Does Benefit Transfer Always Work: a Multi-country Comparison

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Abstract

This paper analyzes the welfare effects of a 50 percent reduction in air pollution caused by road traffic in both Cairo (Egypt) and Rabat-Salé (Morocco) using a contingent valuation method with identical elicitation questions. Despite the fact that both the numbers of inhabitants and vehicles are higher in Cairo the willingness to pay to reduce the impacts of vehicle emissions is higher in Rabat-Salé although incomes are rather similar in both cities. This paper shows that the relatively often-used benefit transfer frequently leads to biases where damage costs are under- or overestimated.

Keywords: Air pollution; Benefit transfer; Contingent valuation; Willingness to pay.

JEL classification: C25; Q53

The authors are most grateful for comments on earlier drafts of the manuscript by Olof Johanson-Stenman and Fredrik Carlsson. The usual disclaimer applies. Financial support from the Swedish International Development Cooperation Agency (SIDA) is highly appreciated.

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1. Introduction

There is a growing literature and use of benefit transfer with the justification of time and resource constraints. The majority of the literature deals with the developed countries perspective (e.g. Dowing and Ozuna, 1996; Desvouges et al., 1998; Brouwer and Spanknings, 1999; León et al., 2003; and Ready et al., 2004). Other studies use valuation studies carried out at different sites in the developed and developing world (e.g. Alberini and Krupnick, 1997; Costanza et al., 1997; and Barton and Mourato, 2003). In this paper we test the validity of benefit transfer between two developing countries, Egypt and Morocco, using the average willingness to pay (WTP) elicited by means of the contingent valuation method (CVM). To the authors knowledge there is no other empirical study dealing with the validity and reliability of transferring benefits between developing countries based on the same CVM questions.

For instance, The World Bank (2002) transferred the Moroccan valuation of air pollution as the "study site" to Egypt as the "policy site" in a cost and benefit assessment of the environment. The objective of this paper is to test the validity and reliability of such a benefit transfer. This is done through the application of the same survey instrument to the policy site on a sample of 670 inhabitant of metropolitan Cairo, and 382 respondents of Rabat-Salé.[1] The remainder of this paper is organized as follows: Section 2 discusses the CVM and Section 3 describes the data. Section 4 analyzes the socio-economic determinants of WTP, while Section 5 tests the validity of cross-country benefit transfer. Section 6 presents some concluding remarks.

2. The contingent valuation method

Different revealed and stated preference methods have been developed to value a good or service not traded in a private market.[2] The CVM is a stated preference or direct way of using surveys to value public goods. This is a survey-based method that has been extensively used to determine household and/ or resource user stated WTP. The valuation question can be asked in several ways that reflect the particular technique used (Mitchell and Carson, 1989,

[1] Rabat is the capital of Morocco

and Hanemann and Kanninen, 1999). In this paper WTP to reduce air pollution by 50 percent was obtained through a contingent valuation survey of inhabitants of Rabat-Salé, Morocco, in July 1995 (Belhaj, 2003). In 2002 the same survey was administered in metropolitan Cairo, Egypt.

In both cases the survey instrument was conducted face-to-face and contained four sections.[3] The questionnaire started by asking each respondent if his/her respective city (Cairo/Rabat-Salé) suffered from environmental problems. Posing such a question was fundamental since asking people about their WTP when they are not aware of any environmental problems would make no sense in the CVM framework. The proportions of the populations who gave a positive answer, i.e. there are environmental problems, were 86 and 93 percent for Cairo and Rabat-Salé, respectively. 40 and 36 percent of those households considered air pollution to be the greatest problem in the area. The other problems reported are in order of importance: water problems and noise from vehicles in the case of Cairo, and household waste,[4] noise from vehicles and water problems in Rabat-Salé. A letter describing the hypothetical market, why the study was being conducted and the instruments to be used to reduce air pollution, followed these questions. The second section of the survey instrument included attitude and behavior questions. The fourth section collected socio-economic and demographic information.

The third section included the valuation part, which was based on a dichotomous choice technique, DC. Based on a discrete response, this technique was first used by Bishop and Heberlein (1979).[5] When using it, the respondent is asked to answer yes or no to the take-it-or-leave-it offer for the object being valued. The DC yields qualitative answers (yes/no). These qualitative responses provide much less information about the respondents' actual values (preferences) than is utilized when continuous numerical responses are obtained with iterative bidding and/or payment cards. This method is, however, preferred by the National Oceanic and Atmospheric Administration (NOAA) Panel (Arrow et al., 1993) since the

[2] For more details on these methods Hanley and Spash (1993)
[3] An extract of the survey instrument is presented in the appendix, the full version is available in Belhaj (1998).
[4] The household waste is inefficiently collected; sometimes it lies around the house for some days before it is collected.

[5] See also Cameron and James (1987) and Kriström (1990).

respondent here does not have a strategic reason to answer untruthfully (Hanemann, 1994). It also reduces the incentives for strategic behavior (Loomis, 1987), since it is more difficult for the respondent to influence the mean WTP. In the scenario, no particular payment vehicle was specified in order to reduce the influence of context on the WTP results. As the efficiency of institutions regulating vehicles may vary from country to country, we avoided introducing probability of provision or transaction cost considerations that were outside the scope of this research. However, using CVM to elicit WTP to reduce air pollution is a difficult task since the degree of reduction is on one hand complex to establish and on the other hand very hard to explain to respondents. Many studies such as Rowe et al. (1980) and Shechter and Kim (1991) showed photographs of both visibly polluted and relatively clean days before asking the respondents about their WTP to reduce air pollution. This may be possible in an industrialized area where emissions from coal-fired plants are substantial.

Metropolitan Cairo is one of the most polluted cities in the world (Abdel-Halim *et al.*, 2003). Here pollution emerges mainly from industries and traffic, while the latter is the cause of the largest bulk of air pollution. The metropolis is the most populated area and comprises the largest number of transport vehicles in Egypt. Therefore, pollution levels differ enormously from one district to an other according to the source of pollution, since some areas have heavily polluting industries (e.g. cement and iron) and others are dominated by vehicle pollution that varies among streets and districts. The cities of Rabat and Salé are two adjacent cities separated by the Bouregreg-river. This urban area belongs to the second most polluted zone in the country where the population and number of transport vehicles are the second largest in Morocco. However, with practically no industries, pollution is dominated by vehicle emissions. To use photographs here to give accurate descriptions of certain percentages of reduction is difficult and might be misleading. However, in order to ask respondents their WTP for population abatement we used a 50 percent reduction, as in Shechter and Kim (1991), since the concept of a “half” is easy to understand compared to other percentages.

After the sample selection and before conducting the final interviews, a pilot study including 60 households in Cairo and 100 households in Rabat-Salé was carried out. The purpose of the pilot study was twofold. First, discussing the questionnaire and its formulation with the

interviewee permitted us to correct misunderstandings and to include other relevant questions. Second, the pilot study served to decide the starting bids, which were then used in the final interviews. From the pilot study the median willingness to pay was 3.19 and 13.56 USD respectively, for Egypt and Morocco.[6] The starting bids used in the final study were calculated so that they would correspond to two lower values and two upper values arrayed around the median. In the stage of conducting the survey, the response rate was about 96% leaving us with a sample of 645 and 382 respondents respectively, in Cairo and Rabat-Salé.

3. Sample description

In July 1995 and with the help of the Moroccan statistical office in Rabat, a stratified random sample of 400 households was obtained in Rabat-Salé.[7] The Egyptian sample was selected in a similar manner in order to make samples as comparable as possible. Table 1 summarizes sample characteristics.

The Egyptian sample was found to be slightly older, more educated, and have a higher marriage prevalence than the Moroccan one. As shown in Table 1, the mean household equivalent income is around 218 and 248 USD respectively, for Cairo and Rabat-Salé. The average household sizes are 4.34 in Cairo and 5.68 in Rabat-Salé. Concerning the gender variable, 46 and 60 percent of the respondents were men, and 54 and 40 percent were women in Cairo and Rabat-Salé, respectively. We believe this is a reasonably representative population since the gender distribution in Egypt is 51 percent men and 49 percent women and the Moroccan counterpart figures are 49 percent and 51 percent, respectively. However, the slight overrepresentation of men in the Moroccan sample may reflect a cultural tradition where women are not supposed to talk to strangers. We did however our best to reduce this small bias by using some women enumerators. Turning to respiratory diseases, 21.4 and 17 percent of Cairo and Rabat-Salé respondents, respectively, believed air pollution to be the cause. When discussing the Egyptian and Moroccan authorities' commitments to taking

[6] The reader should notice that the bids used were in local currency where here for the sake of comparison values are converted to 2002 USD taking differences in purchasing power parity between the two countries into consideration.
[7] For details of the Moroccan sample selection see Belhaj (2003)

measures for reducing emissions, 52 and 56 percent, respectively, agreed that the authorities seem to be indifferent to solving the air pollution problem.

Table 1: Characteristics of the sample

Variables	*Description*	*Cairo-Egypt*			*Rabat-Salé-Morocco*		
		Mean (St. D)	*Min*	*Max*	*Mean (St. D)*	*Min*	*Max*
Sample size		645			382		
Income	Household income, equivalence scaled[a] (USD/month)[b]	218.14 (323.7)	5	1742	247.79 (229.4)	5.18	519.4
Household size	Number of inhabitants in a household	4.34 (1.65)	1	13	5.68 (2.77)	1	16
Age	Respondent age in years	44.86 (12.44)	20	95	43.2 (13.25)	20	80
Gender	= 1 if the respondent is a male	0.46 (0.5)	0	1	0.60 (0.49)	0	1
Literacy	= 1 if the respondent is literate	0.8 (0.4)	0	1	0.57 (0.5)	0	1
Married	= 1 if the respondent is married	0.87 (0.34)	0	1	0.77 (0.42)	0	1
Disease	= 1 if the household has experienced a respiratory disease	0.21 (0.41)	0	1	0.17 (0.37)	0	1
Authority indifference	= 1 if respondent thinks that the authorities are indifferent towards the problem of air pollution	0.51 (0.5)	0	1	0.56 (0.5)	0	1

[a] The weights used are 1 and 0.7, respectively for an adult and an under 15 year old household member.
[b] Values are in 2002 USD and adjusted to purchasing power parity.

4. Socio-economic determinants of willingness to pay

Apart from the fact that we are interested in the mean WTP for the benefit transfer analysis, we are also interested in the factors impacting the given bid. These factors include various socio-economic characteristics of the household, notably income and respondent characteristics. Also important are factors such as health and opinions about the authorities' commitment to solving environmental problems. It would have been important to also include different pollution levels in order to study their effects on the magnitude of WTP. Unfortunately data on emissions did not exist at the time the Moroccan study was conducted. Therefore it was not taken into consideration since testing benefit transfer hypotheses requires the use of the same distributional and model specification across countries.

Using discrete choice questioning where the dependant variable is binary, a logit model is used. As for the variables included in the models, they are used in order to control for some of the differences that may arise between the two countries. Since variation in WTP is expected, we check if it is measurable by differences in socio-demographic characteristics. For this purpose value functions were estimated for both pooled country data and separately for each country. A likelihood ratio test between the pooled and the country specific model suggests that preferences vary among countries in ways not related to measurable differences in the individuals. As shown in Table 2 household income and the authorities' indifference towards the environmental problems are highly significant. As expected, household income has a positive effect suggesting higher WTP as income increases.

Table 2: Marginal effects of the logit model *p*-values are in parentheses

	Pooled	*Cairo – Egypt*	*Rabat-Salé – Morocco*
Intercept	0.17 (0.03)	0.302 (0.0013)	0.178 (0.2674)
Starting bid	-0.02149 (0.000)	-0.076 (0.000)	-0.02 (0.0004)
Income	0.0007 (0.000)	0.0007 (0.000)	0.00062 (0.0004)
Age	-0.001 (0.4177)	-0.00047 (0.6988)	-0.00348 (0.1714)
Gender	0.0689 (0.0279)	0.0438 (0.1226)	0.117 (0.059)
Literacy	0.0778 (0.0387)	0.0404 (0.2737)	0.133 (0.0617)
Married	0.0253 (0.5163)	-0.00215 (0.9576)	0.095 (0.1781)
Disease	0.0494 (0.1413)	0.00616 (0.8437)	0.153 (0.0275)
Authority indifference	-0.0914 (0.0014)	-0.0445 (0.0947)	-0.139 (0.0128)

Furthermore, gender, literacy as well as if the respondent or one of the household members experienced respiratory disease have significant effects in the case of Rabat-Salé. [8] The gender variable has a positive effect. Since in general women do not possess a remunerated work, the result may be interpreted to mean that women tend to be more prone to uncertainties in terms of income. With regard to the literacy variable, educated respondents are willing to pay more to reduce air pollution. In the model, respondents suffering from respiratory disease would also contribute more to decrease air pollution in Rabat-Salé. An increase in authority actions would reduce the probability of having higher WTP. The starting bid is negative as expected. Unfortunately, this variable is significant in all the models implying a starting point bias.

[8] Most of the explanatory variables used here are binary. Depending on the nature of the binary variables i.e., they take only two values, say 1 for male and 0 for female; the results are not interpreted as marginal effects but rather as derivatives.

5. Welfare estimation and benefit transfer

As shown in Table 3, using the logit estimates and a simplified parametric approach the mean WTP for Cairo and Rabat-Salé are approximately equal to 6.07 and 17.12 USD, respectively, when taking socio-economics into consideration. Since CVM is a tool for cost benefit analysis, its role is to provide aggregate benefits. It could also be used for benefit transfer from site to site when time and budget constraints are existent to perform a survey on a policy site. The normal practice, which is also usually called unit value transfer with adjustment for income differences, is to use the mean WTP obtained from the "study site" corrected for the difference in GDP between sites to obtain the benefits of the "policy site." Since the GDP values of the two economies in question are similar according to the World Development Indicators and since the mean household income ratio between our samples is slightly different from one, the estimated mean WTP will be used directly with adjustment from one site to the other. Hence, if the benefit transfer were made from Morocco to Egypt the WTP in Cairo would be equivalent to 18.07 and 15.9 USD using the logit model and simplified parametric approach, respectively, when no covariates are accounted for, and with and without income correction.[9] On the other hand, if the transfer were made from Egypt to Morocco the WTP in Rabat-Salé would be 5.64 and 7.67 USD respectively, when income is and is not corrected for and the covariates are not considered. Therefore, an over- or underestimation is made in both cases compared to the "ideal" case where a CVM is conducted and WTP values are estimated in each country. Alternatively a value function transfer may be used and the expected WTP in the policy country is calculated using the value function estimated from the study country for an average individual from the policy country sample. However, the values depicted in Table 3 are subsequently used to calculate the transfer error proportions depicted in Table 4.[10]

[9] The ratios of the samples average income between Cair-Rabat/Salé and vice versa are 0.88 and 1.136, respectively.

[10] Transfer error proportion = (transferred WTP - policy site WTP)/policy site WTP.

Table 3: Mean WTP in USD

	Cairo – Egypt	*Rabat-Salé - Morocco*
Without covariates	5.64	18.07
With covariates	6.07	17.12
Value function	6.29	17.74

The first two rows of Table 4 help test the hypothesis that benefit transfers are robust to differences in site characteristics. The following four rows test that the values generated with the coefficients from the study site applied to the policy site characteristic are identical to the values that would be obtained with a primary study at the policy sites. The result shows that it is invalid to transfer the benefits between Egypt and Morocco. Using the Moroccan site to transfer the benefits to Egypt as a policy site results in an overestimation of the benefits of a 50 percent reduction in air pollution ranging between 150 to 220 percent, while using the Egyptian figures to estimate the benefits of a 50 percent reduction in air pollution in Morocco results in an underestimation of benefits of around 60 to 69 percent. However, in our case adjusting for site-specific income and socio-economic variables decreases transfer error considerably when using benefit transfer from Morocco to Egypt.

Table 4: Results from benefit transfer

Model of mean WTP	*Policy site*	*Transfer error proportion* [a]	*Absolute error (%)*
No covariates	Cairo – Egypt	2.2***	220%
	Rabat-Salé – Morocco	-0.688***	68.8%
Conditional on covariates	Cairo – Egypt	1.821***	182.08%
	Rabat-Salé – Morocco	-0.645***	64.55%
Conditional on covariates with sample income adjustment	Cairo – Egypt	1.492***	149.2%
	Rabat-Salé – Morocco	-0.599***	59.9%
Value function transfer	Cairo – Egypt	1.923***	192.3%
	Rabat-Salé – Morocco	-0.632***	63.2%

[a] Transfer error proportion = (transferred WTP - policy site WTP)/policy site WTP.
*** The hypothesis of the validity of benefit transfer rejected at a 99% confidence level.

6. Concluding remarks

The objective of this study is to evaluate the transfer of WTP for a 50 percent reduction in air pollution estimates in both Cairo (Egypt) and Rabat-Salé (Morocco). To our knowledge this is the first contingent valuation study where the same questionnaire was used in two developing country contexts. Testing the validity of transferring benefits using mean WTP

and value functions between Egypt and Morocco was rejected and proved to under- or overestimate the damage cost depending on the direction of the transfer. When faced with the decision of whether to use benefit transfer or to conduct a new valuation study in the policy country, a trade-off must be made among the increased cost and delay associated with a new valuation study, the improvement in reliability that would result from using benefit transfer, and the expected loss associated with making an incorrect decision. We do not find that value function transfer outperforms unit value transfer, but taking socio-demographic characteristics into consideration reduces the transfer error considerably. Our results provide baseline information about the difference in reliability between using benefit transfer and conducting a new study. We conclude that if a policy decision is not sensitive to transfer errors ranging from around minus 50 percent to plus 140 percent or more, then the reliability of a between-country benefit transfer may be acceptable.

Appendix

INTRODUCTION

Cairo/Rabat-Salé is one of the most polluted cities in the world. In the city center high concentrations of toxic gases such as carbon monoxide, sulfur oxide, nitrogen oxides, hydrocarbons, lead, suspended particles etc. can be observed. These gases are emitted mainly from two sources: public and private transportation (approximately 90%). The high concentration of these gases radically affects the ecosystem, the environment and most importantly human health, causing effects such as: bronchitis, allergies, cardiac and cerebral damages, reduction in the pulmonary function, fatigue, headache, etc.

PURPOSE OF THE SURVEY

The demand for consumer goods is generally regulated through the price of the good. Public goods such as recreational parks and the air we breathe are, however, goods whose benefits cannot exclude anyone. For this reason setting a price on these goods is more complex.

The deterioration of environmental public goods demands the application of measures to repair this deterioration. The application of these measures inevitably gives rise to a cost, which directly or indirectly has to be paid by all of us. The atmospheric contamination existing today in our capital, which excludes many persons from such an essential right as to breathe clean air, constitutes an example. In order to compare the social costs from the air contamination plus the required costs to improve air quality with the benefits that clean air gives us, it is necessary to know the willingness to pay for this good. This survey intends to evaluate the willingness to pay and its relation with the total cost provided by the air contamination. You, by answering this questionnaire, can make it possible.

QUESTIONNAIRE

13. There are several measures that could be taken in order to improve the level of air quality in Cairo. Among the possible measures are: the installation of catalytic converters on all gasoline cars built 1995 and later (older cars may be transformed to use natural gas as fuel) the creation of non-traffic areas, the elaboration of gasoline without lead, the use of green buses, improved road infrastructure, etc. As mentioned before, the applications of these measures cause a cost which directly or indirectly will be paid by all of us. This payment could be through: more expensive cars, increased fuel (gasoline and diesel) prices, cost of transforming your car from gasoline or diesel to gas and public transport fares.

Suppose the authorities presented a program which would decrease the level of atmospheric contamination by 50%.

Would you be willing to contribute with (**x** **) LE/DH per month** in order to cover in part the cost of the program?

☐

1. Yes ---> go to 14a
2. No ---> go to 14b

14. Would you be willing to contribute with a sum of:

a. 1½x= LE/DH

☐

1. Yes ---> go to 15a
2. No ---> go to 16

b ¾x= LE/DH

☐

1. Yes ---> go to 16
2. No ---> go to 15b

15. Would you be willing to contribute with a sum of:

a. 2x= LE/DH

☐

1. Yes ---> go to 16
2. No ---> go to 16

b. x/2= LE/DH

☐

1. Yes ---> go to 16
2. No ---> go to 16

16. How much would you maximally be willing to contribute with **per month** ?

LE/DH

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