EFFECTS OF HEALTH AND ENVIRONMENTAL CONCERNS ON CHOICE OF PUBLIC OR PRIVATE TRANSPORTATION

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By

ABDULLATIF BAZRBACHI

Thesis Submitted to the School of Graduate Studies, University Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science.

May 2015

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DEDICATION

This research is dedicated to my beloved parents;

Abdul Monem Bazerbachi, and Maha Abodan.

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in Fulfilment of the requirement for the degree of Master of Science

EFFECTS OF HEALTH AND ENVIRONMENTAL CONCERNS ON CHOICE OF PUBLIC OR PRIVATE TRANSPORTATION

By

ABDULLATIF BAZRBACHI

May 2015

Chairman: Assoc. Prof. Shaufique Fahmi bin Ahmad Sidique, PhD
Faculty : Economics and Managements

Klang Valley is the economic nerve center of Malaysia. In 2010 the population in Klang valley reached 6.3 million, and it continue increasing until it reached 7.2 million in 2013. As a result, the transportation sector in this region has grown rabidly, leading to an increase in the level of air pollution constituting up to 68.5% of total air pollution in the country. This study aims to estimate the value of air pollution emitted via transportation in Klang Valley region by focusing on residents who have experienced the current level of air pollution as they contribute to the same via daily commuting choice. In other words, this study focuses on private vehicle drivers who use their vehicles in their daily commuting.

To achieve this target, this study used the non-market valuation technique, namely the contingent valuation method (CVM) to estimate Klang Valley residents' economic value to reduce the current level of air pollution, produced by the vehicle emissions, by estimating their economic value to continue commuting via private vehicles. This generates information on their mean willingness to pay beyond which they might prefer to switch to public transport commuting mode to reduce associated health and environment effect.

The result from this study shows that the current private car user are willing to pay as much as RM 4.988 per future daily trip to work, in addition to their current commuting cost to maintain the status-quo. Bid value, Gender, Age, Public transportation efficiency, Health index, and income level were found to be significant in this study. Meanwhile, level of education and the air pollution concerns were founds not to be significant. Moreover, this study adopted the theory of planned behaviour (TPB) to determine the respondents attitudes towards the public transportation system. We found that the majority of the respondents have no positive attitude towards public transportation mode. In addition, we found that 56% of the respondents' subjective norm (perception about the view of acquaintances) are against and do not support the idea of using public transportation mode. Furthermore, respondents' "Perceived Behavioural Control" shows that about 46% have enough resources and experiences to voluntarily switch to the use of public transportation

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alternative. Finally, we provide an estimation of commuters' aggregate welfare gain in each of Selangor state and Wilayah Persekutuan state. The aggregate welfare gain respectively computed for these state are equal to RM 3,725,113.02 and RM 12,362,606.8.

This finding will aid future policy direction on transport taxing and pricing in reducing the health and environmental impact of air pollution from transportation. Generally, we found that the higher the respondents' income level, the higher their willingness to pay to maintain the status quo. However, this study does not report the respective economic worth of each attributes associated with private vehicle commuting option. Thus, future research direction on such is recommended for consideration by subsequent studies.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan ijazah Master Sains

PENGARUH KEPEDULIAN-KEPEDULIAN KESIHATAN DAN LINGKUNGAN TERHADAP PILIHAN TRANSPORTASI AM ATAU PERIBADI

Oleh

ABDULLATIF BAZRBACHI

Mei 2015

Pengerusi: Profesor Madya Shaufique Fahmi bin Ahmad Sidique , PhD
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Lembah Klang merupakan nadi ekonomi Malaysia. Pada tahun 2010 penduduk di Lembah Klang mencecah seramai 6.3 juta orang, dan ia terus meningkat sehingga mencecah 7.2 juta pada tahun 2013. Akibatnya, sektor pengangkutan di rantau ini telah berkembang dengan pesat, yang membawa kepada peningkatan dalam tahap pencemaran udara yang membentuk sehingga 68.5% daripada jumlah pencemaran udara di negara ini. Kajian ini bertujuan untuk menganggarkan nilai pencemaran udara yang dikeluarkan melalui pengangkutan di kawasan Lembah Klang dengan memberi tumpuan kepada penduduk yang telah mengalami tahap semasa pencemaran udara kerana mereka menyumbang kepada yang sama, melalui pilihan cara perjalanan ulang-alik setiap hari. Dalam erti kata lain, kajian ini memberi tumpuan kepada pemandu kenderaan persendirian yang menggunakan kenderaan mereka dalam perjalanan ulang-alik mereka setiap hari.

Bagi mencapai sasaran ini, kajian ini menggunakan teknik penilaian bukan pasaran, iaitu Kaedah Penilaian Kontingen (CVM) untuk menganggarkan nilai ekonomi agar mengurangi tingkat polusi udara saat ini, yang dikeluarkan oleh emisi-emisi kendaraan, dengan mengestimasi nilai ekonomi mereka untuk terus berulang-alik dengan kenderaan persendirian. Ini dapat menjana maklumat mengenai min kesanggupan mereka untuk membayar (digunakan sebagai anggaran konservatif kesanggupan untuk menerima) lebih yang mana, mungkin mereka suka untuk beralih ke mod cara berulang-alik dengan menggunakan pengangkutan awam bagi mengurangkan kesan berkaitan dengan kesihatan dan alam sekitar.

Hasil daripada kajian ini menunjukkan bahawa pengguna kereta persendirian semasa akan memerlukan kesanggupan untuk membayar sebanyak RM 4,988 bagi setiap perjalanan untuk bekerja setiap hari di masa hadapan, sebagai tambahan kepada kos perjalanan ulang-alik semasa mereka bagi mengekalkan keadaan sedia ada. Nilai tawaran, jantina, usia, efisiensi transportasi am, indeks keseihatan, dan tingkat pendapatan ditemukan ialah signifikan pada kajian ini. Sementara itu, tingkat pendidikan dan kepedulian-kepedulian terhadap polusi udara ditemukan tidak

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signifikan. Selanjutnya, kajian ini mengadopsi pada *theory of planned behaviour* (TPB) untuk menentukan sikap-sikap responden terhadap sistem transportasi am. Kami menemukan bahwa majoriti daripada responden tidak memiliki sikap-sikap positif terhadap sistem transportasi am. Sebagai tambahan, kami menemukan bahawa 56% daripada norma subjektif responden (persepsi mengenai pandangan daripada orang-orang dekat) ialah menentang dan tidak mendukung ide daripada penggunaan sistem transportasi am. Selanjutnya, "Perceived Behavioral Control" daripada responden menujukkan bahawa sekitar 46% memiliki cukup sumber daya-sumber daya dan pengalaman-pengalaman untuk secara sukarela menukar kepada penggunaan daripada tranportasi am alternatif. Terakhir, kami menyediakan suatu estimasi daripada keuntungan kesejahteraan agregat bagi setiap pengemudi di Negeri Selangor dan Wilayah Persekutuan Masing-masing keuntungan kesejahteraan agregat terhitung untuk negeri-negeri ini ialah RM 3,725,113.02 dan RM 12,362,606.8.

Dapatan ini akan membantu hala tuju dasar masa hadapan ke atas cukai dan harga pengangkutan dalam mengurangkan kesan pencemaran kepada kesihatan dan alam sekitar daripada pengangkutan. Secara umumnya, kami mendapati bahawa lebih tinggi tahap pendapatan responden, maka lebih tinggi kesanggupan mereka untuk membayar bagi mengekalkan keadaan sedia ada. Walau bagaimanapun, kajian ini tidak melaporkan nilai ekonomi masing-masing bagi setiap sifat yang berkaitan pilihan cara perjalanan ulang-alik dengan kenderaan persendirian. Justeru itu, hala tuju penyelidikan pada masa hadapan ke atas perkara ini adalah disyorkan untuk dipertimbangkan oleh kajian seterusnya.

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During the course of my stay in UPM, I have had a lot of moments and memories that I would never forget. Special thanks goes to Dr.Sara Kafffachi for the academic support she had rendered during the course of my research. My gratitude also goes to all my postgraduate student colleagues, I do very much appreciate the moments we have spent together.

Besides, studying as an international student gave me the opportunity to make diverse friends from all over the world. But more importantly, I got new brothers and sisters who stood up for me whenever I needed them. Speaking of brothers, there is no way not to mention Shehu Othman Adam, Omar Ghazal and Rami Kheir who were there for me since ever, and I know they will be there forever.

Finally, But most importantly of all, I am praying to Allah to reward my family, my parents, Abdul Monem BazerBachi and Maha Abodan. I pray that their endless love and sacrifice, which made me what I am today, cannot be commensurately compensated. Only Allah can reward you enough. This is the like of supports I have also received from my siblings; Batul, Subhi, Waseem, and their families. Alhamdulelah for having such great family.

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This thesis was submitted to the Senate of University Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) were adhered to.

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TABLE OF CONTENTS

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LIST OF TABLES

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LIST OF FIGURES

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LIST OF ABBREVIATIONS

ATT	Attitude
BG	Bidding Game
BI	Behavioural Intention
BV	Bequest Values
CM	Choice Modelling
CNY	Chinese Yuan
CAPI	Computer Assisted Personal Interview
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COHb	Carboxyhemoglobin
CS	Consumer Surplus
CV	Compensating Variation
CVM	Contingent Valuation Method
DC	Dichotomous Choice
DMC	Direct Cost Method
DUV	Direct Use Values
EV	Equivalent Variation
FGDs	Focus Group Discussions
GHGs	Greenhouse Gases
Hb	Haemoglobin
HCs	Hydrocarbons
HPM	Hedonic Price Method
IUV	Indirect Use Values
LPT	Land Public Transportation
LPTMP	Land Public Transportation Master Plan
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen

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NOAA	National Oceanic And Atmospheric Administration
NUV	Non-Use Value
O_3	Ozone
OE	Open Ended
Pb	Lead
PBC	Perceived Behavioral Control
PC	Payment Card
PM	Particulate Matter
RP	Revealed Preference Method
SEK	Swedish Krona
SN	Subjective Norm
SO	Sulfur Oxide
SO_2	Sulfur Dioxide
SP	Stated Preference Method
SPAD	Suruhanjaya Pengankutan Awam Darat
TCM	Travel Cost Method
TEV	Total Economic Value
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UV	Use Value
VOC	Volatile Organic Compounds
VOSL	Value of Statistical Life
WHO	World Health Organization
WTP	Willingness to Pay
WTA	Willingness to Accept
XV	Existence Values

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CHAPTER 1

INTRODUCTION

1.1 Study Background

Air pollution describes the existence of certain substances in the atmosphere in excessive quantities that generate undesirable effects on the humans and the environment. Air pollutants could be either gaseous, present in the atmosphere as gases or vapors or in other cases, particulate air pollutants which contain materials in liquid or solid condition suspended in the atmosphere. Millions of people around the world are adversely affected by urban air pollution, which poses significant threat on human health, standard of living, and the environment. Therefore, clean air is considered a very basic requirement of human health. The common air pollutants around the world include gases (such as CO, NO, SO, HC, etc.) and particulate matter (dust, fumes, smoke, etc.), among others. Atmospheric contamination can be classified into two major groups; natural pollutants and anthropogenic pollutants. Pollutants such as dust particles from volcanic disturbances, pollen, and even the salt spray from the oceans and seas, are examples of natural pollutants. Although, there has always been some form of natural atmospheric pollutants contamination on the earth, yet such form of pollutants exist in low concentrations that are usually considered to be harmless.

On the other hand, anthropogenic pollutants are basically caused by human activities. These include such substance as carbon monoxide (CO) and sulfur dioxide (SO_2) emissions from motor vehicles exhausts and from electricity generation. Although, these types of contaminations are usually manageable and controllable, yet, there is virtually no way to avoid the perils of air pollution without causing unrealistic opportunity cost of reduced industrial activities (Callan & Thomas, 2012).

1.1.1 Air pollution and transportation

Accessibility is a key component of well-being and prosperity in the urban societies. However, air pollution did not start to be held as a serious problem until the Industrial Revaluation. As a result of the combination of the high rate of population growth, industrial and manufacturing processes, and the motorized transportation system in the nineteenth century, all resulted into a scenario where air pollution becomes a serious concern (Callan & Thomas, 2012). This created controversial malady.

In the last two centuries, the continuous global growth in the economic sector and the social networks and the spatial distribution of the daily activities, has changed the image of the transportation industry. Transportation has become a very important elements and crucial parts of economic growth and development in any community. Meanwhile, transportation causes a complicated dilemma, although it is an important factor of economic growth and social development. Yet, transportation sector

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introduce a number of issues that need to be solved and reconsidered. This include noise pollution, accidents, congestion, and most notably air pollution. It was proved from existing data and previous studi that air pollution control are not only necessary and current priority in the local context, but also can present a significant potential to control greenhouse gas emissions.

It is documented that the transport sector consumes around 50% of total oil production worldwide, and about 25% of total commercial energy consumption (Gorham, 2002). Unfortunately, we cannot enjoy the advantages of transportation without dealing with the consequences. There are several types of pollutant released in the atmosphere as a result of fossil fuel combustion in the transportation sector. This has a harmful effect on human health and cause many damages on agriculture and ecosystem. Besides, it aids the increased concentration of greenhouse gases, contributing to the global climate change. In addition, the transportation system contributes to the degradation of urban environment via the delay caused by traffic congestion and the stress from the traffic noise (Gorham, 2002).

1.1.2 Causes of air pollution from motor vehicles

Air pollutants from motor vehicles come from different sources, fuel tank, canister, tail pipe, and carburetor. However, exhaust emissions, which come from the fuel combustion in the engine, is considered as the most important element of air pollution from transportation, and there are a number of factors affecting the amount of that emissions. These include the age of the vehicle and its type of technology, vehicles' maintenance, and finally the atmospheric, climatological and topological conditions.

To begin with, it is obvious that there is a significant positive relationship between the age of the vehicle and the amount of pollutant emissions from a vehicle. Older vehicles are built on older technology, which is not sufficient in fuel combustion as well as the deterioration in its performance because of its age. However, a frequent and proper maintenance is important to any vehicle whether it is old or not. Improper or poor maintenance for the vehicle will result in an increase in the emission due to neglected engine and exhaust.

Increase in the number of vehicles on road or excessive vehicle use is an important factor in transportation analysis. A number of studies in the developed countries have shown that the frequency of vehicles use has a significant impact in increasing the concentration of the CO_2 in the atmosphere (Gorham, 2002).

There are two approaches to reduce pollution from transportation emission which has significant impact on air quality. The first approach entails how to reduce the amount of the emission produced by the vehicle itself. This could consider measures such as the technology used in that vehicle. This could include, among others, fuel technology by improving the specification of the fuel to provide a higher level of fuel combustion with lower emissions. The second approach – which this study will be focusing on – is involves the consideration of behavioural strategies to reduce the air pollution level caused by transportation. This approach seeks to reduce the amount of

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vehicular travel undertaken, either by switching to alternative mode which cause a lower pollution to the environment, or by changing the cost associated with the current travel mode.

Behavioural strategies usually focus on future plans rather than focusing on the current situation, that is, it takes more time to change the public behaviour and to introduce new strategies for them.

1.1.3 Health effects of Air pollution

Air pollution is one of the most serious environmental concerns in the urban areas, especially in view of its adverse effect on human health. In 2001, it was estimated that 0.5-1.0 million people prematurely dies each year in developing countries around the world because of air pollution.; This is associated with millions of respiratory cases around the world, which are related to the same reason (Kojima & Lovei, 2001).
Mainly, people get exposed to the transportation pollution in three situations: (a) while they are inside the vehicle; (b) while working or walking close to traffic congested area; and (c) by living in urban neighborhoods where there is a high level of motor vehicle traffic pollution.

Currently, air pollution is considered as a one of the major threats to human health worldwide. According to the World Health Organization (WHO) assessment of burden of diseases related to air pollution, more than 2 million precocious deaths each year can be attributed to the effect of urban outdoor and indoor air pollution. Moreover, more than half of this disease burden is borne by the population in developing countries (Organization, 2002).

1.1.4 Study area description

1.1.4.1 Klang Valley, Malaysia

The Klang Valley region was established in 1973. As shown in Figure 1.1, it comprises the entities of Federal Territory of Kuala Lumpur, Gombak district, Hulu Langat district, Klang district and Petaling district. Klang Valley region spans across approximately 2843 Km^2. It is a basin located in the south-western part of the Malaysia Peninsular, surrounded by mountains exceeding 1,500 m altitude to the east and by the Straits of Malacca to the west (Azmi et al., 2010; Bin Abas & Simoneit, 1996; Rashid & Ghani, 2011; Sharifi et al., 2006; Vien Leong et al., 2009).

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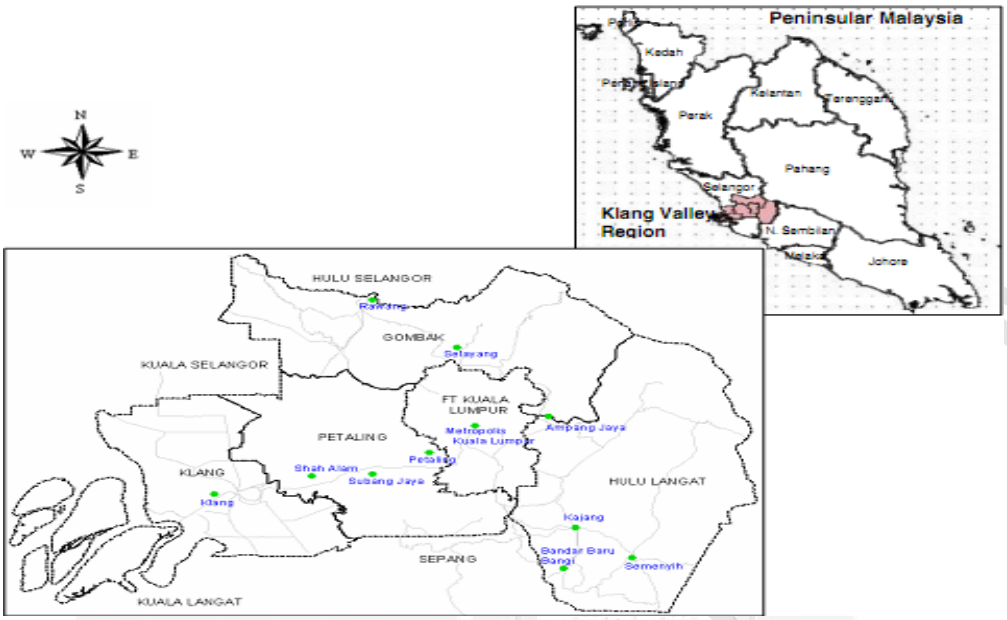

Figure 1.1. The location map of the Klang Valley

Source: (Rashid & Ghani, 2011).

In 2000, the federal territory of Kuala Lumpur had the highest population density in Malaysia with 1269.5 persons per square kilometer, followed by Selangor state with 524.8 per square kilometer (Mohamad & Kiggundu, 2007). In 2012, the federal territory of Kuala Lumpur still supported the highest population density in Malaysia with 7.051 per square kilometer, followed by W. P. Putrajaya with 1,621 per square kilometer (DOS, 2013).

Meanwhile, there has been rapid increase in the population of the Klang Valley region for the past three decades, conferring on it, the status of the fastest growing region in Malaysia. In 1980/81 the population was estimated at 2.02 million, then in 1990/91 it increased to 3.13 million, in 2000 it increased again to 4.55 million, in the year of 2010 it was estimated to 6.3 million, and finally in the year of 2013 it was estimated 7.2 million with additional 2.65 million people compared to the year 2000. This implies that Klang Valley area is considered as a home for 25.4% of Malaysia' population. The largest growths were in the south and west of Kuala Lumpur districts; Putrajaya, as an example (Bunnell et al., 2002; Ludin et al., 2006; SPAD, 2011, 2013).

Klang Valley records one of the highest urban growth in Malaysia. Data shows that the level of urbanization in some state of Klang Valley such as W. P. Putra Jaya, W. P. Kuala Lumpur, and Selangor have the highest level among the other Malaysian states, and even higher than the level of urbanization in Malaysia (Appendix B, Figure 1 and 2) (DOS, 2011).

In 2012, three states of Klang Valley area recorded the highest mean household income and annual growth among other states in Malaysia. These states include W.P.

Kuala Lumpur (RM 8,586 per month) with an annual growth rate 14.9% followed by W.P. Putrajaya (RM8,101 per month) with an annual growth rate 6.1% and Selangor (RM7,023 per month) with an annual growth rate 5.5%. Table 2 in Appendix A and Figure 3 in Appendix B show the mean monthly household income and annual growth rate by state in Malaysia for the years 2009 & 2012 (DOS, 2013).

1.1.4.2 Transportation

The rapid growth in urban population and the increase in household income in Klang Valley have resulted in increasing in the number of motor vehicle ownership in the region. In 2000, it was estimated that 84% of the households in Klang Valley are car owner (Ariffin & Zahari, 2013). However, the change in the life style in Klang Valley has created a greater demand for travel (Ariffin & Zahari, 2013). This has increased the demand in both private and public transportation sectors in the region. Yet, majority of Klang Valley's citizens prefer to use private transportation modes rather than the public alternative. This preference is due to the perceived current experience of the travelers about the public transportation sector. In 2008, the land public transportation share in the morning peak has decreased from 34% in the 1980's to 10-12% in Klang Valley. This share is considered as a low percentage compared to other global cities such as Hong Kong 90%, Singapore 63%, and London 63% (SPAD, 2011). A brief review on the private and public transportation modes in Klang Valley will be provided in the next sub-section.

1.1.4.3 Private modes

Generally, in Malaysia, private transportation modes refer to the use of private types of motor vehicles, either the private cars or the private motor cycles. Due to the continuous development in Malaysia, the ownership of private vehicles has increased. As shown in Appendix Figures 4, 5 and 6, the number of the new registered private motor vehicles increases from 2009, where 513,954 motorcar and 441,545 motorcycle were privately owned to 8,506,080 motorcar and 8,940,230 motorcycle. In 2013 alone, the number of new registered motor vehicles stood at 583,060 motorcars and 528,508 motorcycles with total number of motor vehicles being 10,535,575 car and 11,087,878 motorcycle (Appendix B, Figures 4 and 5) (MOT, 2009, 2010, 2011, 2012, 2013).

In Malaysia, there is no limit to the vehicle's age to be classified as 'road-worth'. Therefore, there are many old vehicles on the road as the new ones (Ariffin & Zahari, 2013). However, not all motor vehicles are active on road, yet, there are increase in the number of active motor vehicles on road (including private and public vehicles). In 2009, there were 14,271,570 active vehicles on roads. By 2013, these had increased to 17,368,234 active vehicles on road, as shown in Appendix B, Figure 6. (MOT, 2012).

This increasing number of vehicles on road increases incidences of road accidents in Malaysia. This is evident as motorcycle and motorcar accidents increases from 586,269 accidents in 2009 to 754,302 in 2013. Besides, as shown in Appendix B,

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Figures 7 and 8, the number of deaths, the number of serious and minor injuries caused by road accidents for the same period had increased (MOT, 2013). More specifically, data shows an increase in the number of road accidents, number of deaths, number of serious, and minor injuries in each of Klang Valley's districts (Gombak, Klang, Petaling, Hulu Langat, W. P. Kuala Lumpur and W. P. Putrajaya) in 2010 & 2011 as evident in Tables 3 and 4 in Appendix A,(DOS, 2011, 2012).

1.1.4.4 Public modes[1]:

Public transportation in Klang Valley comprises public bus service, railway services (KTM, LRT1, LRT2, Monorail, KLIA), and the public taxi services.

1.1.4.4.1 Public Bus:

There are several bus operators connecting the city centre with the suburbs in Klang Valley. Basically, it is concentrated on the main corridors of movement where a high frequency level of service can be found. However, the physical structure of the highway network combined with the way services are actually operated means that service availability, accessibility, and integration is limited (SPAD, 2011).

The existing bus networks in Klang Valley are operated by Rapid KL, Metro bus, and a number of smaller operators. There are 4,200 bus stops in the region and Rapid KL services 380,000 passengers per day. The current bus services have a number of issues which account for its undesirability for citizens in Klang Valley. These include:

I. The location of bus stops at far walking distances from residential apartments.
II. The current bus service has poor coverage in large industrial areas necessitating the preference for contracted buses by employers.
III. The current bus service has a minor protection from traffic congestion as only 13 Km of special bus lane is accessible. Thus, average bus speed during the morning peak hours ranges from 9 to 15 Km per hour.
IV. Other non-desirability factors generally ascribed to public transportation are the low comfort, inadequate safety and long waiting and traveling time, among others.

1.1.4.4.2 Rail:

With 115 stations, the public transport service via rail network in Klang Valley region covers 278 Km. Five existing rail networks operate in the region. These include the KTMB Komuter, Kelana Jaya (Putra) LRT1, Ampang (Star) LRT2, Monorail, and KLIA.

1 unless it is noted differently, all the data and facts provided in (Public modes) have been taken from SPAD report, 2011

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I. Kelana Jaya and Ampang LRT have the highest daily ridership compared to others. Each of these rail transport service has average daily passenger patronage of 160,000 and 141,000 respectively.
II. KTM is usually used for commuting to far distances including locations outside the Klang Valley region with a daily ridership of 95,000.
III. Due to the inaccessibility to some of KTM station, 12 out of 50 stations have less than 250 passengers per day.
IV. Table 5 in Appendix A, provides further details about the number of stations, ridership, and the peak hour headway for each of the rail modes in Klang Valley.

1.1.4.4.3 Taxicab Service

There are two types of taxi services in Klang Valley. These include budget and executive taxis. Over 29,000 licensed budget taxis operate within Klang Valley. Their operation is supplemented with another 1,500 executive taxis which service visitors and business travellers in city centres. In addition, there are airport taxis and private limousines, which patronize Kuala Lumpur city and Selangor state.

1.1.4.5 Travel Demands

Citizen in Klang Valley have higher preferences and intension to use the private transportation modes rather than using the public transportation. This is due to a number of reasons mainly:

I. Changes in the households characteristics for example decrease in household sizes and increase in the household incomes. This brings about a higher ability to purchase cars.
II. The increase in the number and the improvements in the high way infrastructure.
III. The poor quality of public transportation and unsatisfied experience of the citizens about public transportation is related to accessibility, frequency, availability, and safety issues as shown in Figure 1.2.
IV. The gap in the travel time between the public and the private transportation modes is another factor. This existence of this gap implies that the traveling time in the private vehicle tend to be shorter than using public transportation modes.

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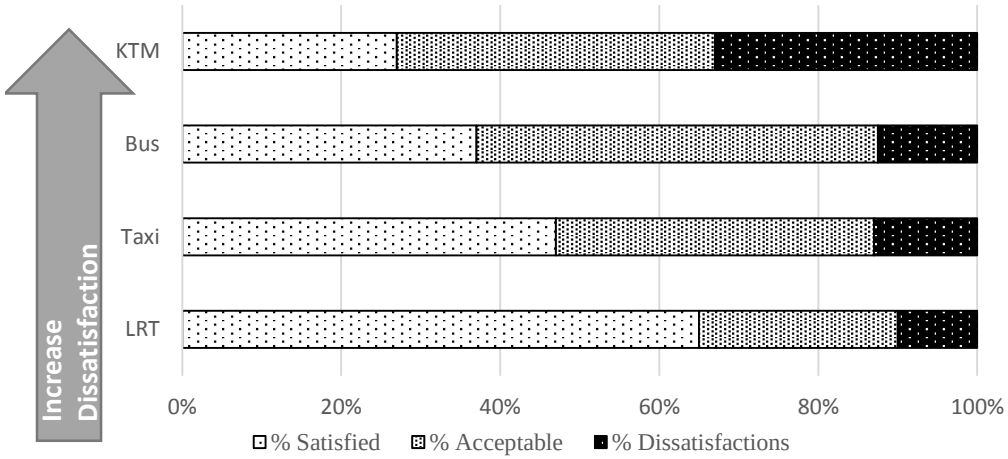

Figure 1.2 Public Transport User Satisfaction Levels.

Source:(SPAD, 2011).

1.1.4.6 Future Plans

Previous studies about the current situation of the public transportation system underscore the need for significant improvements to achieve the expected level of satisfaction envisaged by the current and potential users (Ariffin & Zahari, 2013; Kamaruddin et al., 2012; SPAD, 2011). Therefore, in 2010 the "SURUHANJAYA PENGANKUTAN AWAM DARAT, SPAD" (Land Public Transport Commission) have drafts the Land Public transportation Master Plan "LPTMP" to develop and improve the land public transportation system in Klang Valley area (Greater KL).

This plan sets out an integrated 20 years plan to transform the land public transportation "LPT" in Klang Valley to satisfy the local needs and to achieve the LPTMP objectives. These objectives are mainly concerned about increasing the economic growth by providing a smoother access to jobs and employments centres, assure a higher level health and safety issues for the passengers, improvement in the accessibility and connectivity level, efficiency and affordability, equality of opportunity and reduction in the side impacts of transportation on the environment (SPAD, 2011).To achieve these objectives, a number of improvements are expected to be implemented on each mode of the land public transportation, as contained in the development plan.

1.1.4.7 Air quality

1.1.4.7.1 Air Pollution Index

The Air pollution Index 'API' was introduced by the Department Of Environment 'DOE' in 1996. The index classifies the ambient air quality into five classifications. Indices ranging from 0 to 50 API is classified as a Good condition, 51 to 100 is

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Moderate,101 to 200 is Unhealthy, 201 to 300 is Very Unhealthy, and more than 300 is considered as a Hazardous level (Appendix A, Table 6).

1.1.4.7.2 Monitoring stations

In Malaysia, there are 52 monitoring stations located throughout the country. These stations detect any significant change in air quality which could be harmful to human health and the environment in Malaysia. To calculate the air pollution level, they record the Ground level Ozone (O_3), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), and Particulate Matter (PM_{10}). In addition, there are manual air quality monitoring stations in 14 different sites for measuring total suspended Particulate matter (PM_{10}) and heavy metals such as lead.

1.1.4.7.3 Unhealthy days

In 2012, the overall air quality status was between good and moderate for most of the time in the year. Out of the 52 stations, 23 stations recorded unhealthy level, while Cheras in Kuala Lumpur stations recorded the highest number of unhealthy days with 37 days. Specifically, Batu Muda, Kuala Lumpur station recorded 25 unhealthy days, Klang's station recorded 13 days, Shah Alam 11 days, Petaling Jaya 4 days, and Putra Jaya 2 days. Figure 9 in Appendix B. shows the summary of unhealthy days across Klang Valley in 2012.

1.1.4.7.4 Pollutants emissions

There are six main air pollutants namely Ground Level Ozone (O_3), Lead (Pb), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Particulate Matter of less than 10 microns in size (PM_{10}). Air pollution is deemed to occur when these pollutants are present in the atmosphere.

In 2012, it was found that the highest concentration of (O_3) was recorded at urban areas and secondly in industrial areas. The maximum concentration of Lead (Pb) on the other hand, was found in an area characterized with high density of people, specifically, Pudu Station which is said to have recorded the highest concentration of Lead at 0.0405 $\mu g/m^3$. The harmless natural concentration of Carbon Monoxide (CO) in the air is 0.2 ppm, however, industrial area recorded CO concentration at 0.758 ppm, followed by urban areas at 0.700 ppm. The highest recorded level of Sulfur Dioxide SO_2 was detected at industrial areas, which stood at 0.0022 ppm. Industrial areas also recorded the highest level of concentration of Nitrogen Dioxide (NO_2) at 0.011 ppm, and Particulate Matter (PM_{10}) at 49 $\mu g/m^3$.

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1.1.4.7.5 Source of Air Pollution

There are three main sources of pollution in Malaysia. They include mobile source (motor vehicles), emission sources (industries including power plants), and open burning source (Azmi et al., 2010). In 2012, it was estimated that 63.4% of the total pollutants emission in the atmosphere was CO, followed by NO_2 29.7%, 6.7% SO_2 and finally 0.2% PM. Moreover, Mobile source (Motor vehicles) contributed 68.5% of the emission to the ambient air followed by stationary sources 26.4. The remaining 5.1% is attributed to other sources mainly the open burning (Figures 10, 11, and 12). In addition, due to the increase in the number of on road motor vehicles, motor vehicles emissions have increased in 2012 compared to 2011. For example, CO emission have increased by (6.5%) followed by SO_2 (5.1%) and both NO_2 and PM increased by 4.5% (Appendix B, Figure 13).

1.2 Problem Statement

Klang Valley is geographically the economic nerve-center of Malaysia. In 2000, the population in Klang valley reached 4.55 million, in the year of 2010 it was estimated to 6.3 million, and finally in the year of 2013 it was estimated 7.2 million. With the rapid growth in Klang Valley, the risk of atmospheric pollution has increased; and with this increase a lot of side effects have emerged. Some of these effects are seen in the environment and can affect human health. The environmental effects can be observed in the form of the increased concentration in the levels of CO_2 during the last few years. On the other hand, the effect on the human health is evident in the assertion by many researchers, who have concluded that around 5% of the lung cancer cases around the world is associated to air pollution.

Also, researchers have found that most of the respiratory infections, selected cardiopulmonary diseases and the high rates of low-birth-weight infants are mainly caused by air pollution. Based on that, many researchers have attempted to identify the different sources of air pollutants in order to avoid the different effects that air pollution can have on the environment and the human health. In Malaysia, the three major sources of air pollution are the industry, open burning and the mobile source. The industrial source is related to industrial fuel burning process and the power stations. This group of source has been found to be the highest contributor in (Particulate matter) PM with a percentage of 42%. The open burning and biomass source constitute another important source. This source includes the burning of solid wastes and forest fires which is responsible for the haze recurrence in Malaysia. The third source which is termed “mobile sources” include emissions of all kinds from all motor vehicles such as motorcycles, commercial vehicles and private cars. This source is found to be responsible for 87.8% of CO_2 emission in Malaysia. In fact, the mobile sources seem to be the most important source as many studies have associated it with air pollution. For example, in a study that examines the causes of air pollution, it is found that one possible cause of air pollution is the increase in traffic that lead to great emissions into the atmosphere, which is referred to as the phenomenon of rural to urban migration.

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According to (Molina & Molina, 2004), the rapid growth of urbanization and industrialization as the progressive expansion of suburbs with industrial plants, resulted in consideration of air pollution as very crucial and important. Therefore, this study seeks to find solutions to help in decreasing the level of air pollution in Malaysian environment. One way to achieve this aim lies in regulations within the transportation system in Malaysia. A recent study by Road Transport Department, Malaysia (MOT, 2011), has shown that there was an overall increase in the number of motor vehicles used in Malaysia while the numbers of bus users have decreased. This is because, residents in Malaysia prefer to use their own vehicles due to its associated comfort rather than using the public transportation. The relatively less comfort level and longer travel time peculiar of public transport accounts for less public transport use despite it is relatively costly to commute using private vehicles. By choosing to commute using private vehicles, Klang Valley residents contribute to the increase in the level of air pollution. It is thus, timely to know how much more such residents will be willing to pay to maintain their current commuting mode in favour of private passenger vehicle usage. This information is required to determine how much additional tax could be imposed on such commuting option to encourage the usage of the public transport system alternative. However, there exists dearth of knowledge on how much compensation such private vehicle users will require to forego the comfort associated with their current commuting mode. Knowing such is necessary in reducing both the environmental and health impact of air pollution via decrease in the use of private vehicles.

1.3 Objectives of the Study

The general objective of this study is to assess Klang Valley private vehicle users' economic value for reducing the current level of air pollution and the number of unhealthy days in the region. In order to achieve this objective, the specific aims of this research include;

1. To describe private motor vehicle drivers' attitude, perceived behavioural control, and subjective norm in respect to shifting to public transport commuting mode.

2. To estimate private motor vehicle drivers' maximum willingness to pay to maintain their current welfare level of commuting using private passenger vehicles.

1.4 Significance of the Study

This study seeks to find the value private passenger vehicle users assign to maintain their current commuting mode rather than switching to the more health and environmental friendly option of commuting via public transport mode which has the effect of reducing air pollution in Klang Valley region of Malaysia. Such value is expected to be obtained via interviewing people who have experienced the air pollution in the region. This will provide a better understanding on residents' behaviour and perceptions toward air pollution in Klang Valley. Besides, the result

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from this study will yield an estimate for the maximum amount such commuters are willing to pay to maintain their current transport mode. Such information is relevant in determining how much tax or fines policy regulators could impose in order to discourage the use of private passenger vehicles in favour of public transport system.

A few studies have been conducted on air pollution and transport mode demand in Malaysia. Yet, none of these studies focused on residents who contribute to air pollution in their daily activities. Therefore, this is the first study to use the contingent valuation method (CVM) to derive the value private passenger vehicles users in Klang Valley are willing to pay to continue commuting in private cars rather than shifting to public transport system alternative.

The result of this study will provide a better understanding to the researchers and the policy makers about the attitude and preferences of the residents of Klang Valley area. This will enhance a better management decisions to be made. Moreover, since this study will provide a monetary value, depicting the maximum amounts that the residents are willing to pay for their daily trip, this study will provide good information about the travel costs in any upcoming transport-related new pricing policy.

1.5 Organization of Thesis

This thesis is organized in the following order; the first chapter provides a brief introduction and background of the study followed by the problem statement, objective of the study, significant of the study and finally thesis organization. The second chapter will discuss and review the market valuation techniques, especially the CVM, the welfare theory, and a review of the previous empirical studies, specifically focusing on those that have used the method that will be employed in this study. The third chapter will discuss the methodology that will be used in this study and the design of the questionnaire as well as the estimation techniques and data collection procedure. Chapter four will dwell on the presentation and interpretations of results obtained in this study. Finally, chapter five will summarize the research results and findings. Besides, it will discuss the implication of findings, and recommendations for policy and future studies.

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