

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

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Abstract

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. However in order to include such measures in standard project evaluation and ranking procedures one need to establish 1) how soft quality measures affect demand and 2) whether such measures can be included in conventional transport models.

This paper addresses these questions by providing a broad review of available methods for demand analysis and an assessment of national/regional transport models' build-up and requirements regarding the possible inclusion of soft quality improvements.

Regarding methods for establishing demand effects, it is concluded that direct approaches, in particular time series analyses and combined SP-RP studies, as well as well-designed before-after studies, are best suited. Regarding inclusion of soft quality factors into established transport models, there are several reasons to conclude that, for the time being, this will not improve transport models.

1 Introduction

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 (Fearnley et al., 2011). There is also evidence to suggest that the benefits of soft quality improvements by far exceed their costs (Odeck et al., 2010). Investment in soft quality improvements generally increases social welfare. However, for these kinds of quality improvements 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 paper addresses these two questions, with a focus on urban public transport. The main source for this paper is Fearnley et al., 2015.

A distinction between "soft" and "hard" quality factors is common in the literature. However, their definition is not well established. Hard quality factors are typically easier to measure and to quantify and are included in most transport models. They are often perceived as important demand drivers, they affect passengers' generalised costs or operating costs. Hard quality factors include price, all travel time elements, service frequency and interchanges. Soft quality factors, on the other hand, and for use in this paper, comprise more or less everything else, and include comfort, low-floor buses, accessibility measures, seating availability, travel information, fare structure, on-board amenities, stop/station quality, security, cleaning, driving style, and so on. Some service attributes, like punctuality and crowding, may be labelled either soft or hard, according to circumstance.

Across the world, 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 are 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. Nevertheless, this paper gives an overview of methods in use as reported in the scientific literature. Regarding what can be termed a "method", this paper takes a broad and relaxed stance. Whatever approach that is reported to have been in use, or been suggested by, scientific or grey literature, is included. Newsletter and trade magazine stories of patronage growth following soft quality improvements are deemed anecdotal, and excluded.

The remainder of this paper is organised as follows. Section 2 focuses on methods in use, as reported in the research and grey literature, for the estimation of demand effects of soft quality improvements. Section 3 discusses whether, and how, the established evaluation methods can be developed to include soft quality improvements, before Section 4 wraps up with conclusions and recommendations.

2 Methods in use to establish patronage effects of soft quality improvements

Among methods in use for the analysis of patronage impact of soft quality measures, two main distinctions can be drawn. The first goes between direct and

indirect/implicit methods. The second goes between analyses of stated preferences vs. revealed behaviour data.

2.1 Implicit elasticities and travel time equivalents

The probably most widely used method of estimating demand effects, is the indirect method of translating quality improvements into in-vehicle time equivalents. The principles are described, i.a., in Balcombe et al. (ed. 2004) and Pully et al (2006) and rest 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.

An implicit elasticity can be established by means of a known elasticity, ϵ , and a known relative valuation with this kind of formula:

$$\epsilon_{\text{delay}} = \epsilon_{\text{price}} * \frac{\text{Minutes delay} * \text{Value of delay}}{\text{Price}}$$

In this example, the elasticity of delay is unknown but calculated by means of a known price elasticity, a known value of delay and a known price. Additionally, the reference level of delay, i.e. the state of affairs before the change, must be known.

This approach is straightforward and applicable once WTP for quality improvements is established, provided GJT elasticities are known. It is intuitive and fits in within a generalised cost (GC) or GJT framework of demand analysis.

Pully et al. (2006) show, for example, that the patronage effect of a local bus interchange is equivalent to the effect of a 21 minutes travel time increase. Shires and Wardman (2009) use the same approach. Andersen et al. (2013) describe, in line with this, that the standardised way to calculate demand effects in UK's Passenger Demand Forecasting Handbook, is:

$$I = (\text{GJT}_{\text{new}}/\text{GJT}_{\text{base}})^e,$$

where I is an index for demand, and e is the elasticity of demand wrt travel time.

Currie and Wallis (2008) collected evidence of willingness to pay for soft quality improvements and translated them into travel time equivalents. From this, they apply a travel time elasticity and present estimated patronage impacts of these quality improvements. Table 2.1, below, is taken from their study. Driver attributes are found to have significant patronage effects of between 0.68 and 1.02 percent. The effects of CCTV and air conditioning are found to be above one percent.

Table 2.1: Currie and Wallis' (2008, table 2) demand effects of soft quality factors based on journey time equivalents.

Table 2
'Soft' bus vehicle improvements - value and est. patronage impacts

Soft' bus improvement		Valuation ^a (in-vehicle time minutes)	Notes	Estimated patronage impact (%) ^b
Boarding	No step	0.1	Difference between two and no steps	0.17 ^c
	No pass show	0.1	Two stream boarding, no show pass vs single file past driver	0.17
Driver	Attitude	0.4	Very polite helpful cheerful well presented vs businesslike and not very helpful	0.68
	Ride	0.6	Very smooth compared to jerky	1.02
Cleanliness	Litter	0.4	No litter compared to lots of litter	0.68
	Windows	0.3	Clean windows, no etchings compared with dirty windows and etchings	0.51
	Graffiti	0.2	No graffiti compared with lots	0.34
	Exterior	0.1	Completely very clean compared to some very dirty areas	0.17
Facilities	Interior	0.3		0.51
	Clock	0.1	Clearly visible digital clock with correct time vs no clock	0.17
Information	CCTV	0.7	CCTV, recorded, visible to driver plus driver panic alarm compared to no CCTV	1.19
	External	0.2	Large route number and destination sign front, side and rear plus line diagram on side vs small signs	0.34
Seating	Interior	0.2	Easy to read route no. and diagram compared to none	0.34
	Info of next stop	0.2	Electronic next stop sign and announcements vs no information	0.34
Seating	Type/layout	0.1	Individual shaped seats with headrests all facing forward vs basic double bench some backwards	0.17
	Tip-up	0.1	Tip up sets in standing/wheelchair area compared with all standing area in central aisle	0.17
Comfort	Legroom	0.2	Space for small luggage vs restricted legroom and no space for small luggage	0.34
	Ventilation	0.1	Push open windows giving more ventilation vs slide opening windows	0.17
		1.0	Air conditioning	1.70

^a Based on Australian Transport Council, 2006.

^b Assumes a 20 min bus journey with 5 min access/egress walk, 5 min wait, a \$1.50 fare and a value of time of \$Aust 10.00/h (2006). This makes a weighted generalised cost of 59 min. Forecasts are made by applying a generalised cost elasticity of -1.0 to the change each soft factor has on this base generalised time. These assumptions are based on (Booz Allen Hamilton, 2000b; Australian Transport Council, 2006).

^c The 0.17% impact of a 'no step' bus is small compared to estimates of the impact of low floor vehicles (Balcombe et al, 2004; 5% and TAS Partnership, 2002; 3-9%). We conclude that this is a 'low' estimate or that it concerns only the implementation of a step and not the provision of an entirely new low floor vehicle.

(Enerqi, 5.3) uses the same principle. This is shown in table 2.2, which is pasted from their report. They even summarise a *total* potential, of 31 percent patronage growth, from all service improvements.

Table 2.2: Example of use of journey time equivalents from Enerqi (5.1, table 10)

Quality aspect	Related operational quality criteria	Potential improvement			Potential effect on demand (%)
		Maximum range of improvement (*)	IVT (**) equivalent (minutes)	IVT equivalent (%)	
Time spent on board of vehicle	Time	-20% time	-4	-20%	10%
The waiting environment	Comfort Safety/security	-2 min (IVT equiv.)	-2	-10%	5%
Vehicle or rolling stock characteristics	Comfort Safety/security	-1 min (IVT equiv.)	-1	-5%	3%
Reliability	Time	-3 min standard deviation of time	-4	-20%	10%
Information provision	Information	-0,20€ equivalent	-1.5	-8%	4%
Total (sum)					31%

* The *maximum range of improvement* should be understood as the quantitative change from a service at the bottom end of quality to a service at the higher end of quality.

** Units of in-vehicle time.

All the above are typical examples of the use of travel time equivalents to establish patronage effects. Another way to use equivalences are presented in Wardman and Whelan (2001; builds on Wardman, 1999) where the patronage effect of rail rolling stock quality attributes is presented in terms of percentage of travel time or price.

However, there is one main concern regarding implicit elasticities and travel time equivalents: there is not necessarily a clear link between WTP and patronage impact. For example, service deteriorations, which are associated with high disbenefit or willingness to pay for avoidance, do not always result in a corresponding demand reduction. In passenger rail, a few studies have shown that passengers dislike delays and are willing to pay considerable amounts for improved punctuality. Still, the empirical evidence suggests that punctuality only to a small degree affect demand (Bates et al., 2011; Preston et al., 2009; see also Blainey et al., 2012; Fearnley et al., 2012). High WTP does not translate into the same order of demand effects.

Another important caveat regarding the use of implicit elasticities, is the fact that demand effects are context specific. Fearnley et al. (2012) suggest, for example, that one reason for the discrepancy between willingness to pay for improved train punctuality on the one side, and demand effect on the other, is the availability of alternatives to the train. Therefore, demand effects may differ between settings even if willingness to pay is identical. ϵ_{price} in the formula above should be known for exactly the same context as you want to establish information about ϵ_{delay} .

2.2 Implicit via customer satisfaction

TRB (1999) acknowledges that the empirical basis is weak, but assumes that increased customer satisfaction increases public transport patronage, reduces passengers' price sensitivity of demand and improve their loyalty, and reduces the need for marketing. In Norway, Kjørstad and Norheim concluded that «satisfied customers travel more» (2005:25) and «those most satisfied travel 37 percent more than the rest of the population» (2009:17). They suggest as a rule of thumb that 10 percentage-points increased customer satisfaction increase the amount of travel by 3.7 percent.

(Enerqi, 4.2) concludes that infrequent passengers can be expected to travel more if customer satisfaction increases. (Enerqi 5.3: 59-60) moderates this and states that the patronage effect is difficult to establish. Still, in their further analyses, (Enerqi, 5.3) assumes, or rather: postulates, a total long term potential for all quality factors of 40 percent patronage growth. This potential is released through a customer satisfaction increase from 1 (lowest) to 5 (highest) for information, time, comfort, safety, as well as all other quality attributes.

What drives customer satisfaction? Brechan (2004) identifies a hierarchy of quality attributes that drive satisfaction in which the soft quality factors play only

a minor role. The main drivers of customer satisfaction are the hard quality factors. According to Friman and Felleon (2009), few studies have identified drivers of customer satisfaction. Their study, based on six European BEST cities, shows low correlation between subjective satisfaction and measured quality of service.

In total, there is evidence to dismiss customer satisfaction as a formal approach to demand effects. Despite a few noticeable research contributions, the primary effect of including an indirect link between quality and demand via satisfaction is to bring in additional uncertainties.

2.3 Direct approaches: RP, transport statistics, before-after

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.

2.3.1 Revealed preference

Various types of choice analyses based on observed behaviour are labelled Revealed preferences (RP), or revealed choice. RP studies use real choices and therefore there is no measurement error regarding the choices. However, there is less control with the quality attributes (of both the chosen and the *not chosen* alternative) and their levels. Hence, we observe the choices made (NN takes bus), but know less about quality attributes and their levels (NN paid €3 for the ticket; the bus driver was polite and smiling). We know even less about the travel alternatives that were not chosen (if NN had chosen to go by metro, she would enjoy smooth ride). In practice, one has to rely on coarse zone data from transport models, which do not capture small demand effects of soft quality attributes.

RP studies are limited to what service attributes actually exist. There may be noise in the study that is not easily controlled for, like changes in other demand drivers like for example unplanned service changes. A challenge with RP is the fact that there is often little variation in data, and that explanatory variables are often strongly correlated (like travel time and price). Further, with RP data it is difficult to separate effects of individual quality factors when several quality attributes work at the same time. Adding to this, the demand effects of soft quality improvements may be too small to establish within sufficient confidence intervals.

2.3.2 Before-after, counts, and passenger statistics

These types of approaches rest on observed or reported behaviour. However, the data analysis is quite different from RP where various kinds of logit (choice)

models are the norm. A main distinction goes between aggregate data like traffic counts and transport statistics on the one side, and disaggregate data from user and travel surveys. The latter, travel surveys, can be suitable for combination with SP data (see next sub-section). The Norwegian national and regional transport models are calibrated with National Travel Survey (NTS) data. In section 3, we discuss possibilities for using NTS data to include soft quality factors in transport models.

A proper **before-after study** should, as minimum, include control observations and handle seasonal variations and demand fluctuations that stem from known sources. Control observations are typically demand developments in similar and nearby areas where no quality improving intervention has taken place during the same period.

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 reported studies. Hence, all the observed patronage growth is attributed to the soft quality improvements without any corrections for general demand trends or changes in other demand drivers. For scientific purposes, such studies must be deemed anecdotal. When control areas are included in the study, like in AECOM (2009), there are several examples that demand has increased more in the control area (where there is no quality improvement) than in the intervention area.

Trade journals often present anecdotal evidence of patronage growth following soft quality improvements, where all growth is attributed to one factor. Currie et al. (2013:59) reproduce some examples where control areas are used to varying degrees, citing TAS (2002). Some of these are shown in box 2.1.

Box 2.1: Examples of before-after more or less anecdotal evidence of patronage effects. Copied from Currie et al. (2013:59) who cite TAS (2002).

- The Birmingham Showcase quality bus route resulted in a 91% increase in passengers described as 'encumbered', a 71% increase in mobility impaired passengers, and a 146% increase in children under five, compared with the overall average increase of 31%.
- In Manchester, loadings along the bus priority demonstration corridor were 10% to 12% higher on the low-floor buses than on other buses using the same route, and passengers with pushchairs were 2.5 times more likely to use a low-floor bus than a conventional one.
- 88% of users of low-floor buses in Bilbao thought there was a significant improvement in service quality.
- Low-floor buses were a major part of the package scheme in Florence, where patronage on the affected routes increased by 15%.
- A high percentage of passengers using the SMART low-floor buses in Liverpool felt that they were much more accessible in all aspects than other buses in the city.

Analysis of **counts, time series and cross-section** data is usually performed by various forms of regression analysis, which enable estimation of partial effects of various quality items (Fearnley et al., 2015) through the use of dummy variables

or attribute levels. Loader and Stanley (2009) is one example. They analysed upgrading of public transport services in Melbourne and found that “SmartBus” (a high quality concept) increased patronage by 10.3 percent, much more than the 4 percent underlying growth found elsewhere in Melbourne’s public transport network. They also find that those part that were not upgraded, experienced reduced patronage.

Practice with respect to observed and measured patronage data reveals, generally, 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.

2.4 SP and combined RP-SP

While stated preference (SP) approaches are in general unsuitable for forecast purposes, combined RP-SP appears promising. Very few, if any, properly combined RP-SP studies of soft quality improvements can be found in the literature. We are not aware of any such studies.

Combined RP-SP studies have a history dating back to 1990, when Ben-Akiva and Morikawa (1990) developed a method for combining RP and SP data using extra parameters to capture the two data sources’ differences (like different variance and unobserved factors). Walker and Ben-Akiva (2002) recognise the benefit of combining RP data, where choice is certain, with SP data, where the context and attribute levels are certain. The assumption which enables this, is that the trade-off between important attributes are the same in both types of data. A further assumption is that, despite the fact that trade-offs elicit the same relative valuation, the two different methods produce scale differences

Assume two alternatives are characterised by the attributes cost and a dummy which equals 1 if there is information on board.

$$V_{Bus}^{RP} = \theta^{RP} (\beta_{0,Bus}^{RP} + \beta_{Cost,Bus}^{RP} * C_{Bus}^{RP} + \beta_{Info,Bus}^{RP} * DI_{Bus}^{RP})$$

$$V_{Bus}^{SP} = \theta^{SP} (\beta_{0,Bus}^{SP} + \beta_{Cost,Bus}^{SP} * C_{Bus}^{SP} + \beta_{Info,Bus}^{SP} * DI_{Bus}^{SP})$$

θ^{RP} and θ^{SP} are scale parameters in RP and SP; in a common model only one of them can be estimated (the other is normalised at 1). Scale parameters apply to all alternatives in the choice set.

$\beta_{0,Bus}^{RP}$ and $\beta_{0,Bus}^{SP}$ are constants, which are usually assumed to differ between RP and SP.

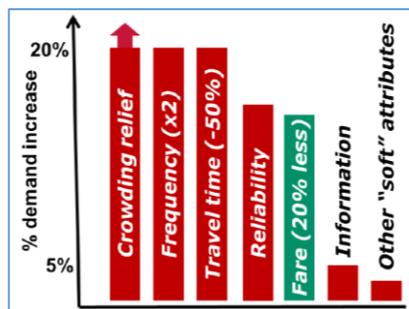
$\beta_{Cost,Bus}^{SP}, \beta_{Cost,Bus}^{RP}, \beta_{Info,Bus}^{RP}, \beta_{Info,Bus}^{SP}$ are the marginal utilities for cost and information. For a combined RP-SP model, $\beta_{Cost,Bus}^{SP}$ must be assumed to be equal to $\beta_{Cost,Bus}^{RP}$, or $\beta_{Info,Bus}^{RP}$ must be assumed to be equal to $\beta_{Info,Bus}^{SP}$.

The valuation ($\beta_{Info,Bus}^{SP/RP} / \beta_{Cost,Bus}^{SP/RP}$) is independent of the scale parameter, while choice probability ($P_{bus}(V_{bus} > V_j, j = \text{train, car, bicycle etc.})$), and thereby demand elasticity, depend on the scale parameter.

2.5 Methods discussed and summarised

A general observation from the literature, is the fact that soft quality improvements in public transport have small patronage effects. Often, the effect is too small to measure, and often, the effect disappears in noise from other factors that affect public transport demand. Anderson et al. (2013) provides a quite representative illustration of the situation (reproduced in figure 2.1). Hard quality factors impact demand considerably more.

Figure 2.1: Expected patronage effects of different rail measures. Source Anderson et al. (2013, figure 3.1)



A critical aspect of this review is the fact that the definition of “quality” varies between studies and appears diffuse. There are no established scales or measurements for soft quality factors. Studies sometimes rely on subjective quality. Sometimes quality is measured as scales (e.g. from 1 to 10), sometimes as dummies (1/0; yes/no) and other times as explanations (the bus is half full) or graphic illustrations. As a corollary, there are sometimes large differences between study findings (see Loader and Stanley, 2009). All this point to the fact that findings are rarely transferable to other contexts.

Table 1 summarises an assessment of alternative approaches to establishing the demand effects of soft quality improvements. Approaches that go via customer satisfaction are associated with several problems of, e.g., causality and are not recommended. Stated choice is, alone, not suitable for forecast purposes. However, SP as correction or addition to Revealed preferences combines the best

of two approaches and as such pose considerable potential. Regarding the use of implicit elasticities, we have seen that this is a frequently used method in the absence of better empirical evidence. However, one must be aware of the major pitfall that willingness to pay not necessarily corresponds to a similar demand effect. Time series and cross sectional data analysis are rarely used for the analysis of soft quality factors. However, as the amount and quality of such data has increased hugely during the last years following the developments in automatic passenger counting systems, this kind of data is promising for analysis of soft quality measures even when expected patronage effects are small. Before-after studies are, in theory, robust and well suited for our purposes. However, in real life it has proven extremely difficult to conduct proper before-after studies with good control design.

Table 1: Methods assessment

Approach	Positive /advantage	Negative / challenge
Customer satisfaction	May appear intuitive	Causal relation. Measurement problems. Hard quality factors drivers. Not recommended
Stated choice	Control with explanatory variables	Hypothetical choice situation not sufficient, alone, for forecasts. H
Revealed choice	Based on real and observed choices	Require much/good data at disaggregate level. Often correlated explanatory variables
Combined SP-RP	Combines the best of two worlds	Resource-, data- and competence-intensive
Implicit elasticity	Intuitive. Valuations are easier accessible than elasticities	Valuations do not necessarily represent demand effects
Time series and cross sectional analyses	Good control with demand. Relatively easy to establish control areas	Less good control with independent variables. Requires much and good quality data
Before-after studies	Good control with independent and dependent variables	Necessitates control area – often neglected. Difficult to generalize

We initially made a distinction between direct and indirect/implicit methods, and between stated vs. revealed behaviour data. Inspired in part by Pully et al. (2006) and in part by AECOM (2009), but primarily by the review presented above, the preference is towards direct and observed approaches. However, it is evident that indirect approaches are suitable where revealed and direct data are unavailable.

3 Transport models and soft quality improvements

A key question for this paper is whether and how the demand effects of soft quality improvements can be addressed within the established transport models and in particular the Norwegian National and Regional transport models. To answer that, we will scrutinise conditions that reflect the build-up of the models and how they are estimated, calibrated, run and interpreted.

Transport models combine a demand model with a supply model (network model). Public transport quality improvements are supply-side measures. We are interested in the effect on demand for public transport.

The typical transport model data flow is as follows: OD-matrices (the number of trips from origin to destination zones) from the demand model are input to the network model. Level of service (LoS) matrices (which indicate average characteristics of the journey at the zone level) of the network model are input to the demand model (Flügel et al., 2014). LoS matrices in today's model include travel times, costs, waiting times, service frequency, etc., but no variables that describe public transport soft quality attributes.

Already today, mode specific variations in values of time reflect, in part, differences in quality. These variations capture, to some extent, overall comfort differences between modes. Lower value of time on trains than in air causes, for example, smaller demand reactions on rail travel time savings than in air. Time values are, however, constant for all ODs. Therefore, it is not possible to measure comfort differences between different train options.

In order to include soft quality attributes in transport models, a number of requirements and 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 holds 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.

To conclude, soft quality improvements are not currently suitable for inclusion in the established models. 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.

The alternative to model inclusion is to treat soft quality factors outside of the models.

4 Conclusions and recommendations

Knowledge about demand effects of soft quality factors are in demand, but is not well researched. Pully et al. (2006), who present a comprehensive overview of decades of demand analyses in public transport, write:

«There is generally less evidence on the demand impacts of service quality variables than that of fares. [...] more evidence is also needed on the demand impacts of service improvements, particularly in terms of IVT, the waiting environment, vehicle characteristics, interchange, reliability and pre-trip information. There are other areas, such as personal security, where there have been very few quantifiable results to date.» (p 302)

AECOM (2009), the most comprehensive study of the effect of quality factors on demand in public transport to date, also underline the lack of, and need for more, empirical research on the topic.

The general conclusion of this literature survey is that soft quality factors have small demand effects and that these demand effects are difficult to measure. To generate statistically significant, general, context independent and empirically founded causality relations between soft quality measures and demand for public transport is doomed to be difficult in terms of research design, data quality and analyses. It is a clear risk that the outcome of such a study will be that no such relations are found.

This paper point at several ways forward.

We recognise that the demand effects can be of a different magnitude in real life than found in implicit studies. The literature suggest that actual demand effects

are smaller than indicated by willingness to pay and customer satisfaction indexes. We therefore recommend to conduct studies that look at the direct relation between soft quality measures and demand, as well as combined RP-SP analyses.

We suggest to focus the efforts on a selection of factors that preliminary studies have shown to be particularly important. Such factors include security, driver attitude and style of driving, information, crowding, seat availability and stop design. Travellers with children often highlight cleanliness and security. Punctuality and crowding are in the borderline between soft and hard factors. They are generally assumed to be important for passengers and empirical studies are in demand.

We suggest to use more methodologically robust approaches, in particular time series analyses and combined SP-RP as well as well designed before and after studies, seem to be promising ways forward.

Finally, we suggest to conduct several studies of the same factors in different contexts in order to isolate the demand effects of a particular improvement. As studies of demand improvement packages have proved to be difficult to analyse.

For the time being, the relation between soft quality measures and demand is too poorly understood to provide an improvement to the existing transport models.

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