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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment  
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**ECONOMIC VALUATION OF AIR QUALITY IMPROVEMENT IN KLANG  
VALLEY: VALIDITY AND RELIABILITY OF CONTINGENT VALUATION  
AND BENEFIT TRANSFER METHODS**

**By**

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The objectives of this study are to evaluate the validity and reliability of contingent valuation method (CVM) and the validity of transferring contingent valuation estimates from a developing to a least developing country. To evaluate the impact of additional information on the willingness to pay (WTP) of the respondents, different sub samples were presented with contingent valuation scenarios offering different levels of information. One sub-sample was given the cause of ill health episodes and the policy to be implemented to remedy the cause of the ill health episodes (context version). Another sub sample was asked to value the avoidance of episodes of ill health, but was not given any details of the cause of the episodes nor the policy that would be implemented to remedy the cause of ill health episodes (non-context version).

The study has found that the CVM estimates are internally valid in both context and non-context versions since the WTP values of the respondents to avoid the ill-health episodes due to air pollution increase with the increase in some socio-economic and health variables such as income, education, asthma attack and duration of ill health episodes. The study also found that the inclusion of additional information in the presentation of scenarios in contingent valuation exercises significantly influenced the WTP values of the respondents to avoid the ill-health episodes. The average mean value of WTP of the respondents for the context version was higher than that

of the non-context version i.e. RM154 for the context version and RM134 for the non-context version. After this survey, a similar non-context survey was conducted in Bangladesh and the validity of transferring WTP estimates was evaluated. The results of the study suggested that on average the mean WTP values of the respondents were US\$39.59 for Malaysia and US\$5.64 for Bangladesh to avoid the ill-health episodes due to air pollution. This could be explained by high income and education and stronger sensitivity to environmental problems in Malaysia. The respondents in Malaysia were willing to share 9.96 percent of their income whilst in Bangladesh the respondents were willing to share 7.17 percent of their income. The respondents with higher income were willing to pay higher share of their income than the respondents with lower income. To evaluate the validity of different approaches of benefit transfer method, several hypotheses were tested by parametric and non-parametric tests. The results of this study suggested that it was not valid to transfer the WTP estimates to avoid the ill health episodes from a developing country, Malaysia to a least developing country, Bangladesh both in terms of unit value transfer and value function transfer because of distinctive socio-economic backgrounds.

The study also evaluated the validity and reliability of contingent valuation method. This was done through split and paired sample surveys using three different question formats i.e. open ended (OE), dichotomous choice (DC) and payment card (PC). The split sample was used for external scope test and the paired sample was used for internal scope test. The results of the study suggested that the WTP values of the respondents do not differ across different question formats i.e. 10.84 Sen for OE, 14.50 Sen for DC and 13.33 Sen for PC. Results of the study suggested that the WTP values of the respondents using the DC format were the highest. In the external scope test, there was significant difference between the mean WTP values for level A (i.e. 10 percent reduction in the concentration of  $PM_{10}$ ) and level B (i.e. 20 percent reduction in the concentration of  $PM_{10}$ ) between the samples. This means that the split sample passed the external scope test. On the other hand, the results of the internal scope test indicated that there was no significant difference between the mean WTP values for level A and level B between the samples. Hence the paired sample did not pass the scope test. The aggregate WTP values of the respondents was

RM0.91 billion for level A air quality improvement and RM1.16 billion for level B air quality improvement in Klang Valley.

The study has great implication for the application of contingent valuation method and benefit transfer method. Since, WTP to avoid the ill health episodes cannot be shown to be independent of the context in which it is valued, the validity of transferring benefits of avoided ill health episodes from one country to another must be called into question and the results of the study will not allow decision makers to apply the estimated values for the avoidance of ill health episodes in the consideration of policies with very different context. This has also great implications to works done by international organizations who intend to transfer benefit estimates from one country to another country. The results of the study indicated that there is no significant difference between the mean values of WTP for different question formats. However due to the nature of the question format, the mean WTP values using the DC method would normally be higher than those of OE and PC. Although the DC method has some limitations, this study recommends using the DC method to be used in contingent valuation survey in developing country because it is relatively easier for the respondents to answer. This study also indicates that since the split sample method has passed the scope test, it would be a recommended approach for CVM survey. Since the results of paired samples did not pass the scope test, the survey method should be taken into caution and if possible should be avoided to reduce sampling bias. Finally, the approach used and results presented in this study would be useful for efficient formulation of policies on air quality management in Malaysia.

Abstrak tesis yang dikemukakan Senat Universiti Putra Malaysia sebagai memenuhi  
Keperluan untuk ijazah Doktor Falsafah

**PENILAIN EKONOMI DALAM KUALITY UDARA DI LEMBAH KLANG:  
KESAHIHAN DAN KEBOLEHPER CARYAAN KEEDAH PENILAIAN  
KANTINGEN DAN KEEDAH PENIDAHAN FAEDAH**

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Objektif kajian ini adalah untuk menilai kesahihan dan kebolehpercayaan “contingent valuation method” (CVM) dan kesahihan pemindahan jangkaan nilai “contingent” dari Negara sedang membangun ke Negara yang kurang membangun. Untuk mengkaji impak kemampuan membayar (WTP) para responden jika peneragan yang lebih lanjut dibekalkan, sub sampel yang berlainan ditunjukkan dengan senario “contingent valuation” yang berlainan, dimana ia menawarkan pelbagai informasi yang berlainan. Sub-sampel yang pertama adalah untuk menilai kadar elakkan episod kemerosotan kesihatan responden, di mana responden tidak dibekalkan dengan sebarang maklumat tentang penyebab episod itu ataupun polisi yang akan diimplimentasi untuk memperbaiki keadaan tersebut (non-context version). Sub sampel yang kedua pula dibekalkan dengan faktor yang menyebabkan kemerosotan kesihatan dan polisi yang akan diimplementasi untuk memperbaiki keadaan tersebut (context version).

Kajian ini telah menunjukkan kaedah CVM adalah sah dalam keadaan “context” dan “non context version” di mana nilai kemampuan membayar “WTP” responden meningkat selaras dengan peningkatan pendapatan, tahap pelajaran, serangan asthma dan tempoh jatuh sakit untuk mengelak episod kemerosotan kesihatan yang disebabkan oleh peningkatan pencemaran udara. Kajian ini juga menunjukkan bahawa maklumat yang menerangkan kemerosotan kesihatan telah membawa pengaruh yang

jelas ke atas nilai WTP untuk mengelakkan episod kemerosotan kesihatan. Nilai purata min WTP responden “context version” adalah lebih tinggi daripada yang “non-context version”, i.e. RM 154 untuk “context version” dan RM 134 untuk “non-context version”. Selepas penyelidikan ini, satu kajian “non context” yang bersamaan telah dijalankan di Bangladesh, kesahihan jangkaan pemindahan WTP telah dinilai. Keputusan kajian ini memaparkan bahawa purata nilai min WTP responden ialah US\$39.59 bagi Malaysia dan US\$5.64 bagi Bangladesh untuk mengelakkan episod kemerosotan kesihatan yang disebabkan oleh pencemaran udara. Keadaan ini boleh dijelaskan dengan kadar pendapatan dan pendidikan yang lebih tinggi dan kepekaan terhadap isu masalah alam sekitar di Malaysia. Responden di Malaysia sanggup berkongsi sebanyak 9.96 peratus daripada jumlah pendapatan mereka manakala responden di Bangladesh hanya sanggup berkongsi 7.17 peratus. Responden yang mempunyai pendapatan yang lebih tinggi lebih rela untuk membayar jika dibandingkan dengan responden yang berpendapatan kurang. Untuk menilai kesahihan kaedah pemindahan faedah dari aspek yang berlainan, beberapa hipotesis telah diuji dengan kaedah parametrik dan tidak parametrik. Keputusan ini telah mencadahkan bahawa ia adalah tidak sah untuk memindah jangkaan WTP bagi mengelak episod kemerosotan kesihatan dari negara yang membangun, Malaysia ke negara yang kurang membangun, Bangladesh dalam aspek “unit value transfer” dan “value function transfer”, ini adalah disebabkan latar belakang sosio ekonomi yang berlainan.

Kajian ini juga menilai kesahihan dan kebolehpercayaan kaedah CVM. Tiga jenis format soalan digunakan (open ended-OE, dichotomous choice-DC and payment card-PC). “Split sample” digunakan untuk menguji skop luaran dan “paired sample” digunakan untuk menguji skop dalaman. Keputusan kajian ini mencadangkan bahawa nilai WTP responden tidak berbeza antara format soalan yang berlainan contohnya, 10.84 sen untuk OE, 14.50 sen untuk DC dan 13.33 sen untuk PC. Keputusan daripada kajian ini memaparkan bahawa nilai WTP responden yang diuji menggunakan format DC adalah yang tertinggi. Dalam ujian skop luaran, perbezaan antara nilai mean WTP tahap A (i.e. 10 peratus pengurangan konsentrasi PM10) dan tahap B (i.e. 20 peratus pengurangan konsentrasi PM10) adalah signifikan antara sampel. Ini bermaksud sampel “split” melulus ujian skop luaran. Sebaliknya, keputusan untuk ujian skop dalaman pula menunjukkan bahawa ia tidak ada

perbezaan yang signifikan antara nilai mean WTP untuk tahap A dan tahap B antara sampel. Maka sampel “paired” tidak melulus ujian skop. Nilai agregat WTP responden untuk meningkatkan kualiti udara di sekitar Lembah Klang adalah RM0.91 billion untuk mencapai kualiti udara tahap A dan sebanyak RM1.16 billion untuk mencapai kualiti udara tahap B di sekitar Lembah Klang.

Kajian ini mempunyai implikasi yang besar bagi aplikasi CVM dan kaedah pemindahan faedah. Disebabkan WTP untuk mengelak episod kemerosotan kesihatan adalah bebas dalam context di mana ia dinilai, kesahihan untuk memindah faedah episod kemerosotan kesihatan dari satu Negara ke Negara yang lain haruslah dipertimbangkan dan keputusan kajian ini tidak membenarkan pembuat keputusan untuk menggunakan nilai jangkaan ini dalam tindakan melaksanakan polisi tersebut di bawah konteks yang berlainan. Keputusan ini telah membawa implikasi ke atas kerja yang dibuat oleh organisasi antarabangsa yang ingin untuk menggunakan kaedah pemindahan jangkaan faedah dari satu negara ke satu negara yang lain. Keputusan kajian ini menunjukkan bahawa ia tidak mempunyai perbezaan yang jelas antara nilai min WTP dalam format soalan yang berlainan. Manakala, disebabkan oleh keadaan format soalan, nilai min WTP yang menggunakan kaedah DC adalah lebih tinggi daripada OE dan PC. Walaupun kaedah DC mempunyai batasan, kajian ini mencadangkan supaya kaedah DC digunakan dalam penyelidikan “contingent valuation” di Negara membangun kerana ia adalah lebih senang dijawab oleh responden. Kajian ini juga menunjukkan bahawa kaedah “split sample” yang melulus ujian skop, harus digunakan dalam kaedah penyelidikan CVM. Untuk “paired sample” yang tidak lulus ujian skop ia harus dipertimbangkan dan dielak supaya tidak digunakan untuk mengelakkan ralat semasa penyampelan. Akhirnya, kaedah yang digunakan dan keputusan yang ditunjukkan dalam kajian adalah amat berguna dalam formulasi polisi pengurusan kualiti udara di Malaysia.

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Finally, I would like to show my confidence in the manner that the followers will drive maximum benefit from this thesis.

The Author



I certify that an Examination Committee met on 1<sup>st</sup> April 2003 to conduct the final examination of Rafia Afroz on his Doctor of Philosophy entitled "Economic Valuation of Air Quality Improvement: Validity and Reliability of Contingent Valuation and Benefit Transfer Methods" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination committee are as follow:

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## **DECLARATION**

I hereby declare that the thesis is based on my original work except for quotations and citations that have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia (UPM) or any other institution.

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