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Route Choice Behaviour in the Northeast Geopolitical Zone Of Nigeria: A Relative Risk Ratio Analysis

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Abstract: *Efficient road conditions are necessary for growth of commerce. However, lack of agency/facility for risk management or risks transfers creates chaos and unaccounted lost. It increases the risks for the exposed group and the performance of the economy over time. The objective of this study is to assess relative risks perception in northeast geopolitical zone of Nigeria. High probability or prevalence of risk, large segments of bad roads and travel risk/hazard due to growing conflicts in the region has affected the economy of Northeast region. A result of relative risk ratio estimates shows increasing risk associated with variables estimated (Network roads and terrain). Increasing terrain conditions has changed travel time and increased arm robbery and religious crisis in all locations. We recommend policies that improve transportation – especially road conditions in the area and a program to end prolong crisis in the region resulting from spill over of large inflow of immigrants. Government policies should importantly end the menace of increasingly porous borders and high flow of immigrants.*

Keywords: *Travel risk, relative risk, road choice, exposed population.*

1. INTRODUCTION

The need for transport services is derived from individuals desire to access various socioeconomic activities. In developing countries like Nigeria, this is important due to fact that most households live on the poverty line. Thus, the 'struggle' for income generating venture is 'fierce,' sometimes risks are relative to the probability of success. The number of opportunities accessible in different locations depended on myriad factors, and in most circumstances, it is assessing the ratio of probabilities of a number of risks or relative risk perceptions of these areas.

Travel decisions are often made without complete information, and this has been the focused of the many-sided issues of prospect theories. Prospect theory is a behavioural theory that describes the way people choose between probabilistic alternatives that involves risk, where the probabilities of outcomes are known. The main thrust of the theory is that people make decisions based on the potential value of losses and gains rather than the outcome.

The number of travel hazards influence individual's travel behaviour, and the prevalence of risks are highly likely in an environment where travel locations have high number of events that defined such risks or hazards - even though issues of risk and uncertainty are critical factors in a wide variety of choice contexts (De Palma et al., 2008). The inhibitions in choice of travel routes and or mode in Nigeria are established in three folds in this study – conditions of roads, travel risks associated with locations and travel locations defined in terms of high cost of transport. Condition of roads defines the state of roads in a particular location. In the northeast geopolitical zone, roads are ranked as poor especially in rural Nigeria. A survey undertaken by an independent body lead by Ibukun Edu, 2013[2], from May 7 to May 9, with 1,002 randomly picked Nigerians of legal age (≥ 18), across the six geopolitical zones, shows that 71 percent of Nigerians believe that our roads are unsafe. In terms of risks, the problems of religious crisis in the North (the Boko Haram sect, communal conflicts, etc.) is prevalent in some locations, along some routes, and in terms of high cost of transport, the two points already highlighted are the causes of high-transport rates in Nigeria.

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[2] Ibukun Edu (2013) – Http:// telegraphing.com

The objective of this study is assessing the relative risks perception in northeast geopolitical zone of Nigeria and simple ratio probabilities of various risk factors.

Other aspects of this study are structured as follows: section 2 literature reviews, section 3 is the data and methodology of this study, section 4 is the results and discussions, and section 5 is conclusions and policy recommendations.

2. LITERATURE

2.1. Individual Choice under Risk and Uncertainty

The Prospect theory (Kahneman & Tversky, 1979) provides a springboard for theoretical basis to understanding people's perception and their behavior in risk assessments. Prospect theory is a behavioral economic theory that describes the way people chose between probabilistic alternatives that involve risk. Thus, decisions are made without definite knowledge of outcomes.

In contemporary road choice in Nigeria, commuters may have a preconceived conclusion of roads. Road conditions are examined in these perspectives: its effects travel time and the associated risks resulting from vehicle conditions, crisis in areas (as it prevails in the Northeast of Nigeria), risks associated with public transport in Nigeria and generally, advantages of private cars over public transport preferences (Turcotte, 2006). However, uncertainties may exist due to two main conditions: (i). travel time consideration and (ii). Travel risks on roads. For travel time requirements, it is due mainly to increased bad segments on roads that require longer travel time. Travel risks create higher probabilities for occurrence of perceive hazards in some areas in Northeast regions roads. Such risks exist and higher uncertainty due to arm robbery attack and the fear of religious sect (Boko Haram) which has become a 'demon' of terror on specific locations in the region (Northeast region).

Augments around the prospect theory are based on issues presented in the awards winning works of Kahneman and Tversky; that 'decisions are probabilistic.' The seminal paper in behavioural economics is a pointer to the fact that for a choice under risk, the probability distribution of the potential outcomes is known, and when such decisions are done under uncertainty (or ambiguity), is unknown to the decision maker. Fields of applications are numerous and include accident and prevention (de Palma et al., 2008). An aspect that defines both certainties and uncertainties on Nigerian road abound. The highly likelihood of occurrence is mainly a familiar terrain on roads transport around Nigeria. However, uncertainties exist for transport routes in border town locations around the northeast region due to increased immigrants from Cameroon, Niger, Chad and entry and exit points on these border roads around the Northeast geopolitical zone of Nigeria. It is thought to harbour 'runaway' soldiers from Mali and Libya to Nigeria. Thus, degree of uncertainties exists in areas around Maiduguri, Yola, Gombe and parts of Bauchi (see figure 2.1) up to far north, Kano and Sokoto and other locations.

3. DATA AND METHODOLOGY OF STUDY

There are 612 respondents for this study all located within two states of the Northeast geopolitical zone (Adamawa and Gombe states); the spread however is in terms of the road locations that extend to Borno states from both Adamawa axis (from Numan-Biu roads and Guyuk – Bayo-Yamultu Deba to Dadinkowa – Gombe roads). From Gombe axis through Numan-Billiri-Gombe highway.

The main thrust of this study is to examine some roads defined as state (B), Local roads (C) and highways (A). ABC defines trunk road classification in Nigeria.

The outlook of roads in the location is classified according responses computed in table 1.1

Table 1.1. *Questionnaire: Daily transport routes (TC_2) (What type of road do you use most times in daily transport?)*

Trunk A, B.C	Frequency	Percent	Cumulative Percent
Highways	67	10.9	10.9
state roads	181	29.6	40.5
local government roads	148	24.2	64.7
both highways and local roads	216	35.3	100
Total	612	100.0	

Source: Survey, 2013

From Table 1.1 we observe the proportion (in percentage) of highway users, state roads and local government roads. The percentage are the state roads users (29.6) – meaning that for both civil servants, for various business activities in for individuals that use state roads for various reasons. It may not be what commuters prefer but state roads may be the only options available to multiple users. The use of state roads in northeast encourages residential mobility and the daily risks, ss a result, of crisis prevalence in the region.

3.1. Methodology of Study

The study applied Relative Risk Ratio (RRR) technique. It is a simple ratio of probabilities. We modeled a simple ratio basis for studying the risk ratio thus:

$$\text{RR}=\frac{The\ prevelence\ of\ commuters\ that\ use\ roads\ in\ a\ location\ (exposed\ population)}{The\ prevelence\ of\ communters\ of\ non-users\ of\ roads\ in\ a\ location\ (unexposed\ population)}$$

The prevalence of commuters that use state roads = $\frac{state\ roads\ users}{non-state\ users}$

$= \frac{29.6}{40.5}$ exposed group = 0.73%

$= \frac{24.2}{64.7}$ unexposed group = 0.37%

Meaning that 73 percent of those that use state roads are exposed to risks relative to the 37 percent non-users, the population of rural people. From the experience of various Boko Haram bombings in cities, including Abuja, most state roads (semi- urban dwellers) had higher casualties than rural people. The main drive for using the relative risk is based on the fact that we are examining the relative for the groups. We take the corresponding ratio = $\frac{0.37}{0.73}$ = 0.501 ≈ 51%, meaning that state road users are exposed up to 51 percent of risks than local road users. The argument is that risk associated with exposure. The relative risk ratio would be the probability of the outcome of the commuters within the location that must use these roads for their daily travel needs, in relation to those that are not along roads in the place that use such roads for official purposes and or other commuters. Risk ratio is a ratio of proportion, and the ratio of the probability of choosing one-outcome category over the probability of choosing the baseline category is often referred to as relative risk (Bruin, 2006).

It is meaningful to notice that prevalence, incidences of risk and hazards exist in the location because these would be the basis for comparing the exposed population and the unexposed population overtime.

To determine the probabilities of chosen option, a route or an alternative *j* rather than alternative 1 can be shown by $\frac{\Pr(y_i=j)}{\Pr(y_i=1)} = \exp(\times'_i, \boldsymbol{\beta_j})$[3], the base for determining the proportionate change is $e^{\beta_{jr}}$, it would the bases for examining the relative risk of choosing alternative *j* rather than alternative 1 when $\times_{ir}$ changes by one unit. Estimated relative risk was calculated using Zhang and Yu (1998) based on the initial definition: Po = prevalence of unexposed population and P_1 = exposed population to hazard, even though it was used in actual disease incidence.

There are several studies that applied the relative risk ratio in employment studies and other socioeconomic cases for instance in the following studies by, Bassuk, Glass, & Berkman, 1999; Robinson, 1989; Jianakoplos & Bermasek, 1998; Manning, Smock, & Majumdar, 2004. Sönmez, & Graefe, 1998; Wells, Mullin, Norton, Langley, Connor, Jackson, & Lay-Yee, 2004 and several related studies. However, the computation of the relative risk ratio will be achieved using stata (version11.2). Estimates would be used to evaluate the safety preference of commuter's choice. The map (figure 1.1) shows some road locations that can be used for locations purpose. It could the bases for determining road hazards. For instance a route from Numan to Biu, Maiduguri, and Gombe to Misau to Potiskum is another route that habours some criminals thought to come from Niger, Libya and neighboring

[3] Note that Pr = Probability, j= alternatives available in the choice set, β=vector of unknown coefficients to be estimated

countries. According to Harvard [4] travel risk rating, the area around the Northeastern Nigeria is classified as having high risks for travelers, including Nigerians.

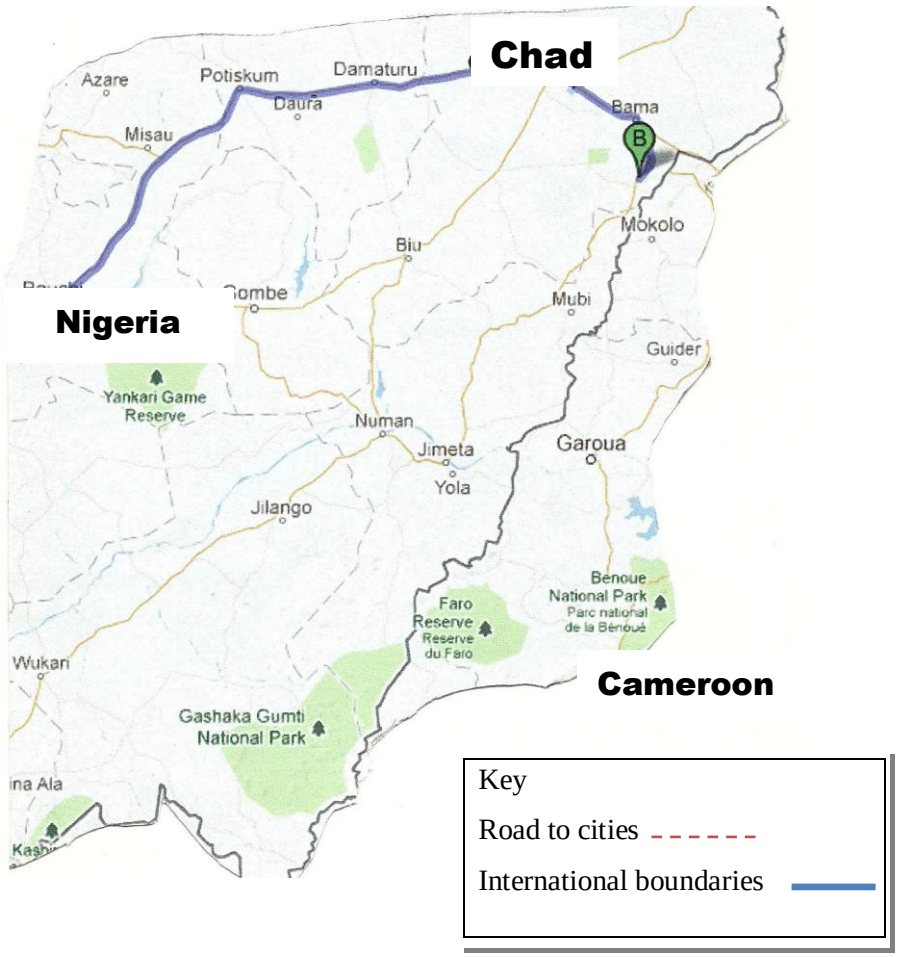

Figure 1.1. *Road locations in Northeast Geopolitical Zone of Nigeria*

Source: Google Maps, 2013

4. RESULTS AND DISCUSSIONS

The results are computed using stata software, a step after computing the multinomial logit (mlogit). The relative risk ratio is then computed using stata command *Mlogit*, *RR*. The output (result) is shown on table 2.1

4.1. Road Conditions and Risk of Travel

Roads are the foundations on which economic activity takes place, and especially for the bulk of small businesses (Rioja, 2001). In rural Nigeria, mainly ago-allied businesses accounted for 60% of the population; roads are essential for their daily subsistence. From the estimates of table 2.1, the basis for explaining the proportion of risks would be based on the significance of each predictor estimated which also indicates the likelihood that a risk measure occurred by chance. The confidence level is at 95%, lower and upper limits as shown on Table 2.1. Our rule of thumb is: if the p value is $\geq .05$, we conclude that there is a statistically significant difference between the level of risk for people who were exposed to risks for choosing a particular road and those who don't use such roads. Terrain describes the geography of transport, and determine the level of activity perform

[4]**H**arvard global services: Travel risk rating high and elevated countries, **(ww.globalsupport.Harvad.edu/ international_health_services/travel.....)**

for which decisions are made. Location choice defines the port of entry, the initial place to locate transport to ones destination. Network roads represent the ability to access all roads from a given location. It is important because lack of access to some roads may influence cost of ransport

Table 2.1. *Relative Risk Ratio (rrr) for route choice in the Northeast geopolitical zone of Nigeria**

Variable	Coefficient (RRR) (Relative Risk Ratio)	Std. Err.	p-value	95 % Confidence Interval (C.I)	
Location choice	.808	.107	0.108	.621	1.053
Network roads	**.569*** **	**.155**	**0.038**	.333	.972
Terrain roads	**.660*** **	**.087**	**0.003**	500	.871
Transport price	1.063	.059	0.269	953	1.186

Source: Survey (questionnaire distribution locations) (Adamawa, Gombe and parts (Biu) of Borno states)

Base Category: Highways.

**Northeast geopolitical region is made of six states. This study surveyed locations in three states (Adamawa, Gombe and Borno states).*

**Roads include all the trunk roads (ABC).*

**p<0.1, ** p<0.05, *** p<0.001*

**Standard error in parentheses*

From Table 2.1 network and terrain lays within the cut off levels of $\geq$ 0.05, for Network roads (0569) and Terrain (0.660). For location choice and Transport price, which lay outside our cut off points, doesn't mean that these are not determinants of risk but the arguments for transport rate is fact for accepting the saying 'security first' not cost of transport. Commuters in the Northeast region value security much more than the payments of cost of transportation and or the initial place for locating types of modes. That is why there are price differential in transport cost if we consider the value of miles travel (VMT) = Price multiplied by kilometres travelled. The main determinant in Africa is the existence of a distorted transport market with several providers, (Teravaninthorn & Raballand, 2009), stock of vehicles is low compared to the population.

From Table 2.1, Network roads, (the ability to access all roads), the estimates of relative risk ratio is 0.569. In the heat of the Boko Haram in 2009, road blocks on most states roads and the porous borders encouraged access to all roads by the insurgents through bush paths to all areas, especially in the northeast. Thus, an increase in network of roads increased the spread of the sect, coupled with the state of emergency in the region, and the ability to spread even to locations (with heavy machinery/armoury) in Abuja and other cities.

Terrain 0.660, is significant in determining the relative risk that an increase in terrain (wash our roads, erosions on the roads, collapse bridges due to heavy rainfall, hot climatic conditions from the Sahara desert) increase travel time and the danger of using some roads. The level of improvement in conditions of road dictates the level of risks, thus relative risk trunk B (state roads) to a (highways) increases the risk by 0.660-ceteris paribus. Other ways of explaining this: the higher the probability for choosing state roads increases the relative risk by 0.660. The conditions may be the same on both roads, but we are measuring the relative safety of roads. Lack of periodic maintenance (Figure 2.1)coupled with other factors of budget constraints, corruption prevalence (Oyewobi et al., 2011) of agencies in construction of roads, increased the risk on road which defines travel time also affects profit levels of small medium enterprises (SMEs) in the region.

Figure 2.1. *Unmaintained highway in the North–East region (Numan-Biu- Maiduguri road)*

Photo: Suleiman, 2013

5. CONCLUSION AND RECOMMENDATION

Roads conditions in Northeastern geopolitical zone have high accessibility constraints in terms of ease in travel to different locations, in addition to areas that are crisis prone. Our conclusions is based on two significant estimates of Network roads, high connectivity and terrain, high deterioration of roads due to the geography of the location that describes risks of travel due to longer travel times. Note that high connectivity means that law enforcement officers are able to police trouble sports. The effect of difficult terrain and increased dangers of travel has eroded the gains of high connectivity because most of the locations experienced security alerts. The region has the highest percentage of unpaved roads (Alaba Adetola, 2011) (see Figure 2.1). This has made travel conditions both hazardous and effecting economic conditions of the region. Travel constraints exist. As a result: (i) High segments of bad roads, (ii) high influx of immigrants that had increased the population of the place in search of various economic activities around the Chad Basin and other economic points in border towns (Metz, 2007), (iii). High-crisis ridden location in Nigeria; resulting from conflict spillovers in the sub-Saharan region. These crises are facilitated by immigrants from Libyan conflicts, Chadian rebels, Mali dissidents and the current terror by Boko Haram.

This study is important because the concept of transport modes and routes are derived from the demand to access an economic activity. The economy of the region is experiencing downward trend as results of the road conditions, high-crime rate facilitated by current crisis in the region (Boko Haram for instance) and related issues. The travel behaviour of individuals has concepts of high risk prevalence such that choices are defined with relative risks. However, risks on some of the locations in the region had been made worst especially in the rainy season and roads around border location, which mostly are around the Mandara Mountain. Terrains around this location are difficult to access. But this location are familiar to most smugglers and run-away solders from Mali, Libya, Niger and other nationals, the risks is higher in this locations, especially around Borno, Adamawa.

We recommend policies that improve transport – especially road conditions in the region and the remedy/dialogue to prolong crisis in the region resulting from spillover of high inflow of immigrants and government policies, and primarily issues relating to porous Nigerian border that has facilitated prolong crisis in the region.

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Appendix 1

Figure 3.1

Locations around Gombe-Biu-Maiduguri highways

Source: Federal Ministry of works, 2013.

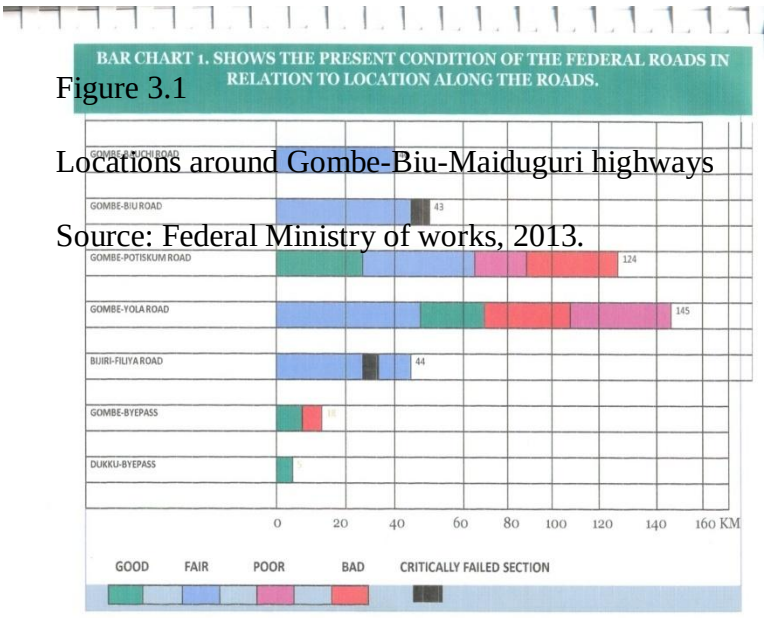

Figure 3.1. *Locations around Gombe-Biu-Maiduguri highways*

Source: Federal Ministry of works, 2013.