Institute of Transport Economics
Norwegian Centre for Transport Research

Summary:

Measuring the patronage impact of soft quality improvements in urban public transport

TØI Report 1408/2015
Author(s): Nils Fearnley, Jørgen Aarhaug, Stefan Flügel, Jonas Eliasson, Anne Madslien
Oslo 2015, 29 pages Norwegian language

Globally, the empirical evidence regarding demand effects of soft quality improvements in public transport is weak. There are several reasons for this, including the facts that demand effects of such improvements are relatively small, that there problems of measuring quality on a meaningful scale, that demand effects of soft quality measures are context specific, and that relatively few scientific studies have looked at this relation.

This report recommends that soft quality improvements in public transport be treated outside of the Norwegian national and regional transport models, and not within these models. In order to assess quality improvements outside of these models, the report provides recommendations for the choice of methodological approaches. Importantly, direct estimation procedures are preferable to implicit approaches. Combined RP-SP and analysis of detailed time-series data are two promising approaches.

There is a growing body of evidence of public transport passenger willingness to pay (WTP) for soft quality improvements, such as information, comfort, security and on-board facilities. There is also evidence to suggest that the benefits of soft quality improvements by far exceed their costs. Investment in soft quality improvements generally increases social welfare. However, for these kinds of projects to be part of standardised project evaluation and ranking procedures, two critical questions need to be addressed. *The first* relates to how soft quality factors affect demand for public transport. Multiple ways to estimate patronage impact of soft quality improvements are available and reported in the literature. They have different merits and limitations. *The second* relates to whether, and how, soft quality measures can be included for appraisal in mainstream and established transport models.

This report addresses these two questions, with a focus on urban public transport.

Chapter 2 focuses on methods in use, as reported in the research and grey literature, for the estimation of demand effects of soft quality improvements. We describe and report a wide number of approaches for establishing empirical evidence of demand effects.

A main distinction goes between direct and indirect estimation methods. Another main distinction goes between analyses of stated vs. revealed behaviour data.

The probably most widely used method of estimating demand effects, is the indirect method of translating quality improvements into in-vehicle time equivalents. This

approach rests on the assumptions that quality improvements affect generalised journey times (GJT) in the same fashion as any other service improvements, and that the impact on demand follows the same mechanisms such that a GJT elasticity of demand applies. This approach is straightforward and applicable once WTP for quality improvements is established, provided GJT elasticities are known. However, our study has identified evidence that there is not necessarily a clear link between WTP and patronage impact. We present examples where this assumption is violated, i.e. where WTP for certain quality attributes is very high, but impact on demand nevertheless is small or negligible.

The literature also provides evidence of another indirect approach to estimating demand effects of soft quality improvements, which rests on a link between quality improvements, via customer satisfaction, to demand effects. We dismiss this approach, despite a few noticeable research contributions in this field, as it primarily brings in additional uncertainties.

Among the *direct* approaches to estimating demand effects of soft quality improvements, we find before/after studies, revealed preferences (RP) analysis, time series analyses, and analysis of cross-sectional data. While these approaches are largely judged robust, practice reveals that they are associated with various problems. In fact, we rarely find rigorous performance of these approaches for estimation of soft quality factors. While the literature presents several examples of before/after studies, only a very few of these are properly controlled. Frequently, control observations are not included in these studies. Hence, all observed patronage growth is attributed to the soft quality improvements without any corrections for general demand trends. Practice also reveals problems to disentangle individual effects of *packages* of soft quality improvements; problems to define and represent public transport quality in numerical models; and, importantly, problems of controlling for the many sources of noise in data sets. Clearly, a main reason for the latter is the fact that soft quality improvements in general bring very small gains in patronage. Often, the insurmountable challenge is to isolate out these small effects from everything else, which affect demand.

While stated preference (SP) approaches are in general unsuitable for forecast purposes, combined RP-SP appears as very promising. Again, very few, if any, properly combined RP-SP studies of soft quality improvements are found in the literature.

Our review of methods in use feeds into a discussion in chapter 3 of the relative performance of the various approaches. Here, candidate methods for future empirical analysis are identified.

Chapter 4 discusses whether, and how, the established evaluation methods, i.e. national and regional transport models, can be developed to include soft quality improvements. We look at the way demand and supply are represented in these models and discuss how quality attributes can be included in the utility function and LOS representation. Several criteria must be satisfied: 1) Explanatory factors that include quality must be possible to measure, for each O-D pair and on a cardinal or nominal scale. As per today, no such database exists. It will be costly to establish and requires continuous updating. There is also a problem to aggregate public transport quality to a zonal level even for very small zones; 2) Utility functions must include parameters for soft quality factors. Today, they don't and they are largely unknown. Due to the differences in utility scales, estimation should be based on the same data as the rest of the utility function, which typically are National Travel Surveys (NTS).

NTS currently hold very limited information about soft quality attributes of the public transport alternatives. Indeed, NTS hold no information about the travel alternatives *not* chosen; 3) Transport models must handle the fact that some quality attributes are endogenous. This applies to, e.g., crowding, comfort and seat availability. An iteration procedure between demand and supply is necessary; 4) The level of aggregation must be appropriate. Today's national and regional transport models are relatively coarse. The full effect of a quality improvement is likely to be smaller than the confidence intervals of hard quality changes, like travel time or cost. For example, public transport fares between any two zone pairs are represented by average prices and the demand model looks at public transport as one alternative. A shift from, say, bus to metro due to metro quality improvements is in general not possible to measure.

The conclusion of this section is that the established models are not suited for appraisal of soft quality improvements. In the short run, it is not possible due to missing information in NTS on which the models are calibrated. In the longer run, there is in principle a possibility to include more quality attributes in NTS. Still, there will remain considerable uncertainty, measuring and aggregation problems. Inclusion of soft quality improvements is more likely to bring in spurious precision than real effects. It is not advised to include them in the models.

However, already today, mode specific variations in values of time reflect, in part, differences in quality.

The alternative to model-inclusion is to treat soft quality factors outside of the models. With reference to chapters 2 and 3 it is concluded that direct estimation procedures and combined RP-SP analysis are best-suited candidate methods for such estimation. Topics of particular interest, which are highlighted in our extensive literature review, include security, driver attitude and style of driving, information, seating availability, and crowding. Information and stop/station quality appear to be important to non-users. Travellers with children often highlight cleanliness and security. A quality factor of both public and private transport, which currently receives much attention, but is studied little, is predictability. We recommend these topics be studied further with the recommended methods. For the purpose of generalisation and transferability of results, we recommend several such studies be performed, ideally on a micro (route) level.

A further possibility to include soft measures in forecasting is to use activity-based models rather than four-stage models. In an activity-based modelling system soft measures or other measures that are not currently included, could be included using a modular model design. Whether this adds to the predictive power of the model than it adds in in terms of cost and increased complexity is, however, an open question.