IOSR Journal of Business and Management (IOSR-JBM)
e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 15, Issue 2 (Nov. - Dec. 2013), PP 82-93
www.iosrjournals.org

A Sectorial Impact of Foreign Direct Investment: A Parsimonious Model

[1]Okoro H. Matthew, [1]Atan A. Johnson
[1]*Department of Economics, University of Uyo, Nigeria.*

Abstract: *If statistics are, indeed, the eyes of the policymakers, then some development empirical researchers, going by their superficial analyses, might have unwittingly, picked up a job that are more demanding than they are willing to pay. This could be the cause of the noise about the ambiguity of FDI-growth impact beclouding the submissions of almost every FDI-growth investigator. As a result of the complex nature of this subject, in-depth knowledge of ordinary least squares (OLS) and the associated statistical techniques are required to do any meaningful analysis. Using the simplest model, we show that running a single regression analysis is like a step out of a journey of 1000 miles. Several other regression analyses must be employed for robustness and test of economic and statistical significance in order to validate the result. Following this rigorous approach, we find that FDI impacts positively on the agricultural growth economy of Nigeria. The contribution is, however, not significant.*

I. Introduction

The contribution of Foreign Direct Investment (FDI) to the growth economy of the world has been strongly disputed for over six decades (see Katerina et al., 2004, for a historical review of early works). Expectedly, an interested reader will, no doubt, be prompted to inquire whether the truth on the growth impact of FDI has been established. Similar questions might be "why is the subject an object of debate?" how is the controversy settled? Or what efforts have been made towards resolving the issue?

While the first question has a universally acceptable and simple answer – NO; the solutions to the rest of the questions are like the proverbial sixty-four-thousand-dollar questions. While is FDI a subject of much debate is a question that, to the best of our knowledge, has not received much attention of FDI-growth related investigators. Rather, what almost every author does is to enthusiastically enumerate the list of opposing publications on FDI-growth studies. After such adumbrations, the same authors will, amusingly, fall victim of finding negative or positive impact of FDI on the economy without proving while he/she is falling on either camp or while those on the other fence might be altogether wrong. This is awful as it smacks of laxity and lack of commitment towards resolving the problem

The question of how the problem is settled has its answer in the first question. The debate is ongoing. A number of efforts (see section 2 for a review of some spirited attempts), thought fruitless, have been made towards sorting out the issues. Since FDI-growth impact has remained inconclusive for so long, the topic or debate, will sooner or later, become unattractive, especially to the public. Instead of increasing the innumerable number of researchers that investigate whether FDI has a negative or a positive impact on the economy, we feel that it is time to focus primarily on the reasons why the field is a subject of confusion. This is the main objective of the present article.

Understandably, the analysis of FDI-growth connection, like a tangled twine, must be carefully loosened from the easiest or smallest part of the knot. Although econometric theory emphasizes the superiority of standard or multiple regression model, the indeterministic status of FDI-growth impact tend to play down the theory. Consequently, alternative approach, the parsimonious models need equally be attempted.

II. Literature Review

FDI is an investment made to acquire a lasting managerial interest (normally 10% of voting stock) in a business enterprise operating in a country other than that of the investors defined according to residency (World Bank, 1996). There are, nonetheless, other definitions of FDI. This is because it is a complex field as it touches almost all facets of human endeavour. Consequently, its definition as well as its usefulness depends on the investing multinational corporations (MNCs) or the recipient/host country positions. The present review will focus more on the relevance of FDI to the Nigeria economy.

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

economics.

On the other side of the wall are the opposing dependency school drawing their arrangement from Marist dependency theory. They doubt whether FDI – which do soak up local financial resources for their own profits – can bring about industrialization because foreign investors see host economics as merely serving the interest of their home countries in supplying basic needs for their companies. This school view foreign investors as "imperialistic predators" that specialize in exploiting the entire globe for the sake of corporate few as well as creating a wet of political and economic dependence among nations to the detriment of the weaker ones. The group thought that foreign investors set artificial prices to extract excessive profits, make insufficient transfer of technology at too high cost, crowds-out domestic investment and exert serious strains on the balance of payment of the host country.

Robu (2010) assert that FDI is usually sought by countries that are going through the transition period and/or those that face severe structural unemployment. This is the situation of Nigeria. Aremu (1997) noted that Nigeria as one of the developing countries of the world, has adopted a number of measures aimed at accelerating growth and development in the domestic economy. One of such measures is FDI attraction. The realization of the importance of FDI had informed the radical and pragmatic economic reforms introduced since the mid-1980s by the Nigeria government. According to Ojo (1998), the reforms were designed to increase the attractiveness of Nigeria's investment opportunities and foster the growing confidence in the economy so as to encourage foreign investors in the Nigeria. The reforms resulted in the adoption of liberal and market-oriented economic policies, the stimulation of increased private sector participation and the elimination of bureaucratic obstacles which hinders private sector investments and long-term profitable business operations in Nigeria. One of the targets of these reforms is to encourage the existence of foreign MNCs and other private investors in some strategic sectors of the Nigeria economy like the oil industry, banking industry, communication industry and others. Since the enthronement of democracy in 1999, the government of Nigeria has taken a number of measures necessary to woo foreign investors in the country. Some of these measures include the repeal of laws that are inimical to the foreign investment growth, promulgation of investment laws, various oversea trips for image laundry by some presidents among others. Umah (2007) asserts that the Nigeria government has instituted various institutions, policies and laws aimed at encouraging foreign investors.

These efforts have not been in vain as the country has witnessed amazing inflow of FDI in the recent times (Adofu, 2010). But whether FDI plays the acclaimed role of pushing the economy forward is a topic that is currently generating a dramatic wave among researchers and economic law makers. The policymakers do not have much analytical tool to assess the performance of FDI in Nigeria economy. They generally add their voice by citing other countries of the world that actively engage in FDI and thus, hopefully, argue that FDI might be playing the same role in Nigerian economy. They rather look forward to the empirical analysts to show, them the way forward.

But the empirical literatures do not have one voice as well. Some of the authors that find positive linkages between FDI and economic development in Nigeria are Aluko (1961), Brown (1962), Oyaide (1977), Obinna (1983), Ariyo (1998), Chete (1998), Anyanwu (1998), Oseghale and Amenkhienan (1987), Okodu (2009). Others such as Oyinlola (1995), Badeji and Abayomi (2011) and Otepola (2002) argue that FDI retard economic growth in Nigeria. Amidst those who report positive connections are those that find that the contribution is statistically insignificant (e.g. Aynwele, 1997; Adofu, 2010) and as such frown at, according to Adofu (2010), "undue attention" given to FDI in Nigeria. The implication of the conflicting economic advice that arises from these multifarious results is palpable.

The question that hangs on all lips at this stage, as indicated in section one, "is what is responsible for these contradictions and what could be the way out of the dilemma". A number of explanations have been adumbrated in an attempt to explain the prevalent lack of consensus on the catalytic role of FDI on the economic growth. Attempt will be made in the next section to examine some of the major reasons fingered by researchers as the kingpin that upsets the apple cart.

2.1 WHY IS FDI-GROWTH IMPACT AMBIGUOUS?

Understandably, empirical literatures that find positive impact would feel at ease since positive impact is in tandem with the a prori expectations. Contrarily, publications finding negative results feel somewhat challenged and, consequently, do respond with all sorts of colourful reasons to argue away the positive role of FDI on the economy. Some of the competing theories are presented. Early works on FDI claim that the target countries of FDI receive very little benefits – because most benefits are transferred to the multinational company's country (Singer, 1950; Prebisch, 1968). Although FDI raises the level of investment and, perhaps, the productivity as well as consumption in the country, FDI lowers the rate of growth due to price distortions or misallocations of resources (Singer, 1950; Presbisch, 1968). Bos, Sanders and Secchi (1974) found a negative relationship between FDI and economic growth of the recipient countries. The reason was blamed on profit repatriations. Additionally, price distortions due to protectionism and monopolization as well as natural

resources depletion are reasons adduced to explain the negative impact. Saltz (1992) equally find a negative correlation between FDI and growth and explained that the level of output of a host country is bound to stagnate if FDI enjoys monopolization and pricing transfers. This is because such incentives will cause under utilization of labour which will in turn cause a lag in the level of domestic consumption demand and eventually will lead growth to stagnate. Other reasons are lack of the envisaged forward and backward linkages between FDI and growth (Aitken et. al. 1997), transnational and corporations and firms (TNCs) tend to locate in high productive industries and could, therefore, force less productive firms to exit (Smarzynska, 2002), crowding out of domestic firms and possible contraction in the total industry size, unemployment (Cotton and Ramachandran, 2001), the host country's capability to absorb the foreign technology and the type of investment climate or FDI and the prevailing FDI policies (Obwona, 2004). Obviously, the foregoing reasons are mainly speculative.

Pragmatic reasons, stemming more directly from data analyses are measurement errors, sample issues, the use of cross country data and finally, errors arising from different methods of analysis. While measurement errors are expected to be a universal problem in econometrics, the rest of the problems can either be completely eliminated or greatly minimized as they are more or less dependent on the researcher's expertise as well as dedication with respect to superficial or rigorous analyses. Specifically, methodological differences should not be an issue in FDI-growth related analysis. This is because statisticians, like their twine mathematicians, will surely arrive at the same solution the method adopted, notwithstanding. Whether a quadratic equation is tackled using the graph method, the method of factorization, by the use of the almighty formula or by the method of completing the square, the solution is invariant. This is the basic idea of using different statistical or mathematical approaches to investigate the FDI-growth relationship.

Violating this principle is surely not good as it would imply creating an un-existing or a peculiar field of mathematics or statistics. Although most development literatures feel that the type of methodology employed could be a crucial determinant of FDI-growth impact results, we do not think that that should be the case. Rather, given the same data, mathematical principles and ethics call for the same answer. The idea of dilemma and uncertainties are the domains of theoreticians, irreconcilable with experimental or empirical studies.

Obviously, reasonable attention has been given to endogeneity problems (Ayanwele, 2007; Okon et al. 2012; Badeji and Abayomi, 2011); the confusion that might arise from country wide data has been removed by using country or Nigeria specific data (Aluko,1961; Brown,1962; Oyaide, 1977; Obinna,1983; Ariyo, 1998; Chete, 1998; Anyanwu, 1998; Oseghale and Amenkhienan, 1987; Eke et al. 2003; Okodu, 2009; Oyinlola, 1995; Badeji and Abayomi, 2011; Otepola, 2002; Akinlo, 2004; Anynwale, 2007; Adofu, 2010; Endozien, 1968) and yet the position of FDI on Nigeria remains questionable.

Any interested reader will, no doubt, think of a turning point with regard to the current methodology, which, apparently, has failed to unravel the mystery. An approach that significantly departs from the current practice is, indeed, required in order to meaningfully test the hypothesis that FDI is an economic growth promoter. Heuristic intuition might be invoked at this stage if FDI-growth study is to be looked at from a different point of view. Such approach is the object of this presentation. But before furthering this, it is important to note here that the general tool used by over 99% of econometricians in the study of FDI-growth impact is the ordinary least squares (OLS) regression technique. The method is such an indispensable tool in econometrics that Gujurati (2004) referred to it as the bread-and-butter tool of econometrics. Although the method is, unarguably, the plumb line of an economist, it is fraught with many problems that are so difficult to handle.

Heteroscedasticity, multicollinearity, the presence of unit root, co-integration and autocorrelation are some of the problems associated with the use of OLS as an analytical tool. Multicollinearity, unit root and autocorrelation appear to be the chief among these problems. Specifically, the presence of autocorrelation can significantly bias the result of OLS and, ultimately, induce spurious regression. It is such an intractable problem that many authors merely speculate its presence in data without accounting or correcting for it. The widely used Durbin-Watson (DW) statistics only serves as a means of detecting the presence of autocorrelation but offers no solution where it exists. As will be detailed in the next section (which considers the impact of the regression problems on OLS analysis), even this widely celebrated DW static is largely subjective and thus, unreliable.

III. Data Source And Econometric Research Methodology

3.1 DATA SOURCE

Secondary data taken from Ogbanje (2013) and Osinubi (2009) are used in the present analysis. The period under study is 1985-2004. The choice of data is guided by the objective of the study. In order not to mix issues, the GDP data and FDI data are from the same sector of the economy – Agriculture. The data used in the present investigation is presented in appendix A.

3.2 RESEARCH METHODOLOGY

3.2.1 INTRODUCTION

As indicated in section 1 and in keeping with the general spirit of econometric theory, almost every development literature attempts to conduct multiple regression analysis. The target is usually to test the place of FDI on the economy. Other economic variables thought to influence growth are usually included for completion or cetris paribus purposes. Although this is okay by econometric standard, there may be a pragmatic trade off between investigating simple and multiple regression models. In addition to the besetting problem of autocorrelation, multiple regression models do introduce multicollinearity in a regression result. An unwary investigator may be misled by this to falsely claim or deny an existing relationship. The failure of the age long FDI-growth multiple regression models to confirm whether FDI impacts positively on the economy is a suggestive of the need for parsimonious regression model. This follows the indications of Ockham's razor which advocates the use of simpler models rather than the complex regression models. As will be illustrated later, inclusion of additional explanatory variables tend to introduce additional regression problems. Since the interplay between FDI and growth is inherently complex, using a complex model to address the problem will surely lead to more complication rather than the aimed simplification.

3.2.1.1 CONCEPTUAL FRAMEWORK AND DESCRIPTION OF VARIABLES

This section intends to highlight the nature and measurement of the economic growth variables around which the whole study revolves while the next section concentrates on the methodology of analysis of these variables. The chief corner-stone among these variables are FDI and GDP and they are, therefore, considered first.

(i) FDI: Tadaro (1999) defines FDI as investment by large multinational corporations with headquarters in the developed nation of the world. To buttress the definition, Makola (2003) noted that FDI is the primary means of transfer of private capital (i.e. physical or financial), technology, personnel and access to brand names and marketing advantage. Viewed as a private investment, some authors (e.g. Adofu, 2010) refer to it as private foreign direct investment (FPI). Amadi (2002) explains that FDI is not just an international transfer of capital but rather, the extension of enterprise from its home country which involves flows of capital, technology and entrepreneurial skills to the host country where they are combined with local factors in the production of goods for local and for export markets (Root,1984).

Still on the definition of FDI as a strong world development indicator, one of the pioneering study on FDI, Hymer (1960), described FDI as asset transfer by the formation of subsidiaries or affiliates abroad, without lots of control. The summary of these definitions is that FDI means asset (capital, technology, managerial abilities) transfer from the developed to the developing world. This is the reason why FDI is regarded as an important world development yardstick.

(ii) MARKET SIZE AND ECONOMIC GROWTH: GDP is taken as a measure of both market size and economic growth. GDP itself refers to the monetary measure of the total market value of all final goods and services (total output) produced within a country in one year. Lipsey (1986) defines economic growth as a positive trend in the nation's total output over long term. Thus economic growth implies sustained increase in GDP for a long time. Dolan et al. (1991) and Katerina et al. (2004) submit that economic growth is most frequently expressed in terms of GDP; taken as a measure of the economy's total monetary output of goods and service. Factors that determine whether Multinational Enterprises (MNEs) that engage in market seeking FDI invest in a country are the host country's market size and economic growth, both of which are represented by GDP in the present work.

(iii) OTHER VARIABLES

Exchange rate and interest variables are equally included in the model for comparative study of the outcome of multiple and simple FDI-growth models. They are not, however, of much importance as will be seen later.

3.3 MODEL SPECIFICATIONS

In order to estimate the relationship between FDI and economic growth in Nigeria, the present study will employ single equation models. Ordinary least-square (OLS) method will be used in the present investigation. OLS is, simply, a method of fitting the best straight line to the sample of XY observations.

The central goal of the present work is to investigate the role of FDI on the growth economy of Nigeria. Other economic variables believed to impact on growth are also included for completion and comparison purposes. A function that relates these parameters can be of the form:

$$GDP = f(FDI) \quad 1$$

This is a simple regression model relating GDP and FDI. For the purpose of comparative investigation, multiple

models of the form below will also be analyzed.

GDP = f (FDI, TFDI) 2

GDP = f (FDI, TFDI, EXR, ITR) 3

Each of equations 1 to 3 can be transformed linearly as

$$GDP = \beta_0 + \beta_1 FDI + ... + u_i \quad 4$$

$$GDP = \beta_1 FDI + ... + u_i \quad 5$$

where equations 4 and 5 are respectively referred to as the traditional/usual OLS and the standardized OLS models. As a result of the almost mystical interaction between FDI and economic growth, the tradition or the general OLS model might not be very useful. Almost every FDI-growth investigation employed it and the fact that the problem remains unsolved is an indication that the model might be wanting. We will rather introduce a new model – the standardized OLS model.

3.3.1 STANDARDIZED REGRESSION MODEL

Regression on standardized variable has a number of advantages over the traditional regression model (equation 4). Gujarati (2004) concludes that all the variables in a regression are put on equal basis when the variables are standardized. The implication for this is that all the coefficients can be compared directly with one another. If the coefficient of one standardized regressor is larger than that of another standardized regressor appearing in the model, then the former contributes more relatively to the explanation of the regressand than the latter. The intercept term of a regression involving standardized regressand and regressors is always zero. And better still, such constant term is of secondary importance here since the primary objective is not to investigate the value of GDP when FDI is not being injected into the system.

3.3.2 LAGGED OLS VARIABLE MODEL

Gujarati (2004) asserts that time lag exists between some economic growth variables. Wilhelms and Witter (1998) equally emphasize the need for using the lagged values of the explanatory variables of economic growth data. It is believed that it takes one to six years for FDI projects to exert any significant effects on the economy of a country. This time lag accounts for registration to actual operation. In order to account for this time lag, a model of the form is equally specified:

$$GDP_t = FDI_{t-i} + u_t \quad 6$$

where i=1,2,3,.....

3.3.3 A PRORI EXPECTATION

The regression models above set out to test if there is a relationship between GDP and FDI. Other variables, believed to impact on the economy, are equally included. The coefficient of FDI is expected to be positive since FDI is thought to boost economic growth. The coefficient of domestic investment is equally expected to be positively related with the economy. The coefficient of exchange rate is not certain as it depends on its variability within the time period.

3.3.4 GRANGER CAUSALITY

Although OLS results can establish the existence of a relationship between two data time series, it cannot explain the direction of the relationship. Since the future cannot predict the past, Granger causality test attempts to establish if changes in FDI precede changes in GDP, that is, FDI causes GDP and not GDP causing FDI. Given:

$$GDP_t = \beta_0 + \sum \beta_j GDP_{t-j} + \sum c_j FDI_{t-j} + u_t \quad 7$$

$$FDI_t = \beta_0 + \sum \beta_j FDI_{t-j} + \sum c_j GDP_{t-j} + u_t \quad 8$$

Equation 7 postulates that current GDP is related to past values of itself as well as that of FDI, and 8 postulates a similar behavior for FDI. There are four implications for each of the equations. (i) $GDP \rightarrow FDI$ [GDP causes FDI, unilateral causality]; (ii) $FDI \rightarrow GDP$ [FDI causes GDP, unilateral causality]; (iii) $GDP \leftrightarrow FDI$ [feedback or bilateral causality]; and $GDP - FDI$ [independence].

The null hypothesis is $H_0 : \sum c_j = 0$, that is lagged FDI and GDP terms do not belong to equations 7 and 8

respectively. The symbol $GDP \leftrightarrow FDI$ implies bilateral causality and is explained thus: Bidirectional causality exists between GDP and FDI in the two equations above if the null hypothesis $H_0 : \sum c_j = 0$ for the two equations are rejected. The test of significance of the overall fit can be carried out with an F test while the number of lags can be chosen with Akaike information criteria (AIC). The details of granger tests are explained in section 3.5

3.4 DETAILS OF ANALYSES

Section 3.3 specifies a number of models ranging from the usual OLS models to granger causality or lagged models. While the ordinary OLS (un-lagged models) is an old and familiar method common in the literatures, other methods such as granger causality test (GCT), unit root test and cointegration test are yet at the infancy stage in the development literatures. Some investigators are in the habit of indicating, for instance, that they conducted GCT but one may have no idea what or how the test is conducted. This section intends to give some little details of these relatively new techniques before quoting the final results in section 4.

3.4.1 UNIT ROOT

3.4.1.1 UNIT ROOT TESTS

The results of FDI-economic growth can only be useful to the society if policy makers can accept the validity or significance of the results. In order to do any meaningful policy analyses with the OLS results, it is important to distinguish between correlations that arise from a sheer trend (spurious) and one associated with an underlying casual relationship. To achieve this, all the data used in the study are first tested for unit root (non-stationarity) by using the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests. Since our data cannot be mere noise, we assumed them to be stationary data with a constant only or stationary data with a constant and time trend. The results in Table 3.1 and 3.2 show that all the variables are integrated of order one, I(1). In order to validate the result, the log-log relationship of the variables is equally tested for the presence of unit root. The result is presented in tables 3.3 and 3.4. Evidently, they also confirm those of tables 3.1 and 3.2.

TABLE 3.1 UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT ONLY

UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT ONLY						
		LEVEL		1st Difference		
	Variables	DF	ADF	DF	ADF	Conc
1	GDP	-2.60	-2.62	-6.33**	-	I(1)
2	FDI	-1.14	-1.34	-4.24**	-	I(1)
3	TFDI	-0.02	-0.57	-4.29**	-	I(1)

Note: From CRITICAL DICKEY–FULLER table, 1% and 5% significance level for sample size less than 50 is given as -3.75 and -3.00 respectively. In this table, '**'and '*', represent 1% and 5% level of significance respectively.

TABLE 3.2 UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT AND TIME TREND

UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT AND TIME TREND						
		LEVEL		1st Difference		
	Variables	DF	ADF	DF	ADF	Conc
1	GDP	-13.75**	-	-	-	I(0)
2	FDI	-1.45	-1.10	-4.23*	-	I(1)
3	TFDI	-2.00	-2.43	-4.19*	-	I(1)

Note: From CRITICAL DICKEY–FULLER table, 1% and 5% significance level for sample size less than 50 is given as -4.38 and -3.60 respectively. In this table, '**'and '*', represent 1% and 5% level of significance respectively.

TABLE 3.3 UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT ONLY

UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT ONLY						
		LEVEL		1st Difference		
	Variables	DF	ADF	DF	ADF	Conc
1	LNGDP	-5.38**	-	-	-	I(0)
2	LNFDI	-1.30	-1.87	-4.16**	-	I(1)
3	LNTFDI	-1.07	-1.15	-3.21**	-1.94	I(1)

Note: From CRITICAL DICKEY–FULLER table, 1% and 5% significance level for sample size less than 50 is given as -3.75 and -3.00 respectively. In this table, '**'and '*', represent 1% and 5% level of significance respectively.

TABLE 3.4 UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT AND TIME TREND

UNIT ROOT TEST FOR STATIONARITY WITH CONSTANT AND TIME TREND						
		LEVEL		1st Difference		
	Variables	DF	ADF	DF	ADF	Conc
1	LNGDP	-17.75**	-	-	-	I(0)
2	LNFDI	-1.05	-0.68	-4.35*	-	I(1)
3	LNTFDI	-1.02	-2.06	-3.17	-2.01	N.A

Note: From CRITICAL DICKEY–FULLER table, 1% and 5% significance level for sample size less than 50 is given as -4.38 and -3.60 respectively. In this table, '**'and '*', represent 1% and 5% level of significance respectively.

IV. Results And Discussion

4.1 SIMPLE REGRESSION MODEL RESULTS

Following the models specified in the previous section, the result of the simple regression model is presented first. Equation 9 shows that FDI significantly impacts on the growth of Agricultural sector.

$$GDP_t = 0.511FDI_t \qquad 9$$

$$se = 0.197, t-value = 2.59, p-value = 0.0179^{*}, R^2 = 0.26, F = 6.71$$

$$DW = 2.7068$$

The contribution is also large. Since the equation is in the level form, the interpretation is straight forward. A unit increase in FDI will translate to 0.511 increases in agricultural output. The R^2 is, however, low, suggesting that there are other variables such as fertility of the land, the amount of rainfall and so on that contributes to agricultural growth. Thus, FDI accounts for only 26% variation in GDP. The F-statistical indicates the goodness of fit. The critical F statistic for 1 and 18 degrees of freedom at 5% level of significance is 4.41 whereas the calculated F statistic of the regression is 6.71. The result is, thus, somewhat reliable. How about robustness test? This will be taken up in the next section.

Suppose the total FDI inflow is used instead of the agricultural FDI, the result will be equation 10.

$$GDP_t = 0.667TFDI_t \qquad 10$$

$$se = 0.17, t-value = 3.9, p-value = 0.00095***, R^2 = 0.445, F = 15.24$$

$$DW = 3.34156$$

This is more interesting than that of the unit of agriculture. The contribution of FDI is larger and the statistics are more statistically significant than those of equation 9. This indicates that if the total FDI inflow is used in the analysis, following the common practice in the literature, the result will yield a different result. While the former finds 0.5 increases in GDP, the later submits 0.7 increases. Again, the specific agricultural FDI explains about 26% variability in their output comes from FDI, the total FDI attributes 45% variation to FDI. This, obviously, suggests a need for FDI sectorial investigation. The coefficient of total foreign direct investment is highly significant (significance level = 0%) whereas that of sectorial FDI is marginally significant. Note that the large Durbin-Watson (DW) test statistics associated with these results might have some serious implication on the result. This will be pursued later. Presently the next section will investigate the multiple regression models specified in section 3.

4.2 MULTIPLE REGRESSION MODEL RESULTS

$$GDP_t = -0.268FDI_t + 0.8899TFDI_t \qquad 11$$

$$se = (0.35)(0.35)$$

$$t = (-0.775)(2.60)$$

$$p = (0.448)(0.018^{*})$$

$$R^2 = 0.463, F = 7.76, DW = 3.4477$$

(The correlation coefficient between FDI and TFDI = 0.866)

The coefficient of total foreign investment is significant at 5% level. Comparing this result with that of 9 and 10 points to some of the causes of the mixed results that characterizes development literatures. While equation 9 shows that the agricultural FDI has a positive and statistically significant impact on output, equation 11 suggests a contrary effect. Again, while equation 10 implies a positive and a highly statistical significant contribution of total FDI to agricultural growth, equation 11 suggests just a slightly significant positive impact. There is no doubt that there is something intrinsically wrong with either the simple or the multiple regression models.

Following the commonly used model, in which other economic variables such as exchange rate and interest rate impacting on GDP or inflow of FDI is considered, we have:

$$GDP_t = -0.15FDI + 0.44TFDI + 0.41EXR + 0.074ITR \quad 12$$

$$se = (0.45) \quad (0.61) \quad (0.36) \quad (0.21)$$

$$t = (-0.33) \quad (0.73) \quad (1.13) \quad (0.35)$$

$$p = (0.75) \quad (0.48) \quad (0.27) \quad (0.73)$$

$$R^2 = 0.52, F = 4.39, DW = 3.68688$$

(Note: The multicollinearity in the regression increases with increasing number of explanatory variables)

Obviously, the result of equation 12 departs more significantly from those of equation 9, 10, and 11. It is suggestive of the fact that as the number of explanatory variables increase, the multicollinearity problem is bound to increase, and thus, the t and F statistics are reduced. This is evident in the result since neither the departmental FDI nor the overall FDI makes significant contribution to growth. Note that the overall regression is significant event, although none of the individual t statistics is significant. The calculated F statistic is 4.39 whereas the critical F statistic at 5% level of significant at 4 and 16 degree of freedom is 3.01. It can be inferred from the two multiple regression models that increasing the number of the control variables makes the understanding of the role of FDI more complicated and thus, more confusing. The implication of these results is that two authors using simple regression models on the same data may arrive at the same conclusion whereas others investigating the same data using multiple regression specifications will submit different perspectives of FDI-growth impact. This will surely increase the number of the opponents or constants in the acclaimed lack of censuses among FDI-growth researchers with the ultimate end of throwing the public and the investment policymakers into more confusion. Since the main objective of the present analysis is to reduce the level of confusion in FDI-growth studies, we pursue the simple regression model further.

We will particularly attempt to test the validity of the simple regression model. This will enable us draw a definitive conclusion on the role of FDI on the agricultural economy.

4.2 ROBUSTNESS TEST

4.2.1 LOG-LOG REGRESSION MODEL

One of the ways of validating a regression result is by using the log forms of the variables. Wilhelms and Witter (1998) whose work is partly similar to ours submit that the robustness of unlogged regression results could be tested by using the semi-logged (linear-log) and the logged forms of the variables. The result of the log-log form is presented in equation 13.

$$\ln GDP_t = 0.55 \ln FDI_t \quad 13$$

$$se = 0.19, t-value = 2.88, p-value = 0.0096^{**}, R^2 = 0.30, F = 8.29$$

$$DW = 2.9957$$

It is interesting to note that the FDI contribution is not only larger but the associated t, p, R-square and F statistics are also more statistically significant than that reported by the level form. The coefficient of FDI is significant at 0.1% level of significance. It is also important to indicate that log-log coefficient is interpreted percentage wise unlike that of level form. Thus, 1% increase in FDI will lead to 0.55% increases in the agricultural output.

How does the total FDI inflow within the period impact on agricultural sector? The result is presented in equation 15. The result shows a larger contribution.

$$\ln GDP_t = 0.601 \ln TFDI \qquad 14$$

$$se = 0.18, t-value = 3.3, p-value = 0.004**, R^2 = 0.36, F = 10.72$$

$$DW = 3.2347$$

The coefficient of total foreign direct investment is significant at 0.1% level of significant. It is interesting to observe that the coefficient of the total FDI remains positive and significant. It should be noted that the linear relationship between GDP and FDI is being validated by the log-log connections and it would be plausible to conclude that FDI exerts positive and significant impact on the agricultural sector. However, before drawing such policy imperative conclusion, there is yet one more validation test.

4.2.2 AUTOCORRELATION TEST

It should be observed that each of the regression result is associated with Durbin-Watson (DW) statistic test. The implication of this on the result will be discussed in this section. Autocorrelation and multicollinearity are about the worst problems that bias OLS estimates. The parameter estimates are not only biased but the associated student t-test statistics and F-distribution test are also unreliable in the presence of these two regression problems. They can, for example, influence both the economic and statistical significance of the coefficients of the predictor variables. In order words, they can change the sign as well as the size of the student t statistic associated with the estimates. Statistical significant variables could become insignificant in the presence of autocorrelation or multcollinearity or vice versa. Detection as well as correction for autocorrelation is, understandably, a giant stride in the direction of robustness test. The commonest way of detecting it is by using the widely celebrated Durbin-Watson (DW) test statistics. The formula is given as:

$$DW = 2\left(1 - \frac{\sum \hat{u}\hat{u}_{t-1}}{\sum \hat{u}_t^2}\right) \qquad 15$$

where u_i is the residual from the regression.

As a result of its universality, it has been integrated in most statistical software analysis packages. Using the formula above, the DW statistic of the regression equations is calculated. It should be noted that DW statistics associated with each of these regressions is large. Whether DW statistics of those magnitudes imply the presence or absence of autocorrelation is a question that has no simple answer. Several steps are required to arrive at that conclusion. Table 3.1 is the Durbin-Watson Decision table that could be used in conjunction with the calculated DW statistic, the lower and upper critical values of DW statistic, to judge whether the results contain autocorrelation.

The DW statistic associated with equation 9, for example, is 2.71. The lower critical and upper limit values of DW statistic associated with 1 explanatory variable and 20 observations are respectively 1.201 and 1.411. From DW decision table, the test is conducted using (4-du) <DW< (4-dL) and the result is 2.59<2.71<2.80, satisfying the limit of inconclusiveness. This reveals the hopeless of using DW test, the universal appraisal notwithstanding. Since the conventionally accepted method of detecting autocorrelation is subjective, is there any other statistic that is more useful?

Table 3.1: Durbin-Watson Decision Table for Test for autocorrelation

Positive AC	Inconclusive	No AC	Inconclusive	Negative AC
0<DW<dL	dL<dW<du	du<DW<(4-du)	(4-du)<DW<(4-dL)	(4-dL)<DW<4

Where AC = autocorrelation, dL = lower DW statistic, du = DW statistic.

In addition to the boundaries indicated above, there are three other more speculative conditions used to decide the existence or absence of autocorrelation using the calculated DW statistic. Conventionally, DW of approximately 2, DW<2 and DW>2 are respectively interpreted as presence of zero, positive and negative autocorrelation in a regression.

Using this more general DW test, we can conclude that OLS estimates in equation 9 are biased and thus

unreliable. This brings both the economic and statistical significance established in equation 9 into doubt. Possibly, the positive and significant contribution of FDI to GDP indicated in equation 9 might be induced by autocorrelation. How does one account for autocorrelation in a data so as to avoid spurious regression result?

4.2.3 REMEDY FOR AUTOCORRELATION

A number of measures could be used to correct for autocorrelation in a regression. Instrumental variables are often used to reduce autocorrelation in a data. Some of such instruments are lagged values of the explanatory variables and growth form of the regressand and the regressors. First, it should be noted that the reason that guide the choice of instrument is to overcome autocorrelation which usually arise when the dependent variable correlate with the error term. Instrument used should, thus, be good at predicting FDI without correlating with the simultaneous dependent variable of interest (GDP in our case). Does our instrument fulfil these criteria? Lensink and Morrisy (2001) admit that finding such instrument is problematic.

Ayanwele (2007), however, find that FDI = (FDI/GDP)*100 could be a good choice of instrument for FDI. We use the same instrument to conduct the final robustness test of equation 9. The result is presented below:

$$GDP_t = 0.11FDI_t \qquad 16$$

$$se = 0.23, t-value = 0.493, p-value = 0.628, R^2 = 0.01, F = 0.2428$$

$$DW = 2.23$$

$$\ln GDP_t = 0.30 \ln FDI_t \qquad 17$$

$$se = 0.22, t-value = 1.37, p-value = 0.19, R^2 = 0.09, F = 1.88$$

$$DW = 2.85$$

The large decrease in the value of DW statistics is worth noting. It reduced from 2.71 (without instrument) to 2.23 when instrumental variable is used. As indicated above, the DW statistic of about 2 is free from autocorrelation. This is an indication that our choice of instrument is good. The absence of autocorrelation in the result further justifies this.

It is evident that the result presented in equation 17 is significantly different from the result it is intended to validate, equation 9. While equation 9 advertises significant contribution of FDI to the agricultural sector, equation 17 shows that the impact is not statistically significant. The log-log form is also presented vis-à-vis for comparison. Although the log-log form without instrument is highly statistically significant, the instrumental variable estimate (equation 18) also confirms that the contribution of FDI to agriculture is not statistically significant.

We conclude this section by asserting that running a single regression (simple or multiple), which is a common practice among development literatures, is just a step out of a journey of one thousand miles. It is evident from this section that several other regression models and test of significance are required to conclude with authority whether FDI plays any significant role on the growth economy of Nigeria. The two giants that stand in the way of OLS applicability are multcollinearity and autocorrelation. The huge influences of the two on OLS estimates have been illustrated in this section. While multicollinearity biases the results of multiple regression models, autocorrelation plays a crucial role in determining the statistical significance of the independent variables in both simple and multiple/standard regression models. The correlation coefficient between the explanatory variables in equation 11 is 0.866. Such high correlation between independent variables is sufficient to induce significant variability in the economic and statistical significance of a regression result. This is instructive to FDI-growth researchers who concentrate more on econometric standard theory but play down the influence of multicollinearity in such a multiple regression. It is thus, obvious that FDI studies requires a more pragmatic approach than suffering the limitations of the traditional econometric theories. While simple regression battles with only one (autocorrelation) out of these intractable problems, multiple regression models are plagued by both autocorrelation and multicollinearity.

4.3 GRANGER CAUSALITY TEST AND LAGGED OLS VARIABLE MODEL RESULTS

Following the granger causality model in section 3.3.4, we tested bilateral flow between GDP and FDI. The result indicates that neither GDP nor FDI granger causes the other. This implies that there is no lag

dependence between GDP and FDI in the agricultural sector. The result points to the type of agricultural product in Nigeria. It might be mostly annual crops which happen contemporaneously (Dominick and Derrick, 2002) with FDI. Attempt to investigate the lagged OLS model also yielded null result, confirming that there is no gestation or incubation period between agricultural production and FDI injection.

V. Conclusions

We assert that FDI contributes positively to the growth of Nigeria economy. The impact is not, however, significant.

Arriving at this conclusion is not as simple as the conclusion sounds. Admittedly, we wallowed through a maze of winding road of OLS and its susceptible estimates before bursting at these straight, express and unbiased results. Although ours is the simplest model, long and rigorous regression techniques cum test of significance are used for result validation in other to scale the hurdles of OLS regression problems. This makes the simple regression analysis, which appears to be an easy exercise tedious, but, interestingly, not complex. The subject, nevertheless, is worth the efforts. Settling the decadal vituperating criticism on foreign investors is a none trivial project, considering the investment laws and policies that could stem from FDI-growth investigation.

Appendix A

GDP	FDI	TFDI	RESIDUALS
85283.6	126.0	6804	-0.7571708
138753.6	128.2	9314	0.5995309
80978.7	117.3	9994	-0.8577665
143706.3	128.9	11339	0.7246938
96783.8	134.8	10899	-0.4738091
149512	334.7	10436	0.6637838
106676.3	382.8	12243	-0.4735995
155934.8	386.4	20513	0.7746496
102759.7	1214.9	66787	-1.4159973
162248.8	1208.5	70715	0.1023898
113497.7	1209.0	119392	-1.1371168
170813.9	1209.0	122601	0.3195638
119486.2	1209.0	128332	-0.9849202
175876.6	1209.0	152411	0.4482314
124674.4	1209.0	154190	-0.8530630
182660	1209.0	157537	0.6206302
129605.8	1209.0	160892	-0.7277324
190369.1	1209.0	166632	0.8165555
203012.6	1209.0	178479	1.1378877
216208.5	1209.0	249221	1.4732591

References

[1]. Adofu, I., (2010). Accelerating Economic Growth in Nigeria, The Role of Foreign Direct Investment. Current Research Journal of Economic Theory 2(1): 11-15

[2]. Aluko, S.A. (1961). "Financing economic development in Nigeria". The Nigerian Journal of Economic and Social Studies, 3(1): 39–67.

[3]. Amadi, S.N., (2002) , The impact of macroeconomic environment on Foreign Direct Investment in Nigeria, Int. J. Dev., 4(2)

[4]. Andren, T., (2007). Econometrics, Thomas and Andren Ventures Publishing ApS.

[5]. Anyanwu, J.C. (1998). "An econometric investigation of determinants of foreign direct investment in Nigeria". In Investment in the Growth Process: Proceedings of the Nigerian

[6]. Economic Conference 1998, pp. 219–40. Ibadan, Nigeria.

[7]. Aremu, J.A.(1997), Foreign Private investment: Issues, Determinants and Performance, A Paper presented at a workshop on Foreign investment policy and practice, organized by the Nigeria Institute of Advance Legal Studies, Lagos, March.

[8]. Ariyo, A. 1998, Investment and Nigeria's economic growth. In investment in the Growth Process Proceedings of Nigeria Economy Society Annual Conference 1998, pp.389-415. Ibadan, Nigeria.

[9]. Ayanwale, A.B., (2007). FDI and Economic Growth: Evidence from Nigeria. .AERC Research paper 165, African Economic Research Consortium, Nairobi.

[10]. Badeji , B. O., and Abayomi, O. M., The Impact of Foreign Direct Investment on Economic Growth in Nigeria International Research Journal of Finance and Economics 73 (2011) http://www.eurojournals.com/finance.htm

[11]. Brown, C.V. (1962). "External economies and economic development". The Nigerian Journal of Economic and Social Studies, 4(1): 16–22.

[12]. Chete, L.N. (1998) "Determinants of foreign Direct Investment in Nigeria", The Nigerian Journal of Economics and Social Studies Vol. No1

[13]. Chingarande, A. Et al. (2012). The impact of interest rates on Foreign direct investment. A case study on the Zimbabwean economy (Febrary 2009-June 2011). International Journal of Management Sciences and Business Research vol.1, No.5

[14]. Dolan, et al., (1991). Foreign Investment as a Tool for Accelerating Economic Growth in Less Developed Countries the Nigerian Experience. In: Unpublished B.Sc Project Department of Economics, Kogi State University. K.E . Elebiyo, (Ed.), (2004). Anyigba, .Nigeria.

[15]. Gujarati, (2004), Basic Econometrics, fourth edition. The McGraw−Hill Companies.

[16]. Hymer, S.H., (1960). The International Operations of National Firms. A study of Direct ForeignInvestments. PhD Dissertation.

Published Posthumously The MIT Press, (1976). Cambridge, Mass.
[17]. Katerina, L., Paranastasiou, J., Athanasios, V., (2004). Foreign Direct Investment and Economics. South Eastern Journal of Economics, 1, 97-110.
[18]. Keller, W. (1996). Absorptive capacity: on the creation and acquisition of Technology in Development. Journal of Development Economics, 49, 199-227
[19]. Lipsey, R.G., (1986). An Introduction to Positive Economics. 6th Edn. Weidenfeld and Nicolson, London
[20]. Lensink, R and Morrisey, O. (2001). Foreign direct investment: Flows, volatility and growth in developing countries. Globalization and Poverty DESG 2001. 32p, Nottingham.
[21]. Obinna, O.E., (1983), Diversification of Nigeria's external finances through foreign direct investment. Nigerian Econometric Society Annual Conference Proceedings, JOS, 13-16th May.
[22]. Ogbanje, E.C, Okwu, O.J. and Saror, S.F., PAT December 2010; 6(2):15-25 ISSN:0794-5213, www.patnsukjournal.net/currentissue
[23]. Ojo, M.O. (1998), Developing Nigeria Industrial Capacity: via Capital Market, Abuja, CBN Bulletin Vol. 22, No. 3 July/Sept.
[24]. Okon, J. U., Augustine, O. U., and Chuku, A.C. (2012), Foreign Direct Investment and Economic Growth in Nigeria: An Analysis of the Endogenous Effects. Current Research Journal of Economic Theory 4(3): 53-66
[25]. Onu, A.J.C. (2012). Impact of Foreign direct investment of economic growth in Nigeria. Interdisciplinary Journal of contemporary Research in Business, vol. 4, No. 5
[26]. Oseghale,B.D. and Amenkhienan, F.E. (1987) "Foreign Debt, Oil Exports and Direct Foreign
[27]. Investment and Economic Performance" Nigerian Journal of Economic Studies, Vol.29, No3.
[28]. Osinubi, T.S., Amaghionyodiwe, L.A., International Journal of Applied Economics and Quantitative Studies V6-2(2009)
[29]. Otepola A (2002). Foreign Direct Investment as a factor of Economic Growth in Nigeria.
[30]. Oyaide, W.G., (1977). The Role of Direct Foreign Investment: A case study of Nigeria, (1963-1973). United Press of America, Washington D.C.
[31]. Oyinlola, O. (1995). "External capital and economic development in Nigeria (1970-1991)".
[32]. The Nigerian Journal of Economic and Social Studies, 37(2&3): 205–22.
[33]. Robu, R.G.P. (2010), The impact of foreign direct investments on labour productivity: A review of the evidence and implications, The Romanian Economic Journal, no. 36
[34]. Root, F.R., (1984) . International Trade and Investment. 5th Edn. South Western Publication Company, Cincinnati, Ohio
[35]. Tadaro, M.P., (1999). Economic Develop men t. 7th Ed n., Addison Webley Longman Inc.Reading. Massachusetts
[36]. Ugwuegbe, S.U., Okoro, A. O., Onoh, J.O., The impact of Foreign Direct Investment on the Nigeria Economy. European Journal of Business and Management, Vol. 5. No. 2, 2013.
[37]. Umah, K.E. (2002), The Direct of Foreign Private on Economic Development of Nigeria, Nigeria Journal of Economics and Financial research Vol. No.3.
[38]. Umah, K.E. (2007), The Impact of Foreign Private Investment on Economic Development of Nigeria, Nigeria Journal of Economics and Financial research. Vol. 1, No.3
[39]. Wilhelms and Witter (1998) foreign direction investment and its determinants in emerging
[40]. economics. African Economic Policy Paper Discussion Paper Number 9
[41]. Worl Bank, (1996), World Debt Tables: External Finance for Developing Countries, Vol. 1 (Analysis and Summary Tables). Washington, D.C.: The World Bank.
[42]. Xu, B. (2000). Multinational Enterprises Technology Diffusion and Host country productivity growth. Journal of Economics, 62, 477-493