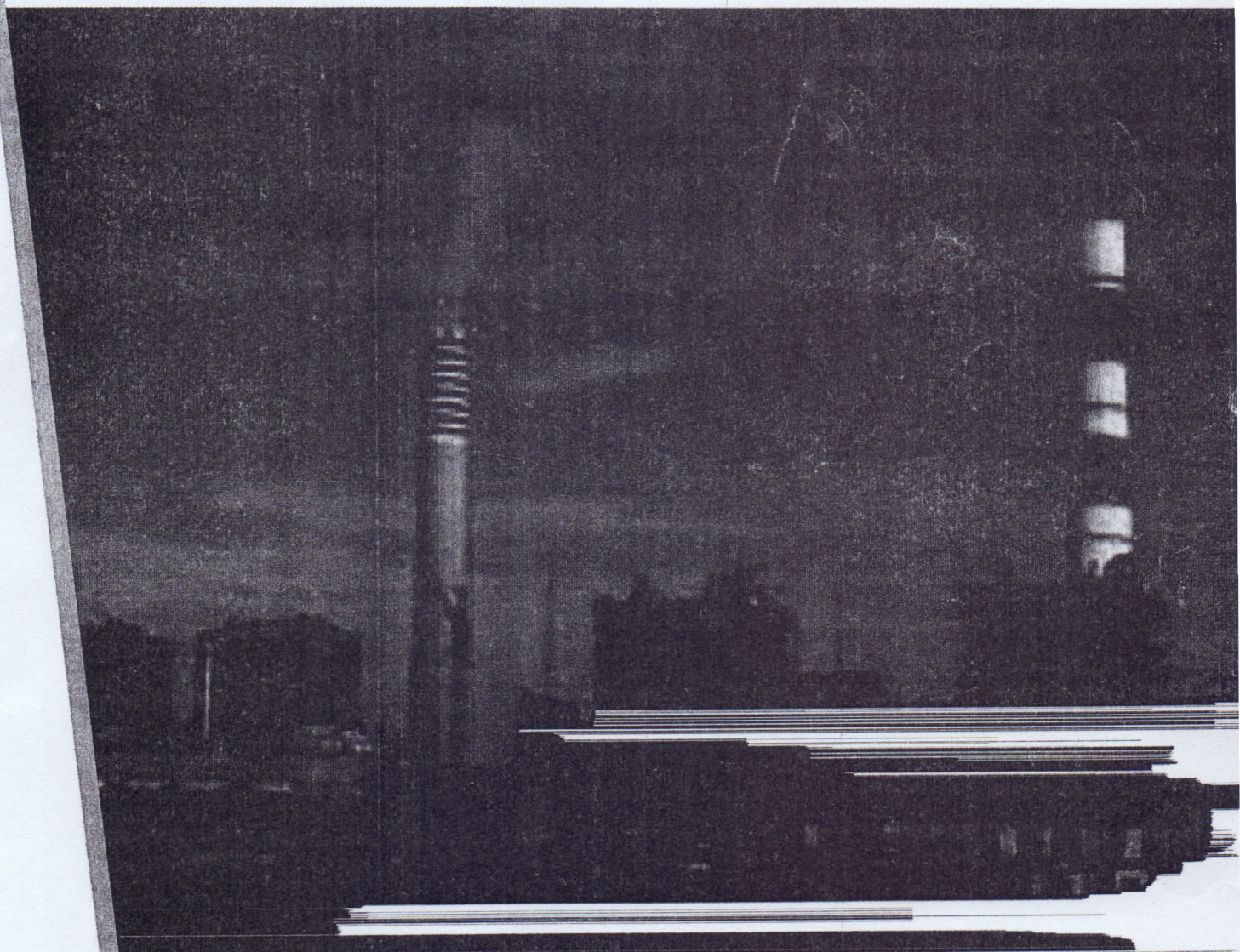


NIGERIA'S INDUSTRIAL DEVELOPMENT, CORPORATE GOVERNANCE AND PUBLIC POLICY



Editors
Ndubisi I. Nwokoma
Wakeel A. Isola

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**Essays in Honour of Michael O. Adejugbe
Professor of Industrial Economics**

ISAAC NWOKOMA

Edited by

**Ndubisi I. Nwokoma
Wakeel A. Isola**

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TELECOMMUNICATIONS INFRASTRUCTURE AND ECONOMIC GROWTH IN NIGERIA: AN INVESTIGATION INTO A CAUSAL LINKAGE

31

Isaac Nwaogwugwu

Abstract

The Nigerian Telecommunication industry has experienced tremendous growth since 2001 when it was privatised by permitting private investment into the sector that was hitherto, under the full control of the Public Sector. Such an unanticipated growth has manifested in the form of domestic and foreign capital inflow into the sector, as well as increased teledensity (spurred by Global System of Mobile Communications, GSM; fixed wired and wireless telephony); and different variants of data services. While the telecommunication sector is booming, it has also been observed that the Nigerian economy has also been recording an impressive GDP growth for equally a period of more than a decade. Hence, this study relying on Granger (1969) Causality technique investigates whether there exists causality between telecommunication infrastructure and economic growth in Nigeria. Results obtained from the analysis shows that telecommunication infrastructure granger-causes economic growth in Nigeria. The reverse could not be validated by this study and thereby suggesting a one way or uni-direction causality relationship that flows from telecommunication infrastructure to economic growth. The government is therefore, advised to ensure a sustained investment into the telecommunication sector.

Key Words: Telecommunication Infrastructure, Economic Growth, Granger Causality, Nigeria

1.0 Introduction

Infrastructure development remains one of the *sine qua non* fundamental ingredients for growth and development of the national economy. This is true for socio-economic and financial infrastructure in general and more specifically to their respective individual components. The role of infrastructure in economic growth is basically enshrined in “easiness of doing business, a much more productive business and economic environment, reduction in transaction and input costs, increased output and income and welfare level enhancement among others”. This way, it could be argued that standard provision of infrastructure would impact positively on economic growth and vice versa.

Insufficient or poor infrastructure limits citizens' access to markets, as well as livelihood opportunities and services such as clean water, education, health, transport, and communication etc., Kumo (2012). ILO (2010) also observed that in as much as Infrastructure development is not a direct MDG target or indicator, without it most of the identified targets and indicators cannot be achieved; it is also an essential part in improving livelihood of the poor while providing opportunities for job creation. The superb role of infrastructure in economic development has as well been documented by Asscher, (1989), Munnell (1990), World Bank (1994) Calderon and Servén, (2003), among others.

The Nigerian economy has always had challenges of infrastructure development and these have continually frustrated all efforts to grow and develop the economy. Even by many developing countries standard, Nigeria had inferior quality of socio-economic infrastructure such as, health, housing, telecommunication, transport services, energy provision (especially electricity) and water. This assertion remains valid even in the face of economic growth performance which has been impressive for the past fifteen years (Akinyosoye 2010). During this period sweeping economic reform programmes have occurred in the economy ---- virtually in all the sectors of the economy and in the process seem to have repositioned the economy on the path of further growth and development.

An investigation into the role of infrastructure development could be done at two levels; one, at the sectoral level where the role of a specified infrastructure such as telecommunication services or electricity is to be identified; and two, at the aggregate or macro level where the impact of total stock of infrastructure on economic performance is to be measured. This study follows the former with reference to Nigeria's telecommunication industry.

The Telecommunication sector is one of the sectors where economic reform programmes have caused a major visible change in terms of investment, teledensity, data service provision and services delivery. This wave of change in this sector and improvement in general telecommunication infrastructure underscores the role of telephony and allied services in the Nigerian economy. As pointed out by Asogwa et al. (2013), the growth of telecommunication services has brought about fundamental shifts in patterns of communication, and human relations and thereby engendering amazing social, economic and cultural revolution.

The Nigerian telecommunication sector was privatised by "Opening Up Mode" in 2000. Opening Up is a mode of privatisation under which a sector or subsector of the economy that is under a full control of the government is thrown open for private capital participation either partially or wholly. And this was immediately followed by

granting of licenses to three players – MTN, Econet and M-Tel – in the Global System of Mobile Communication sub-sector of the industry. This was followed by the entry of Global Communication in 2003 and Etisalat in 2008. There were also Universal Access Services licenses in 2006 which permitted many companies to provide services of fixed wired and wireless telephony, as well as VSAT and Internet Service Providers.

These developments obviously entailed increased opportunities for growth in income, and output as well as for employment. In other words, investment in the telecommunication sector as reflected by better services has impacted positively on the economy. Asogwa et al. (2013) using a simple multiple regression analysis confirmed this. This is also similar to the findings of Tella et al. (2007), Zahra et al. (2008), and Hashim (2009) although Snieska and Simkunaite (2009) and Faridi (2011) suggest otherwise. In fact their studies show that telecommunication infrastructure has a negative relationship with economic growth. This study therefore, makes an attempt to investigate the causal relationship between telecommunication infrastructure and economic growth in Nigeria. Hence, in a standard null hypothesis form, the paper seeks to take a decision on a none causal relationship between the two variables.

The remaining part of the paper is structured as follows; section two deals with Literature Review while Theoretical Framework is examined in section three. Section four examines Data and Methodology. Analysis of Results is contained in section five while section six is devoted to Conclusion and Policy Recommendation

2.0 Literature Review

In modern day Nigeria, daily activities such as shopping, entertainment, banking, manufacturing, office work, education, medical care, governance and even commuting have become increasingly dependent on information and communication networks. The ICT networks now make it possible for developing countries like Nigeria to participate in the global economy in ways that simply were not possible in the past. This reality is reflected in the rapid growth that telecommunication has been experiencing.

The telecommunication sector across the globe has been identified as one with generic effect on almost all other sectors of the economy (Asan & Talabi, 2012). Its functions in any economy can be described as a strategic one aimed at promoting economic growth and as one that has linkage with other sectors. For the developing world, a modern telecommunications infrastructure is only essential for domestic economic growth, but a prerequisite for participation in increasingly competitive world market and for attracting new investments.

Recently, the role of telecommunication infrastructure in enhancing economic growth has generated a lot of interesting discussions and debates, Mahendra, (2013). Arguments are that the development of a modern nation to its full potential in the contemporary world can never be attained without adequate telecommunications infrastructure. This implies that the development of telecommunication infrastructure will significantly boost economic growth and development. Most developed economies such as the US, Japan, UK and France having realised this, deregulated their telecommunication sectors to allow for more investments. The result they got were not just improved telecommunication capabilities, but also increased foreign investments, boom in private sector development, more employment opportunities and better education and training facilities.

The importance of telecommunications on economic and social development, Adedeji (2012) would include among others factors; Providing a cost effective and time efficient medium for accessing and diffusing new ideas and knowledge which have been identified by economists as key elements for stimulating economic growth; Helps to improve information flow between rural and urban areas and also reduces the gap of economic development and disparity between them. The same applies to developed and developing countries; by facilitating information flow and enhancing communication between buyers and sellers, telecommunication increases the efficiency of market operations; Telecommunication networks and their use generate significant spillover effects to other sectors of the economy (linkage effects); The Nigerian telecommunications sector is amongst the best performing sectors of the Nigerian economy and one of the fastest growing employers of labour in the country; Telecommunications also helps to spread education to remote locations, with voice, data and video services through high bandwidth allowing effective distance learning.

The above factors are further supported by a World Bank report, World Bank (2006). The report concludes that the economic development of a nation can be accelerated by improvements in the country's ICT (Information Communication Technologies) infrastructure, because ICT if well harnessed provides a proper platform for development across all sectors of the economy.

In Nigeria, the entrance of Global System for Mobile Communications (GSM) operators from 2001 has positive impact on the entire telecommunications industry and cultural life of Nigerians. It generated employment for many unemployed able persons, Onakoya et al. (2012). Beside improving the business margins of entrepreneurs in the industry and attracting foreign investment, the telecommunication sector has directly contributed to the growth in the country's GDP. Figures from Nigerian Communications Commission's website reveal that

from a paltry contribution of 0.62% in 2001, the sector's contribution grew consecutively to 1.53%, 4.56% and 7.76% in 2005, 2010 and 2013 respectively.

A lot of empirical studies have been conducted on the influence of telecommunication infrastructure and investment in economic growth. An earlier attempt to examine a positive correlation between the level of telecommunication use and some index of economic wellbeing could be traced to Jipp (1963) who studied the relationship between the income of a nation and telephone density, using data for different countries, he found a positive correlation between the two. Also, Bee and Gilling (1967) studied the relationship between telephone facilities and their use and economic performance using data from 29 countries at different stages of development. Garbade and Sibling (1978) proved in their studies that there was statistical evidence that the two innovations in communication technology (the telegraph and trans-Atlantic cable) led to efficient market places worldwide through significant and rapid narrowing on inter-market price differentials. As for Pohjola (2001), he concentrated on 39 countries using data from 1990 to 1995 and observed that IT investment shows 80% gross returns for OECD countries, but developing countries did not experience significant returns.

The studies conducted by Datta and Agarwal 2004; Lam and Shiu, 2010 (cited by Onakoya, 2012) show a positive and significant causal link between telecommunications infrastructure and economic growth. Alleman et al. (1997) examined the relationship between investment in telecommunications infrastructural investment and economic growth with respect to the Southern African countries and concluded that investment in telecommunications will take one period to manifest this impact. This is supported by Jain and Sridhar (2003) in the study of the non-OECD countries: Algeria, Argentina, Brazil, Chile, Costa Rica, Egypt, India, Indonesia, Korea, Malaysia, Mauritius, Mexico, Morocco and Tunisia. Ding and Haynes (2004) empirical investigation of a sample of 29 regions in China covering 1986 to 2002, confirms that fixed investment has a positive effect on economic growth and that telecommunications is both statistically significant and positively correlated to regional economic growth in real GDP per capita growth in China. The study of Tella et al. (2007) on telecommunications infrastructure in Nigeria shows that main landline and cell phone penetration had significant effects on economic growth, after controlling for the effects of capital and labour. The results also show that traditional economic factors like income and price helped explain demand for main land phones, but they do not explain demand for Cell phones. Osotimehin et al. (2010) study also on Nigerian using OLS multiple regression technique upheld a close correlation between telecommunications and economic growth.

3.0 Theroretical Framework

There are various channels through which the effect of infrastructure is transmitted directly and indirectly to economic growth, Onakoya (2012). This effect is manifested only through the economic growth indicators which include real GDP, industrial production, employment, price stability, education, technology, openness, knowledge, innovation. The nature of transmission is determined by the role of infrastructure capital in the production function i.e. whether it is a direct or intermediate input. As a direct input, it can either be in its pure public good form or provided by the private investors, guided by market forces. The transmission channel in this case is said to be direct channels. Where infrastructure capital is an intermediate input in the production function, the consequential indirect transmission channel through which infrastructure affects growth is determined by three factors. These are productivity of physical capital which is in turn determined by reduction in adjustment costs and maintenance of existing infrastructure also derived from the facilitation of reallocation of capital. The second variable is higher labor productivity obtained from improved human capacity development. The transmission impact through human development can be realised through improving health, better nutrition, education, better roads, access to electricity, telecommuting, etc. The third factor is the externalities which transmit key technological innovations to other sectors leading to lower costs, and spill-over effects on other firms and therefore, on the economy as a whole.

Existing studies on the role of public and private investment on economic growth are essentially based on the production function framework, see Sahoo (2010). Also see Abramovitz (1956) and Solow (1957).

Assuming a generalised Cob-Douglas production function and extending the neoclassical model to include Telecommunication Infrastructure, it follows that;

$$Y_t = (K_{pvt}, K_{pub}, LF_t, TI_t)$$

Where:

Y_t	=	Gross Output
K_{pvt}	=	Private Capital
K_{pub}	=	Public Capital
LF_t	=	Labour Force
TI_t	=	Telecommunication Infrastructure

The objective here is to identify the contribution of each factor to the growth of GDP. The general approach is to Mathematically transform the production function into

growth equation which splits the total growth (GNP) into the growth of the individual factors or inputs contributing to the growth and thus can be used to identify the contribution to growth of each, Clunies-Ross et al. (2009).

0 Data and Methodology

The data used is obtained from Central Bank of Nigeria Statistical Bulletin 2012 and the Web site of the Nigerian Communications Commission. The number of lines (Mobile and Fixed as well as wired and wireless) has been used as proxy of development in Nigeria’s telecommunication sector although investment into this sector would have served the same purpose.

One question that frequently arises in time series analysis is whether or not one economic variable helps in the forecast of the other. In the Granger (1969) sense, a time series x is a cause of y if it is useful in forecasting y . Also see Kumo (2010).

To examine the causal relationship between economic growth and the telecom sector, we investigate if it is the growth of the economy (EG) that drives the telecom sector (TEL) ($EG \rightarrow TEL$), or if it is increase performance of the telecom sector (TEL) that fuels economic growth (EG) ($TEL \rightarrow EG$) where the arrow indicates the direction of causality. The procedure for testing statistical causality between economic growth and the telecom sector is the conventional “Granger – causality” test proposed by Granger (1969). The test which utilises the concept of Vector Auto regressive (VAR) model is presented in a two variables Vector Auto regressive (VAR) model as shown in equation 1 and 2 below;

$$EG_t = \sum_{i=1}^n \alpha_i EG_{t-i} + \sum_{j=1}^n \beta_j TEL_{t-j} + U_{1t} \dots\dots\dots (1)$$

$$TEL_t = \sum_{i=1}^n \gamma_i EG_{t-i} + \sum_{j=1}^n \psi_j TEL_{t-j} + U_{2t} \dots\dots\dots (2)$$

Where EG = Economic Growth, TEL = Teledensity a measure for the telecom sector and it is assumed that u_{1t} and u_{2t} are uncorrelated. To determine the direction of causality we test the null hypothesis (H_0) that lagged TEL and EG in equation 1 and 2 are not statistically different from zero as a group in equation 1 and 2 respectively. That is, using the wald F-test which is given in equation 3 below.

$$F = \frac{(RSS_R - RSS_{UR}) / M}{RSS_{UR} / (n - k)} \dots\dots\dots (3)$$

Where, m and $(n-k)$ is the degree of freedom for the numerator and denominator. RSS_R and RSS_{UR} are both the restricted residual sum of squares and the unrestricted residual sum of squares. The decision is if the F-Value exceeds the F-critical value at the chosen level of significance, the null hypothesis is rejected, in which case lagged/past TEL or EG variables belong to the regression of equation 1 and respectively. This would imply that TEL “Granger-cause” EG in equation 1 or EG “Granger cause” TEL in equation 2.

The sample data cover the period 1980 – 2010 and contain 21 annual observations. The data of interest are economic growth measured by real gross domestic product (RGDP). A rising RGDP imply growth of the economy vice-versa, and Teledensity which is a measure for performance of the telecom sector. These data are sourced from the Central Bank of Nigeria (CBN) statistical Bulletin (2010).

5.0 Analysis of Results

The first step in testing for “causality” is to determine whether there is a trend in our data. An essential assumption of time series analysis is that the variables being tested are stationary. Figure 1 below indicates that this assumption is violated. (i.e., both economic growth and teledensity a proxy for the telecom industry follow an upward trend during the period under study).

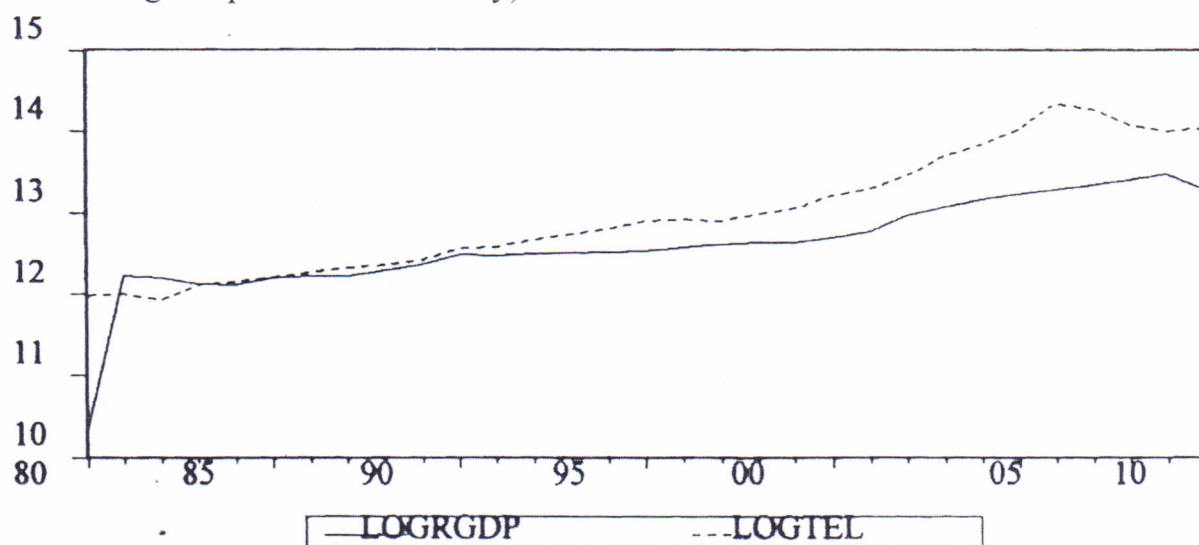


Figure 1: LOGTEL and LOGRGDP (1970 - 2010)

In order to eliminate the trend, we transform the variables by taking their first difference and then examine if the variables are stationary this is done in figure 2 below. Since both variables do not appear to have a trend, we assume that the first difference are stationary and proceed with our causality test.

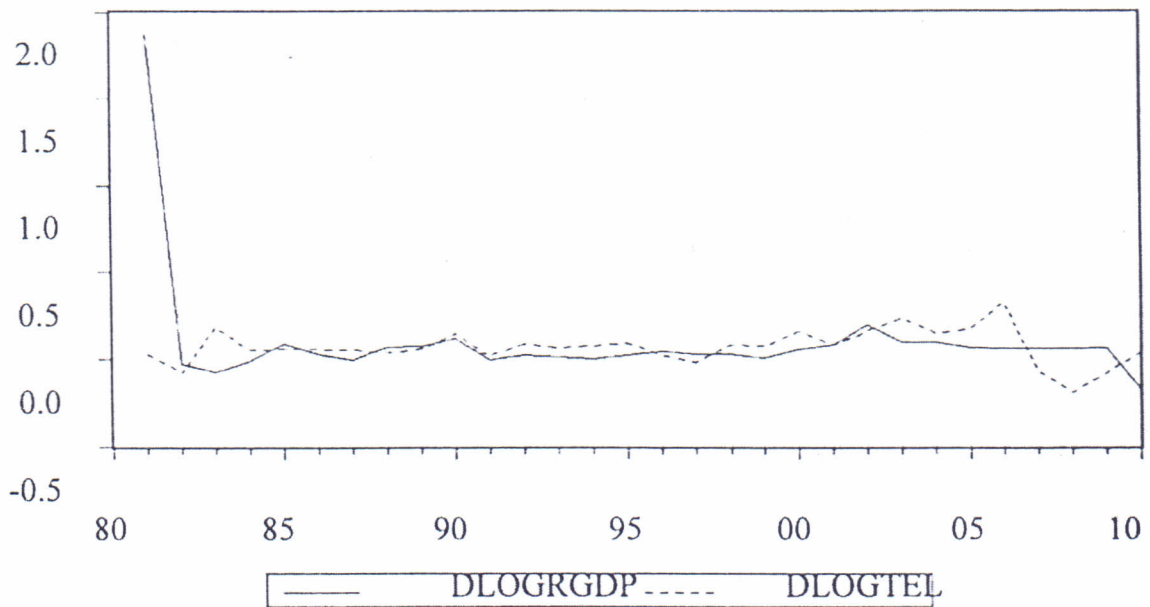


Figure 2: First Difference of LOGTEL and LOGRGDP (1980 - 2010)

The causality test is carried out on the first difference of the variables, since the first difference of the variables are stationary. The result of the “Granger Causality” test is presented in table 1 below;

Table 1: Pair-wise Granger Causality Test between Real GDP and

Null Hypothesis	Number of Lags		F-value	Decision
$\Delta \text{LOGRGDP} \longrightarrow \Delta \text{LOGTEL}$	2		2.36	Do not reject
$\Delta \text{LOGTEL} \longrightarrow \Delta \text{LOGRGDP}$	2		5.67	reject
$\Delta \text{LOGRGDP} \longrightarrow \Delta \text{LOGTEL}$	4		1.31	Do not reject
$\Delta \text{LOGTEL} \longrightarrow \Delta \text{LOGRGDP}$	4		3.71	reject
$\Delta \text{LOGRGDP} \longrightarrow \Delta \text{LOGTEL}$	6		1.88	Do not reject
$\Delta \text{LOGTEL} \longrightarrow \Delta \text{LOGRGDP}$	6		4.29	reject

Source: Authors Estimation using E-view 7

As shown in the result of Causality test presented in table 1 above. The direction of causality is in this table, the six rows represent the relationship that was tested at lag 2, 4 and 6 respectively. The result of the “Granger causality” test shown above indicates that the F-statistics are not sufficient to reject the null hypothesis (H_0) in any

of the lagged periods in equation 1. This implies that during the period under study past growth of the economy does not significantly contribute to the prediction of current performance of the telecommunication sector. Therefore, the growth of the economy does not “Granger cause” the performance of telecom sector. In equation however, the results indicate that increase performance of the telecom sector does “Granger cause” economic growth in all the lagged periods. That is past values of the telecom sector significantly contributed to the prediction of current growth of the economy during the period under study. Possible explanation to this phenomenon could be a dual or multiple channel of impact of investment in telecommunication Industry. For one thing, an increased capital flow into the telecommunication sector would on its own cause output of that sector to grow and in the process increase its share in the GDP of the country, and for another a robust telecommunication industry like Nigeria’s typifies, would inherently spur growth of employment opportunities and emergence of allied industries while their services in general are expected to reduce transactions cost while increasing.

6.0 Policy Recommendation and Conclusion

Nigerian economy has experienced an influx of domestic and foreign capital in the telecommunication sector in the last fifteen years as this study shows it has caused growth of the GDP to occur. This reflects an endorsement of government’s Reform Programme in the telecommunication industry. There is therefore, the need to sustain efforts in further liberalisation of that sector of the economy and also for the removal of all possible impediments to the growth of this sector. However, the major task before the government and the Regulators of the Industry is to ensure quality service delivery which would in turn transmit into further growth of both the sector and the entire economy.

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