


How much of a rail bonus is there?

The Dresden experience

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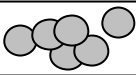


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Alternative 1	Alternative 2
You go by car 	You go by tram 
You need 18 minutes to get to the city centre 	You need 30 minutes to get to the city centre 
You pay 6,- DM for parking (maximum 2 hrs.) 	You have to transfer once 
	You pay 1,50 DM fare for one direction (single ticket) 

Your

preference:



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How much of a rail bonus is there ? : The Dresden experience

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ABSTRACT

This paper summarises the results of a detailed study of the preferences of public transport users and residents of Dresden for different types of public transport. The focus of the analysis is the hypothesis, that rail based forms of public transport are preferred all other things being equal. The hypothesis is a central argument in many current discussions about the reintroduction or extension of tram and light rail systems.

The study is based on a two-wave before and after panel of residents and public transport users in a part of Dresden, where the local operator changed from tram to bus operations. It involved both revealed (RP) and stated preference (SP) surveys in both waves.

The results of the estimated choice models indicate a consistent preference for rail-based in-vehicle time, but it is not clear, if this preference has a large impact on ridership to justify alone the investment cost differentials between road and rail based alternatives

KEYWORDS

Rail bonus – SP/RP survey – Before and after study - Dresden – Germany

WORD COUNT

2000 (including text inside the table), 2 figures and 1 table

1 INTRODUCTION

The inherent superiority of rail-based public transport options over bus-based alternatives - all other things being equal - has been stipulated in the literature and in the public policy discussion for some time (Arnold and Lohrmann, 1997 or Heimerl, Meier, Dobeschinsky, Mann and Götz, 1988). It is said to reflect, among other aspects, the higher reliability of, the higher comfort of and the stronger commitment of the operator to rail-based modes. The exact strength of such a rail bonus is important to a public transport operator for its network planning: introducing or extending light rail or tram network or when replacing rail-based services by bus services. This is also true for the public transport regulators and the public purchasers of services.

The public transport operator of the city of Dresden (DVB), while generally improving its services, has to consider this last option, in particular where the continuing tram operation would require a costly rehabilitation of the tracks. It was therefore prepared to undertake a study analysing the preferences of its ridership using both *revealed* (RP) and *stated preference* (SP) data.

It is difficult to measure the strength of this rail bonus, as it requires a situation, in which nothing is changed but the type of track and vehicle. All other things have to remain constant: network, time table, reliability, price, comfort of the connection and of the vehicles. In most cases, these conditions are not met. A large part of the literature discussing the rail bonus, for example, compares networks constructed from scratch around new light rail services with previous bus only or run-down commuter lines. Too much positive and interacting changes take place in such a situation to identify the rail bonus proper. Situations, in which valid comparisons can be made, are rare. Innsbruck, which does operate diesel buses, trolley buses and trams (street cars) on comparable routes, is one of these cases. Recent results of a SP/RP analysis there showed no consistent rail bonus controlling for the other service attributes, but not for the different ages of the respective vehicle fleets (Axhausen, Köll and Bader, Forthcoming). The other literature is equally inconclusive, especially when considering the details of the case studies reported.

The service changes implemented as part of the new Winter timetable 1998/99 in Dresden provided a unique opportunity to observe the reaction of the travellers to the decommissioning of a tram line and its replacement by bus services and therefore to measure the rail bonus. The southern branch of tram line 8, which used to serve Tharandter Strasse, was realigned to serve the Friedrichstadt area of Dresden. The corridor is now being served by the urban bus line 89 and the regional bus line A. In parallel with these changes, the near-by radial corridor of Chemnitzer Strasse/Budapester Strasse received new services through the urban bus lines 82 and 86.

These changes were accompanied by a complex set of surveys, which allow the assessment of the strength of the rail bonus using suitable statistical methods and models as a by-product of the forecasting models developed. The details of this DVB sponsored study and of the forecasting models are described in Fell, Haupt, Heidl, Wirth, Axhausen and Lohse, 1999.

2 SURVEY PROGRAMME

Given the change a before and after study is required to trace the effects on the travellers. Three surveys were conducted in each wave (early September 1998 and early November 1998):

- One-day travel diary using the well-tested KONTIV survey instrument and protocol, as adapted by the PTV AG in its previous studies.
- A between-mode choice stated preference experiment (See Figure 1). (6 or 7 decisions out of a 27 situation long fractional factorial design) The car option is described with two variables (door-to-door travel time and parking fee) and the public transport option with four (type of vehicle (bus or tram), door-to-door travel time, transfer requirement, one-way fare)
- A within-mode choice stated preference experiment (6 or 7 decisions out of a 27 situation long fractional factorial design) looked at the decision between bus and tram characterising each with egress times, in-vehicle times, transfer requirement and comfort of the vehicle (old or new) (See Figure 2). The four different vehicles were shown on a separate page using photographs of locally used vehicles.

They were accompanied by the usual household- and person surveys and various support materials, including an official cover letter. Only persons over 16 years of age were asked to participate.

Two distinct samples were constructed to investigate different aspects of the service change. The first sample is a random sample of households drawn from those living in the wards affected by the change (506 households selected from the most current telephone book CD), while the second choice-based sample was recruited from among the users of line 8 before the change by DVB staff (359 persons within one day).

The response rate for both samples together was a satisfactory 53% of available households in the first wave and a very satisfactory 82% of the first wave respondents in the second wave. The SP was directed towards to the person approached in the tram in the case of the choice-based sample and to the person with the first name starting with the letter closest to the letter "A".

Figure 1 Example of the between-mode stated preference experiment

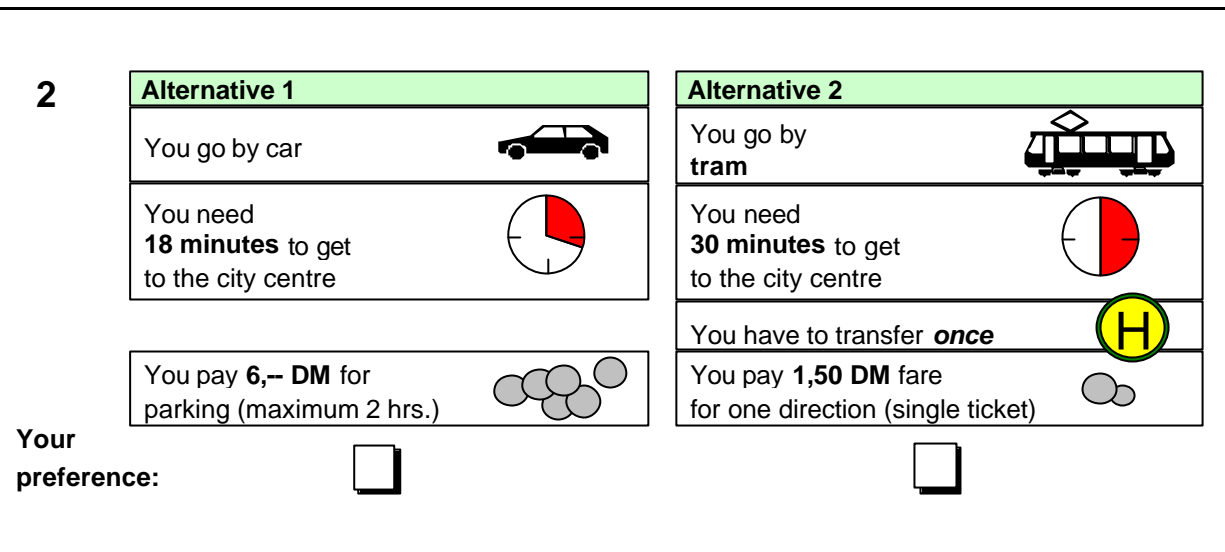
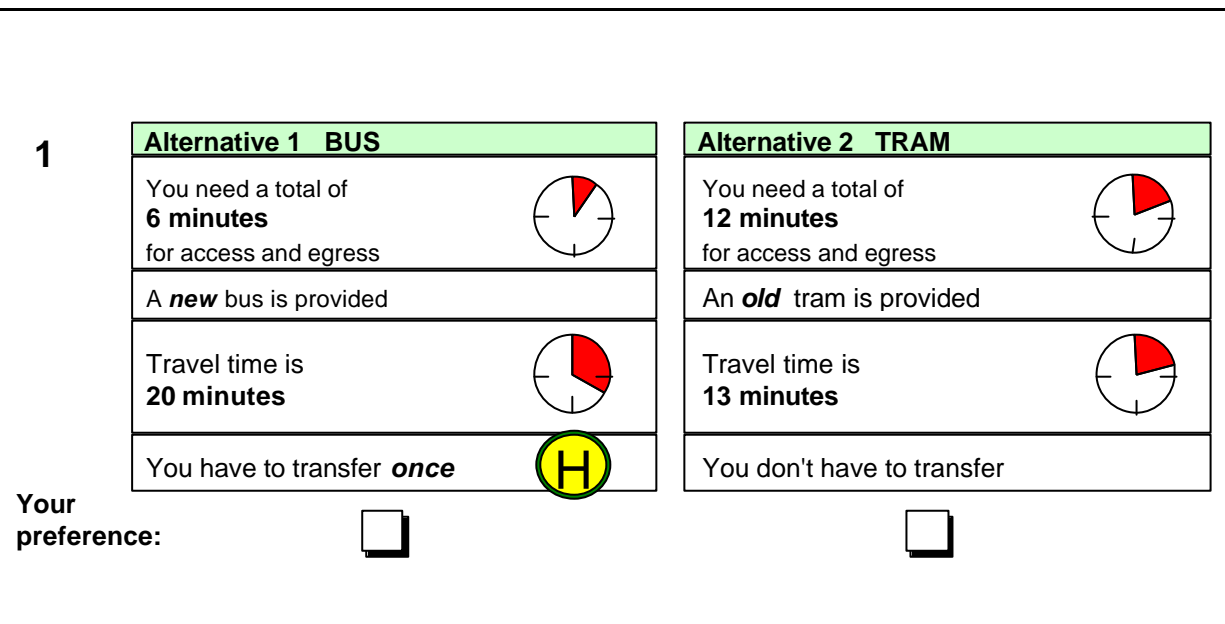


Figure 2 Example of the within-mode stated preference experiment



The data was weighted to reflect the household size distribution in the study area and the known age, sex and residential location distributions.

For the following analysis those mobile persons were identified which had participated in both waves. This reduced the available sample by about a third. This “panel subset” of the complete dataset allows us to concentrate on the changes in use and perception between the two waves and therefore the rail bonus.

3 CHOICE MODELS

The joint estimation of data from different sources allows the merging of information to enrich and restrain the parameter sets (Ben-Akiva and Morikawa, 1990 or Daly and Bradley, 1993). This section will report the results from the merger of the two SP experiments. The results from the merger of all three sources (RP, 2 SP's) are not substantially different and are available in Axhausen, Haupt, Fell and Heidl, 2001.

For all models the set of explanatory variables included the modal attributes and a surprisingly small number of socio-demographic and trip related variables. The general usage of the different modes measured as the annual mileage by bicycle or private car dominated all other socio-demographic variables. In the SP context a further inertia variable was added: the share of trips undertaken by public transport on the respective travel diary day, as the best available estimate of general public transport usage. This experience clearly shows that an indicator of previous commitments should be used in mode choice models. The obvious one for public transport in the European context is the ownership of a local season ticket (see Axhausen, Simma and Golob, forthcoming).

Table 1 presents the result for the joint estimation of the two SP-experiments in the form of the derived ratios of interest (value of time savings, transfer penalty etc.). The statistical goodness-of-fit of the models is high. There were no noticeable differences between the results of the before and after wave. Of the differences between the random and the choice-based sample only the parameters of the bus travel time were significant at the 0.05 level.

The values of time derived are within the ranges presented elsewhere for German conditions (e.g. Paulußen, 1992). The estimated transfer penalties of about 10 min are sensible and in the expected range.

The results indicate a preference of the respondents for the rail-based mode: smaller parameter values for the in-vehicle, respectively travel time, larger bonus for a new tram in comparison to a new bus. On the other hand, the users are less willing to walk to the tram and less willing to change in comparison to a bus only trip. The transfer penalty implies on the other hand that tram users would be willing to accept longer routings, if they are direct.

Table 1 Joint SP estimates: Derived ratios of the choice model parameters

Sample

Mode	Ratio	Unit	All	Random sample	Choice based
Bus	Gain due to new vehicle/Travel time	[min]	-1.44	-1.55	-1.26
	Transfer/In vehicle time	[min]	8.56	7.69	9.21
	Access/In vehicle time	[]	1.08	0.91	1.22
Tram	Gain due to new vehicle/Travel time	[min]	-2.10	-2.32	-1.85
	Transfer/In vehicle time	[min]	11.91	17.98	9.78
	Access/In vehicle time	[]	1.73	2.64	1.40
Value of time (VOT)	Bus(In-vehicle time)	[DM/min]	0.08	0.10	0.06
	Tram(In-vehicle time)	[DM/min]	0.07	0.05	0.07

4 CONCLUSIONS AND OUTLOOK

The work reported here has tried answer the question, if there is a systematic rail bonus in mode choice. The data source available is rich, in particular offering a panel spanning a relevant service change, but it is not perfect, as it only looks at tram to bus change. We can assume that the reverse direction is treated in the same way by travellers, but we cannot be sure in the absence of a relevant data set.

The models estimated indicate essentially no significant changes in preferences over the three month period observed. The period might be too short, but it is still a useful indication of the stability of preference structures. The differences in the estimated parameters between the two samples (choice-based and random sample) are not significant for the SP experiments.

The results indicate, that there is a weak, but consistent preference for the rail-based tram in the sample analysed: lower willingness-to-pay for travel time improvements, lower disutility of in-vehicle-time, higher valuation of new and improved vehicles, but also a higher transfer penalty, which indicates higher expectations of the service quality of rail-based types of public transport. It is also interesting to note, that the preference for the tram is larger for more frequent public transport users.

The influence of prior commitments was noticeable throughout for both the individual and the public transport modes. These effects stabilise choices and lock travellers into habits. Unlearning of such habits is required, which slows down the acceptance of new services by new users, but also maintains usage of changed services by old users, in particular in the case of service reductions or service deterioration. These effects indicate the need for public transport operators to have their services in

place early on in the life cycle of an area or household, as these transitions are typically the time periods with largest openness to behavioural change. The influence of these prior commitments needs to be further studied. Especially, why persons commitment themselves to specific residential location – modal resource combinations.

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The results and views expressed in this paper are those of the authors and not of the sponsor. Any errors are our own.

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