Transportation Research Part A 106 (2017) 453–472

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Estimating policy values for in-vehicle comfort and crowding reduction in local public transport☆

Gunilla Björklund, Jan-Erik Swärdh*

Swedish National Road and Transport Research Institute (VTI), Box 55685, SE-102 15 Stockholm, Sweden

ARTICLE INFO

Keywords:
Comfort
Crowding
CBA policy
Willingness to pay
Value of travel time savings
Multiplier

JEL classification:
C25
R41

ABSTRACT

This study estimates policy values for comfort, defined as getting a seat, and crowding reduction on board local public transport in Sweden. We use stated-preference (SP) data and present crowding as a mode-neutral crowding level among the standing travelers depicted in images presented to the respondents. We analyze whether there are differences in the willingness to pay (WTP) for comfort and crowding reduction among the three largest urban areas in Sweden. In general, we find no significantly different preferences for sitting and crowding reduction among the three urban areas. Still, the point estimates differ in some cases, indicating that there may be differences across the three urban areas, but the estimates have large confidence intervals that overlap each other. Also, these differences are likely to have resulted from mode-share differences and not from differences in preferences across the urban areas. Some significant differences are found among the modes, for example, a higher disutility of standing on a bus versus on a tram. These mode-specific estimates can be used as policy values for a given tram line or metro line. Nevertheless, we also pooled the data suggesting average WTP estimates for sitting and crowding reductions that can be used for national cost–benefit analysis policy in all large urban areas in Sweden where crowding on local public transport occurs. Importantly, analysis of heterogeneity and SP-design differences shows that the results are in line with empirical knowledge of the value of travel time savings.

1. Introduction

Urbanization and urban concentration often lead to an increase in public transport travel. This may in turn reduce the environmental externalities of the transport sector, as well as reduce urban road congestion, as more people shift from car travel to other modes, such as public transport. Problems may arise, however, with crowding on board public transport as the demand for such services increases. The supply can also be increased to meet increased demand, but finding the optimal supply of public transport is difficult.

Besides urbanization, certain policies have recently been implemented in Sweden to increase demand for public transport and facilitate the shift from car travel. Public transport organizations in Sweden have formulated the goal of doubling the public transport share of travel by 2020 (Svensk Kollektivtrafik, 2016). In addition, car congestion charges were permanently implemented in

* Corresponding author.
E-mail addresses: gunilla.bjorklund@vti.se (G. Björklund), jan-erik.swardh@vti.se (J.-E. Swärdh).

http://dx.doi.org/10.1016/j.tra.2017.10.016
Received 10 February 2016; Received in revised form 9 October 2017; Accepted 24 October 2017
Available online 06 November 2017
0965-8564/

Stockholm in 2007 and in Gothenburg in 2013.[1] Furthermore, the congestion charges in Stockholm were both extended and increased in January 2016. There are reasons to believe that in-vehicle crowding in public transport will increase in Sweden in coming years unless public transport supply is increased to meet the presumably increased demand.

Cost–benefit analysis (CBA) has long been important to transport planners, for analyzing both investments in the transport sector and measures implemented (Eliasson and Lundberg, 2012). Increased supply of public transport may reduce discomfort and crowding on board public transport, and travelers may experience increased utility from such changes. This increased utility in terms of the monetary willingness to pay (WTP) metric should be included in the CBA of supply changes in public transport. Policy values in the CBA of transportation measures should therefore be based on individual preferences. However, there is a trade-off between policy values that are simple to apply in CBA and policy values taking individual-specific differences into account, which are more theoretically correct but more difficult to apply in practice.

Such individual-specific differences may depend on variation in preferences (e.g., cultural preferences) among geographical locations and on the fact that income levels differ greatly both within and among countries. This potential problem highlights the benefit transfer problem arising when findings of WTP studies are transferred from one place to another. Empirical evidence on the risks of benefit transfers is relatively common in the literature (e.g., Rozan, 2004). It may therefore be important that the WTP used in a CBA originates from preferences in the study location of the analyzed supply change in public transport. This stands in contrast to the objective of simple policy values, such as single national value units, for use in CBA.

The purpose of this study is to estimate policy values for comfort, defined by getting a seat, and crowding reduction on board local public transport in Sweden. We use stated-preference (SP) data and present crowding as a mode-neutral crowding level among the standing travelers depicted in images presented to the respondents. We also analyze whether there are differences in WTP among the three largest urban areas in Sweden as well as among different transport modes. We focus on the question of whether the same policy values of comfort and crowding reductions can be applied in CBAs for all local public transport modes in all large urban areas in Sweden. It is important to analyze whether valuations of comfort and crowding reductions differ among urban areas within the same country, where the preferences might be relatively similar but still not identical.

A relatively extensive literature considers the benefits of comfort and of crowding reduction in public transport (for overviews, see, e.g., Li and Hensher, 2011; Wardman and Whelan, 2011). This literature captures in-vehicle crowding in various ways. We chose to define crowding by the number of standing passengers per square meter as depicted in images. Compared with defining crowding in terms of different load factors, which have different implications for the discomfort of standing in different transport modes or in different types of the same mode, passengers per square meter is also a metric recommended by Wardman and Whelan (2011). This metric provides a more flexible and mode-generic valuation of comfort and of crowding reductions. In addition, we only analyze comfort in terms of sitting or standing during a trip.

Swedish evidence relies mostly on a study by Transek (2006), in which SP data were used to estimate habitual public transport travelers' ratings of delays, crowding, and seat availability on board buses, metro, and commuter trains in Stockholm, the capital of Sweden. In an earlier Swedish study, Olsson et al. (2001) investigated to/from-work trips, also in Stockholm. As stated above, one important contribution of the present study compared with earlier Swedish studies is its inclusion of Gothenburg and Malmö in addition to greater Stockholm. Moreover, this study uses a web panel in addition to travelers recruited during a public transport trip, meaning that we also sample more infrequent travelers. Furthermore, we use a more updated estimation model than did the latest Swedish study and our sample size is substantially larger than those of earlier studies. Finally, the above argument that increased urbanization results in increased in-vehicle crowding in public transport motivates this updated Swedish study.

Non-market goods, such as comfort and crowding reduction, are mostly valued based on SP or revealed-preference (RP) data (Swärdh and Algers, 2016). SP has the main and powerful advantage that the analyst can design the scenario and thus estimate the preferences that are the objectives of the study, without considering the availability of real data. Known problems with SP estimates, such as the risk of hypothetical or strategic bias, will here be addressed by several analyses of the SP design. Hypothetical bias is defined as bias resulting from the fact that respondents do not pay with actual money, and thus tend not to consider the budget constraint properly. Strategic bias is the risk that respondents realize that future policy changes may support their preferences if they answer the questions strategically.

The WTP measure can also be calculated as a multiplier of the value of travel time savings (VTTS) for a reference travel condition, which is common in the literature (e.g., Wardman and Whelan, 2011; Tirachini et al., 2013; Haywood and Koning, 2015). For example, a VTTS multiplier of two for a given travel condition means that the benefit of reducing travel time given this condition is twice as large as reducing travel time in the reference condition. In other words, one minute of travel time in the worse travel condition is equivalent to two minutes of travel time in the reference condition.

Note that neither comfort nor crowding has a clear accepted definition. Comfort is limited to only sitting or standing in our study. However, the characteristics of sitting can differ among modes and vehicles of different designs. Nevertheless, we do not include any between-mode SP questions, so respondents receive only SP alternatives related to their reference trip, comprising their reference mode only.

In our study, comfort is defined as a physical attribute, measured as the number of standing passengers per square meter. This is

[1] In Gothenburg, travel surveys suggest that commuting trips by public transport have increased by 24 percent across the congestion cordon, while discretionary public transport trips have decreased by 8 percent since the congestion charge was implemented (Börjesson and Kristoffersson, 2015). In Stockholm, the number of passengers on the transit system increased by 4–5 percent when the congestion charge was implemented (Eliasson, 2014). This implementation was met in Stockholm by an increased supply of public transport, leading to a net crowding reduction on the commuter trains, while net crowding increased on the metro (Eliasson, 2014).