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Values of travel time in Europe: Review and meta-analysis

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ABSTRACT

This paper reports the most extensive meta-analysis of values of time yet conducted, covering 3109 monetary valuations assembled from 389 European studies conducted between 1963 and 2011. It aims to explain how valuations vary across studies, including over time and between countries. In addition to the customary coverage of in-vehicle time in review studies, this paper covers valuations of walk time, wait time, service headway, parking space search time, departure time switching, time in congested traffic, schedule delay early and late, mean lateness and the standard deviation of travel time. Valuations are found to vary with type of time, GDP, distance, journey purpose, mode, the monetary numeraire and a number of factors related to estimation. Model output values of time compare favourably with earnings data, replicate well official recommended values obtained from major national studies, and are transferable across countries. These implied monetary values serve as very useful benchmarks against which new evidence can be assessed and the meta-model provides parameters and values for countries and contexts where there is no other such evidence.

1. Introduction

The value of travel time is one of the most important parameters of transport planning and several countries and some international organisations have official values so that transport projects, programmes and policies are evaluated on a consistent basis (Mackie et al., 2014). So-called national studies[1] have been conducted in Denmark, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland and the United Kingdom, in many cases on more than one occasion, and this evidence is backed up with a whole host of specific studies exploring valuations of a wide range of time related variables in contexts as diverse as high speed rail, new toll roads, light rapid transit schemes, congestion pricing, quality improvements to local bus services and inter-urban train services, and infrastructure improvements for cyclists and pedestrians.

This wealth of evidence makes possible the research reported in this paper, which we contend is the largest review and meta-analysis yet of valuations of travel time related attributes. It covers European wide passenger valuations of in-vehicle time (IVT), walk time, wait time, headway, parking space search time, changes in departure time, time spent in congested traffic conditions and travel time variability as measured by schedule delay early (SDE) and late (SDL), mean lateness on timetable or expected arrival time, and the standard deviation of travel time (SD).

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[1] We compare the findings of our meta-analysis with those of national studies in Section 6.3.

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Meta-analysis is essentially the study of studies. The quantitative explanation that it provides of inter-study variations, in this case of monetary valuations of time-related travel attributes, can yield methodological insights and provide important evidence on spatial and inter-temporal variations that might not be possible by other means. In this specific context, it provides country specific valuations where there is a dearth of evidence and otherwise allows an assessment of existing evidence.

The structure of this paper is as follows. Section 2 covers the assembly of the data and Section 3 provides a description of the key features of the data. Section 4 summarises some of the valuation evidence prior to the meta-analysis that is reported in Section 5. Illustrative implied values are presented in Section 6, along with comparison against official values from national studies, and Section 7 provides concluding remarks and recommendations.

2. Data assembly

This study builds upon two previous streams of meta-analyses. The Abrantes and Wardman (2011) study covers British evidence on valuations of time, walk, wait, departure time changes, search time, congested travel time and headway, over the period 1963–2008, building upon three previous studies and exploiting a considerable amount of 'grey' literature. We have here added UK valuations relating to travel time reliability and some post 2008 evidence.

The Shires and de Jong (2009) data set covers European IVT evidence over the period 1990–2004 that is indisputably in the public domain. It also included UK valuations as well as some non-European evidence which have each been removed. We have here added earlier and more recent studies along with evidence from unpublished sources for the 1990–2004 period and valuations other than for IVT throughout.

Table 1 lists for each attribute covered the number of valuations and studies. Overall, we have 3109 monetary values from 389 studies covering 1963–2011. In addition, we cover in Section 6 values from some recent national studies conducted subsequent to the data assembled here.

IVT is public transport travel time and also car travel time where there is no distinction made between time spent in free flow traffic, and, however defined, time spent in congested traffic conditions.[2] Search time is similar in nature and is the time that car drivers spend searching for a parking space. Access time is the time spent getting to and from main modes where the study did not distinguish the specific mode used whereas walk time relates to time spent accessing/egressing a main mode on foot and not to walking as a mode in its own right. We distinguish between wait time at the start of a public transport journey and wait time where an interchange is required, noting that the values of wait time were directly estimated and not deduced from valuations of headway between services which form a separate category.[3]

Departure time changes, which can be earlier, later or a mixture of the two incur inconvenience but apply to journey planning decisions at the origin in a context of certainty rather than the decisions that might be associated with a behavioural response to travel time uncertainty. In contrast, the reliability variables relate to the destination in a context of uncertainty. Late arrival time is mean lateness on timetable, SDE and SDL respectively relate to the disutility of arriving before or after the preferred arrival time expressed as expected values across a set of arrival times, and SD is a common measure of travel time variability.

As expected, valuations of IVT dominate, forming over 50% of the UK and European data sets. This is followed by walk time and headway, each with 10%, and the combined reliability terms, combined wait times, combined departure time changes, and access time valuations each with around 5%.

3. Data characteristics

We here summarise some of the key features of the assembled valuation evidence. We only draw multiple observations per study when the segmentation is based on a variable whose effect we are interested in exploring, such as distance, mode or journey purpose. Slightly over half of the studies (52%) yield five or less valuations, perhaps surprising given that most studies value more than one time-related attribute and segmentations, particularly by journey purpose and to a lesser extent mode and distance, are commonplace. Only 8% of studies yield more than 20 observations.

Monetary values have been obtained for 26 countries as set out in Table 2. The UK provides almost 60% of the monetary values,[4] followed by the Netherlands with around 8%. Denmark, Norway and Sweden are the next three most prominent, each with around 5% or more of the total. France, Italy and Germany each provide less than 2%.

The most common segmentation factor in transport planning is journey purpose. Table 3 illustrates the distribution of values across purposes for five broad categorisations of the variables. Commuting, other trips and no distinction by trip purpose (NoPurp) have broadly similar proportions. The relatively low number of behavioural values for business travel[5] may be due to the widespread use of wage rate based approaches to value business travel time savings rather than estimates from

[2] We note that studies have increasingly distinguished different degrees of car congestion, as discussed in the review of international evidence by Wardman and Ibáñez (2012), but here we simply distinguish values for free flow and congested traffic conditions.

[3] A few studies reported values of wait time when in fact they had estimated values of headway.

[4] The UK evidence dominates as this has been accumulated since 1995 in four prior studies.

[5] Business travel in this review is restricted to so-called briefcase travellers who are transacting business.