

Fuel Price Influence on the Road Users to Ride Public Transport in UMS

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Abstract

Fluctuation of fuel price (RM) per litre is one of the main factors that influences private vehicle users to shift to public transport. The main objectives of this study are to analyze the data related to the factors that influence the decision of students to use public transportation, and to develop a logistic model based on the shift percentage from private to public transportation influenced of fuel price (RM/Litre). This study is conducted in University Malaysia Sabah (UMS) and questionnaires was distributed to 377 of UMS students. Linear regression was used to analyze the collected data and develop a logistics model. From the model, the result shows that 87.53% of respondents are willing to shift to public transport should the fuel price reach RM3.50 per litre. This logistic model will be useful especially for the use of transportation planning in UMS.

Keywords: Fuel Price, Public Transport, Private Vehicle, Modal Shift, Logistic Model.

1. Introduction

The transportation system is the combination of elements and their interactions, which produces the demand for travel within a given area and the supply of transportation services to satisfy this demand [1]. Transportation gives tremendous effects on the economy through production, marketing products and general economic activities. Other than that, transportation also provide benefits in terms of medical sector especially in rural area. Not only that, the use of transportation has allowed people who live some distance apart to socialize by shortening travel times. Unfortunately, transportation has several shortcomings, most notably is the rapidly increasing number of private vehicles that leads to traffic congestion, delay, air pollution and accidents [2].

Over the years, there are various solutions that has been proposed and implemented to deal with the problems that comes with the modern transportation system. Several of the solutions

proposed are land management, green technology vehicle, renewable energy to replace fossil fuels, and alternative mode of transportation. One of the most effective solution is the use of public transportation. As a general rule of thumb, public transport is defined as a shared transportation service that includes urban public transit and intercity public transportation [3]. Public transport has shown a lot of benefit especially in reducing the number of traffic accidents, cutting down on traffic congestion, and reducing air and noise pollution. However, in many places, most of the people refuse to ride public transport due to poor level of services and inflexibility for travel. In order to attract more road users to ride public transport, the service should be designed in a way that accommodates the levels of service required by the customers [4]. As said by the former mayor of Bogota, a developed country is where the rich uses public transport, not where the poor uses cars [5].

Fuel price is a manipulative factor in the economic sector and development planning which also affects the transportation sector. Therefore, the rise of fuel price is one of the catalysts that encourages more road users to shift from private motorized transport to public transportation. The increases of fuel prices is highly linked with the increase of public transport usage [6]. This is due to the fuel price tend influence the road user's behaviour and transportation mode choice. However, as can be seen in Malaysia, the rise of fuel prices rarely changes the preference of drivers to switch to using public transport.

There have been several researches conducted related to this topic but none of the study conducted covers the university students in UMS. Most of the studies focuses on the effects of the hike

of fuel price to the transportation mode choice and traffic accidents. Previous researches also discovered that, fuel price is one of the factors that influences the travellers to reconsider to either use public transportation or private vehicle [7]. Other researches proved that higher fuel prices do lead to the increase of public transit ridership, but the increases in fare revenues are not enough to cover the higher fuel expenses for the transit systems [8].

According to past researches, it has shown that a rise in fuel prices does influence the number of private vehicles on the road. Thus, a smoother transportation services can be achieved to provide benefits to all users and also the government especially in handling the issue of traffic congestion and accidents. In this study, bus is the main focus of public transportation.

2. Methodology

The data used in this study is collected and analysed from a Stated Preference Survey (SPS) and was analysed using linear regression in order to develop transportation model. This study was conducted at the main campus of University Malaysia Sabah (UMS) in Kota Kinabalu, Sabah. The willingness of road users to shift from private vehicle to public transportation is based on the rise fuel price. In order to achieve the objective of this study there are several steps to be conducted. First, the samples and data are collected from the respondents through a SPS by distributing questionnaires to the students of UMS. Followed by the data aggregation and data analysis of all the response obtained from the survey. Using the data obtained, the logistic model was developed through linear regression. The results were then discussed before providing the conclusion and future recommendation for the study.

The survey was conducted in UMS and a sample size of 377 students had been selected randomly for the survey. The questionnaire is distributed using an online system to cut down the use of paper for this research, in line with the purpose of providing a more sustainable solution for the issue of traffic congestion. The questionnaire consists of nine questions that includes demographic data, bus service evaluation, factor that influences public transport usage, transportation mode choice based on fuel price, and suggestions to improve the public transport services in UMS. As the survey is done

online using the Google Form platform, a spread sheet contains of responses from respondents is available to be downloaded. All the acquired data was then proceeded to the aggregation process. The data aggregation was separated according to the specified categories that is required for the linear regression process. The significance of data aggregation is to ensure that the data collected can be analysed, and an equation can be generated. This equation is then useful for future planning and design in the field of transportation.

The same aggregated data was then used for the result analysis, however, only relevant data that is selected to be used in the analysis. According to the main objective of this study, there are two data analysis that must be carried out for the variable to achieve the desired result. The analysis requires linear regression before the logistic model can be generated. The logistic function that is normally used in transportation modelling is:

$$P = \frac{1}{1 + De^{(\alpha x + \beta y + \dots)}} \quad (1)$$

Where,

P is the probability

x and y are the independent variables

α and β are coefficients that should be calibrated

D is constant

3. Results and Discussion

The data obtained were classified into certain categories and the results were presented and discussed below. First, the data was aggregated based on the gender and vehicle ownership as shown in Figure 1. As seen in Figure 1, 55% of students do not own private vehicle and the remaining 45% of students do possess their own private vehicle. It also shows that there are more male students has their own private vehicle compare to the female students.

In Figure 2, the rating of services of the public transport in UMS is shown. It is discovered that the quality of public transport services in UMS is quite good in terms of safety and cleanliness. The rating show that is fair in terms of accessibility to bus and information on bus availability. This shows that there are still students that are confused on the waiting place and bus operation time, as the bus services information is not provided. According to

the data obtained, student of UMS has expressed dissatisfaction in regard to the seat availability and punctuality of the bus services.

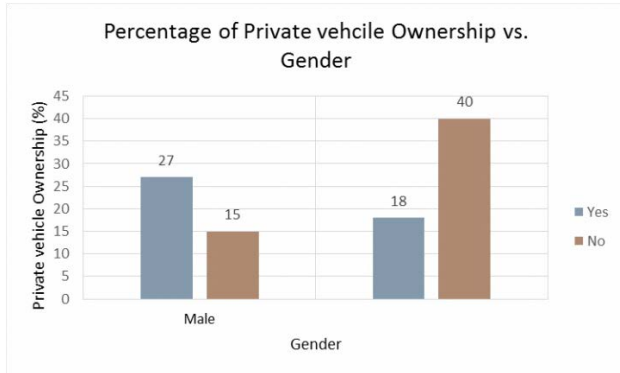


Figure 1. Percentage of Private Vehicle Ownership Based on Gender

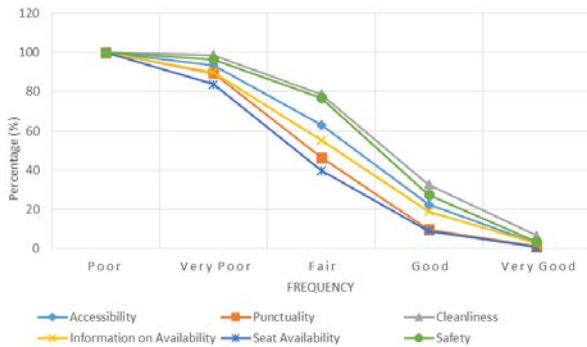


Figure 2. Rating of Services of the Public Transport in UMS

Next, refer to Figure 3 and 4 which presenting the aggregated data for the factors that influences the students to ride public transport in UMS. In Figure 3, it is found that fuel cost has the greatest influence on students to switch to public transport. Followed by transportation mode choice, travel cost, parking space availability, and lastly environmental concerns.

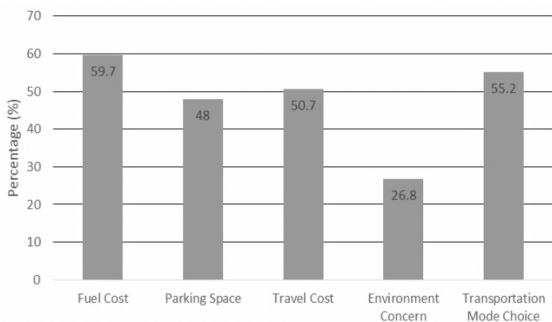


Figure 3. Factors That Motivates Students to Ride Public Transport

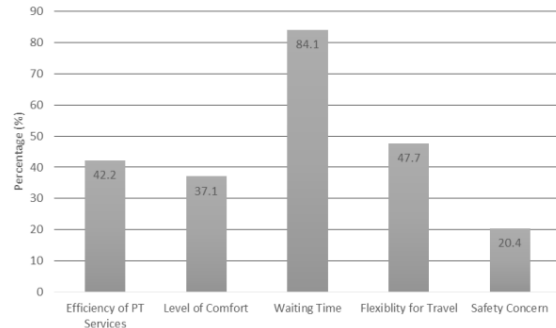


Figure 4. Factors That Discourage Students to Ride Public Transport

Based on Figure 4, it is discovered that the highest factor that discourages students to ride public transport is the longer waiting time. Followed by the inflexibility of travel, efficiency of public transport service, poor level of comfort, and lastly the safety concern during travel in public transport. All of these issues require serious attention from university management to improve the public transportation service in UMS. As it can attract more students to reconsider from using private vehicle and instead choose to use the public transportation provided.

The data obtained was also classified according to the rate of fuel price increase to which the respondents that are willing shift to public transport from private vehicle. The data were aggregated based on rate of fuel price, type of vehicle and gender. The analysis will be done by using linear regression to develop a logistics model from the shift percentage of private vehicle to public transport with three different variables. Table 1 shows the percentage shift from private vehicle to public transport based on the varying fuel prices.

Table 1. Shift Percentage Based on Various Fuel Price

Probability Shift to Public Transport			Fuel Price (RM/Litre)
Yes	No	Shift Percentage (%)	
94	283	24.93	2.00
113	264	29.97	2.25
168	209	44.56	2.50
208	169	55.17	2.75
304	73	80.64	3.00
317	60	84.08	3.25
330	47	87.53	3.50
377	0	100.00	3.75

Table 2 shows the probability of drivers to shift to public transport based on the gender. The data from

Table 2 was also analysed by using linear regression, and two logistic models were developed based on gender.

Table 2. Probability of Driver Shift to Public Transport Based on Gender

Probability Shift to Public Transport				Fuel Price (RM/Litre)
Gender		Shift Percentage (%)		
Male	Female	Male	Female	
29	65	18.24	29.82	2.00
38	74	23.90	33.94	2.25
66	101	41.51	46.33	2.50
71	136	44.65	62.39	2.75
121	182	76.10	83.49	3.00
130	187	81.76	85.78	3.25
136	194	85.53	88.99	3.50
159	218	100.00	100.00	3.75

Table 3 presents the probability shift of individual who own car and motorcycle to public transport. From this table, the two logistics models were developed based on two types of vehicle, which are car and motorcycle.

Table 3. Probability Drivers Shift to Public Transport Based on Type of Vehicles

Probability Drivers Shift to Public Transport				Fuel Price (RM/Litre)
Type of Vehicle		Shift Percentage (%)		
Car	Motorcycle	Car	Motorcycle	
21	2	15.22	5.88	2.00
28	4	20.29	11.76	2.25
53	9	38.41	26.47	2.50
67	11	48.55	32.35	2.75
106	27	76.81	79.41	3.00
112	28	81.16	82.35	3.25
119	30	86.23	88.24	3.50
138	34	100.00	100.00	3.75

4. Conclusions

Overall, the objectives of this study were achieved as three logistic models were developed by using linear regression. This linear regression functions have been applied for all the conditions and types of variables aggregated. The logistics model for individuals who shift to public transport according to the increase of fuel price (RM) per litre is shown in Equation 1 below:

$$P = \frac{1}{1+34.007565e^{-1.360491x}} \quad (1)$$

The logistics model for individual who shift to public transport according to the gender, is shown in Equation 2 for the male gender, while the female is shown in Equation 3:

$$P = \frac{1}{1+69.37898e^{-1.52766x}} \quad (2)$$

$$P = \frac{1}{1+22.52552e^{-1.27225x}} \quad (3)$$

Lastly, the logistics model for conditions of individual who shift to public transport according to the type of vehicle, is shown in Equation 4 for cars, and Equation 5 for motorcycles:

$$P = \frac{1}{1+109.370806e^{-1.67106x}} \quad (4)$$

$$P = \frac{1}{1+1052.39942e^{-2.34909x}} \quad (5)$$

The increase of fuel price (RM) per litre definitely shows a positive effect on the willingness of private vehicle users to shift to public transport. Based on the result of this study, women are more likely to switch to using public transport if the fuel price increases as opposed to the men. Thus, improvements to facilities that prioritize women first, such as women only bus or priority seat in busses is highly beneficial. As the resources spent will not go to waste as there are more women riding the bus as compared to the men as the fuel price increases. Other than that, it is also discovered that motorcycle users are less likely to switch to public transport due to the hike in fuel price it is does not reach RM 3.00 per litre, thus it is more beneficial to provide more incentives to car drivers to switch to public transport at the time of this research.

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