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Effect of Commuters' Income on the Ferry Operational costs in Lagos State

ABSTRACT:

Commuters' mobility plays significant roles in urban economic due to its reliance on the cheapest means and available transportation system from one location to another. Commuters' income in Lagos State affects the amount of traffic generated along the waterways during travel behavior due to commuters' occupation and commuters' level of car ownership. This study aims to estimate the impact of ferry commuters' income on the waterways operations in Lagos state.

This survey was carried out in the four selected waterways terminals in Lagos State. The authors used primary data with the aid of snow balling sampling technique to administered 836 questionnaires at the selected inland waterways terminals in Lagos State. The study used multiple regressions to analyze the obtained data in the study area.

The result of the findings revealed that larger proportion of the respondents representing 63.9% (523) of the sample size had no car. Also, passenger's income that was measured using passengers' occupation and passengers' car ownership had a significant impact on ferry operational costs in Lagos State having R value of .699 (69.9%) and p-value of 0.000. This shows that ferry operational costs can be determined by passengers' daily or monthly income.

The study concluded that **ferry operating costs tend to be lower when the level of**

patronage is minimal due to commuters' income constraints.It was recommended that government should subsidize the freight price and come up with a policy that will enforce usage of ferry service.

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12 **KEY WORDS:** Commuters' Income,Transportation System, Commuters' Level,
13 Ferry

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15 **1. INTRODUCTION**

16
17 Inland waterways play a crucial role in fostering economic development, particularly in
18 remote regions. The potential opportunities in this sector are heavily influenced by specific
19 regional factors, such as geographical conditions, the level of road infrastructure
20 development, and socio-economic conditions. The historical significance of inland water
21 transportation in moving goods and services dates back centuries (Sagan et al., 2020). This
22 mode of transport has been favored due to its cost-effectiveness, energy efficiency, and
23 environmentally friendly nature (Benamara, Hoffmann & Youssef, 2019).

24 However, recent years have witnessed growing congestion on urban roads, prompting a
25 shift towards exploring more sustainable transportation alternatives. This shift has provided
26 an opportunity for water transport to assume a more prominent role in urban mobility
27 schemes worldwide (Canitez, 2019). Water transport has the potential to enhance urban
28 transportation by offering faster, more efficient, and better-integrated services, alleviating
29 issues related to congestion (Venter, Mahendra & Hidalgo, 2019).

30 The pricing dynamics in inland water transportation distinguish it from other industries.
31 Prices are influenced by factors such as fuel costs, demand and supply forces, distance,
32 time, and trip type. The competitive nature of the freight transport markets often dictates
33 pricing, with variations based on direction, season, and service quality. To remain viable,
34 overall prices must cover operational costs (Huang& Yu, 2020). The interplay between
35 transport demand and supply is complex, where transport supply can exist without an

36 immediate corresponding demand, but demand cannot occur without an adequate supply
37 (Hörcher & Tirachini, 2022).

38 In underdeveloped countries, individuals tend to opt for the most affordable and readily
39 available means of transport for mobility (Acheampong et al., 2020). Household income
40 significantly influences modal choices in urban areas, with a positive relationship observed
41 between income levels and traffic flow along waterways. Financial constraints inversely
42 impact the modal choices of citizens, indicating the influence of pricing on travel behavior
43 (Hörcher & Tirachini, 2021). Moreover, daily fare charges were found to have a significant
44 influence on waterways transport operations (Ayantoyinbo & Afolayan, 2023). This research
45 work would access an overview analysis of the ferry passenger's income on waterways
46 operations in Lagos state in relation to transport system efficiency and responsiveness. The
47 needs to provide a lasting solution to the problem of travel demand and supply, availability of
48 necessary facilities at the inland waterways terminal that will influence the rate utilization.
49 Based on the above empirical study, the researchers tend to test for the relationship between
50 ferry commuters' income and waterways operations.

51 **2. LITERATURE REVIEW**

52 **2.1 Conceptual Review**

53 Spatial interaction denotes a dynamic process of movement from one location to another,
54 encompassing the transfer of individuals, goods, services, or information in response to
55 localized supply and demand. This overarching concept includes various forms of
56 movement, such as intra-urban commuting, intercontinental migration, traffic in goods, and
57 the flow of intangibles like information. Spatial interaction is essentially a response to the
58 differentiation in the utilization of inland spaces for activities such as work, school, shopping,
59 and recreation. In the realm of transport studies, three fundamental concepts—
60 complementarity, intervening opportunity, and transferability—help explain the intricacies of
61 spatial interaction, as proposed by Jin Yang, Li, Sha & Wang (2021).

62 The concept of complementarity focuses on spatial interaction arising from area
63 differentiation. It considers two spatially separated areas or towns (y) and their interaction,
64 which is influenced by natural and cultural differentiations. Regions with abundant resources
65 may attract individuals seeking better opportunities in terms of work, housing, or education.
66 In the context of Lagos, for instance, inland water transport enables people to move to more
67 fertile and attractive places with greater opportunities due to high urbanization and
68 industrialization.

69 Intervening opportunity introduces constraints on the possibility of interaction between
70 two areas (x and y) due to alternative sources of supply from another area (z). In other
71 words, when considering potential movement between areas (y) and (x), there might be an
72 intervening origin or alternative destination in another area (z). Intervening opportunity
73 signifies the presence of alternative supply or demand, affecting spatial interaction between
74 two areas.

75 Additionally, transferability acts as a constraint on the movement of goods and
76 individuals based on distance. If the monetary cost or time required for a trip between the
77 origin and destination is prohibitively high, transferability becomes challenging. Even in the
78 absence of intervening opportunities, interaction is hindered if the cost of overcoming the
79 distance exceeds the travelers' willingness and ability to pay.

80 Ullman's spatial interaction concept provides a comprehensive understanding of spatial
81 interaction across various transportation facets, offering valuable insights into the dynamics
82 of movement and connectivity.

83 **2.1.1. Empirical Review of Relevant Studies**

84 Odekunle, Onabanjo, Agabi, Federal, and Adedini (2022) conducted an assessment of the
85 socio-economic characteristics of ferry passengers and the operation of ferry services in
86 Ikorodu Waterways, Lagos State. They employed descriptive techniques to estimate the
87 socio-economic characteristics of ferry patrons in Ikorodu waterways. Despite encountering
88 challenges in ferry operations, passengers preferred waterway transportation due to its
89 perceived speed, convenience, and reliability. The study recommended a focus on
90 enhancing the efficient operation of ferry water transportation to encourage greater adoption.

91 Kamal (2011) investigated the socio-economic characteristics and users' perceptions of
92 the intra-urban public transport system in Ayangburen Park, Ikorodu, Lagos State.
93 Spearman's rank correlation coefficient was used to analyze the relationships between
94 socio-economic characteristics and users' perceptions. The study found irregularity in overall
95 perceptions of the public transport system and recommended the rehabilitation of adjoining

96 roads by the government, along with appropriate subsidies from the local and state
97 governments to ensure sustainability.

98 Oluwole, Akintayo, and Ojekunle (2018) estimated the Private Cost of Commuting in
99 Metropolitan Lagos, focusing on socio-economic characteristics of commuting households.
100 The study revealed a poor understanding and underestimation of immediate costs of private
101 car use, such as travel time, stress, and maintenance. The researchers recommended
102 coordination between housing and transport policies, emphasizing the construction of
103 affordable houses near planned public transport hubs and improvements in areas with a high
104 number of moderate-income workers.

105 Ademiluyi, Afolabi, and Fashola (2016) analyzed intra-city water transportation in Lagos
106 State, utilizing descriptive statistical tools and Spearman's Ranked Correlation Analysis. The
107 study found an insignificant relationship between the frequency of travel, education, and
108 income of respondents. Recommendations included Public Private Partnerships (PPP)
109 initiatives and technological advancements to ensure the safe and efficient deployment of
110 water transportation systems.

111 Madhani (2019) highlighted the importance of strategic cost management for attaining
112 and sustaining a strategic competitive advantage. The focus is on anticipating and forming
113 cost structures, levels, and behavior patterns for products, processes, and resources.
114 Strategic cost management views products, processes, and resources as creative elements
115 for achieving a competitive advantage, emphasizing the need for information beyond
116 traditional cost management practices.

117 **2.2. METHODOLOGY**

118 This study used survey design and having Lagos State as study area. This research relied
119 on a well structured questionnaire survey with the helped of Cochran's sampling formula; the
120 total number of 836 questionnaires from the 1360 passengers using ferry service daily
121 between the hour of 7 am and 4: 30 pm was administered to ferry commuters. The authors
122 used snow balling sampling technique to administered 836 questionnaires at the inland

123 waterways terminals in Lagos State. However, the authors used both descriptive and
124 inferential statistical (Regression) test to identify which variables have impact on analyze this
125 study.

126 **3. RESULTS AND DISCUSSION**

127 The findings presented in Table 1 indicate that 367 respondents (44.9%) fell within the age
128 group of 31-40 years, with 193 respondents (23.6%) falling in the 41-50 age group.
129 Additionally, 117 respondents (14.3%) were in the 21-30 age group, while 80 respondents
130 (9.8%) were in the less than 20 age group. The remaining 61 respondents (7.5%) were
131 above 50 years old. These results highlight that a majority of the respondents belong to
132 active and productive age groups, actively engaging in various business activities and
133 contributing to the generation of trips. This underscores that mobility through ferry services is
134 primarily undertaken by individuals within these active age groups. Salisu (2022) supports
135 this, noting that the active age group tends to make more trips due to their diverse socio-
136 economic engagements. To effectively manage the increasing traffic for various socio-
137 economic activities, a functionally effective and efficient inland waterways transport system
138 that caters to all age groups is essential in the state.

139 Examining the educational background of the respondents in Table 1, a larger
140 proportion of the sample size had diploma education, constituting 292 respondents (35.7%).
141 Additionally, 247 respondents (30.2%) had higher education, and 103 respondents (12.6%)
142 held M.Sc qualifications. Furthermore, 114 respondents (13.9%) had secondary school
143 education, while 62 respondents (7.6%) had primary education. These results suggest that a
144 majority of the respondents possess the educational background to make informed decisions
145 regarding their choice of transportation. This aligns with the findings of Meena et al. (2019),
146 indicating that the majority of respondents travel with a purpose daily, contributing to
147 increased traffic flow along the waterways.

148 Table 1 also reports the years of work experience of the passengers. The table reveals that
149 319 respondents (39.0%) have 1-5 years of work experience, with 119 respondents
150 (14.57%) having between 6-10 years of experience. Moreover, 120 respondents (14.7%)
151 have between 11-15 years of work experience, and 122 respondents (14.9%) have between
152 16-20 years of experience. Additionally, 82 respondents (10%) have between 21-30 years of

153 experience, while the remaining 56 respondents (6.8%) have more than 30 years of work
 154 experience. These results indicate that a significant portion of the respondents in the study
 155 area have substantial work experience, contributing to their daily mobility using
 156 transportation facilities and suggesting that they can offer valuable insights into different
 157 types of transport systems in the study area.

158 **Table 1: Socio-Economic Characteristics of the Respondents**

Variable	Frequency	Percentage
Age of Respondents		
Less than 20yrs	80	9.8
21-30yrs	117	14.3
31-40yrs	367	44.9
41-50yrs	193	23.6
Above 50yrs	61	7.5
Total	818	100
Academic Status		
Primary	62	7.6
Secondary	114	13.9
Diploma	292	35.7
Degree/HND	247	30.2
M.Sc	103	12.6
Total	818	100
Work Experience		
1-5yrs	319	39.0
6-10yrs	119	14.5
11-15yrs	120	14.7
16-20yrs	122	14.9

21-30yrs	82	10
Above 30yrs	56	6.8
Total	818	100

159 **Source: Field Survey, 2023.**

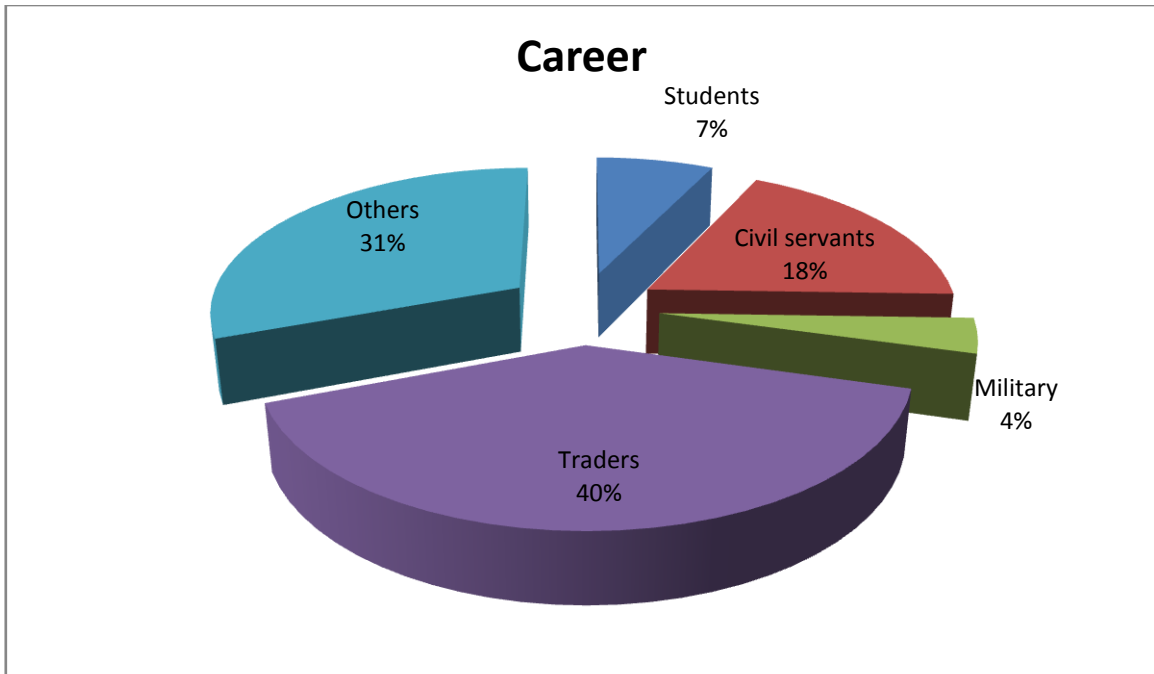
160 **3.2: Distribution by Respondents' Career**

161 Report from Table 2 presents data on the respondent's career. It showed that larger
162 proportion of the respondents are traders which constitutes 327 (40%) of the sample size,
163 followed by 251 (30.7%) of the respondents that are into other businesses. Also, 150
164 (18.3%) of the respondents are civil servants, 59 (7.2%) of the respondents are students
165 while the remaining 31 (3.8%) are military and paramilitary personnel. This indicates that
166 when talking about timely daily delivery, trader's finds waterways transport to reliable during
167 transport demand and supply in the study area.

168 **Table 2: Distribution by Respondents' Career**

Variables	Freq	Per
Students	59	7.2
Civil Servants	150	18.3
Military and para-military	31	3.8
Traders	327	40
Others	251	30.7
Total	818	100

169 **Source: Field Survey, 2023.**



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171 **Fig 1: Chart representing Respondents Career.**

172 **3.3. Passenger's/ commuters' Level of Car ownership**

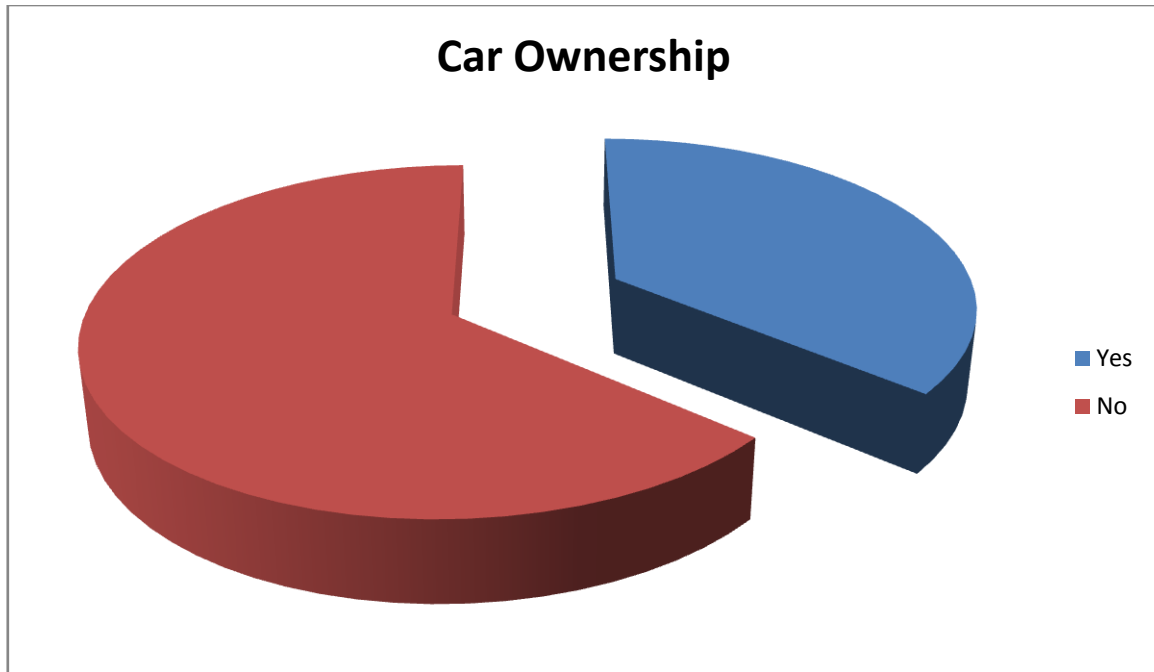
173 Table 3 showed that out of 863 respondents from the study area, 295 respondents that
 174 represent 36.1% of the sample size owns a car, while the remaining 523 (63.9%) of the
 175 respondents have no car. This implied that majority of the respondents rely absolutely on
 176 public means of transport for their daily activities.

177 **Table 3: Respondents' Car Ownership**

Variable	Frequency	Percentage
Vehicle Ownership		
Yes	295	36.1
No	523	63.9

178 **Source: Field Survey, 2023.**

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181 **Fig 2: Level of car ownership**

182 **Hypotheses Testing**

183 **Ho₁:**There is no significance relationship between socio-economic characteristic of
 184 commuters and ferry operating cost.

185 In an effort to analyze the influence of commuters' socio-economic characteristics on
 186 ferry operating costs in Lagos State, multiple regression analysis was conducted and
 187 presented in tables 4, 5, and 6. The results revealed that 69.9% of the variation in the impact
 188 of commuters' socio-economic characteristics on ferry operating costs in Lagos State could
 189 be explained by the multiple regression models. Consequently, the model was unable to
 190 account for only 30.1% of the variation. The statistical significance was confirmed by an F-
 191 value of 388.545, with a significance level of P=.05, as indicated in table 4. Furthermore, all
 192 examined variables were found to be statistically significant. The correlation coefficient R
 193 had a value of .699 (69.9%), while R² had a value of .488 (48.8%), and the adjusted R-
 194 square was .487. This indicates both the combined impact of independent variables on the
 195 dependent variable and the suitability of the data for the model.

196 The impact of commuters' socio-economic characteristics on ferry operating costs in Lagos
 197 State is detailed in Table 4, with these characteristics measured through independent
 198 variables such as commuters' car ownership and commuters' occupation. Among these
 199 variables, commuters' occupation exhibited the highest significant contribution to the
 200 dependent variable at 0.582 (58.2%), followed by commuters' car ownership, making a
 201 substantial contribution of .136 (13.6%) but less than the former variable. Passengers'
 202 occupation has a positive and significant impact on the ferry operation having highest t-value
 203 of 12.995 and a coefficient of 0.582, while passengers' car ownership has a t value of 3.044
 204 and a weak coefficient of 0.136. This indicates ferry passengers' occupation is a major factor
 205 that influence waterways operations in Lagos State.

206 This suggests that socio-economic characteristics, particularly the level of commuters'
 207 vehicle ownership and commuters' occupation, have a statistically significant impact on ferry
 208 fuel costs. This finding aligns with the perspective presented by Oluwole et al. (2018),
 209 asserting that improved fuel costs for ferry services correlate with a higher quality of service
 210 provided by waterways operators in the state.

211 Furthermore, this is in agreement with the findings of Ademiluyi, Afolabi, and Fashola,
 212 (2016) which states that commuters' socio-economic characteristic influences frequency of
 213 travel, mobility means and travel time. Thus, enhancing huge increase in traffic and the
 214 revenue generated along the waterways in Lagos State.

215 **Table 4: Model Summary of socio-economic characteristic of commuters and ferry**
 216 **operating cost.**

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.699 ^a	.488	.487	.53560

a. Predictors: (Constant), Passengers' Occupation, Passengers' Vehicle Ownership

217 **Source: Authors Field Survey, 2023.**

Table 5: ANOVA of socio-economic characteristic of commuters and ferry operating cost.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	222.925	2	111.462	388.545	.000 ^b
	Residual	233.800	815	.287		
	Total	456.725	817			

a. Dependent Variable: Cost of Fuel

b. Predictors: (Constant), Passengers' Occupation, Vehicle Ownership

218 **Source: Authors Field Survey, 2023.**

Table 6: Coefficients of socio-economic characteristic of commuters and ferry operating cost.

Model		Unstandardized		Standardize	T	Sig.
		B	Std. Error	d		
		Coefficients		Coefficients		
1	(Constant)	1.416	.067		21.241	.000
	Vehicle Ownership	.212	.070	.136	3.044	.002
	Passengers' Occupation	.341	.026	.582	12.995	.000

Dependent Variable: Cost of Fuel (Per Liter)

Source: Authors Field Survey, 2023.

219 **4. Conclusion**

220 Utilizing multiple regression analysis to comprehensively assess the impact of commuters'
 221 income on ferry operating costs; this study employed a snowballing technique to explore the
 222 correlation between ferry operating costs and commuters' income in the waterways of

223 Lagos. The empirical findings indicated a significant influence of ferry commuters' income on
224 operating costs. Notably, affordable transport fares, indicative of lower costs, were
225 associated with a substantial increase in patronage, leading to higher running costs for the
226 ferry.

227 Additionally, the research established that ferry operating costs tend to be lower when
228 the level of patronage is minimal due to commuters' income constraints. This suggests that
229 an increase in transport fare results in a reduction in waterway traffic. In essence, a higher
230 level of utilization corresponds to increased operating costs during efficient and responsive
231 mobility along waterway transport networks in Lagos State. It is noteworthy that the empirical
232 relationship between ferry operating costs and commuters' income in Lagos, Nigeria, as
233 determined in this study, differs from those observed in developed countries such as the UK
234 and US, where various promotional strategies are implemented to balance transport demand
235 and supply. This conclusion did not only contribute to waterways operations but to all
236 transport systems operations to promote mobility efficiency.

237 The study suggests that the government should consider subsidizing freight prices and
238 implementing policies that encourage the use of ferry services. Such measures aim to boost
239 traffic along inland waterways in the study area, ultimately enhancing the overall efficiency
240 and sustainability of waterway transportation.

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