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DETERMINATION OF LONG TERM RELATIONSHIP BETWEEN FOREIGN PRIVATE INVESTMENT AND GROSS DOMESTIC PRODUCT USING COINTEGRATION

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ABSTRACT

This study examines the long run relationship between Foreign Private Investment (FPI) and Gross Domestic Product (GDP) using cointegration between the period 1965-2012. Secondary data from Central Bank of Nigeria was used in order to achieve the objective of this study. The data was analyzed using E-View 6.1 version for unit root test, granger causality, Cointegration. The result of the unit root in tables 1 and 2 show that the series is stationary at I(1) as in figure 2. Granger causality test in table 3 reveal that granger causality is unidirectional i.e. GDP granger caused FPI with p-values of 0.0394 which is less than 0.05 while FPI does not granger cause GDP. The result of Cointegration test as presented in Table 4 shows the existence of one Cointegrating equation from Likelihood Ratio test (L.R) at 5% significance level which indicates the present of long run relationship between GDP and FPI.

KEYWORDS: Unit Root, Granger Causality, Cointegration, GDP, FPI

1.0 INTRODUCTION

The growth of any country depends largely on the amount of revenue generated for the purpose of infrastructural development. Many ways of generating revenue exist, but Foreign Private Investment is one of such methods. Despite the flow of investment to developing countries especially, Sub Sahara African countries (Nigerian inclusive), they are still characterized by low per capital income (PCI), high unemployment rates, and low or falling growth rates of Gross Domestic Product (GDP), problems which Foreign Private Investment (FPI) are supposed to solve (Tokunbo and Lioyd 2010).

Abu *et.al* (2011), established the relationship between FPI and Agricultural production in Nigeria which is one of the contributory factor to GDP using a data from the Central Bank of Nigeria. The results of the study show a strong positive relationship between FPI and Agricultural production using regression analysis. He concluded that increase in the inflow of FPI will cause 86% change in total Agricultural output. The research also revealed that exports of Agricultural products will exhibit a positive effect on the level of Agricultural productivity. He further added that despite the economic importance of agriculture such as production of food for population, provision of raw materials for industries and a source of employment, Agriculture has not contributed significantly to the development of the economy.

Gillani*etal (*2009*)* used Cointegration and Granger Causality in Pakistian to investigate the relationship between the followings: Inflation, Crime, Unemployment and poverty. The result shows that they exist a long run relationship Inflation, Crime, Unemployment and poverty. Granger Causality test was also carried out using Toda and Yamamoto's (1969) procedure which is an improvement over the traditional Granger Causality. From the causality result, it was determined that crime is granger caused by unemployment, poverty and inflation in Pakistian

Santo and Chris (2013) reviewed the relationship between expected inflation and nominal interest rates in Nigeria. From their study, money market interest rates and expected inflation move together in the long run but not on one to one bases

Aphion (1990), reviewed that Foreign Private Investment has been known to influence economic growth and development of many countries. This is known to provide financial, managerial, administrative and technical personnel, new technology, research and innovations in products and techniques of production.

In this study, we are looking at the causal relationship between FPI and GDP. Since the data for this paper is time based, we employed the co-integration to avoid spurious regression method and also Granger Causality test. The study will help us to investigate of the effect of FPI on Nigeria GDP, to assess the level of inflow of FPI into Nigeria Economy, the role of FPI in Economic development of Nigeria and the long run relationship between the FPI and the GDP.

Section one of this paper introduces the subject, Section 2 will describe the material and methods used in this study, section 3 is data analysis while section 4will discusses the results and conclusions.

2.0 METHODS AND MATERIALS

The data for this study was gotten from Central Bank of Nigeria bulletin (2011 edition).

2.1 Test for Cointegration and their Relation to Unit Root Tests

Any autoregressive time series of order p can be written in terms of its first difference, one lag level and $p-1$lag differences.

Consider the univeriate case (David *et al*, 1991).

$$y_t^* = l_1 y_{t-1}^* + l_2 y_{t-2}^* + l_3 y_{t-3}^* + \ldots + l_p y_{t-p}^* + \varepsilon_t \qquad 1$$

where $y_t^* = y_t - \mu$ and it denote univariate time series

We can rewrite the (1) as

$$\Delta y_t^* = l_1 \Delta y_{t-1}^* + l_2 \Delta y_{t-2}^* + l_3 \Delta y_{t-3}^* + \ldots + l_p \Delta y_{t-p+1}^* - k y_{t-p} + \varepsilon_t \qquad 2$$

where

$l_i = -1 + b_1 + b_2 + \ . \ . \ . + b_i$ and

$k = 1 - b_1 - b_2 - \ . \ . \ . - b_p$

The Dickey and Fuller test (1979) uses the t-statistic from the ordinary least squares (OLS) regression to test the null hypothesis that the coefficient k in equation (2) above is equal to zero. The t-statistic is the likelihood ratio test of the null hypothesis of a unit root.

Consider the multivariate case where more than one variable are involved

$$Y_t = \alpha Y_{t-1} + \beta X_t + \varepsilon_t \qquad 3$$

where

$\alpha = E^{-1}F \ and \ \beta = E^{-1}G$ are matrices of unknown reduced form parameters(David *et al,* 1991). Equation (3) has a predetermined variable at the right hand side. If K is a lag operator, equation (3) can be

$$Y_t = (I + \alpha K + \alpha^2 K^2 + \ldots)\beta X_t + (I + \alpha K + \alpha^2 K^2 + \ldots)\varepsilon_t \qquad 4$$

Note that $(I + \alpha K + \alpha^2 K^2 + \ldots)$ is infinite series evaluated at $K = 1$ converges to $(I - \alpha)^{-1}$ if all the eigenvalues of α are less than 1 in absolute value for a long run response of Y_t to change in one or more of the elements of X_t, we take the expectation of equation (4)

$$E(Y_t) = (I + \alpha K + \alpha^2 K^2 + \ldots)\beta X_t$$

$$(I - \alpha K)^{-1}\,\beta X_t \qquad 5$$

If we assume X_t to stochastic, the method used to obtain estimated cointegrating vectors has its general form as given below

$$\begin{bmatrix} E & G \\ O & I \end{bmatrix}\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} F & O \\ O & P \end{bmatrix}\begin{bmatrix} Y_{t-1} \\ X_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \qquad 6$$

We assume that

$E(\varepsilon_{1t}\varepsilon_{2t})'(\varepsilon_{1t}\varepsilon_{2t}) = \begin{bmatrix} \sigma^2_{\varepsilon_{1t}}\Sigma_{\varepsilon_{1t}} & 0 \\ 0 & \sigma^2_{\varepsilon_{2t}}\Sigma_{\varepsilon_{2t}} \end{bmatrix}$ for all t. Assume E^{-1}exists so (6) can be rewritten as

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} E^{-1}F & -E^{-1}GP \\ O & P \end{bmatrix}\begin{bmatrix} Y_{t-1} \\ X_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

$$\begin{bmatrix} Y_t \\ X_t \end{bmatrix} = \begin{bmatrix} \alpha & \beta P \\ O & P \end{bmatrix}\begin{bmatrix} Y_{t-1} \\ X_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \qquad 7$$

Cointegrating vectors and it interpretation is based on the assumption made aboutα *and* P. If all the eigenvalues of α are less than one, so that the conditional on $Y_t X_t$ is stationary, the common trends in the system are the result of X_t, being non-stationary. The number of common trends will be equal to the number of unit roots in P (David *et. al* 1991). For detail of unit root test check Gujarati (2004), Dickey and Fuller (1979), Fuller (1976).

2.2 Granger Causality

The most common ways of testing the causal relationships between two variables is the granger causality test proposed by Granger (1969) which involves estimating following vector auto regression (VAR)

$$X_t = \sum_{i=1}^{n} \beta_i y_{t-1} + \sum_{j=1}^{n} \gamma_j X_{t-j} + \varepsilon_{1t} \qquad 8$$

$$Y_t = \sum_{i=1}^{m} \delta_i y_{t-1} + \sum_{j=1}^{m} \lambda_j X_{t-j} + \varepsilon_{2t} \qquad 9$$

Where ε_{1t} and ε_{2t} is the white noise, β, δ, γ *and* λ are the parameters involve. X *and* Yrepresents the GDP and FPI respectively. For estimation of parameter see (Gujarati, 2004).

2.2.1 Toda and Yamamoto (1995)

Toda and Yamamoto procedure is a methodology of statistical inference which make parameter estimation valid where the Vector Auroregressive (VAR) system is not cointegrated. This procedure is given below

Let $\{Y_t\}$ sequence be generated by the followings functions

$$y_t = \beta_0 + \beta_1 t + \ldots + \beta_q t^q + \emptyset_t \qquad 10$$

Were t is the time and assuming that $\{\emptyset_t\}$ sequence is a vector autoregressive with lag length and it can be presented as

$\emptyset_t = J_1\emptyset_{t-1} + J_2\emptyset_{t-2} + \,.\,\,.\,\,. + J_k\emptyset_{t-k} + \varepsilon_t$

K is the lag length and is optional. If we transform (7) above we have

$$y_t = \alpha_0 + \alpha_1 t + \,.\,\,.\,\,. + \alpha_q t^q + J_1 y_{t-1} + J_2 y_{t-2} + \,.\,\,.\,\,. + J_k y_{t-k} + \varepsilon_t \qquad 11$$

As the order of integration$d > 0$, the order of the trend α n becomes lower than order q. If $d = 1,\ q = 1,\ \alpha_2 = \alpha_3 = \ \ldots = 0$ then (8) becomes

$$y_t = \alpha_0 + \alpha_1 t + J_1 y_{t-1} + J_2 y_{t-2} + \,.\,\,.\,\,. + J_k y_{t-k} + \varepsilon_t \qquad 12$$

This procedure is interested in the significance of coefficients of lagged y in (9) above and not the VAR stationary position.

Accordingly, the null hypothesis is to jointly test the vectors J

$H_0: J_1 = J_2 \ = \,.\,\,.\,\,. = \ J_k = 0$

$H_1: J_1 \neq J_2 \neq \,.\,\,.\,\,. \neq J_k \neq 0$

For more detail, check Toda and Yamamoto (1995) and Santos and Chris (2013)

3.0 Analysis and Results

E_View statistical software (3.1 Version) was used to implement the methods described above.

Table 1: Unit Root Test for FPI Using Augmented Dickey-Fuller (ADF)

ADF Test Statistic	-4.384445	1% Critical Value*		-3.5814
		5% Critical Value		-2.9271
		10% Critical Value		-2.6013
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-1.165093	0.265733	-4.384445	0.0001
D(GDP(-1), 2)	0.220602	0.210984	1.045582	0.3019
D(GDP(-2), 2)	0.117604	0.154914	0.759159	0.4521
C	0.141594	0.059129	2.394675	0.0213
R-squared	0.482856	Mean dependent var		-0.000490
Adjusted R-squared	0.445016	S.D. dependent var		0.446204
S.E. of regression	0.332410	Akaike info criterion		0.719792
Sum squared resid	4.530354	Schwarz criterion		0.880385
Log likelihood	-12.19533	F-statistic		12.76051
Durbin-Watson stat	1.997944	Prob (F-statistic)		0.000005

Table 2: Unit Root Test for GDP Using Augmented Dickey-Fuller (ADF)

ADF Test Statistic	-4.031987	1% Critical Value*		-3.5850
		5% Critical Value		-2.9286
		10% Critical Value		-2.6021
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FPI(-1))	-1.658562	0.411351	-4.031987	0.0002
D(FPI(-1), 2)	-0.100519	0.310572	-0.323657	0.7479
D(FPI(-2), 2)	-0.209890	0.151873	-1.382017	0.1746
C	0.219463	0.111378	1.970426	0.0557
R-squared	0.843039	Mean dependent var		-0.023513
Adjusted R-squared	0.831267	S.D. dependent var		1.514180
S.E. of regression	0.621981	Akaike info criterion		1.974694
Sum squared resid	15.47442	Schwarz criterion		2.136893
Log likelihood	-39.44326	F-statistic		71.61365
Durbin-Watson stat	1.895601	Prob (F-statistic)		0.000000

Tables 1 and 2 above, shows the unit root test for stationarity using ADF. The result shows that all the variables FPI and GDP are stationary at $I(1)$ series at $1\%, 5\%$ and 10% with the followings values $-3.5850, -2.9286$ and -2.6021 respectively for FPI and that of GDP is a follows$-3.5653, -2.9202$ and -2.5977 respectively. Aside the ADF value, we still consider the Durbin waston value which has a standard value of 2 for a series to be stationary. From the above tables, the Durbin waston values are 1.9979 and 1.895 for FPI and GDP respectively which is approximately 2.00. This also agreed with the result of ADF. Figure 1 below the pattern of the series which is not stationary (i.e contain unit root) but figure 2 confirmed the result of the ADF and Durbin waston unit root test I (1).

Table 3: Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Probability
GDP does not Granger Cause FPI	46	3.50215	0.03943
FPI does not Granger Cause GDP		0.15138	0.86000

Table 3 Above, Shows the Granger Causality Test Using Augmented Englegranger Test for the Causality Between the GDP and Fpi. the Result Reveals That Gdp With p-value of 0.0394 is less than the alpha level of 0.05 which implies the rejection of the null hypothesis and conclude that GDP in Nigeria within the study period is granger cause FPI (i.e. unidirectional).

Table 4: Cointegration

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.333018	19.78753	15.41	20.04	None *
0.034135	1.562911	3.76	6.65	At most 1
*(**) denotes rejection of the hypothesis at 5%(1%) significance level L.R. test indicates 1 cointegrating equation(s) at 5% significance level				
Unnormalized Cointegrating Coefficients:				
LFPI	LGDP			
-0.189867	0.165160			
-0.001448	0.078699			
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
LFPI	LGDP	C		
1.000000	-0.869871	1.972990		
	(0.08605)			
Log likelihood	-57.10391			

The result of cointegration test as presented in Table 4 shows the existence of cointegrating equation. This reveals the present of long run relationship between GDP and FPI

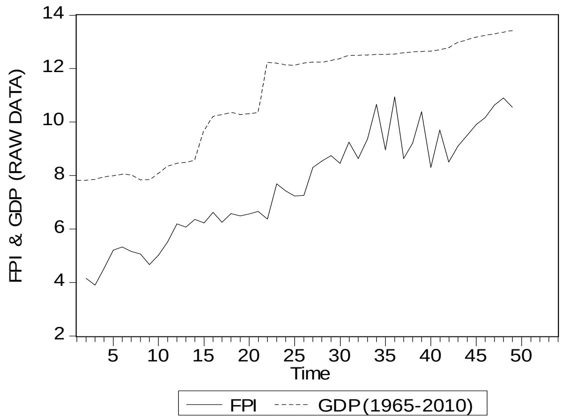

Figure 1

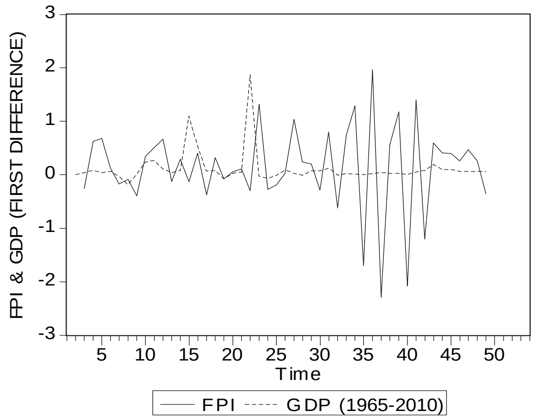

Figure 2

CONCLUSIONS

From the result of Granger causality above, we found out that the GDP granger caused FPI which imply that many private investors came to the country for investment because of high GDP. The above result also signifies that an appropriate investment will lead to high GDP which in turn affect the economy positively since it attracts inflow of investors.

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