Determinants of Economic Growth in Nigeria: Evidence from Error Correction Model Approach.

Elias A. Udeaja Ph.D.
Head, Economics and Statistics Unit, CBN Learning Centre, Central Bank of Nigeria (CBN), Lagos, Nigeria

Obi, Kenneth Onyebuchi Ph.D.
Department of Economics, Nnamdi Azikiwe University, P.M.B. 5025, Awka, Anambra State, Nigeria

Abstract
The determinants of economic growth have attracted increasing attention in both theoretical and empirical research. One reason why issues of economic growth have been given much attention is that a sustained economic growth is essential for a country's long-term development and stability. Like many developing countries, the Nigerian economy, has had a volatile "growth-history". Against this backdrop, this paper investigated the determinants of economic growth in Nigeria through the application of the Johansen co-integration technique and the vector error correction methodology. The results of the co-integrating technique suggest that there is long run relationship among domestic savings, expenditures on education and health, openness to trade, FDI, public infrastructure, and financial deepening with growth of real GDP per capita. The results of the VECM reveals that while domestic savings, expenditure on education, openness, and financial depth (in the second lag) are positive determinants of economic growth, FDI and public infrastructure do not drive economic growth in Nigeria. It was also discovered that expenditures on health had negative effects on growth. A major policy implication of our result is that concerted effort should be made by policy makers to ensure macroeconomic stability and a conducive investment climate (in terms of stable power supply) so as to increase FDI inflow, and relaxation of credit constraints in Nigeria.
Keywords: Economic Growth, Johansen Co-Integration, VECM, Nigeria.

1.0   Introduction and Motivation

Following the seminar contribution of Solow (1956)[1], the determinants of economic growth have attracted increasing attention in both theoretical and applied research.[2] While Solow suggests that much of the growth in an economy is explained by changes in the amount of labour, the endogenous growth theorists emphasize the importance of knowledge capital (Romer, 1986), human capital (Lucas, 1988), learning by doing (Stokey, 1988), and research and development, and horizontal/vertical innovation (Romer, 1990; Grossman and Helpman, 1991; and, Aghion and Howitt, 1992) in the long-run growth of an economy. In addition, other schools have highlighted the significant role of non-economic factors such as institutional structures, legal and political systems, and socio-cultural factors in economic growth (see, North and Thomas, 1973).

These theoretical developments in economic growth literature have been closely complemented by empirical studies. These studies initially focused on issues of economic convergence/divergence. However, focus shifted to factors determining economic growth following the seminal studies by Kormendi and Meguire (1985), Grier and Tullock (1989), Barro (1991) and Mankiw*et al*., (1992). Since then there has been burgeoning empirical literature on the determinants of economic growth. One reason why considerations of economic growth have been given much attention is that a sustained economic growth is essential for a country's long-term development and stability. Thus, it is the interests of economists and policy makers to explore factors driving economic growth.

Like many developing countries, the Nigerian economy, has had a volatile "growth-history". For instance, in the period 1960-70, the Gross Domestic Product (GDP) recorded an annual growth of 3.1 per cent. During the oil boom era (1970-78), GDP grew positively by 6.2 per cent annually. However, negative growth rates were recorded in the 1980s. In the period 1988-1997 which constitutes the period of structural adjustment and economic liberalisation, the GDP grew at a positive rate of 4.0 (Ekpo and Umoh, 2004). This growth-experience has been blamed mainly on the high inflation rate, a mounting fiscal deficit, increasing foreign debt and debt servicing, political instability, and, among other factors, economic mismanagement and corruption.

The underperformance of the Nigerian economy relative to its enormous resource endowment in comparison with the emerging Asian countries, notably, China, Malaysia, India, and Indonesia that had lower per capita GDP in 1970 but have, in recent past, transformed their economies to become major players on the

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[1] In the article "A Contribution to the Theory of Economic Growth" Robert Solow from the MIT Department of Economics pioneered the subject of growth theory.
[2] Economic growth - often measured as per capita GDP growth, not only indicates a country's economic performance but, to some extent, also reflects its residents' welfare.

global economic scene has called for a closer look on the key factors driving economic growth in Nigeria against the backdrop of theory and other countries experience, particularly the emerging countries. For instance, China is positioned as the second largest economy in the world although in 1970 while Nigeria had a GDP per capita of US$233.35 and was ranked 88th in the world, China was ranked 114th with a GDP per capita of US$111.82 (Sanusi, 2010).

In line with the forgoing, the objective of this paper is to conduct an empirical study to identify factors driving economic growth in Nigeria using variables suggested by economic theories and some empirical studies as well as peculiarities of the Nigerian economy. Specifically, the study seeks to assess the degree of influence of the various determinants have on economic growth. To achieve the objective of the study the paper is organized in five sections. Following this introduction is Section 2 which characterizes the state of the Nigerian economy. Section 3 provides a brief literature survey on the theoretical and empirical determinants of growth. Section 4 presents the econometric model to investigate the variables affecting economic growth and also describes the data used in this paper. Section 5 presents the analysis of the empirical results; and Section 6 concludes the paper.

2.0   Macroeconomic Variables, Growth and the Nigerian Economy: Stylized Facts

Nigeria's economic aspirations have remained that of altering the structure of production and consumption patterns, diversifying the economic base and reducing dependence on oil, with the aim of putting the economy on a path of sustainable, all-inclusive and non-inflationary growth. The implication of this is that while rapid growth in output, as measured by the real gross domestic product (GDP), is important, the transformation of the various sectors of the economy is even more critical. This is consistent with the growth aspirations of most developing countries, as the structure of the economy is expected to change as growth progresses (Sanusi, 2010). In the first decade of independence, primary agricultural produce were the main exports. In fact, Nigeria was the world's largest exporter of groundnut, the second largest exporter of cocoa and palm produce and an important exporter of rubber, cotton, and hides and skin World Bank (1975). In real terms, in 1970, the country produced 305,000 tonnes of cocoa, 800,000 tonnes of palm oil and Kernel and over one million tonnes of groundnut CBN (2000). The contribution of the sector to total GDP has fallen over the decades, from a very dominant position of 55.8 % of the GDP in 1960-70 to 28.4 per cent in 1971-80, before rising to 32.3, 34.2 and 40.3 per cent during the decades 1981-90, 1991-2000 and 2001 – 2009, respectively (see, Table 1). However, it is noted that the agricultural sector has not been able to accomplish its main role of meeting the raw material needs of industries, feeding the population, and providing substantial surplus for export. Undeniably, the fall is not because a strong industrial sector is displacing agriculture but largely as a result of low productivity, owing to the dominance of peasant farmers and their reliance on rudimentary farm equipment and low technology. Another inhibiting feature in this sector is under-capitalization which results in low yield and declining output, among others.

Table 1: The Sectoral Percentage (%) Composition of RGDP in Nigeria from 1960 – 2009.

Sector/ Year	1960	1970	1980	1985	1990	1995	2000	2005	2009
Agriculture	64.27	44.74	20.61	32.70	31.52	34.19	35.83	41.19	41.84
Crude Oil	0.44	11.04	21.41	35.89	37.46	33.24	32.45	24.26	16.05
Manufacturing	4.58	7.53	11.05	5.99	5.50	4.92	4.24	3.79	4.19
Building/ Construction	4.45	5.24	9.69	1.65	1.63	1.86	1.95	1.52	1.93
Services	12.99	18.45	15.05	9.45	10.25	11.55	12.12	15.21	17.50
Total GDP	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Computed by the Author from the CBN's Statistical Bulletin (2009).

From the 1970s, the Nigerian economy has been dominated by crude oil. Figure 1 shows that oil export has been on the rise since the 1970s. Also, since 1975 to date, there has been no year when the proportion of crude oil exports in total export fell below 91% (see also, Table 2). For example, in 1999, Nigeria exported 706,693,478 barrels of crude oil as against769,195,205 (96% of total export) barrels in 2009(NNPC ASB; 2009). A closer look at Figure 1 reveals that the percentage contribution of oil to total export in Nigeria has remained very high since the early 1970's till date. As the figure depicts, oil export accounted for more than 50% of the total export in Nigeria in 1970 and has since then remained above this percentage.

Figure 1: Percentage Contribution of Oil and Non-Oil to Total Import and Exports
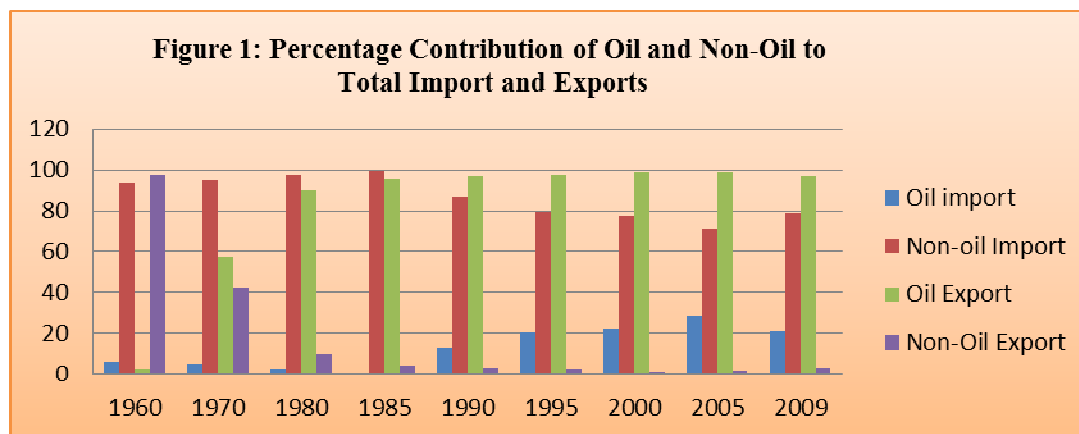
*Source: Author's drawn; u*nderlying data sourced from the CBN's Statistical Bulletin (2009).

The over-dependence on oil has created vulnerability to the vagaries of the international market. As a result, in 1986, the government of Nigeria accepted the International Monetary Fund-sponsored Structural Adjustment (SAP). The Programme aimed at eliminating awkward administrative controls and creating a more market-friendly environment reinforced by measures and incentives that encourage private enterprise and more effective allocation of resources.

Table 2: Share of Oil Exports in the total Exports in Nigeria (Selected Years).

1970	1975	1980	1985	1990	1995	2000	2005	2009
58%	93%	96%	96%	97%	98%	99%	99%	96%

Source: Nigerian National Petroleum Corporation (NNPC) Annual Statistical Bulletin (2009).

As a result of increased liberalization in economic management and deregulation, the economy of Nigeria witnessed some economic gains. It was not quite long before these gains came to a halt as a result of policy reversals and inconsistencies. Generally, frequent policy inconsistencies and reversals that characterized the1986- 1999 period created distortions in the economy and were further exacerbated by external shocks, including the external debt overhang. Whether or not SAP was able to achieve its goals remains an open question as most of the policies were terminated prematurely or reversed out-rightly. This "start-stop" approach to policies by the government is reflected in the volatile movement of some economic indicators overtime as shown in the Figure 2 below.

In the figure, we notice that the real exchange rate remained unchanged over the period before the introduction of the free floating regime. To be specific, this trend changed in 1986 and has remained a rising curve. Sequel to this is the sharp jumps witnessed in the inflation rate. Of all the periods captured in the figure, 1975 and 1995 had the most jumps. The figure also shows that inflation rate begun to fall after the year 2000 until about the third quarter of 2007 when it resumed a rising trend. The percentage contribution of the current account balance to the GDP as captured in the figure is striking. Notice that its trend was a rising one until after 1990 when it suddenly assumed a downward trend. A very noticeable fact about the current account balances is that its contribution to the GDP in 1995 dropped by 9%. However, it recovered and contributed a high value of 33 % in 2005 before decreasing gradually to 13% in 2009. The percentage contribution of Foreign Direct Investment (FDI) to the Nigeria's GDP has been abysmally low. Its highest contribution was in 2006 when it contributed at 6%. Although the FDI's contribution slightly increased from 2.65 in 2008 to 3.34 in 2009, a lot still needs to be done by the government to restore confidence and put the economy back on the path of sustained growth. The unpredictable socio-economic and political environment of Nigeria which scares foreign investors away could have been responsible for this.

Figure 2: Trend of Some Macroeconomic Indicators in Nigeria
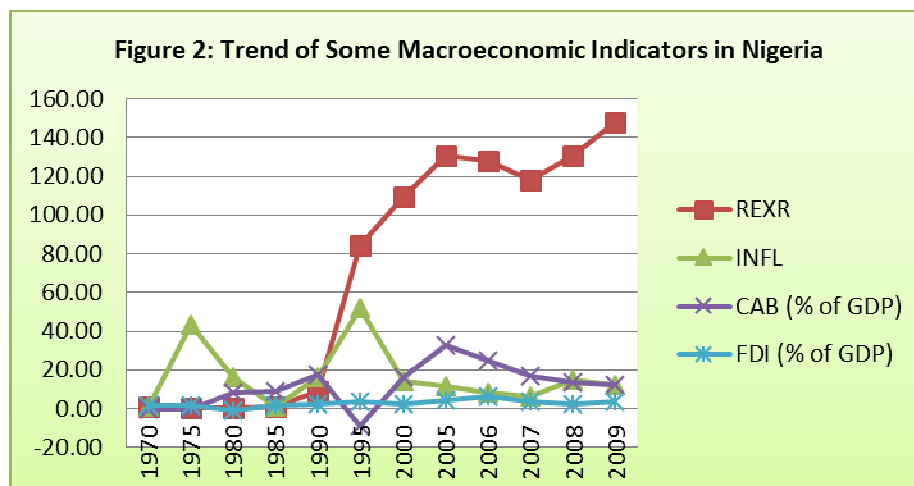
*Source: Author's drawn; u*nderlying data sourced from the CBN's Statistical Bulletin (2009).

Following elections in 1999, the first administration of President Olusegun Obasanjo (1999-2003) focused on ensuring political stability, strengthening democratic practices, and tackling corruption. The second Obasanjo administration (2003-2007) embarked on a comprehensive economic reform program based on a home grown strategy, the National Economic Empowerment and Development Strategy (NEEDS). The development of NEEDS at the federal level was complemented by individual State Economic Empowerment and Development Strategies (SEEDS), which were prepared by all 36 Nigerian states and the Federal Capital Territory (FCT). The NEEDS program emphasized the importance of private sector development to support wealth creation and poverty reduction in the country. The objectives of NEEDS were addressed in four main areas: macroeconomic reform, structural reform, public sector reform and institutional and governance reform. Although there have been notable achievements under the program, significant challenges exist, particularly in translating the benefits of reforms into welfare improvements for citizens, in improving the domestic business environment, and in extending reform policies to states and local governments (Iweala and Kwaako, 2007).

While identifying binding constraints such as physical infrastructure, low access to finance, the poor investment climate, and labour skills as major structural challenges to the economy, the World Bank (2003) stresses the need to address the critical challenge of employment-creation if growth is to become meaningful to the average citizen. It is hoped that the Bank Group's areas of focus, which include the stimulation of private sector-led growth in the non-oil sector through enhanced infrastructure, will contribute towards addressing this constraint.

The global financial meltdown (2009-2010) had a diminishing impact on macroeconomic growth of Nigeria. It contributed to the challenges facing the banking and financial sector. The Nigerian capital market was before March 2008 adjudged the most attractive in the world, by virtue of its high returns on investment. With the worsening shortage of credit around the globe, numerous major foreign investors made a call on their investments, resulting to billions of US Dollars been taken out of the capital markets and the commercial banks over the last two years. This has obviously compounded the credit squeeze and worsened the capital adequacy ratios of some of the commercial banks.

Figure 3 below further reveals that the macroeconomic growth of Nigeria has been stochastic. It is very clear from the figure that in Nigeria, total federal collected revenue is just a mirror image of oil revenue, suggesting monotonic structure of the economy. The truth embedded in this is that the oil sector remains indispensable in the economic survival of the Nigerian nation. Also, it can be observed that government expenditure followed almost the same trend with the oil revenue. The figure further suggests that the real GDP has been crawling (somewhat trending) over the years. The amnesty programme of the federal government in the Niger Delta led to resumption in growth of the oil and gas sector. However, the activities of the dreaded Islamic set popularly referred to as Boko Haram has posed serious security threats in the country, and thus discouraging FDI inflow.
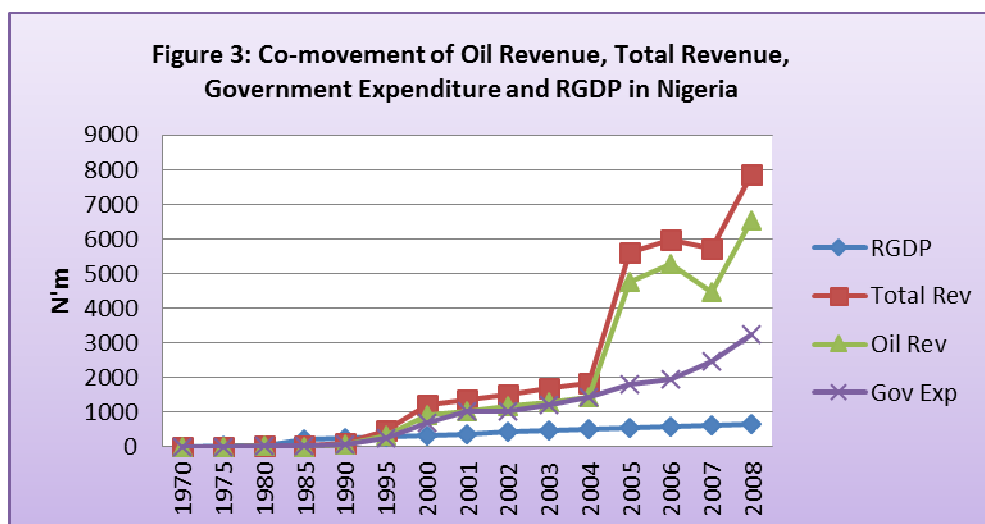
*Source: Author's drawn; u*nderlying data sourced from the CBN's Statistical Bulletin (2009).

3.0   A Brief Survey of Literature

Theoretical Literature

Long before the institutional dimensions of economic growth literature, Smith (1776) had noted that not only capital accumulation but also institutional and technological progress and social factors play a crucial role in the economic development process of a country. Kibritcioglu and Dibooglu (2001), however, opine that the starting point of conventional economic growth theorization is the neoclassical model of Solow (1956). The basic assumptions of the model are: constant returns to scale, diminishing marginal productivity of capital, exogenously determined technical progress and substitutability between capital and labour. As a result the model highlights the savings or investment ratio as important determinant of short-run economic growth. Technological progress, though important in the long-run, is regarded as exogenous to the economic system and therefore it is not adequately examined by this model. Considering the issue of convergence/divergence, the model envisages convergence in growth rates on the basis that growth of the poor economies will be faster compared to the rich ones.

The role of technological progress as a key driver of long–run economic growth has been brought under examination in the more recent studies, which accept constant and increasing returns to capital. These theories, referred to as endogenous growth theories, suggest that the introduction of new accumulation factors, such as innovation, knowledge, etc., would induce self-maintained economic growth. Triggered by the Romer's (1986) and Lucas' (1988) seminal articles, studies within this framework highlighted three significant sources of growth: namely, new knowledge (see, Romer, 1990, Grossman and Helpman, 1991), innovation (Aghion and Howitt, 1992) and public infrastructure (Barro, 1990). Consequently, and contrary to the neoclassic counterpart, policies are deemed to play a considerable role in advancing growth on a long-run basis. In relation to the convergence/divergence debate, the endogenous growth models suggest that convergence would not take place at all.

However, in a similar dimension, the New Economic Geography (NEG) posits that economic growth tends to be an unbalanced process favouring the initially advantaged economies (see for example, Krugman, 1991 and Fujita *et al*, 1999). On the other hand and in contrast to the former, this strand of literature develops a formalized system of explanations which places explicit emphasis on the compound effects of increasing returns to scale, imperfect competition and non-zero transportation costs. The core of this theory is that economic activity tends to cluster in a specific region and choose a location with a large local demand resulting in a self-reinforcing process. The spatial distribution of economic activity can be explained by agglomeration (or centripetal) forces and dispersion (or centrifugal) forces. The former include backward and forward linkages of firms, externalities and scaled economies while the latter include negative externalities, transport costs and intensification of competition. Consequently, NEG is mainly concerned with the location of economic activity, agglomeration and specialization rather that economic growth. However, growth outcomes can be inferred from its models.

From a more macro perspective, other theoretical approached have emphasized the significant role non-economic factors (at least in the conventional sense) play on economic performance. Thus, political science focused its explanation on political determinants (Lipset, 1959; Brunetti, 1997), economic sociology stressed the importance of socio-cultural factors (Granovetter, 1985; Knack and Keefer, 1997), institutional economics has underlined the substantial role of institutions (see, Matthews, 1986; North, 1990; Jutting, 2003), and others shed

light on role played by geography (Gallup *et al.*, 1999) and demography (Brander and Dowrick, 1994; Kalemli-Ozcan, 2002).

Another strand of literature developed by Myrdal (1957) and Kaldor (1970) is the growth theory of cumulative causation. Fundamental to this theory is the argument of 'cumulative causation' in which initial conditions determine economic growth of places in a self-sustained and incremental way. As a result, the emergence of economic inequalities among economies is the most possible outcome. Although there are positive spill overs spreading growth from the more to the less advanced economies, they are incapable of bringing the system into a state of balance if market forces alone are left at work. Unlike the theories mentioned above, theories of cumulative causation has a medium term dimension and is often described as "soft" development theories due to a lack of applied mathematical rigor. However, certain similarities are evident between the cumulative causation approach and the theory of endogenous growth (Petrakos *et al,* 2007).

Methodological Literature

Different methodological approaches have been applied to offer explanations on the determinants of economic growth. These methods, which have their relative strengths and weaknesses, have been applied for both cross-country and single country analyses. Studies based on the general framework of cross-country regressions employed panel data approach. For instance, Barro (1991, 1997); Persson and Tavellini (1992); Knight *et al.,* (1992); Barro and Lee (1994); Fisher (1993); Chen and Feng (1996); Feng (1997); and Bassanini and Scarpetta (2001) for the OECD countries; Loayza and Soto (2002) for 79 countries; used the Pooled cross-country time-series data. The main advantage of the pooled cross-country time-series technique is that country-specific effects can be controlled for while allowing for short-term adjustments and convergence speeds to vary across countries, and imposing restrictions only on long-run coefficients. However, as noted by Bassanini and Scarpetta (2001), the estimator imposes homogeneity of all slope coefficients, allowing only the intercept to vary across country. An alternative approach which involves estimating separate regressions for each country and calculating averages of the country-specific coefficients (i.e. the mean-group (MG) approach) requires large country samples. For single country cross-sectional analysis, Chen and Feng (1999) applied a cross-country analytical approach to investigate the sources of cross-provincial variations of economic growth in China, while Cai, Wang and Du (2002) estimated the determinants of economic growth in Chinese provinces during the period 1978-1998 using panel data by Ordinary Least Squares (OLS) and Feasible Generalised Least Square (FGLS). Also, Dermurger (2001) utilized an empirical panel data framework to analyze panel data from a sample of 24 Chinese provinces throughout the 1985 to 1998 period. Papyrakis and Gerlagh (2007) analyze empirically determinants of economic growth in the United States using cross-sectional data on 49 states.

Using cross-sectional data for 48 Russian regions, Berkowitz and DeJong (2003) estimate growth regression by Ordinary Least Squares (OLS) and Two Stage Least Squares (2SLS). The drawback of the OLS estimation - the *omitted variable bias* which does not control for factors constant over time yet differing between countries or factors differing over time yet constant between countries, motivated the random-effects estimation technique employed by Zhuang and St. Juliana (2010) that controls for year and country fixed-effects.[1] More recently, Tolo (2011) uses a fixed effects panel regressions technique to study determinants of per capita GDP growth in the Philippines.

Other single country case studies such as Piazolo (1996), Babatunde and Adefabi (2005), and Kogid *et al.,* (2010) use *Johansen* co-integration analysis to investigate the long-run relationship between economic growth and the determinant factors in Indonesia, Nigeria and Malaysia, respectively. The Johansen co-integration approach tests for the co-integration rank for a VAR process, estimates the TRACE and LMAX stats, the eigen values, and the eigenvectors. It also computes the long-run equilibrium coefficients, the adjustment coefficients, as well as the covariance matrix of the errors. However, in the analysis of the causal relationship, Piazolo, and Kogid *et al.,* adopts the Engle and Granger Error Correction Model (ECM) while Babatunde and Adefabi employed a Vector ECM. In the current study, based on the information obtained from the Johansen cointegration test, we estimate an error correction model to analyse the effects of our variables of interest on economic growth. This approach deviates from Babatunde and Adefabi (2005), and is theoretical plausible given that our interest here is not on recursive causality within the system. In addition, we do not restrict the study to the relationship between education and economic growth (as in, Babatunde and Adefabi, 2005) but capture a larger sphere of economic growth determinants. Also, we restrict our source of data to two data sources (see appendix); this reduces wide shots in estimated results given variance in methods of data collection. Finally, by increasing the data sets to 2009, the results of this study prove more useful for policy given the present realities of the Nigerian economy.

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[1] Actually, Zhuang and St. Juliana first performed an Ordinary Least Square (OLS) estimation; but the drawback of the estimation informed the use of random-effects estimation technique.

Empirical Evidence

On the empirical front the literature shows that economic growth is positively related to:

- Total factor productivity (TFP), see:King and Levine (1994), Sarel (1998), Prescott (1998), Hall and Jones (1999), Crafts (1999), Easterly and Levine (2001), Iwata, Khan, and Murao (2003), and Islam (2003).
- Saving rate, see: Levine and Renelt (1992), Howitt and Aghion (1998), Bernanke and Gurkaynak (2001), Aghion, Comin, and Howitt (2006)
- Capital Stock, see: Romer (1986), Lucas (1988), Rebelo (1991)
- Education, proxy by the starting level of average years of school attainment at the secondary and higher level, see: Barro(1991, 1997, 2003), Levine and Renelt (1992), Benhabib and Spiegel (1994), Barro and. Sala-i-Martin (1995), Doppelhofer, Miller, and Sala-i-Martin (2004).
- Investment rates, see: Barro (1989, 2003), DeLong and Summers (1991), Mankiw*et al.,* (1992), Levine and Renelt (1992), Mankiw, Phelps, and Romer (1995), McGrattan (1998), Bernanke and Gurkaynak (2001), Abdi (2004)
- Technological progress and technological diffusion - Romer (1986, and 1990), Lucas (1988), Rebelo (1991), Grossman and Helpman (1991), Gordon (2002)
- Research and Development - Grossman and Helpman (1991), Aghion and Howitt (1992), Coe and Helpman (1993), Barro and Sala-i-Martin (1995)
- labor and capital productivity –Bergoeing*et al.,* (2002)
- institutional framework - Knack and Keefer (1995)
- macroeconomic stability - Fischer (1993), Easterly and Levine (1997)
- better maintenance of the rule of law - Barro (1996, 2003)
- Investments in infrastructure - Barro (1989), Canning*et al.,* (1994), Easterly and Levine (1997)
- maintenance of the property rights - Barro (1989)
- development of the financial and banking system - King and Levine (1993), Levine and Zervos(1998)
- Foreign Direct Investments - Borensztein, De Gregorio, and Lee (1995), Adofu, (2010).

Some studies have also found that economic growth rates are negatively related to:

- The initial level of real per capita GDP - Barro (1991, 1996, 2003), Mankiw, Romer, and Weil (1992), Levine and Renelt (1992),
- taxation level - Barro (1989)
- Government consumption - Barro (1991, 1996, 2003), Levine and Zervos (1993)
- Market distortions - Barro (1989, 1991, 2003), Fischer (1993), Easterly and Levine (1997)
- Political instability - Barro (1989, 1991), Mankiw, Phelps, and Romer (1995), Gallup *et al.* (1999)
- High inflation and inflation fluctuation - De Gregorio (1992, 1993), Barro (1995, 1996, 2003), Easterly and Levine (1997)
- Fertility rate - Barro (1996, 2003)
- Budget deficit - Fischer (1993), Easterly and Rebelo (1993).

A closer look at studies on economic growth determinants within the Asian context (China in particular) reveals evidence of conditional convergence.[1] Also, that reforms, openness as well as infrastructure endowment account significantly for observed growth performance across provinces. For Indonesia, Piazolo (1996) showed that the determinants of economic growth in Indonesia were human capital, investment, government consumption, imports and inflation especially in the long term. In the short term, he finds that exports played a strong positive influence on Indonesian economic growth.

The study of Hsiao and Hsiao (2006) on some East Asian countries showed export and FDI as strong precursors to economic growth.[2] The result of their research found that FDI has a direct one-way effect on GDP and an indirect effect through export. In another study, conducted by Baharumshah and Thanoon (2006) on various types of flow models towards the growth process in East Asian countries, they revealed that positive domestic savings contributes to economic growth in the long run. Their study corroborates the findings of Hsiao and Hsiao (2006) that FDI causes growth and its effects can be experienced in both short and long-term. An important discovery of their study is that FDI contributes largely to the development of East Asian economy and suggests that the countries which succeed in attracting FDI inflow can generate more investment, leading to faster overall development.

The evidence of cross-country and single-country studies of economic growth determinants suggests that Nigeria needs to learn many lessons from the studies on growth (particularly, the emerging countries studies).

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[1]For instance, per capita GDP in the initiative year is negatively related to growth rates in the following years; and labour market distortions negatively impacts growth rates (see Cai, Wang and Du, 2002). Dermurger (2000) had earlier found from a sample of 24 Chinese provinces (excluding the municipalities) that significant and negative coefficient associated to the logarithm of lagged per capita GDP indicates a catch-up phenomenon among Chinese provinces.

[2] The countries consider are China, Korea, Taiwan, Hong Kong, Singapore, Malaysia, Philippines and Thailand

4.0   Methodologyand Estimation Techniques

In this section, we estimate a model of economic growth in other to empirically identify factors driving economic growth in Nigeria. We follow the strand of the empirical endogenous-growth literature which seeks to link a country's economic growth rate to economic and non-economic variables using data from 1970 to 2009. Also our discussion of the results accords with the mainstream of the literature.

We estimate the following regression:

$$\dot{Y} = \alpha + \beta' X_i + \varepsilon \quad \text{--------------------} \quad (1)$$

In the above equation, $\dot{Y}$ represents annual growth rate of real GDP in Nigeria.[1] α is the intercept while β' which represents the vector of the coefficients of the parameters. X_i represents a vector of variables that affect growth, and ε (the error term) captures other factors that explains variations in the regresand. The explanatory variables chosen in the broader specification below follow the growth regressions of Hussain*et al.,* (2009), Gylfason (2001), Pritchett (1996); Benhabib and Spiegel (1994), Easterly and Rebelo(1993), Easterly *et al.* (1991), and Barro (1991), as well as several others that are common in the literature.[2]Specifically, we are interested in

RGDPg = f (DS, EDU, H, PUBINFRA, FDI, OPEN, FINDEP)----- (2)

Where RGDPg is growth rate of real GDP per capita, DS is the domestic saving rate; EDU and H are expenditures on education and health respectively; PUBINFRA represents public infrastructure (proxied by per capita electricity consumption); FDI is the foreign direct investment; OPEN measures trade openness; FINDEP represents all share index and financial deepening (proxied by private domestic credit as a ration of GDP) respectively used to measure institutions.

Specifically, we estimate

$$RGDPg = \beta0 + \beta_1 DS_t + \beta_2 EDU_t + \beta_3 H_t + \beta_4 PUBINFRA_t +$$

$$B_5 FDI_t + \beta_6 OPEN_t + \beta_7 FINDEP_t + \varepsilon \text{-------} \quad (3)$$

It should be noted that domestic saving rate, expenditure on education and health, and financial depth were normalised by GDP before econometrically estimating equation (3). This helps eliminate certain econometric problems, particularly multicollinearity among the explanatory variables. The justification for the inclusion of some of the selected explanatory variables used in the above expression is briefly discussed below. In this study, we use openness (OPEN) as a proxy for trade. Romer (1990) shows that trade stimulates productivity and thus economic growth. It may also promote economic growth through introducing the economies of scale and improving the optimal allocation of resources between commodity production sector and knowledge production sector (see, Krugman, 1979). A number of studies, for example, Pritchett (1996); Benhabib and Spiegel (1994), and Spiegel (1994), have found a negative association between human capital and growth (proxied in this study as expenditures on health, and education as percentages of GDP, (H/GDP) and (EDU/GDP) respectively).

Estimation Technique

In order to estimate the model, we first perform the unit root on the time series macro-variables in our sample test to all the variables. The essence of this is to enable us check if they are stationary. The determination of whether a variable possess a unit root is to know if the variable exhibits certain characteristics such as mean reversion characteristics and finite variance, transitory shocks with the autocorrelations dying out with the increase in the number of lags under the alternative hypothesis of stationarity (Babatunde and Adefabi, 2005). In, testing the nature of the time series, we examine their order of integration. This assists us to determine the subsequent long-run relationship among the variables. In this study, the Augmented Dickey-Fuller unit root test is adopted to test for stationarity.

Next, we test for co-integration among the variables. According to Granger (1986), a test for co-integration can be believed to be a pre-test to avoid 'spurious regression' situations. In this study, we adopt the expanded by Johansen and Juselius (1990, 1992, and 1994) approach for cointegration test. Unlike the Engle Granger static procedure, the Johansen co-integration approach provides more information on the cointegration tests.

We proceed to specify the short-run dynamic equation. The short-run dynamics is specified as an error correction model (ECM) incorporating the one period lagged residual from the static regression. The regressive distributed lag technique was used to obtain an over-parameterized equation (see appendix). Finally, through sequential reduction guided by the Akaike Information Criterion (AIC), a parsimonious result was obtained. The results of the parsimonious regression are summarized below in Table 5.

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[1] As in Vojinovic (2008), we use annual growth rate of real GDP (but in its per capita form) as a proxy for economic growth because per capita GDP (as mostly used in the literature) is influenced by changes in population.

[2]Table 1 in the appendix provides the definitions of variables used and the sources of the data.

5.0   Empirical Analysis and Discussion of Results

Test for Unit Roots

The augmented Dickey-Fuller (ADF) test was employed to determine the integration level of the variables. The results of these tests are reported in Table 3 below. The table shows the behavior of the variables in their levels and first difference form respectively. The null hypothesis states that each variable under investigation has a unit root, meaning that they are non-stationary in their level form. The lag length, which was determined by the AIC for the ADF test was selected to ensure that the residuals were white noise.

Table 3 **Results of stationarity test for the variables**

Variables	Levels	First-diff	Critical Value at 5%	Order of Integration
RGDPg	-1.9656	-4.7862*	-2.9458	$I(1)$
LDS	-1.6286	-5.2575	-2.9411	$I(1)$
LEDU	-1.0334	-7.7389	-2.9411	$I(1)$
LHLTH	-2.0339	-9.9897	-2.9411	$I(1)$
LPUBINFRA	-2.4216	-5.8035	-2.9434	$I(1)$
LFDI	-0.3407	-5.2580	-2.9411	$I(1)$
LOPEN	-0.2369	-6.0804	-2.9411	$I(1)$
LFINDEP	-1.1941	-5.8214	-2.9411	$I(1)$

Notes: ADF denote unit root tests to Dickey-Fuller (1979). Critical values for ADF are from Mackinnon (1991).

The results of the ADF test statistics show that at conventional level of significance all the variables represent a non-stationary process. Since differencing of the non-stationary series produces stationarity, it is concluded that the concerned variables are integrated of order one (i.e., $I(1)$).

Co-integration Test

Having obtained the order of integration of the variables (and given that they are all integrated of order 1), we test for co-integration among the series. Co-integration indicates the presence of a combination of non-stationary variables that are stationary. As earlier indicated, we employ the Johansen procedure. As presented in the Table 4 below the Johansen-Juselius likelihood ratios statistics shows five co-integrating equations between the variables respectively.

Table 4 *Johansen Co-integration Test*
Sample (adjusted): 1972 2009
Included observations: 38 after adjustments
Trend assumption: Quadratic deterministic trend
Series: RGDPG DS EDU HLTH PUBINFRA FDI OPEN FINDEP
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.929308	293.6010	175.1715	0.0000
At most 1 *	0.805869	192.9230	139.2753	0.0000
At most 2 *	0.704484	130.6326	107.3466	0.0006
At most 3 *	0.532162	84.30930	79.34145	0.0200
At most 4 *	0.513260	55.44327	55.24578	0.0480
At most 5	0.437667	28.08230	35.01090	0.2267
At most 6	0.147831	6.207144	18.39771	0.8524
At most 7	0.003370	0.128290	3.841466	0.7202

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The Trace statistics indicate 5 co-integrating equations at the 5% level respectively assuming a linear deterministic trend and two lags in the test equation. This indicates that there is stronghold evidence on the long-run relationship among the variables. The existence of long-run relationship necessitated the specification of an

ECM for this study.[1] Table 5 shows the parsimonious regression results for growth of real GDP per capita to changes in the determinant factors of growth in Nigeria. The short-run estimates as well as diagnostic statistics are shown. The model was chosen on the basis of the following criteria: data coherence, parameter consistency with theory, and goodness of fit. Specifically, we assume a linear trend and intercept in the co-integrating equations.

Table 5 *Parsimonious Regression Results on determinants of Economic Growth*
The dependent variable is per capita real gross domestic product growth rate (RGDPg)

Variable	Coefficient	Standard Error	T-Value
C	-0.094904	0.794966	-0.119381
D(RGDPG(-3))	0.454337	0.098257	4.623964
D(DS)	-1.195780	0.348781	-3.428452
D(FDI(-3))	0.000128	6.08E-05	2.112812
D(FINDEP(-1))	-0.386785	0.246688	-1.567911
D(OPEN(-1))	-1.646123	0.751938	-2.189175
D(OPEN(-3))	-1.585540	0.784659	-2.020674
D(EDU)	-70.50705	39.41421	-1.788874
D(EDU(-2))	-84.96461	39.47675	-2.152270
D(EDU(-3))	-219.3748	66.59696	-3.294066
D(HLTH)	140.1045	97.42144	1.438128
D(HLTH(-1))	281.6307	106.6703	2.640197
D(HLTH(-3))	451.1175	130.7509	3.450206
ECM(-1)	-0.861724	0.154959	-5.560983
R-squared	*0.814530*		
Adj. R-squared	*0.704934*		
S.E. equation	*3.856601*		
F-statistic	*7.432113*		
Log likelihood	*-90.8095*		
Akaike AIC	*5.822751*		
Schwarz SC	*6.438564*		

Source: Computed by the authors using E-View 7.

From the result it is clear that growth in the past period (3rd period, in particular) positively affects current economic growth. As the result indicates, a 1% growth in the third period will generate a 0.45% growth in the current period. The result also shows that domestic saving has a significant but negative effect on economic growth in the initial period. Basically, a 1% change in domestic savings reduces economic growth by about 1.2%. A possible economic intuition could be that the level of domestic savings has not been sufficient to meet-up with the required level of investment needed to achieve desired rate of economic growth in Nigeria; thus, creating a saving-investment gap.

Expenditure on the educational sector has a significant negative impact on economic growth in the initial period, second period, and third. Notice that the negative impact increased over the periods. This finding that education impacts negatively on economic growth is contrary to Lawal and Iyiola (2011) who found that investment in education is a vital ingredient and an important one to the economic growth of the Nigerian economy. The observed negative effects may be attributed to under-capacity utilisation of the educational output.

While the result shows that expenditure on health promotes economic growth in all the periods, FDI drags growth. The result on FDI is not totally contrary to *a priori* expectation; but it is not surprising that its positive impact on growth is negligible given its percentage contribution to Nigeria's GDP has been abysmally low. The unpredictable socio-economic and political environment of Nigeria which scares foreign investors away could have been responsible for this. In addition, this finding partially supports Adofu (2009) who found that FDI has an insignificant impact on economic growth (measured by GDP) in Nigeria.

Financial deepening measured by credit to private sector is insignificant. This suggests that credit to the private sector is either not sufficient to drive investments for growth or that constraints to credit access reduce potential investors' demand for credit.

A striking finding from the result reveals that public infrastructure, as measured by electricity consumption per capita, is not part of the parsimonious results. Thus, suggesting that it does not determine economic growth in Nigeria, at least in the short-run. This may be explained by the low generation, distribution, and thus, consumption of electricity in the country. The erratic supply of power has been a major factor

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[1] See Table2 in the Appendix for the overparameterized result

dampening industrial activities, hence, retarding economic growth in Nigeria.

In addition, the t-statistics on openness reveals that the variable is significant in determining economic growth in Nigeria. However, the impact is negative. This suggests that given the structure of the Nigerian economy, openness does not improve its terms of trade, hence, retarding growth.

The coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium is negative and significant at 1% level. This implies that the rate at which variation of growth of RGDP per capita at time t, adjusts to the single long-run co-integrating relationship is different from zero. In other words, the equation of growth of RGDP per capita contains information about the long run relationship since the co-integrating vector does enter into this equation. The coefficient of the ECM revealed that the speed with which growth of RGDP per capita adjusts the regressors is about 86% in the short run.

All the explanatory variables jointly explained about 70% of the variation in growth of real GDP per capita. The remaining 30% can be attributed to the influence of omitted variables such as stabilization policies, political stability (as in Mankiw*et al.,* 1995, Gallup *et al.,* 1998), market distortions (as in, Fischer, 1993; Easterly and Levine, 1997), etc.

Diagnostic Test

Having presented and analysed the results of the parsimonious regression we now consider several diagnostic tests of model adequacy to check how "good" the fitted model is. Specifically, we shall employ the Jarque-Bera (JB) Test of Normality, the Breusch-Godfrey (BG) test for serial correlation, White heteroskedasticity and Ramsey Reset Test. The JB test of normality is an *asymptotic*, or large-sample, test. It is also based on the OLS residuals. The Breusch-Godfrey test, which is also known as the Lagrange Multiplier (LM) test, is used to test for autocorrelation. It is more robust that the Durbin Watson test statistics, in the sense that it allows for: (i) non stochastic regressors such as lagged values of the regressand; (ii) higher-order schemes; and, (iii) simple or higher-order moving averages of white noise error terms. White Heteroskedasticity Test is a test of heteroskedasticity in the residuals from a least square regression (White, 1980). OLS estimates are consistent in the presence of heteroskedasticity, but the conventional computed errors are no longer valid. White's test is a test of the null hypothesis of no heteroskedasticity against heteroskedasticity of some unknown general form. The Ramsey Reset Test which was proposed by Ramsey is a general test of specification error. If the *F* value is highly significant, it is an indication that the initial model might have been mis-specified.

Table 6 **Summary of Diagnostic Tests for the Model**

Test	RGDPg
Jarque-Bera Normality	0.42 (0.81)
Breusch-Godfrey (B-G)	1.28 (0.29)
Heteroskedasticity	0.77 (0.67)
Ramsey Reset	0.85 (0.36)

Source: Computed by the Authors using E-views 7

Note: The probability is given in parenthesis while the F-statistics are above the probability value.

The outcome of the diagnostic tests as shown above is satisfactory. Under the null hypothesis that the residuals are normally distributed, the JB test for residual normality assumption is not violated. The table also shows that the error process could be described as normal for the determinants. The B-G test which is noted to have stronger statistical power indicated the absence of serial correlation. Also, the absence of white heteroskedasticity and specification error was validated. The results of the tests suggest that the model is well specified, and hence the results are plausible.

6.0   Conclusion and Policy Implications

Nigeria's economic growth has remained volatile over the years. This has caused serious concern to policy-makers, academics, and foreign donor agencies. This paper investigates the determinants of economic growth in Nigeria through the application of the Johansen co-integration technique and an error correction model. The results of the co-integrating technique suggest that there is long run relationship among domestic savings, expenditures on education and health, openness to trade, FDI, public infrastructure, and financial deepening with growth of real GDP per capita.

After analysing an overparameterized regression model, a parsimonious result was obtained after sequential reduction judged by AIC. The result of the ECM reveals that domestic savings, expenditure on education and health, FDI, and openness are determinants of economic growth in Nigeria. However, with the exception of the expenditure on health, and FDI, the other aforementioned variables have negative impacts on

growth either in the initial period or lagged period. While FDI has a negligible positive effect on growth, public infrastructure does not drive economic growth in Nigeria. The special case of public infrastructure could be explained by the deplorable state of electricity (our proxy for public infrastructure) in the country despite the enormous monetary expenditure in the sector. Also, the increasing level of insecurity (human and property) could be the cause of low FDI inflow in the country cum its negligible effects on growth.

A good performance of the Nigerian economy as revealed by the results may therefore be attributed to expenditures on health which translate to a well-developed human capital base. The result highlights the importance of encouraging savings as it suggests that level of domestic savings is not robust enough to drive investment for growth. A major policy implication of our result is that concerted effort should be made by policy makers to ensure macroeconomic stability so as to increase FDI inflow; a conducive investment climate (in terms of stable power supply), and relaxation of credit constraints in Nigeria.

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Appendix

Table 1: Definition and Source of Variables Used in the Analysis

Variable	Definition	Source
RGDPg	Growth of real gross domestic product per capita	WDI, 2010 Note: Computed by GDP (constant LCU) as a ratio of population, and then taking the growth.
DS	Domestic Saving Rate	Central Bank of Nigeria, Statistical Bulletin, 2009
EDU/GDP	Expenditures on education as percentage of GDP.	Central Bank of Nigeria, Statistical Bulletin, 2009
H/GDP	Expenditures on health as percentage of GDP,	Central Bank of Nigeria, Statistical Bulletin, 2009
OPEN	Trade openness (measured by Exports + Imports/GDP)	Underlying data from Central Bank of Nigeria, Statistical Bulletin, 2009
PUBINFRA	Electricity consumption per capita	WDI, 2010
FDI	Foreign Direct Investment	Central Bank of Nigeria, Statistical Bulletin, 2009
FINDEP	Financial deepening measured as domestic credit to private sector	Central Bank of Nigeria, Statistical Bulletin, 2009

Table 2:**Ordinary Least Squares Estimation in Levels**

Dependent Variable: RGDPG			
Method: Least Squares			
Sample: 1970 2009			
Included observations: 40			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.14483	12.39377	1.544714	0.1322
DS	1.022142	0.703477	1.452985	0.1560
EDU	16.95509	60.09441	0.282141	0.7797
LFDI	-0.624546	1.535202	-0.406817	0.6869
FINDEP	-0.919355	0.462513	-1.987740	0.0555
HLTH	-29.14645	135.4515	-0.215180	0.8310
LPUBINFRA	-2.880691	4.935441	-0.583675	0.5635
OPEN	0.844575	0.628775	1.343209	0.1887
R-squared	0.262303	*Mean dependent var*		1.639232
Adjusted R-squared	0.100932	*S.D. dependent var*		6.243743
S.E. of regression	5.920268	*Akaike info criterion*		6.571497
Sum squared resid	1121.586	*Schwarz criterion*		6.909273
Log likelihood	-123.4299	*F-statistic*		1.625463
Durbin-Watson stat	1.783787	*Prob(F-statistic)*		0.163977
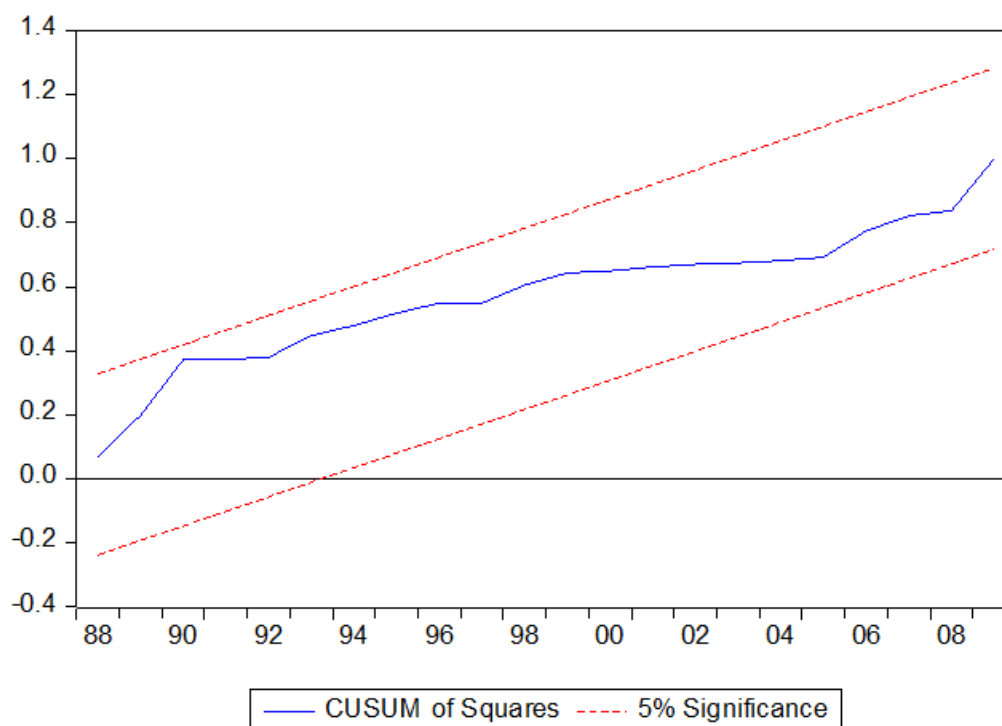
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