Mode Choice Analysis of Inter-Island Passenger Travel from Iloilo to Negros Occidental, Philippines

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Abstract: Effectively managing inter-island travel is critical to the unified economic position of a country, especially for archipelagos like the Philippines, where inter-island travel directly affects the local economy, its capacity for development, and even its basic functions. To efficiently manage a transport network, it is important to understand how the travelling population makes their travel mode choices, just as much as the operating characteristics of the network itself. This can be done by conducting a mode choice analysis of the travel network. This study covers the development of a logit choice model, based on revealed preferences of the Iloilo-Negros Occidental travelling population. It was found that the main factors affecting travel mode choice are total time spent travelling on land and cost per unit time spent during the travel. It was also found that age and income class affect the behavior of the traveller as well.

Keywords: Inter-island travel; Mode choice; Logit modelling; Revealed preference;

1. INTRODUCTION

In the Philippines, inter-island travel is highly prevalent, considering it is composed of more than 7100 islands. In the Visayas region, inter-island travel is more common as compared to the Luzon and Mindanao regions, simply because of the number of islands composing it. Two major contributing provinces to this travel traffic are the provinces of Iloilo and Negros Occidental, being two highly urbanized provinces having populations of 2, 232, 195 and 2, 907, 859 respectively (NSO, 2010), and located at the heart of the Visayas region. With its capital cities separated by a distance of only 43.78 km, the two provinces are bound to share high travel demand between each other. Furthermore, with the Gross Domestic Product (GDP) increase of the region continuously rising from 3.5% to 5.5% from years 2010 to 2011 (NSCB, 2012), inter-island travel across the region can be expected to increase even further in the future.

The ferry route between Iloilo and Negros Occidental is one of the busiest in the Philippine archipelago. Various ferry operators offer different trip routes to travel this distance, giving the travelling population a number of options to choose from. With an average of 140 trips per week, the Fastcraft ferry (A) travel option caters to most of the demand. RORO (roll on roll off) (B) ferry travel, on the other hand, offering around 100 trips per week on the average, serves as an effective alternative. Still another, this travel can be made through inter-modal travel through the island of Guimaras. Iloilo-Guimaras passenger travel can be done using pumpboats in two ways. One is through Parola port in Iloilo to Buenavista in Guimaras (C), while the other through Ortiz wharf in Iloilo to Jordan in Guimaras (D). Land transportation across Guimaras island going to San Lorenzo wharf can be made through jeepneys, multicabs, and vans, with seating capacities of 24, 16 and 8, respectively. Guimaras-Negros Occidental travel can then be performed using pumpboats from San Lorenzo wharf going to Pulupandan in Negros Occidental, completing the Iloilo-Negros travel. These travel routes can be divided into four major operations (A, B, C, and D) as seen in Figure 2.

Figure 1. Location of Iloilo and Negros Occidental Provinces

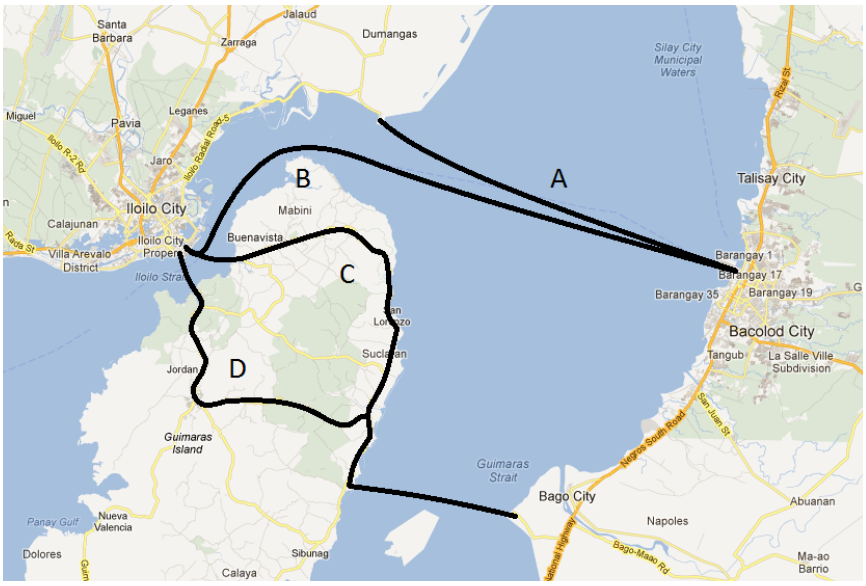


Figure 2. Major Iloilo-Negros Occidental Travel Routes

The basic travel options for the Iloilo City to Negros Occidental travel can be summarized into various categories as shown in Table 1, based on the data gathering performed. Based on the data shown, it can be seen that a great deal of the population uses the fastcraft ferry option (Route B), around 70.56% of the inter-island travelling population. This option has the shortest total travel time and does not involve intermodal transfers. However, this option is the most expensive among all options, which costs around more than twice the total travel costs incurred using the nearest alternative. This shows that the travelling population prioritizes travel time and comfort, in terms of the number of transfers, greatly over the travel cost. This is not uncommon, as established in numerous mode choice analyses of various transport networks around the world. However, with the anticipated increase in the demand, it is important to study how the travelling population would respond to various transport policy changes that may be applied to the inter-island transport network. Determining the bases for their travel mode choice would help in predicting the future demand across the various travel options.

Table 1. Iloilo-Negros Occidental Inter-Island Travel Options (Daily Basis)

<table>
<tr><th>Route</th><th colspan="2">Transport Mode</th><th>Average Number of Passengers</th><th>Average Number of Trips</th><th colspan="2">Average Total Travel Time [Hour]</th><th colspan="2">Travel Fare (per pax) [Php]</th><th>Transfers</th><th>Users</th></tr>
<tr><td rowspan="3">A</td><td colspan="2">PUJ, Van, Multicab [A-1]</td><td>-</td><td>-</td><td>1</td><td rowspan="3">3.65</td><td>25</td><td rowspan="3">130</td><td rowspan="3">2</td><td rowspan="3">1805 (28.40%)</td></tr>
<tr><td colspan="2">Tricycle [A-2]</td><td>-</td><td>-</td><td>0.5</td><td>25</td></tr>
<tr><td colspan="2">RORO (Roll-on Roll-off) [A-3]</td><td>95</td><td>19</td><td>2.15</td><td>80</td></tr>
<tr><td>B</td><td colspan="2">Fastcraft Ferry</td><td>195</td><td>23</td><td colspan="2">1.5</td><td colspan="2">335</td><td>0</td><td>4485 (70.56%)</td></tr>
<tr><td rowspan="5">C/D</td><td rowspan="3">Pump boat</td><td>[C-1]</td><td>41</td><td>140</td><td>0.33</td><td rowspan="5">3.88 / 3.5</td><td rowspan="2">14</td><td rowspan="5">154 / 134</td><td rowspan="5">3</td><td rowspan="5">66 (1.0%) {See note}</td></tr>
<tr><td>[D-1]</td><td>45</td><td>150</td><td>0.25</td></tr>
<tr><td>[C/D-3]</td><td>33</td><td>2</td><td>0.75</td><td>60</td></tr>
<tr><td rowspan="2">PUJ, Van, Multicab</td><td>[C-2]</td><td>-</td><td>-</td><td>2.75</td><td>80</td></tr>
<tr><td>[D-2]</td><td>-</td><td>-</td><td>2.5</td><td>60</td></tr>
<tr><td colspan="4"></td><td>Average</td><td colspan="2">3.1325</td><td colspan="2">188.25</td><td colspan="2"></td></tr>
<tr><td colspan="4"></td><td>Standard Deviation</td><td colspan="2">1.099</td><td colspan="2">98.395</td><td colspan="2"></td></tr>
</table>

Legend: - : Value does not affect the numbers being studied

Note: Value of "66 (1.04%)" is based on the assumption that all users of travel option C/D-3 originally came from Iloilo City. Otherwise, use value of "7 (0.11%)", based on the statistic that only 1 out of 10 of those using option C/D-3 originally came from Iloilo, in accordance to the statement made by the officiating body at the wharf hosting the said travel option.

This study characterizes the inter-island travelling population across the Iloilo-Negros traffic and their mode choices. Effectively understanding what the people want and how they make their travel mode choice can help in the planning and execution of transport policies, answering to the need for an efficient, affordable and reliable transport system. With recommendations on travel condition improvements based on the travellers' preferences, the population is bound to be satisfied. Hence, effective management of a transport network is best done by understanding the population using it and moving forward from there, always taking into consideration how they would respond.

Mode choice analysis involves characterizing the transport mode choice, taking into consideration the possible impacts of various travel parameters on the decision making process. By accounting for all possible significant variables in the transport mode choice, the travelling population can be effectively characterized. Mode choice analysis covers the relationship of variables not only with the travel mode choice but with each other as well, effectively characterizing the subject of the study being performed.

2. THEORY

In order to simplify the mode and route combinations and further limit the choice set, the route choice was divided into three parts: mode choice in going from the origin to the port, mode choice in inter-island travel, and mode choice in going from port to destination, completing the entire route choice. For the first and third components, the concept of the dominant mode was used, where for cases where intermodal transfers were made, the mode used for the longest time was used as the dominant mode. In the choice decision process, it is assumed that every public transport commuter follows the economic consumer theory, which states that when faced with a choice situation, an individual will choose to maximize his utility of travel. This utility can be expressed as given in the following equation

$$U_n(j) = V_{jn} + \varepsilon_{jn} \tag{1}$$

where V_{nk} is the part of the utility that can be measure by the modeller, also called the deterministic or observable component; and ε_{nk} represents those components unobservable to the modeller, also called the random component of the utility.

The former can be expressed as a function of the attributes of the alternative. The function $f(\beta_n, X_{jn})$ is free from any prior assumptions allowing linear formulation in the area of discrete choice modelling, such that the observed utility shall be simply $\beta_n X_{jn}$ (Rajaonarison, *et al.*, 2005). This is then divided into different variables having its own significance in the choice equation through its own coefficients in the utility equation, as seen in equation (2). The latter, on the other hand, is present in each of these variables, but were all accounted for through the inclusion of what is called the error component, as seen in equation (3), giving the final form of the utility equation as given by equation (4).

$$V_j = \beta_1 X_{j1} + \beta_2 X_{j2} + \cdots + \beta_n X_{jn} \tag{2}$$

$$U_n(j) = \beta_n X_{jn} + \varepsilon_{jn} \tag{3}$$

$$U_n(j) = \theta_{jn} + \beta_n X_{jn} + \varepsilon_{jn} \tag{4}$$

where θ_{jn} is the intrinsic utility of alternative j for individual n, β_n is a vector of parameters estimated for an individual n, X_{jn} is a vector of the attributes of alternative j for individual n, and ε_{jn} is a random error.

The inclusion of the random error, or unobserved utility, means that the deterministic choice now becomes probabilistic, leading to a random utility model. With this, the alternative with the highest observed utility shall have the highest probability of being chosen. The probability equation can be written as equation (5) where P(j) is the probability of choosing mode j for the inter-island trip.

$$P(j) = \frac{\exp(U_j)}{\sum_{j'=1}^{J} \exp(U_{j'})} \tag{5}$$

Given the requisite data, a logit model can be estimated that assigns a probability to an individual n travelling from origin A to destination B, choosing mode j. The model shall be able to capture the relevant variables that affect the utility, or benefit, of choosing a particular transport mode (Ewing *et al.*, 2004).

To quantify the significance of the variables, maximum likelihood functions are used as basis for deriving the estimators for the parameters. Maximum likelihood estimation represents the backbone of statistical estimation, with the Likelihood Principle stating that all the relevant information in the sample is contained in the likelihood function (Bierens, 2002). Stated simply, a maximum likelihood estimator is the value of the parameters for which the observed sample is most likely to have occurred (Ben-Akiva and Lerman, 1985). Ben-Akiva and Lerman continues that the likelihood of the sample can be written in a straightforward manner as a function of the parameters, in the form seen in equation (6), where the estimate for θ_N is solved for, to maximize L*.

$$L^* = \prod_{n=1}^{N} f(y_n|x_n, \theta) \tag{6}$$

The most widely used approach is to maximize the logarithm of L*, rather than L* itself. This approach is easier to perform and is acceptable, considering that it does not change the values of the parameter estimates, with the logarithmic function being monotonically increasing. This gives the form seen in equation (7).

$$\max_{\theta_N} \log L^* = \max_{\theta_N} L = \max_{\theta_N} \sum_{n=1}^{N} \log f(y_n|x_n, \theta_N) \tag{7}$$

In most cases, L will be continuous in θ_N, so if a solution for equation (7) exists, it must satisfy the usual first-order conditions given by equation (8).

$$\frac{\partial L}{\partial \theta_{Nk}} = 0 \qquad \text{for } k = 1, \ldots, K, \tag{8}$$

where θ_{Nk} is the kth element in θ_N.

However, since the preceding equations are necessary but not sufficient for a maximum of L, second-order conditions must also be checked. For any θ_N satisfying equation (8) to be a local maximum, the Hessian matrix ∇^2L, must be negative semidefinite when evaluated at θ_N. Among the solutions that satisfies this, the one for which the log likelihood function L is greatest shall be selected.

With the fundamental idea of statistics being that useful information can be accrued from individual small bits of data, estimation theory follows that not only will a summarized body of data contain information over that set of data, but will also reveal common features of the situation. Summary is the fusion of data used to expose similarities while comparison is the separation of data to show differences. Inferential theory is used to check the significance of both these processes, preventing possible errors due to limitation of the data set. Estimation is the theory that concerns making summaries of summaries and inferences, allowing probabilities and likelihood estimation (Efron, 1981). Estimation theory supports the maximum likelihood theory, which is the primary basis of the discrete choice modelling tool used in this study.

3. METHODOLOGY

The study was conducted in the Iloilo, Guimaras and Negros Occidental Provinces. Survey questionnaires were used to gather information on the travel preferences of the travelling population. The approach used to acquire the perceptions of the travelling population is

Revealed Preference surveys. This involves acquiring information on the travel mode choice of the individuals based on actual or observed events in real market. Revealed preference data represents events that have been observed to have actually occurred. It involves acquisition of the perceptions of the individual over the various parameters for all alternatives, both the chosen and non-chosen. It is used as a replication of the actual market share condition, given that the data is collected on a representative sample of the population. Ergo, a model developed based on revealed preference data can be used to model the actual market.

Respondents were interviewed while waiting at the ports/terminals of their chosen travel mode choice. The survey location points can be seen in Figure 3. These points are composed of ports/terminals offering inter-island transport options covered in the transport network. In Iloilo province, these points include two main locations: in Iloilo City and in the municipality of Dumangas. In Iloilo City, the survey locations are the following ports: fast craft terminals and the ferry boat wharves. In Dumangas, surveys were conducted in the Dumangas RORO Passenger Terminal. In Guimaras province, the survey points are at the port and wharves which are the entry and exit points going to and from the province. In Negros Occidental province, the survey points are port terminals in Bacolod City and in Bago City.

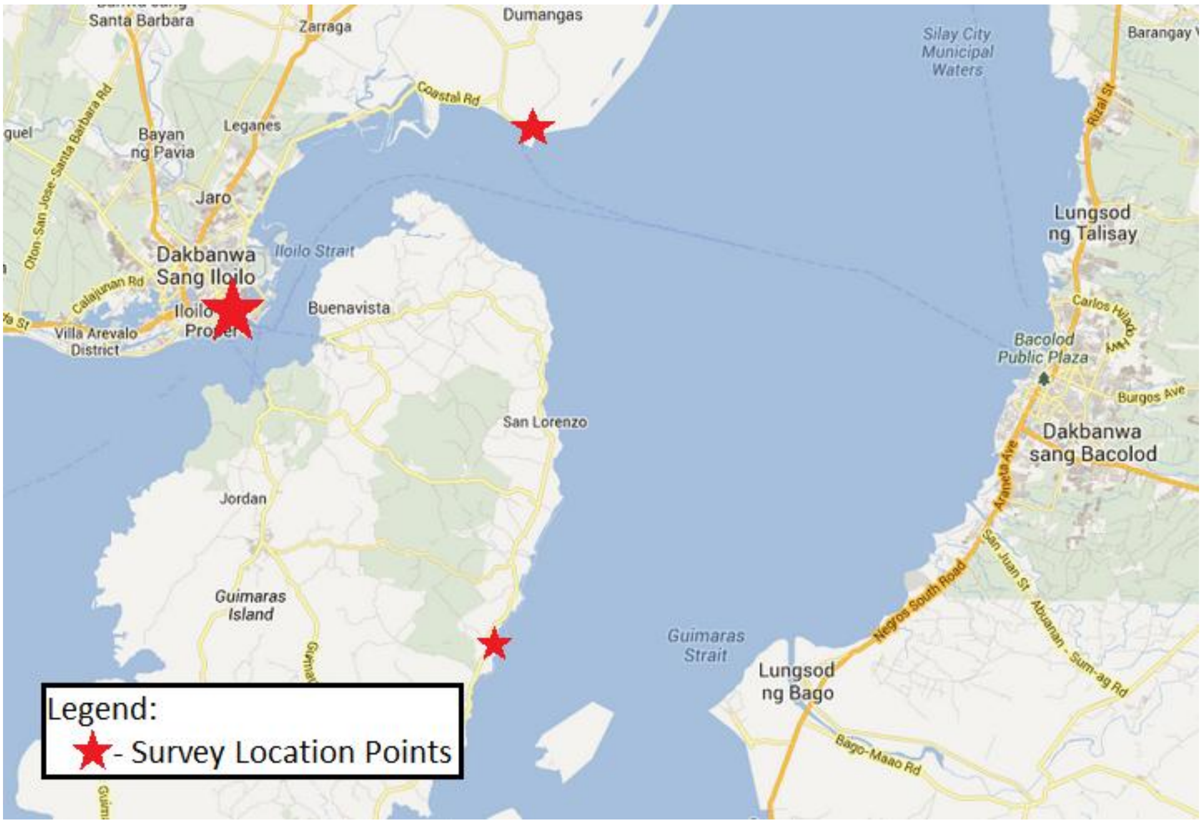


Figure 3. Survey Form Distribution Locations

The survey questionnaire included questions on trip characteristics such as trip purpose, trip origin and destination, transportation mode, access distance to/from wharves, among others. It also included the traveler's socio-demographic information such as gross monthly income, civil status, gender, age, etc. It also included information on travel cost and travel time that the traveler spent to complete the trip. Total travel time is the sum of the perceived processing and waiting time at the ports and in-vehicle travel time. As for travel cost, it includes the travel costs to and from the ports from the origin and to the destination respectively, in addition to the travel cost of the transport mode used.

The input data for each trip maker was notated as, Income (I), Travel Times (T), and Travel Costs (C). The travel time and travel cost variables were split into time differentials (ΔT) and cost differentials (ΔC). The rationale behind developing such differential variables is to include the marginal utility that a passenger gets when choosing a particular transport mode. In this way, the socio-economic characteristic of the trip maker (Income), trip characteristics (Trip Purpose), and the service characteristics (Time and Cost Differentials, Level of Comfort, Safety) can be considered individually.

The calibration of the model was done using the LIMDEP software, NLOGIT 4.0. Goodness of fit measures was covered by the software used as well, having rho-squared and chi-squared measures of the models. Choice based sampling was used in modeling the choice probabilities among the alternatives in the choice set. The variables included in the modeling process can be seen in Table 2.

Table 2. List of Modelling Variables Used

ALTIJ	Alternative id	MARRIED	Respondent married
CSET	Number of alternatives	NUM_CHL	Number of children of respondent
CHOICE	Choice taken	INCOME	Income of respondent
COM_VEH	Comfort in using alternative	COMORPR	Comfort in using mode used going from origin to port
PURWORK	Purpose of trip is work	T_ORPR	Time going from origin to port
PURVACA	Purpose of trip is vacation	C_ORPR	Cost going from origin to port
PURSCHL	Purpose of trip is school	COMPRDE	Comfort in using mode used going from port to destination
PURBUSI	Purpose of trip is business	T_PRDE	Time going from port to destination
PURHOME	Purpose of trip is home	C_PRDE	Cost going from port to destination
NUM_GRP	Number of people in group	TOTTIME	Total time using alternative route
CHL_GRP	Number of children in group	TOTCOST	Total cost using alternative route
FREQNCY	Frequency of travel	TOTCOM	Total comfort of using alternative route
USEDRT	Options that have been tried	TC_INC	Total cost divided by income
INVEHT	Estimated time using the alternative	C_TVEH	Cost divided by time using alternative
INVEHC	Estimated cost for using the alternative	C_TORPR	Cost divided by time going from origin to port
WAITTME	Waiting time at the port	C_TPRDE	Cost divided by time going from port to destination
AGE	Age of respondent	C_TTOT	Total cost divided by total time
GENDER	Gender of respondent	LNDTIME	Total travel time spent on land
SINGLE	Respondent single	SEATIME	Total travel time aboard a water vessel

4. RESULTS

4.1 Descriptive Statistics

A total of 1254 samples were gathered for the study. As seen in Figure 4 (a), of the 1254 samples, respondents aged 21 to 30 years old make up most of the respondents (39.952%).

Those aged 31 to 40 make up 22.648%. Those aged 20 and below, 41 to 50, and above 50 make up 13.716%, 11.563%, and 12.121%, respectively.

As shown in Figure 4 (b), the samples are distributed almost equally based on gender with 51.754% male and 48.246% female.

In Figure 4 (c), it can be seen that the respondents are distributed almost equally based on civil status as well, with single people making up 49.681% of the samples, and 46.81% and 3.509% for married and widowed/separated, respectively.

As shown in Figure 4(d), majority of the sample have incomes ranging from Php 3000.00 to Php 30000.00, with those belonging to the 6-10k bracket making up 20.893% of the respondents. Those belonging to below 3k, 3-6k, 10-15k, 15-20k and 20-30k brackets make up 10.048%, 17.145%, 16.667%, 12.44% and 11.962%, respectively. The 30-50k bracket make up 7.735%, while the 50-70k, 70-100k, 100-200k and above 200k groups make up the remaining 1.595%, 1.116%, 0.239% and 0.160%, respectively.

In Figure 4 (e), the distribution of the samples based on source is shown. A majority making up 60.128% were gathered from source B, while 33.254% and 6.619% were gathered from source A and C, respectively.

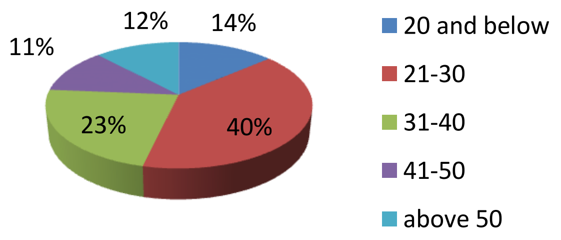
As seen in Figure 4 (f), majority of the respondents travel for vacation or home purposes, making up 33.333% and 39.474%, respectively. Those travelling for work, school, business and other reasons make up 11.244%, 2.153%, 6.619% and 7.177%, respectively.

As shown in Figure 4 (g), the respondents mostly travel once-a-year or once-every-6-months, making up 32.397% and 33.014%, respectively. Those travelling once-a-month and once-a-week make up 24.721% and 6.938%, respectively. Only 0.797% travel daily, while 2.233% of the respondents were travelling for the first time.

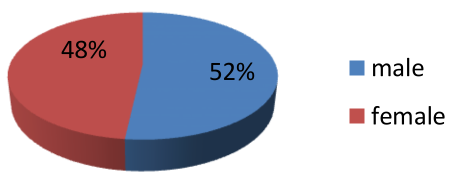
In figure 4 (h), it can be seen that of the 1254 samples, 619 (49.362%) have tried travelling using option A, while 877 (69.936%) have tried option B. 90 (7.177%) have tried using option C, while only 9 (0.718%) have tried using option D.

Figure 4 (i) shows the average perceived total travel times using the different options, summing the time going from origin to port, waiting time at the port, in-vehicle time, and time going from port to destination. It can be seen that option B is seen as the fastest option, taking approximately 220 minutes to travel across. Option A is viewed to be the next, approximately 310 minutes, while options C and D have approximate values of 450 and 360 minutes, respectively.

Figure 4 (j) shows the average perceived total travel cost using the different options, summing up the cost of going from origin to port, option specific travel cost and cost of going from port to destination. Option A is viewed to be the cheapest option, costing a total of approximately Php230.00. Option B, on the other hand, as the most expensive, costing around Php540.00. Approximate values for options C and D are Php310.00 and Php400.00, respectively.



(a)



(b)

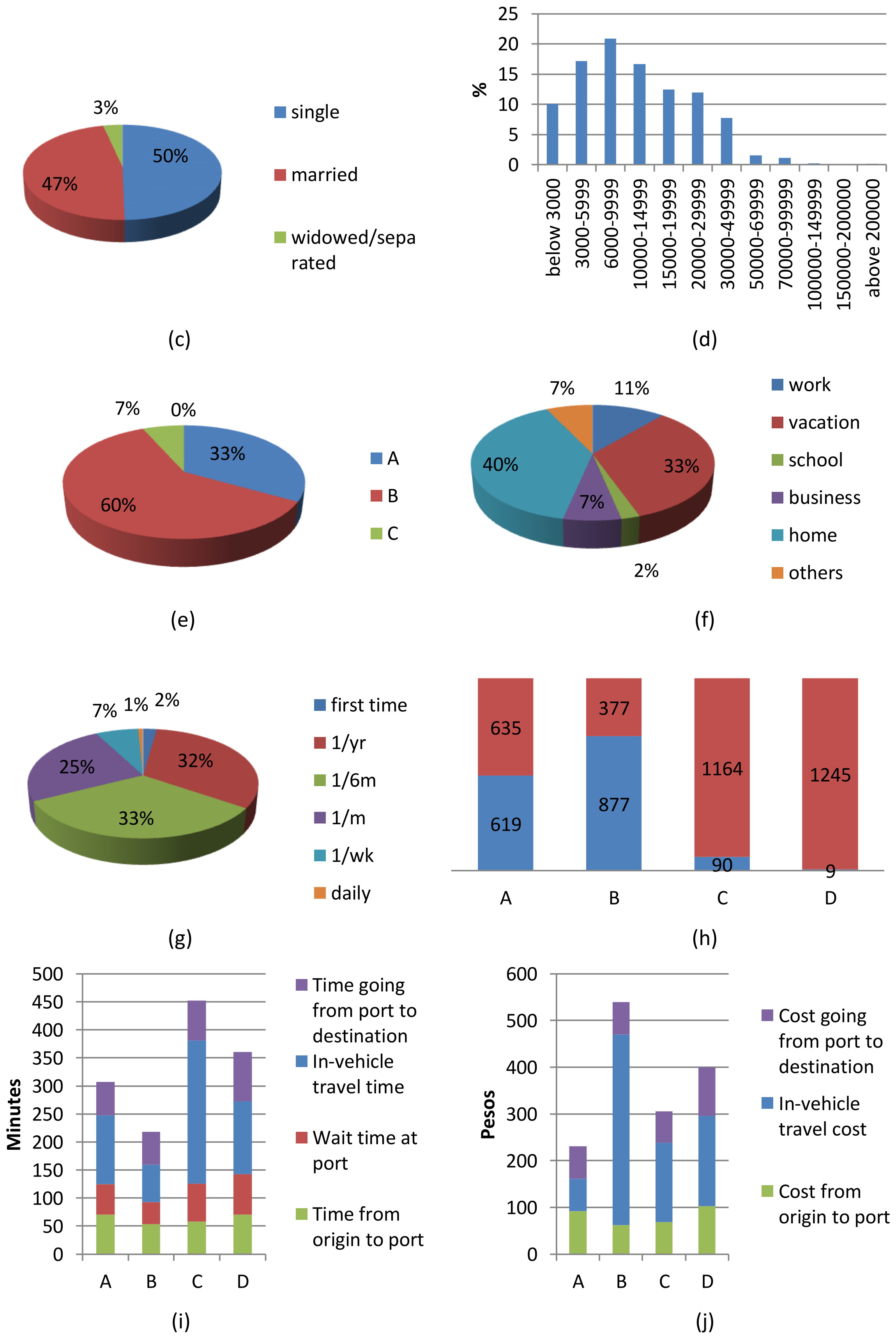


Figure 4. Descriptive Statistics of the Samples Gathered

Figure 5 (a) shows the distribution of the respondents based on option chosen and gender. It can be seen that the difference between genders do not vary much among the different options.

Figure 5 (b) shows the distribution of the respondents based on option chosen and age. It can be seen that for the three options, the distribution based on age varies greatly, having significant differences in values of contribution from different age groups.

Figure 5 (c) shows the distribution of respondents based on option chosen and income bracket. It can be seen that the distribution based on income class vary greatly as well, for all three options.

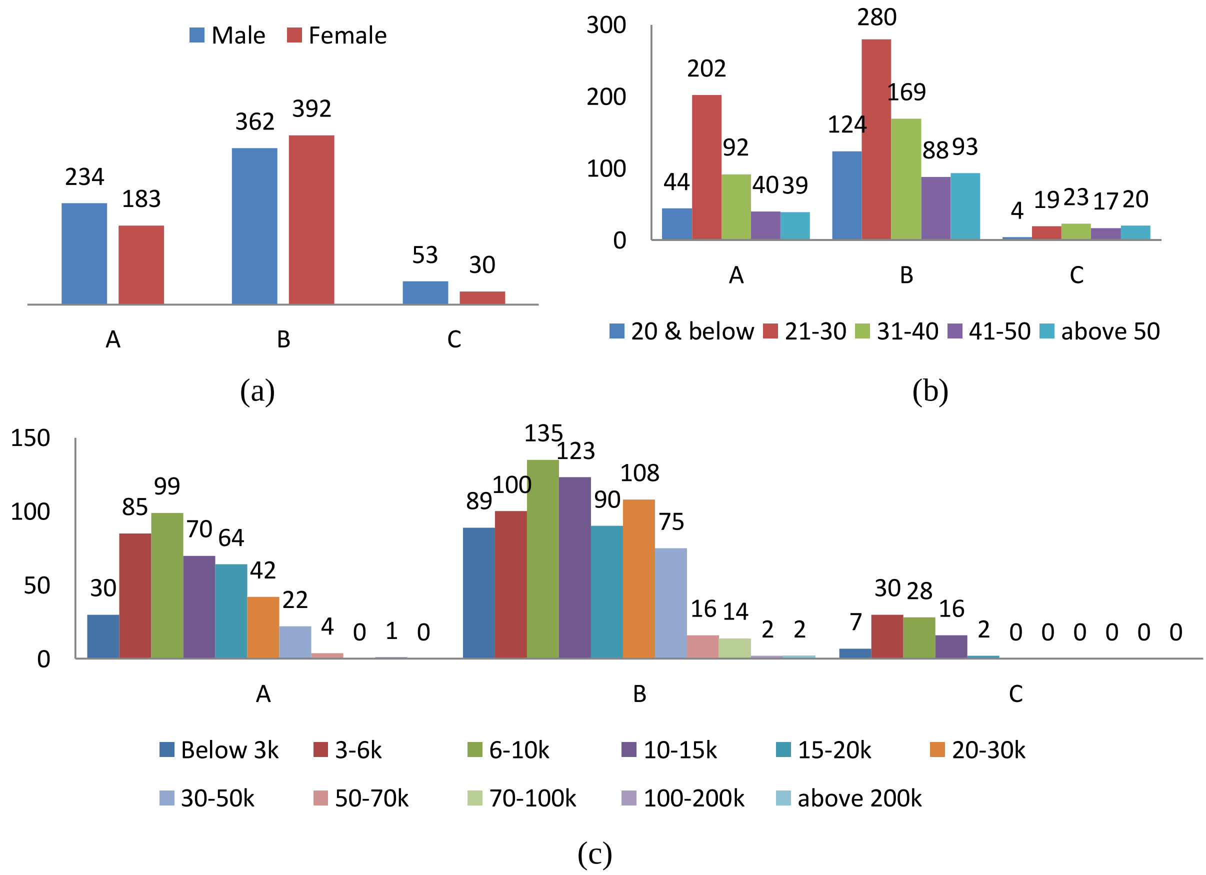


Figure 5. Histogram of Chosen Option Based on Gender, Age and Income Class

4.2 Logit Choice Model

In the modelling component of the study, Routes C and D were combined into one option covering both options using Guimaras as part of the travel route. This was done due to unavailability of samples using option D. The following multinomial logit (ML) models were developed using only three options, A, B and C.

Table 3. Multinomial Models Developed with its Variables

Variables	**Base Model**		**ML1**	
	Coefficient	**P - value**	**Coefficient**	**P - value**
A_A	1.61424561	.0000	1.86557595	.0000
A_B	2.20655176	.0000	2.49230392	.0000
LNDTIME			-.00242685	.0173
C_TTOT			-.00552845	.0002
AxINC1			.00010654	.0000
AxAGE1			-.05127068	.0000
BxINC2			.00012880	.0000
BxAGE2			-.05119851	.0000
Goodness-of-fit Measure				
Log Likelihood	-1068.047		-1004.278	

As seen in Table 3, for the ML1 model, LNDTIME and C_TTOT were used as general deterministic variables, while INCOME and AGE were used as option-specific deterministic variables. Going over the coefficients, it can be seen that LNDTIME and C_TTOT have negative signs, meaning the items are considered disutilities, which follows priori knowledge since these consider values spent by the individual. As for age AGE and INCOME, the coefficients have consistent negative and positive signs, respectively among the options.

Going over the p – values, all fall below the value of 0.05, meaning the variables included in the model are statistically significant. As for the Log Likelihood function, it can be seen that ML1 is considerably an improvement over the base model.

Table 4 shows the cross tabulation of actual versus predicted choices according to model ML1. Table 5 shows the accuracy of model ML1 in predicting the choice. Based on Table 5, it can be seen that model ML1 is approximately 50% accurate. Table 6 shows the direct and cross elasticities of the variables with respect to each of the alternatives.

Table 4. Cross Tabulation of Actual VS Predicted Choices

	PREDICTED				
ACTUAL	ALTERNATIVE	A	B	C	TOTAL
	A	**148**	243	25	417
	B	244	**465**	46	754
	C	25	46	**12**	83
	TOTAL	417	754	83	1254

Table 5. ML1 Accuracy in Predicting Choices

ALTERNATIVE	**PERCENTAGE CORRECT**
A	148 (35.49%)
B	465 (61.67%)
C	12 (14.46%)
ML1	625 **(49.84%)**

Table 6. Direct and Cross Elasticities

VARIABLE	**LNDTIME**			**C_TTOT**		
ALTERNATIVE	A	B	C	A	B	C
A	-.304	.225	.066	-.169	.413	.015
B	.143	-.144	.066	.083	-.283	.015
C	.143	.225	-.934	.083	.413	-.210

The resulting utility models of the alternatives based on model ML1 are as follows:

$$U_A = -.00242685 * LNDTIME - .00552845 * C\_TTOT + .00010654 * INCOME - .05127068 * AGE + 1.86557595 \quad (9)$$

$$U_B = -.00242685 * LNDTIME - .00552845 * C\_TTOT + .00012880 * INCOME - .05119851 * AGE + 2.49230392 \quad (10)$$

$$U_C = -.00242685 * LNDTIME - .00552845 * C\_TTOT \quad (11)$$

4.3 Discussion of Findings

In the development of the model, it was found that gender is not statistically significant. This can be attributed to the distribution of the respondents by sex, among all the options. There is no indication of any gender having a higher preference to any option.

On the other hand, income and age were found to be statistically significant. This can be explained by the distribution of the respondents based on income class and age, respectively, among all options. It can be seen that the income and age brackets show an effect to the choice. Among those of the same income or age bracket, there is a different distribution among the alternatives, showing the higher preference to one option over the others.

Time and costs going from origin to port, using the alternative, and going from port to destination modelled separately were found to be statistically insignificant. This is an indication of how the choice is based more on the bigger picture, in terms of totals. In the model, the cost per unit time variable that was found to be statistically significant is based on total cost and total time incurred for every alternative.

Waiting time at the port was found to be statistically insignificant as well. This can be attributed to it being relatively similar among all the options.

As for the elasticities of the variables, it can be seen that option B is the least sensitive to the change in total travel time in land, with option A next, and option C far extensively sensitive. This can be explained by the fact that option B currently does not involve much land travel, so extending it by a percent of the current value does not really affect the probabilities. However, for options A and C, especially for option C where most of the travel is done on land, an increase of a percent of the current travel time spent on land is found to cause a significant change in the probabilities.

As for elasticities of the cost per time variable, option B is the most sensitive, with option C next, and option A the least. This can be attributed to a percent increase of the cost per time value for option B being relatively higher than those of the other two. However, it can be seen that the effects are not drastically different among the three options. This can be explained by the fact that the variable being considered is a value considering both cost and time which balances out the differences among the alternatives, for example, the high cost of option B for a short travel time is accounted for by the low cost of option C for a longer travel time.

5. CONCLUSION

It was found that the significant factors the travellers take into consideration in their decision making process are LNDTIME (total time spent travelling on land) and C_TTOT (total cost per time spent for travel). The former can be explained by all the factors that may contribute to the discomfort experienced by the individual when travelling on land, e.g. traffic delays, pollution, noise, among others. Compared to time spent aboard the sea vessels, that spent riding land vehicles is considerably more energy-consumptive, with all the discomfort coming from inter-modal transfers, lane-changes, stops and turns at road intersections, and possibilities of accidents and/or other human-influenced disturbances to flow of traffic. The latter, on the other hand, can be explained as the individual's perception of his/her money's worth. It is a value indicating the marginal disutility of cost per unit of time spent. It can be accounted as the unit cost for every unit time it takes to complete the trip.

It was found that those with higher income has higher tendency to choose option B, then A, with option C last, based on the coefficients of the variable INCOME. This can be interpreted as the individual's capacity to pay. Those with higher income are less sensitive to travel cost; they are more sensitive to other factors like travel time and comfort. As for AGE, it was found that older individuals are more likely to use option C than the other two. This can be interpreted as the decrease in sensitivity to time as the individual grows older. With older people less likely to be in a hurry, time is understandably not as much a major factor as cost.

In conclusion, it can be noted that the models developed followed the expected outcomes with regard to the signs of the coefficients of the variables, taking time and cost spent as disutilities to the individual. Furthermore, the apparent effects of income and age of the individual can be considered acceptable. However, the model is found to be approximately 50% accurate only, which could still be improved.

Moreover, no indication of significance of trip purpose has been found in the model development process. This can be interpreted in two ways: 1) the sample gathered does not represent the various trip purposes effectively, or 2) the behavior of the individual is consistent among the different trip purposes. If ever the former is proven to be more true, the findings in this study can still be considered acceptable for VACATION and HOME trips, as these were considerably significantly represented in the samples gathered.

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