

ANALYZING TRANSPORT COST EFFECT ON COMMUTERS' MOBILITY IN DUTSE METROPOLIS, JIGAWA STATE, NIGERIA

Tukur Mohammed Ahijo (ORCID No.: 0000-0002-0039-9547) and Monday Ejiga

Department of Environmental Sciences, Faculty of Physical Sciences,
Federal University Dutse, Jigawa State,

Corresponding Author: ahijo.tukur@fud.edu.ng; GSM:08065806003

ABSTRACT

This paper focused on road transport commuters in Dutse, Jigawa State, Nigeria who might be considered more vulnerable to travel expenditure shocks. It examined how the cost of transport affects the lives of commuters in Dutse metropolis specifically and taking into consideration the transport money cost (transport fare) on household income & disposable income and sensitivity analysis of money cost on travel demand (elasticity of demand). The study focused on the 5 wards that covers Dutse metropolis, using the Taro Yamane formula with 95% confidence level and 5% margin of error, the sample size is 400. Where 400 questionnaires were distributed. The study found out that there is high number of low-income earners in the range of N30,000-N60,000 per month, with a high number of self-employed, and most are educated up to the University Degree level. There was an increase of 60% of transport fare after the removal of fuel subsidy, and a resultant 35% of commuter's monthly income is spent on transport fare. Transport demand also reduced, commuter mobility also reduced, and respondents resorted to walking for their mobility due to the price hike after fuel subsidy removal. Lastly, the knowledge and understanding of what carpooling is low, however, respondents use the available public transport. One of the recommendations of the study is to integrate land-use and transport planning processes and related institutional arrangements at the city level to reduce travel time by locating offices, schools, markets, and areas of public interest along public transport route and within walking distance of each other.

Keywords: Transport cost, commuters, household income, disposable income, travel demand

INTRODUCTION

Transportation is the pillar that sustains the movement of goods, services, commuters from one geographic area to another and transport cost is incurred in the process. Transport cost is multifaceted and it implies the transport expenses (Smith *et. al.*, 2012) . The transport cost can be categorized into several types based on different aspects of the transportation process. These are: transport cost in terms of money (transport fare) paid to be transported from one geographical area to another, transport cost in terms of time spent in the course of mobility, transport cost in terms of inconvenience experienced in the process of commuting. Venter (2011) noted that demystifying the transport expenses of

household and individuals as well is of critical importance considering formulation of transport policy that is pro-poor as well as monitoring and quality assurance. Therefore, the type of transport mode and means such as road, rail, air, sea, have a way of impacting commuters significantly because each mode has its cost peculiarity. For instance, fuel consumed, requirements for infrastructure, costs of labour transit times, availability of equipment.

Transportation does not exist in vacuum, there is need for commuting, and commuting is seen as the periodically recurring travel from point A to point B or between someone's place of residence and work place or one's place of study (Cain & Jones, 2008). The traveller here is

referred to as the commuter. Though commuters face various challenges ranging from long travel times due to traffic congestion and other causative factors to difficulty in accessing transport options, the social, economic importance of commuter's mobility in urban economy cannot be overemphasized (Ayantoyinbo & Afolayan, 2024). Every commuter belongs to a particular household and the amount of money that can be spent on transportation by households depends on the household's disposable income and commuter's income affects travel behaviour. Cain & Jones (2008) clarified that household income includes the amount of money earned by households while the disposable income is the specific amount of money available to household for transport cost or fare after deduction of taxes and recurrent expenses. This was corroborated by Turczak & Partycja (2014) where they found out that household disposable income is highly correlated with modal choice in the cities.

Khan *et al.* (2017) stated that demystifying transportation costs involves navigating the financial highway to unravel the factors contributing to transportation expenses. Key elements that shape transportation costs and provide insights into optimizing expenditure can be explored. In this vein, Ojekunle (2014) said rising energy prices are making transport cost and affordability a problem of increasing seriousness for low-income people especially in developing countries. Cain & Jones (2008) demonstrated that households in the lowest quintile already spent an unaffordable proportion of their income on transport fare as much as about 40%, where the level of affordability was pegged at 32.5%. The total household budget spent on transport is pivotal when evaluating affordability and easy access to mobility (Mattioli *et al.*, 2018). Ability to pay among households defines how critical household transport expenditure can be. Findings from Cain & Jones (2008) indicates that transport expenses are consuming a larger proportion of the incomes of the poor than of the rich. Hence, the major criticism of the principle of urban road transport pricing is that it is regressive. This means the implementation of a

charging scheme is likely to lead to imposition of an inequality of large financial burden on low-income commuters and their dependents, thereby resulting in hardship (Milanovic, 2011; Palma, 2011; Piketty, 2003). However, Gandelman *et al.* (2019) has shown that when income inequality is high, the decision to consider transport as a necessity or a luxury depends on which income group is being put into perspective.

In mobility, inconvenience of transportation is most times encountered. It is indicative of the level of difficulty and/or discomfort experienced when using any choice of transport modes. For example, boarding a bus to work could be an inconvenience due to how crowded and slow it is especially in developing countries. So, an alternative to this is carpooling. Carpooling is attractive when public transportation is not readily available, especially for long distances (Eriksson *et al.*, 2008). As elaborated by Shaheen *et al.* (2018), carpooling inculcates the practice whereby people living in the same area share a ride to a common or similar destination using their private cars or driving the vehicle in turn. Thus, reducing the cost of commuting, the stress of driving, or the number of cars on the roads. In actual sense, motive to save travelling costs has been touted or pictured as the dominant carpooling motivator (Canning *et al.*, 2010; DeLoach & Tiemann, 2011).

Equally, because of the premium people put on their privacy when driving, they tend to show no interest in carpooling (Correia & Viegas, 2011). Consequently, Canning *et al.* (2010) stated that there is a widely accepted notion that socio-demographics do not strongly influence non-household carpooling behaviour. The non-household carpool defines where two or more commuters from different residences travel together in the same private vehicle. Yet, the British Social Attitude Survey found out that 55% of respondents admitted they should reduce car travel for environmental reasons (Park *et al.*, 2012). From the foregoing, most fare changes have affected ridership of lower income groups. This is supported by Molnar *et.*

al. (2011) who said for bus services in Britain, higher-income commuters are actually less fare sensitive.

In most developing countries, inadequacy of transport means, services and infrastructure are being experienced. The effect of the inadequacy is the reliance on importation of fairly used vehicles to meet the travel demands. Adeyinka (2013) mentioned that some residents in the cosmopolitan urban area who have less access to transport services commute on foot in order to meet their travel demand. In general, the demand for transportation is a derived demand because movements or trips are made based on necessity and not for the sake of travelling *per se*. Therefore, the number of trips that households decide to undertake considering the terms and condition of travel such as transport fare, trip convenience, time, security point to the travel demand (Hensher & David, 2008). Metrics for ascertaining transportation demand are number of vehicles, number of passengers on board, number of trips, number of trip miles etc. Wardman (2014) made known that the demand for any transport services is in relation to the features of the system of activity which encompasses the entirety of social, economic, political and other related functions and system of transport which is the aggregate of physical facilities, components of operations and policies of constituted authorities that make travelling across various points in a transportation network possible while incorporating service attributes such as travel time, travel cost (transport fare), safety & security, comfort & convenience.

The focus of this study is specifically on road transport commuters who might be considered more vulnerable to travel expenditure shocks. Therefore, the objectives this study are:

- i. to examine how the cost of transport affects the lives of commuters in Dutse metropolis
- ii. to consider the transport money cost (transport fare) on household income & disposable income and sensitivity analysis of money cost on travel demand

(elasticity of demand), and

- iii. to assess the inconvenience cost associated with traveling with a view on distance-travel, degree of seat comfort and carpooling.

Literature Review

Literatures on fare elasticity of demand are quite large such as the ones from Hensher & David (2008), Holmgren (2007), and Wardman (2014). Elasticity defines the variation of transport demand in accordance with the variation of the fare or price variation. The higher the variation, the more the traffic in a transport system is affected by transport cost. In furtherance, findings from Dike *et al.* (2018) reveal that overall fare elasticities are low, so that increases in fare levels will almost always lead to increases in revenue. The 2008 National Travel Survey in Britain used by Molnar *et al.* (2011) to estimate fare elasticities for local bus service in areas outside of London revealed that travellers that were selected from the three middle quintiles of annual household incomes (i.e. from £12,500 to £50,000 approximately \$21,000 to \$84,000 as at 2015) got the same fare elasticity of -0.36 while travellers in the lowest had slightly more fare elasticity of demand of -0.39. The ones in the highest quintile of household incomes were slightly more inelastic at -0.32. Additionally, Transport Malta (2016) illustrated the inequality displayed between people utilising different modes of transport by also incorporating travel time. In lending credence to these studies, Mifud *et al.* (2017) found that journey times by bus took longer than by car. An average morning journey time by car was pegged at 19 minutes in comparison to 48 minutes by bus as reported by Transport Malta (2016).

In developing countries, affordability is one of the prominent issues when it comes to the provision and management of urban transport services (Ojekunle, 2014). Consequently, the concern that lower-income commuters may be

disproportionately affected coupled with the fact that the commuters mostly rely on inexpensive transit fares for basic mobility and access to jobs is part of the political resistance to fare increases. This notion requires further research to look at the two conflicting forces. First, commuters in lower-income have limited chances of having a car. This means that they cannot easily switch modes and means of transport in showing elasticity or sensitivity to transport fare increase. This indicates that the commuters would be less fare responsive than commuters in higher-income with greater car access.

In this case, lower income commuters have less ability to tolerate the effects of a fare increase because it represents a larger proportion of their daily budget. More so, encourage a commuter to carpool is still a challenge. For instance, Taylor *et al.* (2013) reported that in 2012, 86% of work trips by car in the United Kingdom were single-occupied. Similarly, in the United States, solo-drivers accounted for 76% of all work commutes (McKenzie & Rapino 2011). This is unsurprising, since solo commuters can travel with privacy and flexibility over destinations and schedules. Buliung *et al.* (2010), Canning *et al.* (2010), and Correia & Viegas (2011) further explored factors that encourage carpooling.

In Nigeria, the average fare paid by commuters for each trip of bus travel within an urban area increased by 120.63% from N586.61 in June 2022 to N1,285.41 in June 2023 according to the data by *BusinessTrumpet* (2018). In addition, the average fare paid by commuters for intercity bus rides was N5,686.49, representing a 55.25% increase from N3,662.87 in June, 2022. These impacts are widely acknowledged in policy at most national levels and at supra-national levels including the European Commission (2011). Most policy documents agree that public transport systems, walking and cycling are key to sustainable transport systems, particularly in cities.

There are over 68% of the adult population holding a valid driving licence, within which a strong gender and age bias is observed. The percentage of females over the age of 40 able to drive is significantly less than males (National Statistics Office, 2016b). However, household transport expenditure is usually the subject of new research, income inequality was only considered as an explanatory variable in a reduced number of studies (Dike *et al.* 2018; Valenzuela-Levi, 2018).

According to the literatures that have been reviewed, it is apparent that the transport costs impact commuters in many ways that are not really conducive to the commuters. The correlation between income inequality and household transport expenditure are different in sign and size. This relies on the type of income distribution measure and the transport expenditure sub-item (i.e. purchase of vehicles, operation and maintenance, or transport services) that are being analysed.

Materials and Methods

The study area is Dutse city which is the capital of Jigawa State, and it is situated within Dutse Local Government Area (LGA). Dutse LGA has a population of 251, 135 (2006 Census), and the number of wards in the LGA is 11 (Independent National Electoral Commission, 2019). Thus, the average population of each Ward in Dutse LGA is:

$$251,135 \div 11 \text{ Wards} = 22,830.$$

Dutse city is within 5 Wards of Dutse LGA. The Wards that are within the city limits are: Kachi, Limawa, Jigawar Tsada, Kudai, and Madobi Wards. Hence, the total population size of the study is

$$22,830 \times 5 \text{ Wards} = 114,150.$$

Using Taro Yamane formula with 95% confidence level and 5% margin of error, the sample size is:

$$n = \frac{N}{1 + N(e)^2}$$

Where $N = 114,150$.

e (error margin) = 0.05

$$n = \frac{114,150}{1 + 114,150 (0.05)^2}$$

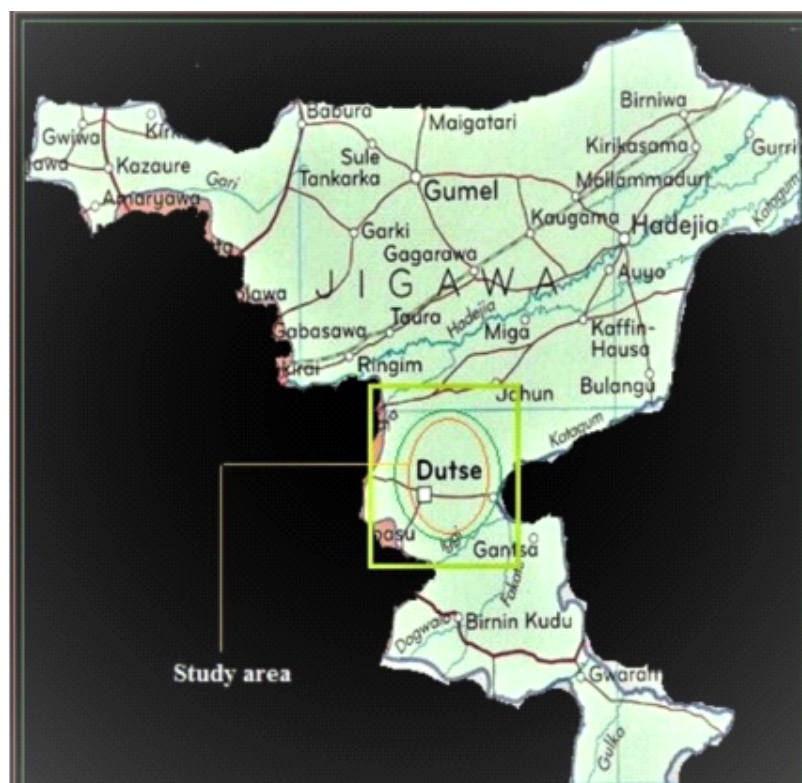
$$n = \frac{114,150}{1 + 114,150 (0.0025)}$$

$$n = \frac{114,150}{286.375}$$

$$n = 398.60$$

$n = 398.60$ = the sample size is approximately 400

Therefore, **400** questionnaires were distributed to 400 respondents.



Map 1: Map of Jigawa State showing the Study Area, Dutse, (Source: google.com)

This study focuses on commuters of various social strata – men/women, young/old, able/disabled, employed/unemployed etc. The need for the simplification of the target population is to determine a sample size that can represent results for the entire population with good precision and exactness.

Sampling Technique and Data Collection

Primary data was used to understand transport cost based on transport cost being a multifaceted (Smith *et. al.*, 2012) and it is categorized into transport cost in terms of money (transport fare) paid for transportation from one geographical area to another, transport cost in terms of time spent in the course of mobility, transport cost in terms of inconvenience experienced in the process of commuting. Also, sensitivity analysis was analysed to know how quick a change in any of the two variables would affect the other. Primary data would be sourced using a structured questionnaire with standardized survey questions and would be supplemented with direct observations of the Dutse metropolis' transport fare structure. Owing to the dispersed nature of would-be respondents, a random sampling technique is adopted. The sample size is 400 as calculated using Taro Yamane formula as illustrated in Section 3.0.

Data Analysis Method

The IBM *Statistical Package for the Social*

Sciences (SPSS) version 27 was used to analyse the data. Spearman rho correlation was used to understand how the different data correlate with each other. Secondly, ordinal regression was used to estimate and predict possible changes in future if some of the variables or data changes. Bryman (2006) noted that usage of the SPSS in data analysis complements, expands, and gives diverse results for the research in question.

Specifics of the Questionnaire

This paper explores the variation in transport expenditure patterns and their links to affordability perceptions among transport commuters in Dutse. A heuristic clustering exercise would be performed to find optimal clusters of individuals that are distinctly different in terms of either their average costs per trip, or the average percentage of income spent on transport, or the average affordability perception. Variables used to define clusters included the mode used, personal income and trip length.

Results and Discussion

This section presents the socio-economic background of the research respondents. The socio-economic background of the research respondents to be presented is – their gender, age, level of education, occupation, and monthly income. All the responses are illustrated in Table 1 overleaf.

Socio-economic Variables	Responses						Invalid Responses	Total
Gender	Male	Female						
	214 (53.3%)	175 (43.8%)					11 (2.8%)	400 (100.0%)
Age Range	10-17	18-25	26-33	34-41	42-49	50 & above		
	17 (4.3%)	202 (50.5%)	123 (30.8%)	29 (7.2%)	15 (3.8%)	4 (1.0%)	10 (2.5%)	400 (100.0%)
Educational Qualification	Primary School Certificate	Secondary School Certificate	HND/B.SC	M.SC	PH. D	Others (NCE/OND/Trade Cert)		
	4 (1.0%)	109 (27.3%)	226 (56.5%)	24 (6.0%)	13 (3.3%)	10 (2.5%)	14 (3.6%)	400 (100.0%)
Occupation	Self-Employed	Employed	Unemployed	Student	Housewife			
	110 (27.5%)	93 (23.3%)	39 (9.8%)	122 (30.5%)	19 (4.8%)		17 (4.3%)	400 (100.0%)
Monthly Income Range	30,000-59,999	60,000-89,999	90,000-119,000	120,000-149,999	150,000 & above			
	266 (66.5%)	55 (13.8%)	17 (4.3%)	15 (3.8%)	15 (3.8%)		32 (8.0%)	400 (100.0%)

Table 1: Frequency Table for Socio-Economic Variables of Respondents

The gender of the respondents 214 (53.5%) male and 175 (43.8%) female with 11 (2.8%) invalid responses. Table 1 illustrates the age range of the respondents. The 18 – 25 age range have the highest respondents with 202 (50.5%), followed by the 26 – 33 age range with 123 (30.8%), 34 – 41 with 29 (7.2%), 10 – 17 with 17 (4.3%), 42 – 49 with 15 (3.8%), 50 & above with 4 (1.0%), and 10 (2.5%) responses as invalid.

Furthermore, Table 1 illustrates the level of education of the respondents. All the respondents have had some form of western education however, 3 (0.8%) of the responses are invalid. From the lowest number, with 4 (1.0%) responses, those with Primary School Leaving Certificate are the lowest respondents. Followed by those with NCE/OND/Trade Certificates with 10 (2.5%), then Ph.D. (Doctorate) with 13 (3.3%) responses, then M.Sc. (Masters) with 24 (6.0%), and then those with Secondary School Leaving Certificate are 109 (27.3%). Lastly, 226 (56.5%) of the respondents are those with HND/B.Sc., and they are the highest respondents.

The occupation of the respondents is also illustrated in Table 1. The Table illustrates that Students responded highest across the occupations with 122 (30.5%), followed by the Self-employed with 110 (27.5%), and the Employed with 93 (23.3%). Furthermore, responses from the unemployed was 39 (9.8%), housewives were 19 (4.8%), and invalid responses was 17 (4.3%), respectively.

The monthly income of the respondents varies. The variation is that those having the highest

income are lowest in number while those with lower income are highest in number. This is illustrated in Table 1 above. 15 (3.8%) of the respondents earn 150,000 and above monthly. The same number of respondents earn 120,000 – 149,000, monthly. 17 (4.3%) of respondents earn 90,000 – 119,000, 55 (13.8%) earn 60,000 – 89,999, and 266 (66.5%) earn 30,000 – 59,999, respectively. However, 32 (8.0%) are invalid responses.

Akanmu *et al.* (2020) – gender, age, occupation, marital status, educational qualification, and monthly income – Bassey (2022) – occupation, educational qualification, and monthly income – and Balogun *et al.* (2023) – gender and educational qualification – gathered some socio-economic data of their research respondents in their studies of road transport system in some Nigerian cities. This study's socio-economic data differs from Akanmu *et al.* (2020) by gathering from the point of view of married respondents.

Evaluation of Transport Cost Effect on Commuter's Mobility

Fuel subsidy in Nigeria was ceased on 29 May 2024 (*The Cable*, 2023). In order to understand how this decision affected transportation cost of the people in Dutse, this study gathered data (through research respondents) on average transport fare paid per trip before the removal of fuel subsidy, after removal of subsidy, the percentage of income spent on transport fare per month, affordable is transport fare presently in Dutse, and what respondents does when there is a hike in transport fare.

Amount (N)	Frequency	Percentage (%)
N50	79	19.8
N100	99	24.8
N150	103	25.8
N200	65	16.3
N250	43	10.8
Invalid	11	2.8
Total	400	100.0

Table 2: Average Transport Fare per Trip before the removal of Fuel Subsidy in Dutse

Table 2 illustrates that 103 (25.8%) of the respondents pay N150 per trip before the removal of fuel subsidy. They are the highest respondents, while the lowest respondents – 43 (10.8%) – pay N250 per trip on average. However, the lowest price paid per trip is N50 and it is paid by 79 (19.8%) of the respondents.

Amount (N)	Frequency	Percentage (%)
N50	5	1.3
N100	25	6.3
N150	69	17.3
N200	130	32.5
N250 & above	160	40.0
Invalid	11	2.8
Total	400	100.0

Table 3: Average Transport Fare per Trip after the removal of Fuel Subsidy in Dutse

From Tables 2 and 3, it is observed that the highest number of respondents (103; 25.8%) paid an average fare of 150 before the removal of subsidy, and lowest number of respondents (43; 10.8%) paid N250. However, after the removal of fuel subsidy the highest number of respondents (160; 40.0%) paid an average fare

of N250 & above, and the lowest number of respondents (5; 1.3%) paid N50. This shows a percentage rise of 60% of the fare prices. Similarly, the percentage of income spent by a higher number of respondents (142; 35.5%) on a monthly basis is between 21% - 30% (Table 4). This figure is below the notion that about 35% of

commuter's income is spent on transport fare (Table 6).

As mentioned by Usman *et al.* (2023), the effect of fuel subsidy removal by the Nigerian government led to increase in the price of goods and services including urban transportation. Maimodu *et al.* (2024) also found out that fuel subsidy will reduce transport fare but removal of subsidy will increase it, and with fuel subsidy there will be no available funds for efficient and effective transport infrastructure, thus, there is need to remove it. Greve & Lay (2023) also found out that the removal of subsidies in cooking gas in Ghana led to the increase of the use of firewood due to the price increase of cooking gas. As recommended by Usman *et al.*

(*ibid.*), safety nets for the low-income earners should be provided of which one of those safety nets is affordable transport that is locally acceptable, environmentally friendly, and in line with Nigeria's commitment to internationally agreed environmental policies and protocols, and agreements.

In terms of affordability, despite the hike in the transport fare, majority of the respondents – 123 (30.8%) – responded that transport fare is slightly affordable in Dutse (Table 4). Though, 113 (28.2%) of respondents responded that the transport fare is slightly unaffordable. Therefore, the difference between those that feel it is affordable and unaffordable is low.

Responses	Frequency	Percentage (%)
Slightly unaffordable	113	28.2
Unaffordable	102	25.5
Affordable	51	12.8
Slightly affordable	123	30.8
Don't know	1	0.3
Invalid	10	2.5
Total	400	100.0

Table 4: Transport Affordability in Dutse by Respondents

The data in Dutse illustrates (Table 4) that there is low difference between those that can afford the available transport and those that cannot. This is similar to what Akanmu *et al.* (2020) found in Ibadan. Research participants asked on the different factors that influences their patronage of urban transportation, and they found out that affordability is ranked 3rd in a ranking of 7 other factors. However, Oviedo & Sabogal (2020) concluded that incorporating multiple dimensions of transport issues (including affordability) and well-being with

contextual issues of the Global South can lead to different interpretations of transport-related well-being and its relation with social and transport disadvantage. Hence, concluding that affordability of transport (or not) is not the only factor to consider in transportation cost. This is further reiterated by Adom-Asamoah *et al.* (2021) where they found out that that the availability of public transport service largely influenced its patronage, contrary to the 'popular' assertion of affordability as the major determining factor.

Statements	SA (F/%)	A (F/%)	SA (F/%)	D (F/%)	SD (F/%)	NA (F/%)	Mean of Responde nts	W.A. (2.44)	S.D	Decision
Transport fare consumes above 35% of commuter's monthly income	84 (21)	141 (35.3)	128 (32)	26 (32)	7 (3)	3 (0.8)	2.36	2.44	1.11	L.P
Hike in transport fare has reduced the rate of commuters' mobility	60 (15)	154 (38.5)	121 (30.3)	43 (10.8)	7 (1.8)	3 (0.8)	2.49		1.04	H. P
Commuters prefer to work from home	111 (27.8)	43 (10.8)	103 (25.8)	38 (9.5)	10 (2.5)	3 (0.8)	2.39		1.27	L.P
Transport demand can decline due to transport cost (monetary, social and time cost)	29 (17.3)	149 (37.3)	115 (28.7)	32 (8.0)	11 (2.8)	8 (2.0)	2.53		1.22	H. P

SA = Slightly agree, A = Agree, SA = Strongly agree, D = Disagree, SD = Strongly disagree, NA = Not applicable, Weighted Average = W.A., Standard Deviation, L.P = Low Perception, H.P = High Perception

Table 5: Responses on Transportation Cost Effect on Commuter's Mobility (Source: Authors' SPSS Analysis)

In Table 5, the mean of respondents for the statements are: 2.36, 2.49, 2.39, and 2.53, respectively. Weighted average or mean is also called the grand mean and it is calculated by dividing all the mean or averages obtained from each item by the sum of the items. The weighted average is calculated by summing up individual mean and dividing it by the number of responses. The weighted average is used to measure the level of perception of commuters. In this case, if any mean is lower than the weighted mean, it depicts the low perception level. The perception levels tell us how well informed are the respondents about the issue at hand. If there is a low perception about a particular item on the questionnaire, it means there is a need for enlightenment or sensitization for improvement. Low perception (LP) signifies that the commuters do not have a full grasp of the item in question and further orientation or sensitization will boost their understanding of the subject matter. High perception tells us that the commuters are very knowledgeable about the matter in question. Lastly, mean of the respondents tells us how respondents agree to certain items of the questionnaire. For instance,

is that most commuters disagree, strongly agree or feel indifferent.

Transportation cost has an effect on commuter mobility in an urban area (Okeke *et al.*, 2021). This is in addition to socio-economic determinants (occupation, gender, income level, and vehicle ownership), vehicle convenience, travel time, car availability and ownership, purpose of trips, safety of passengers onboard, waiting time, and traffic congestion. This illustrates that commuters have a perception of the linkages between transport cost and their travels.

Respondent's Mobility Correlation and Regression

In order to understand the correlation and regression of the responses, Spearman rho correlation was used because we have a non-parametric data set and the data are not normally distributed for correlation analysis. And ordinal regression is used for the regression analysis.

Correlation Variable	Average Transport Fare before Subsidy Removal	Monthly Income
Respondents' Mobility before Subsidy Removal	0.020 (positive correlation)	- 0.065 (negative correlation)
	Average Transport Fare after Subsidy Removal	Monthly Income
Respondents' Mobility after Subsidy Removal	0.074 (positive correlation)	0.03 (positive correlation)

Table 6: Correlation between Transport Fare and Monthly Income before and after Subsidy Removal

In terms of degree of correlation, since correlation co-efficient ranges between -1 to +1, there is weak, moderate, and high correlations coefficients. In this correlation output as illustrated in Table 11, the average transport fare paid by respondents before subsidy removal shows a positive correlation with respondent's mobility while monthly income is negatively correlated. Also, the average transport fare after subsidy removal and monthly income shows a weak correlation (0.074 and 0.03) with commuter's mobility. This means that despite the increase in transport fare, mobility is not really affected. This really applies to self-employed people because they must go to work almost every day to earn their daily income. The scenario is quite different for civil servants who are quite flexible with their mobility choices. They can choose to work from home or anywhere else.

The ordinal regression coefficients are simply interpreted as the estimated or predicted change in long odds of being in a higher (as opposed to a lower) group/ category on the dependent variable (controlling for the remaining independent variables) per unit increase on the independent variable.

Positive estimate or coefficient is interpreted as follows:

For every one unit increase on an independent variable, there is a predicted increase (of a certain value) in the long odds of falling at a higher level on the dependent variable. More generally, this indicates that there is an increased probability of falling at a greater level on the dependent variable as values rise on an independent variable.

Negative estimate of co-efficient is interpreted as follows:

For every one unit increase on independent variable, there is a predicted decrease of a certain amount in the long odds of being in a higher level on the dependent variable. If P-Value > 0.05, there is no statistically significant effect of independent variable on the dependent variable while If P-Value < 0.05, there is a statistically significant effect. This means there is a high probability either a positive or negative change in the study parameters as a result of a unit change in the variables.

Regression Variable	Average Transport Fare after Subsidy Removal	Monthly Income	Transport Effect
Respondent's mobility after Subsidy removal (Significant Level)	0.12	0.65	0.14
Regression Co-efficient	0.15	0.028	-0.18

Table 7: Regression Analysis between Transport Fare and Monthly Income after Subsidy Removal

The negative coefficient value of -0.18 shows that for every one unit increase in transport effect, there is a predicted decrease of 1.18 in the long odds of being on a higher level on respondent's mobility. Average transport fare paid after subsidy removal and monthly income are significant positive predictors of respondent's mobility as they depict positive regression coefficients of 0.15 and 0.028. This simply means that transport effect resulting from price hike, expenditure of about 35% of commuter's income on transportation will negatively affect the rate at which respondents board public transport leading to adjustments and readjustments to find the best fit with minimum costs outlay. This is the general perspective commuters in regards to commuting in the city of Dutse.

Therefore, our regression model is:

$$\text{Respondent's mobility} = 0.15av + 0.028mi - 0.18te + e$$

Where av= average transport fare after subsidy removal

Mi = monthly income

te = transport effect

e = error term (unforeseen errors that could occur in the system)

The dependent variable here is, respondent's mobility which has the likelihood of being altered by the independent variables like transport fare, respondent's monthly income and transport effect over time.

In terms of demand for transportation for mobility between points A and B, demand can decline due to transport cost (monetary, social and time cost as illustrated in Table 13 overleaf.

Responses	Frequency	Percentage (%)
Slightly agree	69	17.3
Agree	149	37.3
Strongly agree	115	28.7
Disagree	32	8.0
Strongly disagree	11	2.8
Not applicable	8	2.0
Invalid	16	4.0
Total	400	100.0

Table 8: Responses to Transport Demand Decline Due to Transport Cost (Monetary, Social and Time Cost)

Table 8 illustrates that 149 (37.3%) of respondents agree that their transport demand decline due to transport cost followed by the strongly agree responses (115; 28.7%).

Therefore, the transport demand model gives us a vivid view of reactions to demand and supply of transport service as illustrated in Chart 1 below.

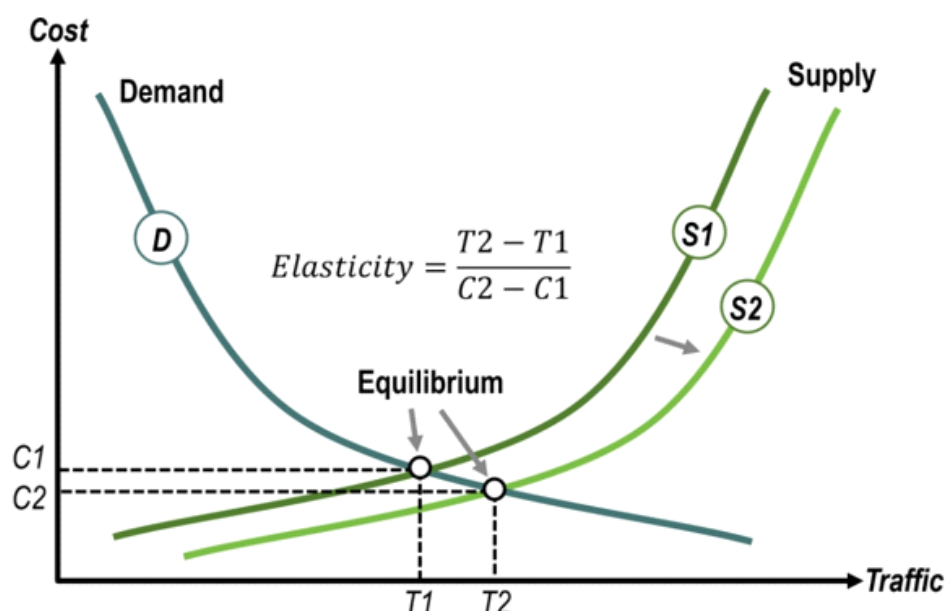


Chart 1: Transport Demand and Supply Function (Source: *Transport Geography* (2018))

Many transport systems behave in accordance with the relationships between demand and supply which are influenced by cost variations. In Chart 1, the demand curve assumes that if transport costs are high, demand is low as the users of transport services e.g. commuters are less likely to use them vice versa. Equally, the supply curve behaves contrarywise. This means if transport costs are high, transport providers will readily want to supply high quantities of services since high profits will likely arise under such circumstances. The demand function in Chart 1 at the equilibrium point represents a point or compromise between what commuters who are willing to pay and what transport operators are willing to offer. In this case, Traffic (T1) will flow at an operating cost (C1). If because of an improvement, a larger amount of service is possible for the same cost, the supply

curve (S) moves from S1 to S2, and a new equilibrium will be reached with quantity of traffic T2 at a price C2. This is the explanation of the demand function.

Sensitivity Analysis

Actions and reactions play out in this phase of analysis. Commuters tend to react either quickly or gradually to transport costs. The reaction can be negative or positive. For instance, in Dutse, when there is a hike in transport fare, respondents usually patronize alternative means of transportation such as walking (191; 47.8%), relying on other available public transportation (74; 18.5%), cut down on trips (63; 15.8%), cycling (32; 8.0%), and carpooling (25; 6.3%). This responses by the respondents are illustrated in Chart 2 overleaf.

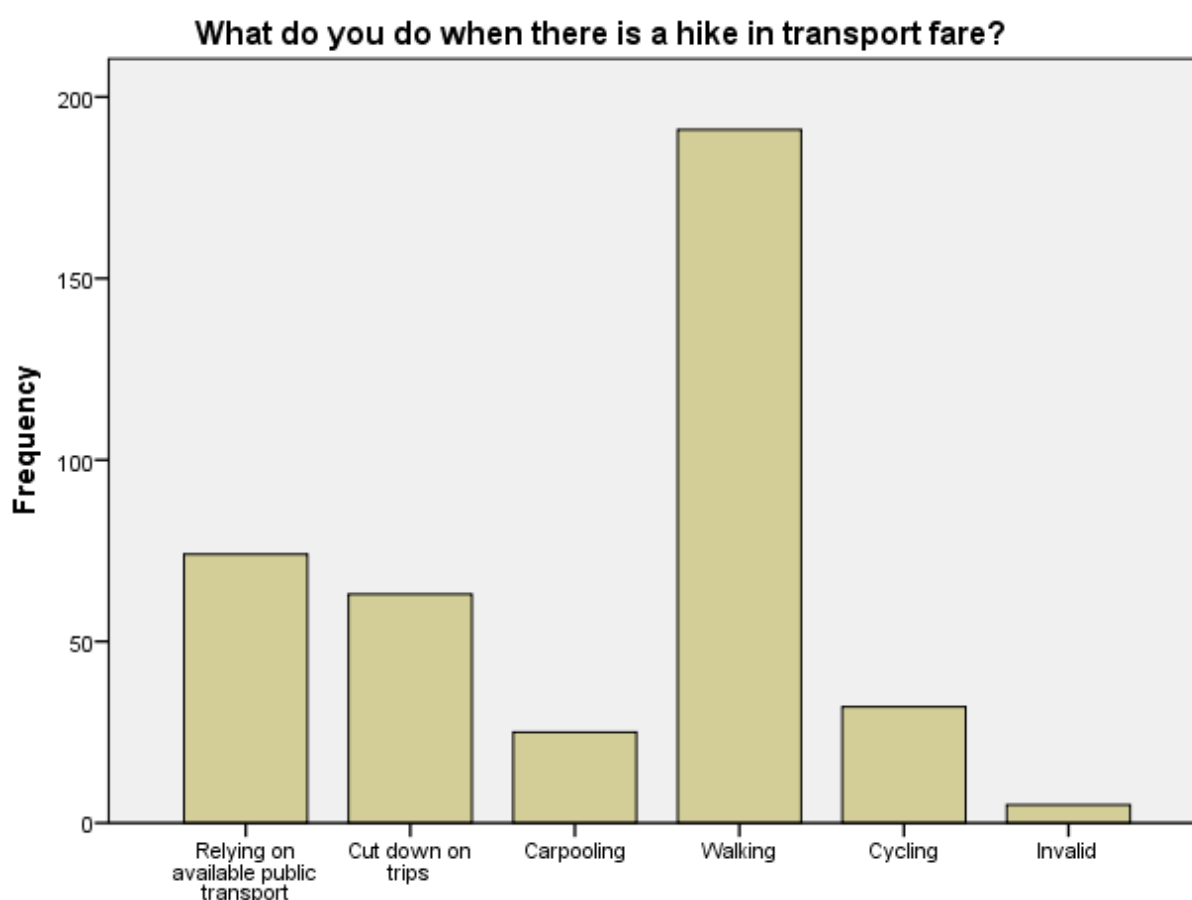


Chart 1: Respondents reaction when there is Hike in Transport Fare

191 (47.8%) of the respondents opted for walking in case of short distance movement or even long distance depending on the gender and age group. The data illustrates that walking is the highest alternative due to hike in transport fare. Yet, Van Soest *et. al.* (2020) found out that commuters walk because of personal, public transport-related (scheduled rail or bus), environmental, and journey-related but not because of price hike. Consequently, Urbanek (2021) found out that increase in fuel prices or public transport fares are not very effective in changing transport behaviours. In Germany, transport fare is an important consideration to carshare or carpool than travel time (Krauss *et. al.*, 2022). Motorcycle-taxis and tricycles are the

predominant available public transport in Dutse (Gumel *et. al.*, 2017), hence, the having the second highest option if there is hike in transport fare as illustrated in Chart 2.

Inconvenience Cost Associated with Travelling – Seat Comfortability and Carpooling Considerations

Transport cost is multifaceted and it implies the transport expenses. One of those aspect of transport cost is cost in terms of inconvenience experienced in the process of commuting. This study, through research respondents, understood the inconveniences experienced by the commuters in Dutse.

Questions	Responses (Frequency/%)			Total (Frequency/%)
	Yes	No	Invalid	
Do you know what carpooling is?	134/33.5%	251/62.7%	15/3.8%	400/100
Do you do carpooling?	97/24.3	280/70.0	23/5.8	400/100
Do you own a vehicle?	89/22.3	293/73.3	17/4.3	400/100
Have you ever used the available public transport in Dutse?	313/78.3	74/18.5	12/3.0	400/100
Are the available public transport vehicles usually loaded beyond their carrying capacity?	192/48.0	183/45.8	25/6.3	400/100

Table 9: Some Responses by Research Respondents

Based on respondents' responses, Table 9 illustrates some responses regarding carpooling, vehicle ownership, usage of public transportation, and carrying capacity of public vehicles in Dutse metropolis. 251 (62.7%) of respondents do not know what carpooling is, and 280 (70%) do not practice carpooling. Furthermore, 293 (73.3%) do not own a vehicle, 313 (78.3%) have used the available public transport, and 192 (48%) of respondents responded that the available public transport vehicles are usually loaded beyond their carrying capacity.

In proffering solutions to traffic congestion in Calabar, Nigeria, Odum & Aloba (2014) listed: sensitization for taxi and bus drivers, provision of parking lots near places of high socioeconomic activities, construction of fly over, synchronizing traffic lights, Others (re-certification of driving license for all commercial taxi and public bus drivers, demarcating separate taxi route from private cars, and removal of touts along the roads and replace them with trained/certified road traffic control agencies), and carpooling (in that order). These proffered solutions are recommended by the research respondents. That is, Odum & Aloba (*ibid.*) considered respondents recommendations which is principle that Faiyetole & Fulani (2020) also advocated. That is, when presenting solution to urban transportation, it should be user-led solutions that will be acceptable to different social groups. Hence, the low level of recommending carpooling by the Odum & Aloba paper might indicate a low understanding of unacceptability of the transport option. Yet, commuters are willing to share trips with family and friends but not in public transport due to COVID-19

(Faiyetole, 2022).

Table 9 illustrated the high number of research respondents with no vehicles in Dutse. However, according to Ukonze *et al.* (2020) found out that the stock of vehicles in Nigeria was 35.3 million in 2018. They forecasted that it will increase to 48.7, 66.2, and 76.1 million in 2030, 2040, and 2050, respectively. These figures are influenced by the Gross Domestic Product (GDP) of the country, per capita income, fuel price, literacy level, stock of public transport vehicles, price of fuel, and literacy level. While the historical data of vehicular increase for Dutse is not available, it can be deduced from Ukonze *et al* (*ibid.*) that vehicle ownership in Dutse will also increase and the attendant effects will be experienced in the city.

Table 9 data illustrated the slight difference between those that responded "Yes" (192/48.0) and "No" (183/45.8) on the question – "Are the available public transport vehicles usually loaded beyond their carrying capacity?" This might not be unconnected to the high number (266/66.5%) of low-income earners (N30,000-N59,999) who participated in this study. This group of respondents depend on the available public transport – motorcycle-taxis (Akinyemi & Olumoyegun, 2020) – however dangerous, uncomfortable, and reckless they maybe.

Overall Level of Transport Satisfaction Subject to Transport Effect

To understand the level of transport satisfaction, this study used the Spearman Rho nonparametric correlation and ordinal regression. This is illustrated in Table 10 overleaf.

Non-Parametric Correlations (Spearman Rho)	
	Transport Effect
Transport satisfaction level (Correlation)	0.23
Statistical significance Level	0.00 (very significant)
Ordinal Regression	
Transport satisfaction level (sig. level)	0.00
Regression co-efficient	0.62

Table 10: Overall Level of Transport Satisfaction Subject to Transport Effect

A significant change in any of the factors transport mobility that could generate negative reactions from commuters such as the subsidy removal which increased fuel pump price from N350 per liter of premium motor spirit (petrol) to about N650 led to a multiplier effect on almost every sector of the economy most especially the commodity market. Hence, the reason for having a statistical significance level of 0.00 in the non-parametric correlation and ordinal regression. This shows consistency and validity of the data. Therefore, satisfaction level of commuters can be measured by how favourable the transport effect is. For instance, if government transport policies are favourable, the commuters will have high satisfaction level. This is depicted by the positive correlation of 0.23 (23% degree of correlation). In Dutse, respondents are generally satisfied with the available transport system. So, for every satisfaction derived from the use of public transportation, there is a 0.62-unit improvement in transport effect in Dutse (Table 10).

Conclusion and Recommendations

This study focused on road transport commuters in Dutse, Jigawa State, Nigeria who might be considered more vulnerable to travel expenditure shocks. It examined how the cost of transport affects the lives of commuters in Dutse metropolis specifically and taking into consideration the transport money cost (transport fare) on household income & disposable income and sensitivity analysis of

money cost on travel demand (elasticity of demand). And an assessment of inconvenience cost associated with traveling with a view on distance-travel, degree of seat comfort and carpooling.

The study found out that there is high number of low-income earners in the range of N30,000-N59,999 per month, with a high number of self-employed, and most are educated up to the Secondary School level. There was an increase of 60% of transport fare after the removal of fuel subsidy, and a resultant 35% of commuter's monthly income is spent on transport fare. Transport demand also reduced, commuter mobility also reduced, and respondents resorted to walking for their mobility due to the price hike after fuel subsidy removal. Lastly, the knowledge and understanding of what carpooling is low, however, respondents use the available public transport even though they fill to over the capacity of the vehicles. And the commuters are generally satisfied with the available transport system. Though, it is not in line with the standard as defined by the sustainable urban transport system.

Based on these findings, this study is recommending the following:

- Encouraging the public to utilize non-motorised transportation due to the benefits it provides to the commuter's income (low or no expenses), health benefits (cycling and walking as a form of exercise), social benefit (no traffic

- congestion), and environmentally friendly (no carbo emissions into the atmosphere) by providing facilities and infrastructure for non-motorised transportation;
- ii. Provision of environmentally friendly, socially sustainable urban transport system that is seamless, integrated, multimodal, affordable, efficient, and effective with the end user in mind;
 - iii. Encourage commuters to reduce the usage of private vehicles and utilize public transportation for their commuting;
 - iv. Establishment of transport regulatory body to regulate the public transport operators in terms of operations, courteous interaction between users and operators, and route planning; and
 - v. Integrate land-use and transport

planning processes and related institutional arrangements at the city level to reduce travel time by locating offices, schools, markets, and areas of public interest along public transport route and within walking distance of each other.

Further research includes understanding the perspectives of different social groups – gender, occupation, marital status – on their view on transport cost. Study on how non-motorised transport in a hot city like Dutse affects the health of commuters. The historical understanding of vehicle ownership in Dutse needs to be studied to know the pattern of private ownership in the city. And lastly, the level of transport inclusion that commuters experience with the available transport system in Dutse needs to be studied.

REFERENCES

- Adeyinka A.M. (2013). Assessment of the quality of urban transport services in Nigeria. *Interdisciplinary studies*, 2(1), 49-58.
- Adom-Asamoah, G., Asibey, M. O., & Nyarko, S. (2021). Rethinking or affirming the “affordability” debate on the efficiency of urban public transport usage: case of Kumasi, Ghana. *Transportation in Developing Economies*, 7, 1-14.
- Akanmu, A. A., Salisu, U. O., Fasina, S. O., Sanni, S. M., Olatunji, O. M., & Faleti, C. A. (2020). State of urban transport in a Nigerian traditional city. *Transport and Communications*, 2020 (II).
- Akinyemi, Y. C., & Olumoyegun, J. M. (2020). Spatiotemporal Pattern and Determinants of Childhood Road Traffic Morbidity and Mortality in Nigeria: 2013-2017. *Nigerian Journal of Economic and Social Studies*, 62(3).
- Ayantoyinbo B.B. and Afolayan I.O. (2024). Effect of commuter’s Income on Ferry Operational cost In Lagos State, Nigeria. *South Asian Journal of Social Studies and Economics*, 21 (4), 56-67.
- Balogun, S. A., Malomo, B., & Aregbesola, M. A. (2023). Demographic Factors and Modal Split Behaviour of Commuters in The Federal Capital Territory, Abuja-Nigeria. *Ethiopian Journal of Environmental Studies & Management*, 16(5).
- Bassey, B. J. (2022). Commuters’ Perspective of Traffic Congestion in Calabar South LGA, Cross River State, Nigeria. *Journal of Developing Economies*, 4(2), 31-50.
- Buliung, R.N., Soltys, K., Bui, R., Habel, C., Lanyon, R. (2010). Catching a ride on the information superhighway: toward an understanding of internet-based carpool formation and use. *Transportation* 37, 849–873. doi:10.1007/s11116-010-9266-0
- Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done?. *Qualitative Research*, 6(1), pp. 97-113.
- Business Trumpet* (2018). Transportation, Safety and Road Experts Meet in Accra to Improve Road Safety and Urban Mobility. Business Trumpet News (Online). Retrieved from <https://business Trumpet.com/transportation> (accessed 15/4/2024)
- Cain A., and Jones P. M. (2008). Does urban road pricing cause hardship to low income car drivers? An affordability-based approach. *Transportation Research Record* 2067(1), 47-55, 2008
- Canning P. E., Hughes S. J., Hellawell E. E., Gatersleben B. C. M., and Fairhead C. J. (2010). Reasons for Participating in Formal Employer-led Carpool Schemes as Perceived by Their Users. *Transportation Planning and Technology* 33 (8): 733–745.
- Correia G., and Viegas J. M. (2011). Carpooling and Carpool Clubs: Clarifying Concepts and Assessing Value Enhancement Possibilities Through a Stated Preference Web Survey in Lisbon, Portugal. *Transportation Research Part A: Policy and Practice* 45 (2): 81–90.
- DeLoach, S.B. & Tiemann, T.K. (2011). Not driving alone? American commuting in the twenty-first century. *Transportation* 39, 521–537 (2011). doi:10.1007/s11116-011-9374-5
- Dike D.N., Ibe C.C., Ejem E.A., Erumaka O. and Chukwu O.E. (2018). Estimation of intercity travel demand for public road transport in Nigeria. *Journal of Sustainable Development of Transport and Logistics*, 3(3), 88-98
- Eriksson, L., Garvil, J., and Nordlund, A.M. (2008). Acceptability of single and combined transport policy measures: The importance of environment and policy specific beliefs. *Transportation Research Part A: Policy and Practice*. 40. pp. 109-129.
- European Commission. (2011). White Paper 2011. Roadmap to a single European transport area-towards a competitive and resource efficient transport system.

- Available at https://ec.europa.eu/transport/themes/strategies/2011_white_paper_en (accessed 17 March 2024)
- Faiyetole, A. A., & Fulani, E. O. (2020). Consideration of users' needs in regard to planning of intelligent transport solutions in an African Metropolis. *Transportation in Developing Economies*, 6(1), 7.
- Faiyetole, A. A. (2022). Impact of COVID-19 on willingness to share trips. *Transportation research interdisciplinary perspectives*, 13, 100544.
- Gandelman, N., Serebrisky, T., & Suárez-Alemán, A. (2019). Household spending on transport in Latin America and the Caribbean: A dimension of transport affordability in the region. *Journal of Transport Geography*, 79, 102482.
- Greve, H., & Lay, J. (2023). "Stepping down the ladder": The impacts of fossil fuel subsidy removal in a developing country. *Journal of the Association of Environmental and Resource Economists*, 10(1), 121-158.
- Gumel, G. B., Adam, I. M., & Rilwan, I. A. (2017). Impact of commercial motorcycle transport in raising income: Evidence from Jigawa state, Nigeria. *CARD International Journal of Social Sciences and Conflict Management*, 2(3), 74-91.
- Hensher, D. A. (2008). Assessing systematic sources of variation in public transport elasticities: some comparative warnings. *Transportation Research Part A: Policy and Practice*, 42(7), 1031-1042.
- Independent National Electoral Commission. (2019). List of Electoral Wards and Local Government Areas. Retrieved from: <https://www.inecnigeria.org/wp-content/uploads/2019/02/RA-LGA-ANALYSIS-NATIONWIDE.pdf> (accessed on: 16 June 2024)
- Khan, A. R., Griffin, K., Riskin, C., & Renwei, Z. (2017). Household income and its distribution in China. In *Chinese Economic History Since 1949* (pp. 1054-1089). Brill.
- Krauss, K., Krail, M., & Axhausen, K. W. (2022). What drives the utility of shared transport services for urban travellers? A stated preference survey in German cities. *Travel Behaviour and Society*, 26, 206-220.
- Maimodu, S., Ahmadu, S., & Geidam, K. M. (2024). Incessant Hike in Transportation Costs and Transportation Fare: Investigating the Role of Subsidy Removal in Nigeria. *Fane-Fane International Multi-Disciplinary Journal*, 8(1, June), 209-221.
- Mattioli, G., Nicolas, J. P., & Gertz, C. (2018). Household transport costs, economic stress and energy vulnerability. *Transport Policy*, 65, 1-4.
- McKenzie, B., & Rapino, M. (2011). *Commuting in the united states: 2009*. Washington, DC: US Department of Commerce, Economics and Statistics Administration, US Census Bureau.
- Mifsud, D., Attard, M., & Ison, S. (2017). To drive or to use the bus? An exploratory study of older people in Malta. *Journal of Transport Geography*, 64, 23-32.
- Milanovic, B. (2011). *The Haves and the Have-Nots: A Brief and Idiosyncratic Guide to Global Inequality*. New York: Basic Books
- Molnar A., Jozsef J., and Nesheim L. (2011). A Disaggregate Analysis of Demand for Local Bus Service in Great Britain (excluding London) using the National Travel Survey. Report prepared for the UK Competition Commission. (http://www.eea-eseem.com/files/papers/eeaesem/2012/2382/StaticTransportModel_2011_12_15.pdf).
- National Statistics Office (2016b). *Transport Statistics*. Available at https://nso.gov.mt/en/publicatons/Publications by Unit/Documents/B3 Environment Energy Transport_Agriculture_Statistics/Transport_Statistics_2016.pdf (accessed 17 March 2019).
- Odum, P. O., & Aloba, O. (2014). Urban transportation challenges in Calabar: causes, implications and solutions. *International Journal of Scientific & Technology Research*, 3(11), 266-269.

- Ojekunle, J. A. (2014). Analysis of fare structure and determination of bus operation in Nigerian cities. *International Journal of Developing Societies*, 3(2), 13-21.
- Okeke, F., Echendu, I., & Rosemary, N. O. (2021). Determinants of intra-urban travel in southeast Nigeria, evidence from the city of Enugu. *Transport Problems*, 16(4).
- Oviedo, D., & Sabogal, O. (2020). Unpacking the connections between transport and well-being in socially disadvantaged communities: Structural equations approach to low-income neighbourhoods in Nigeria. *Journal of Transport & Health*, 19, 100966.
- Palma, J. G. (2011). Homogeneous middles vs. heterogeneous tails, and the end of the 'inverted-U': It's all about the share of the rich. *development and Change*, 42(1), 87-153.
- Park, A., Clery, E., Curtice, J., Phillips, M., and Utting, D. (2012). British Social Attitudes: the 29th Report. National Centre for Social Research, London
- Piketty, T., & Saez, E. (2003). Income inequality in the United States, 1913–1998. *The Quarterly journal of economics*, 118(1), 1-41.
- Shaheen, S., Cohen, A., Bayen, A., (2018). The benefits of carpooling: the environmental and economic value of sharing a ride. DOI: <https://doi.org/10.7922/G2DZ06GF>
- Smith N., Hirsch D., and Davis A. (2012). Accessibility and capability: the minimum transport needs and costs of rural households. *Transport Geography* 21, 93-101, 2012.
- Taylor, E., Humphrey, A., Pickering, K., Tipping, S. (2013). National Travel Survey: 2012. Department for Transport, London (2013).
- The Cable. (2023). Petrol subsidy is gone, says Tinubu. May 29, 2023 1:18 pm. The Cable Newspaper (Online). <https://www.thecable.ng/breaking-fuel-subsidy-is-gone-says-tinubu/>
- Transport Malta (2016). National Transport Strategy 2050. Available at <http://www.transport.gov.mt/transport-strategies/national-transport> (accessed 18 April 2024).
- Turczak, A., & Zwiech, P. (2014). Variability of household disposable income per capita by types of residence in Poland. *Statistics in Transition new series*, 4(15), 573-590.
- Ukonze, F. I., Nwachukwu, M. U., Mba, H. C., Okeke, D. C., & Jiburum, U. (2020). Determinants of vehicle ownership in Nigeria. *Sage open*, 10(2), 2158244020922970.
- Urbanek, A. (2021). Potential of modal shift from private cars to public transport: A survey on the commuters' attitudes and willingness to switch—A case study of Silesia Province, Poland. *Research in Transportation Economics*, 85, 101008.
- Usman, S. U., Kura, N. U., Khalil, M. S., Mallam, I., Umar, D. U. A., & Abdulhamed, A. I. (2023). Effects of fossil fuel subsidy removal on environment and sustainable development in Nigeria. In *Book of Proceedings—2023 Environmental Management Association of Nigeria (EMAN) Annual National Conference* (pp. 199-213).
- Valenzuela-Levi, N. (2018). Why do more unequal countries spend more on private vehicles? Evidence and implications for the future of cities. *Sustainable Cities and Society* 43: 384-394. <https://doi.org/10.1016/j.scs.2018.09.003>
- Van Soest, D., Tight, M. R., & Rogers, C. D. (2020). Exploring the distances people walk to access public transport. *Transport reviews*, 40(2), 160-182.
- Venter, C. (2011). Transport expenditure and affordability: The cost of being mobile. *Development Southern Africa*, 28(1), 121-140.
- Wardman, M. (2014). Price elasticities of surface travel demand a meta-analysis of UK evidence. *Journal of Transport Economics and Policy (JTEP)*, 48(3), 367-384.