CODESRIA

Thesis

By

OLADIPO Samuel Omoniyi

OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA

ANALYSIS OF ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT, ECONOMIC GROWTH AND POVERTY ALLEVIATION IN NIGERIA (1980 – 2010)

2014

ANALYSIS OF ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT, ECONOMIC GROWTH AND POVERTY ALLEVIATION IN NIGERIA (1980 – 2010)

OLADIPO Samuel Omoniyi

SSP/09/10/h/2975

B. Sc. Economics (OAU), M. Sc. Economics (OAU)

A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, FACULTY OF SOCIAL SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHYLOSOPHY (Ph.D.) IN ECONOMICS OF OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA

2014

OBAFEMI AWOLOWO UNIVERSITY ILE-IFE, NIGERIA
HEZEKIAH OLUWASANMI LIBRARY

POSTGRADUTE THESIS

AUTHORIZATION TO COPY

AUTHOR: **OLADIPO Samuel Omoniyi**

TITLE: Analysis of Road Transport Infrastructure Development, Economic Growth and Poverty Alleviation in Nigeria (1980-2010).

DEGREE: PhD (Economics)

YEAR: 2014

I, OLADIPO Samuel Omoniyi, hereby authorize the Hezekiah Oluwasanmi library to copy my thesis in part or whole in response to request from individuals and/or organization for the purpose of private study or research**.**

Signature_______________________________ **Date_______________**

CERTIFICATION

This is to certify that this research work was conducted by OLADIPO, Samuel Omoniyi (SSP/09/10/h/2975) and had been read and approved as meeting requirements for the award of Doctor of Philosophy Degree (Ph.D.) of the Department of Economics, Faculty of Social Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria.

……..……………….……….……….
Prof. A.A Adebayo
(Head of Department)

…...……………………………….
Prof. P.A Olomola
(Supervisor)

DEDICATION

This thesis is dedicated to the ALMIGHTY GOD and UNCHANGEABLE FATHER in whom all glory is given. BABA, I will forever be grateful.

ACKNOWLEDGEMENTS

My deepest appreciation goes to Almighty God for His kindness towards me, to Him alone the glory and honour is given. I would like to thank a number of people who have made valuable contributions towards the completion of this research study.

First and foremost, I am indebted to my supervisor Prof. P.A. Olomola who imparted on me the importance of conducting meaningful research and critical thinking. Also for painstakingly read and modified all that is needed to be done in the work, despite his tight schedule and commitment in the University, may our Lord Jesus Christ bless you Sir.

My gratitude goes to the Head of Department, Prof. A.A Adebayo for providing the necessary official arrangement, assistance, and condition for the completion of this work, in spite of the tight schedule and other commitments in the Department. I will also thank Prof. J.A. Fabayo for his fatherly advice and support. My profound appreciation also goes to Prof .S. I. Oladeji; the formal Provost of the Post Graduate College for providing the needed academic and official assistance when need, both at the departmental level and at the post graduate college. I warmly appreciate Prof. A.E. Akinlo for been exceptionally helpful, with constructive comments and intellectual thoughts on many occasions.

I am sincerely grateful to Dr. O.R Olayeni and Dr. A.G. Aremo for being extremely helpful at all stages of the work and for being helpful in developing my research focus; not allowing me to wandering too far from the right track and enlightening me on how to do good research. Specifically, they provided invaluable comments and feedback throughout the research period.

My sincere appreciation goes to Prof. (Mrs) J.O. Olusi, Prof (Mrs) S.O Soetan, Dr T.O. Akinbobola, Dr. R.A. Ajisafe, Dr. B. A. Folorunso, Dr. T.P. Ogun Dr M.A.

Olagunju, Dr. O. T. Ajilore, Dr. O.B. Obebe, Dr. P.O. Olofin and Mr. A.V. Adejumo Dr (Mrs) Orisadare for their contributions to the completion of this work. May the help of God be available for you when you call upon Him. Big thanks to Dr. D.O Olayungbo and Mr O. O. Aiyegbusi for been there for me morally, and hospitably, indeed they are more or less a family to me.

I am also grateful to a number of helpful academic staff members in the department for suggestions and comments (during and after my proposal presentation) which I have endeavoured to incorporate in the final thesis; and Messer's, S.A. Adedokun, A. Adedokun, A. A. Adegboye, O.T. Apanisile, O. Falade and many others

I am sincerely grateful to the authority of Bells University of Technology Ota (my employer) for creating an enabling and conducive atmosphere for the completion of this programme. I am particularly grateful to the Dean of my college Prof. Chris Ajila and the Head of Department Economics, Accounting and Finance Dr. O.S. Enilolobo for their special interest in making my dream to come to reality. So also is my gratitude goes to my colleagues in the college, among whose are; Mr C. Ogboi, Dr. Adigun and Mr D. A. Adesunmi among others for your love and cares towards me. May the mercy of God be upon you all.

My immeasurable thanks to the Abosedes, Abulatans, Ogundeles, Ayandos, Olayungbos and all of the Oladipo's family for buying into this viable dream. Our God have made it profitable. I will not disappoint any of you in Jesus' name. Also I will not forget to mention my friends; Dr Kunle (Maths), Br Gbanga, Br Emma, Adesoji, Olutade, Odewale, Animasaun , Mr John, Mr Akinlo, Animasun Tunji, Dr. Egbetunde, Foye, K.C Osaiga, Daniel, Orisunbare boys and to those who I might have not mention for providing needed social atmosphere during the programme. We shall all make it in Jesus' name.

Lastly but not the least, I am especially indebted to my lovely wife, Oluwafunke of inestimable value; a woman of wit, persuasive appeal and immeasurable foresight. I wish to thank her for the supportive role in all aspects of my life. More also, is my earnest gratitude to our children Temitope, Eniola and Teniola they have made the home front conducive for me. I want to thank them for their love and forbearance, especially on many occasions of absence from home during the course of this programme. May they live to realise their dreams and destinies in life, Amen.

Big thanks to Council for the Development of Social Science Research in Africa

TABLE OF CONTENTS

CHAPTER THREE: METHODOLOGY

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This study examined the relationship existing among road transport infrastructure development, economic growth and poverty level in the Nigerian economy. It specifically analysed the long run relationship among road transport infrastructure development, economic growth and poverty level, determined the causal effects and the direction of causality, both in the long run and the short-run. The interactive effects among road transport infrastructure, economic growth and poverty level in Nigeria were also examined. This was with the view to providing empirical evidence on the possible linkages among road transport infrastructure, economic growth and poverty level.

The study employed annual time series data from 1980 to 2010 collected from Central Bank of Nigeria (CBN) Statistical Bulletin (2010), National Bureau of Statistics (NBS) various publications and World Development Indicators (2010) published by the World Bank. Both descriptive statistics and econometric techniques were employed in the study. The Structural Vector Autoregressive (SVAR) econometric technique was applied in the analysis of standard neoclassical macroeconomic framework. In addition, Cointegration, Impulse Response Function (IRFs), Forecast Error Variance Decomposition (FEVD) and Granger Causality Test (GCT) were used as analytical tools.

The result showed that road transport infrastructure development growth rate was very low relatively to economic growth rate over the years. The result further showed that economic growth was increasing over the year. However, poverty was on the high side given the trend analysis. The cointegration test confirmed the existence of long run relationship among road transport infrastructure development, economic growth and poverty reduction. It also indicated that 1 per cent increase in road transport infrastructure development and economic growth reduced poverty level by about 1.per cent (t-value= 1.64, $P>0.05$) and 0.6 per cent (t-value=4.27, $P<0.05$) respectively. The

SVAR results indicated that an unanticipated 1 per cent increase in road transport infrastructure development led to an increase of only 0.06 per cent, 0.19 per cent and 0.24 per cent in economic growth at the $1^{st,}$ 5^{th} and 10^{th} periods and reduces thereafter. Also, is the positive response of about 0.14 per cent and 0.27 per cent produced by real consumption expenditure per capita, as a proxy for poverty reduction in the 1^{st} and 5^{th} period before it fell gradually to about 0.10 per cent in the 35^{th} period due to an innovation in road transport infrastructure development. Further, real consumption expenditure per capita increased immediately by 0.04 per cent following an innovation in economic growth at the 1^{st} period but falls also thereafter. The FEVD revealed that at the 20^{th} period road transport infrastructure development contributed about 70 per cent to the forecast error variance of economic growth and about 49.5 per cent to the forecast error variance of the real consumption expenditure per capita, while economic growth contributed about 17 per cent and 4.5 per cent to the fluctuation in poverty reduction and road transport infrastructure development respectively at the 20^{th} period. Poverty reduction shock also accounted for only 3 per cent and 6 per cent of the forecast error variance of road transport infrastructure development and economic growth respectively at the 20^{th} period. The Granger causality result indicated that road transport infrastructure development and economic growth were the sources of poverty reduction in the long run and that poverty reduction and economic growth could influence one another in the short run.

The study concluded that road transport infrastructure development had impacted positively on economic growth and poverty reduction in the Nigeria.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Road transport infrastructure is defined in this study as a capacity expansion or addition to an existing road network. Road transport infrastructure has been recognized as a key ingredient for economic development, both in the developed and developing countries. Considerable efforts have been devoted to theoretical and empirical analyses of the contribution of road transport infrastructure development to growth and productivity (Aschauer, 1989, Straub, 2007, and Usman, 2008). More recently, increasing attention has been paid also to the impact of infrastructure on poverty alleviation (Ogun, 2010; and Wei Zou, Fen Zhang, Ziyin Zhuang, and Hairong Song, 2008).

Transport infrastructure plays an important role in economic, political, and social development of any society. Whether in rural or urban societies, transportation constitutes the main avenue through which different parts of the society are linked together. In other words, as a society grows in terms of population and functions, the need for interaction among its various components also grows, thereby requiring quality and effective transportation systems. The relationship between transport infrastructure development and economic development has always been contentious. The colonial authorities in Africa believed that investments in transport infrastructure positively influenced economic development through job creation, poverty reduction and increase in economic growth. This explains why these authorities were preoccupied with putting in place road and railway projects throughout the continent. Their actions were informed by regional and industrial development theories which assign a critical role to transportion. At the time, transport costs were viewed as a leading factor explaining the location of economic activities (Pedersen, 2001).

Provision of transport infrastructure helps in stimulating economic growth and reducing poverty through various channels. Roads are important for communications, social integration and economic development. In Nigeria where the road accounts for more than 90 per cent of the movement of people, goods and services, the road network is essential for national socio-economic activities. In recognition of the role transport plays in the overall development of any society and the desire to promote rapid socio-economic development particularly in the rural areas, the federal, state and local governments in Nigeria have been working towards the improvement and development of road transport infrastructure in the country. The Federal Government is responsible for about 17 per cent, State Governments 16 per cent and Local Governments 67 per cent of road maintenance in Nigeria, CBN (2003). According to Buhari (2000), only 50% of federal roads and 20% of state roads in the country were in reasonably good condition, and only an estimated 5% of total rural roads were freely motor able. More lately Uche (2011) is of the opinion that, out of Nigeria's 198,000 kms of roads, less than 20% are paved and over 65% are in bad condition.

Over the years, efforts have been made to improve and maintain the road transport infrastructure to make it functional. For instance, between 1981 and 1985, a sum of N7457.912 million was allocated to road development. In 1989, a sum of N230 million was spent on rehabilitation, reconstruction or construction of a total length of 937km of roads by the Federal Government. In 1990, a total of 24 road projects with a total length of

610 km were completed at the cost of N492 million. In 1991, a total sum of N800.2 million was expended on the construction of about 640.9 km length of roads. From February 1997 to December 2001, a total of 96 road contracts, mainly rehabilitation, reconstruction and expansion, were awarded by the Federal Ministry of Works at a total contract sum of N186.999 billion. 20 contracts worth N40.24 billion were for the South-South Zone; 19 contracts worth N35.346 billion in the South-West; 18 contracts valued at N45.l22 billion in the North-Central; 14 contracts worth N26.774 billion in the North-East; 13 contracts valued at N21.603 billion in the South- East; while 12 contracts with a contract sum of Nl7.915 billion were situated in the North-West. By the end of 2002, 23 of the projects have been completed, 9 in the South-West, 8 in the South-South, 2 each in the North-Central and North-West, as well as 1 each in the South-East and North-East (CBN, 2003). A significant improvement does exist, but the overall demand for road transport infrastructure in Nigeria exceeds supply.

The replacement value of road network at 2001 prices is estimated between N3,500 billion and N4,300 billion (FGNDNTP, 2010). In 2004, Nigeria's Federal Road Maintenance Agency (FERMA) began to patch 32,000Km federal roads and in 2005, it initiated a more substantial rehabilitation. Recently, in 2009 the ministry has consciously embraced the Public Private Partnership Scheme to complement the developmental efforts of the Government. The pioneering project in this regard is the Lagos-Ibadan Expressway (105km). The ministry, on behalf of the Federal Government of Nigeria (FGN), entered into a 25-year concession with Bi-Courtney Consortium at the cost of N89.53 billion (approximately USD 604.95 million). The scope of work covers the reconstruction, expansion and modernization of the expressway. The expectation was that the road would be expanded from the existing four lanes to eight lanes under a Design Build Operate and Transfer (DBOT) agreement. In July 2013, the contract was taken away from the Bi-Courtney Consortium to Julius Berger and Reynords Construction Company (RCC) due to inability to execute the project with a new agreement that, the construction companies would provide 70% of the project fund.

Infrastructure plays a central role in improving competitiveness, facilitating domestic and international trade, and enhancing a country's integration into the global economy. Transport infrastructure is an important determining factor in the development of a nation. Coupled with better human development, the development of infrastructure could generate a spillover effect that could affect a country's economic growth and poverty reduction efforts (Wei et al., 2008). This is because it helps in diversifying an economy production base, expanding trade and building resources and markets into an integrated economy, which could increase directly or indirectly the welfare of the people.

While the empirical literature on the interaction among these variables is far from unanimous, on the whole, a consensus has emerged that under the right condition, infrastructure development can play major role in promoting productivity and equity, and, through both channels, help reduce poverty and promote economic growth. This is because mobility and transport are important requirements for economic prosperity. The mobility of people and goods provides for a more enhanced division of labour, increased productivity, structural change, greater competitiveness, growth in incomes and higher employment. Economic activity, reflecting higher productivity and consequent economic growth, is made possible by transport. In this chain of cause and effect, polices on transport efficiency would be necessary for further progress in economic growth and poverty alleviation program through an empirical investigation in Nigeria.

1.2 Statement of the Problem

The Federal Government of Nigeria recognized that the development of transport infrastructure is essential to the growth of the economy, and for this purpose, substantial allocation has been made, following different developmental policies. As evidenced from Table 1.1 below, government spending on road infrastructure led to an increase in federal road network from 14,673.72 kilometres in 1980 to 32,179.86 kilometres in 1992 and 36,455.61 kilometres in 2010 respectively. The implication is that increased access to good roads will stimulate rapid economic activities, both in the urban and rural areas. Evidently, Gross Domestic Product (GDP) rose from ₦49, 632.32m in 1980 to ₦532, 613.83m in 1992 and ₦ 29, 205,782.96m in 2010.

Despite the increases in gross domestic product as well as road networks, poverty level (measured by one dollar per day) rose from 27.2% in 1980 to 54.4% in 2004 and 69% in 2010.

TABLE 1.1: Federal Road Network, Economic Growth and Poverty Level

YEAR	*Poverty Level (%)(1$per day)*	*Federal Road Network FRDNTW(K)*	GDP((N̶)*m*	*Per capita income (N̶)m*	*Govt. Exp. on RTI/GDP (%)*
1980	*27.2*	*14673.72*	49,632.32	0.001	*15.03*
1992	*42.7*	*32179.86*	532,613.83	0.005	*0.90*
2004	*54.4*	*34340.95*	11,411,066.91	0.080	0.001
2010	*69*	*34855.61*	29,205,782.96	1.790	0.002

Sources; CBN, 2010, NBS, 1980-2010 and WDI, 2011

Although economic indicators in Table 1.1 show an upward trend in GDP and per capita income, it cannot be concluded that the upward movement is enhanced by road transport infrastructure development without proper empirical investigation. The primary objective of the Federal Government is to achieve a reasonable level of standard of living through economic growth, however, there is no clean-cut evidence to conclude if this has been obtainable in Nigeria given Table 1.1 above. Then, one begins to imagine if this increase in GDP has translated into economic development by increasing the level of road transport infrastructure and per capital income which could bring about poverty alleviation in the country. However, instead of a reduction in poverty level, the reverse is the case. This then calls for an investigation to know if the growth in GDP is not sufficient to propel the country into the realm of per capita income increase that is needed to overcome poverty in Nigeria.

The need to address poverty in Nigeria has become an issue and various intervention programmes have been considered, as a result of the fact that poverty in Nigeria has been increasing over the years (see Table 1.1), with the highest proportion located in the rural regions, where most of the people are disconnected from profitable and efficient economic activities due to lack of adequate or decayed transport infrastructure. Jacoby (2000) has linked the asset value of poor farm areas to the distance to agricultural markets and maintains that improvement in road transport infrastructure implies capital gains for poor farmers.

It is also imperative to determine if the problem of overshooting upward trend of poverty could be addressed given the increased rate in road transport infrastructure development over time in Nigeria. For instance, the average annual loss due to bad roads is valued at N80 billion, while additional vehicle operating cost resulting from bad roads is valued at N53.8 billion, bringing the total loss per annum to N133.8 billion. This figure does not take into account the man-hour losses in traffic due to bad roads and other emotional and physical trauma people go through plying the roads and the consequent loss in productivity besides the number of road accident across the country (CBNRDOPS, 2003). It is then important to know if this scenario has any empirical effect on economic growth and poverty in Nigeria.

Interestingly, empirical investigations on the dynamic interactions among transport infrastructure development, economic growth and poverty reduction seem to be very scarce in Nigeria. Although there exit some studies on the effect of infrastructure development on economic growth in Nigeria (see Akinlabi and Jegede, 2011; Onakoya et al., 2012 and Akanbi et al., 2013), however, they failed to examine the issue of road transport infrastructure development on poverty reduction which is the major policy target of government. Ogun (2010) examined the effect of infrastructure on poverty reduction in Nigeria, but failed to address the effect of transport infrastructure on economic growth which could be a medium through which transport infrastructure affects poverty reduction.

Most of these studies employed investment in transport and communication services rather than physical stock as a proxy for infrastructure development. Moreover, Calderon and Serven (2008a) and Sahoo et al., (2009) have argued that stock of physical infrastructure is more reliable than investment in infrastructure when considering empirical implications of infrastructure development on economic development. This is because in time-series context the issue of simultaneity is arguably more problematic for those studies using investment flows (or their cumulated value) to measure infrastructure than for those using physical asset stocks. Therefore, the result of these studies may not show a true picture of the transport infrastructure – economic development nexus in Nigeria, since the data employed is the recurrent expenditure on transport – communication services rather than capital expenditure on infrastructural sector. In spite of this, it is difficult to formulate policies towards transport sector based on these findings.

The issue of causality among road transport infrastructure development, economic growth and poverty alleviation is also crucial since such nexus suggests that economic growth, transport infrastructure development and poverty reduction may perhaps be jointly determined in formulating appropriate policies (Gramlich, 1994). With respect to Nigeria, the issue of causality has not been addressed between road transport infrastructure development and economic development (economic growth or poverty reduction). Even in developed and some developing countries where attention has been paid to this issue, it remains essentially unclear whether the direction of causation is from transport infrastructure to economic growth on the one hand and to poverty reduction on the other hand or vice-versa.

One of the main shortcomings in addressing causation among transportation infrastructure development, economic growth and poverty reduction, is that, most scholars fail to adequately account for simultaneity issue. For instance, scholars have argued that, road transport infrastructure reduces poverty mainly by increasing economic efficiency, that is, by lowering costs and prices and enhancing opportunities. Poverty reduction as a result of connectivity to economic activities could also lead to increase in industrial sector, expansion in market of both agricultural output and manufacturing output as a result of increase in aggregate demand. Given this scenario, tax revenue of the government could increase, thereby enhancing government to expand or construct more roads. However, provision of good road network is an indirect way for growth to occur and pace of reducing poverty level in the economy. Although, attentions have been devoted to the issue of causality between road transport infrastructure development and economic growth with little evidence on the causal relationship between road transport infrastructure development and poverty reduction in the literature, however, conflicting result have been given (see Sadanada (2005), Jiwattanakulpaisarn et al., (2010), Keho and Echui (2011), Faridi et al. (2011) and Rudra and Tapan (2012).

Therefore, the causal relationship among economic growth, poverty reduction and road transport infrastructure development remains controversial giving the conflicting results among scholars. For instance, Sadanada (2005) and Niloy and Emranul (2005) find uni-directional causality between economic growth and transport infrastructure development. Jiwattanakulpaisarn et al., (2010) observes bi-directional causality, while, Faridi et al. (2011) reports no existence of causality.

Hence, the empirically interactions among road transport infrastructure development, economic growth and poverty reduction has not been specifically address in Nigeria. Most of the existing studies in Nigeria are either concentrated on investigating the effects of transport – communication recurrent expenditure on economic growth or on poverty level. The present study will serve as an extension of knowledge in the area of transport policy and its interactions with poverty alleviation programs and economic growth. Therefore, this study intends to fill these gaps by providing an empirical assessment of the interaction among road transport infrastructure development, economic growth and poverty reduction in Nigeria.

1.3 Key Research Questions

On the basis of the issues above, the following research questions are raised:

(a) What has been the trend of road transport infrastructure development, economic growth and poverty level in Nigeria?

(b) What is the long run relationship among road transport infrastructure development, economic growth and poverty level in Nigeria?

(c) What are the interactions among road transport infrastructure development, economic growth and poverty level in Nigeria?

(d) Is there any causal relationship among road transport infrastructure development, economic growth and poverty level in Nigeria?

1.4 Objectives of the Study

The broad objective of this research work is to examine the relationship between road transport infrastructure development, economic growth and poverty alleviation in Nigeria between 1980 and 2010.

The specific objectives are to:

(i) examine the trends of road transport infrastructure development, economic growth and poverty level in Nigeria;

(ii) determine the long run relationship among road transport infrastructure development, economic growth and poverty level in Nigeria;

(iii) examine the interactive effects among road transport infrastructure development, economic growth and poverty level in Nigeria; and

(iv) investigate the nature and direction of causality among road transport infrastructure development, economic growth and poverty level in Nigeria.

1.5 Justification for the Study

The importance of transport infrastructure development in promoting economic growth and reducing poverty level has not received adequate attention in the literature. Also, most studies concentrate on developed countries while few studies are found in developing countries. In the available studies, there exist contradicting views as to whether or not transport infrastructure development could affect economic growth and poverty level. The outcome of these studies has served as a guide for policy makers on policy formulation and implementation in the transport sector of many of the countries where the studies are carried out to improve the economy.

For instance, evidence have shown that, the expansion of road network, in addition to policy reforms and improvements in human capital, has been identified as one of the major engines of China's economic growth over the past decade (Fan, and Zhang 2002). Therefore, a good knowledge of how policy initiative like road transport infrastructure development could impact on poverty level and economic growth is very important for policy formulation.

There have been unsettled controversies related to the channels existing among road transport infrastructure development, economic growth and poverty level, The channels that are identified in the literature include: road transport infrastructure development and economic growth; economic growth and poverty; and road transport infrastructure development and poverty. The controversies among scholars on each of these channels have occupied a large body of literature. A vast majority of works that have been done in this area of study are carried out in the developed world. There is need to carry out similar studies in developing country like Nigeria to establish the existence of these channels. The macroeconomic situations in Nigeria require a thorough understanding of how and through what channel road transport infrastructure development, economic growth and poverty interact in the Nigerian economy. The knowledge of this is important to policy makers to fully understand how transport policy is impacting on the welfare of the people.

This study is also necessary in providing empirical evidence and hence some implications for transport infrastructure policy towards promoting economic growth and poverty reduction. While there is a large body of empirical research addressing this, the study differs significantly from previous studies in terms of the measurement of road transport infrastructure development, poverty level and analytical frameworks. Therefore, this study is timely and important since substantial economic expansion is expected in Nigeria, and more also considering the transformation agenda of the government, there will be the need for empirical findings in assisting the government towards achieving their primary objective.

The need to address the issue of poverty becomes so important considering the high rate of poverty in Nigeria. The over 70 per cent Nigerian are living in abject poverty. This increasing rate of poverty is occurring at the same time that the nation's economic growth is moderately increasing. The literature suggests that an increase in economic growth is expected to enhance poverty alleviation in an economy (Oyejide, 1999). Unfortunately Nigeria's case appears to be evidently different from what obtains in the literature. This relationship between economic growth and poverty level still subsists despite all the poverty alleviation strategies initiated by successive Nigerian governments. What is even worrisome is that despite government numerous efforts to develop the Federal road transport infrastructure in Nigeria over years, the poverty level continue to increase. However, logically, it is expected that as expansion and construction of road network increase, economic activities become cheaper, and the more it becomes easier to accumulate wealth which could take people out of poverty. Therefore, this study becomes necessary and timely given the present state of road network in Nigeria, the growth rate in economic growth and increasing rate of poverty level in Nigeria.

1.6 Scope of the Study

This study is limited to examining the relationship between road transport infrastructure development, economic growth and poverty alleviation in Nigeria. This is because the road transport infrastructure is a necessity if not the sufficient means of moving both goods and services within and outside the country. This is because the road network is most affordable in carrying out economic activities which could bring about attainment of economic growth and poverty alleviation. What is more, the literature on the effects of other modes of transport infrastructure (rail, water and air) on economic growth and poverty reduction is relatively scanty. The study will cover the period of 31 years (1980-2010). The choice of this period was informed by the availability of data on the variables to be considered in this study. Also, the period was the oil boom period during which proactive economic policies were formulated and implemented. It was also during this period that poverty rate increased in Nigeria. Therefore, this period is long enough from statistical point of view to capture the existence or otherwise of the relationship between transport infrastructure development, economic growth and poverty alleviation in Nigeria.

1.7 Organisation of the Thesis

The thesis is divided into six chapters. The first chapter introduces the subject matter and formulates the research objectives. In Chapter Two, a review of literature on the various forms of theoretical nexuses of relationships that exist among transport infrastructure development, economic growth and poverty is done. Chapter Three describes the theoretical framework, model specification, sources of data, description and measurements of variable and techniques of data analysis. While Chapter Four looks into a brief history of road transport infrastructure development in Nigeria and makes a critical analysis on the trend of road transport infrastructure development, economic growth and poverty in Nigeria, Chapter Five delves into the presentation and discussion of results from empirical analysis, studies the long-run relationship of the variables, and also, empirically examines the interactions among road transport infrastructure development, economic growth and poverty level in Nigeria. The major findings from the analysis are summarised in Chapter Six, which also contains policy recommendation and conclusion.

CHAPTER TWO

LITERATURE REVIEW

In this chapter, the theoretical, methodological empirical and literatures are reviewed. Following the introduction, section 2.1 sheds light on the various theories that underlie the theoretical literature of the issues of transport infrastructure development, economic growth and poverty alleviation. Transport Infrastructure Development and Economic Growth Theory (Microeconomic Theory; Macroeconomic Analysis; Transport, International Trade, and Spatial Interaction Theory; Transport and Industrial Location Theory; Historical Models and Spatial Economic Theory; and Alternative Theoretical Perspective); Growth and Poverty Theory; Transport Infrastructure Development and Poverty Theory; and Infrastructure Development, Economic Growth and Poverty Theory are reviewed. This serves to provide critical empirical frameworks for the analysis intended in this study.

2.1 Review of Theoretical Literature

2.1.1 Microeconomic Theory

In the microeconomic theory, considerable attention has been devoted to roads because of the perception that they will ineluctably lead to poverty reduction and income generation, especially in rural areas. Microeconomic models determine gross prosperity by adding up consumer's surplus, producer's surplus and production costs. The benefit of transport is given by the area below the demand curve. Extensive results in this area may be obtained by the use of cost-benefit analysis, which is normally applied in the assessment of concrete infrastructure projects. This notwithstanding, the true economic value of a transportation system may not be best captured by measurement of individual parts, but in fact by the overall network quality. How the quality of the network impacts economic outcomes is based on the interaction of a given transportation network, government policy, the legal framework and other economic fundamentals that are inherent in a given region.

The effect of transport infrastructure on the economic growth is one piece of evidence emerging from recent studies that have applied duality theory to analyse the productivity effect of highway infrastructure using a cost function (e.g. Seitz, 1993; Seitz and Licht, 1995; Nadiri and Mamuneas, 1998; and Cohen and Paul, 2004) or a profit function (Deno, 1988). In the cost function studies, it is explicitly assumed that firms are price takers, and that the cost function represents the cost minimising behaviour of such firms with respect to their combination of inputs (i.e. labour, private capital and materials) in producing a given level of output for a given level of technology. The stock of highways is considered a fixed and free input that influences production technology. More highway infrastructures could enhance production possibilities, resulting in cost-minimising firms adjusting their demand and use of inputs, given input prices and the existing output level. Cohen and Paul (2004) focus on the short-run effect of highway investments on manufacturing production by treating private capital and highway infrastructure as quasi-fixed factors. In addition, they present an extension of earlier studies by measuring the extent and significance of spatial spillover effects of highway infrastructure investment.

The conventional assumption in evaluating transport improvement is that the sectors using transport are perfectly competitive. Thus, any change in transport costs will bring about a commensurate change in the prices charged by these firms and the true value of the economy of any transport improvement is measured directly by the willingness to pay for the use of the transport system. The appraisal of any transport improvement has only to measure the transport demand function accurately, while the transport user benefits will be a complete and accurate measure of the full economic value (Dodgson, 1974; and Jara-Diaz, 1986).

Suppose, however, that there are transport-using firms which are in imperfectly competitive markets, the key feature of such firms will be that their prices do not directly reflect costs. Imperfectly competitive firms which are engaged in rent-seeking behaviour will thus be able to benefit from transport cost reductions without passing these benefits on to their customers, as long as this does not induce increased competition from firms in the same sector located in other regions or new entrants into the sector. The problem is that this behaviour is not predictable a priori. More importantly, however, such a situation shows how firms may not have a vested interest in seeking transport improvements since poor transport access to a market can act as an effective barrier to a competition from outside (Hotelling, 1929). As long as a firm can gain sufficient scale economies within the local market, there is no incentive to seek transport cost reductions. In such circumstances, the benefits of a transport cost-reducing measure will not be measured accurately by the transport user benefits. Since lowering a transport cost barrier may have the effect of increasing competition, the impact on prices may be greater than the cost reduction. As a result, the total benefit to consumers will be larger than the conventionally measured transport-user benefits. Whether this will happen, and by how much, will depend on the availability of scale economies and the ability of the local firms to maintain entry barriers in the absence of transport cost barriers.

This recognition of what has been termed the “two-way road” effect that the benefits from the improvement of transport do not accrue solely in one direction, for example, to the region promoting the transport improvement – needs a little clarification. Recognition of this may lead to regions being less willing to improve transport. This argument can be criticised for taking in effect the mercantilist view, which seems to be implicit in Hotelling’s argument, and ignore what are assumed to be universal pro-competitive effects of better transport. The assumption that improved transport is always pro-competitive is, however, difficult to justify. It assumes that the only effect of poor transport is to introduce market imperfections into what would otherwise be a perfectly competitive world. This is similar to the justification for infant industry protection to firms in emerging economies. However, under different assumptions concerning the demand elasticity facing the transport-using firms, the extent of market power, the extent of linkages and agglomeration effects. Venables and Gasiorek (1999) have shown that there could be additional benefits which could be anything up to 40 percent of the conventionally measured benefits. This assumes that markets are fully integrated as a result of the improvement. Where firms are allowed to discriminate between different regional markets as part of their rent seeking, such large additional benefits would not arise.

Interestingly, Venables and Gasiorek (1999) also demonstrate that there can be circumstances where the firms in a sector are charging a price below marginal social costs, while the conventional user benefits overestimate the wider benefits. In such cases, the transport improvement would support, for example, an existing subsidy which may have been given to compensate for poor access to markets and which should clearly be removed if that access is improved. In the long run, transport improvements will lead to the entry and exit of firms. The links between firms will have implications of changes in one sector for the demand and cost conditions of other sectors. In general, a more integrated market tends to support fewer firms, which charge lower prices and remain profitable by producing on a larger scale. It also encourages relocation when costs change, by taking into account not only the transport costs of supplying final consumers or intermediate users but also feedback on wage costs and externalities from the presence of other producers. Central to the welfare implications in general equilibrium is whether imperfectly competitive sectors elsewhere in the economy expand or contract relative to perfectly competitive ones.

2.1.2 Macroeconomic Theory

Macroeconomists have concentrated largely on endogenous growth theory, viewing that the provision of transport infrastructure could affect economic growth either through its direct contribution as a factor input in the production process or through improving technological innovation (Meade, 1952; Aschauer, 1989; and Hulten and Schwab, 1991). The arguments so far are related to impacts on the level of economic activity. The final set of arguments relates to possible impacts on the rate of economic growth. This involves the introduction of arguments from the endogenous growth literature which suggest that certain changes will lead to a continuing increase in the rate of growth in the economy, rather than a shock to the system which shifts the level upwards but ultimately leads to a return to an exogenously given underlying rate of growth. Baldwin (1989) suggests that there might be a substantial additional "growth dividend" from the Single Market as some of any initial gain in income would be reinvested and efficiency gains would lead to a lower incremental capital-to-output ratio (ICOR) and an increasing growth rate of the capital stock.

The strength of the impact of this on long-term output growth depends on assumptions about diminishing returns. In addition, there could be favourable effects on technology transfer and on innovation. Despite the possible theoretical ambiguities of the implications of greater openness to trade and the problems for empirical work in measuring openness well, at the national level, the evidence seems to be clear that reducing barriers to trade raises Total Factor Productivity (TFP) growth. Edwards (1998) finds a robust and sizeable relationship across countries between their openness to trade measured in several alternative ways and TFP growth. It seems plausible that similar effects will result from substantial improvements to transport networks. For this to occur, improvements in transport would need to have an impact on the process of industrial restructuring through the entry and exit of firms and the seeking of wider markets, on the rate of innovation and technology transfer (e.g. through the parallel improvement in flows of information) and ultimately on the growth of total factor productivity. Underlying this argument is a belief that the transport-using sectors are, inherently, imperfectly competitive.

2.1.3 Transport, International Trade and Spatial Interaction Theory

Trade theory explains interregional movements in commercial merchandise, commodity trade and interregional equalization of income, under the assumption that factor mobility is negligible. It has been primarily applied to international trade in which labour and capital movements are restricted by national regulations, but it is sometimes used in regional analysis. For instance, Siebert (1969) combines commodity trade with neoclassical arguments in developing his model of regional growth. Ricardo's international analysis is the starting point for most trade theory. In his model, there are two nations and two goods. Each nation specializes in the goods for which it has comparative advantage.

Comparative advantage is measured by the opportunity cost required to produce each good in terms of the other goods. Transportation cost involved in shipping goods and raw materials are not considered. Ohlin (1933) applies Ricardo's theory to interregional trade. Hecksher (1949) simplifies the analysis by assuming that regions will specialize in the production of goods which intensively use are more plentiful factors. Neither of the theories, however, incorporates transportation costs. By introducing transportation cost into trade theory, the relationship between transportation improvements and commodity flow can be analysed. For interregional analysis with transportation cost, comparative advantage will be partially reflected in absolute price differences at the production sites. The cost of moving goods to market is another component of comparative advantage. Region (i) will specialize in those products which it can produce and transport cheaper than its regional rival (j). That is, product for which:

$$(P_i + T_i) < (P_j + T_j)$$

Therefore, FOB price advantage can be eroded by a transportation disadvantage.

Several inferences can be drawn from the relationship between transportation and economic development. Uniform transportation improvement will enhance the importance of comparative advantages in production (as reflected in FOB prices) in regional commodity specialization. If a transportation corridor linking an uncompetitive region to markets is improved, production there might become competitive with other regions. However, the transportation improvement might also make its market more vulnerable to competition from other regions. Each of these situations will be illustrated using market area location analysis.

2.1.4 Transport and Industrial Location Theory

Locational Analysis emphasises the importance of interaction between transport cost on one hand and market size and economies of scale on the other hand. With decrease in transport costs and economies of scale, a firm in a location gains a larger market area and dominance which in turn promote the concentration of other firms in the same location. Getting an appropriate location with good access to markets and suppliers for one firm improves the market and the supply access of other producers there. The process of cumulative causation (where a location becomes more attractive to successive firms as more firms come to join) derives from earlier ideas of economics geography. The central feature of this theory of agglomeration (as noted by economics geography and regional sciences) is the presence of external economies of scale in the Marshallian sense. The starting point of industrial location can associated to Weber (1929) in a book tilted Alfred Weber's theory of location of industries. Different firms clustered in a location experience positive externality in the form of agglomeration economies, industrial complexes and social networks engaged in untraded interdependencies. In a technical term, regional specialization develops. Indeed, without increasing return to scale in the context of transport improvement, it is impossible to account for the observed spatial concentration of the firm and regional specialization in the region and national economies.

The existing models of freight transportation planning, in general, are adopting from the ones used for passenger transportation like the four-stage-model (Houlguin-Veras et al., 2001; Southworth, 2002; and De Jong et al., 2004). Southworth (2002) introduces a model of freight transportation which is known as a multi-step freight planning model. The conceptual framework of this model originally consists of: (a) freight generation/attraction;

(b) flow modelling/trip distribution; (c) modal split; and (d) traffic route assignment respectively. When the planning process is intended to translate the commodity flows into vehicle movements so the fifth step is required, this is called modelling of vehicle load factors. This vehicle/fleet loading may occur as step four in the modelling process, which is conducted after mode split model or alternatively, it may occur at trip generation stage, producing truck trip forecasts that are suitable for direct application to the subsequent traffic route assignment stage. Where truck traffic is concerned, it is usual to carry out mixed freight-passenger travel assignments to capture the effects of traffic congestion on shipment times and freight delivery costs.

In theory, these congestion inclusive costs can be fed back through the freight flow modelling, modal split, and vehicle loading steps, and iterated until the system of model equations stabilizes on a set of transportation costs and flows. Variations on such process have been used to analyse corridor-specific, metropolitan area wide and state-wide freight movement systems (Holguin-Veras and Thorson, 2000; 2003a; and 2003b). Holguin-Veras and Thorson (2000) and Holguin-Veras et al., (2001) have promoted the models of freight transportation planning which are known as commodity-based and trip-based models.

2.1.5 Historical Models and Spatial Economic Theory

Tinbergen (1957) can be considered a starting point. In an original piece of work, he compares the effects on final aggregate output arising from road projects with the benefits obtained within partial equilibrium Cost Benefit Analysis (CBA). Both perfect and monopolistic competition situations are considered in a simple three-region general equilibrium framework with four goods. The transport benefit measure employed is restricted to cost savings on existing trade volumes between regions, ignoring induced traffic effects. Two main characteristics of his work are the explicit attempt to recognize geographical differences in production and consumption –location of workers and firms— and the use of multipliers to adjust partial equilibrium measures. These multipliers capture welfare effects showing up as increased output at an aggregate level, which are ignored in cost savings measures. These two are distinguishing characteristics of recent related works, (Hussain, 1990).

Concerning the transportation literature, Mohring and Hartwitz (1962) address explicitly the surplus equivalence for the case of highways when production occurs under monopoly. In a simple single link network, they evaluate the equivalence of changes in Transport Communication System (TCS) and total benefits, finding the former to understate the later. The subsequent discussion on the suitability of transport benefits measures turn to the consideration of second best conditions in the transport sector, maintaining a perfect competition assumption for the rest of the economy. Vickrey (1969), investigate the dependency of investment's value on the pricing regime under congestion, in a single link and two-links-two-nodes network models. This work was conducted as an extension of the debate on first-best long-run pricing and investment rules in urban transportation also addressed in Mohring and Hartwitz (1962).

In a decade of significant highway investment in developed countries, the appropriateness of Marshall-Dupuit type of welfare change measures was subsequently studied for the case of networks when alternative modes or paths were available. Transport demand interactions arising from a uni-modal infrastructure improvement were found to generate a path-dependency problem in the computation of consumer surplus. Mohring

(1976) address this issue under a sort of general equilibrium in the transport market finding that under these circumstances an extended consumer surplus concept should be adopted. In an attempt for a synthesis, Jara-Diaz and Friesz (1982) reconsider the surplus equivalence problem in a simple one-good spatial price equilibrium model of the Enke-Samuelson type with two specialized regions one importing, another exporting– iceberg-type of transport costs and a one-way trade link. The discussion in Jara-Diaz and Friesz (1982) was conducted in order to generate an aggregate transport demand and supply and consider only first-best conditions with regard to transport and non-transport sectors.

Jara-Diaz (1986) further develops the surplus equivalence question both under perfect and imperfect competition by means of the same simplified spatial price equilibrium structure. He shows analytically that no difference in surplus change measures exists when a first-best situation with competitive markets is assumed. An underestimation of benefits from TCS was found in two simple second-best cases: firstly, as in Mohring and Harwitz (1962), when production is under monopoly in the delivering region, and secondly under duopoly with the exporting region having stronger monopoly power than the importing region. Only when the importing region has a relatively higher monopoly power does the TCS overstate total benefits. Kanemoto and Mera (1985) consider a simple general equilibrium model of two regions incorporating intermediate demand and complete specialization in production. The good produced in each region is consumed in both regions and used as an intermediate input in the production process of the good in the other region, generating a two-way trade link. The issue addressed in the paper is similar to the one in Tinbergen (1957), while the comparisons are enriched by the consideration of alternative total welfare change measures. Recognizing induced effects not related with location decisions of a transport costs reducing large infrastructure investment, they examine whether or not three economy-wide benefits measures (Marshall-Dupuit consumer surplus, compensating variation and Allais surplus) can be reduced to the area to the left of a suitably-defined general equilibrium transportation demand in a first-best economy with no price distortions. Additionally, a computation of multipliers contrasting general and partial equilibrium measures on the one hand and partial equilibrium and simple cost savings measures on the other hand was conducted.

Hussain (1990) and Hussain and Westin (1997) revise the use of multipliers in general equilibrium in view of the difference between a particular economy-wide welfare change measure –equivalent variation and the traditional change in TCS results arising from a large scale transport infrastructure project. They considered a three-region economy with fixed-location production generated from primary inputs without migration (labour and capital) and intermediate inputs. They simulate the impacts of transport-cost reducing large infrastructure investments of different magnitudes. The regions are connected to each other by a two-way trade links arising from final consumption and intermediate inputs from other regions. This work provides contrasting results for first-best and second-best situations, the latter based on the existence of scale economies in production.

The discussion of location effects arising from infrastructure improvements and its contrast with traditional CBA measures, which was formally initiated in Mohring and Williamson (1969), Venables and Gasiorek (1996 and 1999), Brocker and (1998) Oosterhaven and Knaap (2000)constitutes the basic reference of economy-wide models featuring imperfect regional economies with applications to the evaluation of alternative transport infrastructure benefits measures. The definition of partial and general equilibrium effects as well as the transport and economy-wide benefits measures normally differ, but all these papers share a common economic structure.

In Venables and Gasiorek (1996) a computable spatial general equilibrium exercise is conducted for transport projects in four European countries: Greece, Ireland, Spain and Portugal. These projects were financed by the cohesion fund in the European Commission and its aim was to aid these countries in the process of integration. The approach here is similar to that in Tinbergen (1956) since their focus is on effects on aggregate output –real income and its distribution per region. Transport cost savings in the short, medium and long runs are also compared with economy-wide aggregate output effects, and finally multipliers are reported. Venables and Gasiorek (1999) conduct a similar exercise without reference to any specific region but considering several scenarios for representative cases. Both studies include intermediate demands and base heavily their modelling on Neoclassical Equilibrium Growth (NEG) unless no core-periphery structures are considered. Brocker (1998) discusses benefits estimation under perfect and imperfect competition, distinguishing three sources of total welfare change arising from a reduction in transport costs: income, substitution and competition effects. In addition, he constructs a computable general equilibrium model for Europe featuring tradable and non-tradable goods and incorporation trade in intermediates. This model is based on Neoclassical Equilibrium Growth (NEG) and is used to calculate welfare effects of establishing new road links in Central and Eastern Europe. A comparison of results under perfect and imperfect competition is conducted and reported in the form of multipliers. Oosterhaven and Knaap (2000) conducted a similar exercise for a rail project in The Netherlands. These three studies share a similar economic structure when discussing imperfect competition conditions and go a step further in relation to previous transportation literature when attempting to use real data based calibration of parameters. Despite a discussion of possible sources of welfare change, a detailed discussion on the channels-driving results or the consequences of using certain production or consumption structures is not examined in these studies.

Furthermore, they do not elaborate either on the relations with previous transport economics or cost-benefit literature. Other recent contributions in benefits estimation include Kidokoro (2004). Kidokoro (2004) considers infrastructure improvements in some links of a network featuring a competitive general equilibrium setting without location effects. Second-best conditions characterized by congestion in some links are considered as well. In a more methodological discussion, Venables (2004) and Rossi-Hansberg (2004) are recent contributions focusing on urban transport projects and partial equilibrium settings. Venables (2004) and Rossi-Hansberg (2004) emphasise the presence of extra benefits arising from transportation improvement projects in a context of production externalities closely linked with the NEG approach.

While the role of public infrastructure investment in stimulating economic growth and development within a recipient region has been the subject of considerable research efforts for many decades, another important issue that has recently received attention is whether or not infrastructure geographically affects other regions. The general idea is that the effect of public infrastructure investments may not be confined to certain regions where publicly provided facilities are located. Rather, such effects could spatially extend to immediately contiguous regions or even other distant regions (Vickerman, 1991b; Munnell, 1992; Button 1998; and Rietveld and Bruinsma, 1998). Transport infrastructure is usually considered as a primary source for spatial spillovers because of its network character. Other types of public infrastructure without network effects could also have spatial implications across jurisdictions. For instance, economic benefits of public facilities such as schools, hospitals, and recreation facilities may accrue to both local residents and people living in neighbouring regions. Another reason for economic spillovers from public infrastructure is the role of regional differences in infrastructure endowments in triggering spatial competition in factors of production.

Given the importance of access to public infrastructure, it is likely that a region with more or better infrastructure services could draw economic activities away from elsewhere. A theoretical model derived from Boarnet (1998) shows that private capital and labour inputs migrate from regions with relatively poor levels of public infrastructure to those with well-developed infrastructure. In particular, the model states that output will increase in regions where infrastructure development are made, whereas other regions in which emigration of labour and capital flight takes place will experience a decline in the level of production. As such, public investments in infrastructure may not only have a positive output effect locally but also create negative output spillovers across regions. Given the disagreement on the productivity effect of public infrastructure at different levels of aggregation, Munnell (1992) contends that small or insignificant output elasticities of public capital obtained from data from United States are due to the failure to capture cross-state spillovers in productivity benefits. Following the work by Holtz- Eakin and Schwartz (1995) which seeks to address this hypothesis, several researchers have attempted to gain insights into the existence of economic spillovers from public infrastructure.

Moreover, Johansson (2007) argues that since infrastructure investment affects spatial organisation, this aspect has to be addressed in a more direct way like firms' accessibility to labour supply, input suppliers, customers, and knowledge providers. For households, accessibility to jobs and services is relevant. Further, he emphasises the physical aspects of the infrastructure investment such as time distances, travel costs, capacity and comfort. Johansson (2007) makes a distinction between intra-regional and extra-regional market phenomena. The local markets are characterised by local competition and face-to-face contact between buyers and sellers. The growth in such markets is endogenous, self-generated and depends on population growth and regional enlargement (which in turn might be dependent on localisation changes of local activities). Extra-regional market phenomena are characterised by exogenous demand, global competition, infrastructure designed to establish accessibility to global networks, low transaction costs, and scheduled delivery systems.

Growth Pole theory encompasses more than the ideal conditions for fostering planned growth poles. It is also concerned with the elements of the growth process and the spatial pattern of development induced by growth poles. According to standard textbook treatment, growth poles pass through two stages of spatial development. During the initial period, "backwash" occurs; increasing urban polarization is experienced; and the hinterland lags behind in growth and development. During the following period, the region undergoes "spread" and diffusion of innovation and growth to the hinterland occurs. One of the initial effects is to draw industries from the immediate hinterland into the central growth centre because of its more centralized location and agglomerate advantages. The growth centre becomes a greater exporter of services used in the periphery. However, the loss of jobs to the growth centre leaves unemployed residents with the choice of migrating, commuting to the growth centre, or remaining unemployed.

The increasing concentration of industrial labour in the vicinity of the growth centre will lead to additional economies in growth centre industries. The economic effect of the new highway changes from primarily redistributive to generative. These economies allow the region consisting of growth centre and periphery counties to offer more competitive goods and services. Therefore, the region is able to compete more effectively in the provision of goods and services, and the export bases of both growth centre and the region expanded. Although it is not illustrated here, the economic expansion of the growth centre resulting from an expanding economic base eventually spreads to the periphery. Polarization turns to de-concentration as household and industries seek out lower location in the intermediate vicinity of the growth centre. At the end, uniform spatial economic growth is achieved by taking advantage of destabilising agglomeration forces.

2.1.6 Alternative Theoretical Perspective

Accessibility-based planning expands the range of solutions that can be applied to solve transport problems, including some strategies that reduce total vehicle travel, for example, improving alternative modes (walking, cycling, ridesharing, public transit, etc.), encouraging more efficient use of existing transport resources (such as more efficient road, parking, insurance, fuel pricing, and roadway management that favours more efficient modes and higher value trips, such as high-occupant and freight vehicles), more accessible (more compact, mixed, connected, multi-modal) land use development, and improved mobility substitutes (telecommunications and delivery services). These strategies can result in more efficient use of transport resources, for example, by encouraging travellers to shift to more resource efficient modes (such as walking, cycling, ridesharing, public transit, and teleworking) when feasible, so higher value vehicles (freight, service, bus, urgent personal errands, etc.) can travel unimpeded by congestion.

Mobility-based transportation improvements reduce travel costs and so tend to increase Value Movement Time (VMT). Other strategies improve accessibility in ways that often reduce vehicle travel. This distinction between mobility and accessibility is becoming more important. Various trends are reducing the marginal economic benefits of increased automobile travel and increasing demand for alternative modes (Litman, 2006a), including increasing traffic and parking congestion, increasing road and parking facility expansion costs, increased urbanization, rising future fuel prices, and improved communication technologies. As a result, policies and projects that encourage more efficient use of existing transportation resources are likely to provide greater economic returns that simply expand road and parking facility capacity. Accessibility-based analysis allows these opportunities to be identified. For example, in many situations, business experts will find it more cost effective to efficiently manage parking facilities (using more sharing and efficient pricing, encouraging use of alternative modes, more accessible locations, etc.) than to expand parking facilities, while transport agencies will find it more cost effective to efficiently manage roadways (using efficient pricing, encouraging use of alternative modes, smart growth land use policies, etc.) than to continue to expand roadways. Investment through Public Private Partnerships (PPPs) has emerged recently. The use of private investment is appropriate to address the infrastructure deficit and improve public services in a sustainable way. The legal and institutional framework provided for PPP is to ensure that the transfer of responsibility to the private sectors is obtainable.

2.1.7 Growth and Poverty Theory

The discussion of the nexus between growth and poverty has occupied a large body of literature. The relationship was proposed to follow an inverted U-curve, meaning that income inequality increases in the initial phases of development and then declines as growth continues. This manner of trend was derived from the study by Kuznets (1955) who investigated a time series of inequality indicators for England, Germany and the United States. The generation of the Kuznets' curve was based on some propositions. The first, proposition is the transfer of labour from a sector with low productivity and low inequality to another sector with higher productivity and higher inequality as elucidated in the model proposed by Lewis (1954). The result would hold if the inequality between the sectors was substantially greater than the inequality within them.

Some empirical studies carried out recently have refuted the inverted–U relationship between the income level and level of income inequality. The studies by Deininger and Squire (1998) provide little support for an inverted–U relationship between levels of income, and inequality when empirically vested on a country-by-country basis. Ninety per cent of the countries investigated did not show evidence of the existence of Kuznets' curve. Ravallion and Chem (1997) advance the argument that growth seemed to reduce inequality in the transitional economies of Eastern Europe and Central Asia. They however postulated that the pattern of income distribution in developing countries have over a long period of time been stable.

It has been established that countries with higher growth rates achieved faster decline in poverty. This occurred largely through growth which induced increased employment and higher real wages which led to a significant reduction in poverty. Similar studies have equally emphasised the role of higher economic growth to tackle the problem of poverty. Examples of those studies include: Tendulkar (1998), Ravallion and Datt (1996), Bhagwati (2001), and Datt and Ravallion (2002).

The literature reveals that there is the need to distinguish between absolute poverty and relative poverty as this has significant impact on the findings derived from different studies. Overwhelming pieces of evidence have shown that economic growth contributes to reduction in absolute poverty in studies embodying individual countries and also cross countries. Ravallion and Chem (1997) establish that there is a statistically significant relationship between, absolute poverty and economic growth. Thus, it would appear that it is possible that economic growth negatively affect the poor unduly in a situation of wide income inequality. Thus income inequality can aggravate the absolute poverty.

2.1.8 Transport Infrastructure Development and Poverty Theory

One of the first systematic attempts to link infrastructure development indirectly to poverty reduction was made by John Maynard Keynes in 1936. In the General Theory of Employment Interest and Money, Keynes argues that in an economy characterized by depression and market failure, high public expenditure is necessary to adjust the economy back to high levels of employment. This implies that high public investment in transport infrastructure would increase national income, employment and the welfare of people.

Anderson, Renzio and Levy (2006) maintain that public infrastructure produces two main effects which are microeconomic and macroeconomic in nature. According to these authors, the microeconomic effects of public investment produce two main impacts:

quantity effect and price effect. A public infrastructure investment increases the quantity and/or quality of public goods and services. Since public goods are exclusively produced by the government, the quantity of these goods is initially rationed by firms and households. However, with additional public infrastructure investment, there is an increase in the quantity and/or quality of this rationed good, therefore benefiting both firms and households in the process. In this case, much public infrastructure provides direct welfare benefits in the form of increased quantity and/or quality of final goods and services. The price effect, being a crucial component of the microeconomic impacts of infrastructure investment, changes the prices of various market goods and services produced or used by firms and households. This situation occurs when the public good produced is either a substitute for or complement to other market goods and services used by households or by firms. Price change can also occur when the good or service produced by the government is not a pure public good but merely contributes to existing private sector production.

The macroeconomic effects of public investment focus on the impact of public infrastructure on macroeconomic aggregates and its ultimate effect on economic growth. Anderson, Renzio and Levy, (2006) argue that the macroeconomic effects of public infrastructure investment transmit through five basic channels to affect economic growth. These authors maintain that public investment complements private capital, crowds-in private investment, increases market integration, and raises aggregate demand and national savings. Given the increase in aggregate demand, and assuming that national savings translate into investment, economic growth occurs.

Jahan and Mcleery (2005) emphasize that infrastructure development can lead to poverty reduction through direct or indirect channels. Through the direct channel, there is reduction in poverty as people's access to health and educational services improve, there is cleaner energy available and the government provides for protection against national disasters. The indirect effect of infrastructure provision on poverty occurs when the productivity of workers increases, transport costs are reduced and more employment is generated, thereby leading to economic growth. This implies that infrastructure provision can have economic and social impacts on the lives of people.

2.1.9 Transport Infrastructure Development, Economic Growth and Poverty Theory

Jahan and Mcleery (2005) argue that the impact of infrastructure on economic growth and poverty reduction takes the form of first-round effects, followed by subsequent impacts. In the first round, infrastructure development produces two initial effects that could lead to poverty reduction through economic growth. These two initial impacts are the supply side and demand side impacts. The development of infrastructure improves the supply side of the economy by reducing cost, enhances business climate, makes room for better access to market opportunities and opens up new opportunities. These supply side effects attract domestic and foreign investment, increasing employment and national output. The demand side effect of infrastructure development occurs when projects are implemented. In this case, the new project, say road construction, creates new jobs through which incomes are generated.

The social dimension of better infrastructure is that it increases access to basic social services, thus improving the living conditions of the poor. The subsequent effect of infrastructure development arises from fiscal revenue generated from it. As fiscal revenue increases through growth, additional budget can be generated for programmes that improve the living conditions of the poor. The theoretical exposition presented above has indicated that the link between infrastructure and poverty is not simple, but is rather a complex one. Infrastructure development can directly or indirectly lead to poverty reduction. It has also been emphasized that the extent to which infrastructure leads to poverty reduction through economic growth depends on the quality of governance and the institutional setting.

In general, access roads in rural and urban areas make only a modest contribution to national income growth, but they are likely to have a direct and significant impact on the daily life of the poor. On the other hand, inter-city transport modes such as trunk roads, rail and shipping are of strategic significance to a national economy. They are provided with the objective to stimulate and facilitate national income growth; their impacts on poverty reduction are likely to be indirect. The process through which the benefits of transport infrastructure development and policies lead to improvements in the standard of living of the low income groups often involves many links, and the final general equilibrium outcomes and incidence pattern across various groups are very difficult to predict (Prud'homme, 2004) and World Bank (2004)

Development in transport infrastructure improves access to economic opportunities by reducing transport costs. Provided transport-market structures are reasonably competitive, this will be reflected in a reduction in prices for both freight and passenger services. Again, under competitive conditions, significantly predictable consequences will result. These include lower market prices for final products (both rural products and consumer goods), spatial extension of the market (due to the transport-induced changes in production and consumption patterns), higher personal mobility, and stimulation of socio-economic activities. In general, this dynamic process can be expected to benefit all income groups in society in the form of real income effects and increased opportunities. In addition to improving accessibility, transport infrastructure development affects employment. The provision of transport services, including the construction and maintenance of transport infrastructure, generates demand for labour (often unskilled labour) and provides income earning opportunities for the poor. If a transport project generates jobs for the poor who are otherwise unemployed or under-employed, then it contributes to the reduction of poverty. In many developing countries, the construction aspect of transport sector development is often viewed equally as important as the service aspect of the sector in promoting economic growth.

2.2 Review of Empirical Literature

In the literature on public infrastructure and economic development, the majority of empirical studies have been concerned with the question of whether or not infrastructure contributes towards output and productivity growth. The basic premise is that public investments in infrastructure can raise private output and productivity in both direct and indirect ways. Directly, public infrastructure services are thought of as intermediate inputs that enter into a firm's production process in the same way as private inputs (e.g. labour and private capital),while the indirect effect arises from the role of public infrastructure in augmenting the productivity of other private inputs. The selection of an appropriate paradigm provides us with some clue as to the likely effects of transport infrastructural investment; the issue is ultimately an empirical one. Today, there is a vast body of researches that examines the relationship between transport infrastructure development and economic growth with very few of them being on the impact of transport infrastructure improvement on poverty level. These studies have been carried out mostly in developed countries while little seems to have been done in developing countries. In some of these studies, cross-sectional and time series data were utilised.

2.2.1 Empirical Evidence from Developed Countries

Empirical research on the impact of infrastructure emerged recently, following the seminal work of Aschauer (1989), which has boomed over the last twenty years. Literally, hundreds of empirical works have been devoted to assess the effects of infrastructure on growth, productivity, poverty, and other development outcomes, 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), Straub (2007) and the work of Ayogu (2007) on one hand and David and Elizabeth (2000), Khandker, Bahkt and Koolwal (2006), and Dercon and Krishnan (1998) among others have considered the important of infrastructure on economic growth on the other hand.

2.2.1a Infrastructure Development and Economic Growth

Aschauer (1989), and Munnell (1990), estimated the macro effect of infrastructure investment on American economy based on annual data for the United States, their time-series production function estimates indicate a very strong contribution from aggregate public infrastructure to private sector output. Aschauer (1989) finds that the elasticity of national GDP to infrastructure was high in the United States of America (USA), roughly 0.4 for total public capital and 0.24 for core infrastructure. Munnell (1990a) estimates that the elasticity of non-military expenditure on growth is between 0.31 and 0.39. Using Cobb-Douglas translog aggregate production function and data of 48 States in the USA in 1970-

1986, Munnell (1990b) measures the positive output elasticity of development of highway, water supply, and drainage, as well as investment on government offices, hospital, and educational building.

These studies have been widely criticised for yielding implausible results due to several methodological drawbacks including omitting the influence of energy prices and the pace of technological changes, spurious regressions due to the non-stationary nature of the data, and possible endogeneity of public capital (e.g. Tatom, 1991 and 1993; Munnell, 1993; Hulten and Schwab, 1993; World Bank, 1994; and Gramlich, 1994). At the state level, many production function studies (e.g. Costa et al., 1987; Munnell, 1990b; and Garcia-Mila and McGuire, 1992, Williams and Mullen, 1992), albeit yielding the output elasticities that are lower than national estimates by both Aschauer and Munnell, have also been questioned on econometric grounds. Apart from simultaneity bias, another major criticism of these state-level studies has centred on the absence of controlling for state-specific characteristics (e.g. climate, topography, geographical location, and resource endowment) that may influence the overall productivity of firms within a state (e.g. Holtz-Eakin, 1994; Evans and Karras, 1994; Baltagi and Pinnoi, 1995; and Garcia-Mila et al., 1996).

Similarly, Nadiri & Mamuneas (1994) analyse the effect of public infrastructure investment on the cost structure and performance of manufacture, and provide evidence of significant positive productivity effect. Bougheas, Demetriades and Mamuneas (2000), based on the endogenous growth model (Romer, 1987), introduce infrastructure as a technology which can reduce the costs of intermediate products, and conclude that infrastructure investment is positively related with cost-reducing specialization with manufacture data, that and there is robust “inverted-U shape” non-monotonic relation between infrastructure investment and economic growth with cross-section data. Fernald (1999) examines the relation between construction of inter-state highways in the USA in 1950s and 1960s and the growth in 1970s and then proves that transport investment is productive. For the same period of time, he points out that the productivity effect of transport to growth is once-and- for-all, instead of a permanent one.

Easterly and Rebelo (1993) use cross- section data of more than 100 countries between 1970 and 1988 and find out strong correlation between investment in transport and telecommunications and growth; the contribution of transport to growth is between 0.59 and 0.66. Demetriades and Mamuneas (2000) use panel data of 12 OECD countries to find out positive long-run effect of transport investment on production and demand. However, many others find out that the relation between transport investment and growth is either insignificant or even negative. Holtz-Eakin (1994) classifies public investment into four sub-groups: education, road and highway system, drainage system and public utilities. Although road and highway investment take a share of 34.5% in total public spending, there is no significant evidence of its positive effect on growth. This notwithstanding, studies have shown that the positive effect of transport investment on growth is tiny or even neglectable (Hulten and Schwab, 1991; and Garcia-Mila, McGuire and Porter, 1996). Tatom (1991 and 1993) shows that there are no significant productivity effects of transport investment. Evans and Karras (1994) establish their empirics with panel data of public spending of the USA between 1970and 1986, and concludes that productivity effect of transport is insignificant, a fact which offsets the positive effect of education and results in a gross negative effect of public spending on growth.

When taking these econometric problems into account, subsequent studies find weak evidence on the link between public capital and private sector production. At the national level, Tatom (1991) and Sturm and Hann (1995) find no significant evidence that public infrastructure is productive when including energy prices and time trends in regressions or using first-difference specifications. Based on usual specifications of error components for panel data analysis, state production function estimates indicate that the productivity effect of public infrastructure is much smaller than those obtained by previous studies (Andrews and Swanson, 1995) or even statistically insignificant (e.g. Evans and Karras, 1994; Holtz-Eakin, 1994; Baltagi and Pinnoi, 1995; and Garcia-Mila et al., 1996).

In another stream of research, many studies have employed the duality between production and cost functions to investigate the productivity effect of public infrastructure. This is in contrast to studies based on an estimation of a production function in estimating a cost function in various forms revealing consistent evidence of production cost savings and productivity growth associated with public capital provision in manufacturing industries using data from the United States of America (Nadiri and Manuneas, 1994; Morrison and Schwartz, 1996; and Cohen and Paul, 2004), the United Kingdom (Lynde and Richmond, 1993a), and West Germany (Seitz, 1993; and Seitz and Licht, 1995). Broadening the cost function analysis to explore the cost saving and productivity effects in other industrial sectors, some studies have confirmed the link between infrastructure and reduced production costs for 35 two-digit industries of the USA economy (Nadiri and Mamuneas, 1998), and for three sectors of the West German economy: manufacturing, construction, trade and transport (Conrad and Seitz, 1994).

Fernald (1999) similarly estimates huge rates of return on investment in roads for US industries that use roads more intensively: in terms of a Cobb-Douglas specification like the ones used in state-level studies. He finds an output elasticity of road investment around 0.35. After noting that this is consistent with the initial results from Aschauer, he argues that the massive interstate highway network built in the 50s and 60s generated a one-time boost in productivity (of approximately 1%) rather than a permanent one, also explaining the post-1973 slowdown in productivity. In short, initial large investments in infrastructure may produce very high rate of returns, but this is no guarantee that additional investments would also be characterized by the same returns. In this view, Aschauer's results adequately captured the pre-1973 period. Additionally, this line of argument coincides well with the idea that once basic infrastructure is in place, adequate investment in maintenance might actually have a higher rate of return than new investment, as argued in Hulten (1996), who uses a cross-country sample similar to that of Easterly and Rebelo (1993) and finds that the impact of an effectiveness index of infrastructure is more than seven time larger than that of public capital itself (see also Rioja, 2003).

In recent years, many researchers have investigated the productivity effect of public infrastructure using a vector autoregressive (VAR) approach. Despite being recognised as "atheoretical" in the sense that less a priori information or theoretical underpinning is required to explicitly specify structural relationships between various sets of economic variables, the VAR approach has one major advantage. It allows for dynamic interactions among the variables of interest, treating all variables as jointly determined in its model specification and estimation. Therefore, the major criticism about the endogeneity of public capital can be explicitly addressed with the VAR framework.

Interestingly, many VAR studies provide weak evidence that there has been a strong linkage between infrastructure investment and private production as suggested in the previous empirical literature. McMillin and Smyth (1994), for example, use U.S. national time series data to estimate VAR models and find no clear evidence of a significant effect of publicly provided capital on private output. The VAR estimation by Pereira and Flores de Frutos (1999) reveals that public capital is productive but its contribution to private sector output in the U.S. is substantially smaller than that found in the prominent work of Aschauer (1989). In the Australian context, Otto and Voss (1996) find that the estimated elasticity of output with respect to public infrastructure within the VAR framework is approximately one-half of their earlier estimates using a production function approach (Otto and Voss, 1994). However, exceptions are a VAR analysis by Sturm et al, (1999), which shows that public investments in aggregate infrastructure and transport infrastructure have a positively significant impact on GDP in the Netherlands, and the estimated VAR models of Pereira and Roca-Sagales (2003), which identify a strong contribution of public capital to private sector output in the economy of Spain.

Empirical evidences at international level using cross sectional and panel data sets are also reviewed. Aschauer (1989c) studies the economic contribution of public investment, of which transport capital forms part for the G7 countries using panel data for the period of 1966-1985. He specifies a Cobb-Douglas function and comes out with an output elasticity of 0.34 to 0.73 which clearly shows the importance of public investment in productivity and growth. In a subsequent study, Aschauer (1995) also uses a total productivity growth function with fixed country and time effects to study the similar effect for 12 OECD countries over the period of 1960-1988. He reports a contribution between 33

– 55% of the non-military public capital stock to output growth. Nourzad and Vrieze (1995) also study a panel data for 7 OECD countries over the period of 1963-88 on the effect of public investment on output. Using similar econometric specification as Aschauer (1989c) but controlling for energy input price and taking into account random effects, they found a relatively low but significant output elasticity of 0.05 with respect to public investment. Canning (1999) estimates an aggregate production function for a panel set of 77 countries. He uses annual cross country data for the period of 1960-1990 and his production function (a Cobb-Douglas function) incorporated labour, physical capital, human capital and infrastructure variables (number of telephones, electricity generating capacity and kilometres of transportation routes). His approach includes panel data co-integration methods, which took account of non-stationary nature of data and are also robust to reverse causation. Canning found that the elasticity of output with respect to physical capital is around 0.37. However he observed no significant impact of elasticity generating capacity, or transportation structure on growth. But since these types of infrastructure capital have already been included in his physical capital stock, the implication was that that they had the normal growth effect of capital as a whole, thus justifying their importance.

In another study, Canning and Bennathan (2000) build on the above data set (they extended the sample to 89 countries) and methodology to analyse the hypothesis. The other important difference as compared to Canning's (1999) study was that they also estimated a translog specification which allows for flexibility in the elasticity of substitution between factors and also flexibility in the pattern of rates of returns across countries. The authors report, in the Cobb Douglas case, positive rates of return for the case of paved roads

(0.048-0.083). When both are added together, they retain their positive coefficient and are statistically significant. Results from the trans-log function show that both kinds of infrastructure were necessary but not sufficient by themselves to trigger large changes in output. The study also revealed that infrastructure is more productive with higher levels of physical and human capital.

However we should also note that other studies at international level have proved to be insignificant with mixed results of public investment on productivity and output growth. For instance, Ford and Poret (1991), using data on non-military public capital stock, and also including privately provided infrastructure services as well, for 11 OECD countries over the period 1960-1988, found that his broad definition of infrastructure (including structures in electricity, gas and water and structures in transport and communication) had significant effect on productivity and output for 5 of the 12 countries, namely, US, Germany, Canada, Belgium and Sweden. He uses a total factor productivity growth and Autoregressive of order 1 and 2 models for his estimations. Other researchers report that the importance of infrastructure on economic development has been overemphasised. For instance, Taylor-Lewis (1993), using public capital data from Ford and Poret (1991) for the G7 countries over the period of 1970—87, but regressing a Cobb-Douglas function, contends that the contribution of public physical infrastructure to output was insignificant.

Romp and de Haan (2005), while reviewing the literature, note that 32 of 39 studies of OECD countries found a positive effect of infrastructure on some combination of output, efficiency, productivity, private investment and employment. (Of the rest, three had inconclusive results and four found a negligible or negative impact of infrastructure). They also review 12 studies that include developing countries. Of these, nine find a significant positive impact. The three that find no impact rely on public spending data which is a notoriously imprecise measure, especially for cross-country analysis. One other meta-analysis also shows a dominance of studies that point to a generally significant impact of infrastructure particularly in developing countries. However, Lahiri and Yao (2006) question the composition of transport infrastructure data used in previous studies and develop a leading economic indicator for the US economy based on transportation sector data. As the US economy has shifted from manufactured goods to service goods, the Bureau of Economic Analysis has had a general problem with counting service sector output as opposed to physical goods. Lahiri and Yao (2006) develop the Transportation Services Index to provide the BEA and the National Bureau of Economic Research with better measures of service sector performance. The Transportation Sector Index is being maintained by the Bureau of Transportation Statistics of the US Department of Transportation. The data series is currently considered preliminary in nature.

Kim (2006) in his dissertation on the effects of infrastructure on economic growth explores the impact of highway infrastructure on regional labour markets. Kim tests models both on a state (51 states) as well as for 81 Metropolitan Statistical Area (MSA). By studying the impact of changes in highway demand as well as highway supply, the author is able to estimate over a period of 19 years (1982-2000) the elasticity of net immigration of labour to a given region with respect to highway supply or demand. He gets an elasticity ranging between +0.129 and +0.454 for highway supply (as measured by per capital lane miles) and an elasticity of -1.511 to -0.015 for the demand for highways (as measured by vehicle miles travelled per lane mile) as compared to state economic performance. Both exhibit the expected sign for the elasticity. Additions to the supply of highways cause a positive impact on state economic performance and additional congestion causes a net reduction in the state economic performance. Kim also examines the location specific amenities including and excluding highway services. Interestingly, he defines New York State as an amenity poor state if we do not consider transportation resource but an amenity rich state if we include transportation services. Therefore, in Kim's ranking, transportation serves as a key differentiator in terms of social amenities.

In addition, Berechman, Ozmen-Ertekin and Ozbay (2006) model the impact of transportation capital investments at the state, county and municipal levels using panel data of 48 US states (1990-2000). They discover a significant impact of private and public capital on output at the state and county levels, but this impact became insignificant at the municipal level. The authors theorize that the impact diminished as the scale of study decreased due to significant spillover effects of investments in surrounding regions. The authors test and confirm the results of Hansen (1965) which states that the impact of highway capital is greatest in economies that are classified as intermediate in terms of their economic intensity. This was later supported by a further finding by the authors in 2007 by studying the impact of highway investment on economic development. Using data at the county level for New York and New Jersey, the authors found that investments in highways impacted output with a significant time lag and that there was a strong level of correlation between current output and output in prior periods. Although, most of these works are supported by recent studies despite their criticisms based on methodology and data estimated, among these critics are Montolio and Sole-Olle (2009) and Stephen et al., 2012. Sole-Olle (2009) support the idea, that productive public investment in road infrastructure has positively affected relative provincial productivity performance

Recently, Stephen.et. al., (2012) argued that, empirical evidence of the effects of transport and infrastructure investment on economic outcomes has been provided at the macro-level (for a review see Straub, 2011). This literature has focused the impacts of investment in roads and public infrastructure on several economic outcomes, such as aggregate productivity, growth or employment, finding mixed results (Gramlich, 1994; Martin and Rogers, 1995; Boarnet, 1998; Chandra and Thompson (2000) and Jiwattanakulpaisarn et al, 2010). Some recent papers have estimated, using careful identification strategies, the effect of roads on other outcomes in the US: urban growth (Duranton and Turner, 2011), road traffic (Duranton and Turner, 2011), sub-urbanisation (Baum-Snow, 2007), commuting patterns (Baum-Snow, 2010) or demand for skills (Michaels, 2008). In these works the effect of transport is usually capture by connectivity to the network (either connected or not) or by some measure of the density of the network within some geographic boundaries and the focus is on correct identification of (long-run) effects. Other studies (Faber, 2012; Donaldson, 2010) have focused on developing countries (highways in China and railroad in colonial India) to study the effect of the reduction of transport costs due to transport networks development on trade integration and the consequent economic development. Only a handful of studies have looked at the effect of increased accessibility on firms' outcomes, and they have mostly focused on the analysis of firm relocation (Coughlin and Segev, 2000; Holl, 2004a and 2004c) or firm birth (Holl, 2004b, Melo et al, 2010), all finding positive relationships between the presence of roads and firms' relocation and creation. Holl (2011) studies the relationship between market access and firm productivity when market access changes due to road investments and changes in population. She exploits data for a panel of firms during a period of intense road construction in Spain. When using plant fixed-effects the estimates are imprecise, so she relies on GMM techniques in order to overcome endogeneity problems, with which she finds positive significant effects of markets access on productivity. Li and Li (2010) use the construction of the Chinese highways system to evaluate the impact of improved transport infrastructure on the amount of inventories held by firms, arguing that the reduced inventories due to road construction improve efficiency and aggregate productivity.

Therefore, based on the above, Stephen.et. al., (2012), examined the impact of road transport infrastructure improvements on firms by using Firms' exposure to transport improvements as a measured of changes in employment accessibility (or effective density) along the road network in Britain, linked by detailed geographical location (10,500 wards) to the British road network and major improvements in it between 1998 and 2008. Estimates are based on an instrumental variables strategy using two-stage least squares. They find that, road improvements encourage firm entry or discourage exit but do not affect existing firms. This was in contrast to, Tatom (1991 and 1993), Holtz-Eakin (1994), Holtz-Eakin and Schwartz (1995) and Garcia-Mila et al. (1996) suggesting little evidence of an effect from infrastructure to income growth in a panel of U.S. state level data, particularly when fixed effects are included.

2.2.1b Infrastructure Development and Poverty Reduction

Most of the empirical works in developed countries have focused on economic effects of transport infrastructure development. This is because improved productivity due to infrastructure investments is assumed to create job opportunity and income redistribution, and thereafter reduce poverty level of an economy. However, and this is most glaring in the literature, there are few studies that concentrated on some macro-issues outside productivities.

Some empirical studies examining the productivity effect of public infrastructure, reviewed earlier, have shed some light on these relevant issues. However, the results obtained from these studies are mixed. By estimating cost and input demand functions simultaneously, most studies find that public capital and labour are substitutes (e.g. Shah, 1992; Lynde and Richmond, 1992; Lynde and Richmond, 1993a; Seitz, 1993; Seitz, 1994; Conrad and Seitz, 1994; Nadiri and Mamuneas, 1994; Seitz, 1995a; Seitz and Licht, 1995; and Nadiri and Mamuneas, 1998). In contrast, the complementary relationship between public capital and labour demand has emerged from studies estimating profit functions (i.e. Deno, 1988; and Crihfield and Panggabean, 1996) and translog production functions (e.g. Costa et al., 1987; Munnell, 1990b; and Moomaw et al., 1995).

In addition to the productivity effects that could lead to changes in labour demand, other researchers suggest that public infrastructure investments also affect the supply side of the labour market (e.g. Eberts and Stone, 1992; Dalenberg and Partridge, 1995; and Dalenberg et al., 1998). As public infrastructure is one type of household consumption good, improvements in the availability and quality of infrastructure services could enhance residential amenities, thereby stimulating in-migration, which in turn increases the supply of labour. More specifically, Dalenberg et al. (1998) argue strongly that studies using the production or cost function approach to examine the role of infrastructure in employment changes may yield underestimated results because such an approach, which considers the importance of public infrastructure from a firm perspective, ignores the fact that considerable benefits of improved infrastructure also accrue to the household sector.

When taking into account the influences of infrastructure provision on both labour demand and labour supply, several studies find a positive and significant association between public infrastructure investments and employment. Eberts and Stone (1992) who estimate a structural model of labour demand and labour supply come to the conclusion that public infrastructure stocks are positively associated with employment. A subsequent work by Dalenberg and Partridge (1995) and Dalenberg et al. (1998) obtains similar results when estimating a reduced form equation of employment growth in which public capital and other factors influencing the demand for and the supply of labour are included. They however, note a negatively significant relationship between employment and highway expenditures. The employment effects of public infrastructure have also been empirically investigated by several different approaches. Various researchers (e.g. Munnell, 1990b; Mofidi and Stone, 1990; Crane et al., 1991; Lombard et al., 1992; Thompson et al., 1993; Singletary et al., 1995; Haughwout, 1999; and Islam, 2003) estimate a single equation regression that incorporates several measures of infrastructure investment and other exogenous factors that are hypothesized to affect employment.

Another group of econometric studies estimate simultaneous equation models of population and employment in which the variables representing the availability of public infrastructure services are included (e.g. Carlino and Mills, 1987; Boarnet, 1994; Luce, 1994; and Clark and Murphy, 1996). Other studies estimate vector auto-regression models and perform Granger causality tests to examine whether or not employment is temporally influenced by infrastructure investments (e.g. Eagle and Stephanedes, 1987; Stephanedes, 1990; Zografos and Stephandes, 1992; Seitz, 1995b; Pereira and Flores de Frutos, 1999, Pereira, 2000, and Ozmen-Ertekin, Ozbay and Berechman (2003). Generally, estimated results from most of these studies indicate a positive impact of public infrastructure. However, exceptions are some studies showing that the relationship between infrastructure and employment is insignificant (Eagle and Stephanedes 1987) and Thompson et al, (1993) or negative (Lombard et al, 1992; Pereira and Flores de Frutos, 1999, Pereira, 2000, and Banister and Berechman (2000).

For instance, Banister and Berechman (2000) using a microeconomic three sector model (production, household and transportation) illustrated 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 increase employment. However, they have been criticized in another work by Ozmen-Ertekin, Ozbay and Berechman (2003) in examining the impact of accessibility index to 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. Their analysis suggests that further highway improvements provide small economic returns: a dollar spent to increase interstate highway capacity could increases private sector output just $0.15 in the long run (more than a decade), with even smaller productivity gains from expansion of lower functional road categories. Hymel (2009) examines the impact of traffic congestion on employment growth in large U.S. metropolitan areas. The study concludes that congestion reduces employment growth, particularly over the long run in highly congested places. The analysis suggests that in a large congested city such as Los Angeles a 10% increase in congestion would reduce subsequent long-run employment growth by 4%.

On the contrary, some studies suggest that highway investments that stimulate sprawl are economically harmful. For instance, a study of 44 US metropolitan regions by Nelson and Moody (2000) maintains that controlling for other factors, per capita economic retail and service activity declined as the number of urban beltways increases. They conclude that beltways deconcentrate people and businesses to levels that reduce for industrial agglomeration efficiencies. Although Graham (2007) shows how transport investments stimulate agglomeration economies, in a UK-based study, he finds particularly large agglomeration effects (i.e. increased productivity) for the transport and communication sector, finance sector and business services. However, some of these sectors might locate in large cities, not only due to agglomeration aspects but due to their central position in long distance transport networks (Hymel, 2009). Jiwattanakulpaisarn et al. (2010) have examined some of these criticisms by separating them into three sectors and allowing for reversed causal directions from the economy to road investments. They find that interstate and non-interstate road investments in the US are determinants of state employment growth in the service sector. However, gains from improvements in interstate highways may have negative spillovers, shifting services and construction jobs away from other states. Further, Jiwattanakulpaisarn et al. (2010) contend that the effects are bi-directional. State highway investments, which are at the same time a response to service sector growth, may trigger manufacture industries to relocate to larger and more productive units leading to state employment losses. They further argue that it is essential to distinguish between growth (nationwide) and redistributive effects, though it might be difficult since these effects are interrelated.

This type of distributional effects combined with increased productivity is also likely to occur in the service sector. If small businesses previously protected by distance become open for competition after road investments, the result might be concentration of services and retail due to scale economy and the attractiveness of large centres with a broader supply. However, productivity is likely to increase due to increased sales per employee. Graham (2007) argues that agglomeration effects exist at all regional levels. However, Johansson (2007) argues that since infrastructure investment affects spatial organisation, this aspect has to be addressed in a more direct way like firm's accessibility to labour supply, input suppliers, customers, and to knowledge providers. For households, accessibility to jobs and services is relevant. He further emphasises the physical aspects of the infrastructure investment such as time distances, travel costs, capacity and comfort. Johansson (2007) makes a distinction between intra-regional and extra-regional market phenomena. The local markets are characterised by local competition and face-to-face contact between buyers and sellers. The growth in such markets is endogenous, self-generated and depends on population growth and regional enlargement (which in turn might be dependent on localisation changes of local activity). Extra-regional market phenomena are characterised by exogenous demand, global competition, and infrastructure designed to establish accessibility to global networks, low transaction costs, and scheduled delivery systems.

Holl (2007a) declares that after massive motorway investments in Spain (1980-2000), the average distance (measured as a straight line) from the 7939 Spanish municipalities to the nearest inter-regional motorway was reduced from 60 km to 20 km. However, the relation between motorway access and industrial location was complex and depended on type of industry, distance to large cities, etc. After the completion of the whole network, there seemed to be a spread of activities from large urban agglomerations to sites along the motorway. Thus, in this latter phase of infrastructure development impacts occurred close to the motorway corridors; and for manufacturing industries the importance of nodes is reduced while distance to corridors is important. For other sectors where agglomeration effects are important, clustering at nodes is the trend (see Graham, 2007). This is more elaborated by Jon Inge and Joachim (2011), who present results from a statistical analysis of wider economic benefits of 102 major road projects in Norway (completed 1993-2005) with findings from three selected case studies. A quantitative analysis reveals a rather weak relationship between investment level and population development. Effects of infrastructure investments on employment, income and industrial development were not found. Case studies show that linking together regional centres within a travel time of 45-50 minutes may lead to a consolidation of local supply of services and local labour market and reduced leakage to nearby larger cities. The success of economic base industries, such as maritime industries, offshore supplies and tourism, is to a large extent determined by international trends rather than local infrastructure projects. Nonetheless, road investments seem to be a necessary requirement for the adoption of contemporary just-in-time production patterns, which rely heavily on road transport.

2.2.1c Economic Growth and Poverty

Economic growth has continued to occupy the centre stage in development literature. There have been studies, arguing that pattern of growth is important from the point of view of its effectiveness in reducing poverty (World Bank, 1990; Lipton and Ravallion, 1995; Squire, 1993; McKay, 1997; and DFID, 1997). Squire (1993), for example, recognizes that "economic growth that fosters the productive use of labour, which is the main asset owned by the poor, can generate rapid reductions in poverty." Yet, his empirical analysis does not include this aspect. Rizwanw (2004), worked on this weakness by examining the nexus between economic growth, employment and poverty reduction using OLS. The study shows that economic growth has positive effect on employment which has influence on poverty reduction. The paper concludes that employment could be a medium through which economic growth could affect poverty.

Ravallion and Chen (1997), Dollar and Kraay (2002), and Bourguignon (2003) all agree that aggregate growth significantly reduces poverty, while Quah (2001) makes the important point that in the dynamics of income distributions, first moment effects (i.e. aggregate growth) historically dominate second moment effects (i.e. changes in income distribution) in determining the proportion of the population in poverty. Later work has corroborated these first-order earlier conclusions. Adams (2004), Fosu (2008)) and a number of other papers have explored further nuances. For example, Bourguignon (2003) explores the heterogeneity of the growth elasticity of poverty, finding that it is a decreasing function of both income level and degree of income inequality in a country.

In conclusion, although, the literature on the effect of public infrastructure on private sector productivity is already crowded and extensive, the magnitude and significance of the productivity effect has been a subject of continuing controversy. The empirical findings from the recent literature vary dramatically, ranging from no role to a very strong role of public capital investment, according to the geographical scale of analysis, data set on this variables, and econometric modelling framework. Given the different empirical strategies employed, one would expect the lack of clear-cut results. Using solid and well-ground econometric methodology to address several econometric issues (e.g. endogeneity, spurious correlation, omitted variables, and heterogeneity of cross-sectional units), many of the previous works tend to suggest that the contribution of public infrastructure to private productivity and output is modest or even insignificant. While this highlights the complexity and substantial challenges in examining the link between infrastructure and productivity, there remain some relevant issues and gaps in empirical knowledge that limit our understanding of the role of transport infrastructure in pace of economic development.

2.2.2 Empirical Evidence from Developing Countries

Due to data availability, prevailing studies in developing countries are mainly on macro level and basically most of the literature has focused on the development impact of infrastructure in China, India, Turkey, Pakistan and most of the countries in Africa . Most of the studies deal with the growth and productivity effects of infrastructure development.

2.2.2a Infrastructure and economic growth

An earlier study, Sylvie (2001), examines data from China to establish that infrastructure might explain the regional disparities of economic development. Xu et.al (2007) formulated a two-stage correlation between highway transport and economic development. In a more empirical work by Huang and Harata (2010), there is an employment of a production function method and a VAR (Vector Autoregression) approach to study the relation with national empirical data (1978-2004) of China. The result of production function method is discussable because the elasticity of infrastructure to the output is negligible and may contradict common knowledge. The explanation for this includes data limitation and potential unfixed effects. It is also shown that more developed areas benefit more from infrastructure than undeveloped areas. The VAR method shows that infrastructure counts for a significant part of economic growth and that a shock in infrastructure might lead to significant short-term effect on economic growth but has small long-term effect. The causality of the infrastructure and economic development is vague in statistic meaning but it seems more likely that infrastructure explains the economic growth but not reversely. This was supported by Pradhan (2010) who explores the nexus between transport infrastructure (road and rail), energy consumption and economic growth in India over the period of 1970-2007. He finds evidence of unidirectional causality from transport infrastructure to economic growth.

In addition, Sadananda (2006) juxtaposes whether or not expansion of railroad transportation facility can act as a means to supplement domestic investment for achieving a higher level of economic growth in India by constructing a railroad transportation index (a proxy for railroad transportation facility) using Principal Component Analysis (PCA), a special case of factor analysis. In order to examine the long-run relationship among real economic growth, real domestic investment and railroad transportation facility during the period of 1971 – 2005, time series tools (i.e., unit root, causality and cointegration tests) is used. The findings of the paper are: (i) there exists a high degree of positive correlation between railway route length and road length; (ii) domestic real investment causes not only real economic growth but also railroad transportation facility; (iii) higher domestic real investment and more railroad transportation facility lead to higher real economic growth in India in the long- run. The above findings suggest that if India wants to achieve 8 per cent economic growth target as mentioned in the Tenth Five Year Plan (2002-2007), it should take some special measures by encouraging private investment in infrastructure, especially in construction of railways and roads.

Kamps (2005) gives a brief survey of the studies that apply VAR/VECM methodology to analyze the dynamic effects of public capital. The majority of these studies have found that the long term effect of public capital on output is positive. Most of the studies that are not surveyed by Kamps (2005) use VAR/VECM methodology also affirm that public capital increases output (Ramirez, 2000; Ligthart, 2002; Everaert and Heylen, 2000; Looney, 1997; Ramirez 2004; Mittnik and Neumann, 2001; Pereira 2001; Kawakami and Doi, 2004; and Kamps, 2005). The only exception is the study by Ghali (1998) that investigates for the impact of the public investments on Tunisian economic growth over the period 1963-1993. Ghali (1998), using a vector error correction model, claims that, public investments have contributed negatively to Tunisia's economic growth. The studies that emphasize the role of infrastructure variables separately are very limited in the literature. Among others, Looney (1997) analyses the role of infrastructure variables such as energy and transport in Pakistan's economic expansion for the period of 1973-1995 based on a vector error correction model and finds that public facilities expand largely in response to the needs by private sector.

Although there is a voluminous literature on the dynamic effects of public capital using VAR methodology in other countries, for Turkey such studies are very limited (Ismihan, Metin-Ozcan and Tansel, 2005; and Karadag, Deliktas and Onder, 2004). 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 of 1980-2000 using a VAR model. They show that public capital affects private output positively in aggregate and in all regions apart from the Black Sea and Mediterranean regions. However, public capital is found to crowd out private employment and capital in the aggregate. At the regional level, only in the Marmara region public capital is found to crowd in both private capital and employment. Ismihan et al. (2005) corroborates the above findings at the aggregate level. Their study differs by studying the effects of macroeconomic instability on public and private capital accumulation and growth in Turkey over the period of 1963-1999 using a VECM. The results show that while total public investment has a positive effect on output of Turkey, it crowds in private investment in the short run to medium run, but crowd it out in the long run. In the paper, this last finding is attributed to the increasing and chronic macroeconomic instability of the Turkish economy. Macroeconomic instability damages, or even destroys, the complementarity between public and private investment in the long run.

In addition, Aysegul, Muhteşem and Merter (2012) analyse the effect of transportation-communication capital on gross domestic product in Turkey for the period of 1968-2006 based on a vector error correction model. Since transportation-communication capital is a kind of infrastructure capital, in the related literature, its impact on the level of output and productivity has generally been investigated together with the other public infrastructure capital. The study analyses transportation- communication capital separately and the result shows that both coefficients are found to be statistically significant. The transportation-communication capital appears to exhibit a positive and significant effect on output for Turkish economy. For the period of the study, it appears that a ceteris paribus 10% increase in expenditure in transportation-communication infrastructure would have been expected to increase output in Turkey in the long run by 3%, which is a remarkable effect. This finding is reasonable within the framework of recent related literature. For example Ramirez (2004), using a VEC model, reports a 3.7% increase in output as a result of a 10% ceteris paribus increase in expenditure on public capital for Mexican economy.

Boopen (2006) reviews literature on panel data analysis on economic impact of infrastructure and finds out that most empirical works were examined in developed countries and could not therefore be used in drawing economic policy for developing countries. He therefore analyses the contribution of transport capital to growth for a sample of 38 Sub- Saharan African countries using both cross- sectional and panel data analysis. In both sample cases, the analysis concludes that transport capital has been a contributor to the economic progress of these countries. Zou et al. (2008) analyse data from China and discovers that higher economic growth level comes to a greater extent from better transport infrastructure and that public investment on road construction in poor areas is crucial to growth and poverty alleviation. Moreover, Keho and Echui (2011) examine the temporal relationship between transport infrastructure investment and output in Cote d'Ivoire over the period of 1970-2002. Using cointegration and causality tests within a multivariate framework, it was found that the public investment in transport infrastructure, private investment and economic output are cointegrated. The results of the Granger causality tests reveal that public investment in transport does not have a causal impact on economic growth; conversely economic growth has a causal impact on transport investment

Romp and de Haan (2005), while reviewing the literature, note that 32 of 39 studies of OECD countries found a positive effect of infrastructure on some combination of output, efficiency, productivity, private investment and employment. (Of the rest, three had inconclusive results and four found a negligible or negative impact of infrastructure). They also review 12 studies that include developing countries. Of these, nine find a significant positive impact. The three that find no impact rely on public spending data which is a notoriously imprecise measure, especially for cross-country analysis. Other meta-analyses also show a dominance of studies that point to a generally significant impact of infrastructure particularly in developing countries. Calderon and Serven (2004) report that 16 out of 17 studies of developing countries find a positive impact as do 21 of 29 studies of high income countries. Briceno et al. (2004) carry out a similar review of about 102 papers and reach similar conclusions.

Reinikka and Svensson (1999) use data from Uganda's industrial enterprise survey to test the impact of poor infrastructure as reflected by an inadequate supply of electricity on firm level investment. Their results show that unreliable electricity is a significant investment deterrent. In another work, Deichmann et al, (2002) it is observed that, the quality of transport infrastructure makes a difference in growth performance in different areas while Dercon et al. (1998) come to the conclusion that there is complementary relation between physical and human capital accumulation and transport development, which in all can contribute to growth and poverty alleviation. This finding is in agreement with the work of Demurger (2001) who examines data of 24 provinces of China (excluding municipalities under direct control of central government) between 1985 and 1998, and points out that the inequality of transport infrastructure is one of the main factors leading to growth inequality across provinces.

Estache, Speciale and Veredas (2005) present pooled OLS growth regressions based on an augmented Solow model, including a variety of infrastructure indicators. Their main conclusion is that roads, power and telecommunications infrastructure, with the exception of water and sanitation, contribute significantly to long-run growth in Africa. Other studies base their studies on the same production function approach, such as those by Ayogu (1999), and Boopen (2006) make similar findings. In the same vein, Perkins, Fedderke and Luiz (2005) use a detailed database on infrastructure investment and capital stocks, spanning as long as a hundred years, to test for the existence of a long-run relation between different infrastructure measures and GDP. Their results suggest a bi-directional relation in most cases.

Perkins and Luiz (2005) use endogenous growth theory and show that the investment in infrastructure leads to economic growth in South Africa directly and indirectly (the latter by raising productivity of capital). Though, there is a weak evidence of feedback from output to infrastructure, the findings of infrastructure growth impact was robust. Fedderks and Bogetic (2009) observes that past studies in South Africa have shown the effect of public infrastructure investment on economic growth to be ambiguous and contend that this result of not controlling the endogeneity of infrastructure investment. However, in an industry level panel study on South Africa's manufacturing sectors by Fedderks and Bogetic (2009) there is a significant positive impact of infrastructure on productivity growth even after controlling the endogeneity effect of infrastructure measures. Similarly there have been some cross country studies on impact of infrastructure on economic growth in developing countries which show positive and significant relationship between these variables (Canning and Fay, 1993; Easterly and Rebelo, 1993; Roller and Waverman 2001; Calderon and Serven, 2003; Canning and Pedroni, 2004; Sahoo, 2006; and Sahoo and Dash, 2010).

Nketiah-Amponsah (2009) reveals that in Ghana, between 1970 and 2004, the aggregate government expenditure had negative impact on economic growth, noting however that disaggregated expenditures (in the short run) on health and infrastructure had positive impact while education expenditures had negative impact on growth and that the political economy variables such as governance, political instability were significant in explaining growth. In contrast to this, is the study by Rudra and Tapan (2012) that examined the effect of transportation (road and rail) infrastructure on economic growth in India over the period 1970e-2010 Using Vector Error Correction Model (VECM), they finds bidirectional causality between road transportation and economic growth, bidirectional causality between road transportation and capital formation, bidirectional causality between gross domestic capital formation and economic growth, unidirectional causality from rail transportation to economic growth and unidirectional causality from rail transportation to gross capital formation. They concluded that expansion of transport infrastructure (both road and rail) along with gross capital formation will lead to substantial growth of the Indian economy.

Nevertheless, Dissou and Didic (2011) indicate that crowding out effects of public infrastructure is sensitive to the mode of financing chosen by the government. Overall, their findings suggest that public investment in infrastructure can support private investment and sustain capital accumulation. The positive impact of public investment on private investment can be explained through the infrastructure financing channels such as public private partnerships and sub-contracting which in turn tend to crowd-in private investment.

Moreover, a study by Estache et al. (2009) shows that foreign aid funded infrastructure does produce Dutch Disease effects but that the negative impacts are dependent upon the type of investment. Furthermore, the growth effects contribute to attenuating the negative effects. The work of Vagar et al. (2013) has a similar conclusion but is more rigorous than that of Estache et al. as it takes two approaches to public investment. In the first approach, production taxes finance the additional public infrastructure investment and in the second, foreign borrowing provides resources by examining the role of infrastructure in economic growth and welfare using a dynamic CGE model linked to a micro-simulation model to estimate the macro-micro impact of public infrastructure investment. Their results reveal that public infrastructure investments have the same direction of impact whether funded by taxation or international borrowing, particularly when looking at macroeconomic gains and poverty reduction in the long run. However, in the very short run, tax financing puts a strain on output in the industrial sector and thus reduces economic growth in the short run. The financing from international borrowing has a Dutch disease-like impact in the short run, as indicated by a decline in exports.

However, most studies (see Calderon and Serven 2008a; and Sahoo, 2009) have argued that stock of physical infrastructure is more reliable than investment in infrastructure when considering empirical implications of infrastructure on economic development. For example, Estache, Speciale and Veredas (2005), cited in Calderen and Serven (2008a) present pooled linear 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. Sahoo and Dash (2009) also show for India that stock of infrastructure positively contributes towards growth and there is a unidirectional causality for infrastructure development to output growth.

Calderon (2009) provides a comprehensive assessment of the impact of infrastructure development on economic growth in African countries. Based on econometric estimates for a sample of 136 countries over the period of 1960–2005, it evaluates the impact of a faster accumulation of infrastructure stocks and an enhancement in the quality of infrastructure services on economic growth across African countries over the 15-year study period. The study findings indicate that growth is positively affected by the volume of infrastructure stocks and the quality of infrastructure services. The simulation shows that if all African countries were to catch up with the region's leader, Mauritius, in the infrastructure stock and quality, their rate of economic growth would be enhanced on average by 2.2 per cent per year, or ranging from 0.6 to 3.5 per cent.

2.2.2b Infrastructure and Poverty Reduction

Amis and Kumar (2000) investigate the relationship between urban economic growth, the provision of urban infrastructure and poverty reduction in Visakhapatnam, one of the largest ports and industrial towns in India. In the study, the authors identify many dimensions of poverty which include inadequate income, lack of assets ('no shelter, no property, no gold'), lack of support (especially for widows, deserted women and the handicapped), illness and debt. The results of this participatory study indicate that the city's growth was constrained by inadequate investment in infrastructure, especially for water and electricity. This study suggests that the provision of physical and social infrastructure is important for poverty reduction. This was in accordance with the work of Canning and Bennathan (2000) compares the relative impact of infrastructure investment in electricity generation and paved roads in 52 and 41 countries, respectively. These authors conclude that: (i) the return to investment on electricity generation is likely to be higher in low-income countries; (ii) the return on investment from paved roads is likely to be higher in middle-income countries due to the low costs of road construction in these countries relative to low-/high-income countries; and (iii) both types of infrastructure generate less return on investment when not combined with human capital interventions. The study shows that the rate of return to infrastructure investment may vary depending on the income level of the country and the type of infrastructure. The study also suggests that infrastructure in isolation has limited impacts on economic growth, and that there should be a mixture of physical and human capital investment to maximize the return.

Fan et al., (2002) are the first to link investments in infrastructure to rural poverty reduction in China. The authors use roads, electricity consumption, and the number of rural telephones as proxy variables for rural infrastructure in an econometrically estimated equation system. Their analysis of road infrastructure was quite crude, however, as the road variable was expressed in terms of the total length of all types of roads and failed to discriminate between roads of different quality. In another study, Fan, Zhang and Zhang (2002) analyse the effects of different types of public expenditure on growth and rural poverty across Chinese provinces, distinguishing between expenditure on rural education, targeted poverty alleviation, telecommunications, irrigation, power generation, agricultural R&D and rural roads. These authors find that spending on rural roads has the largest impact on poverty. The estimated elasticities with respect to road density are 0.08 for agricultural GDP per worker, 0.10 for non-agricultural employment, and 0.15 for wages of non-agricultural workers in rural areas. Among government infrastructure projects, rural roads are found to have the largest impact on poverty incidence: for every 10,000 yuan invested in rural roads, 3.2 poor persons were estimated to have been lifted out of poverty. Nagaraj et al. (2000) resort to differences in availability of physical capital and infrastructure to explain the growth disparity in 17 states in India.

Fan and Chan-Kang (2006) evaluate the contribution of roads to economic growth and poverty reduction in China. They disaggregate road infrastructure into different classes of roads to account for quality, and then estimate the impact of road investments on overall economic growth, agricultural growth, urban growth, urban poverty reduction, and rural poverty reduction. The study finds that benefit–cost ratios for lower-quality roads (mostly rural) are about four times larger than those for high-quality roads when the benefits are measured in terms of national GDP. Even in terms of urban GDP, these ratios are much greater for low-quality roads than for high-quality roads. In terms of poverty reduction, the study finds that, for every yuan invested, lower-quality roads raise far more rural and urban poor people above the poverty line than high-quality roads. Another significant finding of the study is the trade-off between growth and poverty reduction in different parts of China, implying the need to formulate different regional priorities, depending on whether economic growth or poverty reduction is more important for a particular part of the country.

Studies by Fan, Jitsuchon, and Methakunnavut (2004) in rural India, China and Thailand also estimate the effect of infrastructure investments on economic growth and poverty. The results from these studies consistently show the importance of road investments in promoting economic growth and poverty reduction. In India, public investment in rural roads was found to have had the largest positive impact on agricultural growth (Fan, Hazell, and Thorat, 1999) while in China and Thailand, road investments were found to have contributed significantly to growth in non-farm sectors in particular and overall economic growth in general (Fan, Zhang, and Zhang, 2002 and 2004). This study was supported by Ariyo and Jerome (2004), who explore the impact of infrastructural reforms (that is, implementation of privatization and liberalization in telecommunications and private investment in infrastructure) on poverty reduction. Their study note that infrastructure reforms and privatization in Africa have been carried out without considering the needs of the poor and without meeting the policy preconditions that are indispensable for their effectiveness. The consequence of this is that infrastructure privatization, rather than having a positive impact, has negatively affected the poor in Africa. The authors argue that the goals of infrastructure reforms can only be achieved if such reforms are undertaken in the context of appropriate market and regulatory frameworks.

However, the first two approaches do not give adequate attention to the direction of causality which is the beacon for effective policy formulation. Rudra and Tapan (2012) examine the effect of transportation (road and rail) infrastructure on economic growth in India over the period of 1970-2010 using Vector Error Correction Model (VECM), their finding shows bidirectional causality between road transportation and economic growth. It also presents bidirectional causality between road transportation and capital formation, bidirectional causality between gross domestic capital formation and economic growth, unidirectional causality from rail transportation to economic growth and unidirectional causality from rail transportation to gross capital formation. The paper suggests that expansion of transport infrastructure (both road and rail) along with gross capital formation will lead to substantial growth of the Indian economy.

2.2.2c Economic Growth and Poverty

Goudie and Ladd (1999) in their review of the literature are concerned with the inter-linkages between relative poverty and inequality; and absolute poverty and economic growth. Along the line, development strategies and development policies are designed. Regarding the effect of economic growth on inequality, there is no clear relationship but little evidence that growth alters distribution in a systematic way. Countries with initially severe inequality of consumption and land are worse at reducing poverty probably because they achieve significantly slower economic growth. Goudie and Ladd find that the changes in mean income play the main role in changes in poverty, while high rate of growth has large impact on the absolute poverty. As pointed out earlier these countries are characterised by having poor institutions and lack well-functioning taxation and redistributive systems. Economic growth can reduce urban poverty through the generation of economic opportunities and employment while municipal government has a key role to play in the process (Amis and Grant 2001). In similarity with the sectoral level, a positive relationship between inequality and growth and between political competitiveness and growth was established by Balisacan and Fuwa (2003) using Philippines provincial data. This confirms the importance of institutions and redistribution channels on growth-inequality relationship at different levels within a country.

In respect of the above discussion of growth-inequality-poverty relationship, Ravallion (2001), assuming that initial inequality interacts with growth using data from 47 developing countries in 1980s and 1990s, estimates a non-linear relation in examining the relationship between growth, inequality and poverty based on micro-empirical work on growth and distributional change to identify effective growth oriented policies. Outcomes of policy measure are heterogeneous in their impacts on different income groups. Depending on the initial position of the poor and diversity of impacts, the poor might not only gain more from redistribution, but also suffer more from economic contraction, compared to the rich. As regards heterogeneity in impacts in an earlier study, Ravallion (1998) shows that aggregation can bias conventional tests of negative relationship between inequality and growth. The household and country level regressions are illustrated with 6651 farm-households panel data for 1985-1990 from rural China. The results indicate that asset inequality in the area of residence affects consumption growth negatively. The effect is lost in an aggregate level like in regional growth models.

Bigsten, Kebede, Shimeles and Taddesse (2003) also, in their analysis of growth and poverty reduction in Ethiopia during the period of economic recovery, covering 1994-97, identify several group-specific determinant factors of escaping from poverty. A decomposition of changes in poverty into growth and redistribution components indicates that potential reduction of poverty which is due to the increase in real per capita income was to some extent counteracted by worsening income distribution. In two collections of essays on the issues of growth, inequality and poverty (See van der Hoeven and Shorrocks, 2003; and Shorrocks and van der Hoeven, 2004) aggregate growth is seen as both necessary and sufficient for reducing poverty, but the concern is that benefits of growth is not evenly distributed at the national level across different population subgroups, sectors and regions. Thus in the analysis the consequences of growth for poverty, the level and distributional impacts of growth needs to be taken into account. The overall conclusion points out the need for diverse strategies towards growth-poverty inequality. Initial conditions, institutions, specific country structures, and time horizons all play a specific role in the creation of national solutions to the problem of poverty and in their contributions to the achievement of globally adopted poverty reduction targets.

Applying cross-country regression analysis to a data set that covers over four decades and for 80 countries, Dollar and Kraay (2000) show that, on average, incomes of the poor rise one-for-one with overall growth. In a later study, Dollar and Kraay (2001) examine the extent to which the poorest in society (i.e. those in the bottom fifth of the income distribution of a country) can benefit from economic growth. They empirically investigate the relationship between overall income growth and growth in the average incomes of the poor using a large sample of developed and developing countries. They find that incomes of the poor rise proportionately with (overall) average incomes, i.e. the general relationship between growth of the income of the poor and growth of the (overall) mean income is one-to-one. On a more detailed examination of this finding, they discover that it holds across regions, time periods, growth rates, and income levels; and is robust to controlling for possible reverse causation from incomes of the poor to (overall) average incomes. These findings contradict a number of popular ideas about the poverty-growth nexus. In particular, growth of income of the poor does not appear to respond systematically to a number of supposedly "pro-poor" policies (including formal democratic institutions and public expenditure on health and education). They again affirm that although growth is not all that is needed to improve the lives of the poor, it generally does benefit the poor as much as everyone else. Critics of the doctrine of a strict focus on growth promotion as a poverty reduction strategy contradict these findings.

Dollar and Kraay (2002) using 2SLS and standard Generalized Method of Moments (GMM) estimation procedure in a large sample of 92 countries examine the growth impact on poverty. Their result shows that, average incomes of the poorest fifth of society rise proportionately with average incomes. This is a consequence of the strong empirical regularity that the share of income accruing to the bottom quintile does not vary systematically with average income. It is also established that several determinants of growth such as good rule of law, openness to international trade, and developed financial markets have little systematic effect on the share of income that accrues to the bottom quintile. Consequently, these factors benefit the poorest fifth of society as much as everyone else.

El-laithy, Lokshhin and Barneji (2003) assess changes in poverty and inequality in Egypt between 1995 and 2000 based on the 1995/96 and the 1999/2000 household expenditure survey data. Using household-specific poverty lines that account for the differences in regional prices as well as consumption preferences, size and age composition of poor households, they find the redistribution effect generally weak, and more than the growth effect. The pattern of distribution is also found to vary within regions, with the poorest households in Lower Egypt actually getting proportionately larger shares of expenditure growth. They observe that in spite of the positive relationship between economic growth and poverty in Egypt, many of the poor were not affected by the substantial growth of the preceding decade.

Datt and Ravalion (2011) have examined growth benefits on poverty after major economic reforms of India. They find that there is no robust evidence that responsiveness of poverty to growth has decreased or increased since transformation begins, although there are signs of rising inequality. This was in line with the work of Squire (1993) which uses an international poverty line of $1 per person per day, and employs OLS method in examining the impact of economic growth on poverty. His results show that a one percentage point increase in the growth rate reduced the poverty headcount ($1 per person per day) by 0.24 percentage points. A similar econometric study was done by Bruno, Ravallion and Squire (1998). For 20 developing countries over the period of 1984 to 1993, they regress the rate of change in the proportion of the population living on less than$1 per person per day against the rate of growth (change in survey mean income) and obtain a statistically significant regression coefficient of -2.12, meaning that a 1 percentage increase in economic growth lead to 2.12 per cent decrease in poverty.

Moreover, statistically, economic growth could be expected to reduce poverty if income distribution occurs, more than if it does not. This expectation is confirmed by Bruno, Ravallion and Squire (1998). For the same 20 developing countries, they regress the rate of change in poverty on both the change in growth and the change in inequality.

The result shows significant coefficients of -2.28 for the growth variable and 3.86 for the inequality variable. In other words, even small changes in the overall distribution of income can lead to sizeable changes in the incidence of poverty. However, most of these studies fail to examine the causal relationship between economic growth and poverty reduction.

Considering this short coming, Almas (2004) examines the causal relationship between inequality and a number of macroeconomic variables frequently found in the inequality and growth literature. These include growth, openness, wages, and liberalisation. Almas reviews the existing cross-country empirical evidence on the effects of inequality on growth and the extent to which the poorest in the society benefit from economic growth. The linkage between growth, redistribution and poverty is also analysed. In the review of literature, mainly empirical examples from 1990s are taken. In addition, he tested the conditional and unconditional relationship between inequality and growth in the post-World War II period using WIDER inequality database. Regression results suggest that income inequality is declining over time. Inequality is also declining in growth of income. There is a significant regional heterogeneity in the levels and development over time. The Kuznets hypothesis represents a global U-shape relationship between inequality and growth.

Lately, Salvador and Diana (2012) examine the causal relationship between growth and poverty reduction in developing countries between 1970 and 1998, using traditional Granger causality to test the times series that are available, and panel data model evaluation techniques to test the out-of-sample forecasting performance of competing models. They find a unidirectional causality running from growth to poverty reduction.

The result is confirmed by country groups when splitting the countries' samples into low- and middle-income countries and into mid-high- and very-high-inequality countries. However, in the period of 1980s-1990s, economic growth did not cause poverty reduction growth in a Granger-causal fashion, except in low-income countries for the $1/day poverty rate.

In conclusion, One of the shortcomings of the empirical studies reviewed above is that most studies employ investment in infrastructure rather than physical stock as a proxy for infrastructure development; however, in time-series context the issue of simultaneity is arguably more problematic for those studies using investment flows (or their cumulated value) to measure infrastructure than for those using physical asset stocks. Decision lags and time- to-build suggest that physical assets are likely to be predetermined variables relative to output or productivity, and this may help address identification issues. However, time series data also pose the problem of spurious correlation, which if untreated will result in upward-biased estimates of infrastructure effects on output, particularly in the production-function approach mentioned earlier. Output (or productivity) and infrastructure stocks typically display stochastic trends, and failing to account for them can lead to the spurious finding of a positive and significant association between both variables where in reality there is none. Indeed, this upward bias was largely responsible for Aschauer's earlier finding of a very large impact of infrastructure on output using time series data which was highly criticised.

Hence, previous studies based on Cobb-Douglas production function could not confirm the direction of causation between the development of the transport sector and economic growth. In addition, most of these studies have typically relied on cross-sectional or panel data regressions. A general problem associated with such studies is that they implicitly impose or assume cross-sectional homogeneity on coefficients that in reality may vary across countries because of differences in geographical, institutional, social and economic structures. Hence, the overall results obtained from these regressions represent only an average relationship, which may or may not apply to individual countries in the sample (see Ashipala and Haimbodi (2003), Canning and Pedroni (2008) and Egart et al. (2009).

2.2.3 Empirical Evidence from Nigeria

The empirical study on transport infrastructure development appears to be very sparse in Nigeria. This could have been attributed to unavailability of data on transport infrastructure. However there are few studies which have examined government spending on infrastructure and its impacts on economic growth.

2.2.3a Infrastructure and Economic Growth

Olorunfemi (2008) examines the direction and the strength of the relationship between infrastructure services and manufacturing output in Nigeria using time series data from 1981 to 2005 and Vector Autoregressive (VAR) model. Also, Granger causality test was carried out. Results show that transport and electricity services in Nigeria did not cause growth to occur in the manufacturing sector during the period. It is also revealed in the study that telecommunication and education contributed to the growth in the manufacturing sector. On the contrary, Nurudeen and Usman (2010) use cointegration and error correction methods to analyze the relationship between government expenditure and economic growth in Nigeria; their results reveal that government total capital expenditure, total recurrent expenditures, and government expenditure on education had negative effect on economic growth; while rising government expenditure on transport and communication contrastively results in an increase in economic growth. However, the study fails to inform us of the condition and behaviour of the variables used in the study to back the application of cointegration techniques.

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 either as physical or as an investment in it.

In a more recent study, Akanbi, Bamidele and Afolabi (2013), there is an examination of 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 realise 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 endogeniety that is not accounted for in the study.

2.2.3b Infrastructure and Poverty Reduction

Aderamo and Magaji (2010) examine the role played by road transport in the distribution of public facilities in a rural environment in Nigeria. Using correlation matrix and Ordinary Least Square Method, they collect data through mapping and surveys of the nature of road network and available public facilities in the study area. The results of data analysis show that the area has a poorly connected road network characterised by poor surface condition, narrow bridges and many bends. The level of provision of public facilities is also low. The results also show a strong relationship between road network development in the area and provision of more facilities to make life better for the people. However, this work does not show any possible analysis that captures the effect of either road transport development or public facilities distribution on poverty rate in Nigeria, in which case it could have been a more empirical work that could assist policy makers in formulating transport policies in the country.

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 1970:1 to 2005:4 while the Structural Vector Autoregressive (SVAR) technique is adopted for its analysis. The study unequivocally finds that infrastructural development leads to poverty reduction.

2.2.3c Economic Growth and Poverty Reduction

Aigbokhan (2000) investigates, among other things, changes in Nigeria's profiles of poverty and welfare as well as the causes of poverty among males and females. Based on national consumer survey data sets for 1985/1986, 1992/1993 and 1996/1997 and a consumption-based poverty line (derived by the food energy intake method), he finds some evidence of increased poverty, in spite of some evidence of some positive real growth. His study suggests that the so called "trickle down" phenomenon underlying the view that growth improves poverty (and inequality) is not borne out by the data sets used in the study. For this, he suspects the nature of the growth pursued (oil and mining sub-sectors driven) and the macroeconomic policies that underlie it. He therefore recommends that attention be paid to such areas as policy consistency, rather than reversals; policy consciousness of the need to ensure the use of the main assets owned by the poor (human capital); and the provision of socio-economic infrastructural facilities, in view of the widely acknowledged inverse relationship between educational achievement and poverty. However, this was criticized by Akinbobola and Saibu (2004) who maintain that the main causes of poverty in Nigeria are income inequality and unemployment.

As a result, Akinbobola and Saibu (2004) investigate the nexus between income inequality, unemployment and poverty in Nigeria using a vector autoregressive (VAR) approach. In this study, quarterly data on real per capita income, government capital expenditure, unemployment rate and the human development index are sourced for the period of 1986–2000 and used for the analysis. The results from the four-variable VAR model show that reduction in unemployment rate improves human development and consequently reduces poverty. Moreover, growth in public expenditure reduces unemployment and improves the human development index. The study suggests that infrastructure-based policies, which initially reduce unemployment, would also improve the living conditions of Nigerians. This was later strengthened by the work of Saibu et al. (2011).

Saibu, Nwosa and Ajuwon (2011) argue that studies (World Bank, 2001; Dollar and Kraay, 2002; Agenor, 2004 and Adams, 2004) which investigate the factors that can reduce poverty have consensus on the important role played by the economic growth in reducing poverty. However, there are also numerous studies that emphasize inclusive economic growth. They stress that only growth with equity can reduce poverty. Most important among these studies are (Chani and Chaudhury, 2010; Agenor, 2005a; Kirkpatrick, and Jalilian 2005; World Bank, 2005 and Bourguignon, 2003). Most of these studies have also been criticised for being micro oriented rather than of macro orientation that could be more reliable for policy formulation. Saibu, Nwosa and Ajuwon (2011) therefore examine the impact of financial development and financial volatility on the poverty rate in Nigeria. It also examined the transmission channels of poverty rate in Nigeria for the period spanning 1986 to 2010, using both bivariate and multivariate causality tests and checking for the time series properties of the variable. The result finds a direct link between financial development, financial instability and poverty incidence, and also shows that financial development had a net positive effect on poverty incidence.

Gafar, Mukaila, Raji, Bello and Michael (2011) examine the impact of economic growth on poverty reduction in Nigeria, using a multiple regression analysis. The result shows that the initial level of economic growth is not prone to poverty reduction, while a positive change in economic growth is prone to poverty reduction. Ebong and Ogwumike

(2013) examine economic growth and poverty reduction in Nigeria using a Vector Autoregressive model (VAR) and Error Correction Model (ECM). The results show that in the medium to long term, agricultural development raised human capital poverty, while developing the other sectors of the economy reduced it. In the short term, public capital expenditure on social services, including credit to the agricultural sector, and agricultural development generally, showed a potential to reduce poverty. Public capital expenditure on economic services, growth in the non-agricultural sector of the economy, and increased urbanization intensified the incidence of human capital poverty.

In conclusion, almost all the studies employ investment in infrastructure rather than physical stock as a proxy for infrastructure development that is not good enough for the measure of transport infrastructure development most especially in a country where corruption has deepened down in the budget and also the data on investment on road transport could not be accessible adequately for a proper analysis, therefore, making them questionable. Moreover, in time-series context, the issue of simultaneity is arguably more problematic for those studies using investment flows (or their cumulated value) to measure infrastructure than for those using physical asset stocks.

2.3 Summary of the Literature

In summary, there exist some gaps in the understanding of this research stream that deserve further empirical investigation based on the literature reviewed on the relationship among transport infrastructure development, economic growth and poverty alleviation both in developed and developing countries. Despite various studies on transport infrastructure development and economic development, several issues are yet to be addressed, most especially in the area of the dynamic relationship among road transport infrastructure development, economic growth and poverty reduction. Also, the general question of whether improvement in transport infrastructure can generate economic growth and reduce poverty level, remains inconclusive. Given the mixed and inconclusive evidence on the effects of transport infrastructure on economic growth and poverty alleviation, an important question is: where does Nigeria's economy belong to in terms of the on-going debate? The contradictory evidence in the existing literature would imply that direct use of previous empirical findings in shaping transport policy and supporting particular investment decisions has been rather limited.

It is equally important to note that many of the previous works have generally suffered from several methodological drawbacks. Most of the existing studies build on Vector Auto Regression (VAR) and Ordinary Least Square (OLS) which neither capture nor account for a theoretical dynamic change that takes place over time in an economy. The conventional simultaneous equations technique has been criticized by some researches based on the facts that they are too restrictive and that the selection of endogenous and exogenous variable is arbitrary and judgmental. However many scholars in this field have used OLS techniques, and it should be noted that OLS techniques assume that all its parameters are blue, a phenomenon which is not true in most cases.

Moreover, while VAR is unidentified in its form, the usefulness of Structural Vector Auto Regression (SVAR) as method of analysis is capable of capturing the relative import and effects of various shocks on macroeconomic variables, but this has not been adopted in the literature in investigating the dynamic interaction among transport infrastructure development, economic growth and poverty reduction. Although OLS cannot measure causality among variables and in VAR system all the variables are treated as endogenous and determined within the system without any previous assumptions about the nature of the interrelationships, SVAR specification cuts through the tails of all these difficulties.

Additionally, one of the major gaps observed in the review is that the empirical literature tells very little on whether or not the causation from changes in economic growth and poverty reduction to provision of transport infrastructure does exist. Very few studies, to date, have sought to address this issue in developing countries, while it appears non-existent in Nigeria. As the effects of transport infrastructure generally affect economic growth and poverty level of any economy, it is fruitful to gain insights into the possible existence of its effects on economic growth in stimulating policy formulation in transport sector towards Nigeria's growing economy.

Although there are few studies in Nigeria which have examined this relationship separately, they suffer from improper data since they all make of use investment in infrastructure rather than physical stock as a proxy for infrastructure development. This is because the result provided by these studies could not be a solid ground on which policies towards transport infrastructure development in attaining economic development could be formulated, due to the level of corruption in the country.

CHAPTER THREE

METHODOLOGY

This section describes the methodology adopted in modelling the relationship between transport infrastructure development, economic growth and poverty alleviation. It also includes the theoretical framework of the study. The sources of data, definition and measurement of variables involved in the model, as well as estimation techniques, are all presented here.

3.1 Theoretical Framework

This study modifies the framework of Lakshmanan (2007) by expanding the framework mechanism of transport infrastructure, economic growth and poverty reduction based on theories examined earlier. Lakshmanan illustrates how provision of transport infrastructure could potentially affect long-term growth within the framework of standard neoclassical macroeconomic framework, considering transport infrastructure as an argument in a production function, as that of Cobb-Douglas. This is shown in Figure 1, which offers the mechanisms and processes underlying the wider economic benefits of transport infrastructure development. It is a contemporary version of what Williamson (1974) and O'Brien (1983) call "forward linkages" of transport infrastructure. The lower cost and increased accessibility due to transport improvements modify the marginal costs of transport producers, the households' mobility and demand for goods and services. Such changes ripple through the market mechanisms, endogenizing employment, output, and income in the short run.

Over time, dynamic development effects derived from the mechanisms set in motion when transport service improvements activate a variety of interconnected economy-wide processes and yield a range of sectoral, spatial, and regional effects that augment overall productivity. The lower costs and enhanced accessibility due to transport infrastructure and service improvement expand markets for individual transport-using firms. As such market expansion links the economies of different localities and regions, there is a major consequence in terms of shifting from local and regional autarky to increased specialization, trade and the resultant upsurge in productivity. Opportunities for exporting and importing goods are enhanced, and in turn open up several channels of economic effects, both in product market and in factor markets in a manner analogous to the results from tariff reduction and trade area expansion.

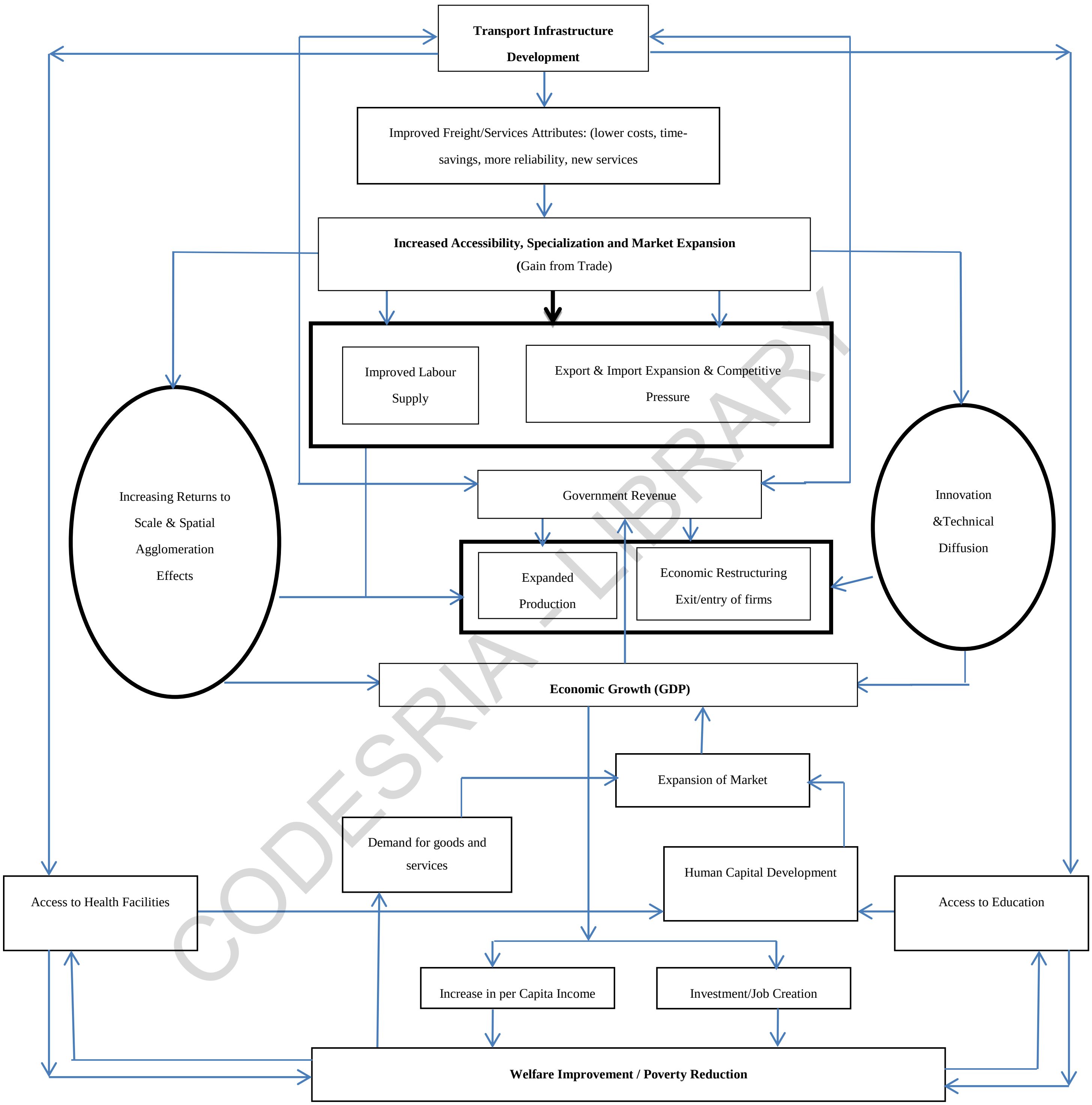


Figure 3.1: Linkage between Transport Infrastructure Development, Economic Growth and poverty Level **(Source: Adapted from Lakshmanan (2007)**

First, export expansion will lead to higher levels of output, which allow higher sales to cover fixed cost of operation, yielding efficiencies; second, increasing imports put competitive pressure on local prices. Such pressures lead not only to the removal of monopoly rents but also to improved efficiency. Schumpeterian dynamics come into play: firm entry, exit, expansion and contraction. As firms promote linear production processes which lower cost of production and raise productivity, further restructuring of the economy occurs. Third, lower transport cost and increased accessibility enlarge the market for labour and other factor inputs. Firm will likely draw labour from a broader area and, with a greater range of attributes, improve labour supply at lower costs. Similarly, effects in land and other factor markets are possible as transport improvement open up new land for economic activities. Finally, there is the suggestion that the two mechanisms in the oval boxes, one dealing with innovation and the other with spatial arrangement in the economy, would create, in the context of transport infrastructure improvements, conditions (in activity clusters) which would enhance economic performance, and promote total factor productivity and endogenous growth.

Transport improvements can have an endogenous growth effect based on the degree of their impact on the rate of growth of the economy through the creation and commercialization of new knowledge, thereby promoting productivity leading to economic growth measured by growth in the GDP. The contemporary knowledge economy present a situation where firms are concerned with the reduction of new class costs or adaptive costs incurred by the firm, monitors the environment for changes in technology and products, identifies competitive strategies, and implements such strategies quickly enough to retain or improve market share (Hage and Alter, Vickerman (2007) and Lakshmanan (2010)).

Firms minimise their adaptive cost by participating in economic network in the activity cluster or agglomeration made possible by transport infrastructure improvements.

Increase in the density of transport connections and accessibility can reduce transport input per unit of production, improve reliability of good deliveries and diminish inventories and storage cost, leading to firm productivity gains, particularly in urban areas. Such improvements can also induce clustering of facilities in a certain place, thus yielding further productivity gains (agglomeration economies). Nonetheless, enhanced accessibility may cause centrifugal forces by allowing some firms to reduce their land costs by choosing low rent locations away from dense activity centres. These relocation decisions can possibly be fostered by establishment of intermodal freight transport facilities in the urban peripheries, which help reduce trans-shipment, cargo handling and storage costs.

In addition, the role of suitable privatization and deregulation policies, which are increasingly adopted, can be critical in the urban and regional development process, since they can increase (privately-provided) transport infrastructure and levels of mobility and service at affordable prices, managerial efficiency and financial viability of transport facilities. The economics literature recognizes the enormous importance of public capital typically associated with infrastructure as an additional factor in the production process, alongside labor and private capital, since it increases its productive capacity. The role of transport infrastructure (mostly roads) and equipment is central in core infrastructure provision, together with the stock of communication and energy facilities, water system and sewers. By and large, transport infrastructure and services can be seriously regarded as partially or purely public goods, and can result in economies of agglomeration and economies of scale in production. Since the late 1980s and throughout the early 1990s, the first studies using formal analysis to measure the effect of public capital on economic activity started to be systematically conducted. Specifically, Aschauer (1989) and Munnell (1992) initiated a new empirical stream of research in the macroeconomic effect of public capital provision.

There are two possible ways in which transport infrastructure could affect firm production (Meade, 1952). The basic premise in the theoretical literature is that the stock of transport infrastructure available enters the production process as an unpaid input, directly contributing to firm production. Obvious examples are public roads that are available free of charge to industrial and commercial activities. On the other hand, transport infrastructure is considered to enter the production process as a factor that augments the productivity of other inputs employed by firms. Therefore, improvements in transport infrastructure can generally be regarded as an increase in the technology of production that could enhance the overall productivity of affected businesses.

Given the channels analysed above therefore, the interrelationship between transport infrastructure development, economic growth and poverty reduction could be vice-versa. This is because the relationship among these variables can either be direct or indirect. For instance, transportation infrastructure enables the movement of goods and workers to be more efficient. It can also increase firm productivity by lowering the transportation costs of inputs and outputs. Moreover, productivity gains may come from a reduction in other business costs. For example, good quality roads could lead to savings on vehicle maintenance costs. An increase in the reliability of transport allows firms to reduce stock inventory costs. In some circumstances, transport improvements may also help improve access to customers or remove trade barriers, encouraging firms to exploit economies of scale by serving larger markets. This will result in a reduction in long-run average costs of such firms that can be translated into an increase in productivity. Therefore, one way in which transport infrastructure development influences firm productivity is by its effect on production costs.

Furthermore, overall productivity growth may also arise because transport infrastructure development can be directly responsible for augmenting the productivity of labour. For example, exhausted workers may be less productive if they have to spend more time commuting. Thus, improvements in transportation services can have a direct impact on labour productivity by lowering commuting time which is spent getting to and from work (Prud'homme and Lee, 1999; SACTRA, 1999; and OECD, 2002). In another particular case, an increase in labour productivity can result from a better match between the supply of jobs and skilled workers. The underlying reason for this is that transport investments can lead to an increase in access to education and health facilities which can spur labour supply by attracting in-migration of households and improve job accessibility. With more choices of prospective employees, firms will have more opportunities to recruit those who have working experience and appropriate skills they need, to the extent that investments in transport infrastructure enhance the overall productivity of firms. This could lead to changes in the quantities of inputs of production on the one hand and result in poverty reduction on the other hand.

Transport infrastructure improvements may leads to a rise in consumption pattern of the people and labour demand by firms. This suggests that the net employment effect is ambiguous. The primary reason for this is twofold. First, the overall cost reduction associated with increased productivity enables firms to expand their markets. One specific example would be the case of competition in goods markets. That is, firms experiencing productivity gains could lower the prices of their products in order to increase market share. Falling relative prices would stimulate the demand for outputs produced by these firms, thus increasing the demand for workers and also increase the welfare of the people. This impact on the demand for labour depends on the price elasticity of product demanded (Button, 1998; and Lakshmanan, et al., 2001). If it is high, then one may anticipate a large increase in output and potentially in employment. Second, a higher productivity environment could be attractive to investment.

Besides, this enhances a region's productivity and competitive position may thus encourage expansion of existing businesses and attract private inward investment to enter the region. This could generate an increase in overall production and a higher demand for employment. Noting the fact that reduced transport costs associated with transport infrastructure development remove trade barriers and allow export of products to other regions, there could be the employment effects from this interregional trade competition (Button, 1998; Rietveld and Bruinsma, 1998; and Rietveld and Nijkamp, 2000). As an increase in the demand for employment is anticipated from those expanding their markets geographically, poverty reduction in the region becomes realizable.

Moreover, when living standard of people increases over time, there emerge 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 emerged 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.

3.2 Model Specification

The study employs the Structural Vector Autoregression (SVAR) econometric methodology. The usefulness of SVAR model stems from its potency to capture the relative import and effects of various shocks on macroeconomic variables. The original meaning of a "structural" model in econometrics is explained in an article by Hurwicz (1962). A model is structural if it allows us to predict the effect of "interventions" deliberate policy actions, or changes in the economy or in nature of known types. To make such a prediction, the model must tell us how the intervention corresponds to changes in some elements of the model (parameters, equations, observable or unobservable random variables), and it must be true that the changed model is an accurate characterization of the behavior being modeled after the intervention.

SVAR, as a methodology, has been extensively applied in macro-econometric analysis (Bernanke, 1986; Ogun, 2010; Omojolaibi, 2010 and Aremo 2012). Additionally, Multivariate Granger Causality Test is estimated. This is because, the use of simple traditional granger causality test has been identified by Engel and Granger, (1987); and Shan and Morris, (2002) as inappropriate when variables are I(1) series, knowing that the simple F-test statistics does not have a standard distribution Jordaan and Eita, (2007).

3.2.1 Model Specification to Achieve Objective 3

In obtaining the interaction effect between transport infrastructure development, economic growth and poverty level, the specification of the SVAR model is made up of three variables depicting the relationship among transport infrastructure development, economic growth and poverty. The structural VAR (SVAR) approach builds on the earlier work of Sims (1980) which employs an identification of the impulse responses through a priori restrictions on the covariance matrix of the structural errors. This becomes useful to avoid arbitrary identifying restrictions that characterise the unrestricted VAR. Several techniques are used to recover the required information.

The approaches of Sims (1986) and Bernanke (1986) apply the short run approach by using non-recursive and direct restrictions on the contemporaneous interactions among the variables. The alternative approach adopted long run dynamic effect of the shock on the particular variables in the system to identify the structural shock. This alternative approach is the long run-restrictions of Blanchard and Quah (1989), Blanchard and Perotti (2002).

Given that the dynamics of the economy could be typically approximated by a system of linear equations, the n-variate SVAR representation assuming p lags, could be explicitly summed up as:

$$A_0 y_t = \alpha + A_1 y_{t-1} + ... + A_p y_{t-p} + u_t \quad (1)$$

where y_t is an nx1 dimensional vector of endogenous variables. u_t is an nx1 dimensional vector of error terms. The perturbation structural shocks or innovations of the variables assume to be an iid N $(0, \Omega)$ when Ω is the variance – co-variance of u_t which is symmetric and positive definite and $A_0, A_1, ..., A_p$ are nxn dimensional coefficient matrices. It should be noted that A_0 represents the contemporaneous relations between components of y_t. The α in Equation 1 above represents the deterministic terms like constant, a linear trend, and / or dummy variables.

Assuming the reduced form VAR representation of the structural Equation (1) becomes:

$$y_t = \pi_0 + \pi_1 y_{t-1} + ... + \pi_p y_{t-p} + \xi_t \qquad (2)$$

Where

$\pi_i = A_0^{-1} A_i$ and $\xi_t = A_0^{-1} u_t$

i = 1, 2, 3……… p and $\pi_0 = A_0^{-1} \alpha$

The co-variance of ξ_t i.e. is presented as matrix $\sum = A_0^{-1} \Omega (A^{-1})'$ and is also symmetric and positive definite since Ω is positive definite and A_0 is invertible.

A necessary condition for estimating SVAR Equation (1) is that the number of parameters in the structural Equation must not be greater than that of the reduced form of VAR i.e. Equation (2). This enables recovering of structural parameters in Equation (1) from the parameters in the reduced form of VAR.

The structural VAR of Equation (1) which presupposes that y_t is an nx1 dimensional vector, has n, $P(P+1)n^2$ and $\frac{n(n+1)}{2}$ parameters in the deterministic term; α, the co-efficient matrix (A_0, A_1, ..., A_p) and the co-variance matrix Ω respectively, leading to a total of $\left(n + (p+1)n^2 + \frac{n(n+1)}{2} \right)$ parameters. In the case of reduced form of VAR in Equation 2, there are, $\frac{n + n^2 p + n(n+1)}{2}$ parameters in $(\pi_{0,} \pi_{1,} ... \pi_p)$ and co-variance $(\sum)$ respectively.

It thus implies that the number of structural parameters to be estimated is more than that of the reduced form VAR;

$$\{n+(p+1)n^2+n(n+1)/2\}-\{n+n^2p+n(n+1)/2\}=n^2$$

The structural VAR in Equation (1) is unidentified in its form. This implies that the reduced form of VAR equation may be compatible with different structural equations or different models, leading to a confusion regarding the exact equation being estimated. This amounts to identification problem. Thus, there is the need to impose n^2 restrictions.

The method that most studies adopts to recover structural parameters from reduced form of VAR is called Wold Causal Ordering (Wold 1954). The identification of the structural VAR model requires that the co-variance matrix (Ω) be subjected to restrictions. The other restrictions can be imposed on either the contemporaneous or on the long-run properties of the VAR system. Given that the total identifying restrictions gives $n(n-1)/2$ restrictions, to exactly identify the parameter of Equation (1), n, additional restrictions are required. This is obtained by either restricting all the diagonal elements of A_0 or of Ω to unity. According to Warner (2000), the choices of the n normalising assumptions approximate impulse response functions and variance decompositions.

On restricting the parameter Ω to $E\xi_t\xi_t^{'}=\Sigma$. The innovation can be written in term of uncorrelated error terms

$$u_t = G*u_t + E_t$$
$$E(\xi_{tt}\xi_t ') = D$$

where D is a diagonal matrix whose diagonal are the variances of E and G has zeros on the diagonals. Now, let $B*u_t = E_t$ or $A*E_t = u_t$ where $B=1-G$ and $A=B^{-1}$, where B and A have unit diagonals Thus

$$A * \Sigma * A' = D = E(\xi_t \xi_t^{'})$$
$$B * D * B' = \Sigma = E(u_t u_t ')$$

This will yield the structural form based on the orthogonalisation.

$$A_0 y_t = A_1 * y_{t-1} + ... + A_p * y_{t-p} + B_0 * X_t + ... + B_p * X_{t-p} +_t M * W + \xi_t. \qquad 3$$

The A's and B's are n x n coefficient matrices.

$y_t = (y_{it}, ..., y_{nt})$ is a vector of observable endogenous variables ;

$X_t = (X_{it}, ..., X_{nt})$ is vector of observable exogenous variables;

W_t is the vector of deterministic variables consisting of a constant, a linear trend, seasonal dummy variables or some specified dummy variables, and

ξ_t is the stochastic white noise process $(0, I_n)$.

The specified reduced form of the structural VAR representation in Equation (3) is:

$$y_t = \gamma_o + \gamma_1 y_{t-1} + ... + \gamma_p * y_{t-p} + \kappa_0 * X_t + ... + \kappa_p * X_{t-p} + v_t \qquad (4)$$

From Equation (3) the relationship existing between the reduced-form VAR (v_t) residual and the structural VAR residual is called AB-model and could be specified as:

$$v_t = A_0^{-1} B \xi_t \quad or \quad A_0 v_t = B \xi_t$$

The variance-covariance matrix becomes $\sum = A_0^{-1} BB'(A_0^{-1})'$

In this study, the Cholesky restriction approach is to be explored. In this wise, factors Σ into $y * y'$ where y is the lower triangular whose diagonals are standard deviations of ξ. Thus, the first variable in the SVAR is only affected contemporaneously by the shock to itself. The second variable in the equation is affected contemporaneously by the shocks to the first variable and the shock to itself, and so on……… $y = A^{-1} B^{1/2}$.

Therefore, in the moving average representation, the following sequences: log of poverty (l*pt*), log of real gross domestic product (*lg*) and log of transport infrastructure (l*q*) can be expressed as a linear combination of current and past structural shocks.

$$lq = \sum_{k=0}^{\alpha} s_{11}(k)v_{1t-k} + \sum_{k=0}^{\alpha} s_{12}(k)v_{2t-k} + \sum_{k=0}^{\alpha} s_{13}(k)v_{3t-k} \qquad 5$$

$$\lg = \sum_{k=0}^{\alpha} s_{21}(k)v_{1t-k} + \sum_{k=0}^{\alpha} s_{22}(k)v_{2t-k} + \sum_{k=0}^{\alpha} s_{23}(k)v_{3t-k} \qquad 6$$

$$Pt = \sum_{k=0}^{\alpha} s_{31}(k)v_{1t-k} + \sum_{k=0}^{\alpha} s_{32}(k)v_{2t-k} + \sum_{k=0}^{\alpha} s_{33}(k)v_{3t-k} \qquad 7$$

The above structural equations can be represented in a vector matrix form as follows:

$$\begin{pmatrix} lq \\ \lg \\ lpt \end{pmatrix} = \begin{bmatrix} s_{11}L & s_{12}L & s_{13}L \\ s_{21}L & s_{22}L & s_{33}L \\ s_{31}L & s_{32}L & s_{33}L \end{bmatrix} \begin{bmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{bmatrix} \qquad 8$$

Where**,** v_{1t}, v_{2t}, v_{3t} are uncorrelated white noise disturbances and $S_{ij}(L)$ are polynomial in the lag operator.

The coefficient of $s_{11}(L)$ for instance, is the impulse response of (transport infrastructure development) shock on poverty level and real gross domestic product are zero in the long run. This suggests that the effects of v_{2t}, and v_{3t} on transport infrastructure are necessarily equal to Zero. That is,

$$\sum_{k=0}^{\alpha} s_{12}(k) = \sum_{k=0}^{\alpha} s_{13}(k) = 0 \qquad 9$$

Equation 8 can be compactly expressed as:

$$X_t = S(L)v_t \qquad 10$$

Where:

$$X_t = \{lq, \lg, lpt\}$$ 11

and

$$v_t = [\ v_{1t} v_{2t}\ \ v_{3t}\ ]$$ 12

The shocks v_t are normalised in order to avoid reaction or collision of any shock effect that may be produced by the white noise disturbance by variables of interest.

$$Var(v_{it}) = Var(v_{2t}) = Var(v_{3t}) = 1$$ 13

Thus, variance –covariance matrix as follows

$$E(v_t v_t) = \begin{pmatrix} Var(v_{1t}) & Cov(v_{1t}v_{2t}) & Cov(v_{1t}v_{3t}) \\ Cov(v_{2t}v_{1t}) & Var(v_{2t}) & Cov(v_{2t}v_{3t}) \\ Cov(v_{3t}v_{1t}) & Cov(v_{3t}v_{2t}) & Var(v_{3t}) \end{pmatrix}$$ 14

The structural shocks (v_t) are not observed. To recover the transport infrastructure impulse, poverty level (l*pt*) and real gross domestic product (*lg*), the estimation process proceeds thus:

To identify the structural model, VAR is first estimated in its unrestricted form:

$$\begin{bmatrix} lq \\ \lg \\ lpt \end{bmatrix} = \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) & \phi_{13}(L) \\ \phi_{21}(L) & \phi_{22}(L) & \phi_{23}(L) \\ \phi_{31}(L) & \phi_{32}(L) & \phi_{33}(L) \end{bmatrix} \begin{bmatrix} lq_{t-1} \\ \lg_{t-1} \\ lpt_{t-1} \end{bmatrix} + \begin{bmatrix} \xi_{1t} \\ \xi_{2t} \\ \xi_{3t} \end{bmatrix}$$ 15

The above matrix representation is compactly expressed as:

$$X_t = \phi(L) X_{t-i} + \xi_t$$ 16

With $\phi(L) = [I - C(L)L]^{-1}$ 17

For the reason that all the variables in the system are assumed endogenous, and they all share the same matrix of regressors. Estimating the reduced-form model implies the application of ordinary least squares (OLS) separately to each model equation in Eq

(15). This is done after the adoption of optimum lag length to eliminate serial correlation from the residuals using Akaike Criterion, Schwarz Bayesian Criterion and Hannan-Quinn Criterion. The estimated unrestricted model is inverted to the Wold moving average representation as in Eq 8.

Based on the assumption that the innovations of v_t in equation 12 are a linear combination of the structural disturbances, the structural shocks can be related to the disturbances of the reduced-form model thus:

$$\begin{pmatrix} \xi_{1t} \\ \xi_{2t} \\ \xi_{3t} \end{pmatrix} = \begin{pmatrix} s_{11}(L) & s_{12}(0) & s_{13}(0) \\ s_{21}(L) & s_{22}(0) & s_{23}(0) \\ s_{31}(L) & s_{32}(0) & s_{33}(0) \end{pmatrix} \begin{pmatrix} v_{1t} \\ v_{2t} \\ v_{3t} \end{pmatrix} \qquad 18$$

Equation 18 is compactly expressed as:

$$\xi_t = S(0)v_t$$

$$E(\xi_t \xi_t^{'}) = E(S(0)v_t v_t{'}S(0)'$$

$$= S(0)S2S(0)'$$

$$\Sigma = S(0)S(0)' \qquad 19$$

The knowledge of $S(0)$, which is the matrix of the contemporaneous effect of the structural disturbances V_t on X_t will enhance the recovery of the structural shocks from the reduced-form innovations, ξ_t

3.2.2 Model Specification to Achieve Objective 2

To determine the long run relationship among road transport infrastructure, economic growth and poverty reduction will be revealed by the cointegration mode specified using Johansen (1988) maximum likelihood ratio test and looks at two test statistics (Johansen & Juselius, 1990), namely, the trace statis- tics and the maximum eigenvalue statistics, specified as thus;

$$\lambda_{trace} = T\sum_{i=r+1}^{n} \log(1-\hat{\lambda}_i) \qquad 20$$

$$\lambda_{\max} = TLog(1-\hat{\lambda}_{r+1}) \qquad 21$$

where $\hat{\lambda}_{r+1}$.............$\hat{\lambda}_n$ are $(n-r)$ smallest estimated eigenvalues. The null hypothesis of r cointegrating vectors is tested here against the alternative hypothesis of $r+1$ cointegrating vectors.

3.2.3 Model Specification to Achieve Objective 4

To investigate the nature and direction of causality among road transport infrastructure development the model is specified as Thus.

$$\lg_t = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta \lg_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta l\, q_{t-i} + \sum_{i=1}^{k} \beta_3 \Delta l\, pt_{t-i} + \beta_4 ECM_{2t-1} \qquad 22$$

$$\Delta l\, q_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \Delta l\, q_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta \lg_{t-i} + \sum_{i=1}^{k} \alpha_3 \Delta l\, pt_{t-i} + \alpha_4 ECM_{1t-1} \qquad 23$$

$$\Delta l\, pt_t = \delta_0 + \sum_{i=1}^{k} \delta_1 \Delta l\, pt_{t-i} + \sum_{i=1}^{k} \delta_2 \Delta \lg_{t-i} + \sum_{i=1}^{k} \beta_3 \Delta l\, q_{t-i} + \delta_4 ECM_{3t-1} \qquad 24$$

Where *lq* is log of transport infrastructure,

lg is the log of real GDP

lpt is the log of poverty level

ECM is the Error Correction Model

And *i= (1………………n),* α, β *and* δ *are the coefficient of the parameters,* Δ *is the first difference of the endogenous variables.*

3.3 Measurement and Definitions of Variables.

g_t is the Real Gross Domestic Product (RGDP) which is defined as the nominal GDP deflated by the composite consumer price index. This will be used to proxy economic growth.

q_t represents road transport infrastructure development in Nigeria, proxy by the length of paved federal road in kilometres as data constraint restricts to segregate the transport capital figures from the country's total investment (k). This has been used in many studies (see Canning, 1999; Canning and Bennethan, 2000; Faridi et al. 2011; Huang and Harata, 2010; Boopen, 2006; Calderon and Serven 2008a; and Sahoo, 2009; among others).

pt represents poverty rate in Nigeria, proxy by real consumption expenditure per capita (RCX). Real Consumption Expenditure per Capital is used as measure of poverty. Though an alternative to this measure is per capita income, this study employs real consumption expenditure per capita on the basis of the consensus of opinion that an expenditure measure of poverty is superior to income measures (Okojie, 2002 and Ogun 2010).

3.4 Sources of Data

This study uses essentially secondary data for analysis. The data on road transport network, RGDP and poverty indicator from (1980-2010) were taken from the following sources: (i)Central Bank of Nigeria (CBN) Statistical Bulletin (2010) (ii) National Bureau of Statistics (NBS) various publications (iii) World Development Indicator (2010)

Table. 3.1 Data Description and Sources

Variables	Description	Source
Road transport infrastructures Development	Proxied by the length of paved federal road in kilometres.	NBS
Economic Growth	Proxied Real Gross Domestic Product	CBN
Poverty	Proxied by real consumption expenditure per capita (RCX)	WDI
Population	Total number of inhabitants	WDI
Inflation	Proxied by consumer price index (CPI)	CBN

3.5 Estimation Techniques

Given the four specified objectives of this thesis, statistical and econometric techniques of data analysis are employed. The first objective which is to examine the trend of transport infrastructure development, economic growth and poverty level in Nigeria is addressed by employing descriptive analysis and graphs.

The second and third objectives which are to analyse the long run relationship and to examine the interactive effects among transport infrastructure development, economic growth and poverty level respectively, are achieved following these steps: as the substantial data used in this study are macroeconomic data; there is the need to first and foremost examine the characteristics of the data to ensure their validity for further econometric application. The variables are initially tested for stationarity. This is essential given the fact that most recent developments in macro econometric modelling suggest that macroeconomic time series are not stationary in their levels and that many time series are most adequately represented by first differences (Dickey, Jensen and Thornton, 1991).

To examine the existence of unit root problem in the data series, two methods are used: Augmented Dickey Fuller (ADF) and the Philips-Perron Tests. Both tests are superior techniques over other methods because they both control for higher order autocorrelation. The unit root test was followed by the determination of the order of the reduced form VAR by employing Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC), and Hannah-Quinn Criterion (HQ). The basis for selection of the appropriate lag length is identifying the criterion with the minimum lag length as the optimal lag length.

This is followed by cointegration test using a multivariate approach proposed by Johansen (1988) and Johansen and Juselius (1990). This approach is based on two likelihood ratio test statistics (trace test and maximum eigenvalue test) used to test the null hypothesis of at most r cointegrating vectors among variables. The approach of the trace test presupposes that the null hypothesis is: the cointegrating vector less than or equal to k, where k=0, 1, 2. In the case of maximum eigenvalue test, the null hypothesis states that k=0 against the alternative hypothesis that k=1.

Having done the initial estimations, in order to obtain the long run relationship, if the variables are *I*(1) but are not cointegrated, the next step is to estimate the reduced-form VAR model in first difference. If they are however *I*(1) and cointegrated, the approach is to estimate the cointegration analysis viz-a-viz the number of the variables and obtaining the normalized co-efficient of the variables. Therefore Eq 20 – 21 were examined

In obtaining the interactive effects among the variables, the study adopts Structural Vector autoregression (SVAR) approach. SVAR is a more refined use of VARs and has become a popular tool for evaluating economic models particularly in the macroeconomic literature (Sarte, 1997; and Ogun, 2010).

In order to achieve some realistic estimates of the models and to avoid over fitting of models, when estimating cointegration and the structural VAR models specified for the study, the need to determine optimal lag length is important. For instance, if there are n variables with lag length k, it follows that n(nk+1) coefficients will necessarily be estimated.

Lag length is particularly relevant in that it is capable of influencing the power of rejecting hypothesis. A large and superfluous lag length is capable of wasting a lot of degree of freedom. On the other hand, when lag length that is too small is used, essential lag dependencies will be omitted from the VAR. This has significant adverse consequence in the presence of serial correlation capable of generating inconsistent estimates of the model parameters. Use of SVAR has also been applauded because it takes into consideration the structure and dynamics of the economy (Amisano and Giannini, 1997; and Breitung et al., 2004). The SVAR econometric framework tests the relative importance and dynamic effect of various shocks on variables of interest (Sims, 1980).

A crucial issue in SVAR is identification without imposing a required number of restrictions, SVAR cannot be identified both in the short run and in the long run. The restrictions in this study are imposed based on some underlying theories earlier discussed in Chapter two of this study. The recursive identification scheme is achieved on the assumption that matrix A which encompasses short run restrictions gives an indication that structural innovations can be obtained from the reduced innovations using Choleski factorization. The A matrix is a 3x3 lower triangular matrix, while B is a diagonal matrix. SVAR verifies the identification conditions for a given structural form to be imposed on an estimated VAR model. The required inputs are the set of constraints to be placed on the elements of the A and B matrices so that

$$A = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix}, B = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix}$$

Recall from Equation 3 that

$$A\xi_t = Bv_t \qquad 23$$

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} \xi_t^{q} \\ \xi_t^{g} \\ \xi_t^{pt} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix} \begin{bmatrix} v_t \\ v_t \\ v_t \end{bmatrix} \qquad 24$$

This can be expressed as thus

$$\xi_t^{q} = b_{11} v_t^{q}. \qquad 25$$

$$\xi_t^{g} = -a_{21}\xi_t^{q} + b_{22} v_t^{g} \qquad 26$$

$$\xi_t^{pt} = -a_{31}\xi_t^{q} - a_{32}\xi_t^{g} + b_{33} v_t^{pt} \qquad 27$$

Equation 25 to 27 above represents the Choleski Decomposition of the residual matrix of co-variance. The implication of Choleski Decomposition is that the first variable in the VAR is only affected contemporaneously by the shocks to itself. The second variable in the VAR is affected contemporaneously by the shocks to the first variable and the shocks to itself, and so on. The equation also depicts the restrictions imposed to the model; thus it expresses the links between the random errors of the reduced form and the structural errors. The structural innovations (v_i) which are orthogonal and uncorrelated need to be identified in order to trace out the dynamic responses of the model to these shocks which provide the impulse response functions.

The ordering of the variables determines the recursive causal structure of the SVAR. This becomes necessary because altering the order unconditionally changes the relationship structure of the innovations. As the variables of interest are three, thus the model is a three dimensional model which involves three-factorial arrangement in orders of endogenous variables. This further heightens the need for an optimal ordering pattern. The ordering is based on theory but could be considerably guided by intuition. In some cases, policy variables are considered first before the non-policy variables in the ordering while in other cases, the study is guided by previous approaches in the literature. For instance, the first selected variable should be that whose future period's variance is best explained by its own structural innovations which can be derived from the pattern depicted by variance decomposition. The challenge here is that every order implies different variance decomposition and as such requires considerable efforts to determine the optimal order (Bahovec and Erjavec, 2009). An alternative ordering mechanism that intuitively guides the ordering of variables is to place the variables by the timeline of their occurrence. This implies that any variables that are presumed to occur first are placed first in the vector of endogenous variables. To ensure that the result of impulse response functions (IRFs) and Forecast Error Decomposition (FEVD) are not affected by variable ordering, sensitivity analysis will be performed to determine how the structural analysis, based on IRFs and FEVD, are affected by causal ordering. The sensitivity analysis is based on estimating the SVAR using variants of variable ordering.

The recursive identification scheme above is just-identified with three restrictions. To achieve the identification, we follow Peersman and Smets (2003), who use a three variable SVAR with some contemporaneous restrictions on impulse responses. The model satisfies Rothenberg (1971)'s order condition that the total number of restrictions equals n(n-1)/2, and using the procedure outlined in Hamilton (1994), the model is locally just-identified. In the short run, restrictions are imposed on the parameters of the variables in the structural model to achieve identification; after having determined the order of lag length. In the short run, as presented in Eq 23, the identification is based on economic theory of transport infrastructure development, economic growth and poverty theory postulated by Jahan and Mcleely (2005).

Jahan and Mcleery (2005) argue that the impact of infrastructure on economic growth and poverty reduction takes the form of first-round effects, followed by subsequent impacts. In the first round, infrastructure development produces two initial effects that could lead to poverty reduction through economic growth. These two initial impacts are the supply side and demand side impacts. The development of infrastructure improves the supply side of the economy by reducing cost, enhances business climate, makes room for better access to market opportunities and opens up new opportunities. These supply side effects attract domestic and foreign investment, increasing employment and national output. The demand side effect of infrastructure development occurs when projects are implemented. In this case, the new project, say road construction, creates new jobs through which incomes are generated.

Given the above short run restrictions, objective 3 which relate to analysing the interactions among the transport infrastructure development, economic growth and poverty reduction is achieved by carrying out the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). The IRFs trace out the response of current and future values of each of the variables to a one-standard error shock in the current value of one of the VAR errors, assuming the errors are equal to zero. On the other hand, FEVD is the percentage of the variance of the error made in forecasting a variable due to a specific shock at a given horizon.

To achieve objective 4, which is to examine the causal relationship among transport infrastructure development, economic growth and poverty reduction, an examination of the direction of causation among the three variables is done. This is achieved within the framework of Structural Vector Autoregression (SVAR) estimates of transport infrastructure development, economic growth and poverty dynamic models of equations 22 to 24. The following robustness tests are carried out: Normality test, Autocorrelation test, and Stability test. This is to examine whether the chosen VAR have the appropriate properties or not. VAR stability test becomes necessary because the focus is to obtain Vector Moving Average (VMA) from the VAR.

Econometric literature proposes different methodological alternatives to empirically analyse causal relationships among time-series variables. The most widely used methods include the two-step procedure of Engle and Granger (1987) and the full information maximum likelihood-based approach due to Johansen (1988) and Johansen and Juselius (1990). All these methods require that the variables under investigation require a step of stationarity pre-testing, thus introducing a certain degree of uncertainty into the analysis.

Moreover if the variables are not integrated and I(0), the Granger causality test is conventionally conducted by estimating vector autoregressive (VAR) models. Based upon the Granger Representation Theorem, Granger (1986) shows that if a pair of I(1) series are cointegrated there must be a unidirectional causation in either way. If the series are not I(1), or are integrated of different orders, no test for a long run relationship is usually carried out. However, given that unit root and cointegration tests stationary and cointegrated, estimating VAR these tests is inappropriate and can suffer from pre-testing bias. However, if the data are integrated but not cointegrated, then causality tests can be conducted by using an unrestricted VAR model by simply conducting whether some parameters are jointly zero, usually by a standard Wald statistic (or F-statistic). Phillips and Toda (1993), show that the asymptotic distribution of the test in the unrestricted case involves nuisance parameters and nonstandard distributions. An alternative procedure to the estimation of an unrestricted VAR consists of transforming an estimated error correction model (ECM) into levels VAR form and then applying the Wald type test for linear restrictions.

However, if our variables are I(1), multivariate framework within the environment of vector error-correction model (VECM) will be employed to unveil Granger causality among the variables. The error-correction terms derived from the cointegrating vectors are obtained through Johansen's multivariate cointegrating testing procedure (Johansen, 1988, and Johansen and Juselius, 1990), which are used as additional channel in order to identify Granger-causation. Since this procedure identifies multiple cointegrating relationships and hence error-correction terms, this is an issue of crucial importance in Granger-causality testing in a dynamic multivariate context.

CHAPTER FOUR

ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT: SOME STYLISED FACTS IN NIGERIA.

This chapter contains a brief history of road transport infrastructure development in Nigeria. The trend analysis of road transport infrastructure development, economic growth and poverty level in Nigeria is also explored in section two of this chapter. The brief history of road transport infrastructure development becomes necessary if we must have a clue on road transport infrastructure development genesis in Nigeria, and is thus given adequate attention.

4.1 History of Road Transport in Nigeria

The history of transportation dates back to the pre-colonial era. During this period, road, rail and air transport were really non-existent. Presently, the modes of transportation in Nigeria include road, rail, airways, inland waterways, coastal waters, the deep sea and the pipeline. The significance of transport development for investment, trade, growth and poverty alleviation has long been recognized. Nigeria is a large country with the longest network of roads in Africa. Road statistics are not up to date but there are 34,000 kilometres (km) of Federal roads linking part of the country.

The road transportation system is known to be the most important transportation system in Nigeria. It is given the most priority when development plans concerning transportation are to be carried out. It could be observed that the history of road transport dates back to 1904 when Lord Laggard attempted the construction of a mule road linking Zaria and Zungeru both in the Northern part of Nigeria. The road was later extended from

Zaria to Sokoto, Katsina and Maiduguri. However, the road linking Ibadan and Oyo constructed in 1906 is recorded to be the first motorable road ever constructed in Nigeria.

In 1925, the Central Government of Nigeria set up a Road Board. By 1926, H. E. Walker proposed a skeletal road system to link the major administrative centres in the country. These roads were designed as a frame upon which the network of secondary roads could be built thus enabling the general road system to be considered as co-ordinate whole rather than as a jigsaw of small dis-jointed sections. The total length of the roads maintained by the government rose from 6, 160km to 9, 453km. In 1951, 1, 782km of roads out of 44, 414 roads maintained by the government were surfaced though they lacked in standard designs and were single lanes with sharp bends and poor drainage systems. Prior to Nigeria's independence in 1960, a number of roads totalling the length of 11, 000km were constructed to link every part of Nigeria. The three regions at the time, and later 12 states in 1976, constructed their respective network of roads.

At independence in 1960, the Nigerian landscape was dotted with a skeletal network of trunk roads as well as secondary and feeder roads that exhibited the characteristics which reflected the purpose of their construction. They were narrow and winding, for they were simply meant to facilitate the evacuation of agricultural produce from the interior communities to the points of export, in addition to serving as links between scattered human settlements, thus permitting ease of administration. The transport policy in Nigeria emphasizes economic efficiency, safety and reliability of services to users of the facilities as spelt out in sectional paper No 1-1965 entitled "Statement of Policy on Transport". The policy contains an explicit statement of government's determination to pursue coordinated development of various modes of transports by concentrating on the modes that are capable of carrying persons and goods at the safest, most convenient and at the lowest cost per unit of service.

There were enormous challenges for funding and the administration of the vast network of federal roads. Thus, in 1971, the Federal Military Government led by Gen. Yakubu Gowon (and having Gen. Olusegun Obasanjo as Minister of Works) set up a Special Commission to study the administration of roads in five selected countries. Led by Mr. S. O. Wey, Federal Commissioner on Special Duties, it had as members Engr M. Tukur Usman (Director of Federal Public Works) and Mr John Oyegun, of the Ministry of Economic Development and Reconstruction. They visited Italy, West Germany, Sweden, United States and Brazil and submitted a report on July 6, 1972 recommending setting up "without delay" a Federal Highways Authority. There was serious debate as to whether the proposed Authority would be in the Ministry of Transport or Ministry of Works at the time. The Committee recommended that Ministry of Transport should be under the Ministry of Works. The Federal Executive Council deliberated on the recommendation but decided in 1973 that the Federal Government could "adequately cope with the funding and administration of the Federal Highway network of 11,000km. However, when the network increased to 29,000km in 1974, there was the need to re-visit that decision.

In the Third National Development Plan Period (1975-80), the Federal Military Government took over 17,000km of roads from the 12 states at the time, bringing the network to 28,000km considered to be of strategic importance for social integration, economic development and defence access. Since then, there have been many attempts to set up the Federal Highways Authority. During this period, a total amount of N9, 677.54

million was allocated to the transport sector out which 72.3% was voted for road development. Under this plan, such new road projects as the Lagos-Island ring road, the Port Harcourt-Aba-Umuaihia-Enugun road, the Kano-Daura-Kangolan roads were scheduled to be constructed. In addition, under this plan, the Federal Government was billed to overtake some of the Trunk "C" roads that were then under the responsibility of the local governments and 16,000km of Trunk "B" roads, the main ones being the East – West roads as well as the North – South roads which were roads that formed the national grid.

4.2 Trend Analysis of Road Transport Infrastructure Development, Economic Growth and Poverty Level in Nigeria

This section addresses the trend of road transport infrastructure development, economic growth and poverty level in Nigeria between 1980 to 2010. Through the trend, we are able to gain insight into the various changes related to road transport infrastructure development, economic growth and poverty level that took place within this study period. The various descriptions are done using graphs.

Table 4.1: Macroeconomic Variables Used in this Study (1980-2010)

YEAR	RGDP(m₦)	POP(m)	INF (%)	PCX(m₦)	RCX(m₦)	RNW(KM)
1980	49,632.32	74,522,934	10.0	27665.54	0.003712	14673.72
1981	47,619.66	76,643,423	21.4	28574.86	0.007988	14673.72
1982	49,069.28	78,726,910	7.2	30411.38	0.002766	14673.72
1983	53,107.38	80,806,944	23.2	35215.14	0.010121	14672.72
1984	59,622.53	82,935,721	40.7	42858.69	0.021039	14672.72
1985	67,908.55	85,150,639	4.7	49302.92	0.002701	19516
1986	69,146.99	87,461,350	5.4	51537.47	0.003176	19516
1987	105,222.84	89,853,441	10.2	75981.13	0.00861	19516
1988	139,085.30	92,311,753	56.0	106678.6	0.064763	20154
1989	216,797.54	94,812,363	50.5	126186.2	0.067166	20154
1990	267,549.99	97,338,277	7.5	177234.6	0.013654	20154
1991	312,139.74	99,886,789	12.7	206813.5	0.026285	20154
1992	532,613.74	102,465,464	44.8	373526.7	0.163341	32179.86
1993	683,869.79	105,079,844	57.2	502775.2	0.273518	32179.86
1994	899,863.22	107,738,753	57.0	610340.2	0.323085	32179.86
1995	1,933,211.55	110,449,331	72.8	1387446	0.91467	32844
1996	2,702,719.13	113,212,070	29.3	2124271	0.549616	32844
1997	2,801,972.58	116,026,774	10.7	2091069	0.192348	32844
1998	2,708,430.86	118,899,179	7.9	2371328	0.156795	34123
1999	3,194,014.97	121,836,150	6.6	2454795	0.133337	34123
2000	4,582,127.29	124,842,371	6.9	2478777	0.137744	34128
2001	4,725,086.00	127,917,961	18.9	3687656	0.543965	34202
2002	6,912,381.25	131,060,791	12.9	5540186	0.544782	34212.54
2003	8,487,031.57	134,269,942	14.0	7044545	0.735863	34340.95
2004	11,411,066.91	137,543,599	15.0	8637732	0.942864	34340.95
2005	14,572,239.12	140,878,575	17.8	11075059	1.403057	34341.25
2006	18,564,594.73	144,273,182	8.2	11834578	0.67588	34341.25
2007	20,657,317.67	147,721,843	5.4	15682906	0.571632	34582.8
2008	24,296,329.29	151,212,254	11.6	15756158	1.206102	34582.8
2009	24,794,238.66	154,728,892	12.4	18859553	1.509108	35324.45
2010	29,205,782.96	158,258,917	13.7	17539050	1.518303	35655.61

Source: NBS (various publications) CBN Statistical Bulletin (2010) and WDI

Note: Real Gross Domestic Product (RGDP), Population (POP), Inflation (INF), Private Consumption Expenditure (PCX), Real Consumption Expenditure per Capita (RCX) and Road Network RNW).

4.2.1 Trend of Road Transport Infrastructure Development in Nigeria

Figure 4.1 below shows the pictures of the length of federal roads calculated in kilometres. A trend line is imposed which gives a general outlook that there is a positive trend all along road development from 1980 to 2010 in Nigeria.

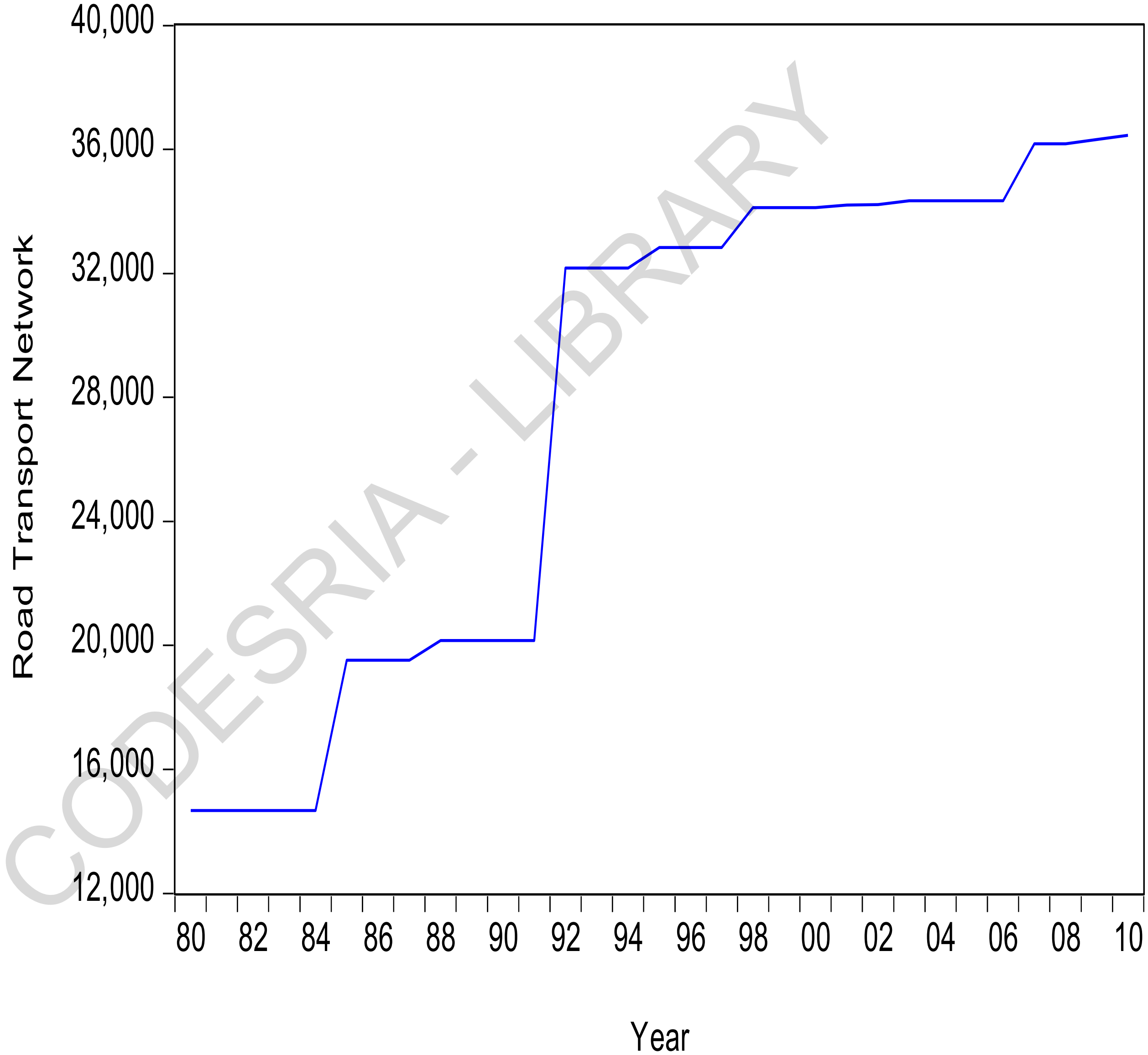


Figure 4.1: Road Transport Infrastructure Development in Nigeria (1980 -2010).

Source: Author's Computation (2014)

Given the graph above, as computed by the data on Federal road network measured in kilometres (Km) presented in Table 4.1, it is observed that road network increased from 15, 480.43km between the period of 1980-1985 to 19, 898.8km within the period of 1985-1990 on average, which was an increase of about 21%. During this period, the Fourth National Development Plan (1981-1985) was initiated where the sum of N7457.912 million was allocated to the road development out of a total N10, 706.616 million that was voted for the development of transport sector. Emphasis in the plan was more on the rehabilitation and improvement of the existing road networks rather than the construction of new ones, the principal objectives being to protect the massive investment on the road construction and development over the years.

However, in 1986, two major road projects—Ahoada-Uli road and Enugun–Oji-River road projects were completed. Several others including the Azare–Buckachuwa, Bauchi–Kogadam–Bakoda, Mayo-Salbe–Jantari as well as the Patani–Kiyama road projects were completed. It was during this period that the Federal Government announced a grant of N1.0 million to each of the 301 Local Government areas in the country to enable them rehabilitate bad roads within their areas. In 1989, a sum of N230 million was spent on rehabilitation, reconstruction or construction of a total length of 937km of roads by the federal government. In that year, the construction of the Tuga Bridge and Kaoje roads in Sokoto and in the Garba-Chede-Bali road in Gongola State amongst others were completed and the Eko Bridge was also rehabilitated. Also, in 1990, a total of 24 road projects with a total length of 610 km were completed at the cost of N492 million. Major road project that benefitted include the Kaduna–Kano dualisation project, the Kaura Namoda Bridge in Sokoto state, the first section of the Mayo–Selbe–Maisamarri road in the then Gongola

State, etc. This could have resulted in the increase in federal road network during the period of 1985-1990.

On the average, 1990-1995 was the period that the highest increase in the road network was observed. This is because the road network increased from 19, 898.8km for the period of 1985-1990 to 29, 907.52km in the period of 1990-1995, which was about 51% increase in road network. During this period, government investment in road infrastructure development was substantial. For instance, in 1991, a total sum of N800.2 million was expended on the construction of about 640.9 km length of roads. Such roads as Kastina–Duura–Zango sections I and II, Kayiji-Gumi–Daki-Takwas, and Zubba–Suleja, benefited from this expenditure.

Similarly, in 1992, a number of road and bridge projects were completed during the course. In fact, within this year alone, seventeen road projects were completed. These include Yola–Furore road, the Kaduna–Kano dualisation project, Katsina-Daura-Zango sections I and II, Kontagora road, Chifu Rigau road projects, etc. in addition to these projects, seven bridges including the Aya-Ombi river bridge, the Chiyako bridges, the river Ore on Badagry – Ishaga road in Ogun, the Oyo – Iseyin road bridges, the Kajiji–Gummi–Daki-Takwas bridge in Sokoto, etc. were completed.

What is more, in 1993, the Federal Government completed twenty road projects and four bridges. Among the roads were the Mayo-Belwa-Jada road, the Maisamari–Nguroje–Gembu road, the Matachibi–Kontonkoro–Zungeru roads, etc. while the bridges completed in that year include the Odo–Asimowu along Ikeja–Apapa Expressway, River Gurara Bridge in Niger State, etc. In 1995, road development efforts decelerated as there was no road or bridge project (except the Imo River bridge) completed. The deceleration was attributed to a number of factors, which include inadequate funding, shortage of bitumen, etc.

Between the period of 1995-2000, the road network increased to 33, 612.4km from 29,907km which was just an increase of about 12.4%. During this period, most precisely in 1999, many roads and bridges were constructed, among which are Approach road /bridge over River Wonderful Kafanchan in Kaduna state, Papalanto-Lagos /Ibadan Expressway in Ogun state, Mararba-Tumi-Pindiga–Kasshere-Futuk-Yola road in Gombe state, Ebocha-Ndoni link road and bridge in Rivers State, Ifaki-Ikole-Omuo-KGS/B road in Ekiti state, the bridge across Anambra River linking Agulani-Otuocha and the asphalt-overlayed Irrua-Uromi-Ubiaja-Ilushi road in Edo state among many others.

The road network also increased to 34, 123.5km between the period of 2000-2005 and increased to 34, 897.3km between the period of 2005-2010 giving about 2% and 4% increase. During this period, more attention was given to road maintenance rather than construction of new roads. For instance, civilian governments, from 1999 to date, have recognized that transport is the lifeline of a nation's economy and social interactions. An inefficient transport system implies stagnation in all sectors of the economy. Their priorities in the transport sector are always to design and implement a new policy on road maintenance. The Federal Ministry of Works is charged with the responsibility of planning, designing, constructing and maintaining Federal Highways. For example, Nigeria's Federal Road Maintenance Agency (FERMA) began to patch 32,000Km federal roads and in 2005.

In addition, the reconstruction of Abuja-Lokoja road, Port Harcourt-Eket road and Kano-Maiduguri road was awarded by former president Olusegun Obasanjo in July 2006 under a presidential initiative at a cost of ₦ 419 billion. During this period, the construction of Sokin Nkporo-Abiriba-Ohafia road was awarded. In 2008, Bichi- Gwarzo in Kano was constructed while the rehabilitation of Zaria Township road Phase 1 was awarded. Between 2009 and 2010, about 61 projects valued at ₦ 214 billion were awarded under the zonal intervention programme of the Ministry of Works, while Abuja's 10 lane road projects gulp ₦ 257 billion in 2010.

Similarly, Public Private Partnership Scheme meant to complement the developmental efforts of the Government was initiated. The pioneering project in this regard was the Lagos-Ibadan Expressway (105km). The Ministry, on behalf of the FGN entered into a 25-year concession with Bi-Courtney Consortium at the cost of N89.53 billion (approximately USD604.95 million). The scope of work involves the reconstruction, expansion and modernization of the Expressway from the existing four (4) lanes to eight (8) in the first half of the road and from four (4) to six (6) lanes in the remaining portion. The intention of the FGN is to bring other economically viable roads in the network under the PPP initiative. Thus the following highly trafficked roads, with approximate distances are targeted for concession and other forms of PPP based on the economic indicators: Port Harcourt – Enugu Dual Carriageway (221km), Warri–Sapele–Benin Dual Carriageway (about 110km), New Lagos-Iseyin-Kaiama-Konkwaso-Kaoje Kwambe-Argungu-Sokoto Road (1020km), Enugu–Onitsha Dual Carriageway (125km), Onitsha-Owerri Dual Carriageway– (102 km), River Niger Bridge at Nupeko (1 km) and River Benue Bridge at Burukku (1km) among others.

4.2.2: Trend of Real Gross Domestic Product

Figure 4.2 below shows the pictures of the absolute values of real GDP in levels calculated in billions of Naira.

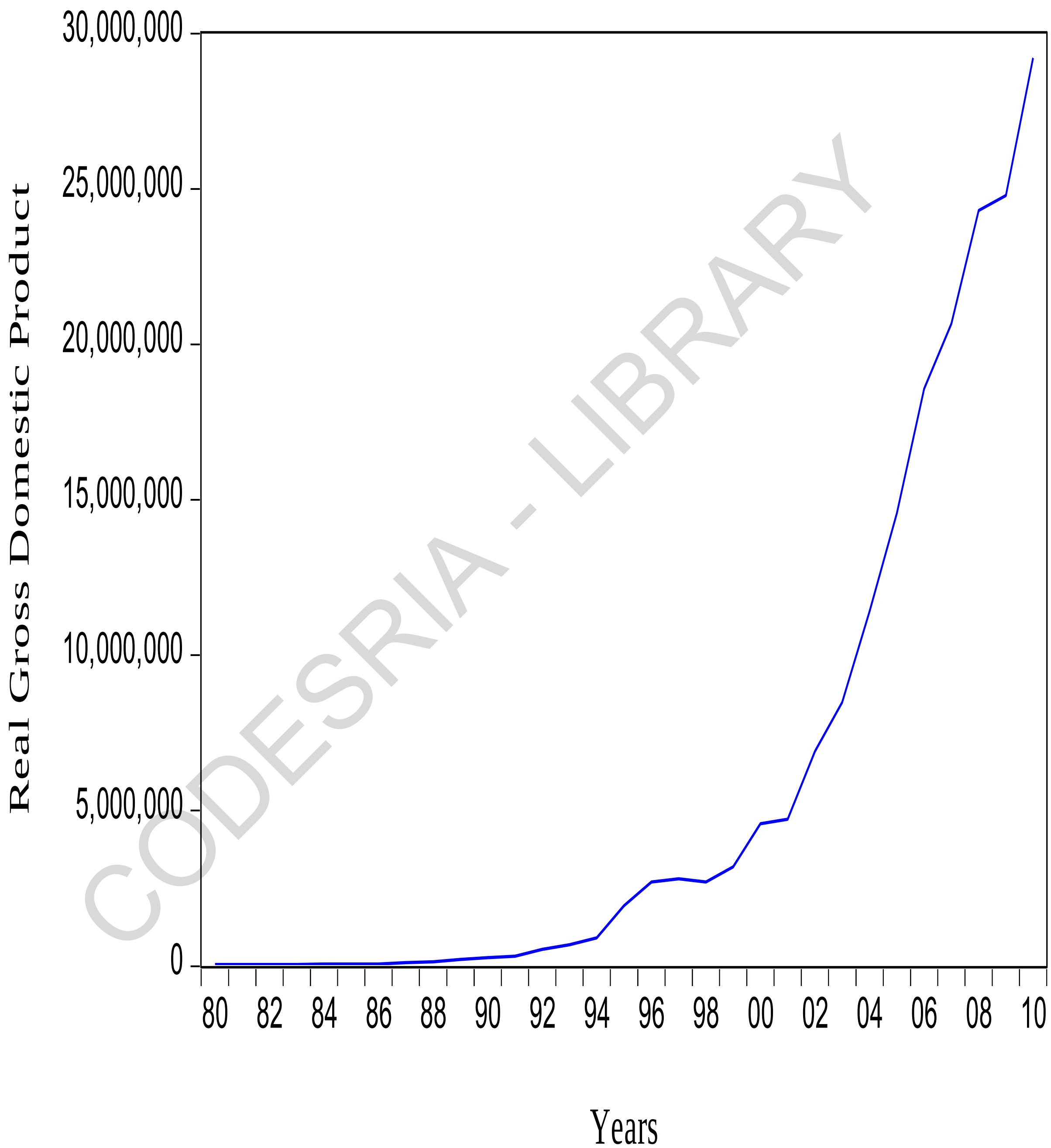


Figure 4.2: Real Gross Domestic Product in Nigeria (1980-2010)

Source: Author's Computation (2014)

As evident in the graph above and given the data used in the computation in Table 4.1, it can be observed that between 1980 and1985, the RGDP on average was 54,493.29 million naira but, increased to 159,560.53 million naira between 1985 and 1990, showing an increase of about 66%. During this, period the road activities contributed about 2.1% of the RGDP.

The increase in RGDP continued as it rose from 159,560.53 million naira between the period of 1986-1990 to 872,339.61 between 1991 and 1995 (an 81 per cent increase on average) and to 3,197,852.97 during the period of 1996-2000 (about 73 per cent increase). During the last two periods i.e. 1991 to 1995 and 1996 to 2000, the increase in RGDP fell, and the rate of increase on average between the period of 2000-2005 and 2005-2010 suffered a drastic fall i.e. from 72.7 per cent to 65.3 per cent and later to 60.8 per cent in spite of the increase in the level of RGDP from 3,197,852.97 to 9,221,560.97 and further increased to 23,503,652.66 on average during these periods respectively with the road activities contributing about 1.9 per cent and 2.4 per cent of the RGDP.

4.2.3 Trend of Poverty Rate

Figure 4.3: below shows the trend of real consumption expenditure per capita.

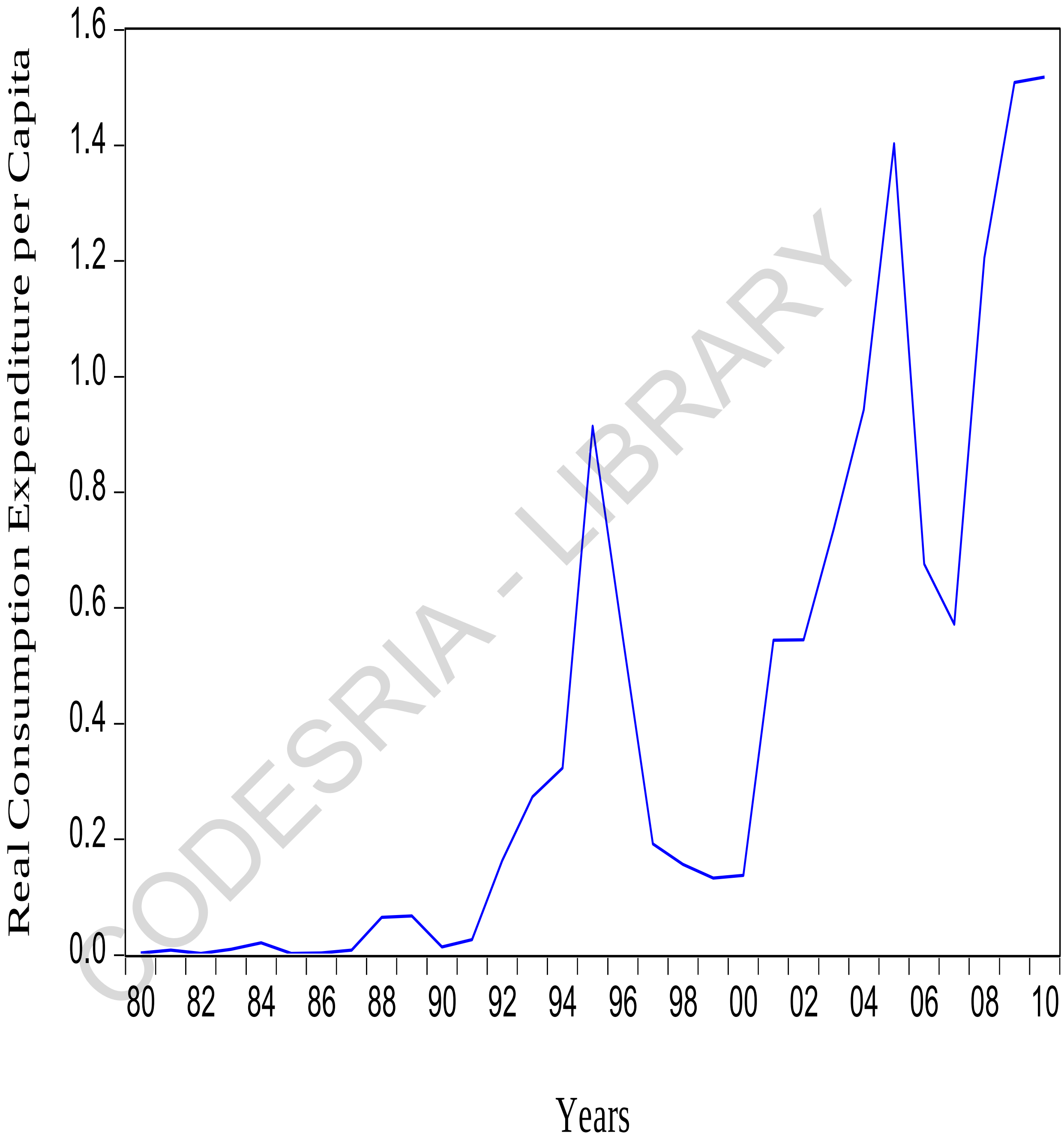


Figure 4.3: Real Consumption Expenditure per capita in Nigeria (1980-2010)

Source: Author's Computation (2014).

The cardinal objective of the Government in Nigeria is to promote poverty alleviation. However, poverty has remained a fundamental problem in Nigeria since the mid-1960s; and its incidence is by no means reducing (Aremo 2012). The period between 1980 and 1985 is usually regarded as the period that ushered in unprecedented deterioration in welfare and increase in poverty in the country given the low level of real consumption expenditure per capita (Ajakaiye and Olomola, 2003) as shown in Figure 4.3 below.

From Figure 4.3 above, it can be observed that real consumption expenditure per capita was 0.003712 million naira in 1980 but picked up to 0.010121 million naira in 1983 showing an increase of about 65 per cent. This increase was not sustained but fell in 1985 to 0.002701 million naira, although, inflation rate decreased from 23.2 per cent in in 1983 to 4.7 per cent in 1985. However, there was an increase in population rate of about 5 per cent within this period which could have accounted for the fall in real consumption expenditure per capita. The decrease continued up to 1987 but picked up in 1988. Between the period of 1990-1995 there exists a continuous increase in real consumption expenditure per capita with an average of 0.286 million naira. During this period, inflation rate on average was 25.8 per cent. Surprisingly, real consumption expenditure per capita fell drastically from 0.915 million naira in 1995 to 0.138 million naira in 2000, which was about 85 per cent fall. Also during this period, Nigeria recorded the highest inflation rate specifically with 1995 recording 72 per cent. This was deregulation regime period with tight monetary and fiscal policy control. A persistent increase began to surface again in 2001 to 2005 when the civilian regime emerged and critical developmental programmes were pursued in the National Economic Empowerment and Development Strategy

(NEEDS). Despite the reduction in inflation rate from 17.8 per cent in 2005 to 5.4 per cent in 2007, real consumption expenditure per capita fell from 1.403 million naira to 0.572 million naira. This could be attributed to the increase in population from 140,878,575 in 2005 to 147,721, 843 in 2007. An interesting observation is the skyrocketed increase in real consumption expenditure per capita in 2009 which persisted to 2010. Fig. 4.4 below is used in buttressing the claims above.

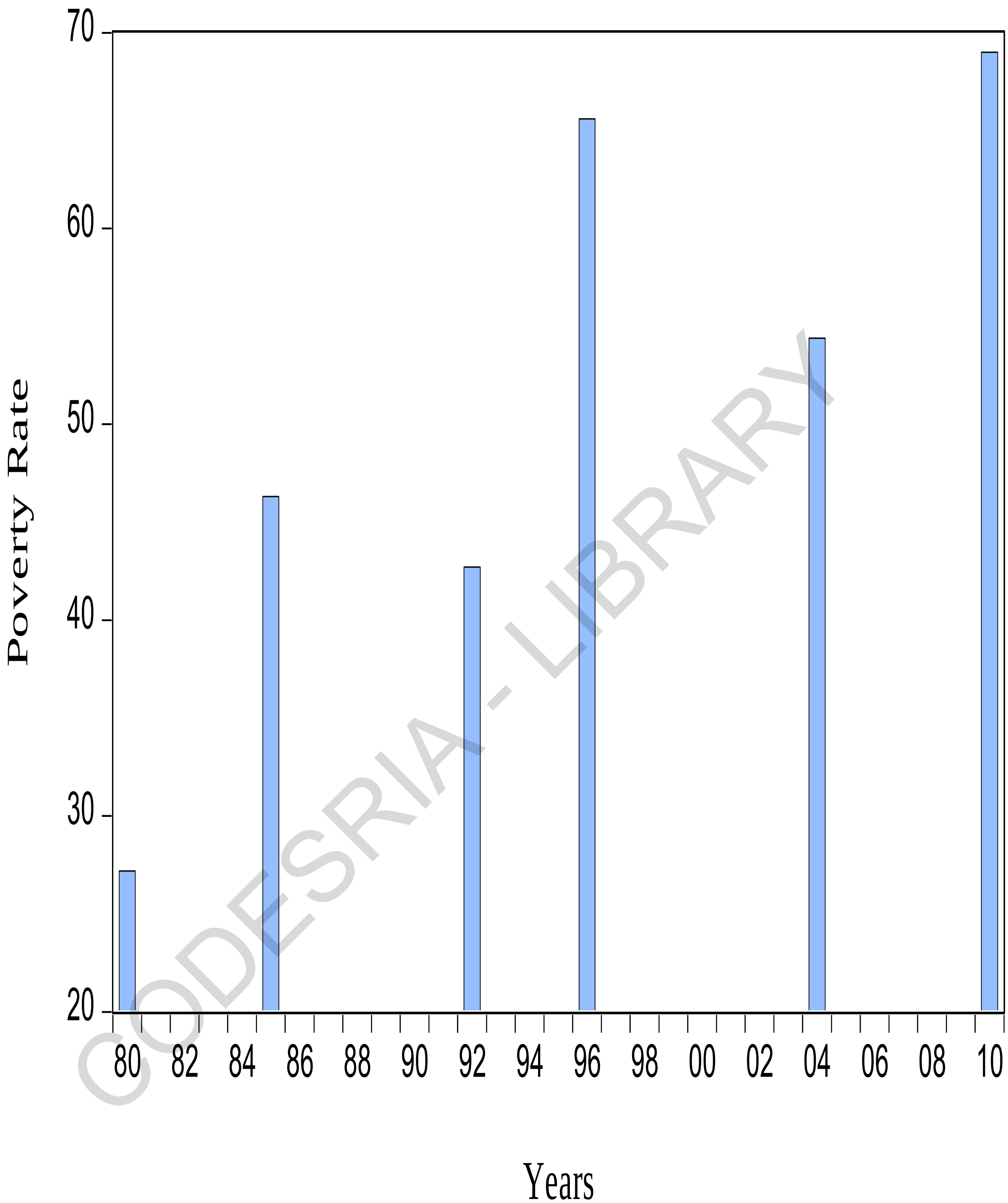


Figure 4.4: Poverty Rate in Nigeria (1980-2010)

Source: Author's Computation (2014) From NBS (2010).

It can be observed from Fig.4.4 that poverty level was 27.2 per cent in 1980 increased to 46.3 per cent in 1985 which is about 40 per cent increase. However, there occurred a slight decrease in 1992 to 42.7 per cent from 46.3 per cent in 1985. Additionally, the increase in poverty level rose again in 1996 to about 67 per cent, which was an increase of 36.2 per cent from 42 per cent in 1992, although the poverty rate fell to 54.5 per cent in 2004 and later rose again to 69 per cent in 2010.

The poverty rate between the period 1992-2004 was alarming as Nigeria was ranked among the 25 poorest nations of the world. During this period, there appeared to be a general concern that the period resulted in higher incidence of poverty in Nigeria. Macroeconomic indices tend to confirm this assertion. For instance, the growth rate of the real GDP since SAP has not been impressive. From 3% in 1993, it dropped to 1.3% in 1994 and then rose to 2.2%, 3.4%, 3.8% and 2.4% in 1995, 1996, 1997 and 1998 respectively. Also, data on unemployment rate, price level and the worsening state of urban and rural infrastructure during the period further point to a dismal picture of the devastating state of the poverty incidence in Nigeria (Godswill and Awogbemi, 2011).

Between the period 1980 to 2010, different policies were implemented in order to reduce the level of poverty rate in Nigeria. Among these programs are the Green Revolution (1980); programmes to alleviate the pains of Structural Adjustment Program (SAP) through the Directorate of Food, Road and Rural Infrastructure (DFRRI) and the National Directorate of Employment (NDE) (1986); the People's Bank of Nigeria (1990) (see Anyanwu and Uwatt, 1993); community banks; the Better Life Program (BLP); Family Support Programme (FSP) and Family Economic Advancement Program (FEAP); establishment of National Agricultural Land Development Authority (NALDA) (1993); as well as the Agricultural Development Programs (ADP) and the Strategic Gains Reserves Programmes (SGRP). Another key measure was the establishment of the Poverty Alleviation Programme (PAP) (2000), which later metamorphosed into the Poverty Eradication Program (PEP) and culminated in the National Poverty Eradication Programme (NAPEP) in 2001. NAPEP was organized around four schemes, namely: the Youth Empowerment Scheme (YES), Rural Infrastructure Development Scheme (RIDS), Social Welfare Schemes (SOWESS) and the National Resource Development and Conservation Scheme (NRDCS). In addition, there was the Interim Poverty Reduction Strategy Paper (IPRSP) which had the aim of building on the gains of PAP and PEP. One of the recent measures that attracted a lot of attention was the National Economic Empowerment and Development Strategy (NEEDS), which was built on the IPRSP. The period 2007 – 2010 witnessed the seven point agenda during which infrastructural development was one of the targeted programs in achieving economic growth and a means of achieving poverty alleviation in the country.

For a better understanding of the trend of Road Transport infrastructure Development, Economic Growth and Real Consumption Expenditure per capita in Nigeria, a trend of the growth rate of the variables are examined in Figure 4.6 given Table 4.2.

Table 4.2: Growth Rate of (Road Transport infrastructure, Economic Growth and Real Consumption Expenditure per capita in Nigeria (1980-2010)

YEAR	DLpt	DLq	DLg
1980			
1981	0.766443	0	-0.0414
1982	-1.06036	0	0.029987
1983	1.297043	-6.82E-05	0.079083
1984	0.731781	0	0.115718
1985	-2.05267	0.285245	0.130128
1986	0.162034	0	0.018073
1987	0.997192	0	0.419846
1988	2.017825	0.032168	0.279007
1989	0.036439	0	0.443877
1990	-1.59314	0	0.210343
1991	0.654962	0	0.154145
1992	1.826849	0.467938	0.534345
1993	0.515526	0	0.249971
1994	0.166546	0	0.274475
1995	1.040648	0.020428	0.764695
1996	-0.50934	0	0.335076
1997	-1.04991	0	0.036065
1998	-0.20437	0.038203	-0.03395
1999	-0.16206	0	0.164909
2000	0.032519	0.000147	0.360885
2001	1.373484	0.002166	0.030722
2002	0.001502	0.000308	0.380428
2003	0.300658	0.003746	0.205225
2004	0.247878	0	0.296044
2005	0.397487	8.74E-06	0.244535
2006	-0.73039	0	0.242138
2007	-0.16752	0.052237	0.106813
2008	0.746653	0	0.162256
2009	0.224125	0.003907	0.020286
2010	0.006075	0.003604	0.163755

Source: Author's Computation (2014)

It can be observed from Table 4.2 that there was no growth in Federal road network in Nigeria within 1980 – 1984. During this period, RGDP growth rate was 0.1 per cent while Real consumption expenditure per capita was growing at about 0.7 per cent. Moreover, between 1984 – 1986, Federal road network exhibited a growth rate of 0.3 per cent. Surprisingly, Real consumption expenditure per capita had a growth rate of about 2 per cent despite the constant growth rate of RGDP. However, there was an increase of about 0.38 per cent in RGDP growth rate without growth in Federal road network between 1986 and 1989. During this period, Real consumption expenditure per capita recorded its highest growth rate of about 2 per cent but decreased to 1.6 per cent in 1990 followed by an increase of 1.8 per cent in 1992. In 1992, Federal road network and RGDP experienced 0.5 per cent growth rate. The growth rate among these variables from 1986- 1992 could be attributed to the Structural Adjustment Programme during which the production base of the economy was diversified. The period 1995 to 1997 witnessed a recession in Nigeria with a drastic fall in RGDP and Real consumption expenditure per capita. This was the deregulation period with tight (contractionary) monetary and fiscal policy control. During this period, there was no addition to the existing road network.

In 2001, the government realised the level of economic hardship in the country and there was a need to rescue the economy from recession. Therefore, the National Poverty Eradication Programme (NAPEP) was initiated in 2001. This was able to move the economy out of recession, while RGDP growth rate and Real consumption expenditure per capital growth rate increased again and this was sustained over some time. However, in 2007 attention was shifted from economic issues to political issues which brought the growth rate of RGDP to 0.1 per cent from 0.4 per cent in 2001. Thereafter, between 2007 and 2009 there was no addition to Federal road network but RGDP and Real consumption expenditure per capita has been fluctuating between 0.2 and 0.7 per cent respectively. However, real consumption expenditure per capita falls drastically to 0.0 in 2010. This could be attributed to the late president Musa Yaradua health crisis and the Niger Delta Militant agitation

This can be represented in graph below:

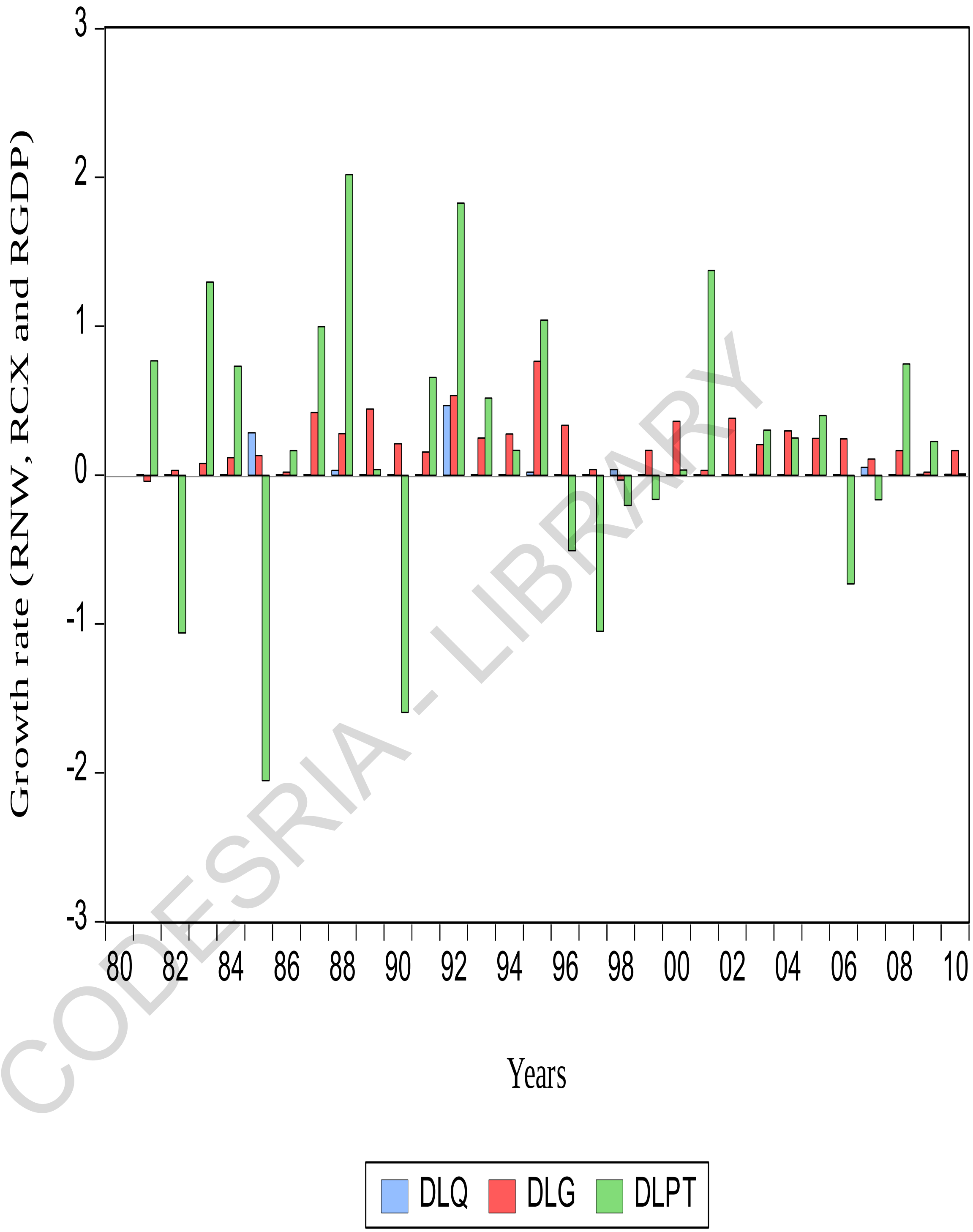


Figure 4.6: Growth Rate of Road Transport infrastructure, Economic Growth and Real Consumption Expenditure per capita in Nigeria (1980-2010)

Source: Author's Computation (2014)

4.3 Conclusion

This chapter examines the trend of road transport infrastructure development, economic growth and poverty level. It is observed that Federal road network in Nigeria over the years has been increasing and that real Gross Domestic Product (RGDP) is growing. However, over some periods, real consumption expenditure per capita growth rate has been tending towards negative while poverty has been increasing, a phenomenon which is the least expected given the growing trend of road transport infrastructure development and most especially that of economic growth rate. This shows policy inconsistency and its implications on the economy.

CHAPTER FIVE

DYNAMIC INTERACTION AMONG ROAD TRANSPORT INFRASTRUCTURE DEVELOPMENT, ECONOMIC GROWTH AND POVERTY LEVEL

The aim of this chapter is to analyse the data collected for the purpose of this study. To achieve this objective, section 5.2 of this chapter focuses on the descriptive statistics of data employed in this study. In section 5.3, the time-series properties of our data series are examined. Under this section, a unit root test is embarked upon to ascertain whether the various data series are stationary in level or first difference. Testing for the time-series properties of variables is of particular importance in the light of the recent observation that most economic time series are non-stationary and could adequately be represented by unit root. This section also tests for cointegration among variables so as to observe the long run relationship, and also to be guided in the estimation of the SVAR model specified for this study as well as testing for causality among variables. Innovation analysis and interpretation of results are carried out in section 5.4; both the impulse response function and variance decomposition are generated to investigate the existence or otherwise of the interactive effects, and the causal relationship among road transport infrastructure development, economic growth and poverty level in the Nigerian economy, Section 5.5 comprises the robustness test of the residuals, while section 5.6, being the last section, presents the main findings of the chapter.

5.2 Descriptive Statistics of Data Series

In an attempt to carry out this study, the various descriptive statistics of the data used are examined. The descriptive statistics of the data series provide information about the sample series such as the mean, median, minimum and maximum values; and the distribution of the sample measured by the skewness, kurtosis and the Jaque-Bera statistics.

Table 5.1 below presents the descriptive statistics of the annual data series used in the analysis for virtually all the data series; it is observed that the values of mean and median are very close. This is in line with the position of Karmel and Polasek (1980) that when a distribution is perfectly symmetrical, the mean, median and mode must converge; and in cases of near symmetry, the three measures are necessarily very close. It could rightly be deduced that the distributions of the series in table 5.1 is in the main, nearly symmetrical. Skewness and Kurtosis provide useful information about the symmetrical nature of the probability distribution of various data series as well as the thickness of the tails of these distributions respectively. These two statistics are particularly important as they are used in computing Jarque-Bera statistic, and also for testing the normality or asymptotic properties of a particular series.

Econometric analyses are often based on the assumptions of normality and asymptotic properties of data series. There is therefore the need to test for the existence or otherwise of these two properties because most probability distributions and test statistics like t, F, and χ^2 are based on them.

As Table 5.1 suggests, all annual data series, save those that are seasonally generated, are normally distributed going by the null hypothesis that variables are normally distributed. The problem of normality becomes obvious, owing to the seasonal pattern of almost all the data series. In testing for the skewness of data series, we are guided by the fact that the skewness of a normal distribution is zero.

Table 5.1: Descriptive Statistics of Annual Data Series (1980-2010)

Descriptive Statistics	*Lg*	*Lpt*	*Lq*
Mean	12.61922	-7.692590	10.17914
Median	12.54756	-8.323223	10.39952
Maximum	13.56130	-3.926260	10.50385
Minimum	10.35923	-11.27443	9.593745
Std. Dev.	0.603485	2.318656	0.344671
Skewness	-1.366564	0.016247	-0.671747
Kurtosis	7.510013	1.538993	1.777440
Jarque-Bera	35.92151	2.758481	4.262020
Probability	0.000000	0.251770	0.118717
Sum	391.1958	123.0358	315.5533
Sum. Sq. Dev	10.92583	2.401586	3.563942
Observations	31	31	31

Source: Author's Computation

5.3 Time Series Properties of Data

5.3.1 Unit root Test for Annual Data Series

Table 5.2 (a and b) below present the results of unit root tests using Augmented Dickey Fuller test and Philips and Perron test applied on annual data series.

Table 5.2(a) The Result of Unit root Test Using Augmented Dickey Fuller Test

Series	Level	First Diff	Remark
Lpt	-0.09	-5.38	I(1)
Lq	-1.47	-5.76	I(1)
Lg	-0.02	-4.42	I(1)

Table 5.2(b) The Result of Unit root Test Using Philips and Perron Test

Series	Level	First Diff	Remark
Lpt	-1.16	-10.14	I(1)
Lq	-1.58	-5.87	I(1)
Lg	-0.04	-4.42	I(1)

Source: Author's Computation

Note: at 5 per cent critical value = -2.96. *Lg, Lq and Lpt are log (of real gross domestic product, road transport infrastructure development, poverty level.)*

Evidence from the results shown in Table 5.2 confirms that all the variables (real gross domestic product (g), road transport infrastructure development (q) and poverty rate (pt), are not stationary at level. However they became stationary after first difference under the augmented dickey fuller and Philips and Perron test. 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.

Although, the results of the unit root test show that all the variables were random walk processes. It does not however imply that in the long-run, the variables could not express long-run convergence i.e. long run equilibrium. The stationarity of the residuals is a potent evidence that there is evidence of convergence to long-run equilibrium among the integrated variables. To be able to ascertain whether there is cointegration among these variables, it necessary to determine the optimal lag length of variables before proceeding. Therefore, the Akaike Criterion (AC), Schwarz Bayesian Criterion (SBC) and Hannan-Quinn criterion (HQC) are used to indicate the optimal lag structure for the VAR upon which the cointegration analysis is based on. The SVAR models are estimated, in order to obtain the lag length. The endogenous variable orderings enter the structural VAR models in line with equation 1.

5.3.2 Determination of Optimal Lag Length

For the purpose of testing for cointegration among variables as well as the estimation of the structural VAR model specified for this study, the determination of the appropriate and optimal lag length is important. If the lag length is too large, the SVAR is more likely to pick-up within sample random variation as well as any systematic relationship, because there is the need to estimate great number of parameters. If there are n variables with lag length k, it is necessary to estimate n(nk + 1) coefficient. The lag length also influences the power of rejecting hypothesis. For instance, if k is too large, the degree of freedom may be wasted. Moreover, if the lag length is too small, important lag dependences may be omitted from the VAR and if serial correlation is present the estimated coefficients will be inconsistent.

In the light of the above observation, Table 5.3 shows the structural VAR model estimated in this study as well as the list of endogenous variables. The test statistics adopted in testing for appropriate lag length are the Akaike Criterion, Schwarz Bayesian Criterion and Hannan-Quinn Criterion.

Table.5.3 Test Statistics and Choice Criteria for Selecting the Order of VAR Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-62.0423	NA	0.029889	5.003256	5.148421	5.045058
1	16.26747	132.5243	0.000146	-0.328267	0252393*	-0.161058
2	25.32557	13.23876	0.00015	-0.332736	0.683419	-0.04012
3	32.26569	8.541692	0.000191	-0.174284	1.277366	0.243739
4	55.72439	23.45870*	7.45e-05*	-1.286492	0.600653	-0.743062*
5	65.01981	7.15032	0.0001	- 1.309216*	1.013424	-0.64038

** indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Tables 5.3 depict the various test statistics used to determine the optimal lag length for the variants of unrestricted VAR models. In panel 1, the Akaike information criteria (AIC) indicated an optimal lag length of 4. The Schwarz information criteria (SIC) showed a lag length of 1 while the Hannah-Quinn information (HQ) depicted an optimal lag length of 4. The last SVAR model (23) gave optimal lag length using SC as 1 while AIC and HQ as 4. It is so obvious that the results from this optimal lag length selection using these three methods are contradictory. A way to overcome this in the literature is to choose the Schwarz information criterion (SC) as it has a relatively better performance in lag choice accuracy than the other selection methods in majority of the cases (See Hacker and Hatemi-J, 2008). It is therefore selected as the most efficient and reliable criterion. Besides, the Schwarz information criterion (SC) is generally more conservative in terms of lag length than the Akaike Information criteria (AIC).

In selecting the most appropriate lag length, care was taken to ensure that such lag length must necessarily produce a white noise residual besides conserving the degree of freedom. To make a choice between lags 1 and 4 that appeared common, a specification search was conducted using these lags. It was found that almost all the individual equations in the VAR models were not white noise when the lag of 4 is selected. Thus the appropriate choice would appear to be 1. Also the choice of 1 would imply a loss of just one degree of freedom unlike when lag of 4 is used. By implication, a lag length of 1 was chosen as the order of the VAR model and the adopted lag length to carry out cointegration test in the study.

5.3.3: Robustness tests of the Residuals

Having determined the lag length, the next step is to examine whether the chosen VAR have the appropriate properties. Thus, the following tests are carried out: normality and auto correlated tests and the stability test. These tests are carried out on the VAR model.

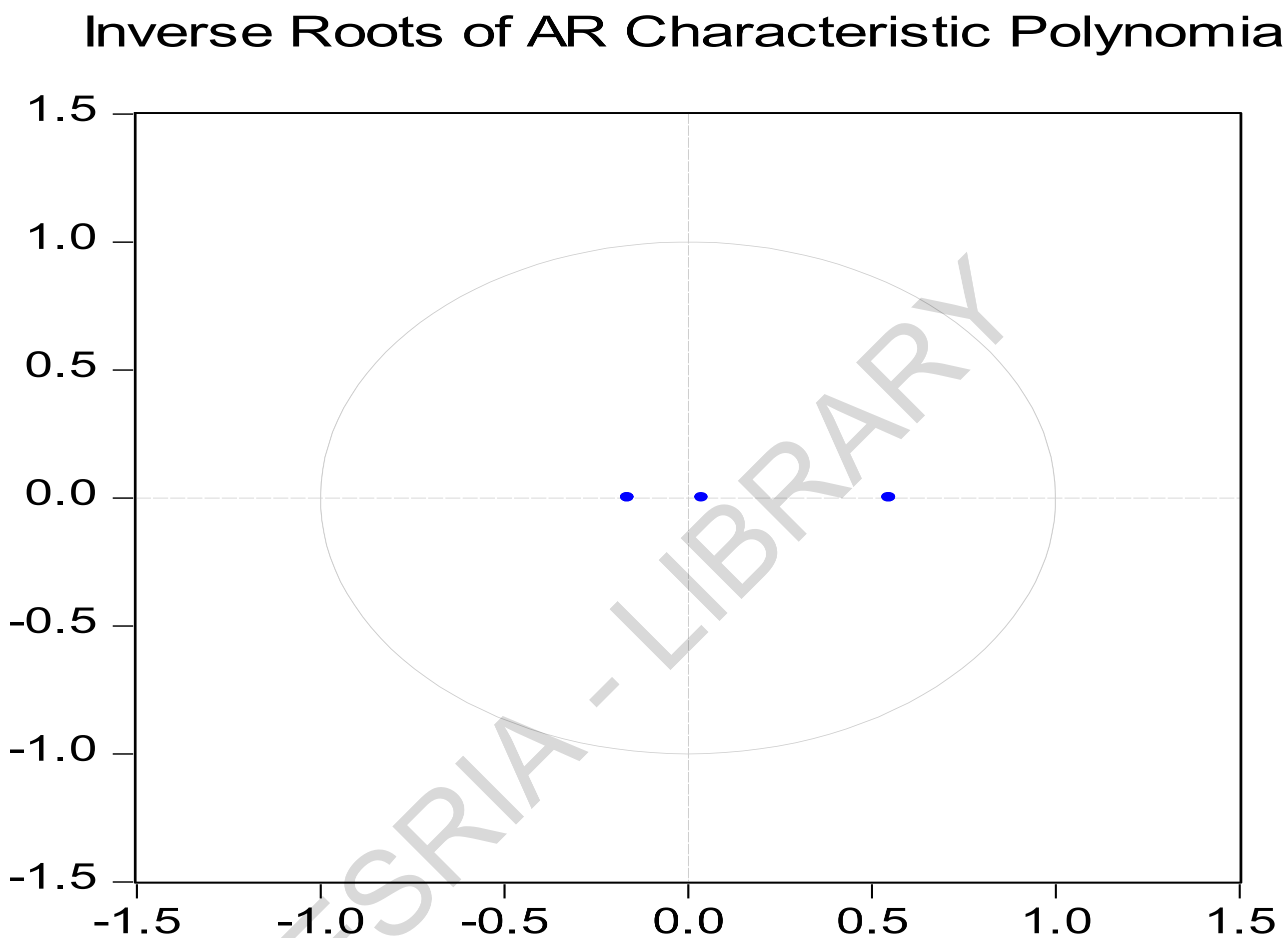


Fig 5.1: The inverse Roots of AR Characteristic Polynomial of the VAR Model

VAR stability test becomes necessary because the focus is to obtain Vector Moving Average (VMA) from VAR. This demands the stability of VAR. The results presented in figures 5.1 imply that the VAR model is stable as all the roots of the model lie within the unit circles

5.3.4 Autocorrelation Test

The structural innovations (v_i) which are orthogonal and uncorrelated need to be identified in order to trace out the dynamic responses of the model to these shocks which provide the impulse response function. This is presented in Table 5.4

From Table 5.4 it can be concluded that, structural shocks are not mutually correlated, i.e. the isolated shocks produced moving from VAR does not have any impact on the shocks produced by the SVAR. Having determined the optimal lag structure and since our variables are I(1) series, the cointegration test was carried out using Johansen cointegration test which is a superior test that lies on asymptotic property (like this study) and therefore sensitive to error in small sample.

However, the weak exogeneity test was conducted before performing the cointegration test, this is to enable us to know which variable is weakly exogenous and then place the variable as dependent variable in estimating the long-run relationship among road transport infrastructure development, economic growth and poverty reduction. It is also robust to many departures from normality as it gives room for the normalization with respect to any variable in the model that automatically becomes a dependent variable.

5.3.5 Weak Exogeneity Test

Interest has been shown in the issue of weak exogeneity testing in a linear Vector Error Correction Model (VECM) (see for instance Johansen (1992, 1995); Ericsson et al.

(1998); Hecq et al. (2002); Rault and Pradel (2003)). Weak exogeneity has also been extensively in the literature, and is now widely recognized as a crucial concept for applied economic modeling. It is now well-admitted that the presence or lack of weak exogeneity depends crucially on what parameters the focus of attention is.

Table: 5.4 Auto correlated Test

Lags	LM-Stat	Prob
1	10.80799	0.2891

Table 5.5: The Result of Weak Exogeneity Test

Variables	Chi-Square	Probability Value
Lq	0.0261	0.87193
Lg	0.0168	0.89595
Lpt	10.58	0.00114

Source: Author's Computation (2014)

One restriction of particular interest is whether the *i*-th row of the α matrix is all zero. If this is the case, then *i*-th endogenous variable is said to be weakly exogenous with respect to the β parameters. However, from the Table 5.5 above the only variable that is significant after subjecting our variables to this test is poverty level. Therefore, we proceed in examining the long-run relationship among the variables by conducting co-integration test treating poverty level as the dependent variable.

5.4 The Relationship among Road Transport Infrastructure Development, Economic Growth and Poverty Reduction in Nigerian

In obtaining the long run relationship among road transport infrastructure development, economic growth and poverty reduction, the Trace Statistics, Max-Eigen Statistics and the Normalized Co-integrating Coefficient is obtained from the Johansen co-integration test. This is presented in Table 5.5 below.

5.4.1: Cointegration Test

Having determined the weakly exogenous variable, the cointegration test was conducted. In testing for cointegration, the maximum likelihood approach by Johansen and Julius (1990) was adopted. This is a superior test that lies on asymptotic property and therefore sensitive to error in small sample. Moreover, since most of the variables used in this study are highly trended, the Johansen test was performed under the assumption of linear deterministic trend in the data. Table 5.6a and 5.6b reports result obtained when the linear combination of variables as reflected in the VAR model was subjected to cointegration test.

Table 5.6(a) Cointegration Test (Trace Value)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.540061	35.0272	29.79707	0.0114
At most 1	0.318846	12.504	15.49471	0.1343
At most 2	0.046109	1.368967	3.841466	0.242

Table 5.6(b) Cointegration Test (Max –Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.540061	22.5232	21.13162	0.0317
At most 1	0.318846	11.13503	14.2646	0.1476
At most 2	0.046109	1.368967	3.841466	0.242

Trace and Max –Eigenvalue indicates 1 contigrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Author's Computation

The results of the co-integration in Table 5.6(a) and 5.6(b) confirm that there is at least one co-integration relationship among the macro-economic variables included in the model. Specifically, the result of the co-integration test suggests that transport infrastructural development has equilibrium condition with economic growth and poverty level at 5% level of significance, which keeps them in proportion to each other in the long run. This evidence of co-integration among the variables rules out spurious correlations and applies that one direction of influence can be established among the variables.

It is important to note that the existence of co-integration vectors among a group of variables did not tell us the nature of the long run relationship and also may not imply that there is causal influence between pairs of variables in the model of co-integration test. Therefore the Normalized Co-integrating Coefficient is obtained from the Johansen co-integration test in ascertaining the nature of the long run relationship as thus:

$$lpt = 1.57lq + 0.62\,\mathrm{lg} + c \qquad 28$$

$$\begin{array}{ll} (0.958) & (0.145) \\ [1.639] & [4.266] \end{array}$$

Note that Standard error in ( ) *and t-statistics in* [ ]

From equation 28 above, with one lag period shows that 1 per cent increase in road transport infrastructure development insignificantly reduces poverty level given an increase in real consumption expenditure per capita by 1.6 per cent. Also, 1 per cent increase in economic growth increases real consumption expenditure per capita by 0.62 per cent bringing about a reduction of 0.62 per cent in poverty level. Moreover, only the effect of economic growth on poverty reduction is significant at 5 per cent level of significance.

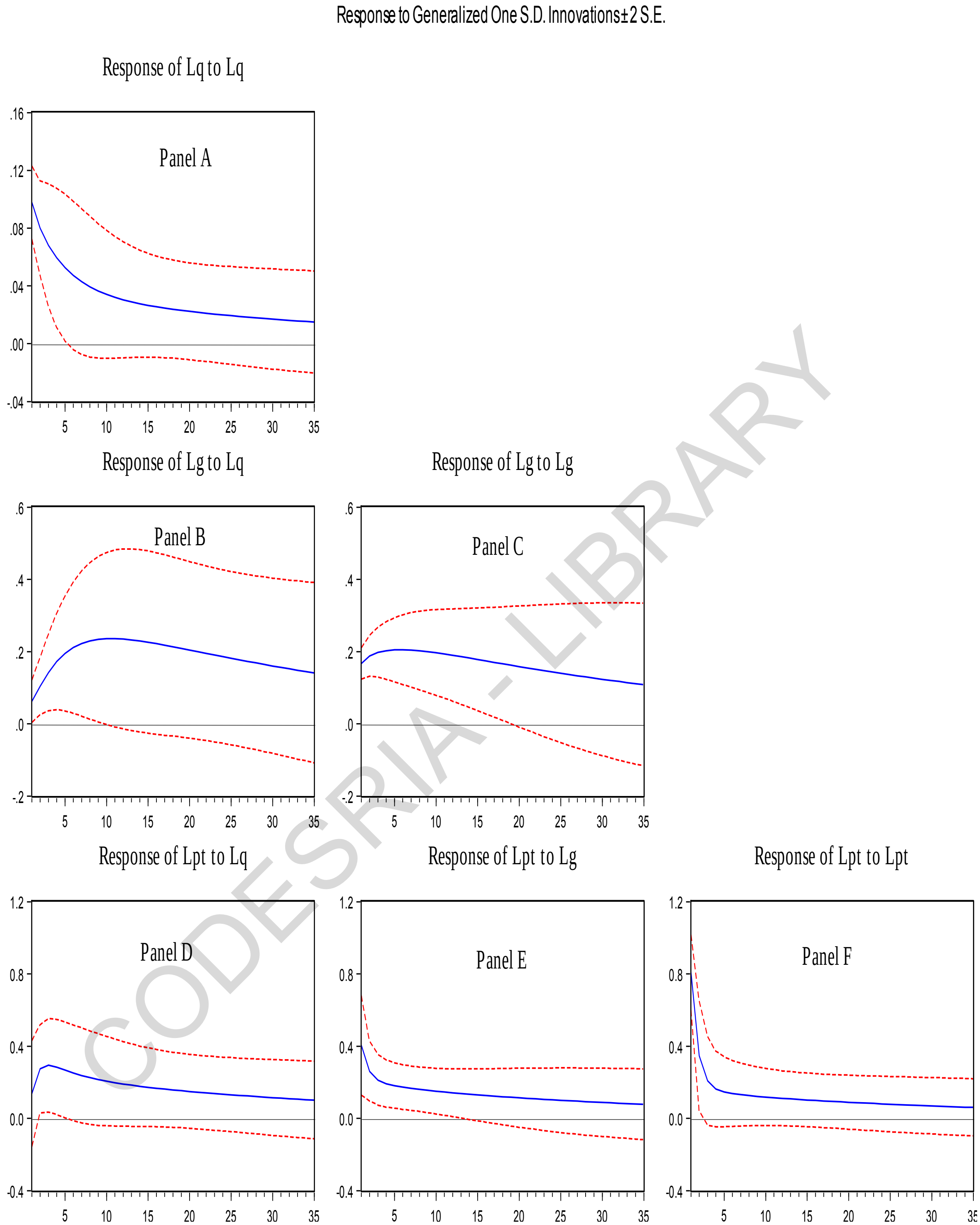
5.5 SVAR Impulse Response Functions (Irfs) and Forecast Error Variance Decomposition (FEVD) of the Specified Model

The results of the Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD) derived from Structural Vector Autoregression (SVAR) estimates are presented in Figure 5.2 and Table 5.8. This becomes necessary in order to empirically determine the dynamic characteristics and sources of changes in the road transport infrastructure, economic growth and poverty level. 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, FEVD shows the percentage of the forecast error variance for each variable that might be attributed to its own innovations and the innovations of the other variables in the system. IRFs and FEVD give an idea of the determination and transmission mechanism of the policy shocks in the system in line with the standard practices. This section is organized into parts: Section 5.5.1 reports the analyses of the Impulse Response functions (IRFs) for the SVAR model's equations while section 5.5.2 presents the reports of the Forecast Error Variance Decomposition (FEVD) in similar fashion for the SVAR model equation. The model contained the following variable combinations: LY, LQ and LPT.

5.5.1 Results of SVAR Impulse Response Analysis Based on the Specified Model

The interpretation would rely on the magnitude and signs of the estimates, but the signs on the estimated responses are more important than the size of the estimates because the magnitude shows the statistical influence while the signs provide the desired economic content for the impact.

Figure 5.2 shows the impulse responses generated from the recursive structural VAR models estimated in this study. The IRF measures the dynamic response of variables *Lq*, *Lg* and *Lpt* to an unanticipated shock measured as innovation in the model. In Figure 5.2, 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 the responses of the variables. This is presented in Figure 5.2.



Note: Solid line indicate SVAR impulse response while broken lines indicate 95% Hall's Percentile confidence intervals calculated with1000 Bootstrap procedure.

Figure5.2. Structural VAR: Impulse Response Functions (SVAR Ordering = Lq Lq Lpt)

Source: Author's Computation (2014).

Starting with the impact of road transport infrastructure, a shock to it produces a positive response throughout the time horizon of 35 periods. However, interest will not be given to response of a variable based on the shock to itself. Therefore, we are left with three panels based on the restriction placed on the variables estimated in this study as guided by the theories and institutions in Nigeria (i.e. Panel (B, D and E). interestingly, the restriction placed on our variables of estimate was strongly supported by the result of the weak exogeneity test conducted earlier in this study. This therefore, makes our restriction more realistic based on theories and institutions that operates in Nigeria.

From the result of the SVAR impulse response function in Figure 5.2(Panel B), it can be observed that a shock on road transport infrastructure development produces a positive effect on economic growth throughout the period of consideration. For instance, a positive effect of 0.06 per cent, which is observed at the 1st period, increased to 0.19 per cent and 0.24 per cent at the 5th and 10th periods respectively. However, this increase begins to fall gradually from the 15th, 20th, 25th, 30th and 35th periods, by (0.23, 0.20, 0.18, 0.16 and 0.14) per cent respectively. By implication, as road transport infrastructure development increases, it metamorphosis into economic growth, however, this effect increases over a period of time but reduces thereafter.

An observation from Figure 5.2(Panel D) shows that, a positive response of about 0.14 per cent is produced by real consumption expenditure per capita, as a proxy for poverty reduction due to an innovation on road transport infrastructure development in the 1st period. This increases greatly to 0.27 per cent in the 5th period before it begins to fall gradually to (0.21, 0.17, 0.15, 0.13, 0.11 and 0.10) in 10th, 15th, 20th, 25th, 30th and 35th respectively. This implies that when road transport infrastructure development occurs, it increases real consumption expenditure per capita in the economy, but this increase in real consumption expenditure per capita reduces over time.

In addition, in Figure 5.2(Panel E), a positive response of about 0.40 is produced by real consumption expenditure per capita as a result of an innovation on economic growth. The response reduces heavily from 0.40 per cent in 1st period to 0.18 per cent in the 5th period and thereafter reduces gradually up to 35th period. This implies that when economic growth occurs, it increases real consumption expenditure per capita in the economy, but this increase in real consumption expenditure per capita reduces over time.

5.5.2 Results of SVAR Forecast Error Variance Decomposition (FEVD) Based on the Specified Model

The result in the preceding section indicates that improvement in road network is crucial and pre-conditioned to achieving a sound economic growth and pace of poverty reduction in Nigeria. In order to further shed light on the link among road transport infrastructure development, economic growth and poverty level, the variance decomposition derived from the SVAR is generated and analysed. This is a decomposition of forecast error in an endogenous variable into the component shocks to the endogenous variables. According to Akinlo (2003), while impulse response functions are very useful in ascertaining the direction of the effect of a shock to innovations of a variable, the magnitude of the effect of the shock to the innovation can only be deciphered by Forecast Error Variance Decompositions; in other words, they show the explanatory contribution of the shock to the innovations of the variables. They indicate the proportion of the forecast error in a given variable that is accounted for by innovations in each endogenous variable.

Table 5.7: SVAR Forecast Error Variance Decomposition

Variance Decomposition of Lq (Panel A)

Period	S.E.	*Lq*	*Lg*	*Lpt*
1	0.097822	100	0	0
5	0.166584	96.83434	1.320607	1.845051
10	0.192192	94.71360	2.726234	2.560165
15	0.205036	93.33249	3.768438	2.899074
20	0.213442	92.38580	4.506968	3.107231
25	0.219501	91.72488	5.027928	3.247193
30	0.224028	91.25440	5.400041	3.345557
35	0.227462	90.91331	5.670125	3.416561

Variance Decomposition of Lg (Panel B)

Period	S.E.	*Lq*	*Lg*	*Lpt*
1	0.166868	13.96677	86.03323	0
5	0.482569	44.06563	50.05894	5.875431
10	0.769863	60.62098	33.16688	6.212141
15	0.969129	66.83003	27.05761	6.112363
20	1.107715	69.70555	24.25759	6.036859
25	1.206329	71.25560	22.75372	5.990679
30	1.278072	72.18254	21.85557	5.961885
35	1.331168	72.77830	21.27859	5.943110

Variance Decomposition of lpt (Panel C)

Period	S.E.	*Lq*	*Lg*	*Lpt*
1	0.807977	2.848920	22.23078	74.92030
5	1.055472	29.73214	18.19407	52.07379
10	1.192764	41.43799	16.62180	41.94021
15	1.277440	46.54148	16.17934	37.27919
20	1.336745	49.47120	15.99195	34.53685
25	1.380339	51.36823	15.88739	32.74438
30	1.413062	52.67342	15.81958	31.50700
35	1.437885	53.60348	15.77228	30.62424

Source: Author's Analysis (2014)

The SVAR model estimated comprises the following variables: road transport infrastructure, *Lq*; economic growth, *Lg*; and poverty rate, *Lpt*. The results presented in Table 5.7 (Panel A) show that is own shocks explained a large proportion of the variations in the variance of road transport infrastructure. The magnitude, which however decreases from a high value of 100 per cent to 96.8 per cent in the fifth period, later decreases marginally over the periods. Other variables that are of importance are economic growth and real consumption expenditure per capita. Although they explain a neutral proportion of variations in the variance of road transport infrastructure at the first period, this increases from 0.00 per cent to 1.3 (economic growth) and 1.8 per cent (real consumption expenditure per capita) and later to 2.7 per cent (economic growth) and 2.6 per cent (real consumption expenditure per capita) in the fifth and tenth periods respectively and this continues for rest of the periods.

Panel B in Figure 5.7 depicts the proportions of forecast error variance in economic growth, LY, explained by innovations of the considered endogenous variables. The two variables appear crucial in determining the variation in the variance of economic growth. The magnitude of road transport infrastructure development (*Lq*), which is about 14 per cent in the first period, increases greatly to 44 per cent in the fifth period and at thirty fifth period it increased to 72.8 per cent. The innovations in economic growth and the variation in itself which are very high at the first period, reduces greatly over time. For instance, it reduces from 86 per cent in the first period to 50%, 24% and 21% in the fifth, twentieth and thirty fifth periods respectively. The variation in economic growth as a result of an innovation in real consumption expenditure per capita is neutral in the first period but becomes 5.9 per cent in the fifth period and increase to 6.1 per cent in the fifteenth period but reduces slightly from twenty fifth period up to the thirty fifth period by 5.9 per cent on average.

From Table 5.7 in Panel C, the innovation in road transport infrastructure makes the real consumption expenditure per capita variance to be decomposed by 2.8 per cent in the first period but increased sharply to 29.7, 46.5, 51.4 and 53.6 per cent in the fifth, fifteenth, twenty fifth and thirty fifth periods respectively. Moreover, the magnitude of economic growth reduces from 22.3 per cent in the first period to 18.2 and further reduces over time.

5.6 The Directions of Causality among Road Transport Infrastructure Development, Economic Growth and Poverty Reduction in Nigeria

This section addresses the fourth objective of this thesis which is to investigate the causal relationship among road transport infrastructure development, economic growth and poverty level in Nigeria. Although regression analysis deals with the dependence of one variable on the other variable, it does not necessarily imply causality. In other words, the existence of a relationship between variables does not prove causality or direction of influence. However, in a regression analysis which includes time series data, the situation may be somewhat different. It is possible that event A is causing event B. In other words, events in the past can cause events to happen in the present or vice-versa

Given that all variables for the study, as earlier established, are stationary at I(1) and co-integrated, the Multivariate Granger Causality relationship among variables is investigated in the context of Vector Error Correction Model (VECM). In the estimation of the VECM model, a period lag of the first difference of variables as well as the error correcting term is used. The p-value of the Wald statistics which follows F-distribution was observed. Moreover, the significance of the error correction term determines the long-run direction of causality, while the significance of the first differenced explanatory variables determines the short-term direction of causality. This is reported in Table 5.8(a, and b) observing the p-value of the Wald statistics which follows the Chi- Square, both in the short –run and long-run respectively.

Table 5.8a Short Run Multivariate Granger Causality Test Result

$\alpha_1 = \alpha_2 = 0$	χ^2	$p-value$	Remark
$Lg \rightarrow Lq$	0.360	0.548	No Causality
$Lpt \rightarrow Lq$	0.243	0.622	No Causality
$Lq \rightarrow Lg$	0.541	0.462	No Causality
$Lpt \rightarrow Lg$	2.935	*0.086***	Causality
$Lq \rightarrow Lpt$	0.668	0.431	No Causality
$Lg \rightarrow Lpt$	*3.096*	*0.078***	Causality

Table 5.8b Long Run Multivariate Granger Causality Test Result

$\alpha_1 = \alpha_2 = \alpha_3 = 0$	χ^2	$p-value$	Remark
DLq	0.025	0.874	No Causality
DLg	*0.021*	*0.888*	No Causality
$DLpt$	*5.7714*	*0.0163**	Causality

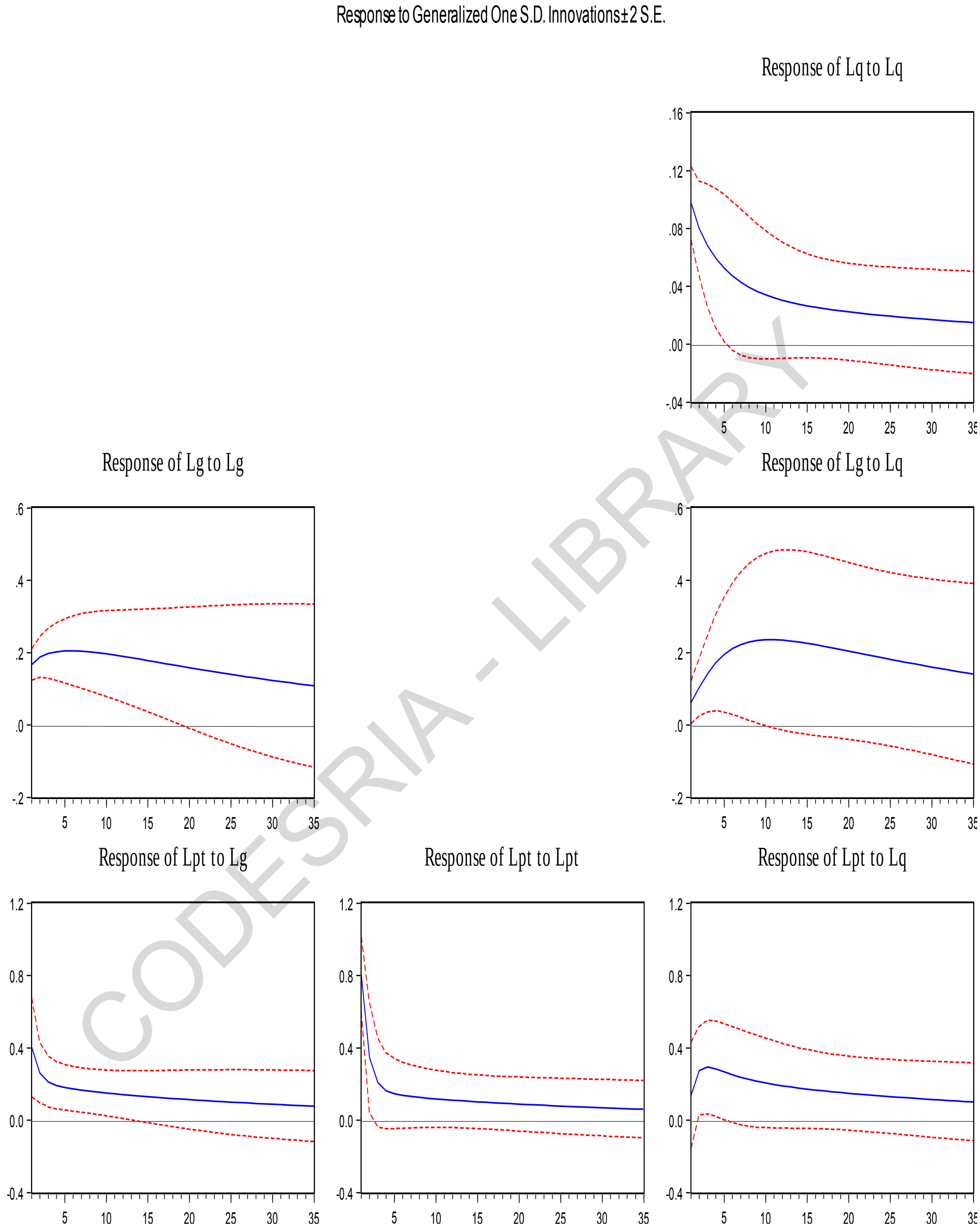
Source: Author's Analysis (2014)

*Notes: *and ** indicates statistical significance at 5% and 10% level of significance, while* χ^2 *is the Chi-Square of the Wald statistics and the hypothesis is that each of the coefficients of lagged explanatory variables is zero.*

Table 5.8(a and b) above shows the Granger Causality Test carried out among road transport infrastructure, economic growth and poverty reduction in Nigeria based on 5 and 10 per cent significance level. The result in Table 5.8a shows that, there is no causal relationship among the variables in the short run except that of bi-directional causality that exists between economic growth and real consumption expenditure per capita at 10 per cent level of significance. This implies that increase in economic growth granger-cause poverty reduction and vice-versa. Moreover, in Table 5.9b, a strong unidirectional causality was found between poverty reduction and road transport infrastructure development with the causality running from road transport infrastructure development to poverty reduction at 10% level of significance in the long run. More also, a unidirectional causal relationship exists between economic growth and poverty reduction running from economic growth to poverty reduction at 10 per cent level of significance in the long run.

5.7 Sensitivity Test Analysis

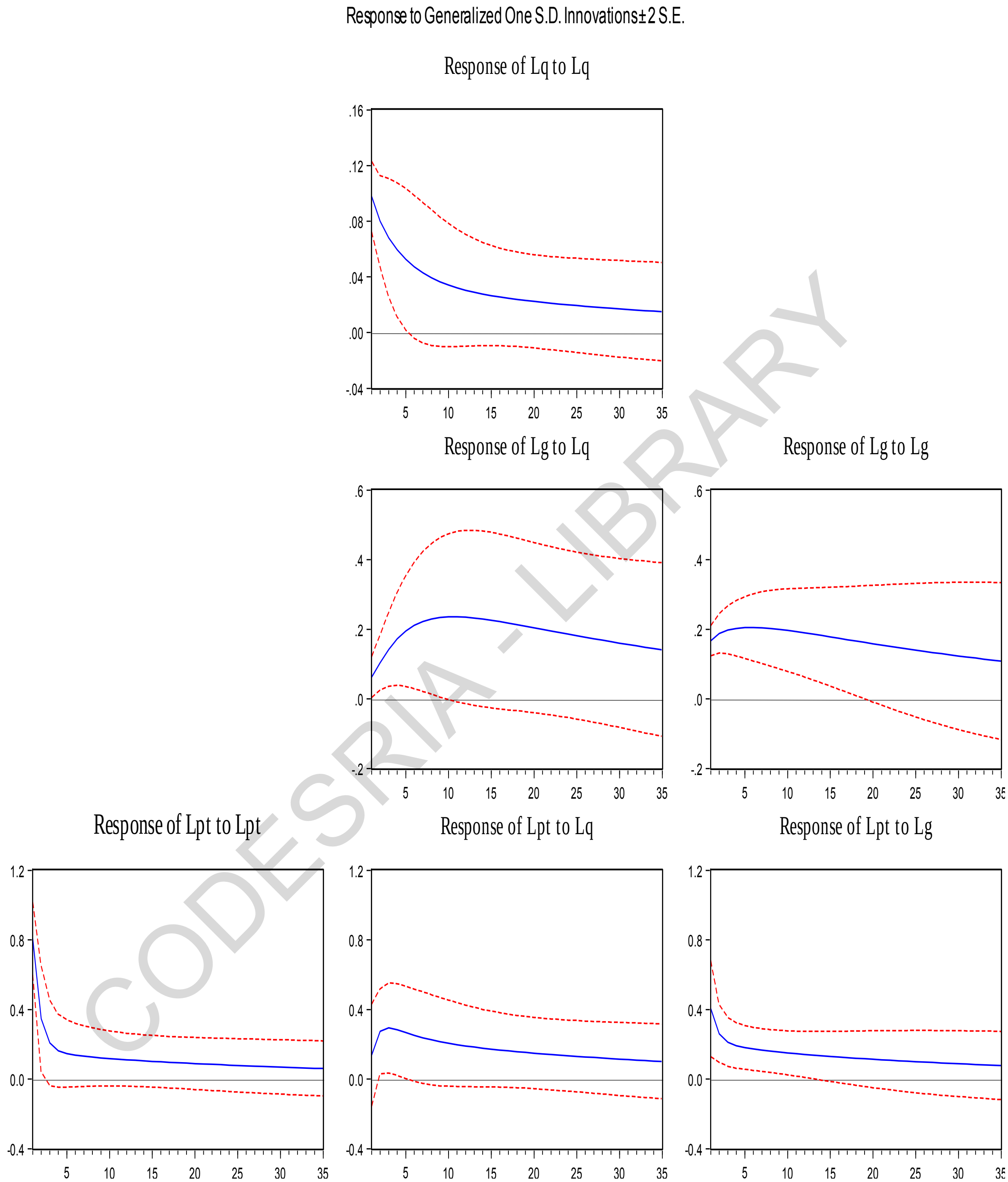
The sensitivity analysis carried out in this study became necessary to examine the robustness of our SVAR analysis. This is to investigate that the result of impulse response functions (IRFs) is not affected by variable ordering. Therefore, sensitivity analysis will be performed to determine how the structural analysis, based on IRFs and FEVD, are affected by causal ordering. The sensitivity analysis is based on estimating the SVAR using variants of variable ordering. This is presented in Figure 5.3, and 5.4.



Note: Solid line indicate SVAR impulse response while broken lines indicate 95% Hall's Percentile confidence intervals calculated with1000 Bootstrap procedure.

Figure5.3. Structural VAR: Impulse Response Functions (SVAR Ordering = Ly Lpt Lq)

Source: Author's Computation (2014).



Note: Solid line indicate SVAR impulse response while broken lines indicate 95% Hall's Percentile confidence intervals calculated with1000 Bootstrap procedure.

Figure5.4. Structural VAR: Impulse Response Functions (SVAR Ordering = Lpt Lq Lg)

Source: Author's Computation (2014).

From the sensitivity test in Figure 5.3 and 5.4, it can be observed that, our variables are not sensitive to ordering. Therefore, it can be concluded that, our analysis is robust given no vibration between Figure 5.3, Figure 5.4 and Figure 5.2 respectively

5.8 Discussion of Results

This study has empirically investigated the existence or otherwise of the road transport infrastructure development, economic growth and poverty level nexus in the Nigerian economy. Relating to this issue are the questions of whether road transport infrastructure development leads to economic growth and poverty reduction or vice-versa in the Nigerian economy. Also, to know how important is the road transport infrastructure development in the light of pursuing the welfare of the people through economic policies, if economic growth has been able to contribute to poverty reduction and road transport infrastructure development in Nigeria?

The long run estimate has shown that road transport infrastructure development, economic growth and poverty reduction exercise a long run relationship, and specifically confirmed that road transport infrastructure development and economic growth impacts positively on poverty reduction. This is supported by the impulse response analysis result. The result of the IRF indicates that the effects of road transport infrastructure development on economic growth and poverty reduction is positive, though the positive effect reduces over time. This is indicated by the positive response of economic growth and real consumption expenditure per capita to road transport infrastructure shock throughout the time horizon, and a greater fall in the value of their responses over time. The implication from this is that: the initial high positive impact on real consumption expenditure per capita could be interpreted to be that poverty level reduces at the initial stage of road transport infrastructure development, but that the fall in the value shows that the road transport infrastructure developed could no long reduce poverty level of the country over time and this is also supported by the insignificance of the positive effect of road transport infrastructure development on poverty reduction in the long-run estimate.

This is a true picture of the Nigerian economy since most of the time in Nigeria, roads transport infrastructure are not properly constructed and maintained to stand the test of time, and the consumer of these roads increase at a very high increasing rate, thereby leading to diminishing return and decay of the road transport infrastructure over time. Interestingly, the positive effect of road transport infrastructure on economic growth as observed from the IRF in this study is in line with the work of Akanbi et al. (2013) and Onakoya et al. (2012), despite the variation in data and the methodology applied.

More interesting, is the significant of the long run positive effect of economic growth on poverty reduction through an increase in real consumption expenditure per capita. By implications, this means that when the economy experiences growth, it increases real consumption expenditure per capita (which is a measure of poverty reduction in this study). Moreover, when economic growth emerged, per capita income increases, bringing about increase in aggregate demand for goods and services by Nigerians and since the firm will always want to maximize profit, this will make them to expand their scope in order to meet the new demand in goods and services that emerge from an increase in real per capita income given an increase in economic growth. The increase in economic growth could also motivate both foreign and domestic investors since the demand for goods and services rises given an increase in real income, this could thereby bring about an increase in employment rate which brings about increase in welfare of the people.

The analysis of the importance of road transport infrastructure development on economic growth and poverty reduction in Nigerian economy and vice-versa, using FEVD, indicates that road transport infrastructure development has a greater magnitude on the shock created on economic growth and poverty reduction over time, but much more on economic growth than that of poverty reduction. By implication, this can be explained that road transport infrastructure development impacted more on economic growth than poverty reduction in Nigeria. However, the result reveals that economic growth seems to be more important in considering policy actions towards attaining poverty reduction at early stage of real consumption expenditure per capita but reduces over time in Nigeria. Interestingly, the importance of road transport infrastructure development in determining the pace of poverty reduction in Nigeria increases over time given the FEVD results.

The result which emerges from the Granger causality test also strengthens the outcome of the long run relationship, IRF and FEVD that was observed earlier in this study. This is because the result reveals that, road transport infrastructure development and economic growth granger causes poverty reduction in the long -run. The implication of the granger causality is that, if road network increases, it could cause poverty level to reduce in the long -run. It is also interesting to know that variation in economic growth could lead to poverty reduction in Nigeria both in the short run and long run, while in the short run as poverty reduces, economic growth begins to emerge. This finding is in accordance with the works of Ogun (2010), and Lustig, Arias and Rigolini (2002) who posit that actions to reduce poverty can create vicious cycles that raise economic growth which in turn reinforces poverty reduction. Surprisingly, there was no causal relationship between road transport infrastructure development and economic growth both in the short-run and long-run, which was also supported by the study of Olorunfemi (2008).

CHAPTER SIX

SUMMARY, RECOMMENDATION AND CONCLUSION

This chapter presents a summary of the major findings in this study based on the interactions of road transport infrastructure development, economic growth and poverty reduction in Nigeria. The policy implications as well as the limitations of the study are thereafter discussed. The chapter outlines the study's specific contributions to knowledge and suggestions for future research.

6.1 Summary of the Study

Attempt has been made in this study to account for the possible interaction among road transport infrastructure development, economic growth, and poverty level in Nigeria over the period 1980 and 2010. The history and trend of road transport infrastructure development and assessment of the variants of road transport infrastructure development policies implemented by the successive Nigerian government are looked into while the trend of poverty rate and economic growth in Nigeria are also examined.

To achieve the stated objectives, the study adopts the following this pattern: in the introductory chapter, the necessary background is laid; the problems are identified and justified accordingly. In Chapter Two, a critical review of the literature was done with a view to identifying academic gap in the existing knowledge. The review shows that empirical studies have produced inconclusive results on the interactive effect among road transport infrastructure development, economic growth and poverty reduction, and the direction of causality between them; moreover, the effect of road transport infrastructure development on poverty reduction have not been adequately explored in Nigeria. Also, the existing studies have not sufficiently and empirically examined the interactive effects among road transport infrastructure development, economic growth and poverty level. The chapter also explores the theories of transport infrastructure development transmission mechanism as well as the link between economic growth and poverty reduction.

Chapter Three presented the methodological model and techniques of analysis that are more appropriate for the analysis. The Structural VAR approach adopted takes cognisance of the shortcomings of previous studies, and the model is carefully identified to incorporate the basic features and the dynamism of the contemporary Nigerian economy. The study covers the period of 31 years (1980-2010). Secondary data are utilized. Data on road transport network, Real Gross Domestic Product (RGDP) and real consumption expenditure per capital are sourced from the Central Bank of Nigeria (CBN), Statistical Bulletin (2010) and National Bureau of Statistics (NBS), Abuja.

Furthermore, in Chapter Four, the history and trend analysis of road transport infrastructure development and the trend of poverty rate and economic growth in Nigeria were examined. While chapter five estimates the series dates based on the variables presented in the model, by first examining the property test before the long-run relationship of the variables is investigated. Also, in order to empirically examine the interacting effects existing among road transport infrastructure development, economic growth and poverty level, the impulse response and Forecast Error Variance Decomposition derived from the Recursive Structural Vector Autoregression model are examined.

On the basis of the empirical analyses, the findings that emerge could be summarised below:

(i) The long run effects show that road transport infrastructure development has a positive relation with poverty reduction. As road transport network increases, poverty level reduces in Nigeria. The research also finds that economic growth has positive effect on poverty level through real consumption expenditure per capita. Interestingly, only the effect of economic growth was significant at 5% level of significance.

(ii) An innovation on road transport infrastructure produces a positive shock effect on economic growth throughout the periods. Interestingly, a high positive response by poverty is observed at the initial period but this positive response reduces over time as a result of an innovation on road transport infrastructure. An important finding from this study is that of poverty reduction response to an increase in economic growth (RGDP). This is because of its increase in rate over time i.e. real consumption expenditure increases over time due to an increase in economic growth.

(iii) The magnitude of contribution of the road transport infrastructure innovation to economic growth, and poverty reduction is very important in Nigeria, although the magnitude of the innovation of that of economic growth to poverty reduction is not as higher as that of innovation on poverty reduction to economic growth based on the findings from the forecast error variance decomposition in this study.

(iv) As revealed by the findings, it could be observed that road transport infrastructure development as well as economic growth Granger-causes poverty reduction in the long run. Interestingly, there is the existence of Bi-directional causality between economic growth and poverty reduction in the short-run.

6.2 Conclusion

The general observation from these findings is that road transport infrastructure development could be seen as useful policy as it has the potential to contribute to the economic growth and poverty reduction and vice-versa in the Nigerian economy. However, the way it is being handled through the various Federal Government agencies without proper monitor and implementation needs to be critically examined and corrected. At present, road transport infrastructure has not been effectively utilised to generate maximum benefits in the Nigerian economy. Its benefits are not being significantly felt in the economy, particularly in the area of poverty alleviation in Nigeria.

Overall, the interactions among road transport infrastructure development, economic growth and poverty reduction appear very weak and do not follow a predictable pattern in Nigeria. It is expected that road transport infrastructure development should lead to increase in economic growth and eventually reduce poverty level significantly. However, the insignificant effect of road transport infrastructure development on poverty reduction suggests that, there are some structural rigidities in the economy that are preventing the impact of road transport infrastructure development from being fully felt by the economy. This further suggests the presence of some institutional factors that create inherent problems in the economy that could frustrate any valid and sincere transport policies formulated by the government. This probably explains in part why poverty level is still very high in Nigeria. The causal chain established in this study emphasises the need to boost economic growth to alleviate poverty and to derive maximum benefits from transport sector development in general. Also, for road transport infrastructure development to be effective, poverty needs to be tackled using multi-dimensional approaches. This is necessary because poverty level itself could positively impact on the economy and brings about improvement in road transport infrastructure over time.

6.3 Recommendations

From the findings that emerge in this study, some vital policy implications can be drawn. Our findings have shown to us, that transport infrastructure development has impacted poverty level positively, although, the impact is not significant.

First, this implies that most of the federal roads constructed in Nigeria were majorly constructed in urban areas leaving most of the rural areas with no or inadequate roads to carry out their economic activities which in turn could lead to increase in the welfare of the entire populace and bring about reduction in the poverty level of the country. Although the available federal roads encourage economic activities, which could reduce poverty rate in Nigeria, the reduction rate is very minimal to the extent that the poverty rate remains very high. This could also be factual since the demand for road transport infrastructure surpasses the supply at every point in time in Nigeria. Therefore, if policy makers could tailor transport policies towards developing rural roads in Nigeria, there could be a great improvement on poverty reduction (which is, of course the ultimate goal of any government). Second, the fact that the effect of road transport infrastructure development on poverty reduction contradicts the theory in Nigeria given the insignificant level of road transport infrastructure development on poverty reduction in the long run and reduction in poverty level response to a shock on road transport infrastructure development suggests that, there is the need for the Nigerian government to re-assess its existing federal roads to know if many of them are motorable or truly in existence. This is because despite numerous poverty alleviation programmes formulated and implemented from the inception of independence in Nigeria, is highly worrisome experiencing the level of poverty rate in the country. For instance, many industries has close down while many others have relocated to other countries due to inability to break even given the decayed level in road transport infrastructure that increases cost of doing business in Nigeria.

Therefore, Federal Road Maintenance Agency (FERMA) should wake up to their responsibilities by properly and critical put in place every decayed road network in order to stimulate economic growth and poverty reduction in Nigeria.

Although the study confirms the crucial role of economic growth to enhance the reduction of poverty level and as a means to ensure the success of road transport infrastructure development in the Nigerian economy, however, government should encourage both domestic and foreign investors by creating a more conducive environment which could increase government revenue in building more road network and implementation of poverty alleviation programmes.

More importantly, it could then be recommended that good governance, budget control, integrity, reforms, effective leadership, transparency and accountability should be pursued in the transport sector, most especially in the area of poverty alleviation programmes since they can all lead to economic growth and road transport infrastructure development in Nigeria. Additionally, there should be an improvement in government budgets towards transport sector, most especially the road network which is the most effective and more affordable mode of transportation in carrying out economic activities, when considering the rural poor, in Nigeria.

Also, the adoption of Public Private Partnership (PPP) procurement and attraction of foreign investors on road infrastructure will be necessary and has to be encouraged by government in order to complement its efforts in developing road networks across the country, since the government cannot meet the demand for road network in proportion to population growth in Nigeria. Moreover, implementation of plans is an important issue that policy makers should look into. This is because most of the roads constructed in Nigeria cannot withstand the tension that confronts them over time due to lack of best practice in project management and capacity building.

6.4 Limitations of the Study

The main limitation of this study is that some of the useful data on transport infrastructure are either not existing in the form that could be used in time series analysis or are unavailable anywhere. This imposes limitation on the extent and nature of econometric analysis that could be carried out in this study. For instance, this study would have been more elaborate assuming data are available on other modes of transport infrastructure development, in which case, it is possible to empirically analyse the effects of the development in the sector (as a whole) on economic growth and poverty reduction rather than using the road transport infrastructure only.

6.5 Contribution to Knowledge

The study has contributed to knowledge in some major ways. First, the study provides additional information on and insight into the interactions among road transport infrastructure development, economic growth and poverty level in Nigeria. This insight stems from the finding that road transport infrastructure development could positively affect economic growth and reduce poverty level in the Nigerian economy. It also establishes that economic growth is potent enough to greatly and positively influence poverty and road transport infrastructure development if corruption is eradicated with all seriousness, particularly if there could be an even distribution of income. In addition, the study has shown that the relationship among road transport infrastructure development, economic growth and poverty level suggests that it is only the impact of road transport infrastructure development on economic growth that can conform with the theory in Nigeria while the impact of road transport infrastructure development on poverty seems not to yield any positive result.

The study also contributes to the inconclusive evidence in the literature on causality between economic growth and road transport infrastructure development, by revealing that road transport infrastructure development in Nigeria affects economic growth and poverty reduction. Similarly, in the area of methodology, employing the technique of Structural Vector Autoregression (SVAR) in analysing the dynamic interactions that exist among road transport infrastructure development, economic growth and poverty level in Nigeria, is an improvement on the various existing methodologies in the literature.

6.6 Suggestions for Further Research:

Based on the limitation identified in section 6.4, researches need to be conducted on other modes of transports infrastructure development, since road mode of transport alone cannot be a yard stick to measure transport sector performance in Nigeria. Also, in view of the fact that road transport infrastructure did not affect Nigerian economic activities alone, there is the need for the expansion of the scope of the study to cover some other West African countries and, if possible, other Sub-Saharan African countries. Developing economies appear to face largely the same unique problems. Such an analysis could be done within the context of a panel study.

REFERENCES

Adams, R. H. (2004). "Economic Growth, Inequality and Poverty: Estimating the Growth Elasticity of Poverty". World Development, 32:12, 1989-2014.

Adenikinju, A. (2003). Efficiency of the Energy Sector and its Impact on the Competitiveness of the Nigerian Economy International Association for Energy Economics 27

Aderamo, A. J. and Magaji. S. A. (2010). Rural Transportation and the Distribution of Public Facilities in Nigeria: A Case of Edu Local Government Area of Kwara J Hum Ecol, 29(3): 171-179 (2010) Kamla-Raj 2010

Agenor, P. (2004). The Economics of Adjustment and Growth, 2nd edition, Boston (Mass.), Harvard University Press.

Agenor, P. (2005a). "Infrastructure, Public Education and Growth with Congestion Costs", Centre for Growth and Business Cycle Research, Working Paper, No. 47, University of Manchester, January

Aigbokhan, B.E. (2000a). "Poverty, Growth and Inequality in Nigeria: a case study", *African Economic Research Consortium Research Report No. 102 (October).*

Akanbi B, Bamidele, A. and Afolabi, D. (2013). Improvement in Transport Infrastructure and Economic Growth in Nigeria. Available at www.ijhss.org vol. 2 issue 8, pp 26-31.

Akinlabi, B. H, Kehinde, J.S and Jegede, C.A. (2011). Public infrastructures: An approach to poverty alleviation and economic development in Nigeria. The European Journal of Humanities and Social Sciences, ISSN 2220-9425 4(1): (Special Issue)

Akinbobola, T. O., and Saibu, M. O. (2004). 'Income Inequality, Unemployment, and Poverty in Nigeria: A Vector Autoregressive Approach'. *Policy Reform, 7 (3): 175-83.*

Almas, H. (2004). Growth, Inequality and Poverty Relationships. IZA Discussion Paper No. 1338 October 2004.

Amis, P., and Kumar, S. (2000). 'Urban Economic Growth, Infrastructure and Poverty in India: Lessons from Visakhapatnam'. Environment and Urbanization, 12 (1): 185-96.

Amisano, G. and Giannini, C. (1997). Topics in Structural VAR Econometrics, 2nd edition. Berlin: Springer.

Amis, P. and Grant U. (2001). Urban Economic Growth, Civic Management and Poverty Reduction, *Journal of International Development 13, 997-1002.*

Anderson, E., Renzio, P. and Levy, S. (2006). 'The Role of Public Investment in Poverty Reduction: Theories Evidence and Methods'. ODI Working Paper 263. London: Overseas Development Institute.

Andrews K. and Swanson J. (1995) Does public infrastructure affect regional performance? Growth and Change 26, 204-216.

Aremo, (2012). Trade Liberalisation, Economic Growth and Poverty Reduction in Nigeria (1980-2009): Unpublished Thesis in Department of Economic, Obafemi Awolowo University, Ile-Ife. Osun State Nigeria.

Ariyo, A., and Jerome, A. (2004). Utility Privatization and the Poor: Nigeria in Focus. Global Issue Papers No. 12. The Heinrich Böll Foundation, July http://www.boell.de/downloads/ global/ GIP%2012%20Nigeria_Engl.pdf.

Aschauer, D. (1989). Is Public Expenditure Productive? *Journal of Monetary Economics 23*, 177-200.Aschauer, D. (1989), 'Does public capital crowds out private capital?' *Journal of Monetary Economics,Vol. 24, pp 171-188*.

Ashipala, J. and Haimbodi, N. (2003). The Impact of Public Investment on Economic Growth In Namibia. NEPRU Working Paper No. 88. [Online] Available: http://www.unhabitat.org/pmss/getElectronicVersion.asp?nr=2078&alt=1

Ayogu, M. (1999): 'Before Prebendalism: A Positive Analysis of Core Infrastructure Investment in a Developing Fiscal Federalism' African Development Review, 11 (2): 169– 98.

Ayogu, M. (2007): "Infrastructure and Economic Development in Africa: A Review", *Journal of African Economies Supplement 1, 75-126*

Aysegu, E., Muhtesem, K. and Merter, M. (2012). Transportation–Communication Capital and Economic Growth: A VECM Analysis for Turkey. European Planning Studies Vol. 20, No. 2, February 2012

Bahovec, V. and Erjavec, N. (2009). *Uvod u Ekonometricjsku analiza*. Zagreb Element

Baldwin, (1989). The Growth Effects of 1992 "Economic Policy" 9,Pp 247-282

Baltagi, H. and Pinnoi, N. (1995). Public Capital Stock and State Productivity Growth: Further Evidence from an Error Components Model. Empirical Economics 20, 351-359.

Balisacan, A. M. and Fuwa, N. (2003), Growth, Inequality and Politics Revisited: A Developing Country, Economics Letters 79, 53-58.

Banister, D. and Berechman, J. (2000). Transport Investment and Economic Development. London: University College, London Press. (cited in Cerevo, 2006.)

Baum-Snow, N. (2007). "Did highways cause suburbanization?" *Quarterly Journal of Economics 122(2):775–805*.

Baum-Snow, N. (2010). "Changes in Transportation Infrastructure and Commuting Patterns in US Metropolitan Areas, 1960-2000," *American Economic Review, American Economic Association, vol. 100(2), pages 378-82, May*.

Berechman, J., Ozmen –Ertekin, D. And Ozbay, K. (2006) Empirical Analysis of Transportation Investment and Economic Development at State, County and Municipality Levels, Transportation 33 , 537-551.

Bernanke, B. S. (1986), "Alternative explanations of the money-income correlation," Carnegie-Rochester Conference Series on Public Policy, 25, 49- 100.

Bhagwati, J. 2001. "Growth, Poverty and Reforms." Economic and Political Weekly. 11 March.

Bigsten, A., B. Kebebe, Shimeles, A.and Taddesse, M. (2003), Growth and Poverty Reduction In Ethiopia: Evidence from Household Panel Surveys, World Development 31,1, 87-106.

Blanchard, O.J. and Quah, D. (1989). " TheDynamic Effect of Aggregate Demand and Supply Disturbances ". *American economic Review*.Vol.79, 655-673.

Boarnet, M.G. (1994): An Empirical Model of Intrametropolitan Population and Employment Growth, *Papers In Regional Science 73, 135-152.*

Boarnet, M.G. (1998). Spillovers and the locational effects of public infrastructure, *Journal of Regional Science 38, 381-400.*

Boopen, S. (2006). "Transport Infrastructure and Economic Growth: Evidence from Africa Using Dynamic Panel Estimates". *The Empirical Economic Letters*, 5(1).

Button, K. (1998). Infrastructure investment, endogenous growth and economic convergence, *The Annals of Regional Science 32, 145-162.*

Bourguignon, F. (2003). The Growth Elasticity of Poverty Reduction: Explaining Heterogeneity across Countries and Time Periods. In R. Eicher And S. Turnovsky (Eds.): Inequality and Growth. MIT Press, Cambridge, MA.

Bougheas S., Demetriades P.O. And Mamuneas T.P. (2000) Infrastructure, Specialization, and Economic Growth, *Canadian Journal of Economics 33, 506-522.*

Briceno-Garmendia, C., Estache, A. and Shafik, N. (2004), "Infrastructure Services in Developing Countries: Access, Quality, Costs and Policy Reform", Policy Research Working Paper 3468, World Bank, Washington D.C.

Brocker, J. (1998). 'Operational Spatial Computable General Equilibrium Modelling', in: Ann. *Regional Science, 32: 367-387.*

Bruno, M., M. Ravallion, and Squire. L. (1998). "Equity and Growth in Developing Countries: Old and New Prospectives on the Policy Issues." In V. Tanzi, and K. Chu, eds., Income Distribution and High-Quality Growth. Cambridge: MIT Press.

Buhari, M. (2000). "The Role of Infrastructural Development and Rehabilitation in Sustainable Economic Growth in Nigeria", A Paper Presented At The All Peoples Party Economic Summit, Held at the Ladi Kwali Conference Center, Sheraton Hotel and Towers, Abuja, 9th - 10th November, 2000.

Button, K. (1998). Infrastructure investment, endogenous growth and economic convergence, *The Annals of Regional Science 32, 145-162.*

Calderon, C. (2009) Infrastructure and Growth in Africa, Policy Research Working Paper 4914, the World Bank, Washington, D.C.

Calderon, C. and L. Serven, (2008). "Infrastructure and Economic Development in Sub-Saharan Africa," Policy Research Working Paper Series 4712, The World Bank.

Calderon, C. And L. Serven, (2004). "The Effects of Infrastructure Development on Growth and Income Distribution," Policy Research Working Paper Series 3400, The World Bank.

Calderon, C., Easterly, W. and Serven, L., (2003). "Infrastructure Compression and Public Sector Solvency in Latin America." In: Easterly, W., Serven, L., eds., The Limits of Stabilization: Infrastructure, Public Deficits, and Growth in Latin America. Stanford University Press and the World Bank, 119-38.

Canning, D., Fay, M. (1993). The Effects of Infrastructure Networks on Economic Growth. New York: Columbia University, Department of Economics.

Canning, D. (1999). "The Contribution of Infrastructure to Aggregate Output." The World Bank Policy Research Working Paper 2246.

Canning, D. and Bennathan, E. (2000). “The social rate of return on infrastructure investments”, World Bank research project, RPO 680-89, Washington, D.C.

Canning, D., Pedroni P. (2004). Infrastructure and long run economic growth. Working Paper 99(9), Center for Analytical Economics, Cornell University.

Carlino, G.A. and Mills, E.S. (1987). The Determinants of County Growth, *Journal Of Regional Science 27, 39-54*.

Central Bank of Nigeria (2003): Highway Maintenance in Nigeria: Lessons from other Countries. *Research Department Occasional Paper No. 27*

Chani, M.I. and Chaudhary, A.R., (2010). Import Demand Behaviour in Pakistin: An Empirical Analysis. Saarbrucken Germany: LAP Lambert Academic Publishing

Chandra, A and Thompson, E., (2000). "Does public infrastructure affect economic activity?: Evidence from the rural interstate highway system", Regional Science and Urban Economics, 30(4):457-490, July.

Christiano, L. J., Eichenbaum M. and Evans C. L. (1996). “The Effect of Monetary Policy Shocks: Evidence from the Flow of Funds.” *Review of Economics and Statistics.*78(1), 16-34.

Clark, D.E. and Murphy, C.A. (1996), Countywide Employment and Population Growth: An Analysis of the 1980s, *Journal of Regional Science 36, 235-256.*

Cohen J.P. and Paul C.J.M. (2004) Public Infrastructure Investment, Interstate Spatial Spillovers, and Manufacturing Costs, *The Review of Economics and Statistics 86, 551-560.*

Conrad, K. and Seitz H. (1994). The Economic Benefits of Public Infrastructure, *Journal of Applied Economics 26, 303- 311*.

Costa, J.S., Ellson, R.W., Martin, R.C. (1987). "Public capital, regional output, and development: some empirical evidence." *Journal of Regional Science*, 27(3), 419-437.

Coughlin, C.C. and Segev, E., (2000). "Location Determinants of New Foreign-Owned Manufacturing Plants", *Journal of Regional Science, Blackwell Publishing, vol. 40(2), pages 323-351*.

Crane, L.M., Burke, D. and Hanks, C. (1991). Highway District and Economic Sector Employment Effects of Transportation Expenditures, Transportation Research Record 1305, 190-200.

Crihfield, J.B. and Panggabean, M.P.H. (1996). The Structure of Metropolitan Factor and Product Markets, *Journal of Regional Science 36, 17-41*.

Dalenberg, D.R. and Partridge, M.D. (1995). The Effects of Taxes, Expenditures, and Public Infrastructure on Metropolitan Area Employment, *Journal of Regional Science 35, 617-640.*

Dalenberg, D. R., Partridge M. D. and Rickman d.S. (1998) Public infrastructure: Pork or jobs creator? *Public Finance Review 26, 24-52.*

Darat, A. E. (1996). Trade and development: The Asian Experience. Cato Journal, 6: 695-699

Datt, G., and Ravalion, R. (2011). Has India's Economic Growth Become Poorer in the Wake of Economic Reforms. *World Bank Economic Review, 25(2), 157-189.* *http://dx.doi.org/10.1093/wber/lhr002*

Datt, G., and Ravallion. R (2002). Is India's Economic Growth Living the Poor Behind? 'World Bank Washington D.C. Mimeo

David, B., Lucia, H. and Elizabeth, L.(2000). Poverty and Transport: A report prepared for the World Bank in Collaboration with DFID. Overseas Development Institute, Portland.

Deichmann, U., M. Fay, J. Koo, and Lall, S. V. (2000). Economic Structure, Productivity, and Infrastructure Quality in Southern Mexico. Policy Research Working Paper Series 2900. Washington, D.C.: World Bank.

Deininger, K. and Squire, L. (1998). New ways of looking at old issues: Inequality and Growth, *Journal of Development Economics 57, 259-287.*

De Jong, G., Gun, H. F., Walker, W. (2004). National and international freight transport models: an overview and ideas for further development. Transport Reviews 24 (1), 103 – 124. Retrieved from http://eprints.whiterose.ac.uk/2015 (16 June 2009).

Demetriades, P. and Mamuneas, T., (2000). "Intertemporal Output and Employment Effects of Public Infrastructure Capital: Evidence from 12 OECD Economies." *The Economic Journal 110, 687–712.*

Demurger, S. (2001). Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China? *Journal of Comparative Economics 29: 95–117.*

Deno, K.T. (1988). The Effect of Public Capital on U.S. Manufacturing Activity: 1970 to 1978, *Southern Economic Journal 55 , 400-411.*

Department for International Development (DFID) (1997). Eliminating World Poverty: A Challenge for the 21st Century. CM 3789. The Stationery Office, London.

Dercon, S., Gilligan, D.O. Hoddinott, J. and Woldehanna, T. (2007), "The Impact of Roads and Agricultural Extension on Consumption Growth and Poverty in Fifteen Ethiopian Villages", Oxford University, CSAE WPS/2007-01.

Dercon, S., and Krishnan, P. (1998). Changes in Poverty in Rural Ethiopia 1989–1995: Measurement, Robustness Tests and Decomposition. WPS/98-7. Oxford: Centre for the Study of African Economics.

Dissou, Y. and Didic, S. (2011) Public Infrastructure and Economic Growth. Working Paper, Department of Economics, University of Ottawa.

Dodgson, J.S. (1974). Motorway investment, industrial transport costs, and sub-regional growth: A case study of the M62, *Regional Studies 8, 75-91*.

Dollar, D. and Kray, A. (2002): “Growth is Good for the Poor”, *Journal of Economic Growth, 7, 195-225*.

Dollar, D and Kraay, A (2000) Growth is Good for the Poor. The World Bank. Washington D.C

Dollar, D and Kraay, A (2001). Trade, Growth and Poverty. World Bank Policy Research Working Paper No. 2615

Donaldson, D. (2010). “Railroads of the Raj: Estimating the Impact of Transportation Infrastructure”, National Bureau of Economic Research, NBER Working Paper No. 16487.

Duranton, G. and Turner M.A., (2011). "The Fundamental Law of Road Congestion: Evidence from US cities," *American Economic Review*.

Eagle, D. and Stephanedes, Y.J. (1987), Dynamic Highway Impacts on Economic Development, Transportation Research Record 1116, 56-62

Easterly, W. and Rebelo, S. (1993). Fiscal Policy and Economic Growth: An Empirical Investigation. *Journal of Monetary Economics. 32 (3), 417-458.* *http://dx.doi.org/10.1016/0304-3932(93)90025-B*

Eberts, R.W. (1990). "Public infrastructure and regional economic development." *Federal Reserve Bank of Cleveland Economic Review*, 26, 15-27

Eberts, R.W. and Stone J.A. (1992). Wage and Employment Adjustment in Local Labor Markets .W.E. Upjohn, Institute for Employment Research, Michigan.

Ebong, S. and Ogwunike, O. (2013). Economic Growth and Poverty Reduction in Nigeria Available @ www.iiste.org>Home>vol4,No7>ebong.

Edwards T.H. (1998). Openness, Productivity and Growth: what do we really know? *Economic Journal 108, 383-398*

Egart, B., Kozluk, T. & Sutherland, D. (2009). Infrastructure and Growth: Empirical Evidence. OECD Economics Department Working Paper 685. [Online] Available: http://EconPapers.repec.org/RePEc:oec:ecoaaa:685-en.

El-Laithy, Lokshin, M. & Barneji, A. (2003). Poverty and economic growth in Egypt,1995 – 2000. World Bank Policy Research Working Paper No. 3068.

Engle, R. F. and Granger, C. W. J. (1987). Cointegration and Error Correction: Representation, Estimation and Testing. Econometrica. 55 (2), 251-276. [Online] Available: http://www.jstor.org/stable/1913236

Estache, A. (2006a). Africa's infrastructure: challenges and opportunities. IMF. Paper presented at the high-level seminar: Realizing the Potential for Profitable Investment in Africa Organised by the IMF Institute and the Joint Africa Institute Tunis, Tunisia, Feb. 28 2006 http://www.imf.org/external/np/seminars/eng/2006/rppia/pdf/estach.pdf

Estache, A., B. Speciale and D. Veredas. (2005). "How much does Infrastructure Matter to Growth in Sub-Saharan Africa?" unpublished, World Bank, June.

Estache, A., Perrault, Jean-Francois, L. Savard (2009). Impact of Infrastructure Spending in Mali: A CGE Modeling Approach. Universite Libre de Bruxelles, Ecares, ECARES Working Papers: 2009_009.

Evans P. and Karras G. (1994). Are government activities productive? Evidence from a panel of U.S. states, *The Review of Economics and Statistics 761 , 1-11*.

Everaert G. And Heylen, F. (2000). Public Capital and Productivity Growth: Evidence or Belgium 1953-1996, *Economic Modelling f, vol.18, 1, pp. 97-116*

Faber, B. (2012), "Market Integration and the Periphery: The Unintended Consequences of New Highways in a Developing Country", Mimeo, London School of Economics.

Fan, S.G., Zhang, L. and Zhang, X. (2002). Growth, inequality, and poverty in rural China: The role of public investments. Research Report 125. Washington DC: IFPRI

Fan, S. Hazell, P and. Thorat, S. (1999).Government spending, agricultural growth and poverty: An analysis of interlinkages in rural India. IFPRI Research Report No. 110. Washington, D.C.: International Food Policy Research Institute.

Fan, S., Jitsuchon, S. and Methakunnavut, N. (2004). The importance of public investment for reducing rural poverty in middle-income countries: The case of Thailand. DSGD Discussion Paper No. 7. Washington, D.C.: International Food Policy Research Institute.

Fan, S. and Chan-kang. C (2006) Road development, Economic Growth and Poverty reduction in China: Transpot Policy 15(5): 305-314 www.ifpri.org/sites/default/shenggenfan_cv.pdf.

Faridi, M, Malik, S. and Bashir, F. (2011): Transportation, Telecommunication and Economic Development in Pakistan, *Interdisciplinary Journal of Research in Business Vol. 1, Issue. 7, July 2011(pp.45-52).*

Federal Government of Nigeria (2010). Draft of National Transport Policy August 2010.

Fedderke, J.W.; Perkins P.; Luiz J.M.. (2006). "Infrastructural Investment in Long-run Economic Growth: South Africa 1875-2001." World Development 34:6, 1037-59

Fedderke, J. W. and Bogetic, Z, (2009). Infrastructure and Growth in South Africa: Direct and Indirect Productivity Impacts of 19 Infrastructure Measures, World Development, 37, Pp 1522 -1539.

Fernald J. G. (1999). Roads to Prosperity? Assessing the Link between Public Capital and Productivity. American Economic *Review. 89 (3), 619-638. http://dx.doi.org/10.1257/aer.89.3.619.*

Ford, R. and Poret, P. (1991). 'Infrastructure and private sector productivity', OECD Economics Department working papers No 91.

Fosu, A.K. (2008). "Inequality and the growth-poverty nexus: Specification empirics using African data". Applied Economics Letters, 15:7, 563-566.

Gafar .T, Mukaila.A, Raji .A and Michael .A. (2011). Economic Growth and Poverty Reduction in Nigeria: *International Journal of Business and Social Science. Vol. 2 No. 15; August 2011*

Garcia-Mila, T, and McGuire, T.J (1992). 'The contribution of publicly provided inputs to states' economies', Regional Science and Urban Economics, Vol.22, pp229-241

Ghali, K.H. (1998). Public Investment and Private Capital Formation in a Vector error Correction Model of Growth, Applied Economics, 30, pp. 837–844.

Goudie, A., and Paul, L. (1999)."Economic Growth, Poverty and Inequality". *Journal of International Development, vol. 11.*

Graham, D. J. (2007a). Agglomeration, productivity and transport investment, *Journal of Transport Economics and Policy 41, 1-27.*

Gramlich, M. (1994). "Infrastructure Investment: A Review Essay." *Journal of Economic Literature* 32:3 (September) 1176-96.

Hage and Alter, (1997). "A Typology of Interorganisational Relationship and network" In contemporary Capitalism (eds) JR Hollingsworth and R.Boyer, New York: Cambridge University Press 94-126.

.

Hansen, N.M. (1965a). The structure and determinants of local public investment expenditures, *The Review of Economics and Statistics 47, 150-162.*

Haughwout, A.F. (1999). State Infrastructure and The Geography of Employment, Growth and Change 30, 549-566.

Heckscher, E. (1949). The Effect of Foreign Trade on the Distribution of Income. In Reading the Theory of International Trade ed. L. A. Metaler.Homewood, IL: Richard, D. Irwin.

Hecq, A., Palm, F. C., and Urbain, J. P. (2002). Separation weak exogeneity and P-T decomposition in cointegrated VAR systems with common features. Econometric Reviews, 21:273–307.

Holguin-Veras, J., Thorson, E. (2003a). Modeling commercial vehicle empty trips with a First order trip chain model. Transportation Research Part B 37 (2003), Vol. 37 (2), 129-148.

Holguin-Veras, J., Thorson, E. (2003b). Practical implications of modelling commercial vehicle empty trip., Transportation Research Record 1833, 87-94.

Holguin-Veras, J, Teng, H. and Yahahom, S. (2001). An assessment of methodological alternatives for a Regional freight model, Appendix I: literature review on freight transportation demand modelling. New York Metropolitan Transportation Council Report, New York, NY. Retrieved from http://www.utrc2.org/research/assets/6/regionalfreight2.html (12 September 2012).

Holguin-Veras J., Thorson E. (2000). Trip length distributions in commodity-based and trip-based freight demand modelling: investigation of relationships. Transportation Research Record No.1707, 37– 48.

Holl, A. (2004a). “Manufacturing location and impacts of road transport infrastructure: Empirical evidence from Spain”, Regional Science and Urban Economics 34 (3): 341-363.

Holl, A. (2004b). “Transport infrastructure, agglomeration economies, and firm birth”. Empirical evidence from Portugal’, *Journal of Regional Science, 44 (4): 693-712.*

Holl, A. (2004c). “Start-Ups and Relocations: Manufacturing Plant Location in Portugal”, Papers in Regional Science, 83 (4): 649-668.

Holl, A. 2007a. Twenty years of accessibility improvements. The case of the Spanish motorway building programme. Journal of Transport Geography, 15, 286-29

Holl, A. (2011). “Market potential and firm-level productivity in Spain”, Journal of Economic Geography, in press.

Holtz-Eakin, D. & Schwartz, A. E. (1995). Infrastructure in a Structural Model of Economic Growth.Regional Science and Urban Economics. 25 (2), 131-151. http://dx.doi.org/10.1016/0166-0462(94)02080-Z.

Holtz-Eakin, D. (1994). “Public Sector Capital and the Productivity Puzzle”, Review of Economics and Statistics 76, p. 12–21.

Hotelling H. (1929), Stability in Competition, Economic Journal 39, 41-57.

Huang, Q, and Harata. N, (2010). Role of Transport Infrastructure in Economic Development: An Empirical Study in China: Traffic and Transportation Studies Pp. 166-173; http;/ascelibrary.org/doi/pdf/10.1061/41123(383)15.

Hulten and Schwab (1993). 'Public Capital Formation and the Growth of Regional Manufacturing Industries', *National Tax Journal XLVI, Pp 261-274.*

Hurwicz, L. (1962): "On the Structural Form of Interdependent Systems," in Logic, Methodology and Philosophy of Science, pp.232–239.StanfordUniversityPress, Stan- ford, CA.

Hussain, I and Westin (1997). Network Benefits from Transport Investments Under Increasing Returns to Scale: A SCGE Analysis. Umea Economic Studies, Paper No. 432.Center for Regional Science (CERUM), Umea.

Hussain, I. 1990, 'Road investment benefits over and above transport cost savings and gains to newly generated traffic', in Highway Appraisal and Design Management: Proceedings of Seminar J held at the PTRC European Transport and Planning 18th Summer Annual Meeting, University of Sussex, 10-14 September 1990, PTRC Education and Research Services Ltd, London, pp. 101-3.

Hymel, K. (2009). Does Traffic Congestion Reduce Employment Growth. *Journal of Urban Economics (65), 127-135*.

Islam, S. (2003). Distance Decay in Employment and Spatial Spillovers of Highways In Appalachia, Paper Presented at the Annual Meeting of the North American Regional Science Association, Philadelphia, PA.

Ismihan, M., Metin-Ozcan, K. and A. Tansel (2005) Instability in Public and Private Capital Accumulation and Growth: The case of Turkey 1963- 1999, Applied Economics, 37, pp. 239–251.

Jacoby, H. G. (2000). Access to Markets and the Benefits of Rural Roads. *The Economic Journal 110: 713–737.*

Jahan, S. and R. McCleery (2005).*Making infrastructure work for the poor*. UNDP. Available at: www.undp.org/poverty/docs/fpage/Synthesisreport.pdf.

Jara-Diaz, S. R, (1986). 'On the Relation between Users' Benefits and the Economic Effects of Transportation Activities', *Journal of Regional Science, vol. 26, 2*.

Jara-Diaz, S. R, and T. Friesz (1982). "Measuring the Benefits Derived from a Transportation Investment," Transportation Research . 16B, 57-77.

Jerome, A., and A. Ariyo (2004). 'Infrastructure Reform and Poverty Reduction in Africa. African Development and Poverty Reduction: The Macro-Micro Linkage'. TIP/DPRU Forum, 13-15 October, South Africa.

Jiwattanakulpaisarn, P., Noland, R.B., Graham, D.J.(2010). Causal linkages between Highways and sector-levels employment. Transportation Research part A 44, 265-280.

Jiwattanakulpaisarn, P. R. B. Noland, and D. J. Graham (2009). Marginal Productivity Of Expanding Highway Capacity, TRB Annual Meeting (www.trb.org).

Johansson, B. (2007). Transport infrastructure inside and across urban regions: models and assessment methods. International Transport Forum, discussion paper no. 2007-12.

Jon Inge, L. and Joachim (2011): Economic Benefit of Road Project in Norway www.vegresen. No/…/publikasjoner/…/514239?ts.

Jordaan, A. C., and Eita, J. H. (2007). Export and Economic Growth in Namibia: A granger Causality Analysis.South African. *Journal of Economics., 75: 540-547.* http://dx.doi.org/10.1111/j.1813-6982.2007.00132.x

Kamps, C. (2005), The Dynamic Effects of Public Capital: VAR Evidence for 22 OECD Countries, International Tax and Public Finance, 12, pp. 533-558.

Kanemoto, Y. and Mera, K. (1985). "General equilibrium analysis of the benefits of large transportation improvements." Regional Science and Urban Economics 15(3): 343-363

Karadag, M., Deliktas, E.And Onder, O. A. (2004). The Effects of Public Capital on Private Sector Performance in Turkish Regional Manufacturing Industries, European Planning Studies, vol.12, 8, pp. 1145-1156.

Kawakami, T. and Doi, M. (2004). Port Capital Formation and Economic Development in Japan: A Vector Autoregression Approach, *Papers in Regional Science, 83, Pp. 723-732.*

Keho, Y. and Echui, A. (2011). Transport Infrastructure Investment and Sustainable Economic Growth in Cote d' Ivoire: A Cointegrated and Causality Analysis *Journal of Sustainable Development. Vol. 4.No. 6. Ccsent org/jbd*

Khandker, S. R., Bahkt, Z., Koolwal, G. B.(2006).The Poverty Impact of Rural Roads: Evidence from Bangladesh. 2006. *World Bank Policy Research Working Paper 3875, April.*

Kidokoro, Y. (2004), Cost- Benefit Analysis for Transport Networks – Theory and Application, *Journal of Transport Economics and Policy, 38 (2), 275-307*

Kim, S. (2006). A New Approach to Measuring the Effects of Infrastructure on Regional Economic Performance: US States VS Metropolitan Areas. Dissertation for the Doctorate of Philosophy in Planning. University of Southern California

Kirkpatrick, C. and Jalilian, H., 2005. Can Financial Development Contribute to Poverty Reduction in Developing Countries? Journal of Development Studies, 41(4): 636-356. 22.

Kuznets, S. (1955). "Economic Growth and Income Inequality". *American Economic Review, vol. 45. Retrieve from Islam 2003*

Lahiri, K., Yao, V.W. (2006) Economic indicators for the US transportation sector, Transportation Re- search Part A, 40 (10), 872-887.

Lakshmanan, T. R. (2010). The broader economic consequences of transport infrastructure investments. *Journal of Transport Geography.*

Lakshmanan, T. R. (2007). The Wider Economic Benefits of Transportation: An Overview Discussion b, Paper No. 2007-8 December 2007 OECD.

Lewis, W. A. (1954). "Economic Development with Unlimited Supplies of Labour," Manchester School 22:139-191, Wiley Blackwell.

Ligthart, J. E. (2002). Public Capital and Output Growth in Portugal: An Empirical Analysis, *European Review of Economics and Finance, 1, pp. 3–30.*

Li, Z. and Li, H. (2010). " Road investment and inventory reduction: evidence from a large developing", country. Mimeo, Hong-Kong University

Lipton, M and Ravallion, M (1995).Poverty and Policy. In Behrman, J and Srinivason, T.N (eds.) Handbook of Development Economics.Vol.III:2553-2657.

Lombard, P.C., Sinha, K.C. and Brown, D.J. (1992). Investigation of The Relationship Between Highway Infrastructure and Economic Development in Indiana, Transportation Research Record 1359, 76-81.

Looney, R. E. (1997) Infrastructure and private sector investment in Pakistan, *Journal of Asian Economics, Vol. 8,3, Pp 393-420.*

Liu, B., Z. Jin-tao (2005). "Empirical Study on Causality between Transportation and Regional Economic Development in China" China Soft Science, 2005(6)

Luce T., F. (1994). Local Taxes, Public Services, and the Intrametropolitan Location of Firms and Households, Public Finance Quarterly 22, 139-167.

Lustig, N., O. Arias. and J. Rigolini (2002). "Poverty Reduction and Economic Growth: A Two-Way Causality".Sustainable Development Department Technical Paper Series. Inter-American Development Bank.

Lynde, C., and Richmond, J. (1992).The role of public capital in production.*The Review of Economics and Statistics, 74, 37e43.*

Lynde, C. and Richmond, J. (1993a). Public Capital and Total Factor Productivity, *International Economic Review 34 , 401-414.*

Martin, P. and Rogers, C. A. (1995). "Industrial location and public infrastructure," *Journal of International Economics, Elsevier, vol. 39(3-4), pages 335-351, November.*

McKay, A. (1997). Poverty Reduction through Economic Growth: Some Issues, *Journal of International Development, 9(4), 665-678.* http://dx.doi.org/10.1002/(SICI)1099-- *1328(199706)9:4<665::AID-JID475>3.0.CO;2-P*

Mcmillin, W. D. and Smyth, D.J. (1994). A Multivariate Time Series Analysis of the United States Aggregate Production Function, *Empirical Economics 19, 659-673*.

Meade, J .E. (1952) External Economies and Diseconomies in a Competitive Situation, *The Economic Journal 62, 54-67*.

Melo, P. and Graham, D.J. and Noland, R. B., (2010), "Firm Formation and Transport Infrastructure: A Study of Portugal", Transportation Research Record: *Journal of the Transportation Research Board, volume 2163, number 1, pages 133—143.*

Michaels, G (2008) "The effect of trade on the demand for skill: evidence from the Interstate Highway System". Review of economics and statistics, 90 (4). pp. 683-701.

Mittnik, S. and Neumann, T. (2001). Dynamic Effects of Public Investment: Vector Autoregressive Evidence from Six Industrialized Countries, *Empirical Economics, vol.26, 2, pp. 429-446.*

Modifi, A. and Stone, J.A. (1990). Do State and Local Taxes affect Economic Growth? *The Review of Economics and Statistics 72, 686-691*.

Mohring, H. and Harwitz, M. (1962). Highway Benefits: An Analytical Framework, Northwestern University Press, Evanston, Illinois

Mohring, H and Williamson. F (1969). Scale and "Industrial Reorganisation" Economies of Transport Improvements: www.bath.ac.uk/e-journals/jtep/pdf/volume_111_No 3_251-271pdf

Mohring, H. (1976). Transport economics. Cambridge, MA: Ballinger. Available in Sergio .R, Jara-Diaz and Anotonio. G Transport Reviews Vol. 23, No 4, 454-469.

Moomaw R. L., Mullen J.K. and Williams M. (1995). The Interregional Impacts of Infrastructure Capital, *Southern Economic Journal 61, 830-845.*

Montolio, D. and Sole-Olle, A. (2009). Road Investment and Regional Productivity Growth: The Effects of Vehicle Intensity and Congestion. *Papers in Regional Science. 88 (1), 99-118. http://dx.doi.org/10.1111/j.1435-5957.2008.00167.x*

Munnell, A.H. (1993) an Assessment of Trends in and Economic Impacts of Infrastructure Investment. In Infrastructure Policies for the 1990s, Oecd, Paris.

Munnell, A.H. (1992). "Infrastructure Investment and Economic Growth", Journal of Economic Perspectives, American Economic Association, vol. 6 (4), p. 189–198.

Munnell, A.H. (1990a). Why Has Productivity Growth Declined? Productivity and Public Investment. *.New England Economic Review January/February , 3-22.*

Munnell, A.H. (1990b). How Does Public Infrastructure Affect Regional Economic Performance? *New England Economic Review September/October, 11-32.*

Nadiri, M.I. and Mamuneas, T.P. (1998). Contribution of highway capital to output and productivity growth in the US economy and industries. Report prepared for the Federal Highway Administration, Office of Transport Policy Studies (available at http://www.fhwa.dot.gov/policy/gro98cvr.htmon April 27th 2012.

Nadiri, M. I., Mamuneas, T. P. (1994). "The effects of public infrastructure and R & D capital on the cost structure and performance of U.S. manufacturing industries", *The Review of Economics and Statistics 76 (1), 22–37.*

Nagaraj, R., A. Varoudakis, and Veganzones, M. A. (2000). Long-run growth trends and convergence across Indian states. Journal of International Development 12, 45-70

National Bureau of Statistics (various years). Annual Abstract of Statistics. Abuja: National Bureau of Statistics

Nelson, A. C. and Moody. M, (2000), "Effect of Beltways on Metropolitan Economic Activity," *Journal of Urban Planning and Development, Vol. 126, No. 4 (http://ojps.aip.org/upo), December, 2000, pp. 189-196.*

Niloy. B and Emranul .H (2005), Causality between Public Investment in Transport and Communication and Economic Growth: Journal of Economic Development 95 Volume 30.

Nketiah-Amponsah, E. (2009) Public Spending and Economic Growth: Evidence from Ghana (1970-2004). *Development Southern Africa. Vol. 26, No. 3.*

Nourzad, F. and Martin V. (1995).' Public Capital Formation and Economic Growth: Some International Evidence.' *Journal of Productivity Analysis, Vol. 6, No. 4, 283-295.*

Nurudeen. A. and Usman, A. (2010). Government Expenditure and Economic Growth In Nigeria, 1970-2008: A Disaggregated Analysis. Business and Economics Journal. 2010 (4), 1-11.

Nwoji, I. D and Oluwalaiye (2012): Government Spending On Road Infrastructure and its Impact on Growth of Nigeria Economy. IJNBS: Vol. 2: 2231-2463. U8y.

O'Brien, P.(1983) Transport and Economic Development in Europe, 1789-1914 in Railways and the Economic Growth of Western Europe (ed) Patrick O,Brien, 1-27, London Macmillan.

OECD (2002). Impact of Transport Infrastructure Investment on Regional Development, Organisation for Economic Co-operation and Development, Paris.

Ogun, T. P. (2010). Infrastructure and Poverty Reduction. Implications for Urban Development in Nigeria, UNU WIDER Working Paper No. 2010/43.

Ohlin. B. (1993). Interregional and international trade. Cambridge Harvard University Press.

Okojie, C. E. E. (2002).Gender and Education as Determinants of Household Poverty in Nigeria. UNI-WIDER discussion paper. No 2002/37. Helsinki

Olomola, A. S. (2003). "Understanding Poverty in Nigeria: Highlights from NISER Review of Nigerian Development" in NISEREEL, *The Magazine of the Nigerian Institute of Social and Economic Research, Nos. 4 & 5, December, 2003, Ibadan.*

Olorunfemi, Sola (2008). Infrastructural Services and Manufacturing Growth in Nigeria: *A Dynamic Analysis African Economic and Business Review Vol. 6 No. 2, Fall 2008*

Omojolaibi, J. A. (2010). "Fiscal Stance and Macroeconomic Performance in Nigeria." A A Ph.d Post-Field Report Submitted to African Economic Research Consortium (AERC), Mombasa, Kenya..

Onakoya, B., Salisu, A. and Oseni, I. (2012): Infrastructure and economic growth in Nigeria: A multivariate approach; *Research Journal of Business Management and Accounting Vol. 1(3), pp. 030 - 039, October 2012.*

.

Oosterhaven, J. and. Knaap, T, (2003). Spatial Economic Impacts of Transport Infrastructure Investments, in: A. Pearman, P. Mackie. J. Nellthorp & L. Giorgi (eds), Transport Projects, Programmes and Policies: Evaluation Needs and Capabilities, Ashgate.

Otto, G. and Voss, G.M. (1994). Public capital and private sector productivity, The Economic Record 70 , 121-132.

Otto, G. and Voss, G.M. (1996). Public Capital and Private Production in Australia, *Southern Economic Journal 62 , 723-738.*

Oyejide, A.T. (1999). "Trade Policy and Sustainable Human Development in Africa." http:/www.untad.org/en/docs/poedmm.136.en/pdf (accassed:3/01/2012). UNCTAD/EDM/MISC 136, Pp 1-12

Ozmen-Ertekin, D., Ozbay, K., and Berechman, J.(2006). "Empirical Analysis of Transportation Investment and Economic Development at State, County and Municipality Levels", *Transportation*, 33(6), 537-551.

Pedersen, P.O. (2001). "Freight transport under globalisation and its impact on Africa." *Journal of Transport Geography*, 9, 85-99.

Perkins, P., Fedderke, J. and Luiz, J. (2005) "An Analysis of Economic Infrastructure Investment in South Africa" *South African Journal of Economics Vol. 73:2*

Pereira, A. M. and Roca-Sagales, O. (2003). 'Spillover effects of public capital formation: evidence from the Spanish Regions,' *Journal of Urban economics Vol. 53 pp 238-256*

Pereira, A.M. (2001) Public Investment and Private Sector Performance – International Evidence, Public Finance & Management, vol.1, 2, pp. 261-277.

Pereira A.M. (2000). Is All Public Capital Created Equal? *The Review of Economics and Statistics 82, 513-518.*

Pereira, A. M. And De Frutos, R. F. (1999) Public Capital Accumulation and Private Sector Performance, *Journal of Urban Economics, 46, pp. 300-322.*

Perkins, P., Fedderke, J. and Luiz, J. (2005) "An Analysis of Economic Infrastructure Investmentin South Africa" *South African Journal of Economics Vol. 73:2*

Pradhan, R. P. (2010). Transport Infrastructure, Energy Consumption and Economic Growth Triangle in India: Cointegration and Causality Analysis. *Journal of Sustainable Development. 3 (2), 167-173.*

Prud'homme, R. (2004).Infrastructure and Development, Washington DC, Paper prepared for the ABCDE (Annual Bank Conference on Development Economics), May 3-5, 2004.

Prud'homme, R. and Lee, C.W. (1999). Size, sprawl, speed and the efficiency of cities, Urban Studies 36, 1849-1859.

Quah, D. (2001), Some Simple Arithmetic on How Income Inequality and Economic Growth Matter, Draft, London School of Economics.

Ramirez, M. D. (2000). The Impact of Public Investment on Private Investment Spending in Latin America: 1980-1995, *Atlantic Economic Journal, 28, pp. 210-225.*

Ramirez, M. D. (2004). Is public Infrastructure Spending Productive in Mexican Case? A Vector Error Correction Analysis, *Journal of International Trade and Economic Development, Vol. 13, 2, pp. 159-178*

Ravallion, M. (2001). “Growth, Inequality and Poverty: Looking Beyond Averages”, *African Economic Research Consortium plenary paper, Nairobi (June)*

Ravallion, M. (1998). Does Aggregation Hide the Harmful Effects of Inequality on Growth? *Economics Letters 61, 73-77.*

Ravallion, M. and S. Chen (1997). “What can New Survey Data Tell Us About Recent Changes in Distribution and Poverty?” *World Bank Economic Review 11, 2(May) 357-382.*

Ravallion, M. and Datt (1996). “How Important to India’s Poor is the Sectoral Composition of Economic Growth?” *World Bank Economic Review 10, pp. 1-25.*

and Services Affects Private Investment’, The World Bank,

Reinikka, R. and Svensson, J. (1999). ‘How Inadequate Provision of Public Infrastructure

Policy Research Working Paper Series: 2262.

Rietveld, P. and Bruinsma, F. (1998). Is Transport Infrastructure Effective? Transport Infrastructure and Accessibility: Impacts on the Space Economy, Springer Verlag, Berlin.

Rioja, Felix. K. (2003). The Penalties of Inefficiency Infrastructure, *Review of Development Economics, 7(1), 127-137.*

Rizwanul, Islam (2004). The Nexus of Economic Growth, Employment and Poverty Reduction: *An Empirical Analysis Journal (January 2004).*

Roller, L.H. and Waverman, L. (2001). Telecommunications Infrastructure and Economic Development: A Simultaneous Approach, American Economic Review, 91 (4): 909-923.

Romer, Paul M., (1987). Growth Based on Increasing Returns Due To Specialization. *American Economic Review 77, 56-62.*

Romp, W. and de Haan, J. (2005). "Public capital and economic growth: a critical survey" European Investment Bank Papers Vol.10. n1.

Romp, W. and De Haan, J. (2007). "Public Capital and Economic Growth: A Critical Survey", Perspektiven der Wirtschaftspolitik 8 (s1), 6–52.

Rossi-Hansberg, E., (2004). "Optimal Urban Land Use and Zoning," Review of Economic Dynamics, 7:69-106.

Rothenberg, T. J. (1971): "Identification in Parametric Models," *Econometrica*, 39(3), 577–591

Rudra. P. and Tapan. P, (2012). Effect of Transportation Infrastructure on Economic Growth in India: The VECM Approach; Research in Transportation Economics: *Journal homepage: www.elsevier.com/locate/retrec*

SACTRA (1999). *A Framework for Assessing Studies of the Impact of Transport Infrastructure Projects on Economic Activity*, Standing Advisory Committee on Trunk Road Assessment, Dept. of Environment, Transport and Regions (www.roads.detr.gov.uk).

Sadananda, P. (2006). Railroad Transportation, Domestic Investment and Economic Growth: A Cointegration Analysis for India: http://www.eco.uc3m.es/temp/agenda/mad2006/paper/23%20prusty.%20sadanand.pdf.

Sahoo, P. (2006). FDI in South Asia: Trends, Policy, Impact and Determinants " ADBI Discussion Paper Series, No 56.

Sahoo, P and Ranjan, K. Dash. (2009). Infrastructure Development and Economic Growth in India" *Journal of the Asia Pacific Economy Australia, Rutledge, Vol. 14, Issue 4. 2009.*

Sahoo, P and Ranjan K. Dash, (2010). Economic Growth in South Asia: Role of Infrastructure" Forthcoming, the *Journal of international Trade and Economic Development, Australia.*

Saibu M.O Nwosa P.I and Ajuwon O.S (2012) *Financial Development, Financial Volatility and Poverty Reduction in Nigeria: An Empirical Analysis*. A paper presented at the 53rd Annual Nigerian Economic Society (NES) Conference with the Theme Youth Employment and Poverty Reduction in Nigeria held at Niccon Luxury Hotels Abuja from August 27-302012

Salvador. P and Diana. W (2012) Dynamic Medium Term Granger Causality between Growth and Poverty: http//personal. ac. Uk/weinhold/povert_growth_draft.pdf.

Seitz, H. (1993). A dual economic analysis of the benefits of the public road network, The Annals of Regional Science 27, 223-239.

Seitz H. (1994). Public Capital and the Demand for Private Inputs, *Journal of Public Economics 54, 287-307.*

Seitz H. (1995a). The Productivity and Supply of Urban Infrastructure, The Annuals of Regional Science 29, 121-141.

Seitz H. and Licht G. (1995). The Impact of Public Infrastructure Capital on Regional Manufacturing Production Cost, Regional Studies 29, 231-240.

Shan, J., and Morris, A. (2002). Does Financial Development Lead Economic Growth? International Review of Applied Economics. Vol. 16(2), pp 153-168. http://dx.doi.org/10.1080/02692170110118885.

Shah, A. (1992). Dynamics of Public Infrastructure, Industrial Productivity and Profitability. *Review of Economics and Statistics, 74, 28e36.*

Shorrocks A. and van der Hoeven, R. (2004), Eds., Growth, inequality, and poverty: Prospects for pro-poor economic development, Oxford University Press. Available in Almas Heshmati 2004: Discussion Paper Series IZADP 1338

Siebert, H. (1969). Regional Economic Growth: Theory and Policy: Scranton PA: International Textbook Company.

Sims C.A.(1980a) Macroeconomics and Reality. *Econometrica,* 48, 1-48.

Singletary L., Henry M., Brooks K. and London J. (1995). The Impact of Highway Investment on New Manufacturing Employment in South Carolina: A Small Region Spatial Analysis. *The Review of Regional Studies 25, 37-55.*

Southworth, F. (2002). Freight Transportation Planning: Models and Methods, Book Chapter, K.G. Goulias (Ed) CRC Press, USA.

Squire, L. (1993).Fighting Poverty. *American Economic Review papers and Proceedings, 83(2), 377-382.*

Stephen, G, Teemu, L. Herny, O and Rosa. S (2012). New Road infrastructure: The effects on Firms. https://www.esrc.ac.uk/my.../1eae75a5-2flf-41f3-90e0-deb0c11f5a0e

Stephanedes, Y.J. (1990). Distributional Effects of State Highway Investment on Local and Regional Development, Transportation Research Record 1274, 156-164.

Straub, S. (2007): “Infrastructure: Recent Advances and Research Challenges,” Unpublished Manuscript. Retrieved from Susanne. T. 2011

Sturm, J. E., Jacobs, J. and Groote, P. (1999). Output Effects of Infrastructure Investment in the Netherlands 1853-1913.*Journal of Macroeconomics. 21 (2), 355-380. http://dx.doi.org/ 10.1016/S0164-0704(99)00107-X.*

Sturm J.E. and Haan J. (1995). Is Public Expenditure Really Productive? New Evidence for the USA and the Netherlands, *Economic Modelling 12, 60-72..*

Sylvie D´emurger. (2001). “Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China?” *Journal of Comparative Economics 29, 95–117.*

Tatom, J. A. (1991). Public Capital and Private Sector Performance. Federal Reserve Bank of Saint Louis Review. 73, 3-15.

Tatom, J. A. (1993). The Spurious Effect of Public Capital Formation on Private Sector Productivity. Policy Studies Journal. 21 (2), 391-395. http://dx.doi.org/10.1111/j.1541-0072.1993.tb01831.x

Taylor-Lewis, R. (1993), 'The Role of Infrastructure in Productivity and Output Growth: A Case Study of the Group of Seven', Unpublished Ph.D. Dissertation. College Park, MD: University of Maryland, 1993

Tella, S. A., Amaghionyediwe, L. A. and Adesoye, A. (2007). Telecommunication infrastructure and economic growth: Evidence from Nigeria. *UN-IDEP and AFEA Joint Conference in Dakar Senegal*, 1 – 28.

Tendulkar, S. D. (1998). "Indian Economic Policy Reforms and Poverty: An Assessment" In I. J. Ahluwalia and I. M. D. Little, eds., India's Economic Reforms and Development: Essays for Manmohan Singh. Delhi: Oxford and New York: Oxford University Press.

Thompson, G.L., Weller, B., and Terrie, E.W. (1993). New perspectives on highway investment and economic growth, Transportation Research Record 1395, 81- 87.

Tinbergen, J. (1957). 'The appraisal of road construction: two calculation schemes'. *Review of Economics and Statistics, 39, pp 241-249.*

Uche, O. (2011). Infrastructure Concession in Nigeria: Challenges and Opportunities 5th National Diaspora Conference, Abuja 25-27 July, 2011

Usman, S. G. (2008). Towards the Development of Infrastructure for Nigeria Business Day January, 13.

Vaqar, A. Ahsan, A. Sofia, A. and Muhammed, Z. (2013). Public Infrastructure and Economic Growth in Pakistan: A Dynamic CGE- microsimulation Analysis: https://www.gtap.agecom.purdue.edu/resources/download/6171.pdf.

Van der Hoeven R. and Shorrocks, A (2003), Eds., Perspectives on growth and poverty, United Nations University Press, Tokyo, Japan.

Venables, A.J (1996). Equilibrium Locations of Vertically Linked Industries: *International Economic Review, 37, 341-359.*

Venables, A.J (2004). "Evaluating urban transport improvements: cost-benefit analysis in the presence of agglomeration and income taxation" working paper LSE.

Venables, A. J and Gasiorek, M. (1999). The Welfare Implications of Transport Improvements in the Presence of Market Failure Part 1, Report to Standing Advisory Committee on Trunk Road Assessment, DETR, London.

Vickerman, R.W. (1991b). Other regions' infrastructure in a region's development, in Vickerman R.W. (Ed) Infrastructure and Regional Development, pp. 61-74. Pion, London.

Vickerman, R.W. (2007). Recent evolution of research into the wider economic benefits of transport infrastructure investments, in Research Round Table: Macro-, Meso-, and Micro Infrastructure Planning and Assessment Tools, European Conference of Ministers of Transport, OECD.

Vickrey, W S (1969) Congestion Theory and Transport Investment The American *Economic Review, 59, 251-260*

Weber, A. (1929). Alfred Weber's theory of location of industries. Translated by C.J. Friedrich. Chicago: University of Chicago Press.

Wei, Z, Zhang, F., Zhuang, Z. and Song, H. (2008). Transport Infrastructure, Growth and Poverty Alleviation "Empirical Analysis of China" Annals of Economics and Finance 9-2, 345-371.

Williamson, J. G. (1974), Late Nineteenth-Century Americain Development: A General Equilibrium History. London. Cambridge University Press. *Available in Lakshmanan 2007.*

Williams M. and Mullen J.K. (1992). The Contribution of Highway Infrastructure to States - Economies. *International Journal of Transport Economics 192 , 149-163.*

Wold, H., 1954, Causality and Econometrics, Econometrica 22, 162-177.

World Bank (1990) Poverty. World Development Report 1990. New York: Oxford University Press.

World Bank (1994). World Development Report: Infrastructure for Development. Washington, DC, The World Bank.

World Bank (2001), "World Development Report 2000/2001: Attacking Poverty", Oxford University Press, Washington, D.C

World Bank 2004, World Development Report- Infrastructure for Development, Washington D.C., Oxford University Press.

World Bank, 2005. World Development Report 2005: A Better Investment Climate for Everyone. Washington DC: The World Bank. 23.

Zografos K.G. And Stephanedes Y.J. (1992). Impact of State Highway Investment on Employment along Major Highway Corridors, Transportation Research Record 1359, 151-155.

Zou, W., Zhang, F., Zhuang, Z. and Song, H. (2008). Transport Infrastructure, Growth and Poverty Alleviation: Empirical Analysis of China. Annals of Economics and Finance. 9 (2), 345-371. Notes