A Methodology to Estimate Value of Time of Commuters – Evidence from Cities between Fort and Moratuwa (Literature Review)

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Abstract *-Value of time (VOT) measures is valuable in a wide range of public transport policy and planning applications. Public transportation infrastructure projects can be justified through the quantification of the generalized benefits to society, including reduction of harmful emissions, conservation of energy, and recovery of productivity lost in congestion. Quantification of each of these components is a complicated process, which involves estimates of the gains in each category. To develop a single overall figure, these components need to be translated into a single unit, which is usually a monetary currency. Delay and travel time can be converted to dollar amounts through the concept of VOT. But figures of VOT estimated in Sri Lanka are based on income rate method which uses annual level of income and the working hours of the people. This research develops an econometric model for the estimation of VOT specifying trip based characteristics (mode, travel time, and travel cost) along with socioeconomic characteristics, such as profession, education and car ownership. This model is to be applied to short intercity trips between two medium size cities (Fort and Moratuwa) in Sri Lanka. A stated preference internet survey has been designed to a random sample of 300 people. Based on the data, the coefficients of the model are to be estimated for the estimation of VOT measures through three types of models such as ordered logit model, the generalised linear mixed model and binary logit model.*

Keywords: *Measures, Value of Time, Model*

I.INTRODUCTION

Value-of-time (VOT) measures are valuable in a wide range of public transport policy and planning applications. Public transportation infrastructure projectscan be justified through the quantification of the generalized benefits to society, including reduction of harmful emissions, conservation of energy, and recoveryof productivity lost in congestion. Quantification of each of these components is a complicated process, which involves estimates of the gains in each category. To develop a single overall figure, these components need to be translated intoa single unit, which is usually a monetary currency. Delay and travel time can beconverted to dollar amounts through the concept of VOT. (Antoniou and Matsoukis, 2007)

Income rate method is used for estimating VOT measures for assessing public transport projects in Sri Lanka. It can be described as follows:

Hourly income of User Group (Rs./Hr)= Mean Monthly Income x 12
No. of working hours per year (2000hrs)

Here, it is assumed that users in a particular income group make same number oftrips individually. But in reality higher income earners travel more than the lower ina same user group. To accommodate this phenomenon Hourly income ismultiplied by 1.5.Therefore,

Weighted Hourly income of User Group (Rs./Hr) =(Mean Monthly Income x 12) x 1.5
No. of working hours per year (2000hrs)

Time value depends on the trip purpose.If you are at work, there should be allowance for employers' overheads in addition to hourly income rate.Value ofNon-work time which is happening whiletravelling to and from work is stilldebatable.However,RUCS (1993) estimate that,

VOTWT = Hourly Income Rate x 1.2 & VOTNWT = Hourly Income Rate x 0.2
VOTWT&VOTNWT has to be weighted with their composition on road and then aggregatedto estimateVOT for the user group;

VOT of User Group =
Weighted Hourly Income of User Group x (1.2 work time trip% + 0.2 x Non-work time trip %)

Here in this method, only the financial cost has not been taken into consideration and trip characteristics nor socioeconomic factors of the traveler are not attributed.

But, Ortuzar and Willumsen (2011) suggest that generalized cost of travel when given monetary value, it becomes as VOT. This research will enable to develop an econometric model for the estimation of VOT specifying trip based characteristics (mode, travel time, and travel cost) along with socioeconomic characteristics, such as profession, education and car ownership.

II.LITERATURE REVIEW

Kawamura (2000) used stated-preference data from California to estimate the VOT of commercial motor carriers, using a modified logit model in which the coefficients were assumed to be distributed log-normally across the population. The questionnaire included questions about the characteristics of the motor carrier company and 10 stated-preference choices between options with tolls and without tolls. Kurri et al. (2000) present the results of two separate studies for the estimation of freight-specific VOTs for road and rail transport, using the same methodology. Stated-preference data was used, in which hypothetical choice situations between two roads or rail transport alternatives were presented to transport managers in manufacturing companies in Finland. A logit model was employed for the estimation of the coefficients that were used for the determination of the VOT.

Several VOT studies have been conducted in Europe, including The Netherlands (Gunn and Rohr 1996), Norway (Ramjerdi, 1997), Sweden (Alger, 1996), the United Kingdom (Gunn, 1996), and Switzerland (Axhausen, 2004). Wardman (1998) presents a meta-analysis of VOT derived from 105 travel demand studies using revealed-preference and/or stated-preference methods. Kumar et al. (2004) developed multinomial logit models for the estimation of the VOT, the service headway and the comfort levels for trip-makers traveling along rural bus routes in India. Data were collected through a stated preference survey. While trip characteristics and socioeconomic characteristics of the respondents were collected, they were not included in the final models.

Diamandis (1997) estimated the VOT for Greek drivers. The survey was based on revealed preferences made by participating travelers in choosing between alternative modes with different prices and travel times. The collected data were analyzed with the use of the multinomial logit model. Finally the evaluated VOT for nonprofessional trips range between US $3.72/hr and US $4.32/hr and for professional trips between US $5.42/hr and US $6.42/hr.

Polydoropoulou (2000) presented the results of a large-scale study in Greece. The survey used stated-preference data collected via a telephone survey. The scenarios that were presented to the participants included choices between car, bus, train, ship, and airplane. The attributes that were chosen to describe each alternative were mode, time, and cost. The authors identify the incorporation of socioeconomic data into the model formulation as a useful direction for further research. The selected data were analyzed with the use of multinomial logit and mean VOTs were evaluated for each mode: US $6.6/hr, car; US $4.92/hr, bus; US $4.32/hr, train; US $5.64/hr, ship; and US $20.76/hr, airplane.

Bellaire and Thémans (2005) developed models for the prediction of travel decisions and consequently transportation demand with regard to different strategies of traffic management. A combination of revealed-preference and stated-preference data was analyzed using mixed logit models. The VOT was evaluated for short-distance (<50km) and medium-distance trips. The influence of several socioeconomic characteristics was evaluated.

As we can see that most of the studies that are aimed at estimating the VOT have used discrete choice models. Most of them use logit models due to practical reasons where recently, studies like Bierlaire and Thémans (2005) uses the mixed models. In terms of data, most studies have used stated preference data as there are practical problems with finding the revealed preference data. Richardson (2002) demonstrated the use of adaptive stated-preference surveys using simulated data

III.CONCLUSION - PROPOSED METHODOLOGY

A stated preference internet survey has been designed to a random sample of 300 people.Survey respondents are often asked to express their preferences in a rating scale. Such scales are often called Likert scales (Likert 1932; Richardson 2002). A multinomial logit model could be specified with each potential response coded as analternative. This is supported by Antoniou and Matsoukis, (2007). This model is to be applied to short intercity trips between two medium size cities (Fort and Moratuwa) in Sri Lanka.

Suppose the following general formulation for the systematic component of the utility function is used:

$V=\beta 0+ \beta cost * travel\ cost + \beta time * travel\ time+$

Where:
β are the coefficients to be estimated

travel cost and travel time are the variables associated with travel cost and travel time, respectively
… corresponds to additional explanatory parameters in the model.

Tseng and Verhoef (2007) suggests that VOT is usually derived as the marginal rate of substitution between travel time and cost coefficient, typically found in discrete choice models of stated preference data, revealed preference data, or a combination of theses.

The ratio of the coefficient for the travel time over the coefficient for the travel cost wouldhave units of $/min (or $/hr if multiplied by 60), which is the expected unit for aVOT measure:

VOT = $60.\frac{\beta_{time}}{\beta_{cost}}$

Hence the VOT will be estimated.

REFERENCE

Antoniou,C . and Matsoukis,E. (2007) ' A Methodology for the Estimation of Value-of-Time Using State-of-the-Art Econometric Models', Journal of Public Transportation, 10(2007)

Axhausen, K. W., A. König, G. Abay, J. J. Bates, and M. Bierlaire. 2004. Swiss value of travel time savings. Proceedings of the European Transport Conference,Strasbourg, France.

Bierlaire M., and M. Thémans. 2005. Development of Swiss models for transportation demand prediction in response to real-time traffic information. Proceedingsof the 5th Swiss Transport Research Conference, Ascona.

Diamandis P. F., G. P. Kouretas, and P. Tzanetos. 1997. Modelling the choice of the value of travel time savings for the case of the Rion Antirion suspension bridgein Greece. The Annals of Regional Science. Springer Verlag, pp. 473–489

Kawamura K. 2000. Perceived value of time for truck operators. TransportationResearch Record 1725: 31–36.

Kurri, J., A. Sirkiä, and J. Mikola. 2000. Value of time in freight transport in Finland.Transportation Research Record 1725: 26–30.

Ortúzar, J.d.D. and Willumsen, L.G. (2011) Modelling Transport. United Kingdom: John Wiley & Sons, Ltd.

Polydoropoulou, A., S. Kapros, and E. Pollatou. 2004. A national passenger mode choice model for the Greek observatory. Proceedings of the 10th World Congresson Transportation Research (WCTR) Conference, Istanbul.

Ramjerdi, F., L. Rand, and K. Saelensminde. 1997. The Norwegian value of time study: Some preliminary results. Oslo: Institute of Transport Economics.

Tseng, Y.Y. and Verhoef, E.T. (2007) ' Value of time by time of day: A stated preference study', Elsevier,42(2008)

Wardman, M., and G. Whelan. 2001. Valuation of improved rolling stock: A review of the literature and new evidence. Transport Reviews 21 (4): 415–447.

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