IMPACT OF GOVERNANCE AND ROAD INFRASTRUCTURE ON INDUSTRIAL GROWTH IN NIGERIA

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ABSTRACT

This study examined if any predictable relationship exists between industrial growth and infrastructure (governance and road) in Nigeria using data for the period 1980 to 2015. The study employed the vector autoregressive (VAR) model for the analysis. The estimated results showed that infrastructure (governance and road) has an important but restricted role to play in driving industrial growth. Specifically, the results indicated that own shocks constitute a significant source of variation in industrial output (IND) forecast errors in the short run, ranging from 66 per cent to 100 per cent over the 10 quarters horizon. Innovations to corruption (COR) and institutional quality (INQ) (all governance infrastructures) and innovations to road infrastructure explain 0 per cent variance of industrial output in the first quarter and these increase to 0.63 percent in the tenth quarter. The implications of these findings is that in the short-run, infrastructure does not significantly predict industrial output in Nigeria and industrial output seems to have a very strong prediction. The study therefore recommended appropriate governance framework (good institutional and corruption free framework) that would institutionalize best practices in policy formulation and implementation.

JEL classification: L88, R42, O14

1. Introduction

Economists define infrastructure to include social overhead capital such as transport, power, education, health and utilities. Adeyemo (1979) viewed

infrastructure as the basic physical amenities that significantly facilitate all other economic activities in the system. Oshikoya et al. (1999) and Kumar (2005) simplified it further by classifying infrastructure into two complementary categories, viz: social or soft core infrastructure and physical or hard core infrastructure. Soft core infrastructure includes the supply of healthcare and education services, governance structure, accountability and property rights. Soft core infrastructure is unequivocally seen as the driving force for industrial cum economic activity. Hard core infrastructure includes physical structures, and comprises telecommunication, power, transportation, water supply and sewage. Hard core infrastructure are generally viewed as the 'wheels' of economic activity. These definitions of infrastructure strongly suggest that both soft core and hard core infrastructure complement industrialization.

The arguments of the theoretical literature lend credence to the various definitions of infrastructure. It has been argued in the theoretical literature that the development of adequate infrastructure enhances the growth and development of other vital economic and social sectors. Infrastructure is a unifying factor, which, by linking different shades of economic, political and social preferences, helps to improve the quality of life of the nation (Ukpong and Iniodu, 1991). Emphatically, commercial and industrial growth/development can hardly be achieved without adequate provision of necessary infrastructure. This is particularly so given the fact that infrastructural provision is not only essential for the development of a productive labour force but is also a catalyst for nation building as well as an instrument of technological progress and industrial development. This is why investment in infrastructure is regarded as a necessary condition for higher rates of growth in economic cum social activities. The World Bank (2009) estimated the economic cost of poor infrastructure across Africa as being capable of reducing economic growth by 2 per cent per annum. This is especially true in Nigeria where poor infrastructure has led to the relocation of manufacturing giants such as Cadbury and Michelin to other countries. The folding up of these manufacturing companies has undoubtedly reduced industrial output and growth (Mohammed, 2011).

Governance and road infrastructure remain key factors in enhancing industrial development and economic growth through indirect channels. Good governance facilitates policy certainty, political stability, establishment/enforcement of rules that promote property right, the promotion

of quality education, the ability to promote private capital, the reduction of inequality, to mention a few. Good governance, which is synonymous with democratic rule, is believed to be vital in bringing about these indirect benefits. On the other hand, road transportation is by far one of the most important infrastructure both in terms of traffic and investment. Road transportation is seen as being very important for national integration as it is capable of connecting all the important centres and areas of commercial, economic, political and industrial activities to ensure the free flow of goods and services. For instance, the provision and adequacy of good roads in certain remote areas can serve as an incentive to attract certain levels of industrial activity. In that regard, provision of adequate infrastructure facilitates industrial development in less developed areas.

Thirty years after the introduction of the Structural Adjustment Progamme (SAP) and seventeen years after the transition to democratic rule, Nigeria's infrastructural base has remained grossly inadequate to meet the needs of the industrial sector. Governance structure is riddled with rent-seeking behaviour by public agents, public institutions are not only ineffective and retroactive but there is also no respect for the rule of law, and above all, policy inconsistencies or policy reversals are the order of the day. On the other hand, road infrastructure is largely under-developed and decaying, thus, making the movement of people and goods within the country costly and difficult (World Bank, 2009). Undoubtedly, 67 per cent of Nigerian industrial inputs/outputs are delivered by road and the poor quality of the roads is a major setback for the whole economy (NPC, 2009). Surprisingly, up to this point, much of the debate on infrastructure has focused directly on the funding challenges of hardcore infrastructure (road inclusive), whereas the broader public governance dimension (soft core infrastructure) has been neglected. Therefore, it is doubtful if governance and road infrastructures have contributed significantly to industrial growth, given that the industrial sector's share of the gross domestic product has continued to decline instead of grow. Good governance is a prerequisite for industrial growth but the nexus between the two variables is not universal.

The basic questions to be addressed are: a) Is there any predictable relationship between industrial growth and governance infrastructure in Nigeria? (b) Is there any predictable relationship between industrial growth and road infrastructure in Nigeria? The results of this paper will assist government in

prioritizing policies aimed at improving infrastructural supply. The choice of governance and road infrastructure is not surprising. The focus on governance infrastructure is due to the fact that it is believed to be the "dynamic software" that influences the availability and functionality of all other infrastructure in Nigeria. Also, road infrastructure was chosen among the hardcore infrastructure because it is the most important subset of the transport sector and supports the growth of other sectors (the industrial sector inclusive) on a very large scale. It is also seen as the centre of connectivity of all other forms of infrastructure, specifically in developing countries. This study will be conducted within the framework of the vector autoregressive regression (VAR). It is an empirical analysis that is both descriptive and quantitative. It relies on available data on the Nigerian economy within the period 1980 to 2015 to evaluate the relationship of these infrastructure and industrial growth. This paper aims to show that infrastructure (governance and road) are potent macroeconomic overheads that could be restructured to enhance industrial growth.

2. The Concept of Governance

There is a plethora of definitions on governance in the literature. For instance, Shehu (1994) argued that "governance is simply policy making and policy execution regulated by systems of laws and guidelines which are separated into specific operations to achieve specific national objectives." Implicit in that definition is the fact that governance in its essence must influence the political, economic and social aspects of a nation. However, two groups of definition of the term have been broadly identified, viz, the neutral and non-neutral definitions.

Prominent among the non-neutral definitions is that of Boeninger (1991), who defined governance as "the good government of society". The good government guides the country along a course leading to the desired goal – in this case development. This definition is considered non-neutral because it excludes the possibility of bad government and secondly, it equates governance with democracy. The definition of governance proposed by the World Bank (1992) is one good example of a neutral definition. According to the World Bank (1992), governance is the exercise of political power to manage a nation's affairs. This definition is considered neutral because of the implicit recognition

of the possibility of a bad government and because it does not equate governance with democracy.

Good or effective governance is achieved by means of good public policies with clear-cut objectives, targeted programmes and willingness to anticipate and re-assess outcomes if and when necessary. This is why the provision of an effective legal and desirable institutional framework that guarantees the availability of a range of public goods and services is inherent in good governance. In recent times, an emergent consensus is that the conditions favourable to good governance are more likely to be obtained under democracy than under authoritarian rule. Hence, democratic government is believed to be a necessary, if not sufficient, condition for good, desirable governance. Disciplined, accountable, transparent, responsible and selfless leadership is very important to facilitate good governance. It is in view of this that the World Bank (1992) has outlined six indicators of good governance: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption.

With these governance indicators, it is worthy of note that governance comprises of two distinct but intimately intertwined dimensions: one is political and is concerned with commitment to good governance, and the other is technical and is concerned with issues of competence and public management. Without political commitment, little or nothing can be achieved even with an efficient public administration. The performance of a government depends on the role assigned to the state, the efficiency of public agencies and the extent to which there is a conducive environment that enhances enterprising activities by private citizens and honest behaviour by public officials (Anyanwu, 1998). Thus, good governance is a necessary condition for quality growth in enterprising activities. Growth in enterprising activities, on the other hand, will not only speed up the pace of industrialization but will also guarantee it. In other words, the type of governance (be it good or bad) can create a conducive or a non-conducive business environment for economic cum industrial activities to thrive.

3. Governance Infrastructure in Nigeria

Interestingly, from the received literature, governance is seen as a two-pronged dimension which enforces and coordinates policies and laws, and promotes their implementation. The rationale for good governance is to engender allocative and

distributive efficiency. It also entails ruling on the basis of equity and social justice, ending corruption, nepotism, prebendalism, and political manipulation of institutions (Uga, 2002). The antithesis of good governance is bad governance and this is characterized by pervasive corruption, lack of public accountability and the capture of public services by privileged individuals. The World Bank (1992) identified the main characteristics of bad governance to include:

- Failure to properly distinguish between what is public and what is private, thus, leading to private appropriation of otherwise public resources;
- Inability to establish a predictable framework for law and government behaviour in a manner conducive to development;
- Excessive rules, regulations etc., which impede the functioning of markets and encourage rent seeking behaviour;
- Priorities that are inconsistent with development, thereby resulting in misallocation of national resources and
- Exceedingly narrow base for, or non-transparent, decision making.

Uga (2002) emphasized that the positive influence of good governance on national development is a derivative of the checks and safeguards it provides against anti-development forces, especially high-level corruption.

Nigeria's governance history since independence has been somewhat chequered despite the fact that the Nigerian state is hugely endowed with human and material resources. This is not unconnected with the country's economic crisis and the usurpation of political power by the military elite, institutionalization of corruption, lack of transparency and accountability in the conduct of public affairs, gross declining productivity and rent seeking. Governance type in Nigeria has been alternating between military and civilian regimes (see table 1). Under normal conditions (civilian/democratic regimes) where governance is perceived to be good, it is not reflected in good governance indicators such as voice and accountability, control of corruption, political stability, government effectiveness, rule of law and regulatory quality. Nigeria has continuously been performing poorly in terms of these governance indicators as compared to other countries (see table 2). Table 2 shows estimates of Nigeria's score on the indicators ranging from approximately -2.5 to 2.5 (indicating weak and strong respectively). Nigeria is the weakest among the

three selected countries in all the indicators. This further confirms the fact that the development gap between the industrialized countries and developing countries (including Nigeria) is not necessarily as a result of differences in natural resource endowments but results from the great differences in the range and level of governance indicators.

Table 1. Governance Type and its Perception within the Period of Study

Period	Regime Type	Duration	Governance Perception
1979 - 1983	Civilian/Democratic Regime	4 Years & 4 Months	Good
1983 - 1993	Military/Authoritarian Regime	9 Years & 7 Months	Bad
1993 - 1993	Interim Civilian/Democratic Regime	2 & Half Months	Good
1993 - 1999	Military/Authoritarian Regime	6 Years & 6 Months	Bad
1999 - 2017	Civilian/Democratic Regime	18 Years	Good

Source: Authors' Compilation. (2017).

Table 2. Selected Governance Indicators of Selected Countries from 1996 to 2010

Country	Indicators	1996	2000	2012
Nigeria	Rule of Law	-1.26	-1.52	-1.04
	Control of Corruption	-1.15	-1.32	-1.09
	Government Effectiveness	-0.98	-0.96	-0.99
	Political Stability	-1.17	-1.65	-2.07
South Africa	Rule of Law	-0.01	0.04	0.05
	Control of Corruption	0.76	0.33	-0.04
	Government Effectiveness	0.87	0.68	0.26
	Political Stability	-0.42	-0.33	-0.17
Indonesia	Rule of Law	-0.36	-0.89	-0.41
	Control of corruption	-0.56	-0.95	-0.45
	Government Effectiveness	-0.41	-0.45	-0.22
	Political Stability	-1.17	-2.11	-0.59

Source: World Development Indicators, 2016.

It should be noted that the periods of military government (as shown in table 1) are perceived as periods of bad governance in Nigeria because military rule is an expression of the "received state" which "monopolizes and allocates" values by brute, rather than by popular consent (Oshiomhole, 1994). It is obvious from Nigeria's historical experience that military regimes have always assumed

a dysfunctional dimension in the nation. The role of the military in Nigeria has led to the militarization of the political culture and bastardization of democratic procedures. It is an aftermath of this that governance in present-day Nigeria is characterized by vandalism, banditry and plunder of resources (Jega, 1994).

This nature of (poor) governance in Nigeria has created a business environment which makes full participation of the private sector inefficient. The business environment is not conducive for entrepreneurship, competition and innovation. There are bureaucratic impediments that discourage productive investment. Specifically, Nigeria's governance indicators cannot uphold and credibly enforce property rights. That is the right of property owners to extract returns on investments. This right stands crucial, as potential investment financiers will be reluctant to surrender funds in the face of the risk of such funds being expropriated. Investors rely on the state to enforce contracts and offer protection, hence in countries like Nigeria, where the bureaucratic structures/institutions are weak and corrupt without obedience to the rule of law, investors would be unwilling to invest. This explains why such countries (Nigeria) remain industrially poor or under-developed.

4. Road Infrastructure in Nigeria

The history of road transport development in Nigeria can be traced to 1904, when the then colonial government attempted to construct a road linking Zaria and Zungeru in Northern Nigeria. This road was later extended from Zaria to Sokoto, Katsina and Maiduguri. The Ibadan - Oyo road, which was constructed in 1906 is recorded to be the first motorable road ever constructed in Nigeria. Before and immediately after independence in 1960, the Nigerian landscape was covered with a skeletal network of narrow and winding roads (Federal Ministry Works (FMW), 2013). These roads were constructed by the British colonial government mainly to convey raw materials from the hinterlands to the seaports for onward movement to Europe. Thus, during this period, consideration was not given to efficiency and proper planning in the construction of roads.

After the colonial era, fairly impressive improvement has been recorded in road infrastructure in Nigeria in terms of total length and quality. Most of these roads were made possible by the oil boom of the early 1970s. These roads are classified into trunk "A", "B", and "C" categories. Trunk "A" roads are federal roads and form the major grid of the national network to which all other roads

are linked. Trunk "B" and "C" roads are owned and maintained by state and local governments respectively. Notable among these roads are the dual carriage ways as well as four-lane expressways such as the Lagos – Ibadan – Oyo – Ilorin road, the Onitsha – Enugu – Port Harcourt road, the Kaduna – Zaria – Kano road, the Jos – Kari – Maiduguri – Gamboru road, and the East – West road to mention a few. Apart from these national trunks, there are the international highways or roads (constructed by the Nigerian government in conjunction with other international agencies) leading from Nigeria to the borders of other countries such as Chad (through Ndjamena), Cameroon (through Marocia and Mamfe), Benin Republic, Ghana, Togo (through Idiroko) and Niger Republic (through Zinder) (Ukpong and Iniodu, 1991; Anyanwu, Oyefusi, Oaikhenan and Dimowo, 1997).

The road network in Nigeria grew from a total length of 6,500km in 1960 to 10,000km in 1970 to 29,000km in 1980 and 194,00km in 2003. As at 2013, the total road network was approximately 200,000km made up of 33,000km, 50,000km and 117,000km for federal, state and local governments respectively. Only about 65,000km of the 200,000km is paved, and 35,000km of these paved roads belong to the federal government. This represents only 54 per cent of the entire paved roads in Nigeria while 46 per cent is shared between state and local governments. Specifically, federal roads constitute only 17 per cent of the total road stock but they carry more than 80 per cent of the vehicular traffic, thereby underscoring their importance to the economy. Table 3 shows that between 1980 and 2014, Nigeria had an average of 24.5 per cent paved roads. This is very poor, compared to China with an average of 80 per cent for the same period. Interestingly, a total of 95 per cent of passengers and goods are transported by road in Nigeria (World Bank, 2009; FMW, 2013). This is particularly true given the near absence of rail, marine and other forms of transport infrastructure in Nigeria.

Table 3. Paved and Unpaved Roads in Nigeria as a Percentage of Total Roads

Year	Paved Roads (%)	Unpaved Roads (%)
1980	25	75
1990	30	70
2000	24	76
2014	19	81

Source: World development indicators, 2015.

Though the transport sector contributes 2.4 per cent to real GDP, the road infrastructure sub-sector accounts for about 86 per cent of the transport sector output (Nworji and Oluwalaiye, 2012). Table 4 indicates that road infrastructure is the transport infrastructural sub-sector that has contributed the largest to the transport sector among the other forms of transport infrastructure in Nigeria over the years. Despite its contribution however, the World Bank (2009) report revealed that the third most important constraint to industrial activities in Nigeria is road infrastructure. This is because almost 70 per cent of manufacturing firms in Nigeria have their inputs delivered by road and the quality of the roads is very poor. Umoren, Sule and Eni (2011) documented that about 26 per cent of the paved road network in Nigeria was in very poor state, requiring urgent rehabilitation and reconstruction, while 42 per cent was in fair condition, requiring resurfacing to prevent further decline to poor condition. They went further to assert that the conditions of unpaved roads were very bad. Similarly, Nworji and Oluwalaiye (2012) observed that most roads networking places and regions were built more than thirty years ago and have been neglected without due rehabilitation or maintenance. This has led to a situation where most of the roads have major cracks (longitudinal and transverse), depressions, broken down bridges and numerous potholes which have made road transport slow, costly and risky (CBN, 2003). The Central Bank of Nigeria (2003) put the estimated paved roads in Nigeria that are in deplorable state at 51 per cent, 58.3 per cent and 61.0 per cent for federal, state and local governments respectively. These figures must have changed currently, but the pattern remains the same.

Table 4. Contribution of Road Infrastructure to Transportation Sector (₦m)

Year	Road	Rail	Water	Air	Transport
1980	445.17	181.68	315.64	225.72	1,168.21
1990	4,665.62	59.91	280.80	248.53	5,4388.84
2000	6,392.79	1.29	305.84	213.65	7,508.13
2014	22,576.21	2.63	497.57	559.78	24,956.73

Source: CBN Statistical Bulletin, 2015.

The Federal Ministry of Works (2013) has emphasized that a huge funding gap exists in the financing of road projects. This is basically due to the meagre annual budgetary allocation to fund road projects. For instance, the average

annual funding requirement is put at ₦500 billion over the next ten years against an average budgetary allocation of ₦120 billion, leaving a shortfall of ₦380 billion. This shortfall has serious negative consequences for the development of road infrastructure as well as industrialization.

5. Industrial Policies in Nigeria: An overview

In the fifty six years of nationhood, there has been a burning desire to transform the Nigerian economy from an agrarian economy to an industrialized one. This is reflected in the number of industrial policies formulated and perhaps implemented over the years. These industrial policies are analysed briefly under three historical epochs, namely, the pre-SAP era, the post SAP era and the millennium era.

The industrial policies that dominated the pre-SAP era among others include the Import Substitution Industrialization Strategy and the Company Income Tax Act of 1961, the Nigerian Enterprise Promotion Decree or Indigenization Decree of 1972, the Patent and Design Decree of 1970, the Standard Organization Decree of 1970, and the Industrial Training Fund of 1971. The combined objectives of these policies were to ensure even development, rapid expansion and diversification of the country's industrial base; promote indigenous ownership of industries; promote export oriented industries in order to create backward and forward linkages in the economy; and also liberalize entry into the industrial sector for both domestic and foreign investors (Ndiyo et al, 2004). It should be noted that the industrial policies formulated and implemented within this period coincided with Nigeria's first, second, third and fourth national development plans of 1962-1968, 1970-1974, 1975-1980 and 1981-1985 respectively. All these development plans had rapid industrialization as one of their major objectives.

The policies of the post-SAP era, which spanned1986 to 1999, had the objectives of encouraging rapid industrial development by making use of local raw materials, promoting export-oriented industries, and removing bottlenecks that could hamper industrial growth (Ekuerhare, 1988; Ndiyo et al., 2004). To achieve these objectives, the federal government put in place SAP-induced industrial policies such as debt-equity swap, deregulation of interest rate, new export policy incentive and privatization and commercialization. In 1989, the new industrial policy was launched to replace the amended version of the

Nigerian Enterprise Promotions Decree of 1977. The cardinal thrust of this new industrial policy was to create a conducive investment climate capable of mobilizing the private sector to take the lead in industrial entrepreneurship while government provided the required infrastructure (Ndebbio and Ekpo, 1991).

Interestingly, this policy was also meant to promote small and medium-scale industries in Nigeria. The National Economic Reconstruction Fund (NERFUND) was established that same year, 1989. NERFUND was meant to facilitate the provision of medium and long-term financing to small and medium-scale industries and also complement the new industrial policy. The establishment of NERFUND was not completely unconnected with the obvious failure of the Import Substitution Industrialization (ISI) strategy.

In 2004 (the millennium era), the National Economic Empowerment and Development Strategy (NEEDS) was launched with the aim (among others) of economically empowering indigenous small and medium-scale industries. Generally, NEEDS had the objective of grooming the private sector to take the lead in industrial entrepreneurship, and thus accelerate the pace of industrial development and value added at every stage of the value chain. The search for an appropriate industrial policy resulted in the institution of the National Integrated Industrial Development (NIID) Policy by the federal government in 2007. This was a service framework developed by the United Nations Industrial Development Organization (UNIDO) in collaboration with the Nigerian government. The framework according to CBN (2007) is made up of four integrated programmes which included (a) industrial governance and public-private sector partnership, (b) strengthening industry's institutional support base, (c) a cluster development initiative to grow small and medium enterprises and (d) promote rural sector agro-industrial development. Under this NIID initiative, the Lagos, Kano, Aba and Port Harcourt industrial action plans were developed to address the problems of industrial decay and focus on addressing the needs of these four industrial cities. Within this era, the federal government pursued relentlessly, the industrial park development strategy (IPDs). This is a cluster concept aimed at boosting non-oil growth through the creation of industrial parks and special economic zones in areas with basic infrastructural facilities. To support this IPDs, the Nigerian Electricity Regulatory Commission (NERC) issued 14 new licences in 2007 to private operators for the establishment of independent power plants with varied capacities and expected a total output of 6,000MW (CBN, 2007; Udah and Ekpenyong, 2011).

Within these three historical epochs, the federal government has experimented with a lot of industrial incentives aimed at industrializing the country. Some of these incentives are tax holidays, tariff protection, import duty relief, reduction of excise duty, total ban on certain foreign goods, establishment of industrial development financial institutions and so on.

Against the background of this review, it is evident that the Nigerian government is unrelenting in its desire to fast track industrialization, but most of the policies are always beset by challenges, top of which is governance or bureaucratic bottlenecks. A keen look at some indices of industrial development in Nigeria reveals cases of industrial fatigue, distress and failure despite the inherent potential in the country for a viable industrial sector (see table 5). Table 5 presents a summary of the performance statistics of some of the indices. It is obvious that even though industrial output has increased over the years, its average contribution to gross domestic product (GDP) is extremely low.

It can be seen from table 5 that average growth rate and average capacity utilization are declining and very unimpressive. Almost all the indices fall short of the three basic requirements for industrialization as submitted by Ojo (1982). First, the industrial sector must account for 25 per cent of the GDP. Second, about two-thirds (66.6 per cent) of industrial output must be accounted for by the manufacturing sector and finally, at least one-tenth (10 per cent) of its total population must be employed in the industrial sector. Unfortunately, the share of manufacturing output in industrial output has been an average of 24.09 per cent for the past three decades.

Table 5. Summary of Industrial Performance Indices

Year	Industrial Output (₦m)	Average Growth Rate	Percentage of Industrial Output in GDP	Average Capacity Utilization
Pre-SAP (1970-1985)	29,604.71	74.30	28.97	67.88
SAP and Post SAP (1986-1999)	96,939.36	2.13	38.16	36.61
Millennium Era (2000-till date)	145,958.21	2.49	39.93	53. 40

Source: CBN Statistical Bulletin, 2016.

Despite all the industrial policies, available evidence as seen in table 5 shows that industrial performance is not encouraging. Nigeria is yet to be industrialized and its industrial sector is still at the rudimentary stage, mostly engaged in light industries and assembling of imported components.

6. Empirical and Theoretical Issues

6.1 Infrastructure and industrial growth

Development economists, particularly those of the classical and neoclassical persuasion emphasize the need to build up infrastructure as a key stimulus to economic development in developing countries (Jhingan, 2003). The small size of the market is seen by these economists as the major cause of underdevelopment and they believe that only by linking together the many small markets within the country will there be a market of sufficient size to spur development. The linkage can best be achieved by the provision of infrastructure. Implicitly, infrastructural provision and availability precedes development. In Africa, only a few countries (including Nigeria) can boast of the infrastructure that is required for rapid industrialization. This has actually increased the cost of production for manufacturers (Oyefusi and Machame, 2011).

The links between infrastructure and industrial development are multiple and complex. Infrastructure does not only affect production and consumption directly, it also involves large flows of expenditure, thereby creating additional employment, reducing poverty and creating national wealth. Studies (Edame et al, 2011; Udah and Ekpenyong, 2011; Nworji and Oluwalaiye, 2012) have shown that infrastructure can have a significant impact on output, income, employment, international trade, and quality of life. Infrastructure development can promote industrialization, which is one of the prerequisites for driving sustainable economic growth. Provision of infrastructure (be it good governance and road) is vital to economic growth of nations itching to take advantage of global connections.

Interestingly, infrastructure does three basic things: first, it provides services that are part of the consumption bundle of residents; second, it serves as an input into private sector production, thus, augmenting output and productivity; and finally, large scale expenditure on infrastructure increases aggregate demand and provides short-run stimulus to the economy (Aigbokan, 1999). Studies by the

World Bank (1994) and the African Development Bank (1999) have indicated that infrastructure facilitates the generation of industrial and economic growth through the provision of an environment for productive activities. Shah (1992) estimated a cost function equation including infrastructure using ordinary least squares in Mexico and discovered that infrastructure has an insignificant but positive effect on output. Okafor (2008) used descriptive analysis to support the conclusion of Shah (1992) by arguing that poor and inefficient infrastructure (specifically electricity) has adverse implications for industrial development in Nigeria.

Archibong (1997) and Udah and Ekpenyong (2011) opined that the positive side of the Structural Adjustment Programme (SAP) in Nigeria could not be fully realized due to numerous structural rigidities including poor infrastructure. This, according to them, undermined the efficacy of fiscal and other incentives designed to stimulate growth of the industrial sector and the diversification of the economy. In the same vein, Egwaikhide et al. (2001) undertook a critical review of four decades of industrialization in Nigeria and concluded that there is a need to reassess the existing institutional and infrastructural incentives in Nigeria, given the persistent underutilization of installed capacity by industrial outfits. Oke (2006) asserted unequivocally that the non-competiveness of Nigeria's export goods is due to poor infrastructure, especially electricity supply and transportation.

Also, Aschauer (1989) argued that the stock of public infrastructure capital is a significant determinant of aggregate total factor productivity and that investments in the public sector not only improve quality of life but also increase economic growth and returns for private investments. A study by Demetriades and Mamuneas (2000) indicated that public infrastructure capital had significant positive long-run effects on both output supply and input demands in 12 OECD countries. Looney (1997) analysed the effects of several types of public infrastructure in Pakistan and found that public infrastructure had not been instigating private sector expansion but rather had been a response to the needs of the sector. Mamatzakis (2002) found a positive effect of public infrastructure (ports, railways, roads, electricity and communications) on the output and private capital productivity of the Greek industrial sector. The study also found that the causal relationship is from public infrastructure to productivity.

Between 2005 and 2006, the Manufacturing Association of Nigeria (MAN) carried out surveys on the Nigerian industrial sector. The surveys indicated that only 10 per cent of manufacturing outfits could operate at 48.8 per cent of installed capacity and that 60 per cent of the manufacturing outfits were barely able to cover their average variable costs, while 30 per cent closed down completely. According to MAN (2006), most of these industrial outfits suffered from inadequate infrastructural supply (especially electricity and road network). Obviously, these figures are not mere statistical abstractions but a reflection of poor infrastructural supply and accessibility in Nigeria. These facts go a long way to corroborate the assertion that a direct or indirect correlation exists between output growth and infrastructure availability.

In an attempt to present various scenarios to illustrate why infrastructure such as energy, transportation, etc. were important drivers of output growth and development in Japan over the last century, Yoshida (2000) wrote an essay in which an attempt was made to draw lessons that could be useful to developing countries. Yoshida found that the growth rate of demand in infrastructure was much higher than that of per capita GNP in the early stage of development. The study also confirmed that public investment in infrastructure was large and that is one major reason why Japan is industrialized.

In their study, Uma, Onwusogbulu and Enwere (2014) supported the view that sufficient investment in transport infrastructure in Nigeria is imperative for creation of adequate capacity utilization, as well as effective inputs and outputs circulation at the various points of need. They believe that this would raise industrial activities and productivity, and is capable of reducing developmental bottlenecks in the country. They emphasized the fact that adequate infrastructural provision will not only enhance mobility of resources within the country but it will also facilitate the reaping of the positive benefits inherent in resource mobility.

Theoretically, the Cobb-Douglas (C-D) production function, the theory of unbalanced growth and the deadweight loss theory would be reviewed as the theories relevant to this study. By using the basic Cobb-Douglas (C-D) production function as adapted from Ndebbio (2006), it is possible to demonstrate how the formal neoclassical production function can be unrestricted. Typically, the Cobb-Douglas production function is written as:

$$Y = AK^bL^c \tag{1}$$

where:

Y = Output (it could be GDP or industrial output)

A = State of technology or efficiency parameter

K = Capital employed

L = Labour employed

b & c are weights, such that $b + c = 1$ (displaying constant returns to scale)

But today's production processes are characterized by increasing returns to scale. In other words, technology-changing capabilities are characterized by increasing returns to scale. This being the case, the function in equation (1) can be modified. This is basically done to ensure that:

a. Factors or policies that stimulate accumulation of technology-changing skills (disembodied) are accounted for.

b. The efficiency in the use of factor of production associated with technology-using skills (embodied) is taken into account.

The modified Cobb-Douglas (C-D) function is given thus:

$$Y_t = AK_{tb}L^c_t \tag{2}$$

Here, $b + c > 1$, indicating increasing returns to scale.

By introducing an exponential element (e) into the function, equation (2) can be modified into equation (3) to allow for other direct and indirect factors, thus:

$$Y_t = Ak^{nt}\ L_t^{\,1-n}\ e_t^{\,v+s}\ + U_t \tag{3}$$

In log-linear, equation (3) can be shown in equation (4) below:

$$\text{Log } Y_t = \text{Log } A + n\log k_t + (1-n)\log L_t + v\log e_t + s\log e_t \tag{4}$$

where:

V = rate of embodied technology in equations (3) & (4)

S = growth rate of output due to influence of factors which promote technology–changing capabilities (like infrastructure) in equations (3) & (4).

U = error term.

It is important to note that equations (3) and (4) portray that the returns are in two parts – the first is the constant returns to factors of production, while the second is the returns due to technological progress or improvement.

It is important to mention that the Cobb-Douglas formulation has been criticized severally because some of its assumptions are unrealistic. Among other things, it is assumed that the production function is deterministic. There is also the usual quarrel with unitary elasticity of substitution and competitive equilibrium (which ensures that factors are paid the value of their marginal products). These criticisms are "theoretical worries" which exist in all economic models. The practical significance of such worries may not change the economic message of theoretical models (Thirlwall, 1979). Apart from this, more complex models do not necessarily provide more realistic predictions. A complex model may indeed become a problem because it can undermine the complexity of economic occurrences that have to be explained (Essia, 2000).

The theory/doctrine of unbalanced growth maintains that investment should be made in selected sectors rather than simultaneously in all sectors of the economy. No underdeveloped country possesses capital and other resources in such quantities as to invest simultaneously in all sectors. Therefore, investment should be made in a few selected sectors or industries for their rapid development and the resources accruing from them can be utilized for the development of other sectors. Thus the economy gradually moves from the path of unbalanced growth to that of balanced growth. Economists like Singer, Kindleberger, Streeten etc (as cited by Jhingan, 2003) have expressed their views in favour of this theory. It is however, Hirschman (Jhingan, 2003) who propounded the doctrine of unbalanced growth in a systematic manner. It is his contention that deliberately unbalancing the economy, according to a pre-designed strategy, is the best way to achieve economic growth in an underdeveloped country.

According to Hirschman (as cited in Jhingan, 2003), when new projects are started, they appropriate external economies created by previous projects and create new external economies that can be exploited by subsequent ones. There are some projects that appropriate more external economies than they create, which is called convergent series of investments. There are other projects too that create more external economies than they appropriate which is characterized as divergent series of investments. From the point of view of the economy, the

latter may have a greater social desirability than private profitability, whereas induced investment may be less desirable from the social viewpoint. In practice, development policy should aim at (i) the prevention of convergent series of investments, which appropriate more external economies than they create and (ii) the promotion of divergent series in which more economies are created than are appropriated. This is possible by investing either in social overhead capital (infrastructure) or in directly productive activities (DPA). The former creates external economies while the latter appropriates external economies.

Unbalancing the economy with social overhead capital (infrastructure) has been defined as "comprising those basic services without which primary, secondary, and tertiary productive activities cannot function." In social overhead capital are included investments in conventional governance, power, transportation, communications, etc. A large investment in social overhead capital will encourage private investment later in direct productive activities. On the other hand, unbalancing the economy with directly productive activities instead of investing in social overhead capital facilities is likely to lead to shortage of social overhead capital thus raising production cost substantially. In the course of time, political pressures might stimulate investment in social overhead capital also.

This theory has been criticized for failing to point out clearly the optimum degree of "imbalance", where to imbalance and how much in order to accelerate growth. Also, the theory lays so much emphasis on "linkage effects" of social overhead capital and this suffers from the fact that it is not based on data pertaining to an underdeveloped country like Nigeria where social overhead facilities have not been fully developed for over a decade.

The deadweight loss theory exists as the consumer/producer surplus is lost. This is more or less due to the restriction imposed on output by external factors. Let us consider an industry with the standard shapes of the demand and supply curves. The supply of output by the firm is based on the production function that combines capital, labour, infrastructural services (e.g. electricity, governance, roads, etc.) and other inputs. The impact of poor and unreliable infrastructural services would be an increase in the production cost of the firm either through the higher cost incurred in the substitution of private for public infrastructure or through output losses from shutdown by those who cannot effectively find substitutes because they cannot afford to bear the additional cost burden. The

effect of this situation is to shift the supply curve to the left (as shown in figure 1) implying that the producer is only willing to supply each previous level of output at a higher price. The higher market price of the product reduces both the consumers' and producers' surplus. Generally, inadequate and poor quality of infrastructure, such as governance, roads, electric power, etc. are major impediments to industrial production and overall economic growth. Some dimensions of the loss to the economy can be captured in terms of the deadweight loss (the reduction of consumers' and producers' surplus) (Iwayemi, 1991). The size of the deadweight loss can be measured by the area ABCR in figure 1.

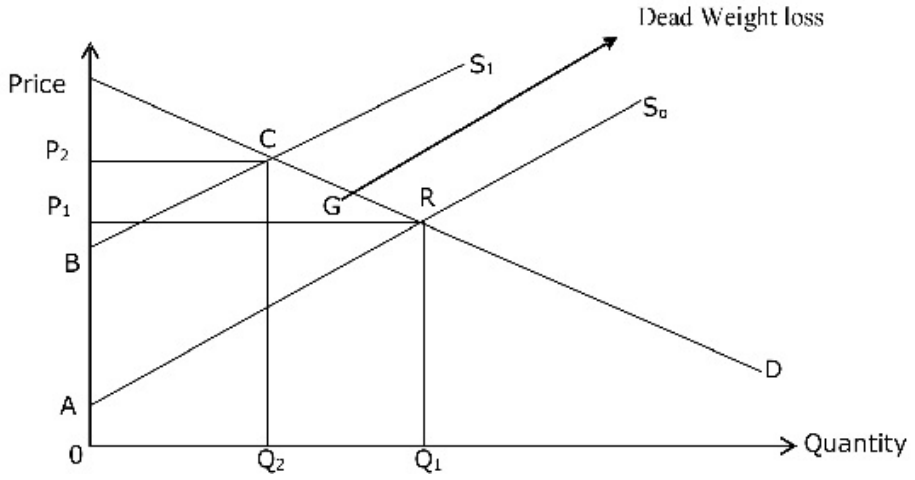

Figure 1. The welfare loss from inefficient/inadequate supply of infrastructure.

7. Model and Data

The period of analysis covers 1980-2015. This is the longest period for which numerical data is not only available but also accessible. The econometric approach is based on a time series data analysis. The model specification is consistent with the Cobb-Douglas production function, which was briefly reviewed in section 6. For simplicity, the Cobb-Douglas production function is thus:

$$Y = AK^{\alpha} L^{\beta} \quad (5)$$

where:

Y = IND = Industrial output at time t

A = Total factor productivity

K = Capital stock

L = LF = Labour force (measured by adult literacy rate for skilled labour force)

α & β are elasticity coefficients

It is assumed that each productive unit will use the same level of capital and labour. The impact of governance and road infrastructures on industrial performance possibly operates through total factor productivity (TFP) or technical efficiency (A). The role that governance and road infrastructures play in boosting technical efficiency has been well established in the literature. Governance involves the process of interaction of many activities and institutions. For this reason, it cannot be captured by a single measure. In this paper, two commonly used measures of governance for which data are readily available for a long period are employed (institutional quality and corruption index). Therefore, TFP is a function of governance (measured by corruption index and quality of institutions) and road infrastructure (measured by the number of paved roads in Nigeria). Thus:

$$A = f(COR, INQ \text{ and } PAR) \quad (6)$$

where:

COR = Corruption index

INQ = Quality of institutions as measured by contract intensive money (CIM), which is the ratio of broad money supply minus currency in circulation to broad money supply, that is, $M_2 - CC/M_2$. It is used as an indicator of property rights and property right measures trust; the degree to which a country's laws protect private property and investments. CIM, according to Clague et al. (1995) and Boschini et al. (2003), is a new, easily accessed and objective measure of enforceability of contracts and security of property rights. Contracts and property rights according to Addison and Baliamoune-Lutz

(2003) are an important investment response that is expected from any reform that changes relative prices in the product market.

PAR = Number of paved roads in Nigeria.

Combining equations (5) and (6), equation (7) is derived as indicated below:

$$IND = f(COR, INQ, PAR, K, LF) \quad (7)$$

From equation (7), an explicit estimation function is specified, after taking the natural logs of both sides as follows:

$$\text{Log}Y = a_0 + a_1 COR + a_2 INQ + a_3 PAR + a_4 K + a_5 LF + Ut \quad (8)$$

where all the variables are as previously defined and *Ut* is the stochastic term.

Institutional quality and corruption index variables as measures of governance in the model are important. This is because institutions theorists believe that economic agents rely on the state for enforcing contracts and protection; hence in countries where corrupt officials abuse their authority for self-enrichment, economic agents would be unwilling to carry out any transactions. This explains why such states remain unindustrialized and underdeveloped. Specifically, according to institutions theorists, upholding and credibly enforcing property rights are crucial in any economic transactions. The proxy for measuring institutional quality is contract intensive money (CIM). CIM is used because it determines to a great extent the quality of institutions and this measure has been extensively used by most scholars (Okoh and Ebi, 2013; Iyoboyi and Pedro, 2014; and Ubi and Udah, 2014). Contract intensive money index ranges from 0-1. A high score means high security of property rights and enforcement of contracts, while a low score indicates poor security of property and contract rights. The sign of all the elasticity coefficients are expected to be positive except for corruption that is expected to be negative.

The time series data were obtained from different sources. The data on industrial growth (measured by industrial output), capital (captured by gross fixed capital formation, K) and institutional quality (measured by CIM) were obtained from the *Central Bank of Nigeria Statistical Bulletin* (2016), while the data on corruption (COR) was obtained from Transparency International

Corruption Index, 2016. The data on labour force (LF, measured by adult literacy rate) was obtained from the National Bureau of Statistics (NBS, 2015).

8. Estimation Techniques

The methodologies are the co-integration and the vector auto-regression (VAR) techniques. In most time series analyses, the employment of co-integration and error correction is now fairly standard. Equally, the use of VAR in empirical analyses is also widespread. The use of VAR methodology in econometric analyses can be traced to the path breaking work of Sims (1980). Sims (1980) proposed an alternative methodology – VAR. It begins with the estimation of an unrestricted reduced form and then proceeds to test economic hypotheses by testing the implied restrictions on the reduced form (Patterson, 2000). The problem of exogeneity is taken care of by treating all variables as endogenous. In VAR methodology, the focus is on the variance decomposition and the impulse response functions. Interestingly, VAR analysis allows us to decompose the variance into parts attributed to each set of the innovation or shock process. The impulse response functions describe the response of an endogenous variable to one of the innovations. Thus, variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

Therefore, the forecast error variance decomposition of all the variables will be computed to see which of the variables of infrastructures measure is most important in promoting industrial growth over time in Nigeria. If a large part of forecast variance of industrial growth is explained by measures of infrastructures (governance and road) or a large portion of forecast variance of infrastructures is explained by industrial growth, then this can be used as evidence of a strong causal relationship between the two variables. In the literature, VAR models can be applied on various levels irrespective of whether the variables are I(0) or I(1) (Pesaran and Pesaran, 1997).

9. Presentation and Discussion of Results

Positive correlation exists among all the variables except corruption as shown in table 6; most variables have relatively very low correlation. For example, the positive correlation between industrial output and institutional quality is 22 per

cent while industrial output and corruption have only 1.6 per cent negative correlation. It should be noted that this analysis relies more on the VAR results for policy analysis.

Table 7 reveals that all the variables are non-stationary at levels. The unit root tests applied to the variables at each level reject the null hypothesis of stationarity of all the variables. The variables are therefore differenced once and they are confirmed to be stationary. Thus, the variables are integrated of order one.

Table 6. Correlation Matrix

	IND	COR	INQ	LF	K	PAR
IND	1.000000	-0.016985	0.222276	0.114469	0.005385	0.128097
COR	-0.016985	1.000000	-0.254913	-0.044084	-0.163018	-0.167242
INQ	0.222276	-0.254913	1.000000	0.051680	0.032152	0.183711
LF	0.114469	0.044084	0.051680	1.000000	0.171457	0.070280
K	0.005385	0.163018	0.032152	0.171457	1.000000	0.225773
PAR	0.128097	0.167242	0.183711	0.070280	0.225773	1.000000

Source: Authors' computation using E-views (2017).

Table 7. Augmented Dickey-Fuller (ADF) Test

Variables	ADF Statistics		Remark
	Level	1st Difference	
IND	-0.807531	-11.84564	I(1)
COR	-0.285301	-5.064711	I(1)
INQ	-0.841850	-3.788040	I(1)
LF	-0.251392	-6.278944	I(1)
K	-1.681555	-2.696755	I(1)
PAR	-0.687174	-5.388674	I(1)

ADF at 5% Level = 2.9627 and ADF at 5% 1st Difference = 2.9665

Source: Computed by the authors using E-views (2017).

9.1 Variance decomposition

This section further captures the qualitative features of the VAR model by computing the variance decomposition. This is useful in assessing whether the

infrastructure data contains information about industrial performance sufficiently far into the future to be operationally meaningful.

The fractions of the forecast error variance for each variable that is attributable to its own innovations and to the innovations in another variable are presented in table 8. Own shocks constitute a significant source of variation in industrial output (IND) and forecast errors in the short run, ranging from 66 per cent to 100 per cent over the 10 quarters horizon. Innovations to corruption (COR) and institutional quality (INQ) (all governance infrastructures) explain 0 per cent variance of industrial output in the first quarter and these increase to 14 percent and 0.21 per cent respectively in the fifth quarter. In the tenth quarter, innovations to corruption and institutional quality increased to 16 per cent and 0.62 per cent respectively. On the other hand, industrial output has 0 per cent, 0.03 per cent and 0.63 per cent of the forecast-error variance explained by road infrastructure in the first, fifth and tenth quarters respectively. What this means is that in the short-run, infrastructure does not significantly predict industrial output in Nigeria and industrial output seems to have a very strong prediction.

Table 8. Variance Decompositions for the VAR Model of IND in Nigeria

Period	S.E.	IND	COR	INQ	LF	K	PAR
1	7.073647	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	10.31381	74.71222	9.664931	0.306890	11.14543	4.161379	0.009148
3	11.71504	74.20802	10.78802	0.306253	10.00818	4.682231	0.007299
4	13.02782	72.69890	12.60944	0.247956	8.718693	5.698933	0.026077
5	14.23217	70.75535	14.38982	0.210379	7.902203	6.716096	0.026158
6	15.39129	68.94096	15.68788	0.182010	7.182619	7.583484	0.078889
7	16.48106	67.65057	16.40297	0.203451	7.182619	8.292887	0.267504
8	17.49730	66.86516	16.73140	0.295036	6.795391	8.864956	0.448057
9	18.45919	66.41698	16.81580	0.437337	6.488729	9.284499	0.556648
10	19.38280	66.21093	16.68428	0.628732	6.310294	9.535145	0.630613

Source: Computed by the Authors.

This result further corroborates the works of Looney (1997) in Pakistan and Udah and Ekpenyong (2011) in Nigeria. Looney (1997) observed that public infrastructure have not been instigating industrial sector expansion in less developed countries, specifically Pakistan, but have been just a response to the

needs of the sector. In the same vein, Udah and Ekpenyong (2011) opined that the positive side of the Structural Adjustment Programme (SAP) in Nigeria could not be fully realized due to numerous structural rigidities including poor infrastructure. These, according to them, undermined the efficacy of fiscal and other incentives designed to stimulate the growth of the industrial sector and diversification of the economy. Thus, the salient feature of the variance decomposition results in this study is that the predominant sources of industrial output growth fluctuations are due largely to own shocks, and to a lesser extent, to infrastructure in Nigeria.

9.2 Impulse response functions

The impulse response functions, according to Adebiyi (2004), as reported in figure 2, are simply a device to display the dynamics of the variables tracing out the reaction of each variable to a particular shock at time *t*. The response of industrial output or production to one standard innovation in institutional quality (governance infrastructure) is initially positive and then negative, ending in the short run. That is, initially, it is neutral. Afterwards, it ascends insignificantly and gradually declines, then mutes, ending with a negative impact in the 9th and 10th quarters. This implies that a moderately high institutional quality may raise industrial production in the short run.

The response of industrial production to corruption (governance infrastructure) is negative from the 1st quarter to the 10th quarter. The explanation for this result is evident. This clearly indicates that the control of corruption is very weak, thus automatically weakening governance. This conforms to Jega's (1994) assertion that governance in present day Nigeria is characterized by vandalism, banditry and plunder of resources, and this in no small way reduces output growth in Nigeria. Available statistics reveal that corruption in Nigeria is very high with an average index of 2.4 in recent years.

Capital and labour force shocks have positive and negative effects on industrial growth in the short run. This means that rising capital accumulation will increase industrial growth in the short run. On the other hand, labour force captured by adult literacy rate does not boost industrial growth in Nigeria. This is at variance with economic theoretical expectations. This implies that a rise in skilled labour force is not likely to increase industrial growth in Nigeria in the short run.

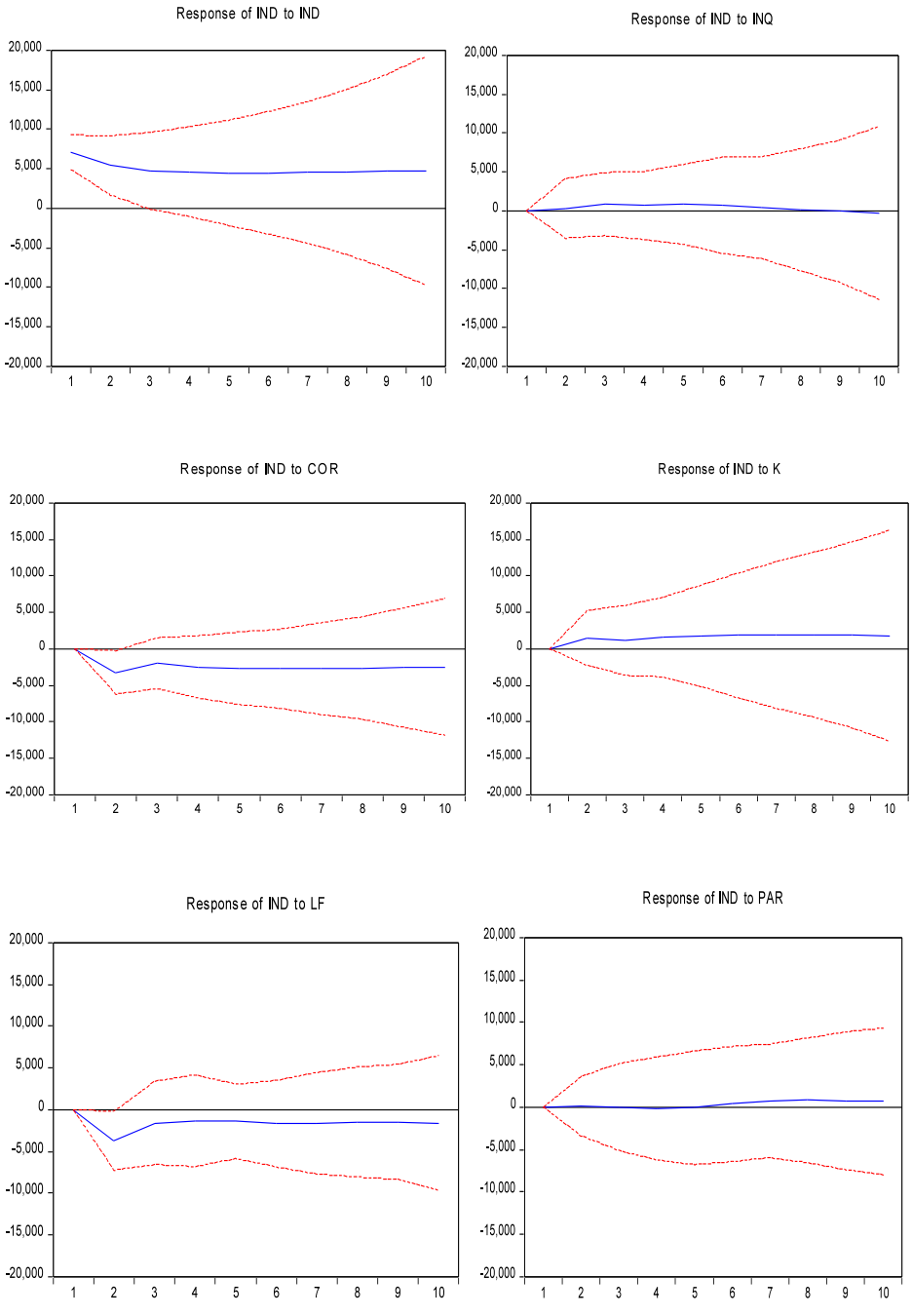

Figure 2. Response to 1 S.D. Innovations ± 5 S.E.

The response of industrial growth to one standard innovation in roads is initially neutral, after which it becomes negative in the 4th and 5th quarters. It rises in the 6th and 10th quarters to an insignificant positive increase in the short run. The implication of this result is that in the long run, industrial growth is insensitive to road infrastructure in Nigeria. On the whole, from the impulse responses, it is obvious that there is no long-run significant positive impact of the shocks of infrastructure (governance and road) on industrial growth for the period under study.

10. Conclusion and Policy Implications

While not doubting the industrial growth capacity of the industrial sector in Nigeria as revealed in the study, it is believed that this must be complemented by an appropriate governance framework (good institutional and corruption free framework) and the will to formulate and execute good policies. Without these fundamentals, industrial growth will continue to elude Nigeria. Sustainable industrial growth will only be achieved when governance and road infrastructure create a business environment that is conducive to entrepreneurship. This study has shown that infrastructural provision in Nigeria is not only poor but also significantly incapable of driving sustainable industrial growth in the long run. The thrust of governance, therefore, should not only be to promote small-scale industries through the removal of all bureaucratic impediments that discourage industrial growth, but also ensure an increase in the number of paved roads network. In view of this result, government should, as a matter of necessity, strengthen the quality of institutions (in terms of the regulation and enforcement of property rights) as this is capable of boosting capital accumulation, which is required for investment vis-a-vis industrialization. Also, government should allow for public private participation in the construction, rehabilitation and maintenance of roads in order to fast-track the industrialization process in Nigeria.

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