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Foreign direct investment and Nigeria's economic growth: a sectoral analysis

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Aggregate flows of foreign direct investment (FDI) to Nigeria, as in economies of the world, fall into different classified sectors of the economy. Studies on FDI in economic literature have been directed at the macroeconomic effects of FDI on economic growth. As sound as the findings of such studies appear, the growth impacts that FDI flows create on each sector of the economy are, however, masked. Thus this paper, using time-series data for the period 1970-2003 and adopting the ordinary least square technique, investigated the impacts of FDI flows on the outputs of some selected sectors in the Nigerian economy. The parsimonious form of analysis of general-to-specific was applied in the analysis of the model. The results shows that FDI flow was significant to sectoral growth of the mining and quarrying, and the transportation and communication sectors, but was not significant to the growth of the agriculture, forestry, and fishery sector.

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1. Introduction

The degree to which foreign direct investment (FDI) contributes to growth in the developing countries of the world varies and depends on some institutional and structural factors existing in the host country. FDI's contribution to economic growth can be positive or negative or a combination of both. Many advocates of FDI have opined that FDI has many beneficial effects in developing

countries, especially with respect to economic growth and development, while opponents, on the other hand, have strongly argued that FDI leads to a form of neocolonialism and a substitute of economic for political domination by the developed countries from where FDI flows. This controversy has remained unresolved.

This notwithstanding, the benefits of FDI to recipient nations are not limited to the provision of finance for the acquisition of new plants and machineries. The benefits include transfer of technology and managerial skills from relatively more technologically advanced economies to the rest of the world, particularly the developing countries. Studies on some developing nations like China and other Asian countries (Sun [1998]; Jun Li [1999]; Lougani and Razin [2001]) have shown that such economies have experienced significant economic growth through FDI inflows.

The issue of the effect of FDI on economic growth has led to several studies in the literature. Among these studies are those by Abdulai [2004] for Ghana; Ahrend [2000] for Russia; Balasubramanyam, Salisu, and Daposoford [1996] for EP and IS countries; Bashir [1999] for MENA countries; Lougani and Razin [2001] for selected developing countries; Moudatsou [2001] for selected European countries; Townsend [2003] for selected less developed countries; UN/ECE [2001] for transitional economies; the United Nations Conference on Trade and Development [UNCTAD 1997] for African, Caribbean, and Pacific (ACP) countries; and Zhang [1999] for selected Asian countries. Some other studies include those by Alfaro et al. [2000]; Alfaro [2003]; Borensztein, De Gregorio, and Leo [1998]; De Mello [1997]; Hausmann and Fernandez-Arias [2000]; and UNCTAD [1999]. Most of these studies used different methodologies and data from different countries and remain inconclusive in their findings.

In Nigeria, the need for additional foreign capital to supplement domestic investment in order to achieve their desired rate of economic growth becomes a justification for the promotion of polices aimed at attracting FDI. For instance, equity bond, external debt, and bank lending (except aid and grants), which are other sources of capital inflow, have their attendant problems of creating negative effects on the balance-of-payment position of an economy like Nigeria, thus proper application and encouragement of FDI in this regard become paramount. Some peculiarities in the Nigerian economy seem to make FDI growth inducing. These include

(a) abundance of natural resources not fully exploited,

(b) underutilized human resources,

(c) poor and inadequate infrastructures,

(d) low capacity utilization in industries,

(e) the oil sector being the major earner of foreign exchange, and

(f) high rate of illegal capital flight and siphoning of public funds to foreign countries by government officials.

Many studies on FDI in Nigeria concentrated on the impact of aggregate flows of FDI on the economic growth (proxied by the gross domestic product [GDP]). The findings of these studies include a bicausal relationship between FDI and GDP, FDI having positive impacts on GDP, and FDI having negative effects on GDP. Among these studies are Adelegan [2000], Oyinlola [1995], and Oseghale and Amenkhienam [1987]. None of these studies evaluated the effects of FDI flows on sectoral growth, thus the need for this study.

As a result, therefore, this study evaluates the effects FDI flows have on the selected sectors of the Nigerian economy (oil, agriculture, and telecommunication), using a data set for the period 1970-2003. The rest of this paper is divided into four sections. Section 2 is devoted to the review of relevant literature, while section 3 presents a descriptive analysis on FDI in Nigeria. Methodology, analysis, and interpretation of the results are featured in section 4 while section 5 concludes the study.

2. Review of empirical studies

A growing number of studies have found statistical relationship between FDI inflows and economic activities in the host countries. Such studies include those by De Mello [1997], Borensztein, De Gregorio, and Leo [1998], Zhang [1999], and each of the studies involved samples of developing countries. Borensztein, De Gregorio, and Leo [1998], while emphasizing the role of human capital in the host country, established a positive relationship between FDI and economic growth, and that with a model of endogenous economic growth; FDI can stimulate long-term expansion of per capita GDP. Alfaro et al. [2000] found that FDI promotes economic growth in economies with sufficiently developed financial markets. The productivity of FDI can be higher than that of domestic firms [Kamin and Wood 1997]. This is because FDI embodies advanced technology and management skills, and enhances access to world markets.

FDI can positively influence total domestic investment, the negative effects notwithstanding. The level of domestic investment will tend to be stimulated if foreign and domestic firms complement each other. Multinational corporations (MNCs) may develop backward and forward linkages, perhaps even assisting partner firms with technology and finance while holding out the prospects

of a stable market for their output. De Mello's [1997] study showed that FDI flows stimulate the long-run growth of China, Indonesia, Hong Kong, Japan, and Taiwan; and the short-run growth of Singapore. The study also showed, however, that FDI is not related to economic growth in South Korea and the Philippines. However, while there are sound conceptual reasons for believing that FDI can ignite economic growth, the empirical evidence is divided. According to Blomstrom and Kokkos [1998], FDI generates productivity spillover for the host economy. MNCs possess superior production technology and management techniques, some of which are captured by local firms when MNCs locate in a particular area.

Most of these studies on FDI used cross-country data to examine the impacts of aggregate FDI flows on the growth of the respective economies. The few exceptions include Alfaro [2003], who examined the benefits of FDI on growth in the primary, manufacturing, and services sectors using cross-country data for the period 1981-1999 and found that FDI tends to have a negative effect on growth in the primary sector, a positive one in the manufacturing sector, but an ambiguous effect in the services sector. While some studies asserted that there is a positive relationship between FDI and economic growth, others observe otherwise. Empirical studies in Nigeria have focused on the different aspects of FDI and have yielded various conclusions as highlighted below.

Edozien [1968] studied the linkages that FDI has on Nigeria's economic development between 1960 and 1963 and concluded that the gains from FDI have not been considerable compared to some other developed economies. Oseghale and Amenkhienam [1987], in their study of foreign debt, oil exports, direct foreign investment, and economic performance in Nigeria between 1960 and 1984, investigated the impacts of certain variables on the sectoral performance of the economy to show that the greater the inflow of FDI, the better the performance of the economy.

As an extension on the work of Oseghale and Amenkhienam [1987], Oyinlola [1995] worked on external capital and economic development in Nigeria for the years 1970-1991 and observed that the negative impacts generated by net factor payment abroad are several times over and above the positive impacts of FDI. Also, using a seemingly unrelated model for the period 1970-1995 on Nigeria, Adelegan [2000] established a weak FDI growth linkage and a significant negative effect of FDI on gross domestic investment.

The presence or absence of foreign investors, especially in the less developed countries of the world, has been premised on certain conditions by various studies. FDI into Africa has been relatively low and is rather concentrated in a number of "frontrunners" [UNCTAD 1998a, 1998b]. The "frontrunners"

formed the basis of the observation of the UNCTAD [1999] in its 1998 World Investment Report (WIR) that "African countries can become attractive locations for foreign investors, even in a period when reports of political unrest and economic instability prevent many investors from exploring the opportunities that the continent has to offer". However, the WIR further showed that large numbers of African countries are still largely bypassed by foreign investors [UNCTAD 1998a].

In this regard, the African countries in general need to adopt an array of political and macroeconomic measures for attracting FDI into the region.

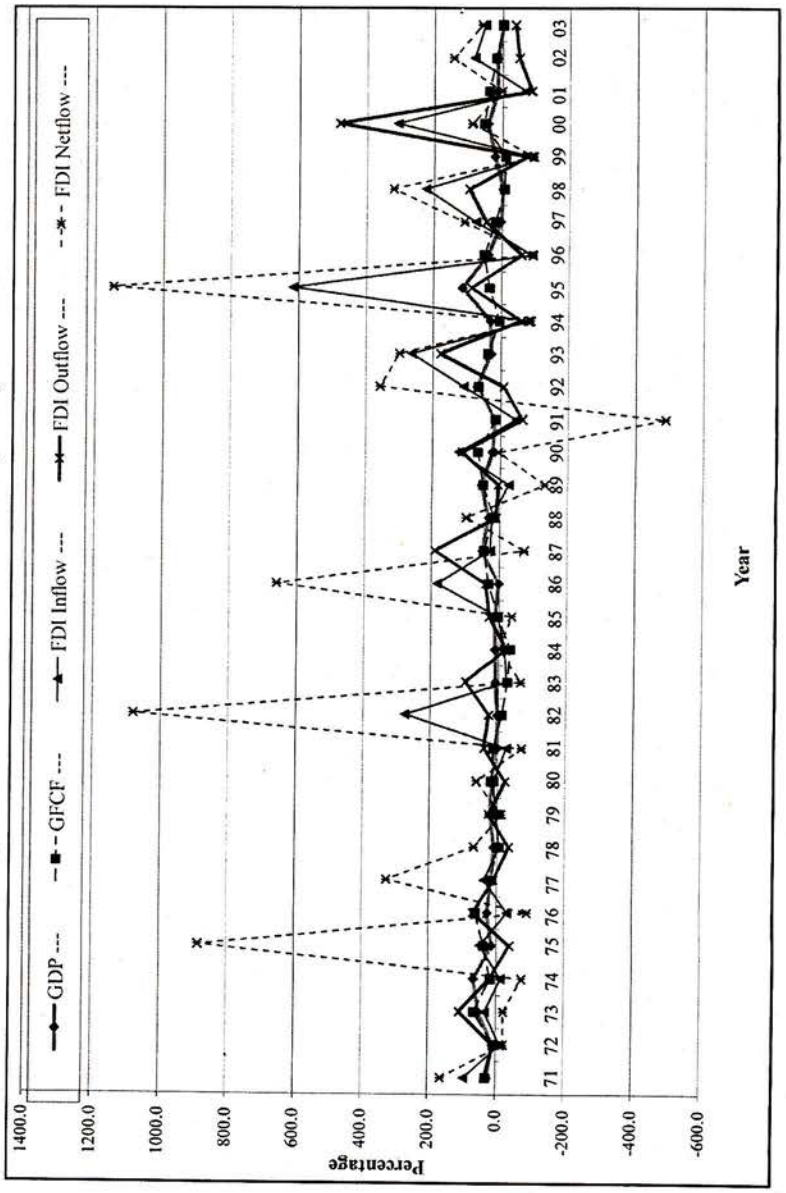
3. Structure of FDI in Nigeria

The origin of FDI was traceable to the colonial era in Africa. Such activities were concentrated in the provision of public utilities, and the export of minerals and agricultural products. These activities created the recognition for external investible funds as well as the accompanying managerial and technical skills.

The First National Development Plan, between 1962 and 1968, was premised on promoting the framework for industrial takeoff of the Nigerian economy. Investment in productive assets and facilities were formulated to the tune of N2.2 billion. Some N400 million was to come from foreign private investors while N652 million was expected from foreign governments and agencies in the form of loans and grants. Most enterprises in the country then had a significant proportion of technical and managerial skills competently occupied by foreign investors. There was an observed upward trend in foreign direct investment inflow after the independence in 1960. However, FDI inflows suffered a setback with the first military coup d'état, the civil war of the late 1960s, and the promulgation of the Nigerian Enterprises Promotion Decree of 1972.

The inflow of FDI into Nigeria was just N251 million in 1970, with a netflow of N121.6 million in the same year [CBN 2004]. The inflows of FDI were at their relative peaks in 1971, 1973, 1975, 1977, 1980, 1982, 1985, 1988, 1990, 1993, 1995, 1998, 2000, and 2003. All these occurred in response to the various policy reforms such as the structural adjustment program that the government introduced to boost investment. Except for 1987, 1992, 1997, and 2002-2003 when FDI inflow has a sustained increase, the inflow reduced significantly each time from its relative maximum. This trend is clearly shown in Figure 1. This observed trend is much correlated with the various investment policies and political instability that the country witnessed over time. A similar trend is observed with respect to FDI netflow.

Figure 1. Growth rates of FDI flows, GDP, and GFC



Source: Computed by the authors

The contribution of FDI inflow to GDP and gross fixed capital formation (GFCF) since the inception of the democratic regime of President Olusegun Obasanjo in 1999 supports the fact that the various policy reforms are yet to boost FDI inflow to Nigeria. FDI inflow constituted just 0.1 percent of the GDP in 1999, 2001, and 2002, and just rose marginally to 0.2 in 2003. Its contribution to GFCF within the same period was negligible when compared to its contributions since 1970.

In terms of sectoral trends of FDI in Nigeria, total cumulative FDI is made up of paid-up capital plus reserves and liabilities in the form of trade and suppliers' credit and other foreign liabilities to head offices. Based on data obtained from the Central Bank of Nigeria (CBN) [2004] during the period 1970-2003, Figure 2 reveals that FDI is concentrated in the mining and quarrying sector. In 1970-1973, the mining and quarrying sector received a share of greater than 50 percent of total FDI in each year. The share dropped and was not steady until 1995 when it received 47.5 percent of total FDI, which has been gradually falling, as it accounted for 34.6 percent of the total FDI in 2003. FDI inflow to agriculture, forestry, and fishery has a meager share of 3.3, 3.2, and 0.7 percent in 1980, 1990, and 2003, respectively. The share of the transportation and communication sector was also negligible over the years. The sector began to witness a rise in its share of FDI in 2001 after a prolonged decrease since 1992.

All FDI flows into Nigeria seem to be inadequate, and this can be traced partly to the political instability and uncertainty in the economic environment.

4. Methodology

4.1. The model

A model that predicts certain impacts of FDI on economic performance is adopted. Earlier studies by Romer [1990], Barro and Sala-i-Martin [1997], and Cuñado and Sanchez-Robles [2001] employed this model. It basically incorporates the endogenous growth model [Romer 1986]. Evidence from economic literature shows that the model has not been applied in Nigeria or Sub-Sahara Africa. Abdulai [2004] used trend analysis in his sectoral analysis of FDI in Ghana. However, the model has been applied by Borensztein, De Gregorio, and Leo [1998] and Bashir [1999] on some cross-country studies, with some other defined X vector variables.

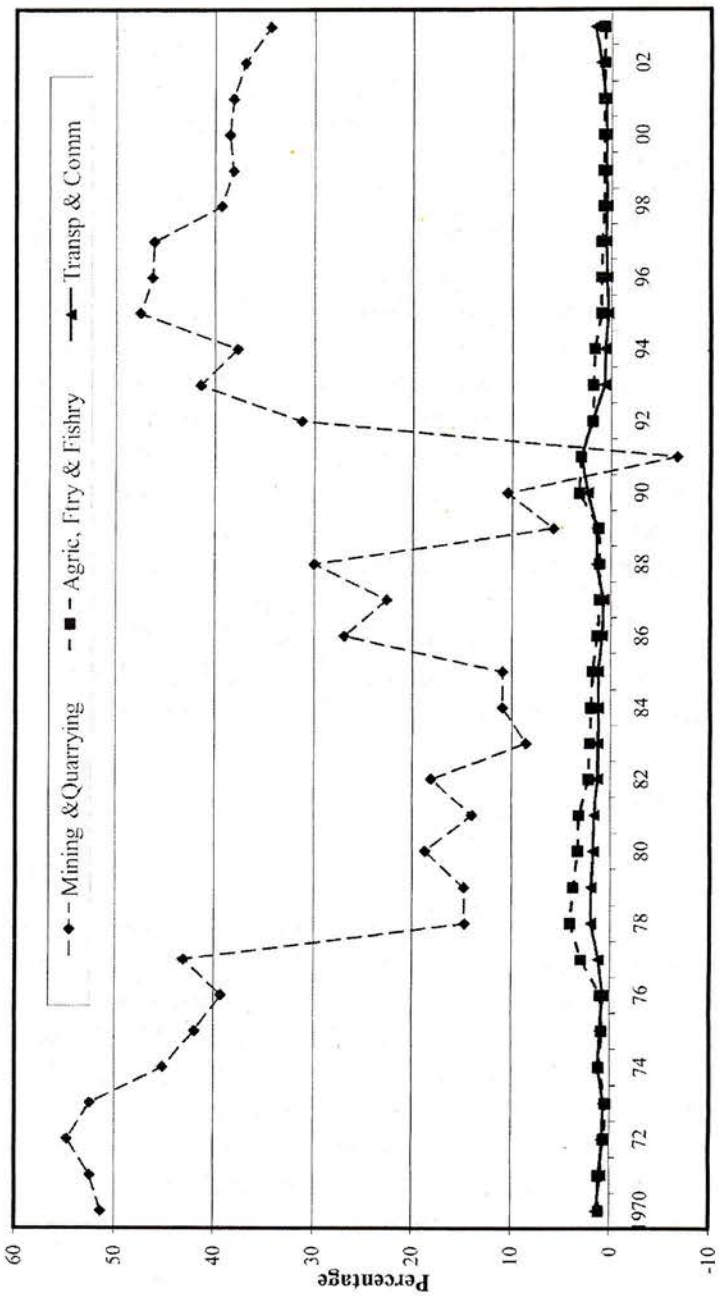


Figure 2. Percentage distribution of sectoral FDI

Source: Computed by the authors

The model is specified as:

$$g = b_0 + b_1 FDI + b_2 H + b_3 FDI^* H + b_4 X + \mu. \quad (1)$$

Equation (1) when extended to the sectors in the host economy becomes

$$g_{it} = \sigma_0 + \sigma_1 FDI_{it} + \sigma_2 H_t + \sigma_3 FDI^*_{it} H_t + \sigma_4 X_t + \varepsilon_t \quad (2)$$

where subscript i denotes each subsector and subscript t stands for each time period. The growth rate of each sector is captured by g. *FDI* stands for FDI flows, H is a measure of the stock of human capital, while FDI^*H is an interactive variable on the product of human capital and *FDI* flows. X represents a vector of other determinants of *FDI* and thus growth, such as domestic investment, *Dinv*; ratio of sectoral *FDI* inflows to sectoral output, FDI_iY_iR; degree of openness, *Opnx*; government spending, *Govsp*; exchange rate index, *Exnd*; population growth rate, *Popg*; and the dummy on investment climate, *Dum*. This study attempts to estimate equation (2) on the mining and quarrying (oil) sector; agriculture, forestry, and fishery; and transportation and communication.

The model's main specification follows from equation (2) and the X vector. This equation is applied to the three selected sectors out of the classified sectors into which FDI flows in Nigeria (CBN [2004]; Obadan [2004]). Table 1 presents the three sectors into which FDI flows in Nigeria, and the notation assigned to the inflow and output of each sector in this study. The variables are as follows:

(a) Sectoral output (y_i): This is the dependent variable of the equations in each sector. It measures the growth rate of the sectoral outputs. The horizontal summation of outputs across the sectors gives the GDP for each year. It is simply the breakdown of the national output, which is the GDP, into all sectors of the economy.

(b) Foreign direct investment inflows (FDI_i): It captures the growth rate of FDI inflows into each sector.

(c) Ratio of sectoral inflows to sectoral outputs ($FDIy_iR$): This variable takes the ratio of FDI inflows to sectoral outputs.

(d) Human capital (H): This measures the growth rate of human capital in the economy. Enrollment into secondary schools was adopted as a proxy here.

(e) Human capital and sectoral FDI (H^*FDI_i): It gives an interactive growth rate of the product of human capital and sectoral FDI inflows and captures the interaction between the two variables. It shows the significance of the application of human capital to FDI.

(f) Domestic investment (*Dinv*): This applies to the general investment climate. Gross capital formation of the country was used.

(g) Degree of openness (*Opnx*): The degree to which a country is open to FDI and the external sector is proxied by the trade-GDP ratio where trade is the sum of exports and imports of goods and services.

(h) Government spending (*Govsp*): It is a measure of the size of government expenditure with respect to domestic economic activities. Past studies related to this study used data on government expenditure to represent government spending [Townsend 2003].

(i) The exchange rate index (*Exnd*): This differs from exchange rate, which is a ratio of a country's currency to the currency of another country. The exchange rate index, however, is the nominal effective naira exchange rate index of the Nigerian currency to currencies of other countries [CBN 2004]. The fixed exchange rate regime of the pre-early '80s ensured lower exchange rate. The policy greatly discouraged all forms of investment. The liberalization of the exchange rate in Nigeria caused the exchange rate to rise. The official exchange rate in 1970 and 2003 were 0.714 and 129.22, respectively, while the exchange rate index over the same period was 99.9 and 0.2, respectively. The lower exchange rate index (high exchange rate) has great influence on increasing the flow of FDI into Nigeria.

(j) Population growth rate (*Popg*): This is the national population growth rate.

(k) Dummy variable (*Dum*): This represents the dummy variable used to capture the investment climate in Nigeria. Years of military rule and civil unrest imply instability and are represented by (0), while years of civil rule that indicate stability are represented by (1).

Table 1. Notations of the three FDI sectors

FDI sectors	*Inflows*	*Outputs*	*Model*
Mining and quarrying	FDI_1	y_1	1
Agriculture, forestry, and fishery	FDI_2	y_2	2
Transportation and communication	FDI_3	y_3	3

Source: Authors' compilation.

On the inclusion of all the main variables of equation (2) and the *X*-vector variables, the working model of this study is specified:

$$y_i = f\begin{pmatrix} FDI_i, FDI_i y_i R, Govsp, H, HFDI_i \\ , Exnd, Dinv, Opnx, Popg, Dum \end{pmatrix} \tag{3}$$

and in the ordinary least square (OLS) form,

$$y_i = \gamma_0 + \gamma_1 FDI_i + \gamma_2 FDI_i y_i R + \gamma_3 Govsp + \gamma_4 H + \gamma_5 H^* FDI_i + \gamma_6 Exnd + \gamma_7 Dinv + \gamma_8 Opnx + \gamma_9 Popg + \gamma_{10} Dum + \mu_t \tag{4}$$

Each of the variables is indexed time '*t*', while the specific variables that relate to each sector are indexed '*it*' such as FDI_{it}, $FDI_{it}y_{it}R$, and H^*FDI_{it}.

The expected signs of the variables are shown in Table 2. All the variables—except the sectoral FDI-output ratio, government spending, exchange rate index, and population growth rate—are expected to be positively correlated with sectoral growth. Increase in the inflows of sectoral FDI is expected to cause increase in sectoral outputs. Human capital, *H*, and its interactive variable, H^*FDI_i, are expected to create positive impacts on growth, with the latter having greater significance since it involves the application of human capital to production activities. A favorable investment climate tends to encourage domestic investment and, thereby, is positively related with growth. Such an atmosphere will stimulate foreign investment. The degree to which an economy is open to international trade is expected to influence growth positively.

Table 2. A priori signs of the variables

Variable	*Expected sign*	*Variable*	*Expected sign*
FDI_i	Positive	*Opnx*	Positive
FDI_iy_iR	Negative	*Govsp*	Negative
H	Positive	*Exnd*	Negative
$HFDI_i$	Positive	*Popg*	Negative
Dinv	Positive	*Dum*	Positive

Source: Authors' compilation.

Lower value of FDI_iy_iR implies higher monetary value of sectoral outputs over the monetary value of sectoral inflows. Thus, with a lower value of FDI_iy_iR, a given amount of sectoral FDI inflow causes greater output in the respective sector. This is desired for growth. On the other hand, higher FDI_iy_iR ratio reduces output and, consequently, the growth of the sector. High government

expenditure will tend to suppress the private sector and the inflow of FDI. Consequently, negative correlation is expected. Depreciation and devaluation of the currency are bound to send negative signals, especially in the short run. Depreciation of the currency implies higher exchange rate but lower exchange rate index. Negative correlation is expected as lower exchange rate will stimulate foreign investment. Rising population growth rate will affect the growth rate of the economy negatively.

4.2. Estimation procedures

The OLS technique is employed to regress the equations of the model on each of the FDI sectors. However, attempt is first made to investigate the nature or the time-series characteristics of all the variables included in this study. A variable is stationary when it has no unit root, which is denoted in the literature as I(0). A nonstationary variable can have one or more unit roots and denoted as I(d), where d is the number of unit roots that the variable possesses and, by implication, the number of times that the variable must be differenced in order to make it stationary. According to Harris [1995], nonstationary variables may yield statistically significant relationships in the regression model, which could be attributed to correlations happening at the same time rather than to a meaningful casual relationship. This is usually referred to as spurious regression. A convenient way of getting rid of nonstationarity in a series is by integrating it between successive observations. An integrated series becomes stationary after being differenced *d* times. Several tests abound in literature to capture this problem.

The augmented Dickey-Fuller (ADF) test statistic [Dickey and Fuller 1981] is adopted as a preliminary test on the variables. This is used in preference to the alternative nonparametric test proposed by Phillips and Perron [1988], as the latter has been found to have poor size properties [Drake and Crystal 1997] because of the tendency to overreject the null hypothesis when it is true.

Specification and estimation of error correction model (ECM) is made in order to subject the short-run dynamic model to some diagnostic tests, particularly tests for parameter stability, misspecification, and normality of the regression residuals. The methodology employed in deriving the preferred short-run dynamic model is the general-to-specific approach. The general model is of the usual autoregressive distributed lag (ARDL) form. Overparameterized general ECM was first specified for each sector, which included lags up to the fourth order for both the dependent and independent variables. The general model was thereafter tested down in order to arrive at a parsimonious preferred short-run dynamic specification. A parsimonious model optimizes its ability to

predict a relationship but minimizes the total number of parameters needed to model the data [Sparck-Jones et al. 2003].

The final result of each model was subjected to some diagnostic tests to ensure their stability, the normality of the residuals, and that the models have not been misspecified such that the findings of this study can be accepted within a satisfactory degree of confidence. To ascertain that the models of the study have not been misspecified, Ramsey's RESET was adopted. RESET is a general test on omitted variables, incorrect functional forms, and correlation between the variables and the error term. A study by Ramsey and Alexander [1984] showed that the RESET could detect specification error in an equation, which was known a priori to be misspecified, but which nonetheless gave satisfactory values for all the traditional test criteria.

Chow's breakpoint test on stability could not be carried out due to the insufficient number of observations in each of the subsamples. This has been the major drawback of the breakpoint test as each subsample requires at least as many observations as the number of estimated parameters. Alternatively, Chow's forecast test was adopted, which estimates two models. The first involves the full set of data, while the second uses a long subperiod of the data set. A long difference between the two models casts doubt on the stability of the estimated relation over the sample period.

Jarque-Bera (JB) statistic is employed to test the normality in the residuals of the estimated equation. It is used here to test whether the series of the residuals are normally distributed. Patterson [2000] agrees with Jarque and Bera [1987] that JB statistic is a standard test for normality of residuals. The test is useful for identifying possible deficiencies in the empirical model in addition to the check on the normal distribution of the residuals. Under the null hypothesis of a normal distribution of residuals, the JB statistic is distributed with two degrees of freedom. The reported probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis. A small probability value leads to the rejection of the null hypothesis of a normal distribution.

The study made use of annual time-series data on a number of macroeconomic variables between 1970 and 2003 inclusive. Both local and foreign sources are used. The main local sources include the publications of the Central Bank of Nigeria such as Economic and Financial Review, Statistical Bulletin, Annual Reports and Statement of Accounts; and Digest of Statistics, Annual Abstract of Statistics, and Economic Reports of the Federal Office of Statistics. Some other data used in the review of literature are from the World Bank and UNCTAD.

4.3. Analysis and interpretation of empirical results

4.3.1. Order of integration tests

The results of the unit root test on all the 18 variables and their level of significance are reported in Table 3. The ADF statistics are shown without trend and with trend at their levels. The null hypothesis on each of the series having unit root or not being stationary is rejected for all the variables at all levels of significance. As such, we can consider the R^2 and adjusted R^2 statistics of the models valid since the growth rates of the sectoral output—the dependent variables—are stationary. In particular, the adjusted R^2 serves as a better measure of goodness of fit of the equation as it imposes a penalty on higher number of variables [Goldberger 1991].

4.3.2. Interpretation of regression results

Table 4 displays the regression results on the three sectors. In mining and quarrying, the value of adjusted R^2 showed that the explanatory variables accounted for 97.14 percent of the variations in the growth rate of FDI in this sector. This observation conformed to the high value of the F-statistic and the corresponding p-value of zero probability that the parameters are not equal to zero at all levels of significance. All the explanatory variables are statistically significant and are of the expected signs, except for population growth rate (*Popg*) and its second lag, *Popg*(-2). The growth rates of sectoral FDI inflows (FDI_1), the second lag of sectoral outputs, $Y_1(-2)$, human capital (H), the product of human capital and sectoral inflows (H^*FDI_1), domestic investment (*Dinv*) and its second lag, *Dinv*(-2), and degree of openness (*Opnx*) positively influence the growth rate of the mining and quarrying sector of Nigeria, according to theoretical expectation. Similarly, the growth rate of government spending (*Govsp*), the nominal index on exchange rate (*Exnd*), and ratio of sectoral inflows of FDI to sectoral output inversely influence the growth of the sector. However, the investment climate as captured by the dummy variable discouraged FDI inflows and, thus, the growth of the sector. Contrary to theoretical expectation, population growth rate positively influenced the growth of the mining and quarrying sector. The error correction term shows that 94.1 percent of the errors are corrected. The Durbin-Watson statistic indicates no serial autocorrelation problem.

Table 3. Unit root tests

	*ADF**				*ADF**		
Variables	*No trend*	*Trend*	*Order of integration*	*Variables*	*No trend*	*Trend*	*Order of integration*
y_1	-4.1800	-4.7100	I(0)	*H*	-2.7200	-4.6600	I(0)
y_2	-7.0800	-7.5300	I(0)	H^*FDI_1	-6.7400	-6.5800	I(0)
y_3	-5.6000	-6.4100	I(0)	H^*FDI_2	-4.3800	-5.3500	I(0)
FDI_1	-6.6000	-6.4200	I(0)	H^*FDI_3	-3.2300	-5.1500	I(0)
FDI_2	-5.0800	-5.7400	I(0)	*Govsp*	-6.6500	-4.9600	I(0)
FDI_3	-3.9500	-5.3500	I(0)	*Dinv*	-2.8300	-4.7800	I(0)
FDI_1y_1R	-3.3900	-4.9800	I(0)	*Popg*	-3.5100	-4.7200	I(0)
FDI_2y_2R	-5.6200	-5.5800	I(0)	*Opnx*	-5.1100	-5.9700	I(0)
FDI_3y_3R	-3.5900	-4.5100	I(0)	*Exnd*	-3.3000	-4.4200	I(0)
1% level	-2.6392	-4.2733		1% level	-2.6392	-4.2733	
5% level	-1.9517	-3.5578		5% level	-1.9517	-3.5578	
10% level	-1.6105	-3.2123		10% level	-1.6105	-3.2123	

* The order of the lag that is chosen is to ensure that the errors are uncorrelated.

The growth rate of FDI inflows is statistically significant to the growth of this sector. A growth rate of 66.2 percent in FDI_1 will generate 1 percent growth rate on the sector, while 2.76 percent rise in the second lag of the growth rate of the sector will have the same 1 percent effect of increasing the growth of the sector in the current year.

In agriculture, forestry, and fishery, the regressors of the model explained 74.74 percent of the variations in the growth rate of the sector. The F-statistic in the model is statistically significant. The variables that are statistically significant in the model meet the theoretical expectations with respect to the signs except for exchange rate index, (*Exnd*). From the model, inflow of FDI into the sector has no significance to the growth of agriculture, forestry, and fishery in Nigeria. The ratio of sectoral inflow to sectoral output, (FDI_2Y_2R), was neither significant to the growth of agriculture, forestry, and fishery during the period 1970-2003. Other variables in this category include government spending (*Govsp*), domestic investment (*Dinv*), and degree of openness, (*Opnx*). But the second lags of population growth, *Popg*(-2); sectoral output, Y^2(-2); human capital, *H*(-2); the product of human capital with FDI inflows ($HFDI_2$); and the ratio of sectoral inflows to output are very significant in explaining the growth of the sector.

Table 4. Results of the model

Dep. Variable	FDI_1	FDI_2	FDI_3
C	-109.51 (-18.00)***	13.628 (0.834)	-294.607 (-2.400)**
FDI_i	0.661 (3.78)***	-0.718 (-1.311)	7.338 (4.3555)***
FDI_iy_iR		36.995 (0.768)	-751.72 (-2.035)*
$FDI_iy_iR(-1)$	80.65 (-10.796)***		
$y_i(-2)$	0.028 (2.05)**	0.368 (5.796)***	-0.1814 (-0.9099)
Govsp	-0.332 (-11.49)***	-0.0311 (-0.340)	-0.498 (-2.96)**
H	2.68 (13.807)***		
H(-2)		-1.99 (-4.718)***	1.104 (2.711)**
H^*FDI_i	0.566 (3.706)***	0.567 (2.142)**	6.974 (4.523)***
$H^*FDI_i(-2)$		0.115 (2.764)**	
Exnd	-0.987 (-21.589)***	0.473 (3.326)***	-1.684 (-2.041)*
Dinv	2.488 (53.73)***	0.148 (1.06)	
Dinv(-1)			2.563 (2.959)***
Dinv(-2)	0.122 (2.28)**		
Opnx	47.81 (4.859)***	-39.729 (-1.54)	337.712 (1.808)*
Popg	40.73 (22.02)***		
Popg(-1)			50.298 (8.156)***
Popg(-2)	3.298 (1.99)*	-7.502 (-1.805)*	

Table 4. Results of the model (continued)

Dep. Variable	FDI_1	FDI_2	FDI_3
Dum	-5.708 (-2.134)**		90.24 (2.012)*
ECMi	-0.94 (-95.909)***	-0.653 (-1.858)*	-0.855 (-2.920)***
R^2	0.979163	0.851929	0.720792
Adjusted R^2	0.971431	0.747409	0.683704
F Statistic	1364.73	8.1508	3.6572
p-value	0.0000	0.0001	0.0076
DW	1.962	2.205	1.972
t, 10%	1.740	1.734	1.734
t, 5%	2.110	2.101	2.101
t, 1%	2.898	2.878	2.878

Note: ***, (**), {*} implies significance at 1 percent (5 percent), {10 percent} level.

Source: Researchers' compilation, 2007.

In the transportation and communication sector, the F-statistic shows that the model has overall goodness of fit. The adjusted R^2 (68.37 percent) also indicates that the explanatory variables account largely for the variations in the growth of the transportation and communication sector. The Durbin-Watson statistic does not pose any autocorrelation problem in the model. All the variables are of the expected sign, except the first lag of population that is positively related to the growth of the transportation and communication sector. The growth of the sector, however, does not depend on the lagged values of the output of the sector, while the remaining variables account for significant impact on the growth of the sector. The dummy on investment climate shows that the investment climate is conducive enough to promote the growth of the transportation and communication sector.

FDI inflow is very significant to the growth of the transportation and communication sector. The sector will grow by 1 percent as FDI_3 grows by 733.8 percent, and as government spending falls by 49.8 percent. Increase of 110.4 percent and 697.4 percent in human capital and its interactive variable, respectively, will spur 1 percent growth in the transportation and communication sector. Empirical evidence supports this finding. Akwani [2005] identified the telecommunication subsector as the fastest-growing employer in Nigeria.

4.3. Diagnostic tests

4.3.1. Regression specification error test

The test for each of the seven models with respect to the seven sectors, and as reported in Table 5, is based on the following:

H_0: All the coefficients on the powers of fitted values are zero.

H_1: All the coefficients on the powers of fitted values are not zero.

The results for each model show high values of F-statistic and log likelihood ratio (LR) with zero percent p-values. Rejection of the null hypothesis for each model implies that there are no omissions of variables, and that the models are rightly specified.

4.3.2. Stability test

Chow's forecast test on the stability of the models is based on the null and alternative hypotheses as stated below. The forecast period for the model is 1990-2003.

H_0: There is no structural change in the growth rate of the FDI sector before and after 1990.

H_1: There is structural change in the growth rate of the FDI sector before and after 1990.

The results on the forecast test are reported in Table 6. The LR statistic indicates that there was no structural change in the respective models on growth rate of the sectors before and after 1990. The F-statistic on the models shows a slight difference. The F-statistic indicates stability of the model on the mining and quarrying sector. The F-statistic on the stability of models 2 and 3 failed to reject the null hypothesis of no structural change in the models before and after 1990. However, the LR statistic shows a satisfactory stability test on the models.

Table 5. Results of regression specification error test on the models

		Ramsey RESET Test:			
Model 1	⇒	F-statistic	27.90565	Probability	0.000023
		Log likelihood ratio	20.7068	Probability	0.00092
		Ramsey RESET Test:			
Model 2	⇒	F-statistic	22.62053	Probability	0.00001
		Log likelihood ratio	70.32684	Probability	0
		Ramsey RESET Test:			
Model 3	⇒	F-statistic	65.9427	Probability	0
		Log likelihood ratio	100.472	Probability	0

Table 6. Results on stability tests on the models

		Chow forecast test: Forecast from 1990 to 2003			
Model 1	⇒	F-statistic	27.90565	Probability	0.000023
		Log likelihood ratio	20.7068	Probability	0.00092
		Chow forecast test: Forecast from 1990 to 2003			
Model 2	⇒	F-statistic	22.62053	Probability	0.00001
		Log likelihood ratio	70.32684	Probability	0
		Chow forecast test: Forecast from 1990 to 2003			
Model 3	⇒	F-statistic	65.9427	Probability	0
		Log likelihood ratio	100.472	Probability	0

4.3.1. Normality test

The Normality test on models of this study is based on the following:

H_0: Residual errors are normally distributed.

H_1: Residual errors are not normally distributed.

Table 8 reports the results on the residual test for the models. The results show that the residuals are normally distributed and bell-shaped for the models. With theoretical value of 5.99 and the JB statistics as reported in Table 7, the null hypothesis cannot be rejected for the three models since the JB statistics are less than 5.99.

Table 7. Results of the normality/residual tests on the models

FDI sector	*Skewness*	*Kurtosis*	*JB statistic*	*P-value*
1	0.001246	2.715600	0.104483	0.949100
2	0.623646	2.612890	2.131991	0.744385
3	0.515336	3.182440	2.075565	0.614857

5. Conclusion

Empirical analysis established that the flow of FDI to sectoral growth in Nigeria for the period 1970-2003 was significant in the mining and quarrying (oil) and the transportation and communication sectors, but was not significant to the growth of agriculture, forestry, and fishery. The descriptive/trend analysis indicated only the oil sector as being significant (Figure 2). The introduction and application of information and communications technologies (ICTs) at the wake of the 21st century in Nigeria have produced some visible effects on this sector

such that the OLS methodology of general-to-specific modeling adopted by this study was able to detect. ICT has successfully aided the performance of various sectors and subsectors of the Nigerian economy such as the manufacturing, education, transportation, tourism, health, banking, commerce, government services, defense, sports, and rural development, among others. It has been able to generate a great number of employment, in addition to raising the level of gross capital formation and capacity utilization.

The flow of FDI into agriculture, forestry, and fishery still requires further inducements in order to yield significant effect on the growth of the sector. The search for white-collar jobs has encouraged rural-urban migration, which is a "form of brain drain", and has consequently aggravated the unemployment situation in Nigeria. Policies are needed to speed up rural and agricultural development to increase the growth rate of the agricultural sector.

Mining and quarrying emerged as the sector in which FDI inflows had the greatest significance during the period 1970-2003. This sector gained this ascendancy because of the vested interest of successive governments and major stakeholders in the oil subsector. This development has been to the detriment of the remaining sectors, particularly the agricultural subsector, which was the mainstay of the economy prior to the discovery of oil and the oil boom that followed. The importance of the agricultural subsector to this economy in terms of provision of food and employment generation cannot be overemphasized.

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