

## Determinants and Growth Impact of Foreign Direct Investment Based on Simultaneous Equation Approach: Evidence in Nigeria

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**Abstract.** Empirical evidences targeted at determining the relationship between FDI and economic growth in Nigeria has drawn inconclusive results. Most studies used the VAR methodology. For robustness of the interrelationships among determining variables, a more comprehensive and dynamic framework, in the form of a simultaneous equations system of Generalized Method of moments (GMM) technique was adopted. This study attempt to empirically analyze two courses of action: (1) the growth impact of FDI in Nigeria; and (2) FDI determinants in Nigeria. This study treats economic growth and FDI as endogenous variables for the period, 1970 to 2010. The results indicate that there is an endogenous relationship between FDI and economic growth. The GMM test confirms the presence of bi-directional relationship. Therefore, the study suggests that for FDI to be a noteworthy provider to economic growth, Nigeria would do better by focusing on improving infrastructure, human resources, developing local entrepreneurship, creating a stable macroeconomic framework and conditions favourable for productive investments to augment the process of growth.

**Keywords:** Economic growth, FDI, 3SLS and GMM estimates.

### 1. Introduction

In the late 1970s and early 1980s, most developing countries of Africa (including Nigeria) experienced unprecedented and severe economic crisis. Noorbakhsh et al (2001) attribute the problem to savings-investment, foreign-exchange and tax-revenue deficits. Attracting foreign direct investment is therefore crucial to the filling of these gaps. In particular, FDI theories reveals that FDI has strong effects on the economy of a host country, as it affects positively production, employment, income, exports economic growth, balance of payments and general welfare of the recipient country. In addition, some recent studies concluded that FDI has been one of the most effective means of transferring technology and knowledge accordingly. According to Althukorala (2003), FDI provides the much needed resources to developing countries such as capital, technology, managerial skills, entrepreneurial ability, and integration into the global market which are essential for developing countries to industrialize, develop, create jobs and attack the poverty situation in their countries.

Nigeria given her natural resource (mainly oil and gas, mineral deposits etc) and large market size qualifies to be a major recipient of FDI in Africa and indeed is one of the top three leading

African countries that consistently received FDI in past decades. During 1970-2010, the Nigerian Government adopts several policies (such as liberalization, privatization, structural adjustment, export processing zone decree and investment promotion etc.) to foster economic development. Particularly, the government implemented IMF monitored liberalization of its economy, welcomes foreign investors in the manufacturing sector, offers incentives for ownership of equity in all industries except key industries like military equipment. Other measures include: repeal of laws that are inimical to foreign investment growth, promulgation of investment laws; initiated policies that create conducive investment environment like ease of registration of businesses; quick exports and imports processing procedures; intensification of wars against advanced fee frauds; instituting economic and financial crimes commission; engaged in various overseas trips for image laundry by government functionaries among others. A Ministry of Trade and Investment, which is primarily concerned with facilitating trade, foreign and domestic investments in the economy was set up in 2011 to complement these efforts.

Nigeria, like many developing countries, is in dire need of foreign investment to complement the domestic investment/resources. In addition, the supply side of the Nigerian economy requires a massive injection of foreign resources to generate the necessary increase in output which is required to reduce the rate of inflation, promote growth in the industrial sector and stimulate the acquisition of foreign technology which would further enhance economic growth. However, the level of FDI attracted by Nigeria is mediocre (Asiedu, 2003) when compared with the resource base and potential need of the country.

This study examines the role of FDI on economic growth in Nigeria for the period 1970-2010. The period under study is important for a variety of reasons. Firstly, it was in the 1970s that Nigeria joined the Organization of Petroleum Exporting Countries (OPEC), which opened its doors to private sector participation.

And secondly, the experience of small number of fast-growing East Asian newly industrialized economies (NIEs), especially Malaysia, a contemporary of Nigeria in the recent past with similar stage of development has strengthened the belief that attracting FDI is needed to bridge the resource gap in Nigeria and avoid further build-up of debt.

In the area of methodology, this study is also important for a number of reasons. Firstly, this study is significant from the view point of the macroeconomic variables included as no other study has included some of the explanatory variables which are included in this study. Secondly, the study is also significant because it differs from all other studies in scope (1970-2010). This gives the study an edge because it examines the FDI-growth relation in the near contemporary context. Thirdly, the study adds to the literature by specifically examining the interactions between FDI and other control variables with a view to examining whether FDI affects growth by itself or through other control variables. Finally, this study is quantitative and uses time series data. The data is analyzed using robust statistical methodology as used by writers in the case of other countries; simultaneous equation model based on endogenous production function, which is unknown in the case of Nigeria prior this study but appropriate for analyzing the impact of FDI in a developing country like Nigeria. Thus, previous results may be regarded as suggestive rather than empirically derived or conclusive. Therefore, this study is advancement on previous studies in the areas of model specification, analytical methodology and reliability of results.

The road map of this study is as follows. Section one introduced and established the need for the study. Section two reviews the empirical studies on the impact of FDI on economic growth and the core determinants of FDI in Nigeria. Section three describes the data and methodological framework used in conducting the research test and analysis. Section four contains analysis of results from the estimations and discussions of findings from the study while Section five, centre recommendations and concluding remarks.

## 2. Empirical studies on FDI and Economic Growth

The role of Foreign Direct Investment (FDI) in economic development has been discussed several times and debate is still ongoing. Many empirical studies have tried to explain the relationship between FDI and growth. As it can be seen in most of these studies, FDI has positive effect on growth. However, despite the positive links of FDI on host country economic growth, the empirical literature has not succeeded in establishing a definitive position (Blomström and Kokko, 1998; Campos and Kinoshita, 2002). Wang (2009) reported that the main conclusion to be drawn from several studies is that results are ambiguous. Among recent studies that have concluded that FDI does not cause economic growth are those of Alfaro et al. (2002), Durham (2004), and Herzer et al. (2008).

Others share the widespread view that FDI generates economic growth, especially Obwona (2001), Zhang and Ram(2002), Bengoa and Sanchez-Robles (2003), Basu et al. (2003), Saha (2005), Li and Liu (2005), Hansen and Rand (2006), Basu and Guariglia (2007) among others.

Several explanations have been advanced for the presentation of mixed results. According to UNCTAD (1999), empirical studies showing positive or negative effects depend on the variables use. 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 technique i.e. Arellano-Bond generalized moment of methods (GMM), they found no robust relationship between FDI inflows and domestic growth.

Bengoa and Sancher-Robles (2003) pointed out that the impact of FDI on economic growth was positive only when host countries had adequate human capital, economic stability, and liberalized markets. Similarly, using a sample of 84 countries, Wang and Wong (2004) indicated that FDI promotes economic growth only when host countries have an adequate level of human capital. By using data from 12 Asian economies over the period 1987-1997, Wang (2003) found

that FDI in the manufacturing sector had a significant and positive effect on economic growth in the host economies. But FDI inflows in non-manufacturing sectors did not play a significant role in promoting economic growth.

There are several but recent Nigeria-specific studies on the relationship between FDI and economic growth. 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 effort must be made to raise the nation's economic growth so as to be able to attract more FDI.

Adelegan (2000) explored the seemingly unrelated regression model (SUR) to examine the impact of FDI on economic growth in Nigeria and found that FDI is pro-consumption, pro-import and negatively related to gross domestic investment. Otepolo (2002) examines the importance of direct foreign investment in Nigeria. The study empirically examined the impact of FDI on growth. He concluded that FDI contributes significantly to growth especially through exports. This study recommends a mixture of practical government policies to attract Foreign Direct Investment (FDI) to the priority sectors of the economy. In a study on the impact of FDI on economic growth in Nigeria, for the periods 1970 – 2001, Akinlo (2004) through his Error Correction Model (ECM) results shows that both private capital and lagged foreign capital have little and no statistically significant effect on the economic growth. The results seem to support the argument that extractive FDI might not be growth enhancing as much as manufacturing 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.

Ayadi (2009) investigates the relationship between FDI and economic growth in Nigeria (1980 – 2007) and finds a very weak correlation and causality between the variables and recommends that infrastructural development, human capital building and strategic policies towards attracting FDI should be intensified. Osinubi and Amaghionye (2010) investigates the relationship between foreign private investment (FPI) and economic growth in Nigeria for the periods 1970 – 2005 and find that FPI, domestic investment growth, net export growth and the lagged error term were statistically significant in explaining variations in Nigeria economic growth.

This unclear empirical linkage between FDI and economic growth in the case of Nigeria may be partly due to econometric problems. Recent evidence affirms that the relationship between FDI and growth may be country and period specific. Asiedu (2001) submits that the determinants of FDI in one region may not be the same for other regions. In the same vein, the determinants of FDI in countries within a region may be different from one another and from one period to another (Kolawole and Henry, 2009).

The review above 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 should be country specific. Furthermore, only a few of the country specific studies actually took conscious note of the simultaneity nature of the relationship between FDI and growth in their analyses, thereby raising some questions on the robustness of their findings. Also, 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”. This discovery from the literature is what provides the motivation for this study on the impact of FDI on economic growth in Nigeria.

Research works include Bende-Nabende and Ford (1998) and Bende-Nabende et al. (2002, 2003) who employed a system of equations in which FDI and growth are treated as the endogenous variables for their respective studies of Taiwan, East Asia and APEC. Borensztein et al. (1998) apply instrumental variable techniques to test the effect of FDI on economic growth using data on FDI flows from industrial countries to developing countries over two decades and show that the IV estimation yields qualitatively similar results to those obtained by SUR regression. Durham (2004) tries the IV estimation which entails a five –equation two stage least square (2SLS) system with growth, the investment ratio, lagged flows, absorptive capability variables and interaction terms as the endogenous variables. However, the 2SLS model obtained is largely unidentified. Tsai (1994) employed a simultaneous system of equations to test two-way linkages between FDI and economic growth for 62 countries in the period 1975-1978, and for 51 countries in the period 1983-1986. He found that two-way linkages existed between FDI and growth in the 1980s.

By using an annual panel dataset for 20 countries in Latin America and the Caribbean for the period 1990-2001, Saha (2005) estimated a simultaneous system of two equations to test the relationship between FDI and economic growth, and found that FDI and economic growth were important determinants of each other in these countries. 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. In line with this notion, 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.

The present study is similar to that of Saha (2005), Li and Liu (2005), Ayanwale (2007) and Ruxanda and Muraru (2010), in that it seeks to examine the determinants and impact of FDI on growth in the Nigerian economy. However, this work is improved because it considers a longer time frame (1970-2010) and use aggregated data, whereas that of Ayanwale was 1970-2002 and the data is disaggregated. This study also use a more robust system of equation i.e. generalized methods of moment (GMM) while previous studies used either two or three stages least squares estimation techniques.

**3. Analytical Framework and Research Methodology**

In this study, Generalized Methods of Moment (GMM) is adopted with two framed and fitted equations. The growth model examines the impact of FDI inflows on economic growth while the FDI model shows the factors influencing the foreign direct investment in Nigeria. Other control variables were incorporated to these two models for robustness and better results. Furthermore, this method is more appropriate in that estimated results are consistent, unbiased and in line with theoretical expositions

**3.1. Model Specifications**

**3.12.1. Economic growth equation model**

For the economic growth equation, GDP is here specified as a function of (FDI) and other control variables. The functional form of the model constructed is specified below as follows:  
 $GR(Y) = f ( K, F, HC, INFRAS, DOP, INF, FD)$

$$\begin{matrix} (+/-) & (+) & (+) & (+) & (+) & (+/-) \\ (+) & & & & & \end{matrix}$$

The econometric form of the growth model is:

$$Gr(y) = \beta_0 + \beta_1k + \beta_2f + \beta_3hc + \beta_4infr + \beta_5dop + \beta_6inf + \beta_7fd + u_1t \dots\dots\dots (1)$$

A priori expectations:  $\beta_0 > 0, \beta_1 < 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 > 0, \beta_6 < 0, \beta_7 > 0,$

Where =  $\beta_1, \beta_2, \beta_3 \dots \beta_8$  are interpreted as the various elasticities.

**3.2.2. FDI determinants equation model:**

There are many variables that are essential in explaining FDI inflows in developing countries. However, the identified variables for the model were chosen because of their importance in attracting FDI to Nigeria and availability of data. For the determinants of (FDI), it is specified as a function of market demand factors, captured here by the GR(Y), and other control variables. Thus, the functional form of the model is specified below as follows:

$$F = f (GR(Y), K, INF, INFRAS, DOP, FD, HC)$$

$$\begin{matrix} (+) & (+/-) & (+/-) & (+) & (+) & (+) & (+) \end{matrix}$$

The econometric form of the FDI model is:

$$f = \alpha_0 + \alpha_1gr(y) + \alpha_2k + \alpha_3inf + \alpha_4infr + \alpha_5dop + \alpha_6fd + \alpha_7hc + u_2t \dots\dots\dots (2)$$

A priori expectations:  $\alpha_0 > 0, \alpha_1 > 0, \alpha_2 < 0, \alpha_3 < 0, \alpha_4 > 0, \alpha_5 > 0, \alpha_6 > 0, \alpha_7 > 0,$

Where =  $\alpha_1, \alpha_2, \alpha_3 \dots \alpha_7$  are interpreted as the various elasticities.

**3.2. Estimation Techniques and Data Sources**

The study uses annual data from 1970 to 2010 for Nigeria. Most of the data for this study are secondary data and were obtained from World Bank (African Development Indicators), As in any regressions analysis, there is of course always the possibility of omitted variable bias.

This study also improved on previous works by taking larger sample size, longer time frame, accounting for factors that were not included on those previous works and by introducing a better measure of variables whenever data is available. The model specification is consistent with the existing theories of international production where the demand for inward FDI depends on a variety of characteristics of the recipient country.

To ensure that the conclusions arrive at are robust and useful for policy making, this study compare two alternative estimation techniques. To this end, the simultaneous equations were compared under Three Stage Least Squares (TSLS) and GMM estimation techniques.

**4. Analysis of Simultaneous Equation Model: Generalized Methods of Moment (GMM) Estimates**

**Table 4: Estimation Results of the Simultaneous Equation System**

Growth Equation		
Variables	TOLS	GMM
	Coefficient(t-stat)	Coefficient(t-stat)
C(1)	17.18183(0.787080)	-21.92820(2.065435)**
C(2)	6.138136(1.174765)	7.647176(2.803063)***
C(3)	-2.044460(-0.340785)	-6.965059(-1.376494)*
C(4)	-29.04744(-0.523325)	-33.27277(-1.556346)*
C(5)	-14.58132(-0.536247)	-29.14713(-1.904357)*
C(6)	-11.86498(-1.040402)	-15.96008(-2.783454)**
C(7)	-13.92426(-0.636315)	-10.12681(-1.482735)*
C(8)	3.726992(0.144960)	-22.48758(-1.225814)
R <sup>2</sup> -squared	= -3.284431	= -5.788126
Adjusted R- squared	= -4.251884	= -7.320931
Durbin-Watson stat	= 1.371909	= 1.871610
FDI Equation		
C(10)	-3.905550(-1.101329)	-3.633649(-2.589720)**
C(11)	0.155479(2.886347)***	0.139289(5.529420)***
C(12)	-0.185570(-0.178575)	0.870862(0.814932)
C(13)	5.780524(0.814573)	4.567453(1.356574)*
C(14)	3.455887(0.764316)	4.096603(1.721711)*
C(15)	2.322627(1.929712)*	2.394988(5.167607)***
C(16)	3.111011(0.457838)	2.838399(1.501418)*
C(17)	-0.176080(-0.036366)	3.359870(1.459544)*
R <sup>2</sup> -squared	= -0.737506	= -0.793334
Adjusted R- squared	= -1.129846	= -1.198280
Durbin-Watson stat	= 1.375831	= 1.761600

Note: \* significant at 1 percent level; \*\* at 5 percent level; and \*\*\* at 10 percent level; The t-statistics figure is shown beside the coefficient values.

Source: Output software E-Views (7)

**5. Discussion of Findings**

The method of GMM estimation though popular in applied work has often been used for cross sectional data, whereas it can also be applied for time series data and specific country analysis. The GMM estimator selects parameter estimates so that the correlations between the instruments and disturbances are as close to zero. The table above presents the results of the two estimation techniques for the model as specified in equation 1 and 2.

In the second column, Three Stage Least Squares Method (TOLS) was used to estimate the system. The results indicate that the coefficient of FDI in the growth equation have the right sign but is statistically not significant. Likewise, for all other variables in the growth equation. This implies that though some of the parameters are having the right signs they are not growth enhancing. For the FDI determinant equation, GRY is FDI enhancing since a close look at the coefficient show that it is positive

and statistically significant at 1% level. The other variable of significant is inflation which is having a positive sign and is statistically significant

In the third column, which was estimated by GMM technique, virtually all variables are having the correct signs significant at 1%, 5% or 10% level of significance and these signs meet the a- priori expectations both in the first and second equations. The coefficients C(1) to C(8) represents the parameter estimates obtained from the growth equation while C(10) to C(17) are the coefficients obtained for the FDI determinants equation. From the growth equation, it can be observed that seven out of eight of the coefficients are statistically significant, i.e. C(1) - C(7). C(2) represent the parameter estimate for FDI on growth. 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 7.64 units increase in the

level of growth. Also, the coefficient C(3) shows that there is a negative relationship between the level of human capital development in the economy and economic growth in Nigeria. The relationship is such that a one unit increase in human capital will on the average lead to 6.96 units decrease in the growth rate. This result is contrary to theoretical expectations, especially following the internalization theory of FDI. The parameter estimate for human capital development is statistically significant at 10%. Also, the coefficient C(4) shows that there is a negative relationship between the infrastructure development index proxy by electricity consumption (kwh per capita) and economic growth in Nigeria. The relationship is such that a one unit increase in electricity will on average lead to 33.27 units of decrease in the growth rate. The coefficient is significant at 10% level. C(5) represents the degree of openness which shows that it is statistically significant at 10% level. The coefficient of the variable is negative, which is contrary to most research findings. Anyanwu (1998) gave the reason for this type of observation as the antithetical SAP policy measures in Nigeria that led to the capital flight experience. Odozi (1995), however, blamed the observed capital flight in Nigeria on the unfavourable trade policy that was in place before the SAP. A 1 percent increase in DOP is estimated to lead to a 29.147 percent drop in growth. Hence we could deduce from the results that the trade policy in Nigeria was not growth friendly. Nigeria economy only depends on oil whose contribution is negligible. C(6) reflects the impact of inflation on economic growth which shows the right sign signifying that there is macroeconomic instability represented by inflation. The negative relationship of the inflation coefficient suggests that the development within the macro economy is such that it discourages growth. This indicates that the various policy initiatives aimed at encouraging growth is not yielding the expected results in Nigeria. However, it was not so in the case of FDI where the coefficient of inflation is positive showing that there is stability in the macro economy.

C(7) is money supply as a percentage of GDP, proxy for financial sector development. It has a negative sign though statistically significant at

10%. This is also the parameter estimate for financial deepening which shows that there is a negative relationship between financial deepening and economic growth. This result is contrary to theoretical expectations. The explanation for this relationship can be attributed partly to underdevelopment of the capital and money markets and also to data measurement and reliability problems. Akinlo (2004) attributed the significant negative impact to capital flight.

Looking at the FDI equation, it is observed that the parameter estimates for C(11), C(13) - C(17) are statistically significant. C(11) reveals that there is a positive relationship between FDI and growth rate of output in Nigeria. This kind of relationship follows the speculations of the market-seeking theory of FDI. Unlike the relationship obtained in the growth model, it is also observe that the degree of trade openness has a positive relationship with the inflows of FDI into Nigeria and is statistically significant. C(12) suggest a positive relation between FDI and the quality of labor, as proxied by the secondary and tertiary institutions enrolment rate . A 1 percent increase in HC is estimated to lead to a 0.870862 percent increase in FDI. Though the variable is statistically insignificant, it however suggests that labor quality is important to FDI consideration. This implies that Nigeria's investment in education is still relatively low and low quality of labor in Nigeria may discourage some FDI in capital-intensive projects where skilled work force is a prerequisite for success. C(14) indicates that a 1 percent increase in DOP is estimated to lead to a 4.096 percent increase in FDI This is a clear indication that the government's privatisation and commercialization drive is on course. Government disinvesting in ownership of business enterprises is resulting in greater FDI. The positive and significant coefficient of DOP at 10% level indicates that foreign investors respond positively to economic reform. The result also gives evidence that adopting an open economy is crucial factor in attracting FDI to Nigeria. C(15), C(16), and C(17), represents macroeconomic stability proxy by inflation, financial sector development proxy by money supply as a percentage of GDP and domestic

capital (K). They all have the right signs and are statistically significant. Inflation and financial sector development are FDI enhancing. The relationship between domestic capital and FDI revealed that they are complementary, meaning that FDI did not crowd out domestic capital. 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 two equations under GMM is 1.87 and 1.76 for growth and FDI equations respectively. It can be seen that the overall performance of the GMM technique is more satisfactory when compared with 3SLS. Most of the coefficients are correctly signed and all explanatory variables statistically significant. The result in the table is largely consistent with some of the a priori expectations though not all.

The conclusion 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. This conclusion further supports the work of Ayanwale (2007).

## 6. Policy Implications and Recommendations

By this result no doubt, FDI has played a crucial role in enhancing the economic growth and development of the country going by the fact that the extractive industry in Nigeria has witnessed massive FDI inflows and the economy is reaping from the revenue accruable from the sector which is close to 90 percent of government revenue.

Thus, the following policies are recommended to policy makers and government, if it is desired that foreign investment should contribute to the growth and development of Nigeria. The government should intensify the policy to acquire, adopt, generate and use the acquired technology to develop its industrial sectors. The Nigerian government needs to come up with more friendly economic policies and business environment, which will attract diverse types of FDI into virtually all the sectors of the economy and to generate spillovers effects in the overall economy

On a final note, the government should provide more financial support for education to enhance

the labor quality and to improve the skill level of laborers. Also government should open doors to foreign companies in the export – oriented services which could increase the demand of unskilled workers and low skilled services and also increases the wage level in these services.

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