The Estimation of Longrun Relationship between Economic Growth, Investment and Export in Nigeria

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Abstract

This paper attempts to estimate the relationship between economic growth, investments and export in Nigeria.The Johansen (1981) cointegration test and Granger causality test was employed to investigate the relationship of the variables for the period 1970-2005. The cointegration tests showed no long run relationship among the variables. However, the empirical result of the Granger causality test shows a bidirectional relationship between Investment (Inv) and Economic growth (Y) and also a bidirectional relationship between Investment and Export (Ex); but the result of the causation between Investment and growth was statistically insignificant.

Keywords: Economic Growth, Investment, Export, Nigeria

1. Introduction

In the recent two decades, numerous empirical studies have been undertaken to determine what the main factors that drive economic growth are. These studies can be divided into two groups. One includes those investigating the correlation between export and economic growth and the hypothesis that export expansion is attributed to a country's economic performance (e.g., Feder, 1983; Kavoussi, 1982; Michaely, 1977; Ram, 1987; Tyler, 1981). The other includes those attempting to determine the relationship between economic growth and investment in the hypothesis that economic growth may be driven by investment through export growth or vice versa (e.g., Baldwin and Seghezza, 1996; Herrerias and Orts, 2007; Rodrik, 1995). Which factor, export or investment, is more responsible for economic growth has remained an issue of debate. The primary objective of this study is to estimate the long run relationship between economic growth, investment and export in Nigeria for the period 1970-2005.

To achieve this objective the paper is structured as follows; following this brief introduction is section two which is concerned with review of related literature, section three deals with methodology of the study, section four is concerned with empirical analysis of result while section five summaries and concludes the study.

2. Review of Related Studies

Baharom etal (2008) carried out a study to examine the role of trade openness and foreign direct investment in influencing economic growth in Malaysia during 1975-2005, using the Bounds testing approach suggested by Pesaran et al. (2001). The empirical results demonstrate that trade openness is positively associated and statistically significant determinant of growth, both in short run and the long run. The result also suggested that foreign direct investment is positively associated in the short run and negatively associated in the long run, both significantly. Besides these two variables, the other control variable namely exchange rate was also significant in the short run as well as in the long run.

Aktar, Ozturk and Demirci (2008) examined the impact of Foreign Direct Investment, export, economic growth and total fixed investment on unemployment in Turkey for the period of 1987-2007. The Johansen cointegration technique was applied to determine long run relationship between the variables. The empirical findings suggest that there are two cointegrating vectors during the concerned period of time in Turkey, which indicates the long run relationship, though all the variables were found to affect the unemployment rate significantly.

Amano (2005) sets up four-variable VAR systems with error-correction mechanisms to search for causal directions between output growth and investment; and between growth and exports for two periods prewar and postwar, and for three countries, Japan, the U.S.A., and the U.K. The study found that in Japan, economic growth was spurred by both investment and exports (particularly the former), but the accelerator-type causality (from growth to investment) was not so strong. For the U.S.A., the study found that output growth was relatively independent of investment and exports but, in the postwar period, the multiplier-accelerator interactive process

was seen to take place. In the U.K., the multiplier-accelerator interactions were seen in both periods. Also, the effect of exports on growth was stronger in the prewar period than in the other.

Pham Mai Anh (2008) followed the structural VAR methodology and procedures used by Bradford and Chakwin (1993) to investigate which factor were the main engine that drives Vietnam's economy since the country launched the Renovation "Doi Moi" in 1986. Two VAR models and four variables, GDP, investment, export and productivity, were used to examine two hypotheses: export-led growth and investment-led growth. In the VAR model of export-led growth, export was assumed to be an exogenous variable that was allowed to have effects on all other variables but they are not allowed to impact export. Similarly, the second model treated investment as an exogenous variable that was supposed to affect the other three variables but they are not allowed to interact with investment. The results of both models supported the investment-led growth hypothesis showing that investment has been the main factor that determines Vietnam's economic growth over the past two decades. On the contrary, the impacts of export implied in both models on the country's GDP growth appeared to be very small. In addition, the results also did not support the expectation that investment or export helped to improve productivity, which in turn promotes economic growth. This study found empirical evidence showing that investment, rather than, export takes the key role in Vietnam's economic growth, but no evidence showing that investment or export promotes economic growth.

Kaushik et al (2008) used Johansen's co-integration analysis and a vector error-correction model to investigate the relationship between economic growth, export growth, export instability and gross fixed capital formation (investment) in India during the period 1971- 2005. The empirical results suggested that there exists a unique long-run relationship among these variables and the Granger causal flow is unidirectional from real exports to real GDP. For example, ceteris paribus, a 1% increase in exports raises GDP by an estimated 0.42% in the long run.

Sinha (1999) examined the relationship between export instability, investment and economic growth in Asian countries using time series data and the cointegration methodology framework. The study found that most of the variables are non-stationary in their levels and not cointegrated. For Japan, Malaysia, Philippines and Sri Lanka, the study found a negative relationship between export instability and economic growth but for (South) Korea, Myanmar, Pakistan and Thailand, the study founds a positive relationship between the two variables. For India, it was found to be mixed results. In most cases, economic growth was found to be positively associated with domestic investment.

Miankhel, Thangavelu and Kalirajan (2009) adopted a time series framework of the Vector Error Correction Models (VECM) to study the dynamic relationship between export, FDI and GDP for six emerging countries of Chile, India, Mexico, Malaysia, Pakistan and Thailand. Stationarity of the series with structural breaks was also examined in the model. Given that these countries are at different stages of growth, they were able to identify the impact of FDI and export on economic growth at different stages of growth. The results suggest that in South Asia, there is evidence of an export led growth hypothesis. However, in the long run, they identified GDP growth as the common factor that drives growth in other variables such as exports in the case of Pakistan and FDI in the case of India. The Latin American countries of Mexico and Chile show a different relationship in the short run but in the long run, exports affect the growth of FDI and output. In the case of East Asian countries, they found bi-directional long run relationship among exports, FDI and GDP in Malaysia, while they found a long run uni-directional relationship from GDP to export in case of Thailand

Carbajal, Canfield and De la Cruz (2008) examined both the existence of causality, in the Granger Sense, and its direction between Gross Domestic Product (GDP), Exports, Imports and Foreign Direct Investment in Mexico (FDI). GDP was broken down into two sectors: industrial and services. The cointegration methodology developed by Liu, Burridge and Sinclair (2002) and the tests of structural changes, for the vector of cointegration developed by Quintos and Phillips (1993); and Quintos (1997, 1998) were applied. The estimation showed a stable and causal relationship of FDI over variables such as the industrial GDP, Exports and Imports. However, the service sector tends not to have a direct effect over investments. Notwithstanding that Mexico greatly benefits from FDI, as such those benefits are triggered by Exports and the industrial GDP, variables that hold a stronger linkage with the economic activity of the United States and not with the actual evolution of the Mexican economy

Ullah et al (2009) investigated Export-led-growth by time series econometric techniques (Unit root test, Co-integration and Granger causality through Vector Error Correction Model) over the period of 1970 to 2008 for Pakistan. In this paper, the results reveal that export expansion leads to economic growth. They also checked whether there is uni-directional or bidirectional causality between economic growth, real exports, real imports,

real gross fixed capital formation and real per capita income. The traditional Granger causality test suggests that there is uni-directional causality between economic growth, exports and imports. On the other hand Granger causality through vector error correction was checked with the help of F-value of the model and t-value of the error correction term, which partially reconciles the traditional Granger causality test.

3. Methodology

3.1 Model Specification

To establish the causality relationship between the three variables, the VAR model in the form: U (VAR) = (Y, INV, EXP) was used. Its advantage is that it allows the interpretation of any variable as a possible endogen one in the model. The primary model showing the estimation of the long-run relationship between economic growth, investment and export in Nigeria is thus specified

$$Y = f(INV, EX) \text{ --- (1)}$$

The function can also be represented in a log-linear econometric format thus:

$$\log Y_t = \alpha_0 + \alpha_1 \log INV_t + \alpha_2 \log EX_t + \varepsilon_t \text{ ------------------------ (2)}$$

Where:

Y represents Economic growth as a proxy for GDP

INV is Investment; and

EX is Export

α_0 is the constant term, 't' is the time trend, and 'ε' is the random error term.

3.2 Data

The study employed annual observation expressed in natural logarithms sample period running from 1970 to 2005. The data source is from the central Bank of Nigeria statistical bulletin which includes GDP measure of economic growth (Y_t), Investment (INV_t), and Export (EX_t).

3.3 Estimation Techniques

The estimation technique employed in this study is the cointegration and error-correction modeling technique. To estimate the cointegration and error-correction, three steps are required: these are testing for order of integration, the cointegration test and the error correction estimation.

3.3.1 Unit Root Test

This involves testing the order of integration of the individual series under consideration. Several procedures for the test of order of integration Has been developed. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979, 1981), and the Phillip-Perron (PP) due to Phillips (1987) and Phillips and Perron (1988). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \Delta y_i + e_t \text{ --------------------------------- (3)}$$

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{n=1}^{n} \alpha_1 \Delta y_i + \delta_t + e_t \text{ --------------------------------- (4)}$$

Where:

Y is a time series, t is a linear time trend, Δ is the first difference operator, α_0 is a constant, n is the optimum number of lags in the dependent variable and e is the random error term; and the Phillip-Perron (PP) is equation is thus:

$$\Delta y_t = \alpha_0 + \alpha y_{t-1} + e_t \text{ -- (5)}$$

3.3.2. The Cointegration Test

This involves testing of the presence or otherwise of cointegration between the series of the same order of integration through forming a cointegration equation. The basic idea behind cointegration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall and Henry, 1989). A lack of cointegration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other (Dickey et. al., 1991). We employ the maximum-likelihood test procedure established by Johansen and Juselius (1990) and Johansen (1991).

Specifically, if Y_t is a vector of n stochastic variables, then there exists a p-lag vector auto regression with Gaussian errors of the following form:

Johansen's methodology takes its starting point in the vector auto regression (VAR) of order P given by

$$y_t = \mu + \Delta_1 y_{t-1} + - - - + \Delta p \quad y_{t-p} + \varepsilon_t \text{ ------------------------------------ (6)}$$

Where:

Yt is an nx1 vector of variables that are integrated of order commonly denoted (1) and εt is an nx1 vector of innovations.

This VAR can be rewritten as

$$\Delta y_t = \mu + \eta_{yt-1} + \sum_{i-1}^{p-1} \tau_i \Delta y_{t-1} + \varepsilon_t \text{ -- (7)}$$

Where:

$$\Pi = \sum_{i-1}^{p} A_{i-1} \quad \text{and} \quad \tau_i = - \sum_{j=i+1}^{p} Aj$$

To determine the number of co-integration vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic test, the first one is the trace test (λ trace). It tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to q against a general unrestricted alternatives q = r. the test calculated as follows:

$$\lambda \text{ trace } (r) = -T \sum_{i=r+1} \text{In} \left(1 - \hat{\lambda}_t\right) \text{ ------------------------------------ (8)}$$

Where:

T is the number of usable observations, and the λ1,s are the estimated eigenvalue from the matrix.

The Second statistical test is the maximum eigenvalue test (λ max) that is calculated according to the following formula

$$\lambda \text{ max } (r, r + 1) = -T \text{ In } (1 - \lambda r + 1) \text{ ------------------------------------ (9)}$$

The test concerns a test of the null hypothesis that there is r of co-integrating vectors against the alternative that r + 1 co-integrating vector.

3.3.3 The Error Correction Model

If cointegration is proven to exist, then the third step requires the construction of error correction mechanism to model dynamic relationship. The purpose of the error correction model is to indicate the speed of adjustment

from the short-run equilibrium to the long-run equilibrium state. The greater the co-efficient of the parameter, the higher the speed of adjustment of the model from the short-run to the long-run

We represent equation (2) with an error correction form that allows for inclusion of long-run information thus, the Error Correction Model (ECM) can be formulated as follows:

$$\Delta \log Y_t = \alpha_0 + \sum_{t=1}^{n} \alpha_{1t} \Delta \log Y_{t-1} + \sum_{i-1}^{n-1} \alpha_{2t} \Delta \log INV_{t-1} + \sum_{i-1}^{n-1} \alpha_{3t} \Delta \log EX_{t-1} + \lambda Ec_{t-1} + \mu_1$$ -- (10)

Where:

Δ is the first difference operator

λ is the error correction coefficient and the remaining variables are as defined above.

4. Empirical Result

4.1 Stationarity Test

Both the Augmented Dickey Fuller (ADF) and Phillips – Perron (PP) tests were applied to find the existence of unit root in each of the time series. The results of both the ADF and PP tests are reported in Table 1 and 2.

The result in table 1 reveals that all the variables (except LINV found stationary at ADF and PP Intercept & Trend) were not stationary in levels. This can be seen by comparing the observed values (in absolute terms) of both the ADF and PP test statistics with the critical values (also in absolute terms) of the test statistics at the 1%, 5% and 10% level of significance. Result from table 1 provides some evidence of non stationarity. Therefore, the null hypothesis is accepted for LGDP and LEX (but rejected for LINV in Intercept & Trend) and it is sufficient to conclude that there is a presence of unit root in the variables at levels. As a result, all the variables were differenced once and both the ADF and PP test were conducted on them; the result is shown in table 2.

The result reveals that all the variables were stationary at first difference; on the basis of this, the null hypothesis of non-stationarity is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of order one, i.e. 1(1).

4.2 Cointegration Test

The result of the cointegration condition (that is the existence of a long term linear relation) is presented in Table 4 and 5 below using methodology proposed by Johansen and Juselius (1990).

From the Cointegration result, both trace statistic and maximum Eigenvalue statistic indicated no cointegration at the 5 percent level of significance, suggesting that there is no cointegrating (or long run) relationship between Economic Growth, Investment and Export.

4.3 Granger Causality Test

Since there was no existence of cointegration between the variables of Economic growth (Y), Investment (INV) and Export (Ex), Granger-causality test was carried out. The result is reported in Table 5.

Granger causality tests are defined as joint tests (F-tests) for the significance of the lagged values of the assumed exogenous variable. The estimation result indicated that we reject the null hypothesis for both LINV and LY and conclude that there exists bidirectional causality between Investment and Economic Growth at the 5% level of significance. There was statistical significant relationship found to exist between export (LEX) and economic growth (LY). Also, with regards to the relationship between investment and export, the result showed that we reject the null hypothesis for both LEX and LINV, indicating that there is bidirectional relationship existing between investment and export in Nigeria.

5. Conclusions

The objective of this study is to estimate the long-run relationship between economic growth, investment and export in Nigeria using annual data sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin for the period 1970-2005. The econometric methodology employed was the Cointegration and Granger Causality test. First, the stationarity properties of the data and the order of integration of the data were tested using both the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test. We found that the variables were non-stationary in levels (except investment variable which was stationary at Intercept and Trend), but stationary in first differences; that is, they are integrated of order one (I (1)). Since we used single equation model(s), the application of Johansen multivariate approach to cointegration was necessary to test for the long-run relationship among the variables. The result showed no existence of cointegration among the variables tested. The result of

the Granger causality test shows a bidirectional relationship between Investment (LINV) and Economic growth (LY) and also a bidirectional relationship between Investment and Export; but the result of the causation between Export and growth was statistically insignificant.

The implications of the result is that increase in investment will lead to production of more good which will cause growth in the economy in one hand; and on the other hand, economic growth will guarantee increase in Investment. This increase in Investment will find development projects such as electricity supply, good road network, good medical care and host of other projects being carried out in Nigerian economy. The workability of these basic amenities enhances a better working condition on every sector of the Nigerian economy which invariably will increase growth. The growth of a country's (Nigeria) economy increase the per capita income and subsequently the capability of the citizens to save and reinvest in the economy; hence, a bidirectional causality. Also Investment which was seen to cause growth will equally enhance export, bearing in mind that increase in export of goods and services will necessitate (cause) Investment in the Nigerian economy.

It is therefore strongly recommended that policies aimed at increasing the level of Investment be formulated in Nigeria economy as a means of engendering economic growth and export which will flow back to (cause) Investment.

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Appendix

Table 1. Unit Root test for Stationarity at Levels

Variables	ADF (Intercept)	ADF (Intercept and Trend)	PP (Intercept)	PP (Intercept and Trend)
LY	-1.035(-3.632)*	-1.904(-4.243)*	-1.123(-3.632)*	-2.092(-4.243)*
LINV	-0.839(-3.639)*	-5.469(-4.284)*	-2.019(-3.646)*	-5.466(-4.262)*
LEX	-0.086(-3.632)*	-2.085(-4.243)*	0.072(-3.632)*	-2.078(-4.243)*

Note: Significance at 1% level.   Figures within parenthesis indicate critical values.

Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6.0.

Table 2. Unit Root test for Stationarity at First Difference

Variables	ADF (Intercept)	ADF (Intercept and Trend)	PP (Intercept)	PP (Intercept and Trend)
LY	-5.077(-3.639)*	-5.102(-4.252)*	-5.002(-3.639)*	-5.041(-4.252)*
LINV	-11.242(-3.639)*	-11.112(-4.252)*	-13.354(-3.639)*	-13.275(-4.252)*
LEX	-6.427(-3.639)*	-6.369(-4.252)*	-6.518(-3.639)*	-6.467(-4.252)*

Note: Significance at 1% level.   Figures within parenthesis indicate critical values.

Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.

Source: Author's Estimation using Eviews 6.0.

Table 3. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.346992	18.92364	29.79707	0.4984
At most 1	0.121747	4.433980	15.49471	0.8656
At most 2	0.000590	0.020079	3.841466	0.8872

Trace test indicates no cointegration at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Table 4. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.346992	14.48966	21.13162	0.3262
At most 1	0.121747	4.413901	14.26460	0.8133
At most 2	0.000590	0.020079	3.841466	0.8872

Max-eigenvalue test indicates no cointegration at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values

Table 5. Pair wise Granger Causality at Lag 2

Null Hypothesis:	Obs	F-Statistic	Probability
LINV does not Granger Cause LY	34	2.55254	0.09526
LY does not Granger Cause LINV		4.66678	0.01749
LEX does not Granger Cause LY	34	0.03715	0.96358
LY does not Granger Cause LEX		0.56880	0.57240
LEX does not Granger Cause LINV	34	3.81389	0.03385
LINV does not Granger Cause LEX		2.84909	0.07419