Infrastructure Development, Unemployment Rate and Poverty Level in Nigeria (1980-2013)

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Abstract

The study investigates the dynamic interaction among Infrastructure Development, Unemployment and Poverty Level in Nigeria. The study examined the interactive effects among Infrastructure Development, Unemployment and Poverty Level; and investigated the nature and direction of causality among Infrastructure Development, Unemployment and Poverty Level in Nigeria. This was with the view to providing empirical evidence on the linkages among Infrastructure Development, Unemployment and Poverty Level.

Secondary data were used in this study. Data on government capital expenditure as a measure of government capital expenditure, unemployment rate and Real consumption expenditure per capita used as a proxy for poverty level were sourced from statistical Bulletin published by Central Bank of Nigeria (CBN) and the National Bureau of Statistic (NBS) Abuja. Vector autoregressive Model was conducted in determining the interaction effects among the three variables and Pair-Wise granger causality Test was conducted in determining the direction of causality among the variables.

The empirical result showed that an attempt to reduce poverty brings about a reduction in unemployment rate in the country. Moreover, government expenditure on capital projects reduces the level of unemployment over time in Nigeria. In addition, an attempt to reduce unemployment brings about reduction in poverty level while poverty increases at an initial stage of increase in capital expenditure but reduces poverty level over time. The study also indicated that as unemployment rate increases, the economic policies adopted by the government increases the capital expenditure of the government. There exists no causal relationship among the variables in Nigeria as revealed by the study.

Introduction

Adequate supply of infrastructure services has long been viewed as a key ingredient for economic development, both in the academic literature (starting with the work of Aschauer, 1989) as well as in the policy debate (e.g., World Bank, 1994). Over the last two decades, academic research has devoted considerable effort to theoretical and empirical analyses of the contribution of infrastructure development to growth and productivity. More recently, increasing attention has been paid also to the impact of infrastructure on poverty and inequality (Estache et al., 2002; World Bank, 2003, 2006). While the empirical literature on these two topics is far from unanimous, a consensus has emerged that under the right conditions, infrastructure development can play a major role in promoting growth and equity and this may create employment opportunities and a means of poverty reduction. It is universally recognized that improvement in infrastructure is crucial for sustained economic development and modernization of a country.

The evolution of modern infrastructure in Nigeria can be categorized into two distinct phases. These are the colonial and post-colonial periods. The colonial period witnessed the origin of modern transport system, electricity supply and communication system. The networks of rail,

water and road developed then were geared essentially to meet the exportation of cash crops, such as groundnuts, cocoa, cotton and palm products and to the importation of cheap, mass produced consumer goods.

Besides, the importance of electricity in enhancing economic activities and improving the standard of living of the people in any country cannot be overemphasized. Sectors such as agriculture, industrial, health, household, banking and other sectors virtually depend on electricity to be more efficient in their services. Presently in Africa, according to United Nations Economic Commission for Africa (2004) among many other things, lack of adequate provision of electricity services has long been regarded as a major obstacle to economic development.

Despite the significant increase in economic growth over some years in Nigeria, there has been no significant improvement in people's access to good infrastructure. According to United Nations Environment Programme (2012), many African countries Nigeria inclusive, faces weak, inadequate and decayed infrastructure such as power production, transportation, infrastructure and pure water system. This adversely affects productivity and regional economic activities. An increasingly common response to the energy crisis has been the short term lease of emergency power generators, which is not only expensive, but negatively impacts the sustainable development of the region. In addition, the African electricity grids lack interconnections which could facilitate network management and have a positive impact on electricity distribution and availability.

Although, Infrastructure is not the end result of economic activity; it is the framework that makes economic activity possible. Every developed nation in the world, plus those still classified as "developing", are working to improve the fundamental tools of modern economic activity. This is simply because infrastructure is a means to an end given its importance in determining the progress of economic activities that can bring about job creation and reduction in poverty.

Studies on infrastructure and its connection to the economy have achieved mixed results. Development of the analytical framework began about thirty years ago with studies of government spending on public capital infrastructure projects (the stock or flow of investment money) to analyze the impact on economic growth and productivity as well as on social welfare (reducing income inequality). In the early 1990s, the basic model was extended to specifically endogenize economic growth and to include private spending on infrastructure. Starting around 1990 to 1995, empirical modelling with data appeared as academic and policy researchers contributed both theoretical and empirical studies on the contribution of infrastructure development to growth and productivity (Calderon & Serven, 2008a).

Over the years, studies have been devoted to assessing the effects of infrastructure on growth and productivity in Nigeria (Tella et al., 2007, Onakoya et al., 2012 and Akanbi et al., 2013), while the empirical study of the effect of infrastructure development on employment and poverty reduction seems to be scarce, except for the work of Ogun (2010) who considered the effect of infrastructure on poverty. Moreover, the work of Ogun (2010) fails to establish the linkage of infrastructure development which may not directly lead to economic growth and poverty reduction without the employment creation channel. More also, is the effect of decayed infrastructure which have set many industries and organisation to either fold-up or pack out of the country for not being able to break even, not to talk of making profit, e.g.

Dunlop, Afri-cola, Elephant cement among many others. Therefore, it is important to investigate if this scenario has an impact on unemployment and poverty level in Nigeria.

Existing studies, (see Al-Yousif 2000, Abdullah 2000, Ranjan and Sharma 2008 and Cooray 2009) have shown that expenditure on infrastructure such as roads, communications, power, etc., reduces production costs, increases private sector investment and profitability of firms, thus fostering economic growth. Specifically, studies like Aschauer (1989c); Nourzad and Vrieze (1995); Canning (1999); and Canning and Bennethan (2000); Vickerman (2001); Banister and Berechman (2001); Xu et.al (2007); Liu et al. (2005); Zhang et al. (2007) Jha and Singh (2001); Tamilnadu, Karne and Venkatesh (2005) established that there is a positive impact of public and infrastructure capital on economic growth. However, the interaction effect among infrastructure development, employment creation and poverty reduction remains an empirical issue that seems to be scarce in the literature. Therefore, this study intends to fill this gap by looking at the dynamic relationship among infrastructure development, unemployment rate and poverty level in Nigeria. Based on this, the following research questions are raised:

(a) What are the interactive effects of infrastructure development, unemployment rate and poverty level in Nigeria?

(b) Is there any causal relationship among infrastructure development, unemployment rate and poverty level in Nigeria?

Therefore, the specific objectives of the study are to:

(i) Examine the interactive effect among infrastructure development, unemployment rate and poverty level in Nigeria,

(ii) Investigate the causal relationship among infrastructure development, unemployment rate and poverty level in Nigeria

The effectiveness of infrastructure investment in stimulating growth and development may be somewhat limited or uncertain; This concern has been prompted by a variety of reasons. However, it should be noted that infrastructure improvement employs a significant percentage of Nigerian population after agriculture and this has a positive impact on poverty reduction. This notwithstanding, the rate of poverty in most rural communities in Nigeria has progressively increased over the years. It is therefore important to know if the issue of infrastructure development and its impact on economic activities is necessary when considering economic development in Nigeria. Therefore, this study will be important to guide the policy makers on how employment and poverty reduction could be achieved through infrastructure development in Nigerian. The study covered the period of 28 years (1985-2013). The choice of the period was informed by the availability of data on the interested variables to be considered in this study. The period is also long enough to assess effect of the interactions among infrastructure development, unemployment rate and poverty level in Nigeria.

Literature Review

There are abundant theoretical works on the contribution of infrastructure to output, productivity and welfare. Many of these focused on the macroeconomic role of productive public expenditure. Arrow and Kurz (1970) were the first to provide a formal analysis of the effects of public capital on output and welfare under alternative financing schemes. In their framework, public capital enters as an input in the economy's aggregate production function, in the context of a Ramsey model with long-run growth exogenously determined. The endogenous growth version of this basic setup was developed first by Barro (1990), who assumed that the government's contribution to current production is driven by its flow of

productive expenditure, and later extended by Futagami *et al.* (1993) to include both public and private capital stock accumulation.

This analytical literature has grown enormously in the last 15 years, exploring a multitude of variants of the basic model, such as alternative tax structures, considering simultaneously public capital and productive current spending flows, adding public capital services in the utility function or allowing for public infrastructure congestion (see, e.g. Baier and Glomm, 2001; Ghosh & Roy, 2004).

In turn, empirical research on the impact of infrastructure started relatively recently, following the seminal work of Aschauer (1989), but it has boomed over the last two decades. Literally, hundreds of research works have been devoted to assess the effects of infrastructure on economic growth, productivity, using a variety of data and empirical methodologies. Calderon and Serven (2008) offer a partial account of the literature on the growth and inequality effects of infrastructure, more comprehensive surveys include Estache (2006), Romp and de Haan (2007) and Straub (2007). The bulk of the empirical literature on the effects of infrastructure has focused on its long-run contribution to the level or growth rate of aggregate income or productivity.

The starting point was Aschauer's (1989) finding that the stock of public infrastructure capital is a significant determinant of aggregate TFP in the USA. However, his estimate (based on time-series data) of the marginal product of infrastructure capital—as much as 100% per year—was implausibly high. The massive literature on the output impact of infrastructure has employed a variety of data, empirical methods and infrastructure measures. The most popular approaches include the estimation of an aggregate production function (or its dual, the cost function) and empirical growth regressions. Infrastructure is variously measured in terms of physical stocks, spending flows or capital stocks constructed accumulating the latter.

Majority of this literature finds a positive long-run effect of infrastructure on output, productivity or their growth rate. More specifically, this is the case with almost all of the studies using physical indicators of infrastructure stocks, but results are more mixed among the growth studies using measures of public capital stocks or infrastructure spending flows (Straub, 2007).

Another strand of recent literature has examined the effects of infrastructure on income inequality. The rationale is that infrastructure provision may have a disproportionate effect on the income and welfare of the poor by raising the value of the assets they hold (such as land or human capital) or by lowering the transaction costs (e.g., transport and logistic costs) they incur to access the markets for their inputs and outputs. These effects may occur through a variety of mechanisms documented in the empirical literature (see, e.g., Estache *et al.*, 2002a; Estache, 2003; Calderon and Serven, 2008). Of course, for infrastructure development to reduce income inequality, the key ingredient is that it must help expand access by the poor, as argued, for example, by Estache *et al.* (2000).

A related strand of the empirical literature focuses on the poverty effects of specific infrastructure projects, using matching techniques that combine samples of beneficiaries with samples drawn from regular household surveys. On the whole, the evidence shows that public investment in infrastructure, specifically in the rehabilitation of rural roads, improves local community and market development. The rehabilitation of rural roads raises male agricultural wages and aggregate crop indices in poor villages of Bangladesh (Khandker *et al.*, 2006).

Likewise, in Vietnam the result is an increase in the availability of food, the completion rates of primary school and the wages of agricultural workers (Mu & van de Walle, 2007). In the same vein, other studies find that access to new and improved roads in rural areas enhances opportunities in non-agricultural activities in Peru (Escobal & Ponce, 2008) and in non-farm activities among women in Georgia (Lokshin & Yemtsov, 2005).

Few empirical studies have tackled directly the inequality impact of infrastructure at the macroeconomic level. Among them are those of Lopez (2004) and Calderon and Serven (2008), both of which use cross-country panel data. Lopez uses telephone density to proxy for infrastructure, whereas Calderon and Servén employ synthetic indices of infrastructure quantity and quality. In both cases, the finding is that, other things being equal, infrastructure development is associated with reduced income inequality. Combined with the finding that infrastructure also appears to raise growth. The implication is that in the right conditions, infrastructure development can be a powerful tool for poverty reduction.

A strand of recent papers has focused on the development impact of infrastructure in Africa. Ndulu (2006) offers an overview of the big issues and Ayogu (2007) surveys the empirical literature. Most of the latter deals with the growth and productivity effects of infrastructure development. For example, Estache *et al.* (2005) present pooled Ordinary Least Squares growth regressions based on an augmented Solow model including a variety of infrastructure indicators, one at a time. Their main conclusion is that roads, power and telecommunications infrastructure but not water and sanitation contribute significantly to long-run growth in Africa. Other studies follow a production function approach. Ayogu (1999) applies it to regional panel data from Nigeria, finding a strong association between infrastructure and output. Boopen (2006) likewise presents panel estimates of the output contribution of transport infrastructure using similar data. South Africa (along with Nigeria) has attracted special attention in this literature, partly reflecting the significantly better quality of its data relative to that of other countries in the region.

The linkage between infrastructure and economic development in which manufacture sector is a factor has been firmly established in the literature. For instance, Rosenstein-Rodan (1943) analyzed the demand side of capital formation and particularly identified one category of physical capital for special attention in the social overhead capital. In his presentation, he showed that infrastructure service is a precondition for private sector investment in manufacturing sector. Cross-country studies, including Shah (1992), Alex *et al* (1996) and Lee *et al* (1999) of economic growth and infrastructure, particularly those concerned with public investment in transportation and communication and those using capital stock of road, railways and telephone, had shown that infrastructure variables were positively and significantly correlated with economic growth.

However, in all the cited studies, the transmission mechanism was not clear. Indeed, neither the time series nor the cross sectional studies satisfactorily explain the mechanisms through which infrastructure may affect growth. Also, the case of Nigeria seems to be that infrastructure is not positively correlated with manufacturing output (Nasir, 2007, and Usman, 2008). In the research carried out by Lee and Alex (1989, and 1992) on the impact of infrastructural deficiencies on the Nigerian industrial sector, results showed that manufacturing undertook significant expenditure to affect deficiencies in publicly provided infrastructural services. This was supported by Adenikinju (2003), in his study on electric infrastructure failures in Nigeria. These studies failed to establish if there is a relationship

between infrastructure services and manufacturing output and whether the relationship even subsists in the long-run.

Although there has been an underlying concept that transport infrastructure has the effect of promoting economic growth, especially among the politicians, according to Vickerman (2001) the correlation between transport infrastructure and economic growth is not so stable. It is difficult to assume a single causal direction of these two factors, regarding the high possibility of mutual interaction. According to Banister and Berechman (2001), it is widely agreed that economic growth happens mainly due to capital, labor, etc. and only partly relying on the infrastructure improvement. Transport acts as a necessary condition for the growth to occur. Although there is no doubt about the direct effect that the transport infrastructure improvement contributes to cost savings of productive sectors, such as time saving and whether there is spillover effect, additional benefit generated from the infrastructure is discussable. The great trend of quantified analysis of this issue could possibly date back to the work done by Aschauer (1989), who estimated the macro effect of infrastructure investment on American economy. His work was followed by many researchers, e.g. Munnell (1990), Ford and Poret (1991), etc. In these first trials, big estimate results were derived. And this was criticized by other researchers who agreed that the high elasticity means unrealistic rate of return of infrastructure. (Gramlich 1994). Yet some explanation was made that a first shock in infrastructure could cause great effect, however, after the basic infrastructure was in place, new investment would not cause much effect. (Hulten 1996). Considering the oversized results of previous work, Holtz-Eakin (1994) argued that results were substantially modified when econometrically taking into account state or region-level unobserved effects. Assumptions were made that the unobserved effects are time invariant.

Review of Empirical Literature
Studies on the relationship that exist among infrastructure, development as unemployment rate on the one hand, and relationship between infrastructure and poverty on the other has been carried out mostly in developed countries, with little in developing countries including Nigeria. In some of these studies cross-country and time series data are utilised. However, there appear to be more concentration on the relationship between infrastructure and economic growth generally.

For instance, Easterly (2001) and Loayza *et al.* (2005) use indicators of telephone density to appraise the effects of infrastructure on growth. One reason behind the single-sector approach is the difficulty of properly capturing the multiple dimensions of infrastructure in a simple way. Another reason is the high correlation often found among indicators of different types of infrastructure assets

Anna and Maurizo (2008) assess the impact of both the highways network and the degree of regulation in the road freight sector on industry productivity by estimating a Cobb-Douglas production function on a panel of twenty one manufacturing and service sectors of eleven EU countries observed over the period 1980-2003. The production function estimates suggest that the highways network elasticity is positive, although they found that, there are differences across sectors and countries. And also that degree of liberalization in the road freight sector might play an equally important role in driving industry productivity. in particular, a non-linear effect of deregulation, which seems to be more effective when the process starts from an already more deregulated environment. The results suggest that policymakers should

consider deregulating the road transport sector as the gains in industry production might be as important as those stemming from further extensions in the infrastructure network.

Banister and Berechman (2000) using a microeconomic three sector model (production, household and transportation) showed that successive additions to highway network capacity exhibited diminishing impacts on employment level after an initial period of improvement. Their findings indicated that if a region has a well-developed transportation network, additional investments in infrastructure do not tend to increase employment. However, they have been criticized in another work by Ozmen-Ertekin, Ozbay and Berechman (2003)who examined the impact of accessibility index on employment growth and income growth. The authors found that counties in the New York Metropolitan region had higher levels of job and income growth if the county exhibited higher levels of accessibility (which is linked in part to transportation system performance). The authors are careful to highlight that these results are at an aggregate level for the transport system as a whole and that they may not generalize to particular transportation projects.

Lately, Jiwattanakulpaisarn, et al. (2009) analyzed the relationship between U.S. highway supply and employment using time-series cross-sectional data on roadway lane miles and private sector employment for the 48 contiguous states over the period of 1984–1997. The analysis found that employment growth is temporally influenced by annual growth in major highways within the same state and all other states, but the existence and direction of these effects depend on highway type and time lags. Jiwattanakulpaisarn, Noland and Graham (2010) have similar results

Empirical Studies from Developing Countries
Looney (1997) analyses the role of infrastructure variables such as energy and transport in Pakistan's economic expansion for the period 1973-1995 based on a vector error correction model and finds that public facilities expand largely in response to the needs by private sector. Similarly, Karadag et al. (2004) examine the impact of public capital formation on private manufacturing sector performance at both regional and aggregate level for the period 1980-2000 using a VAR model. They found that public capital affects private output positively in aggregate and in all regions apart from the Black Sea and Mediterranean regions Sadananda (2006) explore whether expansion of railroad transportation facility acts as a means to supplement domestic investment for achieving a higher level of economic growth in India or not, by constructing a railroad transportation index (a proxy for railroad transportation facility) by using Principal Component Analysis (PCA), a special case of factor analysis. The findings suggest that if India wants to achieve 8 percent economic growth target as mentioned in the Tenth Five Year Plan (2002-2007), it should take some special measures and deepen the ongoing reform process to encourage private investment in infrastructure, especially in construction of railways and roads
Jha and Singh (2001) attempts to quantify the technical efficiency (productive efficiency) of twenty-three major Indian State Transport Undertakings (STUs) mainly providing rural and inter-city passenger transport services for the year 2000-01. They estimate the stochastic frontier production function by using the maximum likelihood method and find that there is huge disparity in technical efficiency across STUs ranging from 56.15 percent for Madhya Pradesh State Road Transport Undertaking to 98.99 percent for Tamilnadu State Transportation Corporation Ltd. (Kumbakonam Division II). Average of technical efficiency scores of sample STUs was found to be 84.22 percent. However, the scope of the above study is limited to road transportation of two states in India, i.e. Madhya Pradesh and

Tamilnadu.Karne and Venkatesh (2005) examine whether splitting of Maharashtra State Road Transport Corporation (MSRTC) into smaller regions would actually help in its financial recovery and improve financial profitability by means of enhanced input productivity. They have measured technical efficiency through Malmquist DEA technique and found that increasing returns to scale prevailing in all the six regions of MSRTC and MSRTC as an organization not adopting cost minimization techniques. Here also, the scope of the study is limited to Maharashtra State Road Transportation.

Empirical Studies from Nigeria

Aigbokhan (2010), in his own study on "Infrastructure, Private Investment and Economic Growth" adopted an extended Cobb-Douglas production function and regressed output on each of the six infrastructural components, introducing each of them at a time. These infrastructural components are transport and communications, agriculture and water resources, electricity generation, electricity consumption, education and health care. His regression results, using OLS method with annual data covering the period 1980 – 97, show that the model has a good fit with adjusted R^2 of 0.98 – 0.99, and that the six infrastructural components are all positively correlated with GDP, with varying levels of significance. The author also found that "human capital components of infrastructure appear to have impact on growth". Expenditure on health care and education record has a statistically insignificant impact on growth.

In a more empirical study by Ogun (2010), the impact of infrastructural development on poverty reduction in Nigeria is addressed. Specifically, the relative effects of physical and social infrastructure on living standards or poverty indicators are examined, with a view to providing empirical evidence for the implications of increased urban infrastructure for the urban poor. The paper employs secondary data for the period of 1970to 2005while the Structural Vector Autoregressive (SVAR) technique is adopted forits analysis. The study unequivocally finds that infrastructural development leads to poverty reduction.

Olorunfemi. (2008) examines the direction and the strength of the relationship between infrastructural services and manufacturing output in Nigeria using time series data from 1981 to 2005. The study examines the unit root problem and cointegrating properties of the data. The unit root problem was tested for by using Augmented Dickey–Fuller (ADF) and Phillip Perron tests. To determine which of the shocks, are the primary causes of variability in the endogenous variables, the study used Vector Autoregressive (VAR) model. Granger causality test was also carried out. Results showed that the present transport and electricity service in Nigeria did not cause growth to occur in the manufacturing sector. It was also revealed in the study that telecommunication and education had contributed to the growth in the manufacturing sector.

Olomola (2003) carried out a study on Understanding Poverty in Nigeria and found out that, inadequate provision of transport infrastructure and services provide a basis for explaining the incidence of poverty across various Nigerian communities in both urban and rural areas. The categories of transport problems that can be identified are: bad roads, fuel problem (high fuel price, shortage of fuel supply and high transport cost), traffic congestion (long waiting time, bad driving habits, hold-ups), inadequate high passenger capacity/mass transit vehicles and overloading, high cost and shortage of spare parts, poor vehicle maintenance and old vehicles.

Onakoya, Salisu and Oseni (2012) investigate the impact of infrastructure on economic growth in Nigeria. A multivariate model of simultaneous equations is deployed (1970 to 2010). The paper utilizes three-stage least squares technique to capture the transmission channels through which infrastructure promotes growth. The research covers 40 years. Their finding shows that infrastructural investment has a significant impact on output of the economy directly through its industrial output and indirectly through the output of other sectors such as manufacturing, oil and other services. However, this study also fails to inform us of the reason for selecting its proxy for infrastructure and also the condition for selecting the sectors used in making conclusion on economic growth.

More specific is the study of Nworji and Oluwalaiye (2012) in examining the impact of government spending on road infrastructure development on economic growth in Nigeria for the period of 1980-2009. The study employs multiple regression analysis model specified on the basis of hypothesised functional relationship between government spending on infrastructure development and economic growth. Indicators used for government spending are values for defence, transport/communication, and inflation rate as the explanatory variables, while gross domestic product constitutes the explained variable. The model for the study was estimated using the Ordinary Least Square (OLS) technique, while further evaluation is carried out using the coefficient of determination to explain the variations between the dependent and independent variables. The result shows that transport and communication have significant impact on the growth of the economy. This is supported by Adenikinju (2003), in his study on electric infrastructure failures in Nigeria. However, these studies fail to establish the variable property test of their variable to confirm if the can real be tested on each other.

Interestingly, and more implicit is the work by Tella, Amaghionyediwe, and Adesoye, (2007), that investigated the simultaneous relationship between telecommunication and the economic growth in Nigeria for the periods 1993 to 2004 using three Stage least square. They find that, capital, labor, number of telephone; sum of main lines and cellular teledensity positively impact economic growth in Nigeria. Interestingly, none of the studies have consider transport infrastructure on economic growth either as physical or as an investment in it.

In a more recent study, Akanbi, Bamidele and Afolabi (2013),examined the impact of transportation infrastructure improvement on economic growth in Nigeria for the period of 1981 to 2011,using the Ordinary Least Square Regression (OLS) technique, and generalized Cobb- Douglas production, and extending the neoclassical growth model to include transport infrastructure stock (i.e. output of transport sector) alongside capital stock (i.e. investment on transport infrastructure) as the input and gross domestic product. They realised that transport output and investment made on transport infrastructure in Nigeria has significant positive contribution to growth. However this study is highly faulty for estimating a component of variables on the same variable i.e. using proxy transport infrastructure improvement as output of transport. This study may have suffered the problem of endogeneity that is not accounted for in the study.

Methodology
As stated before, to the best of our knowledge, there is no study that examines the possible dynamic interactions among infrastructure development, unemployment rate and poverty level for the Nigerian economy. Thus, this paper can be seen as a first attempt to analyse the dynamic interactions among infrastructure development, unemployment rate and poverty level in Nigeria.

Theoretical Framework
This study modifies the framework of Jiwattanakulpaisarn (2008 and 2010) by expanding the framework mechanism of how provision of transport infrastructure could potentially affect long-term employment and poverty level within the framework of labour market theory. The basic principle of the theory maintains that the interaction between the demand for labour and the supply of labour determines the equilibrium level of wages and employment in a local labour market and in addition could lead to increase in welfare of the region. The equilibrium of the labour market would remain unchanged unless it is disturbed by an economic disturbance or shock to the market.

As explicitly pointed out by Eberts and Stone (1992), public infrastructure investment can be thought of as a shock to the labour market. It could lead to the enhancement of a region's attractiveness, thereby affecting the decisions of firms and households in several ways. Therefore, if transport infrastructure investment leads to adjustments in labour demand and/or labour supply, the current equilibrium of the labour market will move toward a new position that subsequently results in changes in the levels of local wages and/or employment. The supply side of the labour market can be influenced by transport infrastructure in two major ways. With a given population, improved access to jobs caused by investments in transportation can lead to adjustments in local labour supply in the short run through changes in the geographical size of the labour market and amount of labour force participation. A reduction in commuting time and costs associated with transport improvements enables people to increase the geographical scale of their job search and could also encourage potential workers to participate in the labour force.

In the long run, improved transport infrastructure could cause the overall population base of a region to increase beyond what it would otherwise be by attracting in-migrations or halting outmigration. As good transportation services can directly serve as a household amenity. Improvements in transport infrastructure in the region can also stimulate employment opportunities, which are bound to attract households. Therefore, it is possible that investments in transportation infrastructure could result in an increase in population size, all else being equal. This in turn increases the number of persons who will be available to supply labour to the market.

The effects of transport infrastructure investment on the demand side of the labour market are relatively more complicated. Additional provision of transport infrastructure can improve production technology. Better transportation systems increase the productivity of firms primarily by facilitating the efficient movement of people and goods, providing lower costs of transporting inputs and outputs, and making the expansion of market areas more profitable. Furthermore, improvements in transportation services can have a direct impact on labour productivity by lowering commuting time spent getting to and from work. As a result of the influences of transport improvements on the availability of the labour supply, an increase in labour productivity in the production process is also probably attributable to a better match between the supply of jobs and skilled workers.

As additional investments in transport infrastructure can be considered as an increase in production technology, the theory of production suggests that this could lead to an upward shift of the production function. However, the direction of changes in labour demand, as productivity enhancements associated with improved transportation services, can have both substitution and complementary effects, making the net impact on employment unclear. If market demand and hence output requirements remain unchanged, growth in firm

productivity simply implies that the quantity of labour demanded may decline. However, firms may take advantage of a reduction in generalised transport costs and production costs to expand their markets, either through lowering price or through serving a larger market from which it was not previously profitable due to high shipping costs. As a result, the demand by such firms for employment will increase to meet the rise in output. Moreover, the provision of transport infrastructure that enhances a region's productivity could induce more businesses to enter a region.

Therefore, to the extent that transport investments attract a number of businesses, this could simply lead to increase in the region's demand for labour.

Figure 3.1.   Linkages among infrastructure Development, Unemployment and Poverty Level
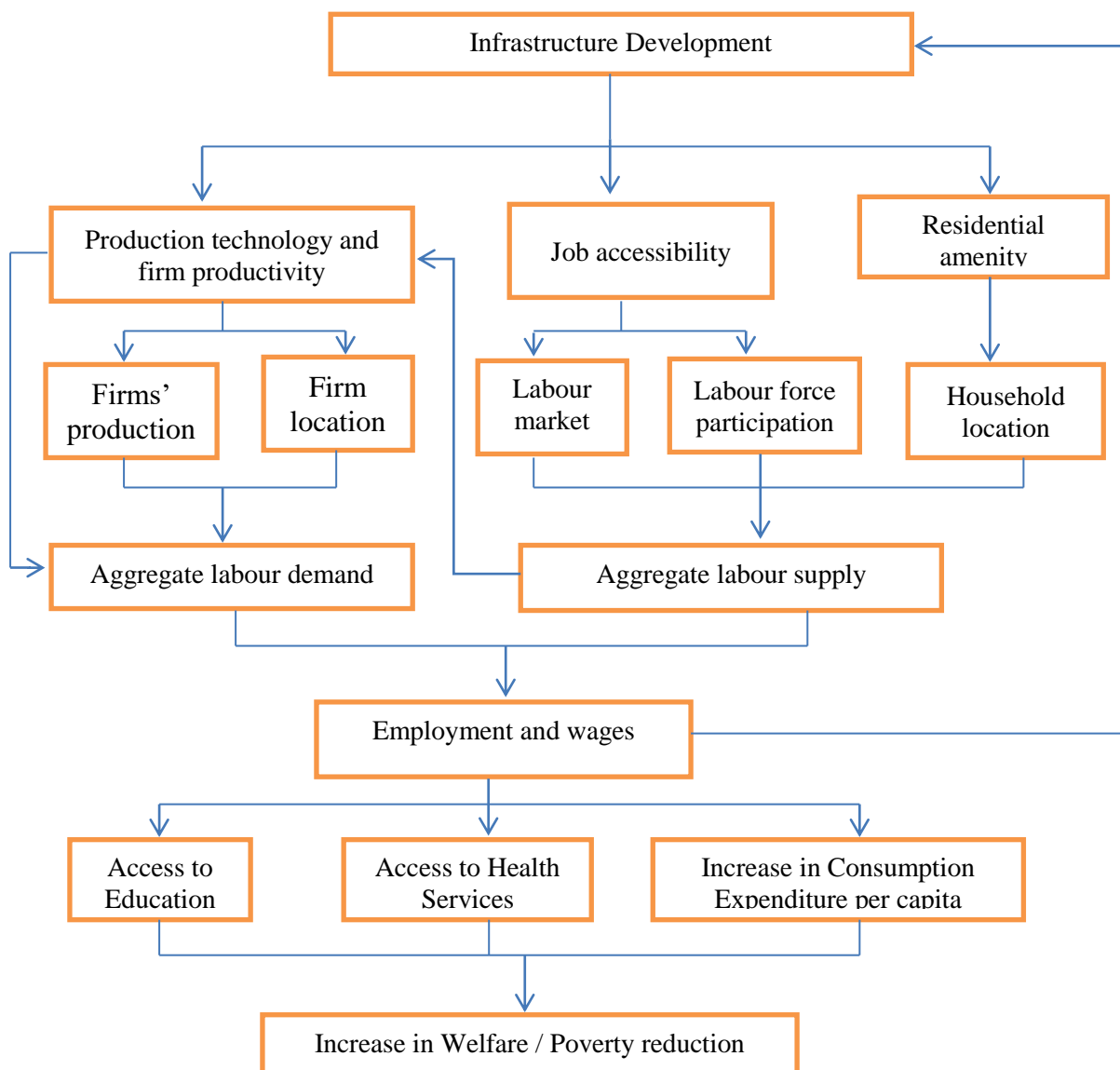
Source: Jiwattanakulpaisarn (2008 & 2010).

Although the structural mechanisms by which transport infrastructure development can have impact on employment are theoretically identifiable, one major criticism against these is the issue of causality. The above theoretical arguments suggest that transport investments could affect regional and local employment. However, an area where employment growth is occurring may attract transport infrastructure expenditures. Likewise, a region that suffers high unemployment may also attract investment with the hope that this spurs employment growth. This reverse causation may potentially arise in several ways. High-employment-growth economies could have a large tax base and can therefore afford further development of their transport network.

Moreover, access to job opportunities brings about income redistribution in the region, by increasing the new labour income which gives them access to education and health services. This, therefore increases the standard of living of the people in the region. When living standard of people increases over time, there will be an increase in aggregate demand for goods and services, access to good health services, expansion of knowledge through access to education and increase in quality of labour supply. The subsequent effect from this is the revenue generated by the government which will emerge from the expansion of the market. As fiscal revenue increases through growth, additional budget can be generated for programmes that improve the living conditions of the poor by providing more transport infrastructure.

Model Specification
A way to summarize the dynamic interactions among macroeconomic data is to make use of vector autoregressions. VAR models have become increasingly popular in recent decades. They are estimated to provide empirical evidence on the response of macroeconomic variables to various exogenous impulses in order to discriminate between alternative theoretical models of the economy. This simple framework provides a systematic way to capture rich dynamics in multiple time series, and the statistical toolkit that came with VARs was easy to use and to interpret. As Sims (1980) and others argued in a series of studies, VARs held out the promise of providing a coherent and credible approach to data description, forecasting, structural inference and policy analysis.

With vector autoregressive models, it is possible to approximate the actual process by arbitrarily choosing lagged variables. Thereby, one can form economic variables into a time series model without an explicit theoretical idea of the dynamic relations. A VAR is an *n* equation, *n* variable model in which each variable is in turn explained by its own lagged values, plus (current) and past values of the remaining *n-1* variables. A VAR can be thought of as the reduced form of a dynamic economic system involving a vector of variables z_t.

$$Az_t = b_1 z_{t-1} + b_2 z_{t-2} + \ldots\ldots + b_p z_{t-p} + u_t \qquad\qquad 1$$

$$z_t = (g_t f_t y_t) \text{ and } u_t = \sum e_t$$

where

$b_1, b_2 \ldots b_p$ are the coefficient of government capital spending, unemployment rate and poverty level. Therefore, z_t can be expressed as thus:

$$m_t = b_1 m_{t-1} + b_2 p_{t-1} + b_3 g c_{t-1} + e_{1t} \qquad\qquad 2$$

$$p_t = b_4 p_{t-1} + b_5 m_{t-1} + b_6 gc_{t-1} + e_{2t} \qquad 3$$

$$tc_t = b_7 gc_{t-1} + b_8 m_{t-1} + b_9 p_{t-1} + e_{3t} \qquad 4$$

Therefore, equation 2 to 4 will be estimated in obtaining the relationship that exists among government spending, financial development and economic growth. Econometric techniques of data analysis will be employed in this study. First objective will be achieved by estimating equation (2) to (4) by analyzing the impulse response of the VAR model while the causality among the variables will be examined using Pair-Wise Granger Causality Test. This study will use essentially, secondary data for analysis. The data on government capital spending, unemployment and poverty rate (1986-2013) will be sourced from statistical bulleting published by Central Bank of Nigeria (CBN).

Empirical Results
Table 4.1: ADF Statistics for Testing Unit Roots in the Variables

Variables	Series	At Levels	At First differences
Capital Expenditure	Cax	-2.55	-7.33
Unemployment rate	Ump	-1.44	-3.90
Poverty rate	Pov	-2.69	-4.18
Critical Value	5%	-2.95	-2.95

Author's Computation 2016

Evidence from the results shown in the table 4.1, confirmed that all the variables capital expenditure, unemployment rate and poverty rate, were not stationary at level. However they became stationary after first difference under the augmented dickey fuller test with intercept only. The study relied on the augmented dickey fuller test with intercept only, since the series are integrated of order one i.e. I (1). Consequently, the presence of significant co-integration relationship among the variables could be determined.

Table 4.2 Cointegration Test
Date: 07/21/15 Time: 17:52
Sample (adjusted): 1983 2013
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: LOG(CAX) LOG(UMP) LOG(POV)
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	0.348012	23.22152	29.79707	0.2354
At most 1	0.245737	9.961916	15.49471	0.2837
At most 2	0.038574	1.219458	3.841466	0.2695

 Trace test indicates no cointegration at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level

The result of cointegration test confirmed the absence of integrating among the variables, showing that the variables do no converge in the long-run. The study then proceed with the VAR model in estimating the interactions among the variables
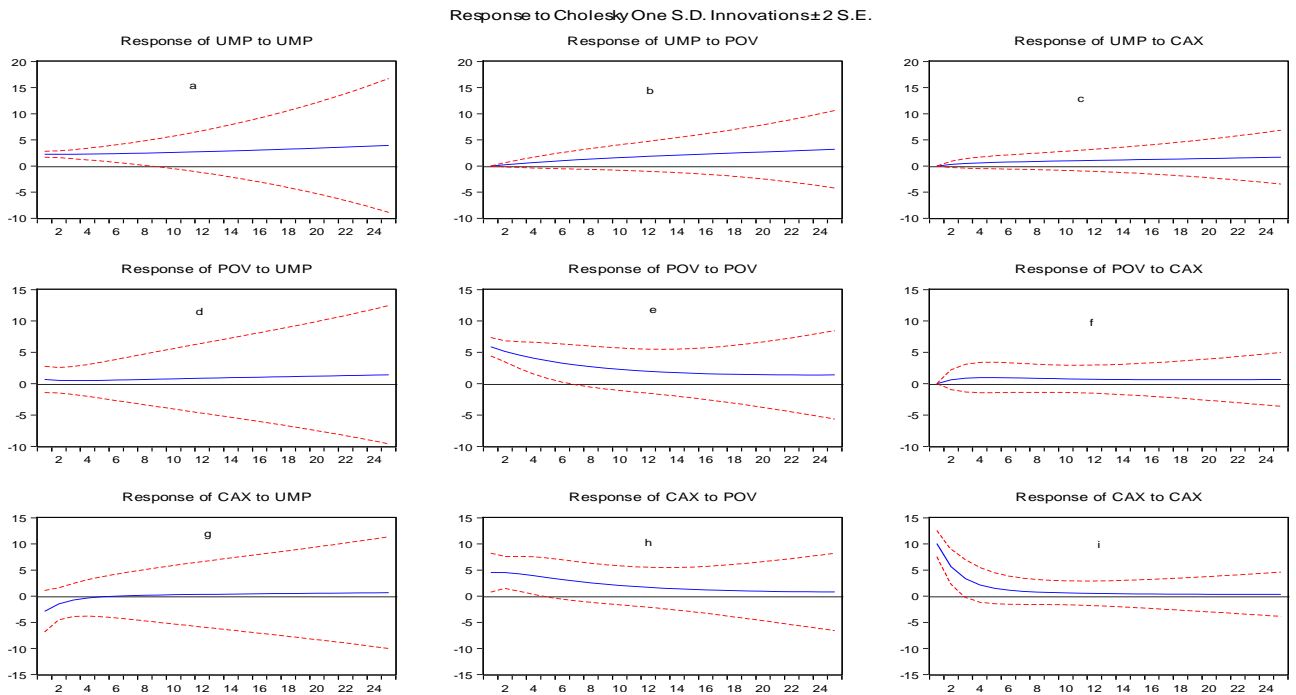
Fig 4.1: Impulse Response Functions (Irfs) of capital expenditure unemployment and poverty

Results of Impulse Response Functions (Irfs) and Forecast Error Variance Decomposition (FEVD) of the Specified Model

The results of the impulse response functions (IRF) and variance decomposition (FEVD) derived from vector autoregression (VAR) estimates are presented below in Figure 4.1 and Table 4.2. This became necessary in order to empirically determine the characteristics and sources of changes in capital expenditure, unemployment rate and poverty rate. This is achieved by examining the impulse response functions (IRFs) and the forecast error variance decomposition (FEVD). The IRFs indicate the directions and the size of the effects of one standard deviation shock to one variable on other variables in the system over time. On the other hand, the FEVD showed the percentage of the forecast errors variance for each variable that might be attributed to its own innovations and the innovations of the other variables in the system. The IRFs and FEVD gave an idea of the determination and transmission mechanism of the policy shocks in the system in line with the standard practices.

Results of VAR Impulse Response Analysis

The interpretation would rely heavily on the magnitude and signs of the estimates, but the signs on the estimated responses are supposed to be more important than the size of the estimates because the magnitude showed the statistical influence while the signs provided the desired economic content for the impact.

Figure 4.1 shows the impulse responses generated from the VAR models estimated in this study. The IRF measures the response of variables capital expenditure, unemployment rate and poverty rate to an unanticipated shock measured as innovation in the model. In Figure 2,

one standard deviation in the model is calculated in percentage. For each of the variables, the horizontal axis of the IRF shows the number of periods that have passed after the impulse has been given, while the vertical axis measures responses of the variables.

Starting with the impact of unemployment rate, a shock to unemployment rate produced a positive response throughout the time horizon of 25 periods. The estimate started from a high value of 2.25 in the first period and increase gradually to 2.3, 2.58, 2.96, 3.41 and 3.9 in the fifth, tenth, fifteenth, twentieth and twenty fifth periods respectively. Since Figure 2(a, e and i) are not important for the analysis of the interactive effects among capital expenditure, unemployment rate and poverty level, we focus our attention on Figure 4.1(b, c, d, f, g and h).

Figure 4.1(b) shows that, an innovation to poverty reduction produced a neutral response by unemployment at the initial stage but becomes positive of about 0.8 per cent at the fifth period. This positive response increases gradually to 1.6, 2.2, 2.6 and 3.1 per cent in the tenth, fifteenth, twentieth and twenty fifth periods respectively. This implies that poverty reduction impacted positively on unemployment level.

From the result of the VAR impulse response function in Figure 4.1(c), it can be observed that a shock on capital expenditure produce a neutral response at the initial stage but becomes positive effect over the periods by unemployment. For instance, a positive effect of 0.6 percent was observed at the fifth period and increased continuously to 1.6 percent at the last period. This implies that, when an increase in capital expenditure per capital occurs, it does not have any impact on unemployment at first but over time begins to impact positively on it over time.

From the result of the VAR impulse response function in Figure 4.1(d), it can be observed that, a shock on unemployment rate produce a positive response by poverty throughout the period of consideration. For instance, a positive response of about 0.7 percent was observed at the first period and reduces to 0.5 percent at fifth period, but increases gradually thereafter. By implication, as unemployment rate increases the rate of poverty also increases.

An interesting observation from Figure 4.1(f) is the neutral response produced by poverty rate to an innovation on capital expenditure at the initial stage, which becomes positive thereafter. That is, no effect was observed by poverty level at the first period, but a positive effect of about 1 per but which later reduces in rate over time. This implies that an increase in capital expenditure did not immediately impact on poverty but as time goes on it reduces poverty level.

Figure 4.1(g) shows that, an innovation in reducing unemployment produced a negative response of about 2.88 at the initial stage, which is at the first period, which reduces to 0.12 per cent in the fifth period by capital expenditure. However, the response becomes positive over time. Also, in Figure 4.1(h), a positive response of about 4.5 was produced capital expenditure as a result of an innovation in poverty reduction but this response reduces gradually over the periods respectively.

Table 4.3: VAR Forecast Error Variance Decomposition

Variance Decomposition of UMP (Panel 1)

Period	S.E.	UMP	POV	CAX
1	2.256101	100.0000	0.000000	0.000000
5	5.282984	91.17430	4.867774	3.957925
10	8.422190	78.75285	14.39929	6.847853

Variance Decomposition of POV (Panel 2)

Period	S.E.	UMP	POV	CAX
1	5.935285	1.326299	98.67370	0.000000
5	10.78315	1.305551	96.05518	2.639271
10	12.66818	2.398664	93.40455	4.196785

Variance Decomposition of CAX (Panel 3)

Period	S.E.	UMP	POV	CAX
1	11.40387	6.383434	15.67893	77.93764
5	15.80018	4.477136	34.79237	60.73050
10	16.96092	3.942343	42.06555	53.99211

Cholesky Ordering: UMP POV CAX

Source: Author's Analysis

The results presented in the first panel in Table 4.3 shows that the own shocks explained a large proportion of the variations in the variance of unemployment level. The magnitude however decreased from a high value of 100 per cent to 91.2 per cent in the fifth period which later decreases to 78.8 per cent in the tenth period. Other variables that are of importance are poverty rate and capital expenditure, although they explained a neutral proportion of variations in the variance of unemployment at the first instance; but this increase from 0.00 per cent to 4.9(poverty rate) and 4.0 per cent (capital expenditure)and later increase to 14.4(poverty rate) and 6.8 per cent (capital expenditure)in the fifth and tenth period respectively.

The second panel in Table 4.3 depicts the proportions of forecast error variance in poverty rate explained by innovations of the considered endogenous variables. The two variables appeared crucial in determining the variation in the variance of poverty level. The magnitude of unemployment varied between 1.3 per cent in the first and the fifth periods and increase greatly to 2.4 per cent in the tenth period. The innovations in poverty rate and the variation in itself were very high at the first period, which is about 98.7 per cent but reduced marginally to 96.1 and 93.4 per cent in the fifth and tenth period. The variation in poverty rate as a result of an innovation in capital expenditure was neutral in the first period but becomes 2.6 per cent in the fifth period which later increased to 4.2 per cent in the tenth period.

From Table 4.3 in panel three, the innovation in unemployment rate makes the capital expenditure variance to decompose by 6.4 per cent in the first period but reduces to 4 .5 and 3.9 per cent in the fifth and tenth period respectively. Moreover, the magnitude of capital expenditure increased from 15.7 per cent in the first period to 34.8 per cent in the fifth period, 42.1 per cent in the tenth period.

Table 4.4: Causal Relationship among Capital Expenditure Unemployment and Poverty

Pairwise Granger Causality Tests
Date: 07/21/15 Time: 17:44
Sample: 1981 2013
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LOG(POV) does not Granger Cause LOG(CAX)	32	3.59111	0.0681
LOG(CAX) does not Granger Cause LOG(POV)		0.51425	0.4790
LOG(UMP) does not Granger Cause LOG(CAX)	32	0.73423	0.3985
LOG(CAX) does not Granger Cause LOG(UMP)		0.93321	0.3420
LOG(UMP) does not Granger Cause LOG(POV)	32	0.37105	0.5472
LOG(POV) does not Granger Cause LOG(UMP)		2.57424	0.1195

The result in Table 4.4 shows that, there is no existence of causality among government capital expenditure, Unemployment and poverty level in Nigeria.

Conclusion and Recommendations
The empirical evidence indicated that an attempt to reduce poverty brings about a reduction in unemployment rate in the country. Moreover, government expenditure on capital projects reduces the level of unemployment over time in Nigeria. An attempt to reduce unemployment brings about reduction on poverty level while poverty increases at an initial stage of increase in capital expenditure but reduces poverty level over time. The study also indicated that as unemployment rate increases, the economic policies adopted by the government increases the capital expenditure of the government.

Based on the findings of the study, the following policy recommendations are made;
For the Nigerian government to achieve a reasonable low level of unemployment and poverty reduction, government should plan for more capital projects in the country. It is also recommended that government should adopt relevant measures to enhance policy coordination among various arms of government, most especially fiscal policy to reduce unemployment which could entrench about poverty in Nigeria.

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