

Research Article

Accelerating Economic Growth in Nigeria, the Role of Foreign Direct Investment: A Re-assessment

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Abstract: Foreign Direct Investment (FDI) cum growth related studies is more than an academic exercise and should be viewed as such by development researchers. This stems from the backdrop that lives of important foreign officials and personnel as well as those of heads of states are involved as they cross country borders to woo foreign investors or manage their FDI in other countries. We are, consequently, concerned with the way some insensitive reports handle autocorrelation and multicollinearity regression problems in their multiple OLS analysis. We equally doubt the model specification of some investigators who, failing to consider the unavoidable time lag between FDI projects gestation period and the time FDI starts contributing to the growth economy of Nigeria, conclude that FDI does not play a major role on the nation's economy. We find, after accounting for some of the limitations of the existing literatures, that FDI occupies a significant niche in the growth economy of Nigeria.

Keywords: Autocorrelation, economic growth, foreign investment, granger causality, lagged variables, methodology, multicollinearity, residuals

INTRODUCTION AND PROBLEM

We conclude that other works, especially those that find a negative or a statistically insignificant impact like Adofu (2010), need be critically re-examined to reduce the number of voices who would exclude Nigeria from the ongoing trade liberalization and economic globalization that is sweeping across almost all the nations of the world.

The main aim of any interested reader of or audience to a work of art or science is to understand the writer or presenter's motivation and to test whether the artist is enthusiastic about his/her work. Convince a reader or an audience of your motivation and interest in your own topic and he/she will not only feel at home, get more interested and quickly decide to stand with or against you, but will do either with the same zeal of yours. The same is expected from the vast contentious literatures that debate the place of foreign direct investment in the growth economy of Nigeria. The literatures devoted to the subject are not only many but a number of them are so similar such that it is difficult, if not impossible, to distinguish the motivation, interest or methodology of one author from another. Except the researchers and policymakers prefer the argument to remain endless and, ultimately, uninteresting, it is certain that this coasting, amble and cyclic approach will hardly settle the dispute. Instead, it is time every researcher should state clearly and succinctly while there is yet a need for another paper and the striking

difference (s) between the intended submission and the existing literatures.

This is the target of the present study. We feel a little uncomfortable to leave the reader in suspense and probably confused as he/she wonders about the problem, our approach and what our contribution is from the introductory stage.

While we admit that the impact of FDI on the economy of Nigeria is disputable, we are concerned about the way some empirical literatures conduct their investigations. The general method used is Ordinary Least Square (OLS) techniques. It is such a fundamental and essential tool that Gujarati (2004) interestingly pictured it as the bread-and-butter tool of econometrics. The upside of the method, however, lies in the numerous intractable regression problems that are associated with its application. The two major problems are autocorrelation and multicollinearity. 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 autocorrelation. The commonest way of detecting it is by using the widely celebrated Durbin-Watson (DW) test statistics. But Andren (2007) find that DW test applicability is dependent on the number of observations used as well as the values of the explanatory variables used in the regression. There is, thus, no precise critical value for the DW test statistic unlike t and F test statistic that have definite critical values. This is evident from the Durbin-Watson decision table that maps a range of limits within which one might speculate autocorrelation and some

boundaries within which the test statistic is of no use as it fails out rightly to detect whether there is autocorrelation or not. This is, of course, distressing, considering the number of authors that rely on it and the serious implications of autocorrelation and consequently, the importance of its detection and correction in regression analysis.

Although regression result that contains autocorrelation is described as nonsense or spurious regression (Gujarati, 2004), some researchers (Ayanwale, 2007; Okon *et al.*, 2012; Adofu, 2010; Ugwuegbe *et al.*, 2013) conduct their analyses on the impact of FDI on the economic growth in Nigeria without detecting/correcting for autocorrelation in their result. Expectedly, such results might lead to misleading policy recommendation.

Bivariate model might be used to investigate the connection between two variables, which is hardly the case in econometrics. This is because economic growth of a nation, for example, demands the inclusion of other variables that are responsible for the economic development of a nation. The use of multiple regression the model is, thus, the conventional method of investigating economic growth. However, multicollinearity is a formidable multiple regression problem that might have great consequences on the OLS result. Some authors have adopted a solution of “do nothing” as they fail to make corrections when confronted with this problem and yet they go ahead to loud their result as if they were free from this serious regression bias.

Aside the regression problems associated with OLS techniques; nonstationarity of data is a problem inherent in some econometric variable. Conducting an OLS analysis without testing for the presence of unit root is an indication that authors are probably unaware of the implications of nonstationarity of data in econometrics. Co-integration and granger causality tests are other important tests which are, disturbingly, just gaining currency among Nigeria FDI-growth investigators.

How about the time lag between FDI injection and the economic growth response time? This is, apparently, an exotic topic to Nigeria FDI-development researchers. Many authors are content with the traditional OLS that use current values of growth variables. But when the time lag between FDI registration in Nigeria and the actual operation as well as the time taken for the FDI to start exerting significant effects on the Nigeria economy are taken into consideration, one tends to doubt the submission of such works. Otepolo (2002) and Badeji and Abayomi (2011) are examples of works that used the current values of FDI and thus, arrive at a negative conclusion.

In spite of this array of issues in FDI-growth related studies, almost every new paper boasts of its

readiness to settle the controversy among researchers on whether FDI inhibits or promotes the economic growth of Nigeria. Obviously, settling such an age long dispute is tasking and requires holistic OLS regression techniques. This is the ambition of the present study.

In order to drive our points home regarding the literature gap or pitfalls of the existing FDI-growth related studies with respect to methodology, we will not introduce a new data. Rather, we will revisit already existing works and use one of the paper as well as its data as a case study.

LITERATURE REVIEW

FDI is an investment made to acquire a lasting management interest (normally 10% of voting sock) 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 separating 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, faster 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 schools 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. This 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 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 overseas 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 Nigeria's economy. They rather look forward to the empirical analyst 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) and Oseghale and Amenkhenan (1987). Others such as Oyinlola (1995), Badeji and Abayomi (2011) and Otepolo (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 (Anyanwu, 1998; Adofu, 2010) and as such frowned 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 every lips at this stage is what is responsible for this contradictions and what could be the way out of the dilemma. But section one already blamed methodology as well as OLS regression problems as the kingpin that upsets the apple cart.

The next section will attempt to disentangle the effects of these major regression flaws like autocorrelation and multicollinearity on OLS regressions. If investment is, indeed, the most development indicator that determines the economic growth of a country, then economic data need be rigorously investigated in order to draw a definite and unbiased conclusion that could have true policy impact.

DATA SOURCE AND ECONOMETRIC RESEARCH METHODOLOGY

Data source: Since this is a re-assessment of the work of Adofu (2010), the data used in the present analyses are those of the study referred above.

Econometric research methodology:

Introduction: Due to the indeterministic nature as well as the complex interplay between the economic growth variables, research methodology is of great importance to the economist. This is because the results and conclusions drawn from the research depend greatly on the method adopted. There is, thus, a need for a researcher to understand and hence, explain in details, the various techniques employed in a particular study. This will give some other person the room to assess the validity of the researcher's claim. This is the main focus of this section.

In order to achieve this aim, the description of the variables used in the analyses were first given, followed by the specification of the econometric models, the description of the problems associated with regression analyses, detection and correction for these problems, significant tests (e.g., unit root and co-integration tests) and finally, illustrative examples are given for various models in attempt to explain how these regression problems and statistical tests are accounted for or implemented in our study.

Conceptual framework and description of variables:

A number of questions were raised in above section about the constituents, measurement and the methods of analysis of world development variables. This section intends to highlight the nature and measurement of these 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.

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 (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.

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 study.

Since FDI is expected to have positive effect on the economic growth of Nigeria, other economic variables that are known to influence the economic development of the nation are included in the present models. Understandably, factors that correlate with GDP may equally have a link with FDI.

Exchange rate (EXR): This is the price of one currency in terms of another. It is usually defined in two ways: Domestic currency units per unit of foreign currency or foreign currency per unit of the domestic

currency. High exchange rate may discourage investors. Devaluation of local currency, for example, will lead to increase in trade volumes and competitiveness. Its connection with GDP tells whether Nigeria exchange rate policy encourages economic growth or not.

Total domestic savings: This is a crucial factor that not only affects the nation's balance of payment but a key parameter that determines the investment status of a country. Domestic saving is such an important economic variable that its lack of accumulation could lead to economic crises. Domestic saving is an important source of capital which helps to run economic progress and maintain financial stability. But there is a serious doubt about that higher saving leads to higher investment, which in turn leads to higher economic growth or surprisingly, empirical results will provide evidence of causality from economic growth to saving. If growth leads to higher savings, then it is important to know that the changing growth rates are likely to result in changing saving which would be a good implication to the policy setting from Nigeria government.

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 study 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:

$$GDP = f(FDI, EXR, TDS) \quad (1)$$

Traditional regression model: Suppose that Eq. (1) has a linear relationship, it can be transformed as:

$$GDP = \beta_0 + \beta_1 FDI + \beta_2 EXR + \beta_3 TDI + u_i \quad (2)$$

where, $\beta_0, \beta_1, \beta_2, \beta_3$ and u_i are, respectively the constant term, the coefficients of FDI, the coefficient of EXR, the coefficient TDI and the error term assumed to be uncorrelated with the dependent variable.

Standardized regression model: Regression on standardized variable has a number of advantages over the traditional regression model Eq. (2). In order to exploit these advantages, standardized model Eq. (3) is also run:

$$GDP = \beta_1 FDI + \beta_2 EXR + \beta_3 TDI + u_i \quad (3)$$

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:

$$GDP_t = \beta_0 + \beta_1 FDI_{t-i} + \beta_2 EXR_{t-i} + \beta_3 TDI_{t-i} + u_i \quad (4)$$

where $i = 1, 2, 3, \dots$

Appropri 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.

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:

$$GDP_t = \beta_0 + \sum \beta_j GDP_{t-j} + \sum c_j FDI_{t-j} + u_t \quad (5)$$

$$FDI_t = \beta_0 + \sum \beta_j FDI_{t-j} + \sum c_j GDP_{t-j} + u_t \quad (6)$$

Eq. (5) postulates that current GDP is related to past values of itself as well as that of FDI and (6) postulates a similar behaviour for FDI. There are four implications for each of the equations.

- $GDP \rightarrow FDI$ [GDP causes FDI, unilateral causality]
- $FDI \rightarrow GDP$ [FDI causes GDP, unilateral causality]
- $GDP \leftrightarrow FDI$ [feedback or bilateral causality]
- $GDP - FDI$ [Independence]

The null hypothesis is $H_0: \sum c_j = 0$, that is lagged FDI and GDP terms do not belong to Eq. (5) and (6), 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 hypotheses $H_0: \sum c_j = 0$ 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 AIC criteria. The details of granger tests are explained in below section.

Details of analyses: Above Section 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 below section.

Unit root and cointegration tests:

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-stationary) 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 1 and 2 shows that all the variables are integrated of order one, I (1).

All the results of the present study are equally tested for long run relationship between the variables before accounting for the short term deviations. Any model whose variables are co-integrated are indicated by including the error correction term (e_{t-1}) to account for the deviations from the long term relationship between the variables.

The implication of the presence of unit root is such that the regression result is spurious or nonsense result. This is why the above test is extremely necessary.

Cointegration: The summary of above section is that stationary (no unit root) data can be used without differencing while that with unit root are non-stationary and must be differenced to get a stationary or stable time series data that is good for OLS application and future prediction. Mathematically:

Table 1: Unit root test for stationary with constant only

Unit root test for stationarity with constant only						
		Level		1st Difference		
		DF	ADF	DF	ADF	Conc
1	GDP	1.054	1.209	-3.022*	-1.261	I(1)
2	FDI	-1.680	-0.119	-4.705**	-3.023*	I(1)
3	EXR	0.238	0.097	-3.851*	-2.033	I(1)
4	TDS	7.438**	0.827	-0.675	-0.298	I(0)

From CRITICAL DICKEY-FULLE 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 2: Unit root test for stationary with constant and time trend

Unit root test for stationarity with constant and time trend						
		Level		1st Difference		
		DF	ADF	DF	ADF	Conc
1	GDP	-0.669	-1.142	-2.958	-1.242	N.A
2	FDI	-2.929	-2.075	-4.819**	-2.925	I(1)
3	EXR	-1.607	-1.534	-4.016*	-2.264	I(1)
4	TDS	1.546	0.367	-2.794	-1.485	N.A

From CRITICAL DICKEY-FULLE 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

$$Y_t = Y_{t-1} + \varepsilon_t \tag{7}$$

$$Y_t = Y_{t-1} + u_t + \varepsilon_t \tag{8}$$

are both non-stationary time series data since the coefficient of Y_{t-1} is equal to 1, implying unit root. Eq. (7) is referred to as random walk while 8 is random walk with drift. Stationary time series is of the form:

$$Y_t = u_t + \varepsilon_t \tag{9}$$

$$Y_t = u_t + \gamma Y_{t-1} + \varepsilon_t, \quad |\gamma| < \pi \tag{10}$$

$$Y_t = u_t + \beta t + \varepsilon_t, \quad t = 1, 2, \dots \tag{11}$$

Eq. (9) is called white noise, implying that it is dominated by the error term, ε_t , while Eq. (10) is autoregressive and (11) is trend stationary. Suppose that:

$$Y_t = Y_{t-1} + \varepsilon_t \tag{12}$$

and

$$X_t = X_{t-1} + \varepsilon_t \tag{13}$$

are two series with unit root. Suppose also that the regression of Y_t on X_t contains no unit root in their residual term, that is, if:

$$Y_t = \beta_0 + \beta_1 X_t + u_t \tag{14}$$

Contains no unit root in the residual, u_t , then Y and X are said to be co-integrated. For two data time series that are co-integrated, inclusion of an explanatory

variable that accounts for the deviation from the long-run relationship is necessary. A regression equation that includes such correction explanatory variable is called an error correlation model. The equation is of the form:

$$\Delta Y_t = \beta_0 + \beta_2 \Delta X_t + \beta_3 e_{t-1} + u_t \tag{15}$$

where, e_{t-1} is the short-run correction factor for the regression. One wonders so much about the ado about unit root test and co-integration. This is because regression of two none-stationary time series may produce a spurious regression. Suppose that bivariate model is specified as follows:

$$GDP_t = \beta_0 + \beta_1 FDI_t + u_t \tag{16}$$

And that Eq. (16) is subjected to a unit root test, then we can confirm whether the regression result is false/by chance or not. The procedure is as follows. After the regression, the residual term, u_t , is tested for unit root. If it contains no unit root, then the result is valid even if GDP_t and FDI_t series are both non-stationary. Regression results of two parameters whose residuals do not have unit root are valid and the two parameters are said to be co-integrated. Put simply, two variables will be co-integrated if they have long term or equilibrium relationship.

Granger test (Vector Autoregression Model (VAR):

Do past values of FDI help to explain the present values of GDP? Or do past values of FDI help to predict the present values of GDP? The test is conducted as follows. The first difference of GDP and FDI was taken resulting to the growth equation. The current GDP growth is regressed on all lagged GDP growth terms and other variables in the model, if any. The lagged FDI

growth will not be included in this regression. This is called the restricted regression and from this, restricted residual sum of squares, RSS_R , is obtained. This is the first stage. The second stage involves re-running the first regression but including the lagged terms of FDI growth form. From this regression, the unrestricted sum of squares, RSS_{UR} , is obtained. The Akaike information is calculated using the formula below:

$$AIC = \ln\left(\frac{RSS_{UR}}{T}\right) + \left(\frac{2j}{T}\right) \quad (17)$$

where

- RSS_{UR} = Error sum of squares of the unrestricted regression
- T = Current time
- j = Number of estimated parameters in the unrestricted regression

The overall goodness of fit is measured by F values. The F value here is not, however, the normal F values embedded (F_{output}) in the regression packages. Instead, the F, generally referred to as F_{cal} in this project is calculated from:

$$F_{cal} = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n - k)} \quad (18)$$

where,

- RSS_R = Restricted Sum of Square Residuals
- RSS_{UR} = Unrestricted Sum of Square Residuals
- m = Number of the lagged terms of the variable that is being tested for dependability. That is the parameter whose control on the depended variable is being investigated.
- n = Number of observations
- k = Number of parameters estimated in the unrestricted regression.

It is the F_{cal} that is used to test the goodness of fit of the regression. In order words, if F_{cal} of a regression is greater than the critical F-values for a regression of the type $FDI_t \rightarrow GDP_t$, then FDI is said to granger cause GDP and otherwise, if not.

RESULTS AND DISCUSSION

Traditional OLS model results: Table 3 presents the results of the ordinary or traditional OLS models. Since this is a re-assessment of Adofu (2010) works, it makes sense to compare the results with theirs. Our results compare very well with theirs both in terms of sign of the coefficients and t values. There is equally a good agreement between the coefficients of the two results except for one major disparity which might be

Table 3: Dependent variable: GDP

Variables	Coefficient	S.E.	T-value	p-value
Constant	85950.0000	3031.0000	28.3580	1.91E-14***
FDI	0.0830	0.0506	1.6410	0.1220
EXR	139.6000	151.8000	0.9200	0.3720
TDS	0.0324	0.0340	0.9530	0.3560

***, **, *, implies significance at 0, 0.1 and 1%; F-statistic = 30.87; Multiple R-squared: 0.8606; DW = 0.4123519

Table 4: Dependent variable: GDP

Variables	Coefficient	S.E.	T-value	p-value
FDI	0.2739	0.1616	1.6950	0.1090
EXR	0.3219	0.3390	0.9500	0.3560
TDS	0.3844	0.3904	0.9850	0.3400

***, **, *, implies significance at 0, 0.1 and 1%; Multiple R-squared: 0.8606; F-statistic: 32.93, DW = 0.4123519

attributed to data treatment. That is the coefficient of exchange rate. They reported 0.308 whereas ours is 139.6 as indicated in the Table 3. Otherwise, the results of their traditional regression model are in 100% agreement with ours.

Understandably, other coefficients are econometrically feasible but that of exchange rate has no econometric meaning. This, no doubt, faults the model especially as the coefficient of exchange rate cannot be distinguished from that of FDI and TDS with respect to significance. This is because the three variables are statistically insignificant and thus are on equal footing and interpretation. In that case, it is completely impossible for exchange rate to make a contribution of 139.6 or 13960% to the economy of Nigeria. Of course, the standard error of the coefficient (151.8) equally indicates that there is, indeed, a problem with the model or EXR data. We adopt a different method - the method of standardized variable to validate the result.

Results of the standardized regression model:

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.

Table 4 confirms that there is a good agreement with the result of the traditional OLS and the standardized OLS regressions. The two major differences between them are the absence of the intercept term and the presence of a normalized or standardized coefficient of EXR in the latter. The coefficients are all positive with total domestic savings

Table 5: Correlation matrix for Table 2

	GDP	FDI	EXR	TDS
GDP		0.8159714	0.8892616	0.9127242
FDI	0.8159714		0.7259624	0.8021865
EXR	0.8892616	0.7259624		0.9586345
TDS	0.9127242	0.8021865	0.9586345	

Table 6: Dependent variable: ΔGDP

Variables	Coefficient	S.E.	T-value	p-value
ΔFDI	0.00088920	0.05271910	0.017	0.9868
ΔEXR	-0.03178110	0.12487100	-0.255	0.8026
ΔTDS	0.72803200	0.19441190	3.745	0.00195**

***, **, *, implies significance at 0, 0.1 and 1%; Multiple R-squared: 0.5707; F-statistic: 6.646, DW = 0.6986392

making the highest impact on the economic growth of Nigeria. But how about the autocorrelation test? The Durbin-Watson (DW) statistic is far below 2 and the common convention is to conclude the presence of a strong positive autocorrelation in the result. But Andren (2007) find that DW test statistic could be misleading in some cases. This is because there is no simple distribution function for DW statistic. It rather depends on the number of observations used as well as the values of the explanatory variables used in the regression. Since the widely celebrated DW statistic usually fails in some cases, we turn to a more reliable means of testing for the presence of autocorrelation in a data.

Gujarati (2004) has some ingenious method of testing for autocorrelation. The two simpler ones are the graph method and the run test. We adopt the graph method here. In this method, the current and lagged residuals of a regression are plotted. There is autocorrelation in a regression result if the graphs of actual and standardized residuals are plotted on the same axis against time and the two curves follow the same pattern and straddle around a zero centre mean; also there is autocorrelation in a regression if the current and lagged values of the residuals are graphed and there is a trend such that the data points concentrate on the first and third quadrants. See Appendix A for details and interpretation of the plot of current and lagged residuals of Table 4 regression residuals.

How about multicollinearity? It was indicated in above section that this is a major problem in a multiple regression model. It should also be recalled that where it exists, it reduces the t values of the coefficients of the regressands making some of the coefficients of the explanatory statistically insignificant. Table 5 confirm the presence of multicollinearity in Table 4 and it might reduce the t-values of the coefficient of the explanatory variables, making them significantly insignificant. Possibly, the presence of multicollinearity in the result of Table 4 is sufficiently responsible for the reported insignificant impact of FDI and TDS on the economy. How is this accounted for in a regression?

The traditional method of accounting for multicollinearity in a data is by dropping some of the variables. We will not, however, go for that method

since that will lead to a different model from the one we are investigating. Instead, we adopt the method of differencing. The result is presented in the Table 6.

The result above is interesting if it can be validated. Recall that the initial multiple regression problems arising from the result presented in Table 4 was that of multicollinearity. The first question in the direction of result validation is to check if the problem of multicollinearity has been accounted for in Table 6. Table 7 is the matrix of the correlation coefficients of the variables in Table 6.

It is evident from that the problem of multicollinearity is overcome and the result of Table 6 is a better result than that of Table 4. The final test is whether the result above (Table 6) is valid or spurious result? Granger and Newbold, cited in Gujarati (2004), assert that a regression result is valid if $R^2 < DW$. This is true of the DW test statistic and the multiple R-squared in Table 6.

Thus, the total domestic savings makes significant positive impact on the growth economy whereas the contribution of FDI is also positive but not significant. This is in agreement with the appropriate expectation. The larger and significant coefficient of TDS compared to FDI makes a lot of economic sense. There can be little or no doubt that domestic savings impacts positively and significantly on the economy of any nation. What is hotly debated is the role of FDI. The small and non-significant positive contribution of FDI to the growth economy is understandable considering the brief period under study. The negative contribution of exchange rate is instructive. It shows that high variability in exchange rate is detrimental to the economy of the Nigerian nation. A plot of the exchange rate (Appendix A) indicates that the exchange rate was highly variable within the period under study while the rest shows an interesting trend. It is easy to observe from Appendix A that EXR data encountered unusual increases from 1998. Such quantum jump in exchange rate variability will surely impact negatively on the economy.

Table 6 is the long term relationship between the variables. It is also good to investigate their Error Correction Model (ECM) or short term relationship. The ECM is displayed on Table 8. The table shows that the contribution of FDI is higher in the short run than in

Table 7: Correlation matrix for Table 3

	GDP	FDI	EXR	TDS
GDP		0.0460186	-0.0068561	0.3731092
FDI	0.0460186		0.0125096	0.3731092
EXR	-0.0068561	0.0125096		0.1995015
TDS	0.3731092	0.1995015	0.3527684	

Table 8: ECM of Table 6

Variables	Coefficient	S.E.	T-value	p-value
ΔFDI	0.004832	0.016441	0.294000	0.77
ΔEXR	-0.018250	0.038950	0.038950	0.65
ΔTDS	0.977500	0.064170	0.064170	4.15E-10***
e_{t-1}	0.157773	0.013320	0.013320	1.11E-08***

***, **, *, implies significance at 0, 0.1 and 1%; F-statistic = 86.35; Multiple R-squared: 0.8606; DW = 0.4123519

Table 9: Granger causality test for two variable models (Bivariate var)

Regression type	No of lags	F_{cal}	Critical F values			
			1%	5%	10%	df_1/df_2
FDI → GDP	1	3.3714**	8.86	4.60	3.10	1/14
GDP → FDI	1	0.01388	8.86	4.60	3.10	1/14
FDI → GDP	2	4.289**	7.21	3.98	2.86	2/11
GDP → FDI	2	0.6342	7.21	3.98	2.86	2/11
FDI → GDP	3	2.727	7.59	4.07	2.92	3/8
GDP → FDI	3	0.8651	7.59	4.07	2.92	3/8

***, ** and * represent significant at 1, 5 and 10% level of significance; The fraction, df_1/df_2 , represents degrees of freedom (numerator and denominator, respectively); It is used to reference upper (critical) points of the F distribution table

Table 10: Dependent variable: GDP_t (Lag = 1)

Variables	Coefficient	S.E.	T-value	p-value
Constant	91080.0000	2315.0000	39.3480	6.63e-15***
FDI_{t-1}	0.0820	0.0377	2.1730	0.0488*
EXR_{t-1}	43.8200	115.7000	0.3790	0.7109
TDS_{t-1}	0.0569	0.0260	2.1940	0.0470*

***, **, *, implies significance at 0, 0.1 and 1%; F-statistic = 45.36; Multiple R-squared: 0.9128; DW = 0.5619802

Table 11: Dependent variable: GDP_t (Lag = 2)

Variables	Coefficient	S.E.	T-value	p-value
Constant	91820.0000	2409.0000	38.117	9.98e-15***
FDI_{t-2}	0.0902	0.0410	2.202	0.0463*
EXR_{t-2}	-10.9900	133.1000	-0.083	0.94
TDS_{t-2}	0.0849	0.0313	2.715	0.0177*

***, **, *, implies significance at 0, 0.1 and 1%; F-statistic = 38.43; Multiple R-squared: 0.8987; DW = 0.4025418

the long run. The same applies to TDS. Although the exchange rate within this time frame inhibits growth, its negative part is comparatively small at the short run.

Results of granger causality test: It was noted in above section that GCT has a number of advantages over the traditional OLS. The none significant contribution of FDI to the growth economy is puzzling judging from the fact that many developed and developing nations of the world regard FDI as an efficient engine of growth and Nigeria can, hardly, be different. However, this insignificant result could be attributed to the time lag between gestation or incubation stage of FDI and the actual time of operation when the spillovers from the foreign company will start impacting on the national economy. The result of granger causality test is presented in the Table 9.

It is interesting to see that FDI granger causes GDP at both 1 and 2 year lag period. GDP does not granger cause FDI. The F statistics at these lags are both significant at 5% level of significant. Even at lag 3, the F statistic is still high, although not significant at the chosen level of significant. It is, however, significant if

25% level of significance is chosen. The direction of causality between GDP and domestic savings was also tested. For the 3 year lag length, neither GDP nor total domestic savings granger causes the other. They are thus, contemporaneous. This explains why TDS is significant in Table 6 while FDI is insignificant. Domestic savings need no time lag to impact on the economy whereas FDI requires at least one year lag period.

Results of lagged OLS variable model: Following the indications that there might be time lag between GDP and FDI, lagged values of FDI and other explanatory variables are used in this model as specified in above section. The granger causality test result in Table 9 implies that FDI impacted significantly on the economy at 1 and 2 lags. The contribution is more pronounced at the second year lag period. The outcome of lag 1 and 2 OLS model is presented in the Table 10 and 11.

It is evident from the two tables that both FDI and TDS are not only positive as found before but both are now significant in the lagged variable model. Another interesting observation is that their coefficients are

larger at the second year period than the first. That is a reflection of the result of granger causality test presented in Table 9. It is also important to note that FDI contributes more to the growth economy of Nigeria than domestic savings. The behaviour of exchange rate in the two table is also worthy of note. It is statistically insignificant at every lag. Furthermore, the magnitude and sign of the coefficient is unreliable as they fluctuate widely. Its sign, for instance, is positive during the 1 year lag and negative in the 2 year lag period. This could arise as a result of data issues as is evidence from Appendix A. It follows that it is difficult to draw any firm conclusion on the role of exchange rate on the economy within the time under study. Note that the two tables used lagged values of the variables and need not be standardized as they have assumed a different transformation or data treatment.

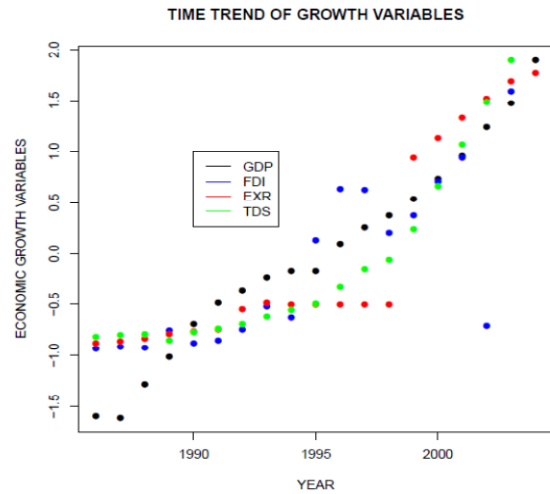
We summarize this section by noting that FDI and domestic savings are the two economic giants that are synonymous with investment and by extension, economic growth and development. Any investigation that submits that they play insignificant role in the economy of any country needs a lot of critical re-evaluation. This is because domestic saving, for example, is the economic corner stone of any state. In fact, the 1997 financial crisis of Thailand is as a result of domestic saving gap.

The significant role of both FDI and domestic saving as find in the present study is in line with government expectations as well as that of a vast number of positive empirical literatures. Ariyo (1998), for example, studied investment trend and its impact on Nigeria's economic growth over the years. He found that private domestic investment consistently contributed to the rising GDP growth rate during the period considered (1970-1995).

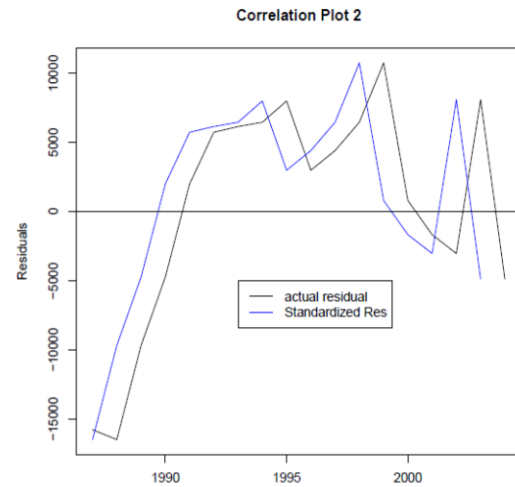
CONCLUSION

The present discussion suggests that the age long disagreement among empirical FDI-growth studies requires a re-assessment with respect to OLS techniques and model specifications. Time lag is also of great relevance to FDI projects and economic growth. Doubtlessly, the results of the present report are significantly differently from that of the paper that originally analysed the same data. While they find that FDI and domestic savings do not exact significant effects on the economy, our rigorous approach confirm that both make significant contribution on the growth economy of Nigeria. It is evident that what makes the difference is methodology. This study (Adofu, 2010), has only been used as a case study. We conclude that other works, especially those that find a negative or statistically insignificant impact like Adofu (2010), need be critically re-examined to reduce the number of voices who would exclude Nigeria from the ongoing trade liberalization and economic globalization that is sweeping across almost all the nations of the world.

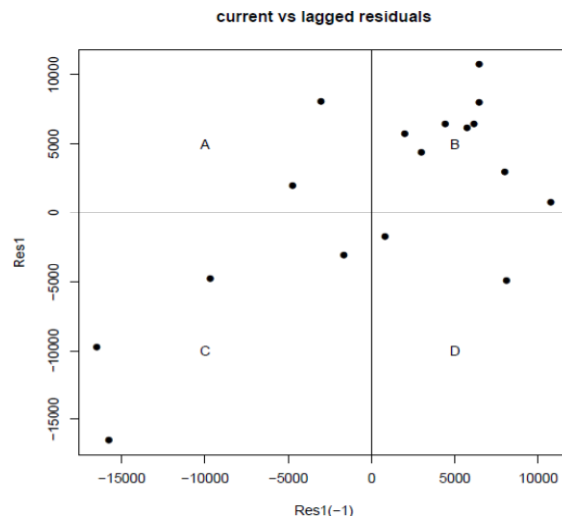
Appendix A:



(A1)



(A2)



(A3)

(Since the data points do not concentrate only on the first and third quadrant, there is no autocorrelation)

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