EVALUATING THE EFFECT OF ROAD INFRASTRUCTURE ON HOUSEHOLD INCOME IN OGONI COMMUNITY, RIVER STATE, NIGERIA

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Abstract
Rural poverty reduction could be enhanced through investment in road infrastructure. The aim of this study, therefore, is to examine rural household earning return to road infrastructure using Ogoni community in Rivers State, Nigeria, as a case study. Using a structured questionnaire and an interview guide to collect data from 400 households, the findings show that Ogoni community had suffered from inadequate access road. Majority (about 56. 6%) of the households indicated that access road in the community is low. However, the study confirms that household earning return to improvement in road infrastructure in Ogoni community is positive and significant ($p<0.01$). The result shows a marginal effect of 0.303 unit increase in the log-odds of being in a higher category of household income given an increase in the categories of good access road. Therefore, to reduce poverty in the community, there is need for more government, cooperate organizations and people-centered efforts towards the provision of more access road in the community.

Keywords: Road, Income, Household, Agriculture, Logistic, Ogoni land
JEL classification: C00, C21, C25, C83

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I. Introduction

Economic development is not only the result of a proper combination of private production factors but also infrastructure in general. Infrastructure has long been recognized as a necessity for economic growth and development. Infrastructural amenities refer to those basic services and facilities required for primary, secondary and tertiary productive activities (Obayelu, Olanrewaju & Oyelami, 2014). It provides essential social services and acts as an input to private sector production of goods and services and augments capital and labour and reduces the overall cost of production due to reduced overhead cost. Idachaba (1985) divided rural facilities in Nigeria into three main groups namely, social (health, education, utilities), physical (transportation, storage, processing, water resources), and institutional (cooperative societies, financial institutions, agricultural research and training and product marketing) infrastructures. Keen attention given to studies on social and institutional infrastructures seems to have crowded out interest and investment on physical infrastructure especially in Nigeria.

As a result, literature on the economic effects of road infrastructure on rural household income in Nigeria seems to be scarce. Yet, such research output is needed to facilitate policy formulation and strategic planning. Consequently, this paper aims at contributing to this gap in literature by evaluating the effect of road infrastructure on household income in rural communities in Nigeria using Ogoni Community as a case study. The hypothesis of the study, therefore, is that road infrastructure has no effect on household income in Ogoni Community.

II. Literature Review

Several studies have examined the socio-economic benefits of infrastructure (Calderon & Serven, 2010; Ajakaiye & Ncube, 2010).Socio-economic benefits of investment in infrastructure include improvement on the quality of life, provision of intermediate inputs to production, promotion of rural employment, improvement of linkages between rural and urban areas which enhances productivity, expends market opportunities which plays critical roles in poverty reduction, economic growth and employment creation for the rural poor (Aina, 2006; Ojeifo, Ojeifo& Aidelunuoghene, 2012; Weiss, Forsythe, Coate&Pease,2013).Rural infrastructure remains a key development vector in Nigeria, particularly roads because it increases market access for subsistence farmers. Investment on rural road construction has been associated to the enhancement of intra-regional trade and economic development (Buys & Wheeler, 2010;UNCTAD, 2013).

Poverty is a major challenge facing rural households in Nigeria. A household could be considered as poor if it does not have enough income (in cash or kind) to cater for the basic needs of its members. According to the Nigerian *National* Bureau of Statistics, there is a clear disparity between urban poverty and rural poverty rates in Nigeria. For instance, in 2010, when the percentage of poor was 36.2 in the urban area, it was 53.5% in the rural areas(NBS, 2010).One of the critical factors that contributed to the high level of rural poverty in Nigeria is

the inadequate and unequal distribution of infrastructural facilities. This is mainly because considerable emphasis is placed on the development of urban road infrastructure either directly or indirectly to the almost neglect of the rural areas (Omofonmwan, 2004).The effects of road infrastructure on the rural dwellers cannot be overemphasized. Road is still the major means of transportation of agricultural produce in Nigeria and on the average, transport accounts for more than 30% of the value of the delivered product. This relative high cost is attributable to the inadequacy and inefficiency in Nigeria's transport infrastructure (Oni& Okanlawon, 2006).

Poor road confines the rural dwellers to agriculture as their main source of sustenance, and limits their opportunities of processing agricultural produce. In other words, poor road infrastructure reduces the chances of livelihood diversification for rural dwellers. Research has shown that infrastructures accelerate economic growth and development which enhance national and household income (Calderon & Serven, 2004; Ndulu, 2006;Oni & Okanlawon, 2006; and Egbetokun, 2009). This paper, therefore, is a further study to ascertain if investment in rural infrastructural development, such as road construction in rural areas, enhances rural household income.

III. Methodology

a. Study area and sample size

This study involved a cross-sectional survey with 400 systematically sampled households Ogoni community in the Niger Delta region of Nigeria. The Ogoni community is situated on approximately 400 square miles or 1,000 square kilometers of land east and southeast of Port Harcourt in Rivers State, Nigeria. There are four local government areas (LGAs) in the Ogoni community: – Eleme, Gokana, Khana and Tai.Oil was first discovered in Ogoniland at Bomu in 1958. However, Ogoni indigenes have remained predominately farmers (Ojide, 2015). UNEP (2011) report on Ogoni community indicates that unemployment rate (% of working age adults) in the community in 2009 was 27.9%, poverty incidence (% total population) in 2004 was 29.09%, and access to safe sanitation (% total population with access to) was only 19.7%. The same report was indicates that access to health care (% total population with access to) was 42.3%, and access to electricity and running water (clean drinking water) was less than 50%, and only 18% were traders. A study conducted in Rivers State in Nigeria shows that most communities in the State including Ogoni had suffered high level of environmental degradation (Baumuller et al., 2011).

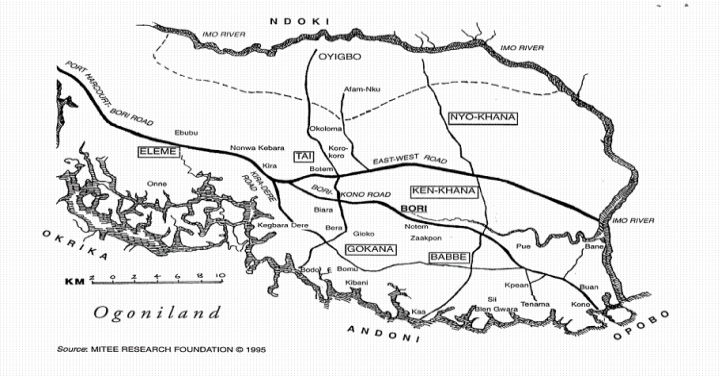

Figure 1: Map of Ogoni community

Using 2010 population estimate, Eleme, Gokana, Khana and Tia local government areas in Ogoni community had 45397, 54422, 69973, and 28015 households respectively (NBS, 2006; World Bank, 2010; Ojide et al., 2015). Sample size formula (equation 1) specified by Yamane (1967) was applied to obtain a sample size of 400 households.

$$s = \frac{N}{1 + N(e^2)} \text{.....} 1$$

s = required sample size.

N = the population size.

e = the degree of accuracy expressed as a proportion (.05).

The sample size was distributed in ratio to the number of households in each local government area in the community. As a result, 92, 110, 141, and 57 households were randomly selected from Eleme, Gokana, Khana and Tai respectively using household listing of Nigerian population commission (NPC) as sample frame. To provide for any unavailable selected household, extra 20% of the sample size was randomly selected prior to the survey.

b. Analytical framework

The analytical framework used in this study, as adapted from Ali and Pernia (2003), is graphically represented in figure 2. This framework depicts that the main factors affecting household income are agricultural productivity, non-agricultural productivity and non-agricultural employment. These factors are directly or indirectly influenced by the state of road infrastructure. Government and corporate organizations consider road infrastructural development as a major area of investment. For instance, Ojide (2015) asserts that government and oil companies' interventions in Ogoniland had significant and positive effect on availability of access roads in the community.Intervention in road infrastructure could lead to an increase in agricultural productivity, non-agricultural employment and non-agricultural productivity. Consequently, it can directly raise wages and employment opportunities for household members and, hence, their real income or consumption. This could be described as the direct income distribution effect of investment in road infrastructure. On the other hand, increase in employment and productivity (agriculture and non-agriculture) could lead to economic growth,

affecting the supply and prices of basic goods and, hence, household real income or consumption. This could be described as the indirect road investment effect on household income. On the whole, the area of influence and the direct channel form the transition mechanism between road infrastructure and household income as depicted in Figure 2.

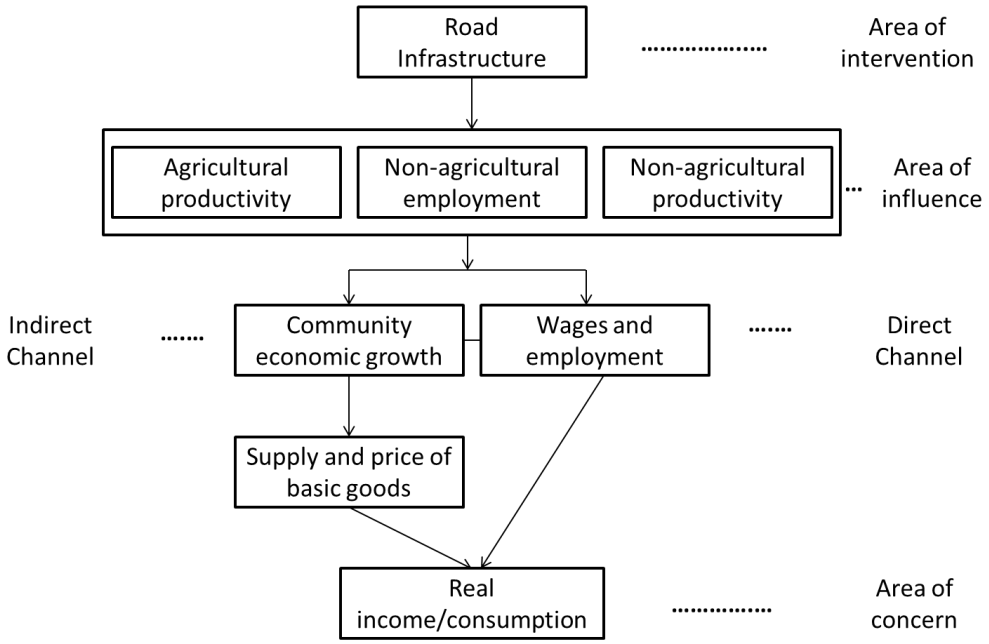

Figure 2. Simple analytical framework depicting the links between road infrastructure and income.
Source: Adapted from Ali and Pernia (2003).

a. Analytical model

In this study, household income, which is the endogenous variable, was obtained in an ordered categories where income ₦18000 and below was represented by 1, ₦18100 to ₦50000 was represented by 2, in that order as shown in Table 1. Given the nature of this endogenous variable, ordered logistic model was adopted to evaluate household earning returns to road infrastructure in Ogonicommunity. According to Kleinbaum (1994), logistic regression imposes threshold and interaction effects and allows for the evaluation of interactions among socio-economic factors. Following McCullagh (1980) and Brenton (2010), the cumulative ordered logistic distribution function for factors affecting household income was specified as:

1

where y* is an unobserved underlying tendency behind the observed ordinal response (rating). The $X_k$denote the exogenous variables, while the $\beta_k$denote the associated parameters. The stochastic variable (ε_k) captures the unobserved variation in the model. Relating the unobserved y* to Y through a series of "cut points", is as shown in equation 2:

$$\left.\begin{array}{l} Y = 1 \text{ if } \ y^* \leq \mu_1 \\ Y = 2 \text{ if } \ \mu_1 < y^* \leq \mu_2 \\ \cdots \\ Y = \text{j if } \ \mu_{j-1} < y^* \end{array}\right\} \ldots\ldots 2$$

where Y is the rating and the μ's represent thresholds of y* that define the groupings of the ordered response variable. These threshold parameters are constrained to be positive where each one is greater than the preceding (Borooah, 2001; Ojide & Ikpeze, 2015). Thus, equation 3 was

$$income = f(road, electricity, HHheadgender, Hhsize, ET, Hhagric, socialcap) \quad \ldots\ldots\ldots\ldots\ldots 3$$

estimated using the ordered logit model specified in equation1.

b. Variable description

The variables used in the study are presented and described in Table 1. As indicated, most of the variables are ordered categorical (quantitative) variables apart from gender of household head and households involved in agriculture which are dummy variables, and household size which is numeric.

Table 1. Variable definition.

Variable	**Definition**	**Expected sign**
Income	Household income (18000 & Below=1, 18100 - 50000=2, 50100 - 100000=3, 100100 – 250000=4, > 250,000=5)	Endogenous variable
Road	Availability of accessible roads (very low=1, low=2, average=3, high=4, very high=5)	Positive
Socialcap	Household social capital measured by level of trust (very low=1, low=2, average=3, high=4, very high=5)	Positive
Electricity	Electricity supply (very low=1, low=2, average=3, high=4, very high=5)	Positive
ET	Education attainment of household head (no formal edu.=0, FSLC=1,SSCE=2,OND=3, B.Sc & above=4)	Positive
HHhead_gender	Gender of the household head (male=1, female=0)	Positive
Hhagric	Household involved in agricultural production (Involved=1, Not involved=0)	Positive
Hhsize	Total number of the members of the household	Positive

IV. Result and Discussion

a. Socio-economic characteristics of the households

The descriptive statistics of the socio-economic characteristics of the households examined in this study are presented in Table 2. The result reveals that the respondents have a mean household size of 6 with a standard deviation of 2. This agrees with the average rural household size of 6 estimated by *National* Bureau of Statistics (NBS, 2010). Majority (69.50%) of the household heads are male. Also, majority (86%) of the household heads have at least secondary education, only 3.67% do not have formal education. Greater proportion of households (75.63%) in Ogoniland is involved in agriculture.Income distribution among the examined households shows that greater percentage (65.58%) of them have average monthly income of 50000 naira and below. Only 17.34% of the households have average monthly income above 100000 naira. Majority (88.85%) of the households indicated that their social capital was at least average; only 1.78% indicated very high social capital.

The respondents were asked to rank the availability of access road and electricity infrastructure in the community. The percentage of households that indicated that access road in the community is either very low or low is 56.56%; while 16.96% indicated that availability of accessible roads in the community is either high or very high; the rest ranked it average. The distribution ofhouseholds' perception in Ogoniland on road infrastructure in the community is further represented in figure 3. Thus, it can be inferred that the general perception of households of Ogoni community on road infrastructure in their community is skewed towards insufficient access road.

Similarly, the percentage of households indicated that electricity supply in the community is either very low or low is 47.42; while 26.55% indicated that electricity supply in the community is either high or very high; the rest ranked it average.

Table 2. Descriptive results.

Household income				**Socialcapital**		
Code	**Freq.**	**Percent**		**Code**	Freq.	Percent
1	161	40.45		1	79	20.10
2	100	25.13		2	97	24.68
3	68	17.09		3	185	47.07
4	35	8.79		4	25	6.36
5	34	8.55		5	7	1.78
Total	*398*	*100*		*Total*	*393*	*100*

Access road		
1	106	27.25
2	114	29.31
3	103	26.48
4	53	13.62
5	13	3.34
Total	*389*	*100*

Education Attainment		
0	15	3.76
1	41	10.28
2	105	26.32
3	91	22.81
4	147	36.84
Total	*399*	*100*

Electricity supply		
1	84	21.65
2	100	25.77
3	101	26.03
4	55	14.18
5	48	12.37
Total	*388*	*100*

Gender of Household head		
0	122	30.50
1	278	69.50
Total	*400*	*100*

Household involved inagriculture		
0	301	75.63
1	97	24.37
Total	*398*	*100*

Household size

Obs.	Mean	Std. Dev.	Min.	Max.
400	6	2	1	16

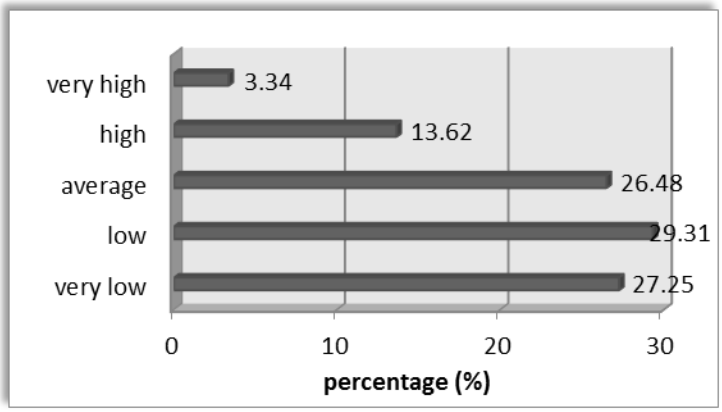

Figure 3. Availability of accessible roads.

a. Ordinary Logit Model Result

The parameter estimates of the ordered logit model used in the analysis are presented in Table 3. The result agrees with previous studies (Oraboune, 2008; and Gunjo, 2015) that investment in road infrastructure had positive and significant effect on household income in Ogoniland. In terms of the magnitudes of the estimated coefficient, the result shows that a unit increase in the categories of access road, as defined in this study, will result in about 0.303 unit increase in the log-odds of being in a higher category of household income (see Table 1) while keeping other variables fixed. As a result, the null hypothesis that road infrastructure has no effect on household income in Ogoni Communitywas rejected with the conclusion that the effect of road infrastructureon household incomein the community is positive and significant. As expected, other exogenous variables (electricity supply, gender of household head, household size, education attainment of household head, and household in agriculture) included in the model also had positive and significant effect on household income in Ogoniland apart from social capital which had negative but significant effect on household income in Ogoniland.No matter the state of road infrastructure in the community,social capital was expected to enhance mobility, access to market and other economic opportunities. However, this result rather indicates that increase in social capital reduces chances of households in the community being in a higher category of income. It could, therefore, be inferred that households in Ogoniland with higher social capital tend to strive less for cash income.

Table 3. Ordered logistic regression ofhousehold income.

Independent variable	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
Access Road	0.303**	0.113	2.67	0.008	0.081	0.525
Electricity	0.271**	0.099	2.72	0.007	0.076	0.467
Gender of Household head	0.491*	0.219	2.25	0.025	0.063	0.920
Household size	0.126**	0.041	3.07	0.002	0.046	0.207
Education attainment of household head	0.444**	0.089	4.98	0.000	0.269	0.618
Household in Agriculture	0.813**	0.218	3.74	0.000	0.387	1.240
Social capital	-0.375**	0.110	-3.41	0.001	-0.591	-0.159
/cut1	3.313	0.578			2.181	4.445
/cut2	4.516	0.597			3.346	5.687
/cut3	5.617	0.620			4.401	6.832
/cut4	6.594	0.650			5.321	7.868
Number of obs					= 380	
LR chi2(7)					= 119.47	
Prob > chi2					= 0.0000	
Pseudo R2					= 0.1097	
Log likelihood					= -484.79	

*Note: *variable significant at 5%, **variables significant at 1%*

III. Conclusion

Improving access road in Niger Delta region of Nigeria has been an area of huge investment for both government and oil companies operating within the region (Ojide et al, 2015). However, whether or not this investment translates to increase in household income in Ogoni community by stimulating agricultural productivity, non-agricultural productivity and non-agricultural employment in the community was the motivation for this study. The results of the study revealed that, relatively, majority (56.56%) of households in Ogoniland indicated that access road in the community is low is 56.56%. Seventeen percent of them indicated that availability of access roads in the community is high,while the rest ranked it average. Furthermore, this paper concludes that household earning return to road infrastructure in Ogoni community is positive and significant – streaming from direct and indirect channels. Therefore, investment towards improving road infrastructure in Ogoni community could be a key supplementary strategy towards poverty reduction in the community, and probably, in other rural communities in developing countries.

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