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Effect of Different Distributional Assumption of Random Parameters in the Mixed Logit Model on Willingness-to-pay Values

WAN NORHIDAYAH W MOHAMAD[a,b*], KEN WILLIS[c] AND NEIL POWE[c]

[a]*Faculty of Economics and Management, Universiti Putra Malaysia, Malaysia*
[b] *Institute Of Tropical Forestry and Forest Product, Universiti Putra Malaysia, Malaysia*
[c]*School of Architecture, Planning and Landscape, Newcastle University, United Kingdom*

ABSTRACT

Understanding consumers' willingness-to-pay (WTP) value is vital for rational valuation of consumers' benefit. Stated preference techniques such as Choice Experiment (CE) have been widely used to account for WTP value and one of the popular model specifications is the Mixed Logit (MXL) model. In the MXL model, it is essential to assume the types of distribution of random parameters. The specification of MXL models with different distributional assumptions of random parameters has been explored by many researchers. Nevertheless, the effect of different distributional assumptions of random parameters on goodness-of-fit, the significance of the coefficients and WTP values has not been studied adequately particularly in the context of Malaysia. In the present work, the analysis is carried out in this regard based on visitors' preferences for tourist facilities at Tasik Kenyir, Malaysia. A number of MXL models were attempted with different distributional assumptions of random parameters; normal, log-normal, triangular and uniform. The results suggested that, in all MXL models, the goodness-of-fit statistics, the significance of the attribute coefficients and WTP values were quite comparable, except for the log-normal distribution. The methodological implications concern the importance of developing several MXL models with different distributional assumptions as well as the recommendation for policy makers to improve the facilities at the lake.

JEL Classification: Q51, Q57

Keywords: Willingness-to-pay; Mixed Logit Model; Stated Preference; Random Parameters; Choice Experiment

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* Corresponding author: Email: w_norhidayah@upm.edu.my

INTRODUCTION

Stated preference data that comes from the Choice Experiment (CE) technique has been extensively analyzed using the Mixed Logit (MXL) model to estimate consumers' WTP for the goods being valued. Each respondent in the MXL model is considered as being one segment and hypothetically each person has unique tastes. The purpose of the estimate is to find the parameters of the distribution from which respondents' tastes are drawn. An interesting part of this model is that the researcher is required '*ex-ante'* to define the functional form of this distribution. In general, there are four most popular predefined functional forms; normal, log-normal, triangular and uniform. As explained by Hensher and Green (2003), distributions are fundamentally arbitrary approximations to the real behavioural profile. Specific distributions are selected with a sense that the "empirical truth" is somewhere in their domain.

Basically, any form of distribution could be used. However, in previous applications researchers mostly specified the random parameters as normal or log-normal distributed because it is easier to be applied (Train, 1998; Revelt and Train, 1998; Layton and Brown, 2000; Train and Weeks, 2005; Garrod et al., 2014; Grisolia and Willis, 2016; Mohamad et al., 2018), where $f(\beta)$: $\beta \sim N(b, W)$ or $ln(\beta) \sim N(b, W)$ with the parameters b (mean) and W (covariance) are valued (Train, 2003). The normal distribution is unbounded where there is no strict sign for the coefficient estimate. Thus, the coefficient values can be both positive and negative. The normal distribution is relatively easy to apply, however, in a certain condition it is inappropriate for any attribute whose coefficient should be bound.

The log-normal distribution, that is distribution skewed to the right is suitable to be used when the coefficient needs to have a specific non-negative sign, or in another words, restricting the sign of the parameter. This property has made the log-normal distribution easily exploited in order to achieve the required restriction. However, it has a very long right-hand tail that makes the WTP calculations difficult (Hensher and Green, 2003). Consequently, the huge percentage of irrational values often casts doubt on the suitability of the log-normal distribution.

In contrast, triangular distributions are suitable to be used when there is no assurance of the sign of the coefficient. One of the weaknesses related to the use of normal distribution is its infinity tails $(-\infty, \infty)$ which may lead to a very extreme coefficient. The triangular distribution may solve this problem because it possesses shorter tails compare to the normal distribution. Furthermore, it also allows for a peak in the density function and asymmetrical shapes (Hess et al., 2005).

The uniform distribution with a (0, 1) bound is suitable for dummy variables. The advantage of uniform and triangular distribution is associated with their values being limited to '$b - s$' and '$b + s$' (where b = mean and the s = spread; b and s are the parameters to be estimated) (Hensher and Green, 2003). Densities have been bound on both sides in order to avoid the risk of estimating extreme values for the coefficients which relate to the application of normal and log-normal distributions (Train, 2003).

A glaring deficiency which all distributions have is related to the sign and length of the tail. As argued by Hensher (2001), none of the random distributions has all the appropriate properties, and the selection of the best random distribution is still an area of current research. Even though the standard assumption for the random parameters is a normal distribution, in principle any of the random distributions expected to fit the estimated coefficients can be used (Nahuelhual et al., 2004).

In addition, it is noticeable from the CE literature that insufficient attention is typically paid to the choice of random parameter distributions in MXL model. This is problematic given that the different distributional assumptions of random parameters chosen in the analysis of MXL model can have a major impact on resulting WTP estimates. With this in mind, some studies point out the importance of testing different distributions when developing the MXL model (e.g., Train and Weeks, 2005; Ghosh et al., 2013). In the present study, an investigation is reported in this regard by referring to the case study of tourist facilities improvement in Tasik Kenyir, Malaysia. The main contribution of this study is outlining the importance of developing several MXL models with different distributional assumptions of random parameters. This research also provides a methodological recommendation for future CE studies. The other contribution is to provide recommendation for policy maker for the improvement of future recreation services.

LITERATURE REVIEW

The sensitivity of coefficient and welfare estimates based on the choice of random distributions specification have been explored by some researchers (e.g., Regier et al., 2009; Gosh et al., 2013). The mutual conclusion is that distribution specification matters. In some studies, the attribute coefficient and welfare estimates were found to be identical for all distributions used. As an example, Hensher and Green (2003) examined the welfare effect of the MXL with normal, log-normal, triangular and uniform distributions. The results revealed that the mean welfare estimates were very similar across the normal, uniform and triangular distributions, whilst the log-normal distribution produced results which contrasted by about triple. However, the log-normal guarantees the non-negative sign of the attribute compared to the other distribution. The similar attribute coefficients estimates were also found by Colombino and Nese (2009) who investigated the used of normal, uniform and triangular distribution to assess visitors preferences towards cultural heritage management policies of an archaeological site at Paestum, Italy. They also revealed a negative WTP of the visitors for one of the attributes used in the study due to the high percentage of respondents gave negative opinion towards that attribute.

Train and Weeks (2005) compared and estimated two different models with convenient distributions (normal and lognormal); 'model in preference space' (parameterized in terms of coefficients) and 'models in WTP space' (parameterized in terms of WTP). In particular, the distributional assumptions and restrictions were placed on the coefficients or on the WTP's. They found that models using normal and log-normal distributions for coefficients (models in preference space) fit the data better than the models in WTP space but provide less reasonable distribution for the WTP.

A study carried out by Regier et al. (2009) who elicited public preferences for a novel genetic technology in order to identify genetic causes of mental retardation/developmental delay also revealed that the WTP estimates were affected by different assumptions of distributions. The WTP measures were derived from the coefficients in the two estimated models: Model 1 was an all parameters random specification and Model 2 specified coefficients that were both fixed and random. The results demonstrated that different distributional assumptions (normal and log-normal) affect the WTP estimates. It was also noted that when the cost parameter was assumed to be log-normally distributed, WTP calculations were complicated to perform. For instance, the WTP for one attribute, i.e. additional children receiving a genetic diagnosis varied considerably conditional on if the median or mean of the marginal utility of income was used.

Ghosh et al. (2013) revealed that the WTP values were found to be different across distributions. In a case study regarding a feeder service to bus stops in rural India, Ghosh et al. (2013) estimated the MXL with normal, log-normal, uniform, triangular and Johnson's S_B distributions for the random parameter. The results revealed that the goodness-of-fit of the models and WTP values were varied based on different distributional assumptions of random parameters. Interestingly, constrained distributions produced a better model fit compared to the unconstrained distributions. They also found that MXL with constrained triangular distribution (mean = spread) was superior to other models.

A number of studies in Malaysia have applied the MXL models as a tool to help determine individuals' WTP for the goods being valued (e.g. Matthew et al., 2018; van Gevelt et al., 2017; Mohamad et al., 2014; Yaacob and Shuib, 2009), however, we notice that the different distributional assumption of random parameter has not been tested in the MXL model. The most worrying effect is related to biased welfare estimates since the WTP results are commonly used to inform policy makers in their design and implementation of more effective actions in the future.

To the best of our knowledge, this study is the first to test the different distributional assumption of random parameter in the MXL for the case study in Malaysia and thus contributes significantly to the current literature of determining WTP value using CE. It is worth noting here that we interested to apply the same distribution for all attributes, except for the price attribute that we assumed to be fixed. Even though a combination of distribution for the other non-price attributes can also be applied, the interpretation of the model become uncomplicated when the attribute distributed similarly. As stated by Revelt and Train (1998), when all attributes are permitted to differ in the population, identification is empirically difficult. Hence, for the convenience of the model interpretation, we focus on the similar distribution for all of non-price attributes in our study.

STUDY DESIGN AND IMPLEMENTATION

This study used the data from a CE survey which designed to elicit tourists' preferences for tourist facilities attributes improvements in Tasik Kenyir. Briefly, Tasik Kenyir is among the popular ecotourism sites in Malaysia. With zero money for the entrance fee, this lake offers a number of recreational benefits to the visitors. Nevertheless, the maintenance of the receational facilities and services provided at this lake are not carried out effectively or regularly due to limited budget from the government. This situation can impact on the quality of the recreational facilities and services provided to the visitors, especially those surrounding the main entrance point of the lake, called Gawi Jetty. Poor facilities, whether provision or maintenance, make a trip less pleasant, increases dissatisfaction and discouraging visitors in the long term.

Besides, the overwhelming increase in visitors to this lake every year generates additional or excessive use of the tourist facilities. Based on Table 1, whilst in 2005 Kenyir Lake was visited by around forty to fifty thousands of visitors, this number has increased on a yearly basis, and in 2008 the number of visitors reached more than one hundred thousand. In 2013, the total number of visitors was reaching nearly half a million. Meanwhile, in 2014 and 2015, the total number of visitors reached over half a million. This increasing trend now poses a serious challenge to the lake management, who must cater for and fulfil the needs of the tourists while ensuring that the economics, ecotourism sustainability and recreational benefits are balanced and well-organized. Thus, assessing tourists' preferences for improvement to tourism facilities at Gawi Jetty could help the policy maker in designing a better provision of facilities in the future.

Dependency on government funding to maintain the quality of facilities at public park like Tasik Kenyir is not necessarily the best option for the future. As an alternative, attention towards applying a charging fee could be considered. As stated by Willis (2003), an entrance fee can be introduced for public parks in order to defer the high costs of maintenance in an era where the public funding is limited, provided access points are limited in number. The collection of an entrance fee at a tourist area would be hypothecated for management purposes to provide improved facilities for the tourists. Therefore, examining the impact of the implementation of an entrance fee to a tourist area that currently does not collect a fee, such as Tasik Kenyir, may provide important evidence about the practicality of collecting entrance fees from tourists.

Table 1 Number of Visitors to Tasik Kenyir

Year	Domestic Visitor	International Visitor	Total of Visitors
2005	48,274	2541	50,815
2006	57,505	3027	60,532
2007	87,589	4610	92,199
2008	126,891	6678	133,569
2009	179,919	9469	189,388
2010	214,291	11,279	225,570
2011	261,479	13,762	275,241
2012	377,155	19,850	397,005
2013	444,294	23,384	467,678
2014	616,924	32,470	649,394
2015	670,912	35,311	706,223

Source: Department of KETENGAH (2016)

Attributes and levels describing the improvements of tourist facilities at the lake are carefully chosen based on; 1) two focus group studies of public opinion about what are the important facilities that need to be offered at recreational areas, 2) a rigorous literature review, and 3) a series of discussion with the responsible policy makers who manage the lake. The attributes considered in the design were the car park, toilet, jetty, tourist information centre (TIC) and playground. The entrance fee attribute was also included to enable the calculation of WTP for an improvement in a single attribute tourist facility. The WTP can be estimated by the ratio of the estimated coefficient of the attribute to the coefficient of the cost attribute.

Table 2 shows the attributes and levels used in the CE survey. With the help of these attributes and their levels, 36 competitive choice cards were generated using D-efficient experimental design produced from a SAS programme. With the purpose of reducing the the cognitive burden and to avoid tediousness, the CE choice sets were divided into 6 blocks of 6 choice cards each. The respondent was randomly answered one block of 6 choice card. Respondents were required to indicate their preferences between two hypothetical alternatives in each of 6 choice cards presented to them. As proposed by Johnson and Desvousges (1997), the CE choice cards need not be restricted by the requirement of having the status quo alternative. Thus, the forced choice question without the status quo option was applied. Figure 1 shows an example of CE choice card.

Table 2 Attributes and levels for a CE survey in Tasik Kenyir, where SQ represents the existing condition

Attribute	**Level**	**Description**
Toilet	Basic (SQ)	10 toilets + 2 disabled toilets
	Medium	Basic + bathrooms
	Superior	Medium + Babies' changing rooms
Jetty	One (SQ)	The current small jetty where the speed boats and houseboats load and unload passengers
	Two	One jetty for a speedboat and another one jetty for the houseboats to load and unload passengers
Car Park	30 slots (SQ)	The current slots are limited and cannot accommodate the increasing numbers of tourists' car
	100 slots	Adding more slots can accommodate the increasing numbers of tourists' car
TIC	Basic (SQ)	Brochures, pamphlets and information boards
	Medium	Basic + video presentation
	Superior	Medium + tourist information counsellor
Children's	Small (SQ)	The playground is small, old and limited in equipment
Playground	Large	A large playground with a new equipment can provide a plenty of space for children to play
Entrance Fee	RM 0 (SQ)	per person (Ringgit Malaysia)
	RM 1	
	RM 2.50	
	RM 5	
	RM 7.50	
	RM 10	

Note: SQ is status quo

An example of a choice card is presented below. Two possible development options for the tourist facilities at Gawi Jetty are presented. If you would like to see an additional jetty, a large children's play area, medium toilets and tourist information centre, more car parking slots and are willing to pay an entrance fee of RM 2.50 per person you should choose Option 1.
If you would like to see a superior toilet, but you are happy with the existing jetty, car park, tourist information centre and children's play area conditions and are willing to pay an entrance fee of RM 7.50 per person, then you should choose Option 2.
Please tick √ which option you prefer.

Facilities	**Option 1**	**Option 2**
Toilet	Medium	Superior
Jetty	Two	One
Car Park	100 slots	30 slots
Tourist Information Centre	Medium	Basic
Children's Playground	Large	Small
Entrance Fee	RM 2.50	RM 7.50
Your Option	☐	☐

Figure 1 An example of CE choice card

As stated by National Oceanic and Atmospheric Administration (NOAA) panel report (Arrow et al. 1993), the best method of collecting information from respondents in any stated preference study including CE is a face-to-face interview. Therefore, from March to May 2016, on-site face-to-face interviews were conducted at Gawi Jetty. The respondents were randomly sampled at the site. The targeted respondents were those who showed up at the jetty, aged eighteen years old and above. Once the interview was completed, the next individual to pass was interviewed to avoid any selection bias. The pilot test was done before the actual test to discover several things, for example, to test the suitability of the questionnaire and the time taken to complete the survey.

In the final survey, 180 questionnaires were collected with usable responses. Based on Pearmain et al.'s rule of thumb, a sample size more than 100 can provide a basis for modelling preference data for discrete CE designs, whereas Bennett and Blamey (2001) proposed the minimum sample size of 50 respondents for the sub-sample in the CE design. Thus, both recommendations were referred to in order to determine the appropriate sample size for this study.

ECONOMETRIC SPECIFICATION

The work includes a comparison of WTP values obtained from the MXL models specification with different distributional assumption of random parameters. In a nutshell, the MXL is a highly flexible model that can estimate any random utility model (McFadden and Train, 2000). The MXL model can take a number of different forms (Train, 2003; Hensher and Greene, 2003). Under the random parameter specification, the respondent n faces a choice among j alternatives. The utility can be specified as:

$$U_{nj} = \beta'_n x_{nj} + \varepsilon_{nj} \tag{1}$$

where x_{nj} = a vector of observed variables that relate to alternatives j and respondent n and β_n = unobserved vector of the coefficients for each n and signifies the respondent's tastes which vary in the population with density $f(\beta)$.

The density $f(\beta)$ is a function of parameters θ that denote, for example, the mean and covariance of the β in the population. Therefore, the density can be indicated as $f(\beta_n|\theta)$. Meanwhile, ε_{nj} is an unobserved random term, assumed to be independently and identically distributed extreme value, independent of β_n and x_{nj}. The aim is to estimate the population parameter (θ) *w*hich describes the distribution.

In this study, we specified the distribution to be normal, log-normal, uniform and triangular for all of the attribute parameters, except for the entrance fee attribute. The entrance fee was set to be the fixed parameter. The use of a fixed price coefficient aids the computation of WTP values and the interpretation of the model since the WTP for each attribute is distributed similarly as the attribute's coefficient (Revelt and Train, 1998).

The estimation of the parameter to define density f can be done once the type of distribution is identified. The estimation can be done by maximizing the log-likelihood function. Train (2003) stated that the simulation of the log-likelihood function can be completed through a simulation technique for any given value of θ and the step is as follow. Firstly, a value of β is drawn from $f(\beta|\theta)$ and denoted as βr. Subscript r =1 denotes the first draw. Then, the logit formula Lni (βr) is calculated for this draw. The first and second stages are calculated several times and the results are averaged. The average results are the simulated probability as shown below:

$$\check{P}_{ni} = \frac{1}{R}\sum_{r=1}^{R} Lni\ (\beta_r) \tag{2}$$

where R = *the total number of draws* and $\check{P}ni$ = *unbiased estimator of Pni by construction.*

The simulated log-likelihood (SL) can be derived by inserting the simulated probabilities into the log likelihood function:

$$\text{SL} \sum_{n=1}^{N}\sum_{j=1}^{J} d_{\text{nj}} \ln\check{P}_{nj} \tag{3}$$

where d_{nj} = 1 if respondent *n* chooses alternative *j* and zero otherwise.

Based on the above general econometric specification, we specify and compare four MXL models with the different distributional assumption of random parameters. We used Nlogit 4.0 software to estimate the models with the simulated maximum likelihood using 100 Halton draws. Using the choice model data, the WTP value can be estimated. The calculation of marginal WTP value can be done by dividing the coefficient value of the non-price attribute by the coefficient value of price attribute (Hoyos, 2010). The WTP values indicate how much the respondents are willing to pay in order to have the benefit of the attribute improvement (Bennett and Adamowicz, 2001). Therefore, the WTP for a unit change in attribute *i*, for instance, can be calculated as the negative of the ratio of *i's* β coefficient divided by the parameter of cost attribute βcost.

$$\text{WTP} = -\beta i / \beta\text{cost} \qquad (4)$$

where βi = the coefficient of non-price attributes and $\beta cost$ = the coefficient of price attribute.

EMPIRICAL RESULTS

Descriptive Statistic

Based on Table 3, the sample was made up of 55% males and 45% females. The proportion of males is higher than that of the Malaysian population (51%). It may have been due to a sampling error of non-response, for instance, women may have been absent when the interviewers approached the respondents at the study site, or it may be due to outdoor recreationalists having a higher proportion of men than women. The majority of the respondents in this study belong to the 25-34 age group. This is similar to the majority of the Malaysian population who also belong to that age group. Almost hundred percent of respondents were local visitors. Factors which might explain why the number of local visitors is much higher than the international visitor include distance and travel cost.

More than half of the respondents (63.9%) were highly educated, with at least a diploma (28.9%) or an undergraduate and postgraduate degree (35%). Only a small fraction of them (3.9%) had a minimum of primary education. By referring to the results, it can be seen that the majority of the visitors that come to Tasik Kenyir have a high level of education. Of the 180 respondents, 57.1% had a household number of three to five persons, and the percentages of households with six to eight persons and two persons or fewer were 30. 6% and 6.6% respectively. Meanwhile, the percentage of households with more than eight persons was 5.7%.

In terms of occupation, 25.6% respondents reported working in the administration and management sector, followed by sales (20%), professional and technician (18.9%), service industry (11.6%) and students (10.6%). Business, housewives and retired composed of 8.3%, 3.3% and 1.7% respectively. The monthly gross household income for both samples is also presented in Table 3. The gross monthly income was regrouped within three income levels: high (more than RM 4001), medium (RM 2001-RM 4000), and low (less than RM 2000). The results show that the majority of the respondents fell into the medium income category with 71.1%. Only 13.3% earned less than RM 2000. Respondents who earn a higher income typically are willing to pay a higher price for the entrance fee. The study found that 15.6% of the respondents were in the high-income category (more than RM 4001).

Table 3 Socio-demographic Characteristics of the Respondents

Demographic Variables		**Percentage (%) (n=180)**	**Cencus[a] (%)**
Gender	Male	55	51
	Female	45	49
Age Group	18-24 years old	21.1	21.2
	25-34 years old	36.1	25.8
	35-44 years old	26.7	19.6
	45-54 years old	12.2	15.8
	55 years old and above	3.9	17.6
Nationality	Local	98.9	91.6
	Foreign	1.1	8.4
Education	Primary school	3.9	-
	Secondary school	26.1	-
	Pre-University	6.1	-
	Diploma	28.9	-
	Undergraduate & Postgraduate	35	-
Household number	2 persons or fewer	6.6	-
	3-5 persons	57.1	-
	6-8 persons	30.6	-
	More than 8	5.7	-
Economic Variables			
Occupation	Professional & technician	18.9	-
	Administration & management	25.6	-
	Service industry	11.6	-
	Business	8.3	-
	Sales	20	-
	Student	10.6	-
	Housewife	3.3	-
	Retired	1.7	-
Monthly Gross Household Income	Low (less than RM 2000)	13.3	-
	Medium (RM 2001 – RM 4000)	71.1	-
	High (more than RM 4001)	15.6	-

Note: a – Department of Statistics Malaysia (2014).

Choice Experiment Results

Table 4 presents the MXL model estimation results with normal (I), log-normal (II), uniform (III) and triangular (IV) distributions of random parameters. Based on Table 2, against a critical value 24.996 (with 15 degrees of freedom at alpha level 0.05), Model I was statistically significant with a χ^2 statistic of 433.276, Model II was statistically significant with a χ^2 statistic of 428.838, Model III was also statistically significant with a χ^2 statistic of 432.49 and Model IV was statistically significant with a χ^2 statistic of 432.972.

It seems that all the estimates of the pseudo-R^2 and log-likelihood value are comparable, whatever the distributional assumptions. In addition, all the significant variables in Model I remain significant, with the same significance levels in Model III and IV. The only insignificant variable in Model I, III and IV was TIC-Superior. All the estimates of the mean of β (attribute coefficients) were comparable whether a normal, uniform or triangular distribution was employed. This is similar to the findings of Colombino and Nese (2009).

In contrast to Model I, III and IV, only four random variables were significant in Model II, namely, Toilet-Medium, Toilet-Superior, Jetty-Two and TIC-Medium. From these variables, only Toilet-Superior was positive and according to the expected sign. The standard deviation estimates suggest the existence of heterogeneity in the coefficients of Jetty2 and CarP100 in Model I, III and IV. Meanwhile, in Model II, the result suggests the existence of heterogeneity in Jetty2. Overall, the evidence suggests that the attribute coefficients were very similar across the normal, triangular and uniform distributions; while the log-normal distribution produced results that were very different. The log-normal distribution also differs in terms of the number of significant standard deviations compared to the other distributions.

Table 4 Estimation of the MXL Model with Different Parameter Distributions

Attribute	I - Normal		II – Log-normal		III - Uniform		IV - Triangular	
Random Parameters (mean)	**Coeff.**	**tstat.**	**Coeff.**	**tstat.**	**Coeff.**	**tstat.**	**Coeff.**	**tstat.**
Toilet-Medium	0.714***	5.434	-0.4***	-2.358	0.697***	5.705	0.705***	5.54
Toilet-Superior	1.449***	8.436	0.301***	2.789	1.414***	9.23	1.431***	8.814
Jetty-Two	0.765***	6.391	-0.59***	-2.83	0.738***	6.823	0.752***	6.582
Car Park-100 slots	0.960***	7.759	-0.16	-1.324	0.932***	8.792	0.946***	8.183
TIC-Medium	0.375***	2.954	-1.032***	-2.67	0.363***	2.9	0.37***	2.963
TIC-Superior	0.084	0.732	-2.754	-1.41	0.08	0.714	0.082	0.721
Playground-Big	0.202**	2.046	-1.649	-1.143	0.186**	2.085	0.194**	2.059
Non-random Parameter								
Fee	-0.198***	-8.21	-0.186***	-9.15	-0.191***	-9.70	-0.195***	-8.82
Standard Deviations								
Toilet-Medium	0.270	0.735	0.216	0.773	1.161	0.176	0.478	0.48
Toilet-Superior	0.270	0.735	0.216	0.773	1.161	0.176	0.478	0.48
Jetty-Two	0.762***	4.45	0.766***	3.386	1.205***	4.895	1.797***	4.631
Car Park-100 slots	0.452**	2.073	0.351	1.157	0.688**	2.004	1.034**	2.03
TIC-Medium	0.106	0.338	0.028	0.003	0.093	0.173	0.219	0.282
TIC-Superior	0.031	0.06	0.037	0.001	0.208	0.241	0.164	0.121
Playground-Big	0.018	0.067	0.322	0.069	0.057	0.128	0.076	0.117
Summary Statistics								
LL(β_b)	-531.961		-534.18		-532.354		-532.113	
LL(β_0)	-748.599		-748.599		-748.599		-748.599	
Pseudo-R^2	0.289		0.286		0.288		0.289	
Adjusted Pseudo-R^2	0.28		0.277		0.28		0.28	
Number of Observations	1080		1080		1080		1080	

Notes: ***significant at 1%, **significant at 5% and *significant at 10%

Willingness-to-pay Estimates

Based on Table 5, the comparison between the WTP estimates from Model I, III and IV reveals that the respondents in these models had the same relative importance ranking of WTP estimates. The highest WTP value was Toilet-Superior, followed by Carpark-100 slots and Jetty-Two. In other words, the respondents prefer the toilet services which have additional bathrooms and babies changing room facilities, one hundred parking slots and the provision of two jetties.

The WTP values for all of the significant attributes in the normal, uniform and triangular distributions were quite comparable. For example, the WTP values for Toilet-Superior attribute in the normal, uniform and triangular distributions were RM 7.295, RM 7.373 and RM 7.326. The confidence interval also shows that the WTP values of Toilet-Superior attribute in these distributions overlap. According to Morrison et al. (2002), the WTP values that overlap with the confidence interval are assumed to be the same. In addition, we also refer to Hassan-Basri et al. (2018) and Hassan-Basri et al. (2019) research who apply confidence interval approach whereby the similarity is determined through an overlapping format.

Meanwhile, in the log-normal distribution (Model II), the highest WTP value was also the Toilet-Superior attribute, similar to that achieved in the other distributions. Even though the respondents express their highest WTP value for the Toilet-Superior attribute across the distributions, the WTP value for the Toilet-Superior attribute varied by more than 300% in the log-normal distribution. In addition, the log-normal distribution reveals a negative WTP for most of the attributes. Summarising, the results from this study indicate that the different distributional assumptions of random parameters (normal, uniform and triangular) did not affect the WTP estimates, except for the log-normal distribution. The most likely reason is the attributes were logged, while the attribute of the price remained as the fixed variable across distribution.

Table 5 WTP Estimates (in RM) for the MXL Models

Att.	Willingness-to-pay Value					
	I - Normal			II - Lognormal		
	WTP (t-stat)	95% confidence limits		WTP (t-stat)	95% confidence limits	
Toilet-Medium	3.598 (5.436***)	2.301	4.895	-2.147 (-2.138**)	-4.114	-0.179
Toilet-Superior	7.295 (8.325***)	5.578	9.013	1.618 (2.941***)	0.54	2.696
Jetty-Two	3.854 (6.824***)	2.747	4.961	-3.169 (-2.633***)	-5.527	-0.811
Carpark-100 slots	4.835 (9.012***)	3.782	5.887	-0.858 (-1.303)	-2.149	0.432
TIC-Medium	1.892 (2.927***)	0.626	3.158	-5.538 (-2.613***)	-9.691	-1.385
TIC-Superior	0.427 (0.733)	-0.716	1.571	-14.782 (-1.357)	-36.124	6.56
Playground-Big	1.019 (2.165**)	0.095	1.942	-8.851 (-1.143)	-24.033	6.331

Notes: ***significant at 1%, **significant at 5% and *significant at 10%; t-statistics are in brackets.

Table 5 Cont.

Att.	Willingness-to-pay Value					
	III - Uniform			IV - Triangular		
	WTP (t-stat)	95% confidence limits		WTP (t-stat)	95% confidence limits	
Toilet-Medium	3.633 (5.494***)	2.336	4.929	3.611 (5.464***)	2.315	4.906
Toilet-Superior	7.373 (8.442***)	5.661	9.084	7.326 (8.377***)	5.612	9.039
Jetty-Two	3.849 (6.779***)	2.737	4.960	3.853 (6.803***)	2.743	4.962
Carpark-100 slots	4.859 (9.012***)	3.802	5.915	4.843 (9.007***)	3.790	5.895
TIC-Medium	1.895 (2.889***)	0.611	3.179	1.895 (2.912***)	0.621	3.169
TIC-Superior	0.421 (0.716)	-0.731	1.573	0.423 (0.723)	-0.723	1.569
Playground-Big	0.973 (2.116**)	0.072	1.874	0.994 (2.135**)	0.082	1.905

Notes: ***significant at 1%, **significant at 5% and *significant at 10%; t-statistics are in brackets.

CONCLUSION AND FUTURE DIRECTION

A key issue when analysing the stated preference data using the MXL model specification is to determine the suitable distributional assumptions of random parameters. In the CE literature, analysts commonly specified the random parameters as normally distributed. The other distributions are such the log-normal, uniform, triangular and Johnson's S_B distributions. However, lack of attention is often given to the choice of the functional form of preference distributions. There has been an ongoing debate that the different functional form chosen can have a major impact on WTP estimates which in turn result in potential wrong policy implications. Therefore, a comparison of various MXL models has been carried out in this study with four types of random distributions; normal, log-normal, uniform and triangular. Variation of the goodness-of-fit statistics, significance of the attribute coefficients and the WTP estimates were observed across different MXL models.

Briefly, the specification of normal, uniform and triangular distributions is not found to have a prominent effect on goodness-of-fit, significance of the attribute coefficients and WTP values of any attributes in this study. Meanwhile, the log-normal distribution is found to produce less significance of attribute and much lower WTP value compared to the other distribution. The most likely reason is the attributes were logged, whereas the price attribute remained as the fixed variable across distribution. Thus, the attribute price ratio is likely to be smaller when variables are log-normal. A literature search failed to reveal why the log-normal distribution make such a big difference to WTP values in the MXL model.

The empirical results of this chapter provide some key policy messages for the responsible policy makers at Tasik Kenyir. The key result was that with the proposed amount of entrance fees ranged from RM 1 to RM 10, the visitors were willing to pay for enhancements to most of the tourist facilities attributes presented in this study, regardless of the different distributional assumption employed (except for the log-normal distribution). Thus, the imposition of entrance fee to enhance the quantity and quality of visitors' facilities surrounding the jetty can be implemented in the future. Currently, no entrance fee is charged to the visitors who enter the lake.

Meanwhile, the highest WTP estimate was for the Toilet-Superior attribute for all of the MXL models estimated in this study. This implies that the Toilet-Superior attribute is the most important facility that should be upgraded by policy makers. This is a very useful finding for the policy maker to take a further action for improving the basic facilities at Tasik Kenyir, based on the main preferences of visitors. If the current situation continues, visitors' experience and satisfaction will decrease and it will affect the tourism industry at the lake. Therefore, the responsible policy maker should consider urgent action to improve the facilities at the lake according to the needs of the majority of the visitors. The importance of having an accessible and inclusive public toilet that can cater the need of public has been discussed by many researchers (e.g. Afacan and Gurel, 2015; Siu, 2016; Costigan et al., 2017). In addition, toilets were identified as significant element for engaging into physical activity at the recreational park, as opportunities for women to participate in the activity may be dependent on being capable to monitor and cater for their children's needs at the same time (e.g. Sugiyama et al. 2015; Costigan et al. 2017).

Summarising, from the methodological standpoint, the analysis of this study is intended to serve as a guideline for future research in choosing the most appropriate random distribution, and the recommendation for future research is to avoid the use of the log-normal distribution. This is supported by Hensher and Green (2003) who stated that most empirical studies had a tendency to obtain similar means and comparable measures of variance for normal, uniform and triangular distributions, however, with the log-normal, the results tend to shift around enormously. Even though the results presented in this research are case specific, the findings are likely to deliver significant direction to practitioners and researchers using MXL models in willingness to pay study. The other recommendation for future study is to explore the other alternative functional forms to address the heterogeneity issue. For example, the Latent Class Model that enables the researcher to observe preference heterogeneity through identifying and characterising various preference groups.

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