Identifying the value of time distribution - Evidence from the Swedish Value of Time Study 2008

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Abstract
Introduction
Value of time savings, often abbreviated as value of time (VoT), is of central interest in transport research, being the basis for decisions on very expensive investment projects. Stated Choice methods have now become something of a standard tool to estimate the monetary VoT. The choice set normally includes a fast but more expensive alternative and a slow but cheaper alternative, implying a trade-off value for VoT also called bid. A lot of Stated Choice projects have been carried out, yielding estimates of current values of time.

One of the main objectives of this study is to illuminate the variation of VoT in the population. We investigate both the systematic variation of VoT, i.e. variation depending on observed factors such as income, and the random variation that is due to unobserved factors.

Traditionally more work has been focusing on the systematic variation in the VoT, since the MNL model do not allow for estimation of random distributions. In the recent decade the mixed logit model has become popular as a means to estimate the random variation in parameters. Free software is available that works by allowing parameters to be random, according to some prespecified mixing distribution (Bielaire, 2008). As a consequence, more work has now been focused on exploring the random distribution of the VoT, and there is an increasing awareness that identifying this distribution is crucial also for inferring the population mean VoT.

Fosgerau (2006) shows that the mean value of time is extremely sensitive to the distributional assumptions; VoT can differ by a factor 10 depending on what distribution that is prespecified. This means that the modeller can experiment with assumptions until any desired result is obtained. This is very unsatisfactory and questions the whole credibility of the CBA.

One cause of the observed sensitivity to distributional assumptions is that the mean values are very dependent on the tails of the prespecified distributions, which in many cases extend over the range of bids in the design. This problem seems to be amplified by the fact that the VoT distribution is skewed, implying that a significant mass of the distribution is located towards the tails of the distribution. The implication is that a relatively small share of the populations with very high values of time, at least in the short run, has a vast impact of the populations mean.

If for instance the prespecified distribution has a long, flat tail, like the log-normal distribution, a significant share of the distribution is located even above the range supported by our data. As a consequence, the mean value will be unrealistically high although this distributions fits data well on the range where the VoT distributions is supported by the data. If, on the other hand, the assumed distribution is symmetric or bounded the observations with high values of time have a limited influence of the mean value since they constitute such a small share.
Another problem for inferring the mean VoT, which is related to the problem discussed above, is the difficulties of identifying the right tail of the VoT distribution. The boundary to the lower end of the distribution can be determined using the priori sign information, but the right tail, however, must be observed. If a significant share of the respondents accepts all bids the whole VoT distribution is not identified. However, the share of the population whose VoT is not observed have a heavy impact of the inferred mean value because it can theoretically be arbitrarily high. Hence, identifying the right tail of the VoT distribution is crucial for inferring the mean of the VoT distribution.

Methodology
We use the mixed logit model to estimate the VoT directly, based on the econometric model used by Fosgerau (2005). This model is based on the fact that the State Choice exercise uses only cost and time attributes, and thus can be formulated as the traveller accepting or declining a travel time saving bid. The reformulation has the advantage of being more directly to the point interest, VoT, which is the parameter to be used in CBA, and it fits our data better.

The experimental design was created with the aim to observe the whole right tail and carefully piloting the design was undertaken in this objective. The range of the bid was extended as compared previously collected data. A CV question was also included after the choice with the highest bid, to capture the VoT of the last small share of the respondents accepting all bids. To guarantee that the VoT distribution is not misspecified the distributional test proposed by (Fosgerau and Bierlaire, 2007) is applied. We also explore income elasticity.

Data
In October 2008 a national and large-scale Stated Choice survey was conducted for private trips. The respondents were interviewed over the Internet or by telephone. A number of travel modes was included, namely car, long distance train, regional train, long distance bus and regional bus. For the train and bus modes the respondents were recruited during the trips. To recruit car respondents a random sample of the population was contacted by mail in which they were assigned a particular day, the measurement day. Only respondents who had made a car trip as a driver longer that 5 km during the measurement day was included in the survey.

The sample size of is about 1500 for the car mode, 500 for each for long distance train and bus and 750 for each for regional train and bus, that is 4000 observations in total.

Results
The project is ongoing, but some preliminary analysis shows that the right tail of the VoT distributions is observed. Final results will be available during the spring of 2009.

References
