MJIT 2022 Malaysian Journal of Industrial Technology

COMPARATIVE NUMERICAL ANALYSIS OF VEHICLE ENTRY PERMIT CHARGES PRE- AND POST-IMPLEMENTATION: IDENTIFYING SIGNIFICANT DIFFERENCES

R. Razman Hafifi
Universiti Malaysia Kelantan, Kelantan, Malaysia.
razmanh@umk.edu.my

M.H. Muhammad Zaly Shah
Universiti Teknologi Malaysia, Johor, Malaysia.
b-zaly@utm.my

*Corresponding author's email: razmanh@umk.edu.my

ABSTRACT

This journal article examines the impact of Malaysia's implementation of the Road Charge on the number of Singaporean registered vehicles crossing the Tuas and Causeway borders before and after its implementation. Statistical analyses, including Independent T-Test and Mann-Whitney U tests, were conducted to determine the difference between the numbers of entries based on the year after the implementation of the road charge. The study aims to identify significant differences in travel demand by Singaporean travelers and the fluctuation in the number of Singaporean private vehicles after the implementation of the Vehicle Entry Permit (Road Charge) by the Malaysian government. The results show a statistically significant difference in the median number of cars (P-Value 0.009) and mean number of travelers (P-Value 0.007) between the two years, suggesting that the road charge may have had an impact on reducing the number of cars on the roads and the number of people entering the country. These findings are consistent with previous studies on road pricing and congestion charges. However, further research is necessary to determine the long-term effects of the road charge on travel behavior.

Keywords: *Road Charges, Vehicle Entry Permit, Numerical Data, Singaporean*

1.0 Introduction

Malaysian immigration authorities have reported that over 250,000 vehicles cross the Singapore-Malaysia Causeway daily, with motorcycles accounting for the highest percentage at 58% and cars at 36% [1]. The Singapore Immigration and Checkpoints Authority (SICA) has also confirmed that this crossing is the busiest in Southeast Asia, with numbers increasing significantly during the year-end school and festive holiday periods [2]. To address the growing issue of border crossing, the Malaysian and Singaporean governments have agreed to work together towards deeper integration and the implementation of solutions to accommodate the increasing flow of people and goods [3].

One of Malaysia's initiatives to generate more revenue for the government and reduce congestion at land borders is the imposition of a Road Charge on vehicles entering the country from Singapore. The study aims to examine the impact of this charge on the number of Singaporean registered vehicles crossing the Tuas and Causeway borders before and after its implementation. Road charges are designed to serve two purposes, generating revenue and improving traffic flow [4]. Various types of charges, such as tolls, congestion fees, and mileage-based fees, can be imposed on drivers to achieve different objectives depending on the policy's goals and circumstances. Congestion pricing, for example, aims to generate revenue for the government while also reducing traffic congestion and travel times by incentivizing alternative modes of transportation [4].

Travel behavior is an area of interest to practitioners, researchers, and policy makers in studying the demand side of the transport system [5]. The study of travel behavior involves examining the actions people take to move from their origin to their destination and the impact of those actions on the transport system's performance. The Malaysian government's decision to impose demand-based solutions, such as road pricing, is a step in the right direction to address the impact of incoming traffic from Singapore [6].

Pricing policies have been successfully implemented in various urban areas worldwide, such as London and Singapore, to reduce congestion costs and effects [7]. In this research, we aim to identify significant differences in travel demand by Singaporean travelers and the fluctuation in the number of Singaporean private vehicles after the implementation of the Vehicle Entry Permit (Road Charge) by the Malaysian government. Statistical analyses, including Independent T-Test and Mann-Whitney U tests, were conducted to determine the difference between the numbers of entries based on the year after the implementation of the road charge.

2.0 Literature

Singaporean tourists exhibit a preference for allocating their funds towards household expenses during their trips to Malaysia, where low fuel costs and a favorable exchange rate are alluring features[10]. However, the influx of millions of visitors into Malaysia annually can lead to negative consequences such as traffic congestion, pollution, noise, emissions, and accidents. To mitigate these concerns, the Malaysian government introduced the vehicle entry permit (VEP) on November 1st, 2016. The VEP is a regulatory mechanism that oversees foreign vehicle entry into Malaysia, with the primary goal of addressing undocumented foreign vehicles and enhancing border control.

Foreign vehicle owners seeking to acquire the VEP must register their vehicles and pay a fee online, providing personal and vehicle details, including passport and registration numbers. The VEP is valid for five years, with the option of renewing it online. The enforcement of the VEP involves the installation of Automated Enforcement System (AES) cameras at several entry points into Malaysia. These cameras capture images of foreign vehicles that lack a valid VEP and automatically issue fines to their owners. To effectively implement the VEP, the Malaysian government collaborates with neighboring countries' authorities [8].

However, the implementation of the VEP has sparked criticism. Critics claim that the VEP fee is exorbitant and can dissuade foreign visitors from driving into Malaysia, ultimately reducing tourism revenue. There are also concerns about the fairness and transparency of the VEP enforcement system, as the AES cameras may be prone to errors and issue fines erroneously. Additionally, foreign vehicle owners have reported difficulties accessing the online registration system and experiencing delays in VEP approval, adding to the criticisms [3].

The VEP's potential impact on the tourism industry is significant, as it can affect various business sectors such as hospitality, food and beverage, and services. The absence of Singaporeans due to the movement restrictions brought about by the pandemic has caused the economy in Johor Bahru to stagnate, particularly among SMEs. In contrast, Malaysians who work in Singapore may be affected by increased toll charges resulting from the reciprocal charge by the Malaysian government [3]. Furthermore, forecasting optimal toll charges is crucial to prevent undercharging or overcharging, as people's travel behavior is determined by their willingness to pay for the trip, including road pricing. Toll fees will influence Singaporean travel demand to Malaysia, and their travel behavior will be sensitive to changes in the toll prices.

Table 2.1: Tolls price crossing the Causeway at JB Customs

	Before 1 August 2014 *One-Way (Singapore to Johor)	Current (From 1 August 2014) *One-Way (Singapore to Johor)
Private Cars	RM2.90	RM9.70
Small Lorries	RM4.50	RM14.70
Heavy Lorries	RM6.10	RM19.70
Taxis	RM1.40	RM4.80
Buses	RM2.30	RM7.80

Toll pricing has emerged as a popular method of government funding for road investments. In order to evaluate pricing policies and future investment needs, a comprehensive understanding of demand behavior is crucial, particularly with respect to how demand responds to changes in toll charges. Scholarly studies have indicated that the response of travelers varies depending on the purpose and frequency of their trips, availability of toll-free options, and days of the week. Additionally, the presence of non-tolled road infrastructures has been found to affect traveler demand. To encourage more efficient usage of toll roads, time-varying pricing schemes have been proposed as a means of replacing uniform toll charges throughout the day.

Although the issue of transport pricing has been widely debated, it is an essential element in addressing transport problems. Pricing is designed to increase the cost of transport usage, thereby making users more accountable for the additional costs associated with operating the

transportation system, including safety, operation, repair, recovery, and environmental costs. Congestion pricing discourages drivers from using their vehicles during peak hours and encourages the use of alternative modes of transport, alternative lanes, or off-peak travel times, thereby managing traffic congestion.

Despite theoretical discussions and studies on transport pricing, practical applications have been limited until recently. Most significant applications have been implemented in Singapore, Europe, and North America. Various congestion pricing schemes have been introduced and defined in the literature in several cities. The use of numerical data as a research methodology has become increasingly popular in evaluating the effects of policies and interventions on various aspects of life.

In this study, statistical tests such as t-tests and the Mann-Whitney test were used to evaluate numerical data, assuming normal distribution. However, if the data did not conform to a normal distribution, the Mann-Whitney test was applied to determine the significance level. The reason for selecting these particular methods was due to the fact that the data analyzed did not originate from a homogeneous sample.

3.0 Method

The primary objective of this study is to investigate the impact of the Road Charge on the number of Singaporean private cars entering Malaysia and the number of Singaporeans traveling to Malaysia between 2014 and 2018. The data for this research will be derived solely from secondary sources. The data collection process will involve a survey of Singaporean drivers who enter Malaysia in private vehicles. A comparative analysis will be conducted to determine the change in the number of entries before and after the implementation of the Road Charge. The collected data will be analyzed using inferential statistical techniques. The data utilized in this study are based on an analysis of monthly vehicle crossings data from Plus Malaysia between 2014 and 2018, as well as numbers of Singaporean travelers from Malaysia Immigration Authorities. The researcher will ensure that the data is clean and free from errors by checking for missing data, outliers, and inconsistencies. Any missing data will be imputed using appropriate techniques, and any outliers or inconsistencies will be removed or corrected. To describe the distribution of the collected data, descriptive statistics such as mean, median, mode, range, standard deviation, and variance will be utilized. The Mann-Whitney and Independent T-Test will be used to determine the difference between the numbers of entries based on the year after the implementation of the Road Charge. Independent T-Test will be conducted when the data is normal, and if the data is not normal, the Mann-Whitney test will be appropriate to determine the significant difference. Significance levels of 0.05 will be used to determine whether there is a statistically significant difference in the mean number of entries.

4.0 Finding

Table 2.2 provides evidence of a statistically significant difference in the number of cars between the years 2016 and 2017, as indicated by a P-value of less than 0.05. Specifically, the median number of cars for 2016 is 645563.50 with an Interquartile Range of 77314, while the median number of cars for 2017 is 565360.00 with an Interquartile Range of 56426. These measures of central tendency and variability provide a more comprehensive

understanding of the distribution of the data and the difference between the two years. It is important to note that the Interquartile Range represents the range of values that encompass the middle 50% of the data, which allows for a better understanding of the variability of the data.

Table 2.2: Comparison of Number of Cars between 2016 and 2017 Using Mann-Whitney U Test

	2016 Median (1QR)	**2017 Median (1QR)**	**Mann-Whitney U**	**P-value[a]**
No. of Cars	645563.50 (77314)	565360.00 (56426)	27.000	0.009

[a]A Mann-Whitney U test applied; the normality assumption was not fulfilled.

Table 2.3 presents the descriptive statistics for the number of travelers in 2016 and 2017. The mean (SD) number of travelers in 2016 was 975,299.20 (85,868,212), while in 2017 it was 860,780.83 (103,254,310). The calculated mean difference between the two years was 114,518.367 with a 95% confidence interval of (34,1119.997). The confidence interval suggests that the mean number of travelers in 2016 was higher than that in 2017.

The independent t-test was used to determine the statistical significance of the difference in the mean number of travelers between the two years. The p-value for the test was 0.007, which is less than the predetermined significance level of 0.05, indicating that the difference in the mean number of travelers between 2016 and 2017 is statistically significant.

The assumptions of normality and equal variances were satisfied, making the independent t-test appropriate for this analysis. The findings indicate that there was a significant decrease in the mean number of travelers between 2016 and 2017.

Table 2.3: Comparison of Mean Number of Travelers between 2016 and 2017 using an Independent t-test

	2016 Mean (SD)	**2017 Mean (SD)**	**Mean Difference (95% CI)**	**P-value[a]**
No. of Traveller	975299.20 (85868.212)	860780.83 (103254.310)	114518.367 (341119.997)	0.007

[a]Independent t-test applied; normality and equal varianess assumptions were fulfilled.

5.0 Conclusion

Based on the statistical calculation from the numerical data, there is a statistically significant difference in the median number of cars between 2016 and 2017, as evidenced by a Mann-Whitney U test with a P-value of 0.009. The median number of cars in 2016 was 645,563.50 (with a first quartile range of 77,314), while the median number of cars in 2017 was 565,360.00 (with a first quartile range of 56,426). This suggests that the implementation of the road charge in Singapore may have had an impact on the number of cars in the country.

Similarly, an analysis of the mean number of travelers between 2016 and 2017 reveals a statistically significant difference in the mean number of travelers, as evidenced by an independent t-test with a P-value of 0.007. The mean (SD) number of travelers for 2016 was 975,299.20 (85868.212), while the mean (SD) number of travelers for 2017 was 860,780.83 (103,254.310). This finding suggests that the implementation of the road charge in Singapore may have had an impact on the number of people entering the country.

These results are consistent with previous studies that have shown that the imposition of charges on road use can lead to a reduction in the number of cars on the road and a decrease in the number of people traveling to a particular location. A study by [8] found that road pricing can lead to a significant reduction in car use, while a study by [9] found that congestion charges can lead to a decrease in the number of trips taken by car.

Finally, the results suggest that the road charge implemented in Singapore may have led to a decrease in the number of cars on the roads and a decrease in the number of people traveling to the country[10]. However, further research is needed to determine the long-term effects of the road charge on travel behavior in Singapore.

6.0 Acknowledgement

Thanks to YB Dato' Seri Mohamed Khaled Nordin, Minister of Higher Education Malaysia; Tan Sri Dato' Seri Idris Jusoh, former Malaysian Education Minister; and Dato' Seri Ahmad Husni Mohamad Hanadzlah, former Malaysian Finance Minister, for their unwavering support of this research.

7.0 References

[1] Malaysian Immigration Statistics. (2012). Causeway link statistics. Retrieved from https://www.imi.gov.my/images/statistik_pintasan/2012/CrossingStatistics2012.pdf
[2] Mo, C., Ng, I., & Chan, J. (2014). Enhancing border security in Singapore: A multi-agency approach. International Journal of Disaster Risk Reduction, 10, 284-291. doi: 10.1016/j.ijdrr.2014.08.002
[3] Shah, M. Z. (2018). A study on tourism in Singapore and Malaysia: Impacts and prospects. International Journal of Innovation, Creativity and Change, 4(1), 189-200. Retrieved from https://www.ijicc.net/images/vol4iss1/4111_Shah_2018_E_R.pdf
[4] Rong, Y. (2020). Road pricing: Concepts, theory, and design. Springer.
[5] Avineri, E. (2012). Travel behavior: A review of recent literature. Transport Reviews, 32(4), 443-447. doi: 10.1080/01441647.2012.719645
[6] Nicolae, G., Radosavljevic, M., & Schuurman, D. (2009). A review of road pricing literature. Transportation Research Part A: Policy and Practice, 43(7), 623-633. doi: 10.1016/j.tra.2009.04.003
[7] Christiansen, P. (2005). Congestion charging: A review of impacts and evaluations. Transport Reviews, 25(1), 1-16. doi: 10.1080/0144164042000273909
[8] Börjesson, M., & Kristoffersson, I. (2013). The travel effects of congestion pricing in Stockholm 2006. Journal of Transport Economics and Policy, 47(2), 179-202.
[9] Goodwin, P. B., & Dargay, J. M. (2010). The relationship between charging and traffic volume and composition. In M. A. H. Dempsey & D. S. Siddiqui (Eds.), Towards integrated traffic management in Europe (pp. 203-221). Springer.

[10] Razman, H. R., Zulkifli, M. M., Ratna, H. R., Farha, W. Z. W., Zaly, S. M. H. M., Anuar, M. Y., & Yusoff, W. S. W. (2021, July). Possibility of outbreak of Covid-19 Malaysia in cases of opening national border: A systematic review approach. In AIP Conference Proceedings (Vol. 2347, No. 1, p. 020092). AIP Publishing LLC.