THE RELATIONSHIP BETWEEN DOMESTIC INVESTMENT AND ECONOMIC GROWTH IN NIGERIA

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Abstract

This study aims at investigating the relationship between domestic investment and economic growth in Nigeria using secondary time series data set sourced from Central Bank of Nigeria (CBN) Statistical Bulletin for the year 2010. The data set has been analysed using STATA Version 9.1. This data set covers the period of 30 years, 1981 to 2010. Non probability sampling method in the form of availability sampling technique has been used in selecting the number of years that constitutes the sample size of this study. This technique has been applied due to availability of the relevant data for the selected years only. From the cointegration results, it is clear that there is a significant long run positive relationship among domestic investment, exports and economic growth in Nigeria. For the short run relationship, the results of Granger causality test indicate a significant feedback causality running from domestic investment to economic growth and *vice versa* in the short run. In addition, in the short run, there is a significant negative bidirectional relationship between domestic investment and exports in Nigeria. Nonetheless, the findings indicate no short run causal relationship between exports and economic growth. The findings of this study therefore have the following implications: first, economic growth should be strengthened in order to achieve high level of domestic investment both in the short and long runs. Furthermore, although export does not have any significant influence on economic growth in the shot run, such influence exists in the long run. Therefore, measures that will ensure exports promotion should be adopted.

Keywords: Domestic Investment, Export, Economic Growth

JEL Codes: C22

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1. Introduction

Investment being the most important part of an open and effective economic system also serves as a major factor that facilitates economic growth of most economy. Over the years, emphasis has been placed on foreign direct investment (FDI) for economic sustainability, particularly in developing countries of Africa, Asia and Latin America. In Africa for example, inflows of FDI surged to a record level of $38bn, mainly as a result of large investments in oil-rich economies (Financial Times, 2007). The main factors that contribute to FDI flows into African continent in recent times seem to be the availability of natural resources in the host countries, and to a lesser extent, the size of the domestic economy, thereby improving the productivity and growth of the host country. But the broad issue is that, most increase in the economic growth of the host countries by FDI always affect the size of host country's domestic investment, this concern emanates from the fact that foreign direct investment reduces the output, employment and as well worsen the balance of payment of those countries concerned (Agosin and Mayer, 2000). This is because benefits of those Foreign Direct Investors are not automatically accruing into host countries, but rather crowding out domestic investment by forcing the local competitors out of the market. It is to this end that, Akanbi (2010) observed that a reduction in the widespread poverty which is a major feature of the Nigeria economy can be achieved through a sustained increase in domestic investment, because domestic investment provides more employment opportunity for indigenes than the FDI. In addition, Razin et al. (1999) raised the concern that FDI no longer generate any gain rather entailing domestic welfare losses. Furthermore, Gardiner (2000) also postulates that the larger the proportion of the economy of LDCs in the hands of Multinational Enterprises, the greater the negative externalities.

Evidence from Chile economy shows that domestic investment has contributed up to 21% of their GDP (The Chilean pension system), while in Nigeria, domestic investment contributes about 53.1% of Nigeria's Gross Domestic Product (GDP) by employing about 10 percent of the labour force mostly from industrial sector of the economy (Federal Research Division, 2008). This means that the outcomes of domestic investment may likely influence the levels of economic growth in Nigeria. The persistence growth in output of domestic firms can in fact emerge and produce for export markets, thereby contributing to the total capital formation of the country of origin, and as well serve as foreign investors to other countries.

It has therefore been realized that economic growth in Nigeria only requires diversification and expansion of domestic investment. Emphasis on domestic investment may likely increase diversification of the economy, by accelerating economic growth through high export-led activities, low inflationary rate etc., than FDI driven economic investment. Despite the useful contribution of domestic investment, research works on the relationship between domestic investment and economic growth in Nigeria are relatively scanty. Although most works were based on the impact of FDI on economic growth, (Ayanwale, 2007; Ayorinde, 2002; etc.), it is upon this premise that this study is designed to fill this gap in the body of literature, by investigating the relationship between domestic investment and economic growth in Nigeria. To achieve the objective of this study, the paper is divided into six sections. Apart from this introduction, section 2 deals with theoretical framework. Section 3 reviews the relationship between domestic investment and economic growth. Section 4 explores the methodology adopted while section 5 deals with the results and discussions. Finally, section 6 concerns with conclusions and implications.

2. Theoretical Framework

Neoclassical theory of investment is the appropriate theory that discusses the relationship between domestic investment and economic growth. The theory was developed in the nineteenth and twentieth century at the time of industrialization in the West. Its view on investment is built on the premise of domestic investment climate, where the growth rate of real output is positively related to investment. This means, when inputs and outputs in production are allocated efficiently, they stimulates economic growth. Domestic investment therefore, is likely to be important to some extent for any country's economic prosperity. According to Baroo (1996), a higher saving rate increases the level of domestic investment and it ultimately leads to a steady state level of output per worker, which enhances economic growth rate. A rapidly growing economy through domestic investment would be expected to boost expectations and hence further investment opportunities (Duncan *et al*. 1999).

In conclusion, Kowalski (2000) argues that domestic investment is a fruitful indicator for economic growth. Thus, domestic investments can serve as a means of faster and sustainable channel for modern economic growth, particularly through capital formation, productivity, infrastructural development, export, etc., thereby making the domestic investors to automatically seek out the most favourable investment opportunities.

3. Literature Review

The relationship between domestic investment (DI) and economic growth in most economies has become a central point of policy issue and discourse among researchers. It is therefore worthwhile to investigate the relationship between domestic investment and economic growth. Several studies have investigate the relationship between domestic investment and economic growth such as Villa (2008); Choe (2003); Skully (1997); Serven and Solimano (1992); Jayaraman (1996); Duncan *et al*. (1999); Ghirmay et al. (2001); Sinha (1999); Adams (2009) etc. However, the findings on the relationship between domestic investment and economic growth fail to achieve consensus evidence. For example, Villa (2008) applies a multivariate time series analysis on output growth rate, investment and government consumption in Italy from 1950 to 2005, and finds that the causality is running from domestic investment to economic growth. But empirical findings from Qin et al. (2006) in an attempt to show a causal relationship between domestic investment and economic growth show that the causality is running from economic growth to domestic investment. Furthermore, Tang *et al* (2008) investigate the causal link between foreign direct investment, domestic investment and economic growth for the period 1988-2003 in China, by applying a multivariate VAR system with error correction model (ECM). Their findings show that domestic investment and economic growth are positively correlated, as such great economic growth spurs large domestic investment, and vice versa. By implication, it means China's domestic investment has a greater impact on growth than FDI. They therefore recommend that the country's precedence should be based on encouraging and promoting domestic savings for domestic investment than attracting FDI. On the other hand, in the same study, Tang *et al* (2008) equally found that China's domestic investment and GDP do not have much impact on FDI inflows in the long run.

Export has been considered as one of the important variables in determining economic growth. Therefore domestic investment and export may be fundamental in generating sustainable economic growth. Empirically, Ghirmay et al. (2001) use cointegration test and Granger causality test to investigate the relationship between export-led and investment-led growth for 19 less-developed countries. Findings from their study reveal that exports and investment are cointegrated with economic growth particularly in Malaysia economy. However, these findings do not concur with those of Sinha (1999) who uses the Johansen (1991) cointegration test in some Asian countries and finds that domestic investment and exports are not cointegrated with economic growth in the case of Malaysia. Some studies however, documented a close relationship between FDI and domestic investment in developing economies. In analysing the impact of FDI and domestic investment on economic growth in Sub-Saharan Africa for the period 1990-2003, Adams (2009) reveals that domestic investment is positively and significantly correlated with economic growth in both the Ordinary Least Squares (OLS) and fixed effects estimation.

4. Methodology

This section deals with the method of data collection, variables measurements and method of data analysis.

Method of Data Collection

The secondary time series data set used in this paper comes from Central Bank of Nigeria (CBN) Statistical Bulletin for the year 2010, and was analysed using STATA Version 9.1. The time series data set covers the period of 30 years, 1981 to 2010. Non probability sampling method in the form of availability sampling technique has been used in selecting the number of years that constitutes the sample size of this study. This technique has been applied due to availability of the relevant data for the selected years only. For the years not selected into the sample, the data on the variables of interest were not available.

Variables Measurements

Table 1: ***Variables Measurements***

Variables	*Definitions of Variables*
Real GDP	Real GDP is used as a proxy for economic growth
Domestic investment	This is measured by Gross Domestic Investment.
Export	Export measured using the total exports of goods and services.

Method of Data Analysis

The data collected for this research have been analysed using Johansen (1988) cointegration approach, with help of STATA version 9.1 econometric package. Indeed, there are many different methods used in testing for causal relationship between two or more series variables. Such methods include: Engle and Granger (1987) 2-step procedure; Johansen (1988) and Johansen and Juselius (1990) Full Information Maximum Likelihood approach; Toda-Yamamoto (1995) augmented VAR approach; Davidson and Hinkley (1999) and Hacker and Hatemi-J (2006) Leveraged Bootstrap approach; Hsiao's (1981) Granger (1986) Causality approach; Baek and Brock (1992) and Chiou-Wei et al. (2008)'s Non-linear Causality test; and Pesaran et al. (2001) and Pesaran and Shim (1999) Autoregressive Distributed Lag (ARDL) Bounds Testing approach. However, Aktas and Yilmaz (2008) assert that the most widely applied method is that of Johansen (1988) and Johansen and Juselius (1990). For this reason, this study adopts Johansen (1988) approach.

To apply this approach certain diagnostics have been carried out. First, unit root tests have been conducted. Augmented Dickey-Fuller (ADF) unit root test is widely used to test for stationarity of a series. However, the traditional ADF unit root test, i.e., Dickey and Fuller (1979) type is not consistent in the presence of structural breaks (Esso, 2010; Glynn et al., 2007). At times, a series refuses to be stationary even after differencing due to structural break. To overcome this limitation, several researchers propose other methods that allow capturing structural break in unit root test such as (Perron, 1989; Elliott et al., 1996's DF-GLS; Lee and Strazicich, 2004's Lagrange Multiplier unit root approach; Zivot and Andrews, 1992; Lumsdaine and Papell, 1997;). But some of these new methods are being criticized for leading to inconsistency when there is no break or if the break date is unknown or if there is more than one break period (Esso, 2010; and Glynn et al., 2007). For instance, Perron, (1989) procedure captures only a single exogenous break period dummy variable (Glynn et al. 2007). Nonetheless, this procedure allows capturing a break under both the null and alternative hypotheses though it has less power compared to traditional ADF when there is no break (Glynn et al. 2007). Similarly, Zivot and Andrews' (1992) approach uses full sample and a different dummy variable for each possible break date (Glynn et al. 2007). However, Lumsdaine and Papell (1997) expanded the Zivot and Andrews' (1992) model to capture two structural breaks and allow for breaks in level and trend (Glynn et al., 2007).

But the choice of optimal lag length in unit root test is very critical too for the fact that the size and properties of the unit root tests are sensitive to the number of lags of a series variable used

(Acaravci, 2010). Optimal lag length of a series should be taken into consideration during the test. But there are different criteria used in selecting the optimal lag to be included in unit root test that give different results. It is therefore appropriate to use more than one criterion. On the basis of Perron (1989) criterion, optimal lag length is set at 12, and it continues to reduce the number of lags by one until the last lag is significant at 10 percent level, and if no lags are significant, the optimal lag is set at one lag (Doganlar, 1998). Another method is by adopting F version of Lagrange Multiplier test, starting with one lag and we continue to add extra lag until the residuals of the unit root test regression are devoid of serial correlation, i.e., to make the residuals white noise (Doganlar, 1998; Acaravci, 2010; Hatemi-J and Irandoust, 2005; and Glynn et al., 2007). It has also been argued that this criterion has better size and power properties than alternative criteria that are based on information criteria, such as Akaike Information Criteria (AIC) and Bayes Information Criteria (BIC), also known as the Schwartz Information Criteria - SIC (Acaravci, 2010). Another criterion according to Esso (2010) includes Hatemi-J (2003) information criteria.

In view of the importance of optimal lag length in unit root test, Elliott et al. (1996)'s DF-GLS applies a simple modification of the ADF tests in which the data are detrended, and this approach is more powerful when an unknown mean and trend exist (Acaravci, 2010). This approach also has the best overall power and performance in the event of small sample size. Its routine includes a very powerful optimal lag selection criterion known as Modified Akaike Information Criterion (MAIC) proposed by Ng and Perron (2001). According to Baum (2001), DF-GLS is preferred by many time series econometricians to the traditional or more widely–known tests of Dickey and Fuller (1979) or Phillips and Perron (1988), and inferences drawn from the DF–GLS test are likely to be more robust than those based on the traditional unit root tests. Nonetheless, one may consider the use of KPSS (Kwiatkowski, Phillips, Schmidt and Shin, 1992) unit root test. This test, utilises perhaps more natural null hypothesis of stationarity, or I(0), rather than the Dickey–Fuller style of null hypothesis of I(1) or nonstationary in levels or in difference stationarity (Baum, 2001). It is used to investigate whether a series variable is fractional integrated. This test is a normal test unlike those of Dickey-Fuller and others. If inference from the DFGLS test rejects its null hypothesis of unit root behavior, or nonstationary, while the KPSS test also rejects its null of stationarity, then we might conclude that both I(1) and I(0) are rejected by the data. That sets the stage for an alternative explanation of the time series' behavior of fractional integration, or long-range dependence, in which the series may be characterized as I(d), 0 < d < 1, neither I(0) nor I(1) (Wooldridge, 2006), indicating that the a series is fractionally integrated.

The DFGLS and KPSS unit root tests may both be applied, with hopes that the verdict of one will confirm that of the other (Baum, 2001). The two families of unit root tests may be used in conjunction to establish the nature of the data generating process for a given time series, and in particular to signal the presence of fractional integration in the series (Wooldridge, 2006). Furthermore, Lee and Strazicich (2003) propose an endogenous two-break LM unit root test that allows for capturing breaks under both null and alternative hypotheses (Acaravci, 2010). This particular procedure tallies with that of Perron (1989) model (C) that includes intercept dummy representing a change in the level, break date dummy and a dummy variable representing a change in the slope of the trend function, but with changes in the level and the trend in addition (Glynn et al., 2007). Indeed, there is no conclusive opinion on the most appropriate methodology to undertake unit root tests (Glynn et al., 2007). If break periods are known, modified ADF approaches such as those of Perron (1989, 1990), Zivot and Andrews (1992) among others can be used (Joyeux, 2001). But Zivot and Andrews (1992) approach allows for a single structural break in the intercept and/or the trend of the series over possible breakpoints (Baum, 2001). Subsequently, the procedure conducts a Dickey–Fuller style unit root test conditional on the series inclusive of the estimated optimal breaks.

But one obvious weakness of the Zivot–Andrews strategy, as well to similar tests proposed by Perron and Vogelsang (1992), is the inability to deal with more than one break in a time series (Baum, 2001). In addressing this problem, Clemente et al. (1998) proposed tests that would allow for two events within the observed history of a time series, either additive outliers (the AO model, which captures a sudden change in a series) or innovational outliers (the IO model, allowing for a gradual shift in the mean of the series). The null hypothesis for this test states the presence of unit root, i.e, a series variable is not stationary with structural break (Glynn, 2007) while the alternative states that a series variable is stationary. The null hypothesis is rejected if the calculated t statistic, i.e., Reyes test or rho is greater in absolute values than the critical absolute value. This taxonomy of structural breaks follows from Perron and Vogelsang's (1992) work. However, in that paper the authors only dealt with series including a single AO or IO event.

Nonetheless, Baum et al. (1999) conclude that unit roots can be present even if structural breaks and fractional integration are taken into account. This study therefore applies DFGLS, KPSSS and Clemente et al. (1998) approaches in testing for unit roots.

We have tested that the variables are non-stationary but have the same order of integration, that is, they are both I(1). This has been performed with the DF-GLS unit-root tests described as:

$$\Delta Y_t = \hat{\beta}_0 + \hat{\beta}_1 Y_{t-1} + \Sigma\hat{\alpha}_i \Delta Y_{t-i} + \hat{\mu}_t \qquad (1)$$

Where:

ΔY	=	The first differenced value of a measure of a series.
$\hat{\beta}_0$	=	Estimated constant parameter or intercept.
$\hat{\beta}_1$	=	Estimated parameter of the first level lag value of series
Y_{t-1}	=	First level lag value of series
$\hat{\alpha}_i$	=	Vector of the estimated parameters of the lagged values of the differenced value of series.
ΔY_{t-i}	=	Vector of the lagged values of the differenced value of a series.
$\hat{\mu}_i$	=	Error term.

Second, we specify a VEC rank test model at level values of the integrated variables to conduct cointegration test in order to determine the number of cointegrating vectors. If there are exactly k cointegrating relations, i.e., r = 0, when series variables are integrated of the same order, then there is no cointegration, and the VAR may be specified in terms of the first difference of the integrated variables to run a simple Granger causality test (Acaravci, 2010; Chiou-Wei et al., 2008; Pradhan, 2010; Tehranchian, 2006; Altinay and Karagol, 2005; Omotor, 2008; and Esso, 2010). But if r < k, i.e., r = k-1, then there is at least one cointegrating vector. In this case, the residuals of cointegrating equation should be estimated and the first lag value of the residuals be added to the next VAR model to form VEC model (Acaravci, 2010). But if a researcher is using STATA package for analysis, there is no need for estimating the residuals since the programme will automatically capture the error correction term in form of _cel.

If two nonstationary series variables are cointegrated, the estimated residuals will be stationary. Therefore, the cointegration regression has been specified as:

$$lrgdp_t = \hat{\beta}_0 + \hat{\beta}_1 ldiI_{t-i} + \hat{\beta}_2 lexp_{t-i} + \hat{\mu}_t, \text{ where } \hat{\mu}_t \sim 1(0) \_\_\_\_\_\_\_ (2)$$

Where:

$lrgdp_t$ = Natural log value of real gdp as a proxy for Economic growth

$\hat{\beta}_0$= Estimated constant parameter

ldi_{t-i} = Lag values of domestic investment

$\hat{\beta}_1$= Estimated coefficient vector of domestic investment

$\hat{\beta}_2$ = Estimated coefficient vector of exports

$lexp_{t-i}$ = Lag values of exports

That is, there will be a linear combination such that:

$\hat{\mu}_t = lrgdp_t - \hat{\beta}_1 ldi_{t-i} - \hat{\beta}_2 lexp_{t-i} - \hat{\beta}_0$ _______ (3) will be stationary.

Optimal lag length has also been considered during the test for the number of cointegrating vectors. There are two suggested approaches to choosing lag order. We may use a likelihood ratio test to verify the lag order. We can also use information criteria to choose the lag order that is most pragmatic. But among the information criteria, the best information criterion according to Hoxha (2010) is Hannan-Quinn Information criterion (HQIC). Therefore, STATA command which provides each of the information criterion, such as final prediction error (FPE) through *varsoc* command with the *lutstats* option has been applied to ascertain the optimal lags to be included in the cointegration regression.

However, there are two statistics in Johansen's procedure that test for possible cointegrating vectors, i.e., the maximum eigenvalue and the trace statistic. In a situation where there are differences in the results of the two statistics, the trace statistic is preferred (Spyridis *et al.,* 2010) because it shows more robustness to skewness and kurtosis in the residuals (Cheung and Lai, 1993).

From our analysis, it has been discovered that there is Cointegration among domestic investment, exports and economic growth, hence vector error correction (VEC) model has been applied to get the normalised cointegrating coefficients and test for short run relationships among the variables as follows:

$$lrgdp_t = \hat{\alpha}_0 + \hat{\alpha}_1 ldi_{t-i} + \hat{\alpha}_2 lexp_{t-i} + EC_{t-1} + \varepsilon_t \quad (4)$$

After running the VEC and normalisation imposed, the cointegrating regression will be:

$$EC_t = lrgdp_t + \hat{\beta}_1 ldi_{t-i} + \hat{\beta}_2 lexp_{t-i} + \hat{\beta}_0 \quad (5)$$

Then we display the normalised cointegrated coefficients estimated for the variables from the cointegrating regression, which are the long-run equilibrium coefficients for the detected relationships, as well as their t- statistics (Fernandes, 2009). Therefore, after normalization of the dependent variable (the measure of economic growth) to 1, whatever is the sign of a given coefficient in the cointegrating regression, it will change by making the actual dependent variable as the subject of the formula. That is, if it is negative, it will become positive and if positive, it will become negative by crossing the equal sign. For e.g, the EC equation will now turn to $\ln ecogrowth_t$ equation as:

$$lrgdp_t = - \hat{\beta}_0 - \hat{\beta}_1 ldi_{t-i} - \hat{\beta}_2 lexp_{t-i} + ECt \quad (6)$$

In addition, Vector autoregressive (VAR) model has been applied to test for causality among these variables. Post analysis tests have been carried out to test for the properties of the models used. The VAR model has been expressed as:

$$lrgdp_t = \hat{\alpha}_0 + \hat{\alpha}_1 lrgdp_{t-i} + \hat{\alpha}_2 ldi_{t-i} + \hat{\alpha}_3 lexp_{t-i} + \varepsilon_t \quad (7)$$

Certain tests, such as autocorrelation, normality and stability have been conducted to ascertain the adequacy of the econometric models applied. Lagrange Multiplier test has been conducted to ascertain the existence or otherwise of autocorrelation. The null of Lagrange Multiplier test is, there is no autocorrelation at a give lag order. Lutkepohl (2007) suggests using the multivariate generalization of the Jarque-Bera test [Jarque and Bera (1987)] on $\hat{\mu}_t$ to test the multivariate normality of the $\hat{\mu}_t$. This tests the skewness and kurtosis properties of the $\hat{\mu}_t$ against those of a multivariate normal distribution of the appropriate dimension. The Jarque-Bera test, a type of Lagrange multiplier test, was developed to test normality, heteroscedasticy, and serial correlation (autocorrelation) of regression residuals (Park, 2008). The null hypotheses of the tests are that the residuals are not statistically different from the theoretical normal distribution, i.e., they are normally distributed, no heteroscedasticity and no serial correlation.

To check that a VAR process is stable, we make use of eigenvalue. We check whether the eigenvalues of the matrix are less than one. If they are less than one, then the VAR process is stable, satisfying the stability condition. This indicates that all the eigenvalues lie inside the unit circle.

5. Results and Discussions

This section contains the results of diagnostics tests, regression models and discussion of the results.

The null hypothesis for this test states the presence of unit root, i.e, a series variable is not stationary with structural break (Glynn, 2007) while the alternative states that a series variable is stationary. The null hypothesis is rejected if the calculated t statistic, i.e., Reyes test or rho is greater in absolute values than the critical absolute value.

Table 1: Results of DFGLS, KPSSS and Clemente et al. (1998) Unit Root Tests

Variables	**DFGLS** H0: a series is not stationary		**KPSS** H0: a series is stationary. Critical values: 1% = 0.216		**Clemente et al. (1998)** H0: a series is not stationary with one structural break.	
	Level Value	Difference Value	Level Value	Difference Value	Level Value	Difference Value
	Test statistic		Test statistic		Test statistic	
Natural log of Real GDP	-1.540(8)	-3.022(8)**	0.561(0) ***	0.143(9)	-1.701	-4.884***
Natural log of domestic investment	-1.810(2)	-3.355(2)**	0.296(0) ***	0.144(9)	-2.394	-4.035***
Natural log of exports	-2.094(1)	-4.020(1)***	0.333(0) ***	0.151(9)	-2.372	-6.954***

Source: authors' calculation using STATA software
Note: ** and *** indicate levels of significance at 5% and 1% respectively. In addition figures in parenthesis indicate the number of lags.

Table 1 presents the results of DFGLS, KPSS and Clemente et al. (1998) unit root tests on the variables at their level and differenced values. The DFGLS unit root test results indicate that all the variables are not stationary in their level values even at 5% level of significance, suggesting the acceptance of the null hypothesis that states a series variable is not stationary. However, the results of the test indicate that all the variables are stationary in their first difference values at either 5% or 1% level of significance. Similarly the KPSS unit root tests results indicate the acceptance of alternative hypothesis which states that a series variable is not stationary in the level values of all the variables. But in the first difference value of the variables, the results indicate the acceptance of the null hypothesis which states that a series is stationary. Furthermore, Clemente et al. (1998) unit root tests results indicate the acceptance of null hypothesis which states that a series variable is not stationary in the level values of all the variables. But in the first difference value of the variables, the results indicate the acceptance of the alternative hypothesis which states that a series is stationary. The implication of the results of both tests is that the variables are integrated of the same order at their difference values. According to Eagle and Granger (1987), to conduct cointegration analysis, all variables must be integrated of the same order. Therefore, this gives us room for cointegration test.

Table 2 presents the results of the test for optimal lags to be included in the cointegration regression.

Table 2: Results of the Test for Optimal Lags to be included in Johansen Tests for the Number of Co-integrating Ranks

```
. varsoc lrgdp ldi lexp, maxlag(3) lutstats

Selection order criteria (lutstats)
Sample:    1984     2010                  Number of obs      =        27
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-71.7183				.050852	-3.20116	-3.20116	-3.20116
1	28.8691	201.17*	9	0.000	.000058*	-9.98542*	-9.85698*	-9.55347*
2	36.8777	16.017	9	0.067	.000064	-9.91198	-9.6551	-9.04809
3	39.2129	4.6703	9	0.862	.000113	-9.41829	-9.03297	-8.12245

Source: authors' calculation using STATA software
Note: * Indicates the corresponding optimal Lags to be Selected

From the results, all the criteria, including HQIC are in favour of inclusion of one lag in the cointegration regression. Therefore, one lag has been included in the cointegration regression.

This is because, according to Hoxha (2010) the best information criterion is Hannan-Quinn Information criterion (HQIC).

Table 3: Results of Johansen Tests for the Number of Cointegrating Ranks

```
. vecrank lrgdp ldi lexp, lag(1)

                    Johansen tests for cointegration
Trend: constant                                         Number of obs =      29
Sample:     1982     2010                                        Lags =       1
-------------------------------------------------------------------------------
                                                          5%
maximum                                       trace    critical
  rank    parms       LL       eigenvalue  statistic    value
    0       3     11.062201         .        39.4515    29.68
    1       8     28.965861      0.70909      3.6442*   15.41
    2      11     30.508147      0.10090      0.5596     3.76
    3      12     30.787965      0.01911
-------------------------------------------------------------------------------
```

Source: authors' calculation using STATA software

Note: * Indicates that Trace Statistic value is not significant at 5% level, suggesting no more than one cointegrating rank.

Results of Johansen tests for the number of cointegrating ranks are presented in Tables 3. The results of the test indicate the rejection of the null hypothesis which states there is no cointegrating vector. This suggests the acceptance of alternative hypothesis, that there exists cointegration among the variables captured in the cointegration regression. The results further indicate that there is no more than one cointegrating vector, suggesting that there is one cointegrating rank. This is because the value of the trace statistic at one rank is 3.6442, which is less than its critical value of 15.41 at 5% level of significance. This gives room for running VEC regression to get the normalised cointegrating coefficients and test for short run relationships among the variables.

Table 4: Normalised cointegrating coefficients

```
Identification:  beta is exactly identified

                 Johansen normalization restriction imposed

------------------------------------------------------------------------------
        beta |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_ce1         |
       lrgdp |          1          .        .       .            .           .
         ldi |  -.5557402   .0733714    -7.57   0.000    -.6995456   -.4119348
        lexp |  -.1036426   .0192734    -5.38   0.000    -.1414179   -.0658674
       _cons |  -5.384221          .        .       .            .           .
------------------------------------------------------------------------------
```

Source: authors' calculation using STATA software

Table 4 presents the normalised cointegrating coefficients. After normalization imposed, the cointegrating regression will be:

$$EC_t = lrgdp_t - 0.556ldi_{t-1} - 0.104lexp_{t-1} - 5.384$$

Since per capita real GDP (lrgdp) as a measure of economic growth has been normalised to 1, it then becomes the dependent variable. Thus, the long run economic growth equation will now be:

$$lrgdp_t = 5.384 + \underset{(7.57)^{***}}{0.556ldi_{t-1}} + \underset{(5.38)^{***}}{0.104lexp_{t-1}} + ECt$$

Note: *** Indicates significant statistical value at 1% level and the figures in the parentheses are the t ratios.

From the results of the long run economic growth equation, it is clear that there is a significant long run positive relationship among domestic investment, exports and economic growth in Nigeria. These findings support those of Tang *et al* (2008), Adams (2009) and Ghirmay et al. (2001) but fail to support those of Sinha (1999) who uses the Johansen (1991) cointegration test in some Asian countries and finds that domestic investment and exports are not cointegrated with economic growth in the case of Malaysia.

The results for the robustness of the model have been generated but not presented. However, the results of the test indicate no autocorrelation and the residuals are normally distributed, suggesting that the model is statistically adequate.

In addition, Vector autoregressive (VAR) model has been applied to test for the direction of causality as short run relationship among the variables captured in our analysis. Post analysis tests have been carried out to test for the properties of the model too.

Table 6: Summarised Results of the Granger Causality Tests

Dependent Variables	**Independent Variable**	**Chi-Square Test Statistic**	**Remarks**
Natural Log of Real GDP	**Natural Log of Domestic Investment**	26.226 (0.000)***	Causality running from domestic investment to economic growth
Natural Log of Real GDP	**Natural Log of Exports**	0.188 (0.665)	Causality not running from exports to economic growth
Natural Log of Domestic Investment	**Natural Log of Real GDP**	5.216 (0.022)**	Causality running from economic growth to domestic investment and

Dependent Variables	Independent Variable	Chi-Square Test Statistic	Remarks
			vice versa (bidirectional causality)
Natural Log of Domestic Investment	**Natural Log of Exports**	3.152 (0.076)*	Causality running from exports to domestic investment
Natural Log of Exports	**Natural Log of Real GDP**	1.274 (0.259)	Causality not running from economic growth to exports
Natural Log of Exports	**Natural Log of Domestic Investment**	3.028 (0.082)*	Bidirectional causality running from domestic investment to exports and *vice versa*

Source: authors' calculation using STATA software Ghanian

Note: Figures in the parentheses are *P-Values*. *, ** and *** indicates significant level at 10%, 5% and 1% respectively.

Table 6 presents the results of Granger causality test for short run relationship. The results indicate a significant feedback causality running from domestic investment to economic growth and *vice versa*. But the causality running from domestic investment to growth is negative on the basis of VAR model results (not reported). However, there is a significant negative bidirectional relationship between domestic investment and exports in Nigeria, indicating negative short run feedback relationship between domestic investment and exports in the country. Although there is a significant positive log run relationship between exports and economic growth in Nigeria, the Granger causality test indicate there is no causal relationship in the short run.

Interestingly, the results for the robustness of the VAR model for Granger causality test indicate no autocorrelation, residuals are normally distributed and the model satisfies stability conditions, suggesting that the model is statistically adequate.

6. Conclusions and Policy Implications

This study aims at investigating the long run and causal relationships between domestic investment and economic growth in Nigeria. The study uses annual time series data set for a sample of 30 years, 1981 to 2010 on the basis of the data availability. To achieve the objective of this study, Johansen (1988) cointegration approach and Granger causality test have been applied.

From the results, it is clear that there is a significant long run positive relationship between domestic investment and economic growth in Nigeria. Similarly, from the results, it is concluded that there is a significant positive long term relationship between exports and economic growth in Nigeria.

For causality test, although significant long run positive relationship exists between exports and economic growth in Nigeria, such relationship does not exist in the short run. The results also suggest that domestic investment and economic growth influence each other in the short run, though the influence of domestic investment on growth is negative. Therefore, economic growth should be strengthened in order to achieve high level of domestic investment both in the short and long runs. Furthermore, although export does not have any significant influence on economic growth in the short run, such influence exists in the long run. The findings of this study therefore have the following implications: first, economic growth should be strengthened in order to achieve high level of domestic investment both in the short and long runs. Furthermore, although export does not have any significant influence on economic growth in the short run, such influence exists in the long run. Therefore, measures that will ensure exports promotion should be adopted.

However, caution may be exercised due to one limitation of this study. The number of observations (30) we used as a result of unavailability of data on domestic investment before 1981 may be inadequate in applying Johansen's cointegration approach. This limitation may warrant further investigation using additional observations where available or some approaches that may mitigate this limitation, such as Autoregressive Distributed Lag (ARDL) bounds test approach.

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