5.49029***
	(1.91432)	(1.49326)
D(H)	1.53E-06	0.025996
	(1.74E-05)	(0.0107)
D(O)	-0.0078***	-0.539213
	(0.002556)	(0.0411)
D(CG)	-0.030715	-0.04879
	(0.046470)	(0.1064)
D(BG)	0.485657	-1.2490
	(0.317018)	(3.02124)
D(FN)	0.011264**	0.07518**
	(0.02574)	(0.02040)
SAP	-2.029251	0.075187
	(3.396944)	(0.0107)
ECM(-1)		-0.5168*** (0.1843)
R^2 *Adj*	0.1198	0.3125
D.W	2.89	2.61
ARCH (2 lags)	0.42 (0.6557)	13.41 (0.000)
RESET (2 terms)	0.61 (0.5517)	7.62 (0.0018)
Chow (1986)	2.03 (0.09173)	2.03(0.0913)

***: denotes asymptotic significance at the 1%, **: denotes asymptotic significance at the 5%, *: denotes asymptotic significance at the 10%, Values in brackets represent standard errors for parameters and p-values for the relevant test statistic

The results for the cointegration tests are presented in Table 2.

We utilize the Johansen co-integration test procedure and use both the Trace criterion and the Maximum Eigenvalue criterion to determine the rank of the cointegrating relationships among the variables.

The decision criterion is thus: when the Trace Statistic is greater than the 5% critical value, we reject the null hypothesis of no cointegrating relation and conclude that there is a cointegration among the variables. We continue the testing in an iterative manner until we are no longer able to reject the null hypotheses of no cointegarting relationship. Table 2 presents the Unrestricted Cointegration Rank Test using the Trace Statistic. The test is conducted with the assumption that there is a trend and a constant term in the model. Further, the SIC criterion is used to determine the optimal lag length of the cointegrating VAR equations.

The trace test indicatse that there are 9 cointegrating equations in the FDI-growth equation, while the maximum eigenvalue test indicates that there are 5 cointegrating equations in the model. These results lead to the conclusion that that there is a long- run relationship among the variables in the equation. It is economic commonsense that long-run relationships usually have disequilibrium in the short-run; hence, to tie the short-run distortions in the relationship to the long-run equilibrium relationship, it is necessary to estimate an error-correction model, which will show the speed of adjustment and the average time it will take for short-run distortions in the relationship to be corrected. The results of these models are presented in the next section.

Analysis of the results from the single -equation FDI-growth model: Table 3 presents the results of the single equation FDI-Growth model, the results are presented with the error correction specification side-by-side. From the table, it can be observed that some of the a priori expectations that are expected to hold do not hold.

Column two of Table 3 presents the results from the standard single equation FDI-Growth-model. Model specification tests for the standard model are presented in the lower rows of the column. The adjusted R squared value of 11.98% is an indication that the model is a poor-fit of the relationship between economic growth and foreign direct investment in Nigeria. The Durbin Watson statistic of 2.89, which is well above 2, is also suggestive that there is positive first-order auto correlation in the error terms from the equation. The ARCH test indicates that there is autoregressive conditional heteroscedasticity in the error terms. Finally, the regression specification (RESET) test for omitted variables cannot be rejected; leading to the conclusion that the model may have omitted some relevant variables. For these reasons and others, we do not bother to discuss the results of the FDI-Growth standard model. The results from the error correction model are rather discussed.

Column 3 presents the results of the error correction specification of the FDI-Growth model. The second coefficient t represents the impact of technological development on FDI. A time trend was used as a crude

Table 4: Estimates from three-stage least squares model
Endogenous variables: (YG), F, M, O, SD

	CoefficientStd.	SDE	t-statistic	Prob
C(1)	31.12033	15.23691	2.023372	0.0469
C(2)	0.020170	0.011500	2.340318	0.0341
C(3)	0.004654	0.026319	0.176847	0.8599
C(4)	-3.620234	1.853707	-3.634591	0.0084
C(5)	-1.51E-05	0.000104	-0.145354	0.8846
C(6)	-243461.0	411882.5	-0.591093	0.5553
C(7)	1732940.	2995535.	4.578508	0.0008
C(8)	-60.7641	4284.5733	-0.213527	0.8312
C(9)	3233.385	2031.695	4.591472	0.0054
C(10)	-0.786862	1.021263	-0.770480	0.4422
C(11)	5.401337	642.9134	0.008401	0.9933
C(12)	3.50E-05	0.009056	3.003869	0.0009
C(13)	-46.71519	1718.352	-0.027186	0.9783
C(14)	7.327896	3.132395	2.338379	0.0003
C(15)	6.884509	4. 378795	-1.913439	0.0893
C(16)	287.4563	385.9026	0.744893	0.4575
C(17)	1159.835	2492.008	1.465422	0.0423
C(18)	-17.73678	33.18012	-0.534560	0.5937
C(19)	-0.167051	4.646458	-0.035952	0.9714
C(20)	1.505825	10.30836	0.146078	0.8841
C(21)	10.96158	446.2230	0.024565	0.9804
C(22)	68.60937	27. 45336	-2.024991	0.0001
C(23)	0.171471	7.451989	0.023010	0.9817
C(24)	-0.404457	20.42054	-0.019806	0.9842
C(25)	-5.57E-06	0.000294	-0.018937	0.9849

Determinant residual variance 2.40E+28
Author's computations

proxy for technological development. The positive and significant sign of the coefficient is an indication that technological developments have had a positive impact on the level of economic growth in Nigeria. This can also be interpreted as evidence of technology diffusion which can be attributed to foreign direct investment.

As expected, labour force has a positive relationship with economic growth in Nigeria. The parameter estimate for labour force is significant at the 5% level. This result conforms with traditional growth models which speculate that increases in material input in the production process leads to increases in material output. Further, private capital (*Kp*) assumed a positive and insignificant value. The most crucial parameter in the model, that is, the parameter for foreign direct investment assumed a positive and significant value. This result is in line with the a priori expectations of the Ownership, location and Internalization (OLI) theory of foreign direct investment. This result provides strong evidence of the positive and significant impacts of FDI pn economic growth in Nigeria.

Though not statistically significant, the parameter estimates for trade openness indicates that trade openness has been growth inhibiting in Nigeria. This result can pose policy challenges and it is also difficult to reconcile the fact that FDI causes growth, whereas, openness inhibits growth. Though this kind of inconsistency in results can be attribute to data issues, it is however intuitive for the policy maker, because the results may imply that the nature of FDI-inflows to Nigeria may not have been evenly distributed in such a way that forward and backward linkages can be generated. Indeed Ayanwale (2001) found in his study on economic growth and FDI-inflows to Nigeria, that most of the FDI that came to Nigeria was directed to the extractive industries. This is an indication of the weak interactions that exist between FDI policies and trade policies in Nigeria.

Government size as a ratio of GDP (*Cg*) and the budget balance as a ratio (*Bg*) of GDP, both assumed negative signs. This implies that fiscal activities of government in Nigeria have had negative impacts on growth in Nigeria. This outcome may not be suppressing because, the domination of government's fiscal activities (consumption and production) in the economy is usually not efficiently done, thereby not producing the required effects on growth. Another implication of these negative signs is that government consumption and fiscal activities have some kind of crowding out effect on private consumption and investment behaviours. All of these may explain the reason for the inverse relationship observed between government consumption as a ratio of GDP and government fiscal balance as a ratio of GDP and economic growth in Nigeria. Interestingly, the parameter estimate for the effect of financial structure (*FN*) on economic growth assumed a positive sign as expected. Though the estimate is not statistically significant, it gives us a vague picture of the positive impacts of financial development on economic growth in Nigeria.

The parameter estimate of utmost interest is that of the error correction variable, which seeks to tie short run distortion in the model to the long-run equilibrium path. The ECM variable used in the model, are the residual terms derived from the standard FDI-growth model in Column 2, Table 3. The residuals, as is conventional in econometric practise, are introduced into the ECM model after taking the first lag. From the table, we observe that the parameter estimate is -0.5168 and the estimate is significant at the 1% level of significance. This value can be interpreted to mean that 51.68% of the distortions in the equilibrium relationship between economic growth and the variables included in the model would be corrected in the present period. To find out how long it will take to fully correct any distortion in the long-run relationship, we simply divide one by the ECM coefficient i.e., (1/0.5168) = 1.934. Since this value is close to two, it implies that it will take approximately two years for full adjustments to take place after a shock has occurred.

A quick examination of the model specification tests presented in the lower rows of the Table 3, clearly indicates that the ECM model is superior to the standard model. First, the adjusted R squared value of 13.41, though still poor, better fits the data than the standard model. The Durbin-Watson statistic of 2.6 is a weak indication of the presence of positive serial autocorrelation in the residuals (which can be ignored). The ARCH test clearly leads to the rejection of the null

Table 5: 3SLS specification and summary measures

Growth equation: D(YG) = C(1) + C(2)*D(F) + C(3)*D(M) + C(4)*D(O) +C(5) *D(H)			
Instruments: D(F(-1)) D(M(-1)) D(O(-1)) D(YG(-1)) C			
Observations: 36			
R-squared	-140.802979	Mean dependent var	-0.216325
Adjusted R-squared	-159.100128	S.D. dependent var	7.535132
S.E. of regression	95.34254	Sum squared resid	281796.2
Durbin-Watson stat	1.979974		
FDI equation: D(F) = C(6) + C(7)*D(LOG(Y)) + C(8)*D(M) + C(9)*D(O) +C(10)*D(H)			
Instruments: D(LOG(Y(-1))) D(M(-1)) D(O(-1)) D(H(-1)) F(-1) C			
Observations: 35			
R-squared	-9.808422	Mean dependent var	63696.09
Adjusted R-squared	-11.249545	S.D. dependent var	232059.7
S.E. of regression	812193.9	Sum squared resid	1.98E+13
Durbin-Watson stat	2.066490		
Capital stock equation: D(M) = C(11) + C(12)*D(F) + C(13)*D(LOG(Y)) + C(14)*D(FN) + C(15)*D(SD)			
Instruments: D(F(-1)) D(LOG(Y(-1))) D(FN(-1)) D(SD(-1)) C			
Observations: 36			
R-squared	-0.003299	Mean dependent var	2.741945
Adjusted R-squared	-0.132757	S.D. dependent var	961.1520
S.E. of regression	1022.964	Sum squared resid3	2440118
Durbin-Watson stat	2.999569		
Openness Equation: D(O) = C(16) + C(17)*D(LOG(Y)) + C(18)*D(E) + C(19)*D(M) + C(20)*D(I)			
Instruments: D(F(-1)) D(LOG(Y(-1))) D(E(-1)) D(I(-1)) C			
Observations: 35			
R-squared	-10.347033	Mean dependent var	64.56400
Adjusted R-squared	-11.859970	S.D. dependent var	153.6865
S.E. of regression	551.1321	Sum squared resid	9112397.
Durbin-Watson stat	2.233819		
Savings equation: D(SD) = C(21) + C(22)*D(LOG(Y)) + C(23)*D(I) + C(24)*D(E) +C(25)*D(H)			
Instruments: D(SD(-1)) D(LOG(Y(-1))) D(E(-1)) D(I(-1)) C			
Observations: 36			
R-squared	-89.309799	Mean dependent var	0.239859
Adjusted R-squared	-100.962677	S.D. dependent var	2.782814
S.E. of regression28.09990Sum squared resid	28.09990	Sum squared resid	24477.73
Durbin-Watson stat	1.927645		

Author's computations

hypothesis of the presence of auto regressive conditional heteroscedasticity in the models. The RESET test also suggests that the variable no longer suffers from omitted variable bias.

Tests of structural breaks within the period under review are also carried out. From the results obtained in the standard and ECM models, it is clear that the Structural Adjustment Programme (SAP) which commenced in 1986, caused some kind of structural break in the relationship between economic growth and the variables included in the model. This can be observed from the F values of 2.03 and 2.04 of the Chow breakpoint test with statistically significant probabilities.

Analysis of the results from 3SLS model: The method of three stage least squares estimation is popular in applied work because it is known to be fully efficient since it takes into account all available information in the estimation of the coefficients of a model and then forms weights and re-estimates all the coefficients of the model using the estimated weighting matrix. The use of this approach is appropriate when the right hand side variables are correlated with the error terms and there is both heteroscedasticity and contemporaneous correlation in the residuals (Gujarati and Porter, 2009; Eviews, 5.1 Userguide). The summary of the results obtained by using the 3SLS method are presented in Table 4. In 5, the details of the five equations with their instrumental variables are presented. The coefficient specification and the respective results for the second-order tests, i.e. the econometric criteria such as the R^2 value, $D.W$ and other criteria are also displayed in the .

The coefficients C(1) to C(5) represents the parameter estimates obtained from the growth Eq. C(6) to C(10) are the coefficients obtained from the FDI Eq. C(11) to C(15) represents the estimates for the variables in capital stock Eq. C(16) to C(20) are for the openness Eq. C(21) to C(25) are for the savings function.

From the growth equation, it can be observed that only three of the coefficients are statistically significant, i.e. C(1), C(2) and C(4). Since C(1) is the constant term, we concentrate on explaining the implications of C(2) and

Table 6: First stage estimates in the hausman endogeneity test

Dependent variable: D(F)

Variable	Coefficient	SE	t-statistic	Prob.
C	46284.12	35911.39	1.288842	0.2084
D(L)	-0.356040	0.652475	-0.545676	0.5898
D(KP)	-0.645883	0.300102	-2.152212	0.0405
D(H)	0.025647	0.027039	0.948498	0.3513
D(O)	21.41647	121.5450	0.176202	0.8615
D(CG)	-293.7612	463.7660	-0.633425	0.5318
D(BG)	-2183.016	3159.445	-0.690949	0.4955
D(FN)	5609.1764	40.70761	2.72766	0.0000
SAP	32567.16	33572.38	0.970058	0.3406
T	-5552.035	1876.839	-2.958184	
	0.0064			
R^2	0.902950	Mean dependent var		69442.33
Adjusted R^2	0.870600	S.D. dependent var		230340.0
S.E. of regression	82858.48	Akaike info criterion		25.71312
Sum squared resid	1.85E+11	Schwarz criterion		26.14850
Log likelihood	-465.6926	F-statistic		27.91182
Durbin-Watson stat	1.647073	Prob(F-statistic)		0.000000

Author's computations

Table 7: Second stage estimates in the hausman endogeneity test

Dependent variable: D(YG)

Variable	Coefficient	SE	t-statistic	Prob.
C	1.223863	6.368191	0.192184	0.8491
D(L)	-2.27E-05	7.25E-05	-0.313835	0.7562
D(KP)	-5.34E-05	6.96E-05	-0.767270	0.4498
D(F)	-6.24E-05	0.000103	-0.608281	0.5483
D(H)	3.13E-06	3.63E-06	0.861662	0.3968
D(O)	-0.006564	0.012315	-0.532989	0.5986
D(CG)	0.012411	0.054292	0.228593	0.8210
D(BG)	0.349634	0.351662	0.994232	0.3293
D(FN)	0.338243	0.565353	0.598286	0.5548
T	-0.233178	0.576338	-0.404585	0.6891
RES-F	6.23E-03	0.000104	2.597376	0.0254
R^2	0.111739	Mean dependent var		-0.241955
Adjusted R^2	-0.229899	S.D. dependent var		7.431376
S.E. of regression	8.241457	Akaike info criterion		7.298005
Sum squared resid	1765.962	Schwarz criterion		7.776926
Log likelihood	-124.0131	F-statistic		0.327069
Durbin-Watson stat	2.897256	Prob(F-statistic)		0.965926

Author's computations

C(4) being significant. C(2) represents the parameter estimate for FDI, the positive sign it assumes implies that there is a direct relationship between FDI inflows to Nigeria and economic growth. The relationship is such that a one unit increase in the inflow of FDI to Nigeria will approximately lead to a 0.02 units increase in the level of growth. Also, the coffecient C(4) shows that there is a negative relationship between the level of openness in the economy and economic growth in Nigeria. The relationship is such that a one unit increase in the degree of openness of the economy will on average lead to 3.62 units of decrease in the growth rate.

Looking at the FDI equation, we observe that the parameter estimates for the GDP and openness variable (i.e., C(7) and C(9)) are the only statistically significant variables. C(7) tells us that there is a positive relationship between the level of output and the inflows of FDI in Nigeria. This kind of relationship follows the speculations of the market-seeking theory of FDI (see Chapter 2). Similar to the relationship obtained in the single equation model, we also observe that the degree of trade openness has a positive relationship with the inflows of FDI into Nigeria.

The capital stock equation, though not of primary concern in this work still contains interesting results that is worth examining. From the capital stock equation, we observe that three variables significantly affects the level of capital stock in Nigeria. They include, foreign direct investment, the financial system and the savings to GDP ratio represented by C(12), C(14) and C(15) respectively. As expected, foreign direct investment has a significant and positive influence on the capital stock in Nigeria. This is theoretically plausible as foreign direct investments is expected to bridge some of the savings gap that may be obtainable domestically. Also, developments in the financial system including financial deepening positively

affect the level of capital stock in the economy. The relationship is such that a 1 unit increase in the level of financial deepening in the economy will lead to approximately 7.32 units of increase the level of capital stock in the economy. Further, the rate of savings in the economy directly affect the level of capital stock in the economy. This follows the expectation of the Keynesian models of savings and investments.

Surprisingly, the openness equation tells the story that only the level of output (i.e. GDP) in the economy significantly influences the level of openness in Nigeria. This conclusion is derived from the estimated value of C(17) which is 1159.83. Finally, the fifth equation, which represents the savings equation also shows that the only significant variable that influences savings in Nigeria is the level of output. This again conforms to the simple Keynesian models of National income, where it is assumed that savings is an increasing function of disposable income.

A quick examination of the econometric criterion of the model reveals that there is absence of serial auto correlation in the residuals of the estimate. This is because the D.W statistic for the five equations as presented in Table 5 ranges from 1.92 to 2.99 which are both close to 2. We neglect the negative *R* squared values obtained for the various equations. This is in line with standard econometric practice.

The conclusions arrived at from the results above are suggestive that there is truly some form of simultaneity between economic growth and foreign direct investments inflows in Nigeria. But an intuitive conclusion of the existence of simultaneity may not be sufficient to prove if there is some kind of bi-directional relationship between economic growth and foreign direct investments inflows to Nigeria. This motivates us to conduct tests of endogeneity as specified by the Hausmen's test. These tests are presented in the next section.

Hausman's test for endogeneity: The usefulness of the 3SLS estimator is conditional on the endogeneity of the explanatory variables. Therefore, it is useful to have a test for endogeneity of the explanatory variable that shows weather the adoption of 2SLS is necessary (Wooldridge, 2006). Wooldridge (2006) suggested directly comparing the OLS and 2SLS estimates and determining whether the differences are statistically significant, or by estimating the reduced form equation of the endogenous variable by regressing it on all the other exogenous variables (including those in the structural equations and the instrumental variables) and then obtaining the residuals, which will be added to the structural equation again and then the statistical significance of the residuals will be tested using and OLS regression. If the coefficient of the residual term is statistically significant, we conclude that the variable is indeed endogenous (Wooldridge, 2006). We follow Hausman's specification in testing weather FDI and economic growth are both endogenous in the system. Table 6 and 7 present the first and second stage results for the Hausman's specification test for endogeneity on foreign direct investment.

Table 6 contains the first stage of the test; it contains the results of the OLS estimation of foreign direct investment on all other exogenous variables in the model, except economic growth.

After estimating the first equation, the residual from this regression are obtained and then the original growth model is re-estimated with the obtained residuals as one of the explanatory variables. The results from this second stage of regression are presented in Table 7. The variable of interest in this regression equation is the parameter estimate of the residual from the FDI equation presented above. This variable is labelled as RES-F. The parameter estimate of the residual variable is statistically different from zero at the 5% level of significance. This can be easily deduced from its probability value of 0.025. The statistical significance of the residuals is an indication that FDI and economic growth are jointly determined, in other words, they are truly endogenous in the equation, thereby, justifying the estimation of the equations by means of 2SLS regression.

POLICY RECOMMENDATIONS AND CONCLUSION

In summary, the models (both single and simultaneous equation models) provide evidence that suggest that there is a bi-directional relationship between economic growth and FDI inflows to Nigeria. Thus, as FDI encourages growth, more growth also encourages more FDI, hence there is a kind of positive-feed-back relationship between FDI and economic growth in Nigeria. These results have far reaching implications for policy making in Nigeria. Specifically, the policy implications are as follows.

- Because of the crowding-out nature of government size in the economy, the results suggest the reduction in government size in the economy. This is better achieved through privatization and down-sizing of most government owned enterprises in the country. This will engender competition and greater efficiency. However, caution should be exercised to ensure that the necessary conditions for privatization and down-sizing are in place so as to avoid industrial actions and the failure experienced during the first privatization exercise in 1988. Government needs to provide the legal and administrative framework for effective privatization. More importantly, there is the need to ensure transparency in the exercise.
- The results equally suggest the need to increase the degree of openness for greater growth performance. Undoubtedly, development policies that are aimed

atensuring greater private (domestic and foreign) participation in the economy will lead to increase in the level of openness. This tends to buttress the argument that the economy needs to be opened up through increased private participation. For example, foreign investors participating in the debt conversion programme could be encouraged to direct their investments to projects that significantly increased production capacity, incorporate new technologies in the tradable sectors and improve the country's infrastructure base.

- Further, the negative sign of financial development possibly suggests the need to stem the problem of capital flight and deepen the process of financial intermediation in the country. Steps to level the legal and administrative playing field for domestic investors and to promote a s macroeconomic environment could contribute to stemming capital flight. Policy makers therefore have the task to keep legitimate private capital at home by encouraging domestic investment.
- Policies to encourage private holders of external assets to repatriate their capital should be implemented. These possibly might include tax amnesties and raising the domestic interest rate. It needs be pointed out, however, that these policies could have adverse effects on already weak private sector in the economy, but then, it will intensive the flows of FDI into the domestic economy.
- The findings on human capital point to the need for Nigeria to follow an educational policy that would further raise the stock of human capital, especially at the tertiary levels. This will aid faster technology diffusion and reduce the extent of capital flight since intermediate and senior staff will no longer be foreigners, but nationals who will retain their profits and incomes in the domestic economy.

On a general note, policies that require reducing political risk, ensuring property rights and policies that bolster growth in market size, as well as wage moderation (ideally lowering real wages of political office holders), lowering corporate tax rates and ensuring full integration of the Nigerian economy into the world economy will go a long way in reinforcing the positive feedback relationship between FDI and economic growth in Nigeria.

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