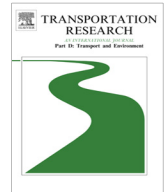




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## Using spike model to reduce traffic congestion and improve public transportation in Malaysia



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### ABSTRACT

In this study, passengers' willingness to pay (WTP) for and willingness to accept (WTA) improved public transportation and shift to public transportation in Malaysia were examined. Specifically, this study aimed to determine the factors or transport attributes that affect passenger WTA and WTP to shift to public transportation. The adopted methodology was based on a contingent valuation (CV) survey, which was conducted on a representative sample of a cross section in residents of Kajang, in Malaysia. This CV primary survey elicited the demand of passengers for improved public transportation. The spike model was adopted to avoid estimation errors caused by a large percentage of respondents who were unwilling to pay and accept at all. The estimation results showed that the best reduction rate for both travel time and cost was 45% among other amounts that range from 15% to 75%. The best parking cost increment was US\$0.30 and the average WTP is US\$0.68.

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### Introduction

Certain strategies, such as transportation planning are necessary to prevent the overall growth of urban areas from disrupting the quality of life of those who dwell in them (Kargarfard et al., 2015; Murray and Wu, 2003). Service quality, no doubt an essential part of urban growth, has long been a subject of interest for city transport planners. It is generally measured by asking users regarding their perceptions and expectations regarding some of its main aspects. The attributes of service quality requiring improvement can be identified based on the importance and satisfaction levels stated by users (Eboli and Mazzulla, 2008; Li and Hensher, 2011; Phanikumar and Maitra, 2010).

In Malaysia and other developing countries, the quality of public transportation is one of the most prevalent issues faced by government and city planners. Providing high-quality public transportation is a challenge in Malaysia; in coping with the consistent growth of its urban population over the last few years, the country has striven to meet the fundamental requirements of transportation to sustain its economy as well as to encourage investment. Through Malaysia's development initiative, the country has improved its public transportation system and decreased the number of private vehicles. Thus, the country has contributed towards mitigating air and sound pollution, as well as reducing traffic congestion (MALAYSIA, 2014). As proven in a number of developed countries, this vision requires market encouragement, such as reducing the

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demand for personal vehicle ownership and increasing the demand for public transportation services (e.g., buses and trains). The current traffic problems in Malaysia can be moderated by encouraging more commuters to use public transportation. However, the real factors that influence private vehicle usage have not been authoritatively identified. This study attempts to model the favored mode of transportation among car drivers as well as the likely effects of various initiatives to encourage them to consider public transportation as a better alternative.

The main reasons for using private vehicles are as follows: less travel time, more privacy, better possibilities of point-to-point travel, as well as avoidance of costly expenses and other problems typically known to be caused by relying on public transportation. However, the probable factors that influence the choice of passengers to use public transportation are less known. This study therefore aims to contribute additional details on the behavior of commuters regarding their choice of transportation mode in order to better understand the strategic measures that can be adopted to encourage more public transport usage. For example, certain incentives or penalties may be imposed to reduce the willingness of private vehicle usage.

As of the end of 2005, approximately 15 million vehicles, including cars, motorcycles, taxis, buses, and freight trucks, have plied Malaysian roads. Currently, the country has an adult population of approximately 15.1 million. Ninety percent of motor vehicles in Malaysia are privately owned (Kasipillai and Chan, 2008). Given that Malaysia is a developing country, relatively cheap motorcycles account for 47% (7 million) of the total number of vehicles, closely followed by passenger cars at 43% (6.5 million), according to the Department of Statistics (MALAYSIA, 2014). From 2000 to 2005, the number of private passenger cars increased at an average rate of 4.5–10%.

At present, public transportation services have low arrival and departure time reliability (long waiting time), low travel speed, low frequency, and high level of discomfort, especially in buses, where overcrowding is common. These travel conditions should be modified to improve public transportation services, and improvement is often associated with increasing fares. Therefore, executing this transportation vision involves focusing on demands, not on supplies. Pricing mechanisms and regulatory measures should be adjusted as well. The pricing of public services is part and parcel of balanced and coordinated quality public transportation. To encourage demand-driven improvements in the existing public transportation system and subsequently understand the public's willingness to pay (WTP) for improved transportation services, we have to evaluate user benefits and understand the values that users place on different travel conditions. Bridging the information gap in demands for policy purposes is also necessary. Past researches were mostly conducted in Western countries and there was a lack of such researches in Asian countries. The previous researches about spike models were last conducted sometime in 2006, meaning that no research or update on the said topic has been conducted since then. In our opinion, an update is necessary because of changes in lifestyle, rises in human and vehicle population as well as improvements in technology and the transport system. This goes to show that these parameters can affect the efficiency of this model. Additionally, in the previous studies, there was a focus on different parameters but our model in this study is just based on costs. Therefore, this study aims to examine the willingness of users to use and pay for improved public transportation. Specifically, this study answers the following research questions:

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Are you willing to accept a given reduction in travel time for shifting to public transportation?		
Would you accept a 75% travel time reduction?	Yes	No
If yes, would you accept a 60% travel time reduction?	Yes	No
If yes, would you accept a 45% travel time reduction?	Yes	No
If yes, would you accept a 30% travel time reduction?	Yes	No
If yes, would you accept a 15% travel time reduction?	Yes	No

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What factors (or attributes of transportation services, such as reduction of travel time, reduction of travel cost for public transportation, and increment of the parking cost for private car users) determine the WTP and willingness to accept (WTA) and shift to public transportation?

The quality and improvement of public transportation can be measured and obtained using discrete choice models. Logit models have been widely used over the last few decades to determine the mode choice models in which the alternatives are different transport modes (Hensher et al., 2003; Prioni and Hensher, 2000). The spike model has also been proposed. It is a parametric model that can be used to estimate the willingness to pay, and it enables a number of respondents to have zero willingness to pay. This model also deals with responses that have negative willingness to pay values (Jakobsson and Dragun, 1996; Kriström, 1997). The utility of the spike models was confirmed by Yoo and Kwak (2002), who suggested that such models could reduce statistical bias.

### Spike model

The spike model was proposed by Kriström (1997) to resolve the issues that arise when the reported price that users are willing to pay is zero or negative (Kriström, 1997). In contingent valuation studies respondents are often assumed to have positive willingness to pay the market price for buying certain goods. Popular distributional assumptions such as the lognormal, or Weibull along with other popular models such as the logit and the probit model, provide examples of cases where

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