Impact of Transportation and Road Network on Goods Delivery by Food Industries in Nigeria as a Total Factor of Productivity (TFP)

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Abstract: **- This study examines the impact of transportation and road network services on the productivity of food industries in Nigeria. Using Cobb-Douglas results shows that transportation(days to clear customs for imports) increase productivity by 0.01percent and also shipment losses (fraction of sales lost) due to breakage, theft, spoilage or other deficiencies of the transport mean reduces productivity of the food industry with 0.01 percent. The Total Factor Productivity (TFP) was estimated as the residual of the Cobb-Douglas function fitted with and without transportation.**

***Keywords*-Transportation, Productivity, Nigerian food industries**

I. INTRODUCTION

In any physical and economic development of towns and cities all over the world, transportation is very important.

Transportation infrastructure is critical to sustain economic growth as it improves the standard living of people and they see increased income as the way to achieve the goal.Bailey, Mokhtarian and Littlel (2008), said transportation route is part of distinct development pattern or road network which is mostly described by regular street patterns as an indispensable factor of human existence development and civilization.

Mobility studies showed that transportation is absolutely essential to economic productivity and remains competitive in the global economy.

An international study found every 10 percent increase in travel speed; labour market expands 15 percent and productivity by 3 percent (Barrister and Berechinan. 2000). Road network is among the important part of infrastructure in most countries in which most of the goods is transported by road.

Food industry is one of the largest and most complex sectors in the economy of Nigeria; it is a series of interdependent and complementary industries which encompass the functions of growing, processing and distributing products from the manufacturer to ultimate consumer. It is transportation that provides the link between these industries and the functions.

Domestic transportation can be classified in six categories such as railroads, trucks, rivers and canals shipping, pipelines and air. Food and food products use all modes in significant quantities except for pipelines and air, although air freight is indispensable for a limited number of high value, perishable commodities in addition to these modes, food moves by ocean shipping in import and export traffic.

The presence of an adequate, reliable and efficient transport system is a critical factor in local economy development. The role of transportation in the spatial distribution of the economic activity and economic performance has become of increased interest to researchers in the last years. Decreasing transport costs is considered to be a central driver of economic integration and the emergence of agglomeration externalities, but solid empirical evidence on the channels through which these effects operate is still needed.

Also, the poor state of the road network causes delays, breakages and high maintenance cost for transport machinery leading to high costs of doing business. This has also resulted in the concentration of industries in areas with a good road network thus creating disparities in regional industrial development.

The main aim of this study is therefore to

1. Estimate the effect of transportation on the productivity of food industries
2. Estimate the effect of transportation on the Total Factor Productivity (TFP) across the food industries.

II. EMPIRICAL REVIEW OF LITERATURE FOR TRANSPORTATION

Antle(1983) estimated a Cobb-Douglas production function for 47 developing countries and 19 developed countries in which infrastructure was specified as the gross national output from the transportation and communication per square kilometre of land area. In which he found out a strong and positive relationship between the level of infrastructure and aggregate productivity.

Further Easterly and Rebelo(1993) and Baffes and Shah(1993) also found transportation infrastructure was an effective factor of production. Fernald(1999) explored the direction of the

causal links between infrastructure and productivity growth entails greater road construction. Canning & Bennathan (2000) compared the relative impact of infrastructure investment in electricity generation and paved roads in 52 and 41 countries, respectively. These authors find that 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 or high-income countries. Boopen(2006), analysed the contribution of transport capital to growth for a sample of sub-Saharan Africa(SSA) and a sample of small Island developing states(SIDS), using both cross-sectional and panel data analysis. He concluded that transport capital has been a contributor to the economic progress of these countries.

Gibbons and Overman (2009) provide an extensive discussion of the potential productivity and scale effects of transport infrastructure. At the firm level, transport improvements could affect the performance of firms. On the one hand, they may improve the logistics and the internal organisation of the firm and can change the optimal input mix choice. Transportation services are used as production input and, if there are a substitution effect between inventories, labour and transport services, the demand and input mix will be affected (Holl, 2006). Input prices could decrease because of reduced transport costs or increased competition between the suppliers. Wages could also change if productivity effects are capitalised into wages or if wages are set as a function of commuting costs, which are affected by the transport network (Gibbons and Machin, 2006). Therefore, firms might change the demand of inputs and depending on the internal returns to scale, this would affect its final output. If output increases with respect to inputs more than proportionally (due to increasing returns to scale), the output/input ratio will change, but this would be a scale effect and total factor productivity would be unaffected. Furthermore, better accessibility to consumers increases customer base and allows firms to expand production and exploit economies of scale.

III. DATA AND VARIABLES MEASUREMENT

The World Bank's Investment Climate Surveys (ICS) on manufacturing sectors in Nigeria is the primary source of the data used in the study. The survey in this country was done in 2009 and the total number of establishments covered is 3,157 in which 242 is extracted and used for food industries. Firm's size was divided into small, medium and large scales. Small scale firms refer to the category of firms which employed between 5 and 19 permanent workers while for medium firms have the number of employees between 20-99 and large firms have above 100 employees.

We measure our productivity variables like capital using the replacement cost of plant and machinery while output and material inputs are measures using total sales value and total cost of raw materials and intermediate goods used in production respectively. Transportation is measure using shipment losses and days to clear customs for imports.

We do our estimations using panel regression in which city is set as the time-invariant for Random effects and fixed effects. The Total Factor Productivity (TFP) was estimated as the residual of the Cobb-Douglas function fitted.

Production functions for Cobb Douglas:

Log (Yi) = cons + alog (li) +blog (ki) + c(days to clear customs for imports) +shipment losses

Where ($Y_{i,}$): Value added (Total sales less Total Purchased material)

K_i: Capital

L_i: Labour

i: Industries

IV. RESULTS, PRESENTATION AND ANALYSIS

This section presents and discusses the result of responses to the survey Estimation of Transportation on the Productivity of Food Industries

A Cobb- Douglas function has been estimated for the industry, the advantages of the model is that the coefficient of labour and capital are expressed in a logarithmic form which can be treated as the variable's direct elasticity. The coefficients of capital and labour are about 0.03 and 0.04 are strongly statistically significant at 1% level of significance. This implies that food industries in Nigeria are labour intensive, in which there is need to improve on capital technologies. The results confirm that transportation is critical to development of food industries in Nigeria in which the variable is insignificant in the model. This might be a good reason for relatively low performance of food industry. According to Ajagbe et.al, (2015), said most of the infrastructure facilities especially transportation and power outages need to be given adequate attention in order to address problems of poor returns and high production costs in food industries.

Table 1: Estimates of Cobb Douglas for Food Industries

Variable	OLS	FE
Log capital inputs	0.1814268*** (0.028)	0.16395909*** (0.029)
Log labour inputs	0.9151939*** (0.042)	0.94082912*** (0.048)
Days to clear customs to import	0.0017588 (0.003)	0.00367317 (0.003)
Shipment losses	0.0033704 (0.05)	-0.00178704 (0.05)
Constant	-0.2684 (0.628)	-0.53648965 (0.7150)

Absolute values of standard errors in parenthesis**Significant at 5% level; *** significant at 1% level; * significant at 10% level

Effect of Transportation on Total Factor Productivity (TFP) for Cobb Douglas on Food Industries

Table 2 and 3 show the TFP with transportation and without transportation, according to city and size of the firms.

According to city observation shows that transportation help food industries in Lafia cities to perform better for TFP with transportation and without transportation with the differences of 1.00 and lacked behind in several cities like Akure and Gombe.

It really shows transportation has contributed to the productivity of food industries in Lafia cities.

At size level, transportation helps food industries to perform better at large firms and reduce the productivity of medium and small firms.

Table 2: TFP by city for food industries with and without Transportation

City	TFP With Transportation	TFP Without Transportation	Differences
Abakaliki	2.19	1.99	0.20
Ado-ekiti	1.46	1.00	0.46
Akure	1.12	0.90	0.22
Dutse	1.59	0.08	1.51
Gombe	1.53	0.60	0.93
Lafia	4.25	3.25	1.00
Yanogoa	2.55	2.00	0.55

Source: Field Survey, 2019

Table 3: TFP by size for food industries with and without Transportation

Size	TFP with Transportation	TFP without Transportation	Difference
Large	2.11	1.98	0.13
Medium	1.74	0.99	0.75
Small	1.88	1.25	0.63

Source: Field Survey, 2019

V. CONCLUSION

From the analysis in this paper, we can see that road transportation truly acted as a catalyst/engine in the productivity, in which it also served as a lifeline in delivery of goods to the consumers. The results also showed that transportation as an impact on the total factor productivity of food industries at lafia city and majorly on the large firms of the food industries in Nigeria. Improving road network can potentially have a large impact on the competitiveness of the Firms.

REFERENCES

[1]. Bailey, L., Mokhtarian, P. L., & Little, A. (2008). The Broader Connection between Public Transportation, Energy Conservation and Greenhouse Gas Reduction. Report prepared as part of TCRP Project J-11/ Task 3 Transit Cooperative Research Program, Transportation Research Board submitted to American Public Transportation 95 Association. http://www.apta.com/research/info/online/land use.cfm#i, accessed 17 April 2011.

[2]. Barrister & Berechinan, (2001). Transport investment and the promotion of economic growth. Journal of Transport Geography: 209 -218

[3]. Antle, J.M.,(1983). Infrastructure and Aggregate Agricultural productivity International Evidence, Economic Development and Cultural Change 31(2):609 - 620

[4]. Easterly, W., & Rebelo, S. (1993). Fiscal Policy and economic growth an empirical investigation. Journal of Monetary Economics 32(3) December: 417 – 458

[5]. Baffes, J., & A. Shah, (1993). Productivity of public spending, sectoral allocation choices and economic growth. Policy Research working paper series, No 1178, Washington D.C : The World bank

[6]. Fernald, J. (1999). Roads to prosperity? 'Assessing the link between public capital and productivity. *American Economic Review*, 89 (3), 619-638

[7]. Canning, D. & Bennathan E. (2000). The social rate of Return to infrastructure investment. Policy Research Working Paper No 2390. Washington, DC: The World Bank.

[8]. Boopen, S., (2006). Transport infrastructure and Economic growth: Evidence from Africa using Dynamic panel Estimates. The Empirical Economic Letters, 5(1): ISSN 1681 8997

[9]. Gibbons, S. and Overman, H. G., (2009). "Productivity in transport evaluation studies", Report for Department of Transport, London.

[10]. Holl, A. (2006). "A review of the firm-level role of transport infrastructure with implications for transport project evaluation", Journal of Planning Literature 21 (1): 3-14. Kano –Nigeria.

[11]. Gibbons, S. and Machin, S, (2006). "Transport and Labour Market Linkages: Empirical evidence, implications for policy and scope for further research". Background paper for the Eddington report to the Department of Transport

[12]. Ajagbe, F.A. &Ajetomobi, J.O. (2015). Impact of Investment Climate on Total Factor Productivity of Food Industries in Nigeria AERC Research Paper