Private vs. Business and Rail vs. Air Passengers: Willingness to pay for Transport Attributes

Fredrik Carlsson

Working Papers in Economics no 14
March 1999
Department of Economics
Göteborg University

Abstract
Using a stated preference survey on passengers travelling by rail or air between the two largest cities in Sweden, we investigate passenger's willingness to pay for improvements of different attributes of the transport modes. We find that both private and business passengers put a substantial value on improvements of the environmental impact from both rail and air. In general, private passengers have much lower fare equivalents for the attribute, which is explained by the fact that business passengers do not pay for the trips themselves. Further, air passengers have higher fare equivalents than what rail passengers have for both rail and air attributes.

Keywords: *Valuation of attributes, Intercity transport, Random parameter logit*.

JEL-classification: C25, R41.

Department of Economics
Göteborg University
Box 640
SE-40530 Göteborg
Sweden

Tel: +46 31 7734174
Fax: +46 31 7731043
e-mail: Fredrik.Carlsson@economics.gu.se

1. Introduction[1]

In this paper we analyse a stated preference (SP) survey on private and business passengers travelling by rail or air between Stockholm and Gothenburg in Sweden. The purpose of the paper is to investigate and compare private and business passengers' preferences for different transport modes, and the corresponding attributes. Furthermore, we wish to compare air and rail passengers in the same respect. Of particular interest is to investigate whether the environmental impact of the transport mode affects their choice. This paper complements the analysis in Carlsson (1999) who focused on business passengers and compared different econometric specifications. The number of private passengers in the survey is rather low, and therefore, the result should be handled with some caution. Since private passengers will probably become more important for airlines in the near future, we believe that this analysis still could be of interest.

2. The SP Survey

2.1 Business and Private Passengers

The goal of the SP survey was to investigate passengers' choice between rail and air when travelling between Gothenburg and Stockholm. Of particular interest was to investigate whether the environmental impact of the modes is of any importance for the choice of mode. The traditional view is that business passengers travel by air, while private passengers travel by train or car for intercity trips. For trips over 300 km, air travel is still the dominating mode for business travels, as it has 48 percent of the total tripwork[2], while rail has 16 percent and car 36 percent. For non-business trips, car is the dominating mode with 66 percent of total trip work, both rail and air have 14 percent, and bus seven percent (Luftfartsverket 1998).

The most important difference between private and business passengers is that most business passengers do not pay directly for their trips. Therefore we suspect that business passengers will have a much higher willingness to pay for improvements of

[1] The author would like to thank Mattias Lundbäck för useful comments, and SAS, SJ and MA for giving me access to their passengers. Financial support from the Swedish Civil Aviation Administration is gratefully acknowledged.

[2] Tripwork is defined as the total number of trips times the length of the trips.

different attributes, since the price attribute is of less importance. However, there might also be differences in the preferences for different attributes between private and business passengers. For example, business passengers might value reliability higher than what private passengers do.

2.2 Experiment and Design

Apart from the primary attributes price and travel time, we decided to investigate the importance of several secondary attributes. These secondary attributes are environmental impact, reliability and comfort. For rail travel, environmental impact is the share of so called 'green electricity' that is used, reliability is the share of departures that are not more than 10 minutes late on arrival, and comfort is the passenger space. For air travel, the environmental impact is the amount of emissions per flight, reliability is the share of departures that are not more than 5 minutes late on arrival, and comfort is the passenger space. Because of the large number of attributes and alternatives we used a hierarchical design, where attributes are grouped into subsets of primary and secondary attributes in the experiment (see *e.g.* Louviere 1984, Louviere and Timmermans 1990). We created secondary experiments for each mode, and all passengers participated in both experiments. Each respondent was asked to rank six sets of four 2-level attributes: environment, reliability, comfort and increased price. The respondents were informed that there are several possible improvements of the modes, and they were asked to rank different combinations of improvements, where each package would result in a specific increase in the price. The attributes and the levels are presented in Table A1 in Appendix 1.

The primary experiment was a choice experiment with four alternatives: IC-train, X2000-train, Air Arlanda, and Air Bromma.[3] Each alternative was described by three attributes: price, travel time and a composite factor. The attributes and their levels are presented in Table A2 in the Appendix. The composite factor consisted of the three attributes from the secondary experiments: environment, reliability and comfort. If the composite factor is on then all improvements are included, and when the composite factor is off none of the improvements are included.

[3] The IC-train is an old and slower type of train and the X2000-train is a new and faster type. Arlanda and Bromma are the two airports in Stockholm.

Travel time for air travel included the transfer from the city centre to the airport, while rail travel only included onboard time. Time and the composite factor were both 2-level attributes while price was a 3-level attribute; there were thus $3^4 2^8$ combinations of attribute levels, since there are four alternatives in each set. From a resolution IV-design,[4] which consists of 432 sets, we created a D-efficient design with 60 sets using the OPTEX routine in SAS. These sets were then blocked into ten subsets. Consequently each respondent made six choice exercises in the primary experiment. The respondents were asked to answer the question given the circumstances of the trip that they were presently undertaking. The main reason for this was to ensure that business passengers would answer the survey as business passengers and not as private passengers, and vice versa.

2.3 Sampling Strategy

A number of rail passengers were approached on the trains. The questionnaires were handed out during the trip, and collected at the end of the trip. In total 270 surveys were handed out, and 245 were returned. Of these 173 were answered by business passengers and 54 by private passengers travelling between Stockholm and Gothenburg. A number of air passengers were approached at the airport after they had checked in, while they were waiting to board.[5] We covered all departures from Gothenburg in a one-week period. In total 700 mail surveys were handed out, and 382 responded. Of these 322 were answered by business passengers and 24 by private passengers travelling between Stockholm and Gothenburg. A number of respondents refused to participate at all. The non-response rate varied between departures and days, but roughly 10 percent refused to participate.

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[4] With a resolution IV-design all main effects are estimable free of each other and all two-factor interactions.

[5] From the pilot studies we had learned that it was not possible to let respondents answer the questionnaire at the airport since we would lose a large fraction of respondents checking in very late. Therefore we chose to use a mail survey for the air passengers. The sampling strategy was to select as many passengers as possible from each flight. The problem with this strategy is that it is no purely random because while approaching one passenger, the following passengers might not be selected since the questionnaire was handed out immediately after the passengers checked in.

3. Analysis

3.1 Descriptive Statistics

Table 1 reports the descriptive statistics of the respondents whose responses are used in the final estimations. The classification of passengers is based on the circumstances of the trip during which the interview was conducted.

Table 1. *Descriptive statistics observations included in final estimations: whole sample and market segments. Standard errors in parenthesis.*

	Rail passengers		**Air passengers**	
	Business	Private	Business	Private
	Mean	Mean	Mean	Mean
Ticket price in SEK:[6]				
- Single	683 (255)	419.37 (188)	1547 (510)	428 (225)
- Roundtrip	1483 (453)	894 (493)	3096 (1174)	1190 (493)
No. of trips last year:				
- Air	2.2 (4.3)	0.4 (1.1)	12.4 (14.3)	5.6 (4.9)
- Bus	0.03 (0.2)	0.05 (0.3)	0.02 (0.19)	0.1 (0.3)
- Car	0.9 (2.2)	0.7 (1.4)	0.9 (1.85)	1.3 (2.2)
- Train	7.9 (15.8)	3.4 (4.3)	1.5 (3.97)	1.7 (4.2)
Age	43 (11)	45 (16)	45 (11)	41 (20)
	Nobs (freq.)	Nobs (freq.)	Nobs (freq)	Nobs (freq)
Decision about mode:				
- Self	132 (77%)		284 (88%)	
- Boss	9 (5%)		8 (3%)	
- Department rules	5 (3%)		2 (1%)	
- Company rules	26 (15%)		27 (8%)	
Sex:				
- Male	118 (69%)	25 (46%)	248 (78%)	11 (48%)
- Female	54 (31%)	28 (54%)	71 (22%)	12 /52%)
Home:				
- Gothenburg area	116 (68%)	23 (43%)	154 (48%)	9 (39%)
- Stockholm area	15 (9%)	12 (22%)	92 (29%)	9 (39%)
- Other	40 (23%)	19 (35%)	73 (23%)	5 (22%)
Mode:				
- Arlanda			177 (55%)	10 (42%)
- Bromma			145 (45%)	14 (58%)
Number of observations	173	54	322	24

Business passengers are, as expected, more frequent travellers than private passengers are. Many of the respondents travel frequently between Stockholm and Gothenburg. On average, air passengers travel between Stockholm and Gothenburg once a month. Most business passengers make their decisions about the mode for the trip themselves,

[6] US$ 1 corresponds to 8 SEK in November 1998.

although a non-negligible fraction is governed by rules at their company. A majority of the business passengers are men, while half of the private passengers are women.

3.2 Econometric Analysis

In the econometric analysis we will use a simple, but restrictive, conditional logit model. Notably there are two important problems with a multinomial logit specification (i) the alternatives are assumed to be independent, and (ii) there is no taste variation among respondents. A more flexible model, such as a random parameter probit (Chen and Cosslett 1998) or random parameter logit (Carlsson 1999, Revelt and Train 1999, Train 1998) would be more suitable for the analysis of the responses. The main reason for not using a random parameter model is the low number of private passengers. A random parameter model naturally involves more parameters, and with only 75 observations this would stretch the use of the model to its limits. Carlsson (1999) estimated similar models but only for business passengers, and found that in this particular case there were no differences between a conditional logit and a random parameter logit model for the valuation of particular attributes. This is of course not to say that there are not any differences between the models, or that a conditional logit model is not more restrictive than a random parameter logit model.

The results of the secondary ranking experiments for air travel are presented in Table 2. The fare equivalents are calculated as the attributes' coefficient divided by the price coefficient. The distribution of the fare equivalent estimates is obtained with the Krinsky-Robb method (Krinsky and Robb 1986) using 10,000 replications.

Table 2. *Ranking experiment air travel, standard errors in parenthesis.*

	All passengers		**Business passengers**		**Private passengers**	
	Coefficient	Fare eq.	Coefficient	Fare eq.	Coefficient	Fare eq.
Environment	1.542	254.77	1.517	291.35	1.174	141.08
	(0.084)	(40.17)	(0.093)	(75.25)	(0.209)	(18.64)
Reliability	0.839	138.60	0.892	171.35	0.284	23.04
	(0.078)	(17.22)	(0.087)	(36.82)	(0.173)	(12.25)
Comfort	0.340	56.14	0.353	67.75	0.147	11.89
	(0.083)	(6.85)	(0.092)	(8.27)	(0.194)	(16.52)
Cost	-0.006		-0.005		-0.012	
	(0.001)		(0.001)		(0.002)	
Total fare eq.		449.51		530.46		176.01
		(53.64)		(110.79)		(12.49)
Log likelihood	3608		2864		424	

Table 2 indicates that the environmental impact is the most important attribute for air travels both for private and business passengers. The fare equivalents indicate for example that business passengers are willing to pay 291 SEK per trip for reduced emissions from the aircraft, and that private passengers are willing to pay 141 SEK per trip. Reliability is, as expected, relatively more important for business passengers than for private passengers. Comfort is for both types of passengers the least important attribute. Perhaps not surprisingly, business passengers are willing to pay much more for each improvement of the attributes.

Table 3 presents the results of the secondary rail travel experiment.

Table 3. *Ranking experiment rail travel, standard errors in parenthesis.*

	All passengers		**Business passengers**		**Private passengers**	
	Coefficient	Fare eq.	Coefficient	Fare eq.	Coefficient	Fare eq.
Environment	0.927	103.60	0.930	122.06	0.821	49.29
	(0.063)	(11.75)	(0.069)	(21.07)	(0.161)	(6.55)
Reliability	1.046	116.83	1.083	142.21	0.663	39.85
	(0.058)	(14.59)	(0.064)	(26.68)	(0.136)	(6.58)
Comfort	0.249	27.83	0.229	31.07	0.239	14.35
	(0.063)	(4.57)	(0.070)	(5.86)	(0.157)	(8.53)
Cost	-0.009		-0.008		-0.017	
	(0.001)		(0.002)		(0.003)	
Total fare eq.		248.33		294.34		103.48
		(23.70)		(44.85)		(7.85)
Log likelihood	3642		2857		466	

The fare equivalents are lower for all attribute improvements in the rail experiment compared to the air travel experiment, with the exception of reliability and comfort for private passengers. Reliability is more important here than for air travels, and business passengers value that attribute more than the environmental attribute (although the difference is not significant). Comfort is again the least important attribute.

For both ranking experiments it is clear that business and private passengers have different tastes. This is also confirmed by a simple likelihood ratio test (see for example Ben-Akiva and Lerman 1985) where we strongly can reject the hypothesis of equality of coefficients across business and private passengers.[7] It is also interesting to see whether

[7] The likelihood ratio test statistic is $\lambda = -2\left[\ell(\hat{\boldsymbol{\beta}}) - \sum_{g=1}^{G} \ell(\hat{\boldsymbol{\beta}}^g)\right]$, where $\ell(\hat{\boldsymbol{\beta}})$ is the log likelihood for the restricted model and $\ell(\hat{\boldsymbol{\beta}}^g)$ is the log likelihood of the model estimated with the *g*th subset of the data. For the air ranking experiment $\lambda = 640 \sim \chi^2_{4d.f.}$ and for the rail ranking experiment $\lambda = 638 \sim \chi^2_{4d.f.}$.

there are differences in the preferences between air and rail passengers, and between different air passengers. Table A3 in Appendix 2 reports the fare equivalents in both experiments for air and rail passengers. In the air travel experiment, the ranking of attributes is the same for both segments. In the rail travel experiment, air passengers value reliability more than the environmental impact. In both experiments air passengers' total fare equivalents are larger than what rail passengers' total fare equivalents are. Further in a likelihood ratio test we can reject the hypothesis of equal coefficients across the two groups. Table A4 in Appendix 2 reports the fare equivalents for the ranking experiments for air passengers travelling with SAS (Arlanda airport) and air passengers travelling with MA (Bromma airport) respectively. There are essentially no differences between these passengers, the only difference is that SAS passengers have higher fare equivalents in the air travel experiment, but the ranking of the attributes are still the same. Furthermore, in likelihood ratio tests we cannot reject the hypotheses of equal coefficient across SAS and MA passengers.

For the primary experiment, the included variables are, besides the attributes in the experiment, three mode specific constants, an inertia variable for train passengers, and a dummy variable indicating that the respondent lives outside Gothenburg and Stockholm. The estimations for the primary experiment are presented in Table 4 below. The distribution of the fare equivalents is again obtained by the Krinsky-Robb method using 10,000 replications

Table 4. *Estimations primary experiment, total, business, private, standard error in parentheses. Note that price variables are scaled by 0.0001 and time variables are scaled by 0.001 in order to facilitate the estimations.*

	All passengers		**Business passengers**		**Private passengers**	
	Coeff.	Fare eq.	Coeff.	Fare eq.	Coeff.	Fare eq.
Price	-15.727		-14.177		-32.319	
	(0.991)		(1.055)		(3.227)	
Constant: - X2000	1.055		1.118		0.692	
	(0.153)		(0.216)		(0.340)	
- Arlanda	1.253		0.496		0.993	
	(0.550)		(0.753)		(1.386)	
- Bromma	1.711		0.500		1.298	
	(0.534)		(0.742)		(0.356)	
Time: - Rail	-17.82	11.33	-25.795	18.19	-12.270	3.80
	(2.109)	(1.49)	(3.055)	(2.48)	(4.597)	(1.46)
- Air	-21.586	13.72	-22.515	15.88	-17.946	5.55
	(1.786)	(1.40)	(1.888)	(1.75)	(6.249)	(2.06)
Composite: - Rail	0.452	287.56	0.501	353.54	0.347	107.40
	(0.069)	(47.22)	(0.080)	(61.77)	(0.150)	(48.75)
- Air	0.812	516.29	0.809	570.99	1.132	350.27
	(0.063)	(49.45)	(0.066)	(61.02)	(0.227)	(76.03)
Inertia rail passengers	2.891		2.872		2.871	
	(0.094)		(0.105)		(0.280)	
Out: - X2000	-0.965		-1.101		-0.838	
	(0.142)		(0.186)		(0.261)	
- Arlanda	-0.416		-.739		0.901	
	(0.159)		(0.200)		(0.373)	
- Bromma	-1.023		-1.286		-0.171	
	(0.149)		(0.191)		(0.356)	
Log likelihood	-3477		2868		473	

The total fare equivalents for the composite good are higher in the primary experiments than in the secondary experiments. The result is surprising, since we would have expected the opposite result because of diminishing returns of the attributes. For example Kroes and Sheldon (1988), using a similar construction of the survey, find that the total fare equivalents are higher in the secondary experiments compared to the primary experiment. However, if we estimate separate models for air and rail passengers (see Table A5 in the Appendix 2) total fare equivalents for rail passengers are lower in the primary experiment compared to the secondary experiments. Furthermore, we see that the fare equivalents in general are much higher for air passengers than for rail passengers.[8] There are also differences between different types of air passengers (see Table A6 in Appendix 2). SAS passengers have lower fare equivalents than MA

[8] In a likelihood ratio test we can reject the hypothesis of equal coefficients across business and private passengers; $\lambda = 272 \sim \chi^2_{12d.f.}$

passengers. Further, MA passengers have more or less the same fare equivalents for rail and air attributes, while SAS passengers have higher fare equivalents for the air attributes. In contrast to the ranking experiments we can also reject the hypothesis of equal coefficients across SAS and MA passengers.

The value of time is expressed in SEK per minute. For business passengers these values are extremely high in comparison to the results in other studies, *e.g.* the national Swedish value of time study (Algers *et al.* 1995), and the official values-of-time: 150 SEK/hour for air business travel and 140/hour SEK for rail business travel. However, we must keep in mind that for the passengers in this survey the employer pays for the ticket. For a more detailed discussion of this subject see Carlsson (1999). Consequently, we should expect lower value of time for private passengers, which is the case, although the values are still high compare to what is found in other studies. From the estimations on the two segments air and rail passengers (Table A5 in Appendix 2) we also see that the value of time is much higher for air passengers than for rail passengers.

Finally, we can also calculate price and time elasticities for the estimated models. For a logit model the elasticity is the responsiveness of the choice probability to a change in the level of an alternative's attribute. In Table 5 we report both the direct and cross elasticities for the alternatives.[9]

Table 5. *Direct and cross elasticities calculated at sample means.*

	All passengers		**Business passengers**		**Private passengers**	
	Price	Time	Price	Time	Price	Time
IC:						
- Direct	-0.681	-3.985	-0.635	-5.978	-1.104	-2.091
- Cross	0.061	0.381	0.032	0.323	0.431	0.953
X2000:						
- Direct	-0.840	-2.062	-0.769	-3.039	-1.570	-1.284
- Cross	0.400	1.127	0.352	1.566	0.930	0.948
Arlanda:						
- Direct	-1.431	-2.267	-1.283	-2.334	-3.037	-2.037
- Cross	0.311	0.485	0.300	0.536	0.366	0.251
Bromma						
- Direct	-1.094	-1.401	-0.935	-1.378	-2.950	-1.575
- Cross	0.666	0.811	0.664	0.930	0.489	0.264

[9] Note that one restriction of the logit model is uniform cross elasticities, therefore only one cross elasticity for each alternative is reported.

Again we see that business passengers are more sensitive to changes in travel time than changes in price, while the opposite holds for private passengers. The direct price elasticities are in general higher for air travels. For business passengers rail travels have higher time elasticities, and also the highest cross elasticities. There are also some differences between the models estimated for different segments. Rail passengers have higher price elasticity for air travels, while air passengers have higher time elasticity for rail travels. If we compare different types of air passengers we find, not surprisingly, that air passengers have lower elasticities in general for their chosen mode.

6. Conclusions

We find that both private business passengers put a substantial value on improvements of the environmental impact from the transport sector. The environmental improvements in the survey are not directly comparable, but the passengers value the environmental improvement from aviation more highly than the improvement from rail. Of the so-called secondary attributes, the environmental impact is the most important attribute for air travel, while environmental impact and reliability are of equal importance for rail travel. Business passengers value reliability more than private passengers do. In general, business passengers' fare equivalents are very high. One explanation for this is the fact that business passengers do not pay for the ticket themselves, they thus tend to ignore the price attribute in the survey. Our finding that private passengers have much lower fare equivalents for all of the attributes strengthens this explanation. We also find that rail passengers in general have lower fare equivalents for the attributes in both experiments. One explanation to this result could be that individuals who are more sensitive to the price travel by rail (since rail travel in general is cheaper than air travel), and that this is also reflected in our SP survey. The price sensitive in turn could have many explanations, but one is that rail passengers to a larger extent are governed by company rules, and that one of the most common restrictions from the companies is a restriction on price.

To summarise, there are differences between both private and business passengers, and between air and rail passengers. These differences are due to several factors, but two important factors are the decision process for the trips and who bears the cost of trip. Business passengers usually make the decisions themselves and do not pay for the cost themselves. At the same time, some of the business passengers are governed by various rules at their company, and this can of course also influence their choice of mode of transport. It is therefore, particularly in the case of business passengers, important to define clearly whose values we are measuring, how we measure them and whose values we wish to measure.

References

Algers, S., B. Hugosson and J. Lindqvist Dillén (1995), *1994 Års Tidsvärdesstudie*, Transek Consultancy.

Algers, S., P. Bergström, M. Dahlberg and J. Lindqvist Dillén (1998), 'Mixed logit estimation of the value of travel time', Working Paper 1998:15 Department of Economics, Uppsala University.

Ben-Akiva. M. and S. Lerman, *Discrete Choice Analysis*, Cambridge: MIT Press.

Carlsson (1999), 'The demand for public transport: The case of business passengers', Working paper no 12, Department of Economics, University of Gothenburg.

Chen, H. and S. Cosslett (1998), 'Environmental quality preference and benefit estimation in multinomial probit models: A simulation approach', *American Journal of Agricultural Economics* **80**, 512-520.

Krinsky, I. and A. Robb (1986), 'On approximating the statistical properties of elasticities', *Review of Economics and Statistics* **68**, 715-719.

Kroes, E. and R. Sheldon (1988), 'Are there any limits to the amount consumers are prepared to pay for product improvements?' PTRC SAM 1988.

Lindqvist Dillén, J. and S. Algers (1998), 'Further research on the national Swedish value of time study', Paper presented at Economics and Institutions of Transport in Borlänge, May 25-27 1998.

Louviere, J. (1984), 'Hierarchical information integration: A new method for the design and analysis of complex multiattribute judgement problems', in Kinnear, T. (ed.) *Advances in Consumer Research* **11**,

Louviere, J. and H. Timmermans (1990), 'Hierarchical information integration applied to residential choice behaviour', *Geographical Analysis* **22**, 127-144.

Luftfartsverket (1998), *Flyget i fokus nr. 2*, Nyhetsbrev från Luftfart och samhälle, Luftfartsverket, Norrköping.

Revelt, D. and K. Train (1999), 'Mixed logit with repeated choices: Households' choices of appliance efficiency level', *Review of Economics and Statistics*, forthcoming.

Train, K. (1998), 'Recreation demand models with taste differences over people', *Land Economics* **74**, 230-239.

Appendix 1. Designs.

Table A1. *Attributes and levels for secondary experiments.*

Mode	Version	Environment	Reliability	Comfort	Increased Price
Rail	I	Same as today Only green	90% on time 95% on time	Same as today Improved	+ 25 + 75
	II	Same as today Only green	90% on time 95% on time	Same as today Improved	+ 20 + 90
Air	I	Same as today 40% reduction	90% on time 95% on time	Same as today Improved	+ 75 + 125
	II	Same as today 40% reduction	90% on time 95% on time	Same as today Improved	+ 50 + 150

Table A2. *Attributes and levels for primary experiment*

Mode	Price		Time		Composite factor
	Rail pass.	Air pass.	Rail pass.	Air pass.	
IC-train	250 500 650	250 500 650	3 h 55 min 4 h 20 min	3 h 45 min 4 h 20 min	0 1
X2000-train	500 750 1100	500 750 1100	2 h 55 min 3 h 15 min	2 h 40 min 3 h 10 min	0 1
Air Arlanda	800 1000 1200	850 1200 1500	1 h 50 min 2 h 25 min	1 h 50 min 2 h 25 min	0 1
Air Bromma	800 1000 1200	850 1200 1500	1 h 25 min 2 h	1 h 25 min 2 h	0 1

Appendix 2. Results for market segments.

Table A3. *Ranking experiments for air and rail passengers, standard errors in parenthesis.*

	Air travel experiment		**Rail travel experiment**	
	Rail passengers	Air passengers	Rail passengers	Air passengers
	Fare eq.	Fare eq.	Fare eq.	Fare eq.
Environment	228.76	218.96	101.20	89.05
	(28.53)	(209.73)	(11.52)	(13.29)
Reliability	79.08	160.69	77.80	121.69
	(8.36)	(133.64)	(9.83)	(20.85)
Comfort	43.78	68.16	21.09	41.48
	(8.71)	(11.53)	(6.12)	(4.50)
Total fare eq.	351.61	447.89	200.10	252.22
	(28.64)	(348.61)	(16.78)	(34.19)
Log likelihood	1356	2223	1448	2175
Likelihood ratio test of taste variation	$\lambda = 58 \sim \chi^2_{4d.f.;0.05} = 9.488$		$\lambda = 38 \sim \chi^2_{4d.f.;0.05} = 9.488$	

Table A4. *Ranking experiments for SAS and MA passengers, standard errors in parenthesis.*

	Air travel experiment		**Rail travel experiment**	
	SAS passengers	MA passengers	SAS passengers	MA passengers
	Fare eq.	Fare eq.	Fare eq.	Fare eq.
Environment	282.87	185.64	73.20	94.75
	(5116)	(281)	(226)	(17.90)
Reliability	212.43	133.36	98.06	106.94
	(3080)	(169)	(1031)	(21.33)
Comfort	49.01	78.31	55.00	50.80
	(1199)	(17.89)	(402)	(6.30)
Total fare eq.	544.31	397.31	224.25	252.48
	(7263)	(456)	(864)	(42.08)
Log likelihood	1160	1061	1142	1029
Likelihood ratio test of taste variation	$\lambda = 4 \sim \chi^2_{4d.f.;0.05} = 9.488$		$\lambda = 8 \sim \chi^2_{4d.f.;0.05} = 9.488$	

Table A5. *Choice experiment for air and rail passengers, standard errors in parenthesis.*

		Air passengers		Rail passengers	
		Coeff.	Fare eq.	Coeff.	Fare eq.
Price		-11.124		-27.771	
		(1.138)		(1.968)	
Constant:	- X2000	0.915		1.235	
		(0.194)		(0.249)	
	- Arlanda	0.792		-1.507	
		(0.668)		(1.018)	
	- Bromma	1.164		-0.987	
		(0.653)		(0.974)	
Time:	- Rail	-19.603	17.62	-15.941	5.74
		(2.663)	(3.00)	(3.556)	(1.33)
	- Air	-22.905	20.58	-16.986	6.12
		(2.047)	(2.78)	(3.686)	(1.37)
Composite:	- Rail	0.575	516.76	0.339	122.18
		(0.105)	(107.33)	(0.092)	(34.38)
	- Air	0.816	733.15	0.806	290.22
		(0.072)	(97.78)	(0.131)	(48.98)
Out:	- X2000			-0.431	
				(0.135)	
	- Arlanda	0.562			
		(0.121)			
Log likelihood		2097		1354	
Likelihood ratio test of taste variation				$\lambda = 52 \sim \chi^2_{6d.f.;0.05} = 12.592$	

Table A6. *Choice experiment for SAS and MA passengers, standard errors in parenthesis.*

		SAS passengers		MA passengers	
		Coeff.	Fare eq.	Coeff.	Fare eq.
Price		-12.453		-11.228	
		(1.483)		(1.972)	
Constant:	- X2000	0.732		1.305	
		(0.243)		(0.339)	
	- Arlanda	2.010		-0.472	
		(0.856)		(1.112)	
	- Bromma	1.367		0.977	
		(0.832)		(1.086)	
Time:	- Rail	-16.640	13.36	-27.168	24.20
		(3.338)	(3.13)	(4.499)	(6.15)
	- Air	-25.722	20.66	-25.842	23.02
		(2.765)	(3.31)	(3.521)	(5.44)
Composite:	- Rail	0.379	304.53	0.952	847.75
		(0.136)	(116.22)	(0.168)	(222.8)
	- Air	0.853	684.86	0.999	889.86
		(0.097)	(113.88)	(0.124)	(202.68)
Log likelihood		1202		760	
Likelihood ratio test of taste variation				$\lambda = 270 \sim \chi^2_{7d.f.;0.05} = 14.067$	

Table A7. *Direct and cross elasticities calculated at sample means for different market segments.*

	Air passengers	Rail passengers	SAS passengers	MA passengers
IC				
Price: Direct	-0.503	-1.129	-0.555	-0.516
Cross	0.018	0.192	0.029	0.009
Time: Direct	-4.553	-3.355	-3.800	-6.433
Cross	0.160	0.662	0.196	0.107
X2000				
Price: Direct	-0.732	-0.986	-0.827	-0.732
Cross	0.163	1.137	0.178	0.168
Time: Direct	-2.764	-1.242	-2.355	-3.813
Cross	0.667	1.707	0.557	0.941
Arlanda				
Price: Direct	-0.992	-2.586	-0.936	-1.184
Cross	0.322	0.185	0.536	0.140
Time: Direct	-2.199	-2.016	-2.077	-2.944
Cross	0.722	0.150	1.203	0.351
Bromma				
Price: Direct	-0.668	-2.317	-0.955	-0.456
Cross	0.660	0.476	0.535	0.882
Time: Direct	-1.188	-1.437	-1.692	-0.917
Cross	1.160	0.304	0.944	1.731