Inter-Island Travel Mode Choice Analysis: Western Visayas Region, Philippines

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Abstract: The Western Visayas region is located at the central part of the Philippines. Due to its geographic orientation, the Panay-Guimaras-Negros inter-island bridge project which aims to foster economic growth is currently proposed. Because of this enormous and capital-intensive proposal, a study that will address the passengers' behavior on mode choice is needed. There are four main alternatives in travelling from Panay to Negros. In this study, mixed logit models were estimated to determine significant factors affecting mode choice. A total of 1,813 samples were used in this study. Analyses have shown that travel time, travel cost, and trip purpose affect mode choice. Preference heterogeneity around the mean parameter estimate of travel time has also been determined where gender, age, and income class were identified as the possible sources of heterogeneity. This is particularly important for planners to be more accurate in accounting for benefits in the cost-benefit analyses of proposals.

Keywords: mixed logit, inter-island transport, revealed preference, mode choice

1. INTRODUCTION

The Philippines is a developing country and therefore needs to make the most out of its limited public resources. According to the Department of Budget and Management which prepares the overall resource application strategy of the government, a total of 213.5 billion pesos or approximately 10% of the 2.265 trillion 2014 national budget is allocated to the Department of Public Works and Highways, which is responsible for the planning, design, construction, and maintenance of public infrastructure. From this share, approximately 38% is allocated to the regional offices. Region 6 or the Western Visayas region receives the second largest share next to Region IVA adjacent to the National Capital Region (NCR). According to statistics, the population of the Philippines is constantly growing at approximately 2% per annum. This means that there is constant pressure in the road planning sector from the increasing demand in transportation. Effective management of the transportation network is critical in order to stimulate good economic performance of a country. For an archipelagic country like the Philippines, a seamless transportation network is needed in order to achieve a *unified well-integrated economy* where goods and services are transported efficiently (Burgos, 2012). Despite the need for transportation studies that would cater to the less developed regions of the country, much of the focus is on urban areas.

The Western Visayas region is located at the central part of the Philippine archipelago. It consists of three main land masses with six provinces namely Aklan, Antique, Capiz, and Iloilo in the island of Panay, Guimaras in Guimaras island, and Negros Occidental in the island of Negros, as shown in Figure 1. This region has a significant contribution to the gross domestic product (GDP) and along with its increasing growth rates in the past years; it may significantly help in strengthening the nation's economy. The region is also a tourist destination with the world-famous Boracay beach, Guimaras island home of the sweetest mangoes, and cultural festivals like *Dinagyang* in Iloilo, *Ati-atihan* in Kalibo, and *Maskara* in Bacolod. Due to its geographic orientation, an efficient inter-island transport system is necessary to foster economic growth since accessibility is a determining factor. The Panay-Guimaras-Negros (PGN) inter-island bridge project is currently being proposed which intends to connect the three main islands of the region. The proposed bridge is a megaproject due to its enormous size and colossal capital investment required. It is important to determine whether such an enormous undertaking is feasible or not. The first step to address would be to understand how the passengers in the area choose their modes of travel. The factors that influence these choices need to be identified as well thus, a study that will look into inter-island passenger mode choice is essential.

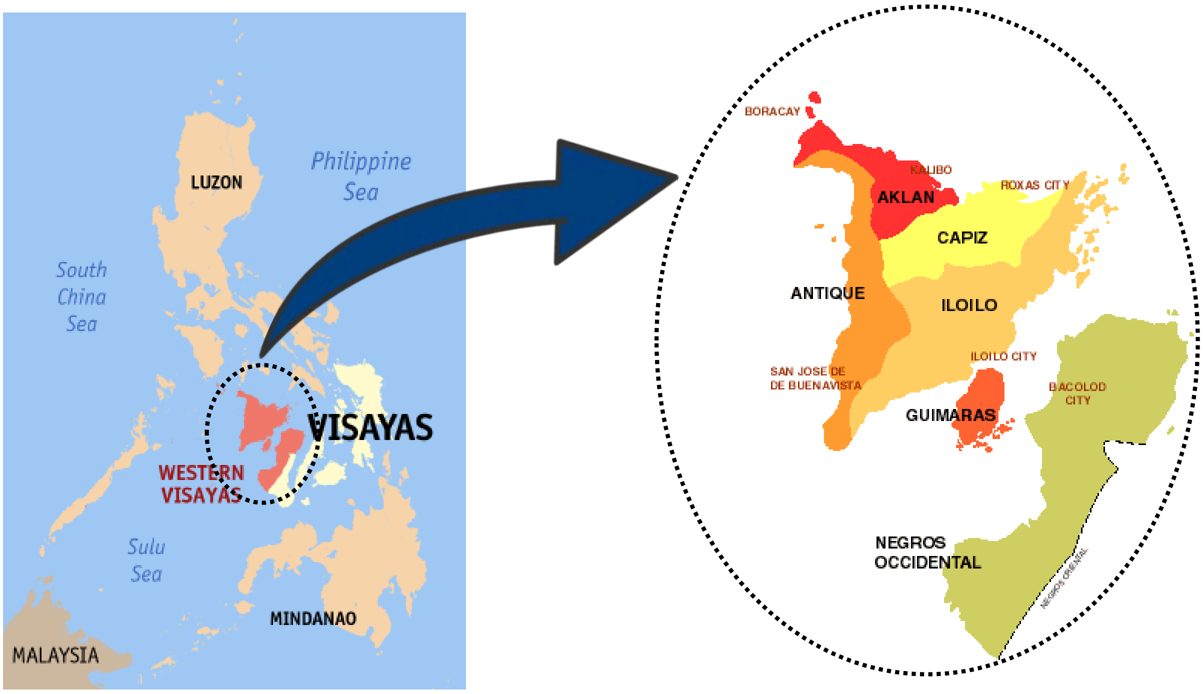

Figure 1. Map of Western Visayas (Region VI)

This study aims to formulate mixed logit models (ML) which will look into the factors that significantly affect mode choice for the inter-island passenger transport in the Western Visayas region. The model formulated may also reveal the presence of preference heterogeneity around the mean of a randomly specified parameter. This is done through the verification of the significance of estimated standard deviation parameters and/or the interaction of the randomly defined parameter with other variables.

This paper is organized as follows. First, a review of literature is presented to describe the landscape of logit choice modeling. Next, the methodology for the mixed logit model is explained followed by the results and discussions. Finally, conclusions were made supplemented with recommendations.

2. REVIEW OF RELATED LITERATURE

Logit choice modeling is essential in investigating discrete choice problems. Progress in logit modeling started in the 1960's until the 1970's (Hensher and Greene, 2003; Hensher, *et al*., 2005). Currently, the multinomial logit (MNL) model is the simplest, most practical, and most popular discrete choice model available (Ortuzar and Willumsen, 2011). It adheres to the utility maximization theory (Hess, 2005). The simplicity of the MNL model comes with a limitation. MNL models assume that the error terms are independent and identically Gumbel-distributed (IID Gumbel). This is the most restrictive assumption of the MNL model since it requires the random terms of the utilities to be homoscedastic (Hensher, *et al*., 2005). Another important assumption of the multinomial logit model is the independence from irrelevant alternatives (IIA) property. This property implies that the ratio of the probabilities for choosing between two alternatives is independent of the addition of a new alternative or changing the attributes of the other alternatives (Small and Hsiao, 1985). Violating this property may lead to invalid estimators thus, incorrectly predicting the probabilities of choosing the alternatives (Hensher, *et al*., 2005).

As mentioned earlier, MNL model is among the most popular choice models today. However, MNL choice models have three main limitations and ML solves them all. Mixed logit permits *random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time* (Train, 2009). It can tackle circumstances wherein respondents in the sampled population who have the same socio-economic characteristics would choose differently. The technique can also check for the presence of taste variation in the observations (Tudela and Rebolledo, 2006). Mixed logit has long been developed. However, it only became invaluable with the introduction and utilization of simulation through the use of computers. It is the most advanced discrete choice method available to transportation planners today. The method is developed by Geweke and improved by McFadden *et al*. (Hensher and Greene, 2001). It introduces random terms specified in the indirect utility in order to accommodate random taste variations present in the observed sample, which is not a feature of the ordinary MNL model (Tudela and Rebolledo, 2006). It is said that ML model may approximate any choice probabilities of any discrete choice model that is based on random utility maximization (McFadden and Train, 2000).

Heterogeneity in transportation demand among the population is taken into account by the disaggregate nature of discrete choice models. The search for the model which best fits the condition being analyzed starts with the specification of the systematic component of the utility function (Cherchi and Ortuzar, 2003). To be able to best capture heterogeneity, the analyst may either estimate separate models by dividing the population into several segments with sufficient sample size or estimate random parameters, which is the realm of mixed logit modelling (Fosgerau and Bierlaire, 2007). Mixed logit models may accommodate correlated and heteroskedastic alternatives and random taste variations in the data. Such type of models may also increase the explanatory power and modelling accuracy of the specification (Sillano and Ortuzar, 2005; Hess and Polak, 2005). Santos (n.d.) added that mixed logit models may avoid problems in estimation that yield illogical parameter signs. However, more complex models do not guarantee a better fit (Cherchi and Ortuzar, 2003). High quality data is needed despite the advances in modelling techniques (Hensher and Rose, 2007). This is especially true for mixed logit modelling in order to take advantage of its modelling capabilities (Hensher and Greene, 2003).

There are two different approaches to specifying ML models (Hess, *et al*., 2004). The first and more commonly used method is the random coefficients logit (RCL) which is capable of accommodating random taste variation across decision-makers while the other method is known as error components logit (ECL). According to the report of Hess, *et al*. (2004), there are several concerns that emerge when specifying ML models. Among them are the choice of which coefficients should be specified as random, the choice of distribution for the coefficients, and the interpretation of the random coefficients. Among the many attributes affecting mode choice, travel time has been repeatedly modelled as a random parameter in several studies (Hess, *et al*., 2004; Algers, *et al*., 1998; Cirillo and Axhausen, 2006). Fosgerau and Bierlaire (2007) warned, however, that a wrong choice of mixing distribution may lead to *extreme bias* in the estimate which led them to develop a technique that will test the appropriateness of a particular mixing distribution. The test is only capable of testing for a single random parameter in the model specification (Fosgerau and Bierlaire, 2007).

In a study by Sillano and Ortuzar (2005), they suggested that a model with coefficients that are all specified to be random becomes unstable. Therefore, in the current study, the random parameters in the models are tested and added one at a time. In including socio-economic variables for the specification of the utility function, Cherchi and Ortuzar (2003) recommended that interaction terms between level of service and socio-economic variables be used instead of a linear specification. Also note that according to Cherchi and Ortuzar (2003), only income is justified to be included in the systematic utility specification since other socio-economic variables serve to divide the population into different subgroups and serve as proxy for other unobserved components.

3. METHODOLOGY

Mixed logit is discussed extensively in Train (2009) and (Hensher, *et al*., 2005) and is reviewed concisely as follows. It is assumed that a respondent (n = 1, …, N) in the sample is confronted with a choice of J alternatives in each of T choice situations. These utilities are expressed in the following form.

$$\boldsymbol{U_{jtn} = \sum_{k=1}^{K} \beta_{nk} x_{jtnk} + \varepsilon_{jtn} = \beta'_n x_{jtn} + \varepsilon_{jtn}} \quad (1)$$

where x_{jtn} is the vector of explanatory variables considered by the modeler and the IID assumption is imposed on ε_{jtn} across respondents, alternatives, and choice situations. A *stochastic* term is added to β_n that may be *heteroskedastic* and *correlated across alternatives* in order to overcome this restrictive assumption such that,

$$\boldsymbol{\beta_{nk} = \beta_k + \delta'_k z_n + \eta_{nk}} \quad (2)$$

where η_{nk} is an additional random term which may vary across choices and respondents. Furthermore, η_{nk} may assume various distributions such as normal, lognormal, uniform, or triangular. For any value of η_n, the conditional probability of choosing j is given as

$$\boldsymbol{L_{jn}(\beta_n | X_n, \eta_n) = exp(\beta'_n x_{jn}) / \sum_j exp(\beta'_n x_{jn})} \quad (3)$$

This is very much like the MNL except that the additional information in η_n of each respondent is included. The expected value of this probability across all possible values of

β_n gives the unconditional choice probability with the following form. The integral in the right-hand side of this expression may not yield an exact solution and is approximated by simulation.

$$P_{jn}(X_n, z_n, \Omega) = \int_{\beta_n} L_{jn}(\beta_n | X_n, \eta_n)\, f(\eta_n | z_n, \Omega) d\eta_n \quad (4)$$

This expression is the ML model which does not exhibit the IIA property. This problem is addressed by the fact that each β_n is treated as a random parameter which varies across observations (Washington, *et al*., 2003). The standard deviation of β_n allows for heterogeneity in the sample. This same effect may also be accomplished through proper data segmentation which is problematic.

4. STUDY AREA

There are several ways by which one can travel around the Western Visayas region, specifically, between the islands of Panay and Negros as shown in Figure 2. The Panay-Guimaras-Negros (PGN) inter-island bridge project is currently being proposed to connect the three main islands of the region. Because of its enormous capital investment required, researches that will be helpful in assessing its viability are encouraged.

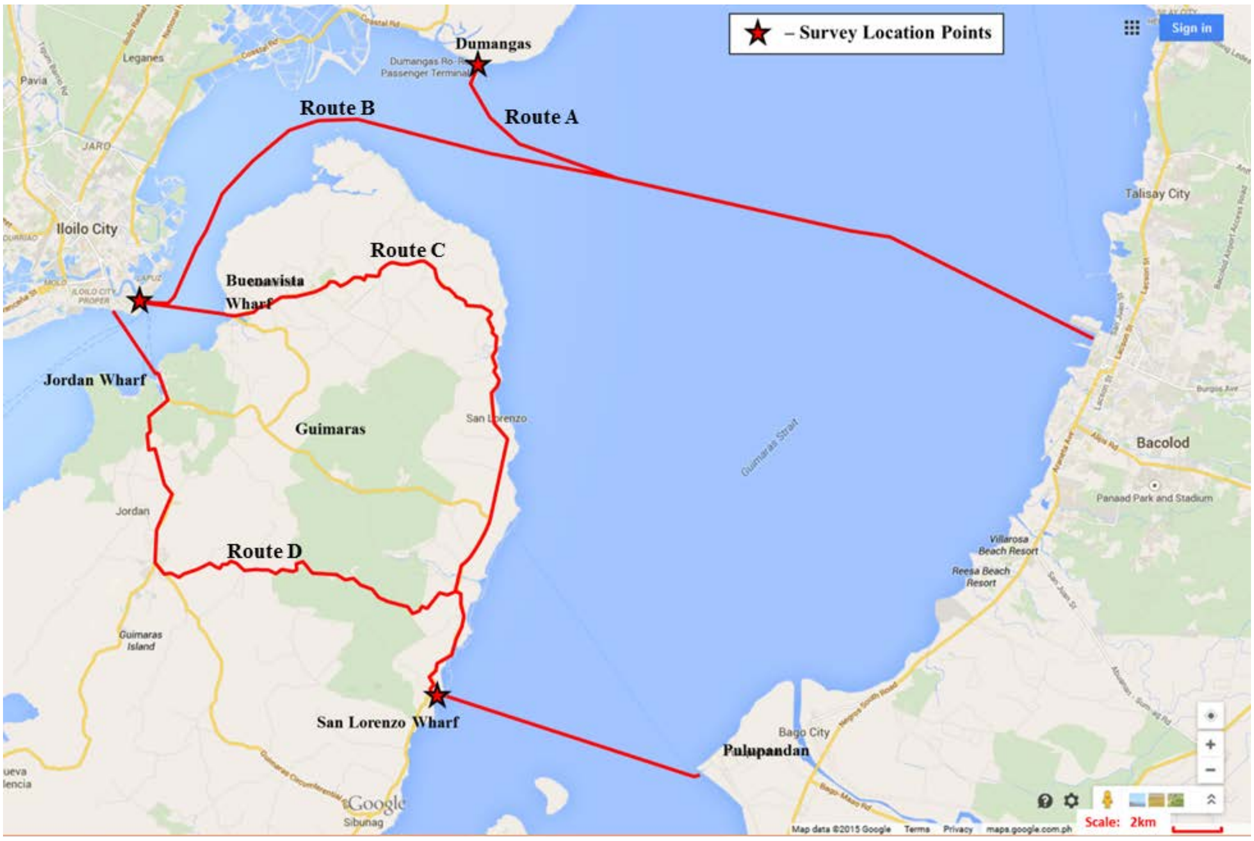

Figure 2. Map of Western Visayas (Region VI)

Roll-on/Roll-off (RORO) services and fast craft ferry operations provide direct link from Panay island to Negros and vice versa. RORO services between Iloilo and Bacolod

(Route A) are available every two to three hours, day and night. The Panay port is located in the town of Dumangas, about 29 km north of Iloilo City. There are also fast craft ferry operations (Route B) between Iloilo City and Bacolod City as seen in Figure 2. The ferries are operated by three shipping companies. These three companies combined are responsible for providing 20 trips per day per direction from 6:00AM until 6:30PM.

Another option in going from Iloilo to Bacolod is to pass through the island of Guimaras where pump boats generally leave the wharf every 15 minutes. There are two ways to traverse the island of Guimaras from Iloilo. One way is to go via the Buenavista route (Route C) and the other one is through Jordan (Route D) as seen in Figure 2. Both of these routes converge in San Lorenzo where two daily pump boat trips take the passengers from San Lorenzo, Guimaras to Pulupandan in Negros Occidental. Pulupandan is approximately 29 km south of Bacolod City. For purpose of this study, the two routes traversing Guimaras are merged into one. This is due to the small number of passengers passing through Guimaras. Also, the travel time through Guimaras of these routes are almost identical.

Inter-island passenger travel alternatives from Iloilo to Bacolod are shown in Table 1. The values indicated in the table were collected from the different boat terminals through interviews of terminal staff members. This study is limited only to the mentioned direction of travel. It can be seen that the fast craft ferry in Iloilo City serves more passengers on a daily basis due to its larger passenger capacity and slightly more frequent trips than the RORO. The fast craft ferry is also faster as compared to the RORO, however, the fare for the fast craft ferry is almost four times more expensive than that of the RORO that docks in Dumangas. However, the cheap RORO fare may be offset by the longer access time and higher access cost because of its port location, which is approximately 29 km north of the city.

Table 1. Iloilo - Negros Occidental inter-island main travel options

Transport Mode	**Average Number of Passengers per trip**	**Average Number of Trips per day per direction**	**Average Travel Time [*Hour*]**	**Travel Fare [*PHP/pax*]**	**Modal Share**
RORO (Roll-on Roll-off) [Route A]	95	19	2.25 *Dumangas-Bacolod City*	80	28%
Fastcract Ferry [Route B]	195	20	1.5 *Iloilo City-Bacolod City*	335	70%
Pump Boat [Route C/D]	33	2	4.5 *Iloilo City-Pulupandan*	135	2%

The average travel time for RORO and fastcraft ferry, as seen in Table 1, only includes sailing time. These were obtained through interviews and actual survey. As for the two pump boats via Guimaras alternatives, the average travel time includes the sailing time from Iloilo City to Guimaras Island, land travel, and sailing time from San Lorenzo to Pulupandan. Note that the travel times for these two alternatives are almost identical and the values were obtained through surveys. The access and egress times and costs of these ports were obtained through the administered survey questionnaires.

5. RESULTS AND DISCUSSION

For this research, questionnaire surveys were administered from February to July 2014 in the port terminals of Iloilo province that are located in Iloilo City (fastcraft) and in the municipality of Dumangas (RORO), as well as the wharf in San Lorenzo, Guimaras as seen in Figure 2. The questionnaires were shown to the respondents and the surveyors were the ones who filled up the information. The socio-demographic characteristics of the respondents were gathered. Information such as the income, social status, number of cars, among others is compiled through the survey instrument. The trip characteristics, modal attributes, and the preferred transport mode of the respondents were noted as well. Finally, the origin, destination, travel purpose, and associated components of travel time and costs for each of the water transport alternatives were gathered.

A total of 1,813 samples were used in this study where 37% of the samples used the RORO, 59% used the fastcraft, and 4% used the pump boats. The number of questionnaires distributed to the different passenger terminals was proportioned to the actual modal shares while the respondents in each of the terminals were chosen at random. These values may be compared with the actual modal shares in Table 1. This study limits the case where the direction of travel of respondents is from Panay Island going to Negros Island. Table 2 illustrates the percentage distribution of trips according to the inter-island travel options of the respondents. It can be verified that most of the trips are either to take vacations or to go home.

Table 2. Percentage Distribution of Trip Purpose According to Travel Mode

	RORO	Fastcraft	Pumpboats via Guimaras	Overall
Work	8.33	15.33	2.56	12.19
Vacation	50.00	24.18	34.62	34.20
School	2.38	3.57	1.28	3.03
Business	9.82	6.49	1.28	7.50
Home	23.21	43.93	58.97	36.90
Others	6.25	6.49	1.28	6.18
Sample size	672	1063	78	1813

The average age of the respondents is about 32 years old where there are an almost equal number of male and female sampled passengers, 51% and 49% respectively. The number of single and married respondents is almost identical, 52% and 48%. An average income of 15697.74PHP is derived from the whole sample. Sampled RORO users have an average income of 14637.65PHP; fastcraft passengers have 16972.72PHP, while the pump boat users through the Guimaras Island have a monthly income of 7455.13PHP. Lastly, the mean group size of travelers is 2.37 persons. Shown in Table 3 is the distribution of respondents depending on their travel frequency. It can be observed that almost 60% of the respondents travel either on an annual or semi-annual basis. Monthly travelers account for approximately 26% while only a small fraction can be attributed to daily and first time passengers.

Table 3. Travel Frequency Distribution of Respondents According to Travel Mode

	RORO	Fastcraft	Pumpboats	Total
Once a year	262	292	16	570
Twice a year	194	295	31	520
Monthly	146	308	25	479
Weekly	60	123	4	187
Daily	1	9	0	10
First time	9	36	2	47
Total	672	1063	78	1813

From the values provided by the respondents, the mean values of the different time and cost components of their trips were calculated. Table 4 illustrates the mean values according to the three modes. It can be seen that the fastcraft is the fastest and also the most expensive travel option from Panay Island to Negros. The average ferry time of RORO is almost two hours while the pump boats through Guimaras take about 2.5 hours. The mean waiting time for pump boats is almost twice that of the values of RORO and fastcraft. RORO has the highest access time while the fastcraft and pump boats, with terminals in the city, have small access times. The mean egress travel time shows that the RORO and pump boat passengers still have 40 minutes of travel time while the fastcraft passengers take 50 minutes to reach their destination. With respect to cost, the RORO has the largest access cost due to the port terminal location which is 29km north of Iloilo City. The pump boats have the cheapest egress cost followed by RORO and the fastcraft. Taking the mean total travel time, it can be verified that the fastcraft is the fastest option, followed by RORO, and finally the pump boats. However, the shorter travel time of the fastcraft is accompanied by a large mean total cost, followed by the pumpboats and RORO, respectively.

Table 4. Time and Cost Components According to Travel Mode

	Mean in-vehicle time (min)	Mean waiting time (min)	Mean access time (min)	Mean egress time (min)	Mean total time (min)	Mean in-vehicle cost (PHP)	Mean access cost (PHP)	Mean egress cost (PHP)	Mean total cost (PHP)
RORO	120.18	49.03	69.29	41.42	279.91	70.98	88.78	49.46	209.22
Fastcraft	71.64	46.48	37.42	50.33	205.87	323.66	49.36	63.22	436.24
Pump boat via Guimaras	282.30	97.02	46.06	40.77	466.15	193.04	33.65	39.62	266.31

Various formulations of ML models were tested and estimated using 20 Halton draws. Halton draws were used since it improves convergence and provides uniform coverage as compared to other types of draws (Hensher, *et al*., 2005). A small number of draws were first used for exploratory purposes of various model formulations as employing a large number of draws will consume a lot of time. In this study, Nlogit software was used in estimating ML models. Mixed logit modelling starts with the estimation of a similarly formulated MNL model where the parameter estimates from the MNL model will serve as the initial values for the estimation of parameters in the mixed logit model through simulation. The final model chosen for this study is estimated using 1000 Halton draws as suggested by Hensher, *et al*., (2005). It assures stable model parameter estimates however, the simulation using the said number of draws consumes long periods of time. Table 5 shows the final mixed logit model estimated and it can be verified that the overall model is statistically significant with a satisfactory R-squared value.

In this model, the TIME is formulated as a random parameter with triangular distribution. A constraint was imposed and the standard deviation is set to be one half of the mean parameter estimate. The triangular distribution is preferred because of the narrower distribution. This is valuable when willingness to pay measures are calculated, especially for VOT where the TIME parameter is a part of its calculation. Note that the number of draws, number of random parameters, and distributional assumptions all affect model simulation.

Table 5. Mixed Logit Model with Constrained TIME Random Parameter and Interaction Terms

	Coefficient	t-ratio	P-value
Generic			
TIME	-0.5068	-4.7259	0.0000
CST	-0.0094	-8.1153	0.0000
CST2	0.0000	6.2832	0.0000
Specific to RORO			
ASCA	0.4504	2.6678	0.0076
TOBUSI	0.7023	3.3119	0.0009
NUM	0.0579	4.5332	0.0000
Specific to Fastcraft			
ASCB	1.3035	4.9073	0.0000
TOWORK	0.6869	3.9252	0.0001
FREQ	0.0059	2.3081	0.0210
TIME:GEN	0.1714	3.6227	0.0003
TIME:INC	-0.1009	-5.1613	0.0000
TIME:AGE	0.0081	4.4329	0.0000
TsTIME	0.2534	4.7259	0.0000
R squared	0.3518		
Adjusted R squared	0.3496		
% Correct	54.94%		
Log likelihood	-1291.166		
Chi squared	1401.236		
N	1813		
# of draws	1000 (Halton)		

Alternative specific constants, ASCA and ASCB, were specified for RORO and fastcraft, respectively. The CST and CST2 parameters are specified as generic, NUM and TOBUSI are specific to RORO, while FREQ and TOWORK are specific to fastcraft. As seen in the signs of the individual parameters, TIME and CST provide disutility to respondents. This result is intuitive as longer total travel time and larger total costs dissuade travelers from the alternatives. By looking at the NUM and TOBUSI parameters, an increase in preference for RORO is observed when the number of members in the travelling group increases and the trip purpose is business. Similarly, when FREQ is large or trips are made more often and PURWORK is equal to one, the preference for fastcraft is increased. Note that all the parameters discussed are significant at the 95% level of confidence. This means that total travel time, total travel cost, number of members in the travelling group, and trip purpose (TOBUSI and TOWORK) are significant factors that affect the inter-island passenger mode choice in the region.

Imposing constraint on the standard deviation parameter has revealed heterogeneity around the mean. As shown in Table 5, the TsTIME parameter, which corresponds to the standard deviation of the triangularly distributed TIME parameter, is significant. It can be verified that the TsTIME coefficient, 0.2534, is exactly one-half the absolute value of the mean parameter estimate of TIME, -0.5068. Also, the significance level for these two parameters is equal. These can be attributed to the distributional constraint imposed earlier. Now that the heterogeneity around the mean population parameter, TIME, has been revealed, the possible sources of heterogeneity has also been determined, as seen in Table 5. The randomly specified parameter TIME is interacted with other variables and attributes that have been collected from the respondents. Other variables and attributes that may possibly be the sources of preference heterogeneity were all tested and only the significant interactions are left in the model, as seen in Table 5.

Gender, income class, and age of respondents were interacted with TIME. The significance levels show that all the three interactions are significant. This means that these variables provide sources of preference heterogeneity. Differences in gender, income class, and age produce different marginal utilities of time and subsequently, different values of time (VOT). Note that the value of time is derived by taking the ratio of the parameters of time and costs. Note, however, that this is true only for linear utility specifications. For the general case, VOT is represented by the marginal rate of substitution between the travel times and costs.

The TIME:GEN interaction has a positive parameter. This indicates that male respondents (GEN =1) will have less negative coefficient of TIME and therefore, correspond to a smaller VOT than their female counterparts. As for the TIME:INC interaction, the estimated parameter is negative. This suggests that the higher the income class of the respondent, the more negative its marginal utility of time and thus the higher the VOT of higher income respondents. TIME:AGE interaction parameter is positive implying that the older respondents will have less negative coefficient of TIME.

These results confirm the different VOTs derived from MNL models estimated on the same dataset. Market segmentation using income and other variables for the various MNL models was done in order to more accurately account for the benefits of transportation project proposals in the cost-benefit analyses. In order to capture the heterogeneity in the dataset, the analyst estimates separate models by dividing the population into several segments with a sufficient sample size or estimate random parameters. This is tedious and problematic since the analyst should be able to precisely determine the exact grouping criteria and the range boundaries that reveal the sources of preference heterogeneity (Hensher, *et al*., 2005). This is where the advantages and realm of mixed logit modelling stand out (Fosgerau and Bierlaire, 2007).

6. CONCLUSION

The Philippines is a developing country and its budget for transportation infrastructure projects should be allocated to more beneficial projects. Reliable models are necessary in order to generate accurate forecasts for project planning. However, without appropriate data, these models would be ineffective as these will yield erroneous estimates. In this study, survey questionnaires were administered in the ports of Iloilo and in the wharf of San Lorenzo, Guimaras. Passenger information, trip characteristics, and their preferences were gathered which facilitated the estimation of mixed logit models.

The mixed logit model presented in this study includes a triangulary distributed parameter, TIME, with a significant standard deviation parameter, TsTIME. This implies that preference heterogeneity around the mean estimated parameter is present. The possible sources of heterogeneity have also been revealed through the interaction terms that were estimated. Gender, income class, and age have been shown to significantly affect TIME. Male, low-income class, and older respondents tend to have less negative TIME coefficient. This result when related to how VOTs are calculated imply that the less negative the TIME coefficient becomes, the smaller the VOT of the passenger. This is particularly important for planners in order to be more accurate in accounting for the benefits in the cost-benefit analyses of proposals.

Results of this study would be valuable to transport planners, especially in the Western Visayas region. This model may be utilized in the preparation of proposals for the inter-island bridges connecting different parts of the region. The project is currently being proposed in Philippine Congress where a joint resolution urging the Philippine president to prioritize the construction of the PGN bridge project is issued. An undertaking as massive as inter-island links in the region will have complex designs and analyses involved. The PGN project has been studied by Japan International Cooperation Agency (JICA) and DPWH with varying projected costs and designs. The costs range from 53 billion pesos in 1999, 28.5 billion in 2010, and 54 billion in 2011. This just reflects the uncertainties in this kind of project. Different designs and alignments have different associated costs, but even if everything has been finalized, there is still no guarantee that costs will not change. Unforeseen problems will be encountered along the way, and together with these problems are unpredicted cost adjustments that pile up resulting to large cost overruns. The Philippines still does not have any experience in constructing a project of such magnitude. Thus, we have no formula for success. In this regard, more studies involving the proposed projects should be undertaken. More complex models should also be explored in order to better quantify different values incorporated in the cost-benefit analyses of the proposals. Therefore, the proposed project may be evaluated more correctly and those projects that deserve to be built are built and those that do not will be rejected.

A more complex modelling technique has been employed for this study. This is done in order to overcome the restrictions imposed by the critical assumptions of simpler models such as the MNL. Other researchers are encouraged to explore more complex modelling techniques and develop more interest in inter-island transport in other less urbanized regions to shed light on less-focused subjects of research.

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