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Valuing transport investments based on travel time saving: Inconsistency with United Kingdom policy objectives

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ABSTRACT

A recent UK study to establish improved values for travel time savings and reliability using Stated Preference methodology has served to draw attention to the problematic nature of this approach to valuing transport investments. There are inconsistencies in the findings of the Stated Preference research. Only a tenuous relationship exists between time savings, which are short-run, and the long-run benefits of investment that are seen as changes in land use and value. Moreover, benefits estimated based on time savings lack any indication of spatial distribution. Lack of adequate consideration of changes in land use and spatial distribution can result in investment decisions whose outcomes are inconsistent with policy objectives.

1. Introduction

The principal concept of transport economics is that the benefits of investment in the transport system can be attributed to users. The main user benefit is generally the journey time saved, time which is valuable since it permits more productive work to be carried out or more leisure to be enjoyed. Small (2012), at the outset of a thorough review, states: 'It is difficult to name a concept more widely used in transportation analysis than the value of travel time.'

The economic benefit of an investment that allows faster travel is estimated as the product of three factors: the time saved per traveller, the number of travellers, and the monetary value of time. Valid estimates of the value of time are therefore crucial to the economic appraisal of transport investments based on cost-benefit analysis (for a recent review of which see Mackie et al., 2014).

When valuing time savings it is conventional to distinguish between travel on business and non-work travel, the latter in turn sub-divided between commuting and leisure. For business travel, it has been the practice to base the value of time savings on labour costs (Wardman et al., 2015), while for non-work travel, a willingness-to-pay approach has been adopted. The United Kingdom Department for Transport (DfT) recently commissioned fresh research that updated values of time savings and extended the willingness-to-pay approach to business travel, in part to address how factors like on-train working affect the value of time savings (Wardman and Lyons, 2016). The new research has been reported in both policy summary (DfT, 2015a) and in detail (Arup, 2015); the implications are discussed in this paper

The conventional approach to the economic appraisal of transport improvements is to suppose that the main means by which such improvements benefit the economy is by reducing the cost of movement to users of the transport system – both time and money costs. Such cost reduction can lead to improved economic performance through a variety of mechanisms including reorganisation of production, distribution and land use, effects on labour market catchment areas, stimulation of inward investment, and unlocking inaccessible sites for development. Although in principle such consequential benefits could be valued, in practice appraisal focuses on the saving of travel time, this being the largest direct cost reduction, as well as being relatively easy to estimate from models.

Given perfect competition in the economy as a whole, conversion of time saving to other economic effects would not increase total value of benefits. Some consequences of imperfect competition can be separately calculated, for instance greenhouse gas externalities and agglomeration effects, as proposed in the Department for Transport's Transport Analysis Guidance (DfT, 2014). However, the conventional approach neglects the spatial distribution of benefits and does not deal with long-term changes in patterns of activity, labour markets and land-use.

The original, simplest formulation of the conventional approach to transport scheme appraisal was to assume that trip origins and destinations were fixed, from which it followed that improvements resulting in faster journeys yield savings in travel time, which have value. Subsequently, it was allowed that trip origins and destinations might change as a result of the improvements. Nevertheless, supposedly real savings in travel time have continued to dominate the appraisal of benefits, despite lack of empirical evidence of their magnitude. Time

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savings are in principle observable, for instance using travel diary techniques, but in practice are not observed due to shortcomings in standard evaluation methods.

The SACTRA (1999) review recognised that transport schemes could 'unlock' previously inaccessible land for development that could create genuinely new opportunities, which could not otherwise be satisfied. Geurs et al. have recognised that time saving as a measure of consumer surplus does not correctly measure welfare effects when land uses change as the result of a land-use and/or transport policy (Geurs et al., 2006, 2010). Bates (2006) noted that a benefit calculation based on travel time saving is only valid when land-use is constant. To respond to these shortcomings, both Simmonds (2012) and Parker (2013) have developed transport economic efficiency appraisal methodologies that incorporate changes in land use that are the result of transport investment. Grimes and Liang (2010) have estimated the benefits of a road extension based on the changes in land values.

Venables et al. (2014), in a comprehensive review for the UK Department for Transport, recognised that user-benefits, of which the most important is time savings, can be transferred to landlords in higher rents; noted that the conventional approach holds land use constant; and recommended that land-use change should be estimated and reported in a wider range of projects, within the conventional user-benefit, time-savings framework.

However, there is empirical evidence that such time savings are short run. The UK National Travel Survey (NTS) provides important evidence. This household survey is used to monitor long-term trends in personal travel by administering 7-day travel diaries to some 16,000 individuals each year. It is found that the average distance travelled by all surface modes increased from 4500 miles per person per year in the early 1970s to 7000 miles by the mid-1990s, since when it has fallen a little, whereas average travel time remained unchanged over the 40 year period at close to an hour per person per day (see Table NTS0101 of NTS, 2016). This invariance of average travel time is a general finding for settled human populations (Schafer and Victor, 2000). The increased distance travelled in the same amount of time was the result of higher speeds of travel, made possible by investment – mainly private investment in cars and public investment in road infrastructure.

The findings of the NTS are consistent with the proposition that people have taken advantage of higher speeds to travel further, to seek more access, opportunities and choices. For instance, faster travel on the journey to work allows more choice of employment accessible from where people live in the time they allow themselves for travel, more choice of homes accessible from the workplace, and similarly more choice of shops, schools etc.

The NTS findings show no evidence of any time savings, as the outcome of investment in the transport system, that would allow more work to be carried out or more leisure to be had. This means that there are no travel time savings in the long run, which is the perspective of the 40-year NTS time series. Hence any time savings must be short run. The NTS may be regarded as revealing the preference of the population for increased access, opportunities and choice in the long run, rather than for more time for work or leisure.

There is therefore a mismatch between investment in long-lived infrastructure and short run time savings. One evident long run consequence of such investment are the changes in land use that result from improved access, where the increase in real estate values reflects the enhanced economic potential arising from such improved access. For example, the regeneration of London's Docklands (the former port area) has depended on public investment in new rail routes that made this brownfield land more accessible, so that private sector developers construct commercial and residential property to accommodate London's growth (Jones et al., 2004). More generally, there is increasing evidence of land value uplift as a result of transport investment, and growing interest in land value capture as a means of financing such investment (for recent reviews see Medda 2012; Page et al., 2016; Higgins and Kanaroglou, 2016; TfL, 2017).

The relationship between transport and land use was first recognised by von Thünen, whose classic work related the value of agricultural land, as measured by the rents that farmers could afford to pay to land-owners, to the costs of transporting the produce to the nearest market (Von Thünen, 1826). This approach, which related land use, land value and transport costs within a spatial framework, was extended to urban situations (Alonso, 1964) and forms part of urban economics (Tabuchi, 2011; Duranton and Puga, 2015). However, transport economists generally suppose that estimates of travel time savings and other user benefits can account for the bulk of the economic benefits of a typical investment. Changes in land and property values are not included in investment appraisal since this would be regarded as double counting. It is nevertheless recognised that the initial user benefits are converted over time to benefits to other users, including property owners.

However, using time savings estimated from transport models as a measure of long run benefits depends on strong assumptions, principally that induced changes in the rest of the economy are quite small and that the rest of the economy is operating perfectly efficiently (Venables et al., 2014). With such assumptions, values of time estimated from Stated Preference (SP) experiments serve as the basis for valuing the changes in economic activity associated with changes in land use (to which are added estimates of benefits from 'wider impacts', to allow in part for market inefficiencies and externalities but not including changes in land use). However, there is a long causal chain from an SP experiment, involving a hypothetical trade off between journey time and cost judged by group of representative individuals, to the scale of economic growth that can result from transport investment that makes land accessible for development.

While the main focus on the benefits of transport investment to users is time savings, another potential user benefit is improved reliability (for reviews see Li et al., 2010; Carrion and Levinson, 2012). Surveys of road users in the UK indicate that an important concern arising from road traffic congestion is lack of reliability – the uncertainty of journey time. When asked about priorities for increased expenditure on motorways, almost half of users ranked improved flow and reduced congestion as a priority, compared with less than a quarter wanting reduced journey times (Costley and Gray, 2013). While such findings do not derive from formal SP experiments, they suggest a clear user preference for reducing trip time uncertainty over increased speed.

It is important to distinguish between time savings and reliability improvement as potential outcomes of investment in the transport system, since these benefits can be achieved in different ways. Reliability can be improved by providing predictive journey time information in advance of the trip, taking advantage of digital technologies (for discussions see Tseng et al., 2013; Sorigura, 2014).

The purpose of this paper is to draw attention to shortcomings of the travel time savings methodology, as exemplified by the new research on the value of time savings, in particular: the tenuous connection between short run time savings and long run benefits seen as changes in land use and value; the problem of valuing reliability; and the lack of any indication of spatial distribution of the benefits of investment. We argue that these methodological shortcomings result in investment decisions that are not likely to be optimal in respect of meeting policy objectives, as illustrated by examples from the United Kingdom. This paper advances a critique developed previously (Metz, 2004, 2008, 2016).

The sequence of this paper is as follows: we discuss how short run time savings relate to long run benefits, as illuminated by the research case study on the value of time savings; following which we review the economic case for number of current and prospective investments in the UK in the light of methodological shortcomings identified.

2. Problems estimating the value of time savings

The outcome of the recent research on valuing time savings (DfT,