A CASE STUDY OF CONSUMERS' PREFERENCES ON GREEN HOME ATTRIBUTES FOR SUSTAINABLE LIFESTYLE

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Abstract

Green home concept is an effort to minimize the negative impact generated by conventional homes which refers to the reduction in energy use, water resources and natural resources, while providing good air quality and comfort, and produce very little residual waste. This concept is consistent with the increasing awareness in Malaysian society towards the importance of sustainable lifestyle. The aim of this study is to examine consumers' preference on green home attributes in Peninsular Malaysia. Self-administered questionnaires were used to obtain necessary data from 600 selected households through stratified random sampling in Kajang and Bandar Baru Bangi, interviewed using two sets of questionnaires that were developed via Focus Group Discussion and Pretest sessions. The results show that the estimated implicit values for green home attributes based on Multinomial Logit regression shows that natural indoor air ventilation is the most important attribute. This is followed by green area, carbon dioxide (CO2) emission and rainwater harvesting system. The findings also reveal that Malaysian society preferred green home as compared to conventional housing based on the attributes. Finally, the study highlighted several recommendations for consumers, developers and government to stimulate the green home development in Malaysia.

Keywords: Green home, choice model, sustainable lifestyle

Introduction

Housing is a basic need for every individual and it is very important in our everyday life. Green Home is a space and energy efficient home which can offer coziness and healthy living environment to its residents. Green Home operates by using sustainable resources. The concept of green home is consistent with the increasing awareness in Malaysian society towards the importance of a sustainable lifestyle. Green home concept was also an effort to minimize the negative impact generated by conventional homes which refers to the reduction in energy use, water resources and natural resources, while providing good air quality and comfort, and produce very little residual waste (Alias et al., 2010). In Malaysia, electricity consumption increased from 5.6 per cent to 6.0 per cent from 2005 to 2010. This scenario may have caused the emission of carbon dioxide (CO2) into the atmosphere to increase and contributed to the increase of greenhouse gases (GHG) (Economic Planning Unit, 2006). This will increase the thinning of the ozone layer and can eventually cause problems of global warming and climate change. Consequently, the community would be in an uncomfortable environment. So, to solve this problem, people will use air conditioners to reduce the heat.

Air conditioning usage, until now, is the largest contributor of carbon dioxide (CO2) emissions while using a lot of electricity consumption. The increase in electricity consumption will increase in the amount of CO2 emissions and this emissions mostly come from the housing sector. This sector is actually one of the largest contributor to environmental problems faced until now (Saidur et al., 2007). The Malaysian government has been continuosly encouraging green home development because of the awareness on the effects of human activities towards global warming and environmental pollution. Generally, the green home is a concept to reduce the impact of pollution and to protect the environment. It will reduce all the negative impacts from conventional housing such as energy consumption, water and natural resource, good and comfortable air quality, and produce only a little bit of solid waste. Alias et al. (2010), reported that this concept is still at the early stage in Malaysian housing development and home owners are not really aware that this concept exists, and lack in the understanding of its, design and benefit. In addition, the Malaysian society's reaction and their acception level of this concept is still very low. An economic analysis was performed on the consumers demand for housing improvements in Malaysia, by estimating the implicit prices of housing attributes of carbon dioxide (CO2) emission, rainwater harvesting system, natural indoor air ventilation and green area. Generally, the objective of this study is to examine consumers' preference on green home attributes in Peninsular Malaysia.

Literature Review

The choice of one particular choice set among all is an example of a discrete choice. The consumer must make an absolute choice among a set of competing alternatives. The use of discrete or qualitative data has necessitated a probabilistic approach to utility estimation that incorporates differences in individuals' characteristics such as preferences and perceptions. This behavioral approach to utility estimation also allows for the consideration of random, unobservable differences among individual consumers. Discrete choice theory allows utility estimation to be performed in accordance with Lancaster's characteristic approach to consumer theory [Ben-Akiva, & Lerman, (1985), Lancaster, (1991) & Manski, (1977)].

Random utility theory is a probabilistic approach to discrete choice problems that specifies the probability that an individual will choose a specific alternative from a set of alternatives given the observed research data [Ben-Akiva, & Lerman, (1985) & Train, (1986)].

ChoiceModelling

The aim of CM is to identify marginal values for green home attributes. This is to allow identification of a desirable green housing plan from the demand side perspective. Typical profile analysis is conducted to provide insights on respondents' socioeconomic, attitudinal, and behavior.

The CM is a class of stated preference technique but has the unique flexibility to evaluate both alternative options and the marginal values of non-market attributes. With CM, it is possible to estimate the value of the individual attributes that make up an environmental good. The CM is also able to derive estimates of the value of changes in the aggregate level of non-market goods quality.

Model Specification

With reference to the utility theory, the paper models the choice of respondents (home ownerships) for characteristics of a house. The underlying assumption is that households evaluate the characteristics of different housing alternatives and then choose the one which leads to the highest utility. By assuming that the utility of living in green home is a function of the price, the housing's attributes (CO_2, rainwater harvesting system, natural indoor air ventilation, green area), household characteristics, and a random component that captures the influence of unobserved factors. The household characteristics can include income, education, environmental consciousness, as well as site-specific characteristics of the household's actual residence. Indeed, according to the random utility theory, the utility of goods or services is considered to depend on observable (deterministic) components, including a vector of attributes (X) and individual characteristics (Z), and a stochastic element e Louviere, Hensher, & Swait, (2000). Thus, the utility function of a bundle of characteristics i for individual q at choice task j can be represented as:

$$Uqij = V(Xqij, Zq) + eqij \qquad (1)$$

where V is the deterministic part and eqij the stochastic element. The deterministic variables that will be used in an empirical model are the housing attributes (Xqij) and the respondent's characteristics (Zq). The probability that individual n will choose option i over other option j is given by:

$$Prob\ (i/C) = Prob\ \{Viq + eiq > Vjq + ejq\ ;\ j \square C\} \qquad (2)$$

where C is the complete choice set. It is assumed that the error terms of the utility function are independently and identically distributed (IID). A consequence of this assumption is the property of independence of irrelevant alternatives (IIA). The IIA states that the probability of choosing one alternative over the other is entirely dependent on the utility of the respective alternatives. This property may be violated by the presence of close substitutes in the choice sets as well as heterogeneity in preferences.

Assuming an extreme value distribution for the stochastic term e_{qij} in model (1), the probability of choosing alternative i out of a set of available alternatives A={1, 2, …, K} can be written in a logistic form as:

$$Pqij = exp(Vqij)/\sum K\ k=1\ exp(Vqkj) \qquad (3)$$

Expression (2) is the basic equation of a multinomial logit Greene (2003) and Thomas (2000). Utility function V is generally assumed to be linear in parameters. In our case, the number of alternatives in each choice task is limited to two possibilities. Thus, the choice set for a given choice task j can be written as A={0, j} with 0 indicating the status quo and j representing the offered alternative. The random utilities of the resulting binary logit model can be written as:

$$U_{qj} = \beta X_{qj} + \alpha Z_q + e_{qj}; U_q 0 = 0 \qquad (4)$$

where Z_q represent the household characteristics that do not vary across choice tasks, and X_{qj} is the characteristics of the alternative situation of choice task j for individual q. α and β are the vectors of model parameters. In a multinomial logit framework, the parameters associated with one of the outcomes are normalized to zero namely, $U_{q0}=0$. Therefore, U_{qj} is the random utility of choosing the alternative situation over the status quo. If all the relevant respondent's characteristics (Z_q) are observed, the model given in Eq. (4) is a simple binomial logit. In general however, Z_q can include a host of parameters, many of which are not observed. In this case, this term can be considered as an individual fixed effect. The resulting model is a fixed-effect binary logit model proposed by Chamberlain (1980) and can be written as:

$$U_{qj} = \beta X_{qj} + u_q + e_{qj}; U_{q0} = 0 \quad \text{with } u_q = \alpha Z_q \tag{5}$$

It should be noted that because of the presence of fixed effects in the model, vector X_{qj} can be equivalently replaced by the $X_{qj} - X_{q0}$, which measures the difference between the characteristics of the hypothetical alternative with the status quo. This implies that U_{qj} measures the net gained value through moving from actual situation (status quo) to a hypothetical status offered in choice task j. Given that the hypothetical alternatives may equally involve a better or worse situation regarding comfort, the individual specific term u_q can be interpreted as the (dis)utility of respondent q from changing their status quo.

Assuming a logistic distribution for the error term, the above model can be estimated by maximization of the conditional likelihood given the fixed effects (u_q). Results show that for a consistent estimation, incidental parameters u_q should be replaced by a minimum sufficient statistic namely, the number of positive responses for a given individual. If we denote the individual q's response for J choice tasks by the sequence ($y_{q1}, y_{q2}, \ldots, y_{qJ}$), where $y_{qj}=1$ if offer j is chosen, and $y_{qj}=0$ if offer j is not chosen, then the number of positive responses (accepted offers) for individual q is obtained by the sum $s_q = \Sigma^J{}_{j=1}\, y_{qj}$. The conditional probability can therefore be written as:

$$Pr(y_{q1}, y_{q2}, \ldots, y_{qJ} | u_q) = \frac{exp\,(\Sigma^I{}_{j=1}\, y_{qj} X_{qj} \beta)}{\Sigma d_{qj\in\Omega}\, exp\,(\Sigma^J{}_{j=1}\, d_{qj} X_{qj} \beta)} \tag{6}$$

where Ω is the set of all the sequences ($d_{q1}, d_{q2}, \ldots, d_{qJ}$) in which the number of positive responses is equal to that of the chosen sequence namely, ($\Sigma^J{}_{j=1}\, d_{qj}\, 1 = \Sigma^J{}_{j=1}\, y_{qj} \equiv s_q$. Hence, the numerator represents the probability of choosing the sequence ($y_{q1}, y_{q2}, \ldots, y_{qJ}$) and the denominator indicates the sum of the probabilities of all possible outcomes that entail the same number of accepted offers. The fixed-effect logit model is estimated using the maximum likelihood estimation method. Once the model parameters are estimated, the marginal rate of substitution between different attributes can be calculated. If one of the attributes is a numéraire or a monetary variable like price (p) the marginal willingness to pay for attribute x can be derived as:

$$WTP = \frac{\delta V/\delta x}{-\delta V/\delta p}$$

which is equivalent to the ratio of the corresponding coefficients in Eq. (4). In this study, the experimental design is constructed based on the compensating surplus (CpS) welfare measure. It measures the change in income that would make an individual indifferent between the initial (lower environmental quality) and subsequent situations (higher environmental quality) assuming the individual has the right to the initial utility level. This change in income reflects the individual's WTP to obtain an improvement in environmental quality. Based on the indirect utility functions, the compensating surplus can be illustrated as follows:

$$V_0(Z_i, X_0, M) = V_1(Z_i, X_1, M\text{-}CpS) \qquad (7)$$

where M is income, X_0 and X_1 represent different levels of an environmental attribute, and Z_i represents other marketed goods. Using the results from the multinomial logit, the CS can be estimated by employing the following equation (Adamowicz et al., 1994).

$$CpS = -1/(\beta_M)\{ln(\Sigma_i exp^{V0}) - ln\,(\Sigma_i\, exp^{\,V1})\} \qquad (8)$$

The above equation allows for the valuation of multiple sites. This study considers only one site. Therefore, following Boxall *et* al. (1996) and Morrison *et* al. (1999), equation (6) is reduced to:

$$CpS = \{-\,1/(|\beta_M|)\}(V_0 - V_1) \qquad (9)$$

where β_M is the coefficient of the monetary attribute and is defined as the marginal utility of income, and V_0 and V_1 represent initial and subsequent state, respectively.

Methodology

A total of 600 heads of urban households were interviewed: 300 respondents were surveyed using the generic format questionnaire, while 300 respondents were also interviewed using the label-specific questionnaire. All of the respondents who were selected as case study, resided in Kajang and Bandar Baru Bangi, Selangor, were selected through stratified random sampling. The lists of Municipal Councils were gathered from the government website and contacted to obtaint the list of residential areas. Considering the high survey cost and budget constraints, the sample sized was deemed comfortable for use in surveys on environmental valuation studies in Malaysia.

The survey took 2 months to complete with the employment of 10 enumerators who picked respondents randomly around the residential areas within Kajang and Bandar Baru Bangi. Prior to conducting the surveys, the enumerators attended trainings conducted by the researchers. They were briefed on the choice model procedure, the idea of economic valuation, exposed to home visual images, the types of green home technologies, and the background of the study. They also participated in role-play exercises to expose the enumerators to ways of obtaining cooperation from the respondents. Enumerators were informed of possible biases during interviews and ways to minimize them. The enumeratos were also taken for a brief tour to familiarize them with the areas of the study sites, and also met with the area heads to seek their help in getting respondents to cooperate in the survey.

The data collected by the enumerators was later analysed descriptively and inferentially after being transferred into the computer. Descriptive and inferential analyses used the SPSS version 18 program while Choice Model (CM) utilized SAS and LIMDEP 8.0 NLogit 3.0 software.

Choice Model Implementation

According to choice model approach, consumers' WTP is ascertained based on their answer through the questionnaire form. Respondents are asked a series of 6 very similar types of questions. This questions form is also known as choice sets with three or more resource use options. Each of choice sets is defined by different levels of similar attributes. An experimental design procedure was used to form the choice sets by using SAS 9.0 statistical software.

Prior to determining the choice sets, there were several focus group sessions (FGDs) and intense literature searches to select the feasible atributes and their levels. All the FGDs members were provided with the background and issues of the study. The outcome of the FGDs with the defined attributes and levels is shown in Table 1.

There were 2 formats (generic and label-spesific) used in this study because the study aspires to identify the labeling effect on the public choice for housing options.The generic format defined as Type 1 (the existing house) and Type 2 and 3 (the improved alternatives). For the label specific format, the actual name was shown, e.g., Terrace House (as existing house) and Green Home 1 and 2 (as the improved options).

Table 1: Attribute Definition and Levels in Generic and Label Formats

Attributes	Definition	Attribute levels	
		Existing Type 1 /Terrace House	Proposed alternative Type 2 & 3 /Green Home 1 and 2
Carbon dioxide (CO_2) emission	Carbon dioxide amount of gas (CO2) that discharged through electric material utilization within one year.	1200kg	360kg 480kg 600kg
Rainwater harvesting system	Catchment system to keep rain water to use for water tree, toilet torrent, washing clothes, cars and motorcycles.	No	3000 liter 5000 liter
Natural indoor air ventilation	Air flow that is sufficient for occupant's comfort in it.	Not good	Good very good
Green areas	Percentage of green area based on housing area more than 5 acre.	7%	13% 19%
Current house price	Double story terrace house.	RM260,000	RM312,000 RM338,000 RM364,000

Model

Multinomial Logit (MNL) basic model (Model 1). For the MNL basic model (Model 1), the utility function derived only based on the attribute variables and its' level:

Generic form

- Type 1 : Baseline or status quo
- Type 2 and 3 : Improvement house with better environmental attributes

Label-specific form

- Terrace house : Baseline or status quo
- Green home 1 and Green home 2: Improvement house with better environmental attributes

The utility of each function is determined by the attribute levels in the choice sets:

$Vi = ASC_0 + \beta_1*CO_2EMS + \beta_2*RWHS + \beta_3*AIRVENT + \beta_4*GREENAR + \beta_5*HSEPRICE$
for i = 1, 2, 3 and $ASC_0 = 0$ for Vi = 1

MNL extended model (Model 2). The MNL extended model assumes that there are several socioeconomic and environmental attitudinal variables influence the preferences and behavior of the respondents. Equation 2 is specified as:

$Vi = ASC_0 + \alpha_1 ASC_0 AGE + \alpha_2 ASC_0 RESD + \alpha_3 ASC_0 RACE + \alpha_4 ASC_0 GENDER + \alpha_5 ASC_0 MBR + \alpha_6 ASC_0 ACADEMIC + \alpha_7 ASC_0 SECTOR + \alpha_8 ASC_0 CATEGORY + \alpha_9 ASC_0 HHINC + \alpha_{10} ASC_0 TERRACE + \alpha_{11} ASC_0 BUNGALOW + \alpha_{12} ASC_0 OWNHSE + \alpha_{13} ASC_0 RENTHSE + \alpha_{14} ASC_0 CONCEPT + a_{15} ASC_0\_SUPPORT + \beta_1*CO_2EMS + \beta_2*RWHS + \beta_3*AIRVENT + \beta_4*GREENAR + \beta_5*HSEPRICE$
for i = 0, 1 and $ASC_0 = 0$ for Vi = 1, variables definition in Table 4.

Table 4: Variables Definition

Variables	Definition
Vi	Individual utility taking the value of one (1) for choose an option and zero (0) not choose option
ASC_0	*Alternative spesific constant* (ASC) taking the value of one (1) for improved options and zero (0) for baseline option
CO_2EMS	Carbon dioxide (CO_2) emission
RWHS	Rainwater harvesting system
AIRVENT	Natural indoor air ventilation
GREENAR	Green area
HSEPRICE	Current house price
AGE	Age of respondent (ratio data)
RESD	Number of residents residing in the respondents' house (ratio data)
RACE	Dummy variable (DV) equaling one (1) if

Table 4 Continue

	respondent is Malay
GENDER	DV=1 for male
MBR	DV=1 if respondents who are members of any environmental related organizations
ACADEMIC	DV=1 if respondents who attain academic qualifications at tertiary level
SECTOR	DV=1 if respondents who are government servants
CATEGORY	DV=1 if respondents who are categorized as professionals and management related personnel
HHINC	DV=1 if respondents whose household income is more than RM5,000.00 per month.
TERRACE	DV=1 if respondents who are residing at terrace house
BUNGALOW	DV=1 if respondents who are residing at banglow house
OWNHSE	DV=1 if respondents who are residing in their own properties
RENTHSE	DV=1 if respondents who are residing in their rent properties
CONCEPT	DV=1 if respondents who know the concept of green home
SUPPORT	DV=1 if respondents who would support environment be protected.

Findings and Discussion

Respondents' Profile

The respondents' profile for the total sample of 600 is analyzed according to their socio-demographic and attitudinal variables. The discussion covered the aspects of gender, race, the number of households, education level, employment status and gross monthly income by comparing between generic format and label format. The composition of male and female respondents was quite balanced, with a mean age of about 36 years. Malay respondents (59.7% and 42.7%) comprised the largest race composition of the survey for both formats. An average household was between 4 to 6 persons. Most of the respondents had completed at a certificate or diploma level (25.7% and 34.7%), implying a high literacy rate of the samples. Respondents were mostly private sector workers (47.7%) for generic and public sector workers (32.7%) for label format. The mean household income was between MYR2001 to MYR3000 (46.0% and 42.3%). The discussion covered the aspects of gender, race, the number of household, education level, employment status and gross monthly income by comparing between generic format and label format as per Table 2.

Table 2 : Respondents' Profile in Generic Format vs. Label Format

Variable	Generic format sample average	Label format sample average
Gender	Male (56.7%)	Male (56.0%)
Age	36.6	36.1
Race	Malay (59.7%)	Malay (42.7%)
Number of Households	4.8	4.8
Education level	Degree (36.0%)	Certificate/diploma (34.7%)
Employment status	Private sector (47.7%)	Public sector (32.7%)
Household monthly income	MYR 2001 – MYR 3000 (46.0%)	MYR 2001 – MYR 3000 (42.3%)

Responses to Choice Sets

Table 3 shows the percentages of respondents who preferred the different options under the 2 questionnaire forms (generic and label): 26.0% and 22.0% of respondents of the generic and label-specific forms of the questionnaire, respectively, opted for the baseline option (i.e., Option1 and Terrace, respectively). The result indicates a strong preference for the Green Home 1 in the both generic format (43.3%) and the specific label-format (45.8%). Nevertheless, there was strong preference for the Green Home 1 in the specific-label format as compared to generic format.

Table 3: Analysis of respondents to choice sets

Options	Generic form (%)	Label form (%)
Option1 / *Terrace*	26.0	22.0
Option 2 / *Green Home 1*	43.3	45.8
Option 2 / *Green Home 2*	30.6	32.2
Total	**100.0**	**100.0**

The results above show that there is a clear influence of realism in product characterization, i.e., specific technology labeling in the choice of options by respondents. This finding suggests that researchers should consider employing and comparing the generic and label-specific options. This is consistent with the conclusion made by Blamey et al. (2000b) in testing labels policy in environmental choice modeling.

Model Results

The results of the model for both generic and label forms are shown in Table 5. All coefficients of the attributes (CO_2 emissions, natural indoor air ventilation, green areas and the current house price) in a generic form, found to be significant at the significance level of 1 per cent, while the rainwater harvesting system, significant at 10 percent significance level, and all have signs that expected (a priori). For example, CO_2 emissions (CO_2EMS) attribute, an increase in emissions of carbon dioxide (CO2EMS) will give negative utility. Label form also show the same effect, but slightly lower in percentage. This is likely because the respondent was informed by the names of a clear and specific technologies used to improve the options available.

Variables	Basic model (Model 1) Generic form	Label form	Extended model (Model2) Generic form	Label form
ASC_0	0.6346*	-0.1247	1.7223***	-1.3231***
	(0.3516)	(0.3511)	(0.4977)	(0.5086)
ASC_0_AGE	-	-	-0.0074	0.0141*
			(0.0073)	(0.0079)
ASC_0_RESD	-	-	0.1033***	-0.05623
			(0.0396)	(0.0362)
ASC_0_RACE	-	-	0.1033***	-0.05623
			(0.0396)	(0.0362)
ASC_0_GENDER	-	-	0.1952	0.0392
			(0.1266)	(0.1264)
ASC_0_MEMBER	-	-	-0.7643**	1.1529***
			(0.3388)	(0.4157)
ASC_0_AKADEMIC	-	-	0.4612***	-0.0033
			(0.1678)	(0.1475)
ASC_0_SECTOR	-	-	0.3348*	-0.4789
			(0.1715)	(0.1499)
ASC_0_CATEGORY	-	-	0.2506	0.2511*
			(0.1648)	(0.1509)
ASC_0_HHINC	-	-	0.9091***	0.2192
			(0.2039)	(0.1864)

Table 5 Continue

ASC_0_TERRACE	-	-	0.7246***	0.6431***
			(0.1438)	(0.1591)
ASC_0_BUNGALOW	-	-	-0.2895	0.6483**
			(0.2593)	(0.2768)
ASC_0_OWNHSE	-	-	0.1773	0.3481*
			(0.1869)	(0.2086)
ASC_0_RENTHSE	-	-	-0.9651***	-0.8164***
			(0.1830)	(0.1896)
ASC_0_CONCEPT	-	-	1.0725***	0.1233
			(0.1532)	(0.1261)
ASC_0_SUPPORT	-	-	0.3068**	0.2189
			(0.1296)	(0.1443)
CO_2EMS	-0.0018***	-0.0015***	-0.0019***	-0.0015***
	(0.0004)	(0.0004)	(0.0004)	(0.3733)
RWHS	0.00006*	-0.000006	0.00008**	-0.000003
	(0.00004)	(0.00004)	(0.00004)	(0.00004)
AIRVENT	0.3173***	0.5115***	0.3269***	0.5116***
	(0.0737)	(0.0744)	(0.0760)	(0.0757)
GREENAR	0.0504***	0.01199	0.0604***	0.0154
	(0.0120)	(0.01195)	(0.0125)	(0.0121)
HSEPRICE	-0.00002***	-0.00002***	-0.00002***	-0.00002***
	(0.000002)	(0.000002)	(0.000002)	(0.000002)

Table 5 Continue

	Summary statistics			
Log-likelihood	-1846.45	-1803.17	-1695.40	-1706.49
R^2 Adj	0.06	0.09	0.14	0.13
Iterations completed	4	4	6	6
Observation	1800	1800	1800	1800

Note: Parentheses indicate the standard errors of the respective coefficients.
*Significant at 10% levels
** Significant at 5% levels
*** Significant at 1% levels

Variables - socioeconomic variables are modeled through the interaction of variables with ASC_0. These interactions capture the influence of those variables on the probability of respondents choosing the type of home that there is an improvement, ie whether type 2 (Green Home 1) or type 3 (Green Home 2). The results show the ASC_0 in Model 1 tested positive for the generic form of 0.6346, while negative for label form of -0.1247. This means the values obtained without the influence of variables, socioeconomic variables and attitude, respondents acquire a high level of utility for a generic form and low levels of utility for the label form. All attributes found to be significant at least at the 10 percent level of significance and all the signs as expected. In its generic form, the results showed that an increase in CO_2 emissions lead to a negative utility in households amounting to 0.18 per cent. This change is lower for label design (0.15 per cent). Meanwhile, rainwater harvesting system attribute shows different compared to CO_2EMS attribute, an increase in RWHS, leading to a positive utility among respondents amounting to 0.006 per cent. Most other attributes showed a similar trend of increase in the attributes of non-financial leading to a positive utility among respondents. The results for Model 2 are listed in Table 6. The results showed that there were 10 and 8 out of 14 socio-economic variables, respectively, for the generic form and label form are significant at least at the 10 percent level of significance. Among them, the generic form are RESD, RACE, MBR, ACADEMIC, SECTOR, HHINC, TERRACE, RENTHSE, and SUPPORT, meanwhile under label form there are AGE, RACE, MBR, CATEGORY, TERRACE, BUNGALOW and RENTHSE. For generic form, all attributes of non-monetary and monetary, just as the basic models (1), namely significant and give a sign as expected. While the label form anyway, just as the basic label model (1), namely not all monetary attributes are not significant and just one non-monetary attribute (RWHS) showed no sign as expected. However, this sign is the same for the basic model (1), namely negative. In addition, , the situation is the same as model 1 for label form, namely only three attributes (CO_2EMS, AIRVENT and HSEPRICE) found highly significant and give the result as expected.

Based on coefficients for generic form variables which are significant, it is clearly stated that a positive and significant coefficient for the variable RESD suggest that increase in household size, leads to a positive utility in the household and tend to support an improvement homes (green home). While for the RACE variable, it found to be significant and have a positive coefficient sign for both forms. This indicates that, on average, Malays race led to positive utility among household and tend to support an improvement home. This is in line with TERRACE variables, namely respondents who live in terrace homes on average leading to a positive utility among household and tend to support an improvement home. Instead, RENTHSE variable, both forms found to be significant but has a negative sign in coefficient. This result indicates that the respondents who rented a house on average leads to a negative utility and tend to support the existing home as compared to an improved homes. The next attribute of ACADEMIC, HHINC and CONCEPT, found to be significant at the 1 percent significance level and has a positive sign of the coefficient. It is clearly stated that respondents with higher education (undergraduate), earning more than RM5,000 and know the concept of environmentally friendly homes leads to a positive utility among the household and tend to support an improvement home (green home). Meanwhile, all these three attributes are not significant for the label form. In the meantime, the SECTOR and SUPPORT attributes found to be significant at the significance level of 10 percent and 5 percent respectively, and a positive sign of the coefficient. This result indicates that respondents who work in the government sector and support the environment be protected tends to lead to a positive utility among household and supporting an improvement homes (green homes) for the generic form. Conversely, respondents who were members of any association relating to the environment (MBR) and rented house (RENTHSE) at present, leads to a negative utility among household and tend to support the existing house. This is because they are not ready to pay or not able to pay a higher amount for a home that have an improvement.

For the label form, the result showed the variables such as RACE, MBR, TERRACE and BUNGALOW, found to be significant at least at the 1 percent significance level and have positive sign in coefficient. It is explained that on average, respondents were Malays, become a member of any association related to the environment, respondents who are living in terraced houses and bungalows, leading to a positive utility among household and tend to support an improvement homes (green homes). Meanwhile, the attributes AGE, CATEGORY and OWNHSE, found to be significant at least at the level of significance of 5 percent and 10 percent, and has a positive sign in coefficient. This result indicates that with an increase in their age, the respondents are employed in managerial and professional career, respondents who own their own homes also lead to a positive utility and tend to support an improvement homes (green homes). Conversely, respondents who rent houses at present (RENTHSE), leads to a negative utility in the household and tend to support the existing house. The explanatory powers of the models (Adjusted R^2) for Model 2 are satisfactory at 14% and 13% for generic and label forms, respectively.

According to Hensher and Johnson (1981), an adjusted R^2 0.2 to 0.4 is extremely good. Thus, the value of R^2 are aligned and this study were obtained at satisfactory category.

Implicit Prices

The implicit price (IP) reflects the marginal rate of substitution (MRS) between each of the identified non-monetary attributes and the monetary attribute. These IP are obtained as the ratio of the coefficients of each attribute to those of the monetary attribute. These also reflect the WTP for an additional unit of that attribute to be present, ceteris paribus. The attribute coefficients from the MNL models were used to compute the IP shown in Table 6.

Table 6: Estimates of Implicit Prices (MYR)

Attribute	Generic		Label	
	MNL (Model 1)	MNL (Model 2)	MNL (Model 1)	MNL (Model 2)
CO_2EMS	90	95	75	75
RWHS	3	4	0.3^{ns}	0.15^{ns}
AIRVENT	15,865	16,345	25,575	25,580
GREENAR	2,520	3,020	$5,995^{ns}$	770^{ns}

^{ns}Coefficient is not significant

Implicit prices for attributes that are budgeted by the econometric model (MNL) is not much differed. Value for the implicit price for non-monetary attributes (CO_2EMS, RWHS, AIRVENT, GREENAR) emphasizes the distinction in magnitude when compared between generic and label forms. In model 2 (MNL), there are three non-monetary attributes such as CO_2EMS, RWHS and GREENAR shows the higher value of the implicit price in generic form as compared to the label form. Consistent with these results, Blamey *et* al. (2000) previously noted that all the attributes must have a higher value of MRS in generic form as compared to the label form. However, only AIRVENT attribute, has a higher values in MRS for the label form compared with the generic form for the Model 2. According to Model 2, for example CO_2EMS, the implicit price obtained suggest that the average household was willing to pay RM95.00 and RM75.00 for a reduction in emissions CO_2EMS for both generic and label forms. Respondents are willing to pay a lower price for the release CO_2EMS in generic form as they remain skeptical of the technology that will be adopted for the proposed home against the label form. These results clearly show that if the government can ensure no contamination through the use of technology, such as the solar panels, so it makes sense that it can be fully implemented. RWHS attribute shows the same scenario as CO_2EMS namely higher in implicit price for generic form as compared to the label form. The respondents were willing to pay as much as RM4.00 for the increase in tank size and this demonstrated that they were willing to pay more to obtain larger water tank for rainwater collection in order to maintain the natural surroundings. This was similarly shown in the label form -; the number of lower ability to pay for that increase in namely RM0.15 rainwater tank size. This demonstrated that respondents believe green homes or intimate nature around can reduce the water supply through the use of rain water. For AIRVENT attribute, it varies with the other non-monetary attributes because of implicit prices for the generic form of this model is less (RM16,870.00 for an increase in indoor natural air ventilation in the house) as compared to label form where implicit price (RM25,495.00 for an increase in indoor natural air ventilation in the house). Respondents are willing to pay (WTP) of RM16,870.00 and RM25,495.00 for an increase in indoor natural air ventilation in the house from bad to moderately good for both forms. The high value of MRS for this attribute in the label form clearly shows that even if respondents knew the real technology that will be adopted, they still need to be more aware of the options.

Namely GREENAR as the last attribute, indicate a high implicit price in the generic form as compared to label forms. In the MNL models, the respondents are willing to pay (WTP) as much as RM3,020.00 for an increase in the percentage of green areas and this explains that respondents appreciate the natural beauty around that area for enhanced percentage something greenish residential areas. The same situation can be seen in the form of a label but at the level of ability to pay (WTP) a little low, namely RM770.00 for accretion percentage of green areas in residential areas to enjoy the greenery. With such, this clearly proves that respondents still skeptical with the ability to type 2 and 3 in addressing issues surrounding nature as promised in attributes improvement. It because after home labeled, they feel the willingness to pay was lower to enjoy the greenery at their residential area. Therefore, the results showed that it is better for the respondents preferred option when they clearly understand the specifications given.

Equilibrium Values and Ranking The equilibrium values (EqV) of each of the non-monetary attributes help to identify the tradeoffs between the non-monetary attributes that would leave the individuals on the initial utility level. Once there is a reference implicit price, the equilibrium values is calculated as: EqV = WTP(Reference attribute) / WTP(Interest attribute) Where carbon dioxide emission (CO_2EMS) emission was used as the references attribute. For example, the EqV for AIRVENT was calculated by dividing the implicit price (or WTP) of CO_2EMS by the implicit price of AIRVENT: i.e., MYR90/ MYR15,865= 0.0057. The EqV for CO_2EMS itself is assumed to be 1.00. The EqV values calculated for each non-monetary attribute, and the attributes were ranked according to their EqV values under generic and label formats (Table 7 and Table 8).

Tabel 7: Estimation of Equilibrium Values in Generic Format

Atribute	MNL (Model 1)	MNL (Model 2)	Ranking of importance
CO_2EMS	1	1	3
RWHS	30	23.75	4
AIRVENT	0.0057	0.0058	1
GREENAR	0.0357	0.0315	2

^{ns}Coefficient is not significant

Tabel 8: Estimation of Equilibrium Values in Label Format

Atribute	MNL (Model 1)	MNL (Model 2)	Ranking of importance
CO_2EMS	1	1	3
RWHS	250^{ns}	500^{ns}	4
AIRVENT	0.0029	0.0029	1
GREENAR	0.0125	0.0974	2

^{ns}Coefficient is not significant

Based on the MNL Model 1 and the work of Jamal (2006), The EqV can be interpreted conceptually as the average utility derived by the households as a result of a unit improvement in CO2EMS, 30 unit improvement in rainwater harvesting system (RWHS), 0.0057 unit improvement in a natural indoor air ventilation (AIRVENT), and 0.0357 unit improvement in green areas (GREENAR) for generic format. The similar trend for label format can be calculated. The EqV allows the attributes to be ranked according to public importance, with the lowest EqV being ranked as the most important (AIRVENT) and the highest or not significant EqV being the least important (RWHS). According to the result, the respondents are concerned about AIRVENT, followed by GREENAR, CO2EMS and RWHS captures the least attention. This may be caused by most houses inhabited today consume a lot of electrical power and do not take into account the thermal comfort with the design and materials used are in accordance with certain condition. RWHS captures the least attention noted and this may be due to people not having problems with the water supply provided by the private sector. In addition, they are willing to pay a sum of money for the use of the water pipe supply.

Conclusion and Implication

The findings of this study reveal that most of the consumers preferred green home as compared to conventional housing for their living in sustainable lifestyle. This study also shows Malaysian consumers were willing to pay (WTP) to obtain the maximum improvement for each attribute that is modeled. This result also reveals a significant labeling effect. The households are more WTP (as shown by the lower Compensating Surplus) when the name and attribute levels defining the facilities were made known to them. The relevant bodies may need to use greener or be more environmentally friendly for housing facilities in terms of their technology. These would give the households higher confidence in accepting the proposed options.

In terms of the composition of the importance for non-monetary attributes, the equilibrium values (EqV) shows that both the generic and label produce almost the same order of magnitude, namely the attributes natural indoor air ventilation (AIRVENT) was the most preferred, followed by attribute green area (GREENAR), carbon dioxide emission (CO2EMS) and the latter was an attribute rainwater harvesting system (RHWS). Studies on the assessment of non-market goods on green home choices carried out shows that this technique can be applied to the selection model successfully in developing countries, such as Malaysia, can apply on issues related to green home. Close consultations with the stakeholders through FGD are critical to understand the nature of the environmental problems and to select the attributes and levels that were the main aspects of choice model design (Pek and Jamal, 2011). The results of the study provided useful information to policy makers in developing and implementing policies that are more consistent in addressing environmental problems. The study also shows that there were policy implications that need to be addressed by the government to ensure green home can be fully implemented in the future so that environmental issues such as pollution, climate change and global warming can be addressed in the interests of the present generation and new generations. In this case, the government has an important role to introduce awareness campaigns, education and knowledge, providing incentive schemes or loans to the public in an effort to promote the use of efficient equipment. Among the incentive scheme may include cash rebates, tax incentives, financial incentives, subsidies or other incentives. The granting of incentive schemes such as this should be provided by the government to its developers. For example, the program provides cash rebates for the use of solar systems or rainwater harvesting system. In addition, incentive schemes in the form of a grant or tax credit should also be given to the manufacturers that produce green products.

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