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Why Do People Use Their Cars: A Case Study In Malaysia

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Abstract: In Malaysia, the rapid increase in the use of own transport prompted by inadequate public transport has resulted in increased traffic congestion, accidents, inadequate parking space and air pollution among other evils. This study sought to identify the factors preventing own transport users from shifting to public transport and to develop model shift from car to public transport in order to formulate the policies to achieve this. A survey was carried out on users of private and public (both bus and urban train transport) (n = 1350). Multinomial legit models were developed for the three alternative modes, Car, Bus and Train. This study found that the most important variables found likely to encourage the use of public transport were reduced travel time and subsidized fares. As expected, for the commuter to switch to public transport he would have to be incentivated to do so.

Key words: public transport policy, traveller attitudes and perception, legit model mode choice

INTRODUCTION

Malaysia is a prosperous rapidly growing country with high private vehicle ownership automobile and only approximately of urban travel is by public transport. In order to make restraint on private transport politically feasible, public transports have to be greatly improved. The increasing number of car users involved in crashes and the associated injury has prompted the government of Malaysia to undertake various studies to address the problem. One of these studies was the shift of transportation mode from private car to public transportation (Bus and Train) in Malaysia[1]. The study targeted to evaluate policies and strategies than can help to formulate, model shift of transportation mode from private car to public transportation in Malaysia, to formulate the modelling of possible model shift from private car to public transportation and to predict the future model shift. The current paper is a part of the research that has focused on model shift initiatives. These initiatives focused on shifting car users to safer modes of transport in order to increase road safety and enhance road environment. To date, many cities have attempted to restrict the use of private cars in favour of public transport[2] Such policies exist in France [3], Germany[4], Britain[2-3], Netherlands[5-6], Romania[7], Australia[8], Asian countries[9-10] , and Canada [11]. The attempts have been by changing the public perception to it. This research bridges the gap so that appropriate Modal Shift could be implemented. This study explores the differences in the characteristics of bus, train and car use, specifically in testing the hypotheses as to whether car users have outperformed buses and train in relation to key characteristics especially travel times and costs. A binary legit model was used to identify factors that are significant in determining the choice of transport and to predict the probability of a change in bus and train rider ship with respect to various travel times and cost.

METHODOLOGY

In order to address the objective of this study, questionnaires[1] study was carried out in selected urban environments of the Kuala Lumpur City Centre area to determine reasons for travellers mode choice from among three transport modes: private cars, bus and train. The survey was carried in a selected corridor in Kuala Lumpur city centre where there was high car ownership and use, and public transport (bus and rail) available. A total of 1350 questionnaires were collected over a period of 6 months from (1March to 1 September 2005). The questions addressing car, bus and train users were addressed contained only in the revealed preference survey and pertained to demographic, socio-economic characteristics and mode attributes. The respondents were requested to report their current travel situation by answering a set of questions. These questions were categorized into: (1) Questions on respondent's current travel modes and associated

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attributes such as current travel mode available to the respondent, his/her current travel mode and associated travel time, cost, and access approach. The respondents were encouraged to report information on other travel mode attribute values. (2) Traveller's personal information relating to travel mode choice such as age, income, gender, occupation, education, total number of household members, and number of vehicle ownership in the household. Some of the questions in this section were categorized. For instance, the income of respondents consisted of five levels with equal intervals. For car users, the questionnaire addressed both revealed and stated preferences. The survey information included socio-economic characteristics of individuals, trip information of individuals, and attitudes and perceptions on travel and policy measures. Socio-economic information included household income, individual's income, age, gender, vehicle ownership, and total number of members in household, occupation and education level. Trip information of individuals included the purpose of the trip, mode of travel, total travel time and travel cost etc. A multinomial logit model was developed for three alternatives namely, bus, train and car, with the aim of comparing the utility of these travel modes and to identify the factors that would influence car users to move from traveling by car to choosing the public transport alternative. The explanatory variables were: age, gender, income, travel time, travel cost and car ownership. Some of the explanatory variables such as age, income per month and gender were categorized. For instance, the income was categorized as; <RM 1000, RM 1001-2000, RM2001-3000, RM 3001-4000, >4001 (1USD = RM3.65) while gender was categorized as 0 for male and 1 for female. Age was also categorized as; 16-29, 30-44, 45-60 and >60.

Model structure: The multinomial logit model was used when there were more than two choices as a final model to investigate mode choice behavior of travellers of three modes of transport namely (car, bus and train) and to determine the tradeoffs travellers make when considering their mode of transport.

The proposed model that contained all terms was

$$V_{car} = \beta_0 + \beta_{1car} X_{tt\,car} + \beta_2 X_{tc\,car} + \beta_3 X_{age\,car} + \beta_4 X_{G\,car} + \beta_5 X_{inc\,car} +$$

$$\beta_{6car} X_A + \varepsilon_i$$

$$V_{bus} = \beta_0 + \beta_{1bus} X_{ttbus} + \beta_2 X_{tcbus} + \beta_3 X_{agebus} + \beta_4 X_{Gbus} + \beta_5 X_{incbus} +$$

$$\beta_6 X_A + \varepsilon_i$$

$$V_{tr} = \beta_0 + \beta_{1tr} X_{ttr} + \beta_2 X_{tcr} + \beta_3 X_{age_{tr}} + \beta_4 X_{Gtr} + \beta_5 X_{inctr} +$$

$$\beta_6 X_A + \varepsilon_i$$

Where

TT denotes total travel time,
TC denotes travel cost, Age denotes Age,
G denotes Gender,
Inc denotes Income and
A denotes the number of automobiles owned by the traveller's household,
tr denotes train

This model formulation implies that the probability of choosing an alternative increases monotonically with an increase in the systematic utility of that alternative. Similarly, the probability decreases with increases in the systematic utility of each of the other alternatives. The data were analysed using the Statistical Package for Social Science Software (SPSS), and the multinomial logit model of mode choice were developed in order to assess the relative importance of demographic, socio-economic and service attributes that influence travellers' choice behavior.

RESULTS

Alternative Mode of Transport for Car Users: The study made an attempt to determine whether car users had access to other modes of transport. Results from the study indicated that about 34% of car users had access to the bus as an alternative mode, 27% to train as an alternative mode of transport and 19% had access to motorcycle as an alternative mode of transport, while 20% had no access to alternative modes.

Alternative Mode of Transport for Bus Users: Respondents who were bus users were asked about their familiarity with other modes of transport as an alternative to the bus. The study indicated that about 54% of Bus users had no alternative mode of transport other than the bus, 11% used the motorcycle as an alternative mode of transport, while 23% used the car as a secondary mode. Only 12% train as a secondary mode.

Alternative Mode of Transport for Train Users: Our survey asked the respondents whether the Train Users had access to other modes of transport. The study indicated that about 29% of Train users had no access to alternative mode, 24% had access to motorcycle as an alternative mode of transport and 24% to Bus, while 23% had access to Car as alternative mode.

Table 1: Factors that encourage the use of the car

No.	Statement	Percent
1	Less Travel time	44.1
2	Desirable Routes not covered by public transport	33.8
3	Comfortable	2.5
4	If its save	2.0
5	Infrequent public transport services	17.6

Table2: Factors Discouraging car users from using public transport

No.	Statement	Percent
1	High risk to road accident involving	17.0
2	High traffic congestion and delay	36.6
3	It is not cheap and no cost saving (fuel and tool)	14.4
4	It is no economical to maintain	10.9
5	Parking and maneuver problem	23.7

Table 3: Likelihood of car users switching to public transport.

No	Statement	Percent
1	Vehicles usually arrive on schedule	37.2
2	Fare is low	28.0
3	Vehicles are not too crowded	3.2
4	Vehicles are clean	2.0
5	The route is more accessible	29.6

Factors Contributing to Car Popularity: The study elicited specific questions in order to explain factors that contributed to car use as opposed to bus and train use. The key factors addressed were: 1) reduced travel time, 2) Desirable Routes not covered by public Transport, 3) Comfortable, 4) save, and 5) Infrequent Public transport services (see Table 1). The main incentives motivating the use of the car were that it reduced travel time, it offered cost savings and it is affordable. About 44.1% of the respondents indicated that the reason for choosing the car as a mode of travel was that it reduced travel time, while 33.8 % and 17.6% considered it Desirable Routes not covered by public transport and infrequent public transport services.

Deterrents to Mode Shift from car to Public Transport: In considering the deterrents to a mode shift from car travel to public transport, it is necessary to understand the factors, which deter the great majority of active car users from using public transport (bus and train) as a regular means of transport. Table2 presented the major deterrents identified when survey respondents were asked to name or, select from a given list, the factors which would influence their decision not to use Public transport. The factor of most significance discouraging car users from using the public transport was that the "High traffic congestion and delay " (see Table 2). This statement received an average rating of 36.0%. Other factors significant to car users included 'the Parking and maneuver problem ' (23.7%) and 'It is not cheap and no cost saving (fuel and tool)' (14.4%).

Likelihood of Car Users Switching to Public Transport: In order to promote greater use of public transport, car respondents were provided with statements, that the answer to which would reveal their perception on public transport services and the improvements that would encourage them to use public transport. It can be clearly seen from Table 3 Improved frequency, reduced fares and route accessibilities were considered to be the passenger transport options that would encourage car users to shift modes. There was significant support for improving passenger transport Services as a means of reducing car use. As evident from Table 3, the factor of most significance in encouraging car users to switch to public transport was the reliability of public transport (arriving on time) (37.2%), route accessibilities of public transport (29.6%). Other factors of importance included the low fare (28.0%). and whether they were not too crowded (3.2%).

Estimation of Multinomial Logit Model (Car, Bus and Train): The multinomial logit mode choice model was estimated in order to test the significance of the contribution of demographic, socio-economic, and mode attribute variables in explaining mode choice behavior. The model constituted demographic, socio-economic characteristics, and mode attributes. Travel time and travel cost represented mode related attributes and were specified as generic variables in the utility specification. Age, income ,gender and car ownership are represented demographic and socio-economic variables. The analysis concentrated on the mode choice decision for people who used car, bus and train and the variables that explained their mode choice behavior. The result of the multinomial legit for mode choice for all trips on the factors thought to influence the travel mode, mode attributes, demographic and socio-economic variables is seen in Tables 4. The coefficients were estimated using the maximum likelihood method.

The Model examined the influential attributes for car users and bus users relative to train use. In this case, the utility of the car had been set to zero as the base alternative. The estimated results were provided in Table 4. It was found that the estimated coefficient on travel time and travel cost for bus and train modes were significant. The negative signs of coefficients indicated that the increase in bus and train travel time and travel cost and increase of car ownership were

Table 4: Estimation Results for Multinomial Mode Choice Model (n=1350)

Mode of transport (a)		B	t-ststs	df	P-value.	Odds ratio
Bus (Choice of bus Relative to car)	Intercept	4.66	0.022	1	.000	
	Age	-0.29	-0.014	1	0.000	0.748
	Gender	1.55	0.000	1	0.016	4.71
	Travel time	-0.12	-0.512	1	0.040	0.886
	Travel cost	-0.33	-0.043	1	0.011	0.718
	Income	-0.04	-0.008	1	0.022	0.960
	Car ownership	-0.44	-0.00	1	0.000	0.644
Train (Choice of train Relative to car)	Intercept	2.82	1.239	1	.000	
	Age	-0.65	0.000	1	0.010	0.522
	Gender	2.44	0.000	1	0.000	11.47
	Travel time	-0.098	-0.016	1	0.000	0.906
	Travel cost	-0.57	-0240	1	0.000	0.565
	Income	-0.002	-0.062	1	0.000	0.998
	Car ownership	-0.76	-0.010	1	0.000	0.467

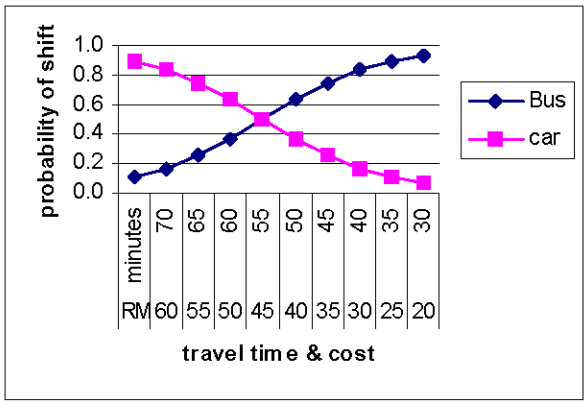

Fig.1: Effect of bus travel cost and travel time Reduction on car users mode choice probability

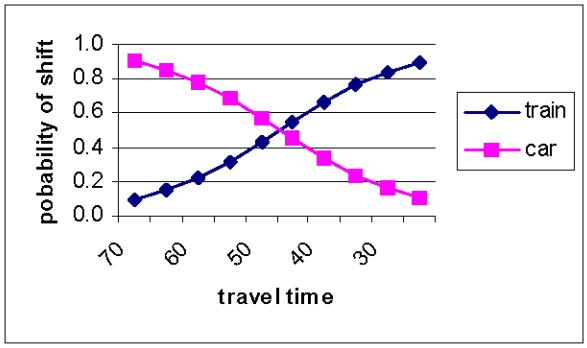

Fig. 2: Effect of train travel time reduction on car users mode

Likely to increase the probability of bus and train users shifting to car. For the demographic and socio-economic variables, the income coefficient of the bus and train users was negative indicating that an increase in bus and train user's income is likely to decrease utility of bus and train use. Findings on interpreting the logit coefficients for the categorical variable are consistent with our expectation of mode choice. For the gender factor, the model estimation suggests that females are more likely to prefer car rather than bus and train use. If the traveler is a male, the odds of selecting car will decrease by five times compared to female for bus users, If the traveler is a male, the odds of selecting car will decrease by twelve times compared to female for train users. For the age factor, elderly people were more likely to use the bus and train opposed to car. The odds ratio increases about 75 % for older people compared with the younger bus riders; the odds ratio increases about 53% times for older people compared with the younger train riders. The model has R square values of 0.82, which indicate that the independent variables explain about 82% the amount of the variation in the dependent variable. Classification matrices were calculated to assess the fit of the model to the data. It was found that the model correctly classified about 92.6% of car cases while for bus and train modes, it classified about 84.5% and 78.12% cases respectively. Accuracy of prediction was 86. 9%.

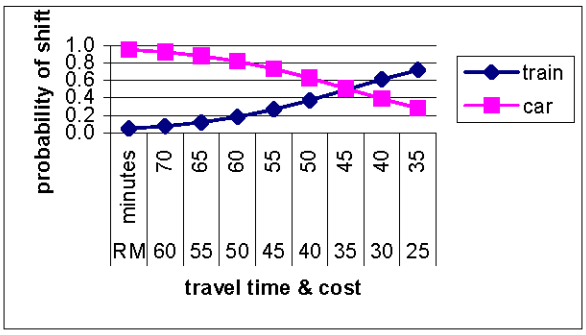

Fig 3: Effect of train travel cost and travel time reduction on car users mode choice probability

Probability Prediction: The mode share probabilities categorized by various levels of travel time and travel cost are shown in Figure 1. Mode choice probabilities ranged from 90% likelihood of car use with current bus minutes and RM=60) to 9% likelihood of car use with a reduction in weekly bus total travel cost and travel time per trip (30minute, RM=20). At the same time, the Probability of bus rider ship increased from 10 % with Current bus total travel time and weekly travel cost of (70 minute, RM 60) to 91% of likelihood with a RM20 and 30 minute reduction in weekly bus total travel cost and travel time. A 50:50 split may be achieved when the travel cost and time are set at RM45 per week and 55 minutes per trip for bus travel. For train commuters, the mode share probabilities categorized by various levels of travel time are shown in Figure 2 Mode choice probabilities ranged from 90% likelihood of car use with current train total travel time per trip (70minutes) to 10% likelihood of car use with a reduction in train total travel time per trip (25 minute). At the same time, the probability of train rider ship increased from10 % with Current train total travel time of (70 minutes) to 90% of likelihood with a 25minutes reduction in train total travel time per trip. A 50:50 split may be achieved when the travel time are set at 47 minutes per trip for train travel.

At the same time, the mode share probabilities categorized by various levels of travel time and travel cost are shown in Figure3. Mode choice probabilities ranged from 95% likelihood of car use with current train total travel time and current weekly travel costs (70 minutes and RM=60) to 20% likelihood of car use with a reduction in weekly train total travel cost and travel time (30 minute, RM=20). At the same time, the

Probability of train rider ship increased from 5 % with current train total travel time and weekly travel cost of (70 minute, RM60) to 80% of likelihood with a RM 20 and 30 minute reduction in weekly train total travel cost and travel time. A 50:50 split may be achieved when the travel cost and time are set at RM 35 per week and 45 minutes per trip for train travel.

DISCUSSION AND CONCLUSION

The study attempted to conduct mode choice behavior of travellers of three modes of transport namely train, car and bus and determined the trade-offs travelers make when considering choice of their mode of transport. Utility of the three modes were compared to determine the important reasons behind the choice of a particular mode and the circumstances, which might cause travelers to change their choice for the car. The binary and multinomial legit models examined the characteristics of bus and car trips such as travel time, travel cost, demographic and socio-economic characteristics to determine the relative influence of demographic, socio-economic variables and mode attributes on mode choice behavior. Multinomial legit also examined car and train alternative modes.

In order to promote greater use of public transport, this study examined the effect on car use if total bus and train travel time and travel costs were reduced. This was understood by solving the binomial legit equation for probability using several options of travel time and cost scenarios. The results suggest that travel time and travel cost are characteristics that determine why car use is a favored modal choice. Our findings revealed that these parameters were significant in explaining mode choice behavior. For the car mode, bus and train alternative comparison, the results of model estimation revealed that, lower travel time; lower travel cost the major barriers for car users not choosing the bus mode. In order to promote greater use of public transport and less dependence on car, an efficient public transport system is clearly needed. Higher capacity transit systems, use of bus lanes, bus gates, and ITS systems are among initiatives that could be implemented to improve the public transport system. The use of traffic restraint policies such as in France[3], Australia[8], Area Licensing in Singapore[12] or London Road Pricing[13] could further enhance a policy that promotes public transport; a policy that is moving towards a more sustainable transport system compared with total dependence on private vehicles. In light of the above discussions, some reflection is necessary in relation to the modal split model for developing and newly developed countries. Although the tendency is more towards shifting to public transport, this has proven unsustainable, long-term, in the developed countries. As such, promoting a shift from car to an efficient public transport system would be advocated as a model in a sustainable transport policy in highly car-registered

countries such as Malaysia. Although, in the short-term, the introduction of a comprehensive public transport system will require government infrastructure funding, such a system is sustainable and will result in higher road crash cost saving. Developing countries should not repeat the mistakes of earlier industrialized countries.

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