Effect of Inflation on Investment in Science and Technology: the case of Road Transportation in Nigeria

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ABSTRACT

Infrastructure development is central to the socioeconomic advancement of any nation and road infrastructure in particular plays a vital and pervasive role in optimizing the benefits of other infrastructure. In Africa, Nigeria ranks high in terms of road network, with the largest road system in West Africa with approximately 200,000 Km of roads linking villages and cities. The importance of road network and transportation in Nigeria is premised on the fact that majority of passenger and freight movement is done by road due to the inadequacy of other forms of transportation. The incidence of about 17% of national road network serving 80% of vehicular and freight traffic coupled with a population growth rate per annum of over 2.5% calls for urgent intervention in road construction and maintenance. This study investigates the effect of inflation on science and technology with a focus on road transportation sub-sector of the transportation sector as a technology used to convey people and goods in Nigeria. The paper seeks to determine analytically the existence of a relationship between inflation and road transportation with a science and technology view of road infrastructure. The scope of the study covers the contribution of road infrastructure and transportation to the Nigerian economy. The research design entails a descriptive approach with the aim of determining possible correlations. The sample size for the analyses of inflation and road infrastructure is based on quarterly data for 2015 to 2016. Secondary data was accessed from specific government organizations and their authorized consultants. Qualitative and quantitative data was used in the analysis, to optimize the strengths of each method in making up for their respective drawbacks. The sub sectoral contribution of road transportation to national productivity was assessed as well as its direct and indirect association with inflation within the same period. The results show that there is no direct and strong correlation between quarterly inflation and road transportation during the period under review. A comparison between both indicators showed that in the first year under investigation, when inflation was fairly stable, road transportation’s contribution to Nigeria’s Gross Domestic Product – GDP – fluctuated. While in the second year when road transportation’s contribution to GDP grew at a more stable pace than in the previous year, inflation increased more rapidly. This study will highlight empirically the need for prompt investment in road infrastructure in Nigeria considering the effect of inflation and the potential to loose economic growth momentum.

Keywords: Inflation, science and technology, road transport, Gross Domestic Product.
I. INTRODUCTION

Inflation refers to the persistent and continuous rise in the general price level of goods and services within an economy. Inflation is an economic phenomenon that occurs in every country, with varying experiences and causative factors. Inflation implies a sustained upward movement in price and not just a onetime increase. The inflation effect in some countries has been positive and accompanied by economic growth, while in most countries it has resulted in economic downturn (Olu & Idih, 2015). Inflation occurs when there is more money in circulation than available goods and services. Inflation thus results from the lopsided interplay of the law of demand and supply (Swain, 2010). The occurrence of inflation is a matter of concern for economist as it affects the real purchasing power of citizen’s income and living standard. Thus, the various perspectives of inflation make it a concern for policy makers (Olu & Idih, 2015). Inflation is measured by a typical index known as the Consumer Price Index (CPI), which tracks the price change from month to month of a basket of goods and services used by the average consumer (Swain, 2010). The problem statement focuses on the road transport infrastructure inadequacy in Nigerian because of insufficient investment resulting from inflation.

II. LITERATURE REVIEW

The nature of inflation

Inflation arises from three of many sources; labour union demands, product market developments and exogenous or endogenous shocks. The labour union factor occurs in response to wage rate in excess of productivity, the product market factor typifies an oligopolistic or monopolistic market structure(s) while the exchange rate depreciation emanates from the price surge in the price of a commodity like crude oil. All three sources of inflation have adverse effects on production costs, which firms pass on to consumers, depending on firms’ competitive position, the elasticities of the demand curves of the products & services and the persistence of inflation (Asekunowo, 2016). Other forms of inflation in developing countries include imported inflation, open inflation and seasonal inflation. Imported inflation is typically transmitted through international trade, from countries experiencing inflation. Open inflation results from uninterrupted market mechanisms and seasonal inflation is associated with a fall in production from seasonal variation typically for farm produce (Olu & Idih, 2015). Furthermore, some schools of thought including the quantity theory of money associate inflation with factors considered to affect supply and demand that creates lags that manifest in higher prices in an economy (Olu & Idih, 2015). Inflation also impacts negatively on investment returns and this makes economic agents worse off on microeconomic and macroeconomic dimensions. The demerits of inflation have short and long-term negative effects. In the short term it weakens purchasing power, while in the long term in devalues savings, to mention a few. (Swain, 2010).

The opposite of inflation, deflation occurs when firm’s market power dwindles in the face of robust economic situations amidst increase local and foreign competition. These factors along with globalization, decreased regulation, new economy - information technology - and productivity growth can entrench deflation (Asekunowo, 2016).
The Role of Firms in Inflation

The competitiveness of firms derives from their ability to mark-up prices within the confines of respective market structure(s). Bowman (2003) and Shahor (2011) indicate that in oligopolistic and monopolistic markets structure; firms, unionized labour and import prices are key sources of inflation. Similarly, they posit that in a perfect market, firms produce at the level where the marginal cost of production equals the market price that would raise prices. In imperfect markets, firms wield their power to set prices where marginal cost is lower than the market price, which induces higher prices to exceed unity, causing inefficient allocation of resources. This implies that mark-up pricing possibility derives from firm’s perception of how strong they are in the market, how well their products are differentiated, how well other products can serve as substitutes and competitors response to a firm’s exercise of mark-up pricing (Asekunowo, 2016). On the contrary, Ball & Romer (2002) disagreed with the position of increased competition being responsible for firms pricing power. They demonstrated a consumer search model to show that low price dispersion and therefore the effectiveness of consumer search channel induces firms to lower propensity to raise prices. In addition, Taylor (2000) submitted that price persistence determines the direction the price level would move, he demonstrated with a utilized model of staggered pricing in which producers are assumed to set prices in advance. Therefore, high price dispersion, costly or inefficient search by customers can influence markup pricing (Asekunowo, 2016).

Inflation, Investment and Economics

According to (Maku and Adelowokan, 2013) low inflation and economic growth are important macroeconomic objectives for economy managers, however, this remains a core unaccomplished quest for many Central Banks. A principal benefit of low inflation is improved certainty and hence the potential to plan and implement long term macroeconomic strategies. In the real world, moderate inflation has been seen to induce the quest for substitutes, such as the case of alternative inputs, which leads to diversification or expansion of economic activity (Swain, 2010). On the contrary, high inflation leads to a drop in living standards, unpredictability of government policy and distortion of the functioning of macroeconomic variables (Obi, Yuni, & Ihugha, 2016). There exist diverse views with empirical evidence from cross country and country specific studies on the relationship between inflation and economic growth. Nonetheless, there is a consensus that inflation inhibits economic growth potential (Obi, Yuni, & Ihugha, 2016). High and spiraling inflation rates above single digits deter investment and this affects the future growth outcome of an economy. According to Dwivedi (2004) economic growth is a sustained increase in per capita national output, which requires that national productivity increase should exceed rate of population growth (Olu & Idih, 2015). Inflation impedes return to human capital and the economic growth rate as it negatively affects consumption and investment within endogenous growth (Gillman & Kejak, 2009).

At the microeconomic level, unfair wealth redistribution may accompany an upward movement of prices which would induce hoarding of unspent income, increase borrowing and therefore constrain investment spending by entrepreneurs. At the macroeconomic level, an upward inflationary pressure may make the export of goods and services dwindle because prices of tradables may become less competitive in the international markets thereby discouraging foreign purchases and consumption. An offshoot of this is that the national income of the economy may fall with attendant adverse consequences on the economy’s unemployment level, economic growth and development process (Asekunowo, 2016).
Inflation in Nigeria

In Nigeria, despite the persistent rate of inflation over the past decades, economic growth has taken place nonetheless, albeit slowly (Olu & Idih, 2015). Historical inflation in Nigeria is ascribed to deficit input resources especially capital goods which resulted in high import dependence from developed countries. This has the tendency to increase the cost of importation which in the long run often increases the price of domestic goods compared with similar finished goods imported. Also this has a negative impact of undermining domestic production which serve as a key source of inflation in Nigeria (Olu & Idih, 2015). Fatukasi (2012) noted that in Nigeria despite several measures to curb inflation, expected results have not been achieved as inflation persists with adverse effects on investment, national productivity, balance of payment and GDP (Olu & Idih, 2015). Inflation in Nigeria has in the past resulted from exposure external shocks and with high volatility such as the importation of highly volatile processed crude products, which in turn spreads inflation through its multiplier effect on economic activity (Obi, Yuni, & Ihugha, 2016). The inflation figures in Nigeria between 2001 and 2010 were mostly double digits as follows: 18.689% (2001); 12.883% (2002); 14.037% (2003); 15.001% (2004); 17.856% (2005); 8.218% (2006); 5.413%, (2007); 11.581% (2008); 12.543% (2009); 13.72% (2010). Despite the recorded GDP growth rates, poverty and unemployment rate remained high and the investment level did not match recorded growth level as a result of general price increase (Olu & Idih, 2015). An International Monetary Fund (IMF) study in 2011 showed that inflation in Nigeria results from high domestic production which makes Nigerian import dependent (Olu & Idih, 2015).

Management of Inflation

A number of economic policies can be employed in the regulation of inflation, such as the infrastructure development approach. Structural economist proposed sufficient infrastructure development to match increasing social service demand from growing population as a long term panacea for inflation control, which they posit to deter the negative effects of inflation. This infrastructure axiom for countering inflation is premised on the fact that underdeveloped economic structure results in the contradiction of typical anti-inflationary measures such as contractionary monetary policy prescriptions which will end up stagnating economic growth. This is buttressed by the fact that infrastructure and social services deficiency increase the demand for increased public expenditure and liquidity in the economic system to accelerate economic growth (Olu & Idih, 2015). Another perspective, neo political regulation focuses on institutions, political process, culture and their effect on economic policy in the real world, which also considers the timing of elections, political stability and the inflation process itself.

Infrastructure and Economic Development

Two major components of infrastructure are: economic and social infrastructure. According to Okumagba (2008), economic infrastructure consists of public utilities; (power, water supply, telecommunications); public works (roads, dams, canals for irrigation); and transportation (urban transportation, railways, ports, airports). Social infrastructure encompasses mainly healthcare delivery and education (Ailemen, 2010). Infrastructure is central to a nation’s growth and development, hence the quantity and quality of available infrastructures and their accessibility to target beneficiaries could be regarded as development indices (Ailemen, 2010). In low income countries, infrastructure investments characteristics portend immense benefits to these economies, albeit at high costs, especially with lagging transportation.
and communication infrastructure coupled with insufficient power. With the cause and effect outcome of the infrastructure gap and low expenditure, infrastructure deficient countries experience low-level equilibrium which makes economic inefficiency to persist.

Overview of Road Infrastructure in Nigeria

In Nigeria, roads are classified as - trunk A, B and C roads. Trunk A roads form the framework of the national road grid which cuts across regional boundaries and extends to international borders with West Africa. Trunk B roads, the second category of link major cities within states with state capitals. While trunk C roads comprise local feeder roads which are earth roads without asphalt and are negatively affected by seasonal weather changes. The 200,000km of road network in Nigeria constitutes 33,000km federal government, 50,000km state government and 117,000km local governments (Federal Ministry of Works, 2013). Data obtained from African Economic Outlook in 2006 shows that Nigeria’s transportation sector contributed about 2.4% real GDP in 2004 with road transportation alone accounting for nearly 86% of the transport sector’s output. Of the total 200,000 km, about 15% are paved with an estimated 23% of the paved roads in bad condition, requiring urgent rehabilitation (Ailemen, 2010). A huge gap exists between actual road infrastructure investment needs and financing being provided for infrastructure development. The government has made efforts to improve infrastructure by instituting specific agencies such as the Federal Environmental Road Maintenance Agency (FERMA) which is to achieve more Public Private partnership (PPP) policy investment in infrastructure financing in the country. Before the 1970s rail transportation dominated the means of movement of goods (mostly agricultural goods) in Nigeria. By the 1970s rapid economic growth and development increased importation of goods, high trade, increased living standards through higher purchasing power. These heralded the need for increased road network in Nigeria to meet the demand for higher vehicular traffic. This resulted in the decline of rail transportation from 85% in 1955/56 to 3% by 1977. Meanwhile, a few years after in the 1980s, a decline in the national economy from inflation and devaluation of the Naira resulted in a reduction in infrastructure development. Other negative indices for road infrastructure development include the simultaneous increase in poverty levels and a reduction in human development, these were compounded by a geometric increase of 439% of newly registered vehicles between 1981 to 1997, while motorcycles registration reached 930% between 1981 and 2000 (Adelekan, 2016). This resulted in a disequilibrium where the demand for transport services in Nigeria exceeded its supply. The problems of road transportation include; bad roads, inadequate road network, inadequate public transport, lack of suitably trained road transport managers, capital restructuring bottleneck and ineffective traffic regulation (Adelekan, 2016). This can be validated by the fact that Nigeria has the second highest record of road traffic accident fatalities based on a 193 countries index. Available data shows that Nigerian records 152 deaths for every 100,000 people making road accidents the third highest killer in the country (Federal Ministry of Works, 2013).

Nigeria’s Road Transport Potential

Nigeria is highly ranked in road network spread among sub Saharan Africa with the largest road network in West Africa comprising 200,000km of roads connecting villages to cities (Federal Ministry of Works, 2013). Road transportation represents the principal means of transportation in Nigeria since the collapse of the rail system in the 1970s and 1980s. Road transportation also contributes more than 90% of the transportation sector’s 3% GDP contribution (Federal Ministry of Works, 2013).
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<tr>
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<td>227449.02</td>
<td>300102.8</td>
<td>294291.4</td>
<td>334450.02</td>
<td>156293.3</td>
<td>303508.9</td>
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<td>56.79</td>
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<td>96.61</td>
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<td>2627.9</td>
<td>1862.4</td>
<td>8071.9</td>
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<td>20599.27</td>
<td>21760.23</td>
<td>24615.1</td>
<td>28761.3</td>
<td>95735.9</td>
<td>22187.7</td>
<td>19473.9</td>
<td>25813.9</td>
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<td>17673.79</td>
<td>21943.8</td>
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<td>72952</td>
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<td>27249.7</td>
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<td>Post &amp; courier</td>
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<td>7044.94</td>
<td>6312.6</td>
<td>7995.6</td>
<td>27729.2</td>
<td>7353.2</td>
<td>7642.4</td>
<td>6847.9</td>
<td>7012.7</td>
<td>28,856.04</td>
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**Source:** National Bureau of Statistics, Nigerian GDP Report Q4 2016

Analyses of data for inflation and road transportation technology spanned the four quarters in 2015 and 2016, which was used for the analysis.

**FIG 2: INFLATION RATE FOR Q1 - Q4 2015 AND 2016**
III. Results and Discussion

There is no direct and strong association between the quarterly data for inflation and road transportation sub sectoral GDP contribution. For instance, Q4 recorded the highest inflation rate for 2015, while Q1 had the lowest. Similarly, Q4 recorded the highest inflation rate for 2016, while Q1 had the lowest. The pie chart as well as the graph shows that inflation in 2015 was more stable than in 2016. The quarterly analysis for road transport contribution to GDP revealed that Q4 recorded the highest sub sectoral contribution for 2015, while Q1 contributed lowest. Similarly, Q4 recorded the highest sub sectoral contribution for 2015, while Q1
contributed lowest. The results show that the road transport sub sectoral contribution recorded similar quarterly pattern with inflation in 2015 and 2016.

**IV. Summary of Findings**

A comparison between both indicators showed that in the first year under investigation, when inflation was fairly stable, road transportation sub sectoral GDP contribution was fluctuating, while in the second year when road transport productivity was growing at a more stable pace than in the previous year, inflation increased more rapidly. This quarterly analysis is tabulated as follows below.

<table>
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<th>Position</th>
<th>INFLATION</th>
<th>ROAD TP. GDP</th>
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<tr>
<td>1st</td>
<td>Q2</td>
<td>Q4</td>
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<td>4th</td>
<td>Q3</td>
<td>Q1</td>
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**V. Conclusion and Recommendations**

**Conclusion**

Feasible and sustained economic advancement depends on simultaneous effective inflation management and road infrastructure development. On one hand, inflation can be effectively curbed through:

- Designing inflation mitigation policies around the main thematic causes of inflation aligned with the propensity of firm’s ability to raise prices within their different market structure.
- Basing inflation regulation policies on macroeconomic frameworks with an optimum blend of inflation rate and level of economic activity, aimed at widening alternative products and service creation towards economic diversification.
- Undertaking a historical review of the causes of inflation in Nigeria is essential in designing inflation control measures to achieve macroeconomic stability.

On the other hand, road infrastructure can be improved by:

- Designing and implementing inclusive road infrastructure projects with multiplier effect across other development areas.
- Expanding the coverage of road network and the quality of existing roads has potential for increased agricultural output by exponentially integrating rural farms with urban markets.
- Undertaking innovating road construction and maintenance programs.

The inflation effect in some countries has been seen to be positive and accompanied by economic growth, whereas in many other countries it has resulted in economic downturn. The potential to raise prices by firms depends on a number of factors such as their pricing power, demand elasticity, the markets structure and inflation persistence. The demerits of inflation have short and long term negative effects. In the short term it weakens purchasing power while in the long term in devalues savings. In the real world, inflation has been a source for the quest for alternatives, such as the case of alternative inputs, which leads to diversification or expansion of economic activity. Inflation in Nigeria is ascribed to a deficit of input resources especially capital goods which resulted high import dependence from developed countries. The unstable inflation rate in Nigeria can be associated with importation of highly volatile processed crude products, which in turn
spreads inflation through its multiplier effect on economic activity. This infrastructure axiom for countering inflation is premised on the fact that an underdeveloped economic structure results in the contradiction of typical anti-inflationary measures such as contractionary monetary policy prescriptions, which will end up stagnating economic growth. Road transportation also contributes more than 90% of the transportation sector contribution to GDP, while the transportation sector contributes 3% of national GDP.

Inflation mitigation strategies should also be market structure sensitive to induce price variation equilibrium in “certain” markets towards better microeconomic functioning. Effective monetary and fiscal policies are imperative considering the short, medium and long-term macroeconomic effects in mind. The quest for alternatives on microeconomic and macroeconomic fronts as panacea to demand-supply induced inflation should be explored by harnessing science and technology resources at the frontier.

Recommendations for policy makers

✓ In-depth sector-specific inflation research should be conducted as the basis for effective inflation regulation strategies towards achieving more stringent price control in target sectors.
✓ Inflation mitigation strategies should also be market structure sensitive to induce equilibrium pricing specific markets for better microeconomic functioning.
✓ The quest for alternatives on microeconomic and macroeconomic fronts as panacea to demand-supply induced inflation should be pursued by exploiting science and technology at the frontier.
✓ The government must adopt a medium to long-term capital goods investment focus with road development projects.
✓ Transportation and other complementary infrastructure must be devised as mechanisms to restructure the economy for stability.
✓ The return on investment in road transportation should be justified by its GDP contribution and other social benefits.
✓ Sustained government deficits should be discouraged especially in the light of the political process and lobbying activities on government budgets.

VI. REFERENCES