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## Temporal framing of stated preference experiments: does it affect valuations?

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### ABSTRACT

In this paper, we explore how valuations of trip attributes by train commuters differ between a short-run (departure time choice) and a long-run (travel routine choice) context using a unique SP experiment explicitly designed for this purpose. In the short-run version of the SP experiment, the respondents receive information about available travel options shortly before they had planned to travel. In the long-run version, the respondents receive information about available travel options one month ahead of the planned travel. The short-run context concerns temporary changes in available travel options, while the long-run context concerns permanent changes. We find significantly higher valuations of trip attributes in the long-run context. Moreover, our results indicate that the usual arrival time at work as well as the intrinsically preferred arrival time at work serve as reference points in the short-run as well as the long-run choice context, with the former dominating in the short-run context and the latter in the long-run context.

### 1. Introduction

Since the 1980s, most non-market valuation studies in the transport sector have been based on stated preference (SP) data. SP studies that are concerned with the valuation of travel time (irrespective of whether that is in the context of departure time, route or mode choice) often adopt a short-run framing of the choice situation. This is particularly true for many SP-based studies published in the past decade. The underlying idea is that framing the SP experiment around a concrete reference situation renders it easier for respondents to take into account (scheduling) constraints, hence reducing hypothetical biases (e.g. Hensher, 2010). Although there are rarely any temporal dimensions mentioned in the explanation of such SP experiments, the choice context tends to be implicitly short-run, as respondents are asked to think about a particular day, including the time constraints and activity schedule already planned for this day, when making the hypothetical travel choices.

So far, the influence of short-run framing on the derived valuations of trip attributes has been widely ignored. However, evidence suggests that short-run framing introduces short-run re-scheduling efforts in relation to a (short-run) reference point as well as reference dependence, as respondents are asked to think about a specific trip when filling in the SP experiment, including the time constraints and activity schedule already planned for this day. Both short-run re-scheduling and reference-dependence are both

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undesirable properties, as they raise the fundamental question of whether respondents respond to the choice tasks in SP experiments in a way that uncovers their long-run reference-free stable preferences, which are essential for standard welfare economic analysis. This is particularly relevant, since in most cases the objective of measuring the preferences is to obtain valuations for investments or policy appraisals with a typical time horizon of 40–60 years.

The presence of short-run re-scheduling efforts in SP experiments is for instance suggested by Börjesson and Fosgerau (2015), based on the observation that respondents are slower in completing choice tasks that include large time differences, and in particular time losses. Short-run re-scheduling would suggest lower values of time in the short run, since an unexpected (short-run) time gain can be used less productively. Indications of that can be found in studies that compare valuations derived from revealed (RP) and stated preference (SP) data: RP data are typically collected in an equilibrium situation hence reflect long-run valuations, whereas SP data yield short-run valuations, not least because of the common short-run framing. In line with higher long-run valuations Brownstone and Small (2005) and Lam and Small (2001) find higher valuations based on RP data than on SP data from the same drivers. Ghosh (2001) comes to a similar conclusion, analyzing data from a congestion charging system. The median value of travel time (VTT) derived from the SP experiment ranged from one third to half of that derived from RP values, depending on the model specification. However, there is no strong reason to believe that RP data always give the most accurate VTT, indeed unreliability in VTT estimated on RP data is a main reason for why we collect SP data.<sup>1</sup> Short-run re-scheduling is also consistent with more loss aversion in the time dimension than in the cost dimension in SP data (Borger and Fosgerau, 2008), and the common finding that the value of time increases with the size of the travel time savings (e.g. Bates and Whelan, 2001; Hultkrantz and Mortazavi, 2001; Cantillo et al., 2006): presumably, a small time gain in the short run is difficult to use productively, since travel time cannot be accumulated and saved like, for instance, money. Hence, there could be many reasons why SP and RP VTT differ, and potentially different temporal dimensions are one of them.

In this paper, we explore how the scheduling model and the valuation of the trip attributes differ between a short-run (temporary) and a long-run (permanent) choice context. We use data from a unique SP survey explicitly designed for this purpose, in which each respondent is randomly assigned to either the short-run or the long-run version of the SP. The short-run version of the SP experiment analyzed in this paper provides the context for departure time choices, whereas the long-run version provides the context for the choice of travel routines. Both versions are designed in a very similar way, with the scheduling and travel time attributes being personalized in order to make the choice situations realistic. In the short-run version, respondents receive information on available (train) travel options shortly before they had planned to depart. In the long-run context, respondents receive information about available (train) travel options one month ahead of the planned travel. While the short-run context implies temporary changes in available travel options, the long-run context concerns permanent changes. We argue that this is the relevant comparison: permanent changes are by definition long-run, and those are the ones relevant for policy and infrastructure appraisals. Temporary changes might be long-run in the sense that they are known in advance (e.g. due to pre-announced construction works), but such contexts are typically not relevant for appraisals, and are not used in standard SP experiments either.

Our estimation results show that the long-run scheduling model differs from the short-run scheduling model in at least two dimensions. First, the usual arrival time and the intrinsically preferred arrival time (at work) define the shape of the scheduling model in the short-run as well as the long-run choice context, but the former dominates in the short-run context and the latter in the long-run context. Second, we uncover consistently higher valuations of trip attributes from the data collected within the long-run context. We find that the value of early and late arrival, as well as the value of travel time are on average more costly in the long run than in the short run. This seems to be at least partially caused by a lower sensitivity to money in the long run, possibly due to more discounting in the money dimension than in the time dimension. The result is also consistent with the idea that time can be used more productively when arrival and departure times are known well in advance and on a regular basis. The value of reliability is also higher in the long run, which might indicate that long-run travel time unreliability causes more anxiety.

Our results are in line with a recent SP study by Beck et al. (2017) who find significant differences in the value of travel time estimated on data from stated choice experiments formulated as a trade-off between (i) monthly travel costs and commuting time, and (ii) wage rate and commuting time. The experiment (i) yields a lower value of time than experiment (ii). Beck et al. (2017) attribute this to the shorter time perspective in experiment (i), although the time horizons and how they are interpreted by respondents are rather unclear. The difference in the valuations could also be due to different ways of presenting the monetary differences (as a travel cost versus a wage difference). Hence, their results are inconclusive, and call for further research on the effect of the temporal framing of SP choice experiments on the valuation of trip attributes.

Our findings are only partially consistent with the findings of Peer et al. (2015), who investigate the dependency of valuations of trip attributes on the temporal frame using revealed preference (RP) data. They find that car drivers value travel time higher in the long-run context (corresponding to the choice of travel routines). Schedule delays, however, are valued higher in the short-run context (corresponding to the choice of day-specific departure times), possibly reflecting a less flexible schedule in the short run decision-making. This would mean that the re-scheduling costs are bigger in the short-run, which contradicts the findings of this paper. A possible reason is the type of mode considered. The paper of Peer et al. (2015) concerns car travel, whereas the present paper concerns train travel. With train travel, commuters may feel more confident in blaming the operator for delays; with car travel,

<sup>1</sup> There is evidence suggesting that the VTT is underestimated in RP studies estimated on travel survey data due to errors in the travel time variable. Walker et al. (2010) and Varotto et al. (2017) show that when accounting for errors in the travel time variable using more advanced model specifications, the time parameter increases implying that the estimated VTT increases. However, Varela et al. (2018) show that when also accounting for measurement errors in the cost variables, the VTT actually declines.

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