Centro de Estudos de Economia Aplicada do Atlântico

WORKING PAPER SERIES

CEEAplA WP No. 01/2006

Willingness to Pay for Airline Services Attributes: Microeconometric Evidence from a Stated Preference Discrete Choice Model

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February 2006

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Fevereiro de 2006

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RESUMO/ABSTRACT

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We interpret these results at the light of the theories found in Kahneman (2003). Willingness to pay for additional daily flights is quite low. This result is important to how should the policy maker liberalize this sector.

Keywords: Stated Preferences Choice Games, Conditional Logit, Willingness to Pay, Airline Services, Air Transportation Policy.

JEL Codes: C35, C93, R41

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Abstract

We analyze consumer preferences for airline services attributes between Ponta Delgada and Lisbon. For this purpose, we conduct a stated preferences choice game and estimate a microeconometric model à la McFadden (1974). Our results are statistically significant and imply willingness to pay measures economically high for attributes such as punctuality warranties and comfort. We interpret these results at the light of the theories found in Kahneman (2003). Willingness to pay for additional daily flights is quite low. This result is important to how should the policy maker liberalize this sector.

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*We thank support from Interreg III-B, MOVIECAM Project. We thank Concepción Román for her comments and suggestions. Please address all correspondence to António Gomes de Menezes, Department of Economics and Management, University of the Azores, Rua da Mãe de Deus, 9501-801 Ponta Delgada, Portugal. E-mail: menezesa@notes.uac.pt.

1 Introduction

It is usually the case that policy makers impose constraints on how airline companies operate. Hence, and if one is interested in the welfare implications of such air transportation policies, then one needs to have a sound knowledge of consumer preferences. Otherwise, one will be left clueless with respect to the welfare properties of a given air transportation policy package.

The aim of our paper is twofold. First, and on a methodological perspective, we are interested in assessing the effectiveness of a stated preferences choice game as an instrument to reveal consumer preferences with respect to airline services attributes. Second, and on an policy perspective, we set ourselves out to shed light on which policy changes may induce social welfare increases. We do just that for the Ponta Delgada - Lisbon corridor: the most important corridor between the Azores and Mainland Portugal.

We note that our methodology is agnostic with respect to the geographical place of its implementation. However, we do have good reasons to focus our attention in the Ponta Delgada - Lisbon corridor: As we argue below, on the one hand, stated preferences data come especially handy, as there are no revealed preferences data, and, on the other hand, policy guidance is much needed.

The Azores are a Portuguese archipelago, with an autonomous government, in the North Atlantic, about two hours by flight west of Lisbon, with roughly the same latitude (36^o) as Lisbon and New York. The Azores have a disperse and exiguous territory, with nine inhabited islands, within 600 kilometers apart, with a total surface of 2.333 km^2 and a population of 241.000 inhabitants. Ponta Delgada is the main city of the Azores, in the island of São Miguel, the largest and richest island in the Azores.

Given its geography and population, it should come as no surprise that airline services are commonly perceived as critical to the economic development and to the social cohesion of the Azores. Thus, there has been heavy governmental regulation in the airline services sector on, at least, two counts: (i) On equity grounds, inter-island mobility and equal access to other regions regardless of island of origin are politically understood as necessary to the social cohesion of the Azores. Hence, inter-island mobility is and has been treated as a public service obligation (on this, more below). SATA - the Azorean flag carrier, owned by the Azorean Government - provides and has provided such service as a monopolist operating under stringent regulations, regarding fares, flight capacity, flight frequencies, among other services attributes. (ii) On efficiency grounds, due to an arguably lacking demand, on the one hand, and high capital and operating costs, on the other hand, airline services are and have been thought of as a natural monopoly.

Under these arguments, there has never been an open skies policy in the Azores. Nowadays, the Azorean Government enforces stringent regulation on air transport, which is allowed in the European Union within the framework of Article 4 of Council Regulation 2408/92. In fact, until 2004 only one airline at a time flew between a given Azorean gateway and Mainland Portugal. Since 2005, two airlines - SATA and TAP (the Portuguese flag carrier, owned by the Portuguese Government) - operate our route of interest, Ponta Delgada - Lisbon, via a code share agreement, as the sole and joint concessionaires of air transportation services between the Azores and Mainland Portugal.

However, both SATA and TAP are obliged to follow a stringent set of regulations regarding several dimensions of their services, including fares, flight frequencies, flight capacities, punctuality warranties and so on.[1] In essence, both SATA and TAP have to implement twin operations strategies and procedures, with virtually no degrees of freedom whatsoever. Therefore, there are no revealed preferences data that can shed light on consumer preferences. But we do need to know consumer preferences if we

[1] See Official Journal of the European Union, 2004/C 248/06, 7.10.2004 (http://europa.eu.int/eur-lex/lex/JOIndex.do?), the European Union policy directive that regulates flights between the Azores and Mainland Portugal.

aim to promote social welfare: the sum of producer surplus with consumer surplus. Therefore, by learning consumer preferences regarding airline services we may provide guidance to future changes in airline services that may promote increases in consumer surplus. Hence, we implement a stated preferences choice game, and then we estimate a discrete choice model à la McFadden (1974).

We resort to a stated preferences choice game and associated discrete choice model since with this methodology, and to be brief, airline customers are asked to choose between competing alternatives that differ, in a trade-off sense, in several attributes. Hence, our choice-based approach is based on a quite realistic task that airline customers perform every day. In addition, our willingness to pay measures are consistent with utility theory (see Merino-Castelló (2003) and Hanley et al. (2001) for extensive discussions on stated preference discrete choice models and the reasons behind the growing popularity of such models).

Several authors have successfully applied discrete choice models to transportation policy issues in a number of ways and settings (see, among others, Ben-Akiya and Lerman (1985), Wardman (1988), for surveys, and Burris and Pendalya (2002), for an application). Cao and Mokhtarian (2005a, 2005b) argue that individuals adapt their travel-related strategies according to a number of objective and subjective influences, and, hence, one should consider individual experiences and characteristics when forecasting the expected outcome of a given policy choice. We follow this reasoning and control in our experiment for a number of individual characteristics.

The evidence that we provide also sheds light on consumer preferences towards flight frequency. Thus, we can use this evidence as an input in the debate if we are indeed in the presence of a natural monopoly or not. Hence, our paper contributes to the literature on the efficiency of the application of public service obligations (PSOs) in air transport within the EU. As Williams and Pagliari (2004) argue, despite the widespread application of PSOs across the European Union, with the aim of promoting sustainable air services to remote regions for economic development purposes, as in the Azorean case, there is very little research on how efficient have such policies been applied. Our paper shows that stated preference discrete choice models are an effective way to root PSOs on deep, structural consumer preferences parameters.

The paper is organized as follows. Section 2 describes the data. Section 3 presents our econometric model. Section 4 discusses the results. Section 5 concludes.

2 Data

2.1 The Sated Preferences Choice Game

Our stated preferences choice game was implemented through questionnaires ministered at Ponta Delgada's Airport, near the boarding gate, after security checkpoint. A total of 347 questionnaires were asked from April 27th to May 5th of 2005. The number of questionnaires ensures a number of observations large enough to estimate the econometric model described below. The interviews were conducted in Portuguese.

Only people who were about to take a flight from Ponta Delgada to Lisbon were interviewed, to make sure that they were familiar with the questions asked. Moreover, people who were traveling with tourist packages, namely, packages with a combination of hotel, air travel, rent a car, and so on, were not considered since these people did not have a clear idea of the exact cost of the air travel portion of their travel package.

The questionnaires had 3 sections. In the first section, a number of questions were asked about the trip, such as: airline; connection at destination; connecting airline; fare class (business, economy); departure time; trip cost; trip motive; trip frequency; who pays for the trip; number of people flying with the interviewee; advance of purchasing the ticket; mode of purchasing the ticket; and frequent flyer program.

In the second section, the individuals were confronted with a stated preferences choice game. In particular, with the aid of a laptop computer, the individuals were asked to choose one of two virtual airlines that differed in the following dimensions, based, on the on hand, on the status quo,[2] and, on the other hand, on what we observe elsewhere, namely in more deregulated and competitive markets:

Attribute	Level	Definition	
Price	0	P + 20%	
	1	P	
	2	P - 20%	
Penaly for changes in the ticket		Business	Cheap Fare
	0	30%	100%
	1	10%	50%
	2	0%	30%
Free Food		Business	Cheap Fare
	0	Cold sandwiches + drink	Not available
	1	Hot food + drink	Cold sandwiches + drink
	2	A la carta (when buying the ticket)	Hot food + drink
Comfort	0	Small space between seats	
	1	Wide space between seats	
Frequency	0	2 flights / day	
	1	4 flights / day	
	2	6 flights / day	
Reliability	0	No compensation for delay	
	1	Free ticket for the same trip	
	2	Reimbursement of the cost of the ticket	

Figure 1: Stated Preferences Choice Game

Other attributes which we may care about were left out of the game in order to preserve a good understanding of the trade-offs involved (see Sudman and Bradburn (1982) for practical issues on questionnaire design). As a corollary, travel time was left out since it is, to a great extent, exogenous to the operator and regulator.

The following picture is a "Print Screen" of WinMint v. 2.1 (in Portuguese), the software used to randomly generate the game menus.

[2] The status quo, to be brief, entails: two fares, economy and business; no penalty to change tickets within a year; cold sandwiches if economy, hot food if business; small space between seats for both fares; two flights per day; and no compensation for delay.

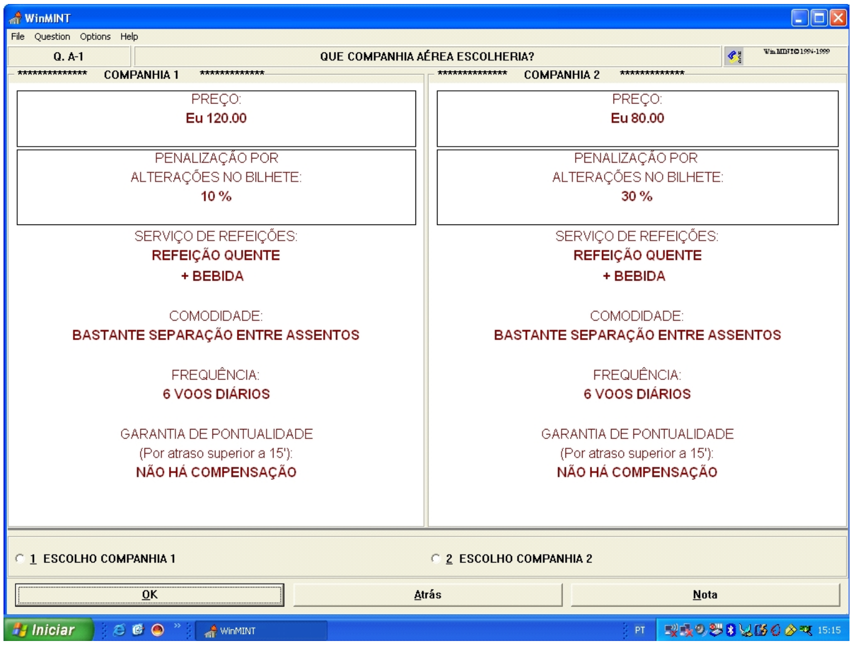

Figure 2: Print Screen of Choice Game

In essence, the stated preferences choice game presented the passengers with a choice between two virtual airlines, none of which dominated the other in all dimensions, as expected. That is, all games considered had trade-offs built-in. Each individual played the game 10 times.

In the third and last section, the individuals were asked about their socioeconomic status, such as: residence county; number of people living in the household; number of workers in the household; household income; age; gender; educational attainment; sector of occupation; type of job; weekly working hours and net monthly individual income.

2.2 Descriptive Statistics

Table 1 summarizes some of the continuous variables in the data set:

Variable	Observations	Mean	S. Deviation	Minimum	Maximum
Trip cost (€)	347	122,37	37,98	-	250,00
Net household monthly income (€)	347	2.645,08	1.679,55	150,00	12.500,00
Weekly working hours (hours)	347	18,80	13,10	0,00	60,00
Net individual monthly income (€)	347	1.196,04	1.325,54	0,00	10.000,00
Age (years)	347	36,53	13,57	19,00	85,00

Table 1: Descriptive Statistics

Mean reported one way ticket cost is € 122. In addition, we note that most interviewees flew with SATA, in a domestic flight with no connection and were males. Most interviewees, 67%, bought the tickets with one week or less in advance of departure day. The travel agency was the mode of purchasing ticket chosen by 69% of the individuals. While 50% of the interviewees paid for their tickets, 35% of the interviewees had their tickets paid for their companies. A slight majority, 51%, of the interviewees had some sort of frequent flyer program. Perhaps not surprisingly, many interviewees held a university degree, 51%, since being at the boarding gate is not a random event across the overall Portuguese population.

3 Model

3.1 Benchmark Model

The econometric work carried out in the paper is based on the random utility theory (see McFadden (1974), Greene (2003) or Train (2003)), briefly described below. Consider that the random utility of alternative j for an individual q, U_{jq}, is given by:

$$U_{jq} = V_{jq} + \varepsilon_{jq} \tag{1}$$

where V_{jq} is the systematic or representative utility (conditional indirect utility) and ε_{jq} is a random term.

Individual q chooses alternative j if and only if $U_{jq} \geq U_{iq}$, $\forall\ i \neq j$. In such a case, and given (1):

$$
\begin{aligned}
U_{jq} &\geq U_{iq} \Longleftrightarrow \\
V_{jq} + \varepsilon_{jq} &\geq V_{iq} + \varepsilon_{iq} \Longleftrightarrow \\
\varepsilon_{iq} - \varepsilon_{jq} &\leq V_{jq} - V_{iq}, \forall i \neq j
\end{aligned}
$$

As utilities are random variables, we can obtain the probability that individual q chooses alternative j as:

$$P_{jq} = P(\varepsilon_{iq} - \varepsilon_{jq} \leq V_{jq} - V_{iq}), \forall i \neq j \tag{2}$$

When the random term ε_{jq} follows a Gumbel distribution, then P_{jq} reads (see McFadden 1973):

$$P_{jq} = \frac{e^{V_{jq}}}{\sum_{i=1}^{N} e^{V_{iq}}} \tag{3}$$

where N is the number of alternatives. The expression for P_{jq} given by (3) is the essence of the well-known multinomial logit model.

3.2 Microeconometric Model

We estimate a conditional logit model, since we have several observations (games) per individual, and, hence, we control for individual fixed effects. The estimation was carried out with STATA Intercooled 8.

As usual in the literature (Bateman et al. (2002), Espíno et al. (2003), Fowkes and Wardman (1998), Fowkes (2000), and Louviére et al. (2000)), we estimate two alternative specifications of the conditional indirect utility, described below. In Model 1 we do not consider interactions between attributes and the conditional indirect utility reads:

$$
\begin{aligned}
V_j &= \theta_C C + \theta_P P + \theta_{F_1} F_1 + \theta_{F_2} F_2 + \\
&\quad + \theta_{LR} LR + \theta_{Fr} Fr + \theta_{R_1} R_1 + \theta_{R_2} R_2, \ j = 1, 2
\end{aligned} \tag{4}
$$

In Model 2 we consider interactions between attributes and hence we write the conditional indirect utility as follows:

$$
\begin{aligned}
V_j \;=\;& \theta_C C + (\theta_P + \theta_{PW})P + \\
&+(\theta_{F_1} + \theta_{F_1 Ec} Ec)F_1 + \\
&+(\theta_{F_2} + \theta_{F_2 Ec})F_2 + \theta_{LR} LR + \theta_{Fr} Fr + \\
&+(\theta_{R_1} + \theta_{R_1 W} W)R_1 + (\theta_{R_2} + \theta_{R_2 W} W)R_2, \; j = 1, 2
\end{aligned} \tag{5}
$$

Table 2 provides a list of variables definitions.

Table 2: Variables Definitions

Variable	Meaning
C	travel cost (euros)
P	penalty for changes in the ticket
F_1	binary variable equal to 1 if food level equals 1
F_2	binary variable equal to 1 if food level equals 2
LR	binary variable equal to 1 if comfort (more leg room) is 1
Fr	daily flight frequency (continuous variable)
R_1	binary variable equal to 1 if reliability level equals 1
R_2	binary variable equal to 1 if reliability level equals 2
E_c	binary variable equal to 1 if fare is economy
W	binary variable equal to 1 if trip motive is work

After estimation of the models above, it is possible to compute the willingness to pay (WTP) for improvements. For continuous variables the subjective value of attribute q_{kj} reads:

$$
WTP^j_{q_{kj}} = \frac{dI}{dq_{kj}} = -\frac{\frac{\partial V_j}{\partial q_{kj}}}{\frac{\partial V_j}{\partial I}} = \frac{\frac{\partial V_j}{\partial q_{kj}}}{\frac{\partial V_j}{\partial c_j}} = -\frac{dc_j}{dq_{kj}}
$$

where I stands for income and $\frac{\partial V_j}{\partial I} = -\frac{\partial V_j}{\partial c_j}$. For binary variables the relevant expression is as follows:

$$
WTP^j_{q_{kj}} = \frac{V^1_j - V^0_j}{\frac{\partial V_j}{\partial I}}
$$

where V_j^i is the conditional indirect utility of alternative j when the level of the attribute equals $i = 0, 1$.

4 Results

Table 3 summarizes the results for models 1 and 2. The signs are as expected and the estimates are statistically significant, with the notable exception of the interaction terms. Adding the interaction terms seems to matter little, both at a qualitative level and at a quantitative level.

Table 3: Results for Model 1 and Model 2

Variable	Model 1	Model 2
Cost (θ_C)	-0.0251^* (-18.02)	-0.0252^* (-18.04)
Penalty (θ_P)	-0.0140^* (-6.97)	-0.0138^* (-5.79)
Food 1 (θ_{F_1})	0.2505^* (3.77)	0.7208^* (2.86)
Food 2 (θ_{F_1})	0.4403^* (6.24)	0.8944^* (3.83)
Leg Room (θ_{LR})	0.5123^* (8.98)	0.5135^* (8.99)
Frequency (θ_{Fr})	0.1266^* (7.09)	0.1279^* (7.15)
Reliability 1 (θ_{R_1})	0.9894^* (14.68)	0.9868^* (11.46)
Reliability 2 (θ_{R_2})	0.8294^* (11.66)	0.8667^* (11.46)
Food 1*Economy (θ_{F_1Ec})		-0.5005^{***} (-1.93)
Food 2*Economy (θ_{F_2Ec})		-0.4828^{**} (-2.03)
Penalty*Work (θ_{PW})		-0.0009 (-0.23)
Reliability 1*Work (θ_{R_1W})		0.0174 (0.13)
Reliability 2*Work (θ_{R_2W}		-0.0849 (-0.70)
$Log - L(\theta)$	-3959	-3956
$Log - L(0)$	-4207	-4207
Number of observations	6940	6940
$*1\%; **5\%; ***10\%$		

In order to obtain a feel of the economic importance of these results we compute the willingness to pay measures, presented in Tables 4 and 5.

Table 4: Willingness to Pay Measures for Model 1

WTP - Model 1	
Event	**WTP (euros)**
Penalty for changes in the ticket	0.57
Food: level 0 to level 1	9.97
Food: level 0 to level 2	17.52
Comfort (more leg room)	20.39
Frequency	5.04
Reliability: level 0 to level 1	39.39
Reliability: level 0 to level 2	33.02

Given that the sample mean cost of a one way ticket is about € 122, we find that willingness to pay measures are quite high. In particular, the willingness to pay to improve reliability from level 0 to 1 is about € 39 or 32% of the sample mean of the reported one way ticket cost. Apparently, comfort is quite valuable: the willingness to pay to have some more leg room is more than € 20.

Willingness to pay measures do not change substantially when we consider interactions between trip attributes (Model 2):

Table 5: Willingness to Pay Measures for Model 2

WTP - Model 2	
Event	**WTP (euros)**
Penalty for changes in the ticket:	
Trip motive: work/business	0.58
Trip motive: other	0.55
Food: level 0 to level 1	
Economy class	8.74
Other type of fare	28.59
Food: level 0 to level 2	
Economy class	16.33
Other type of fare	35.48
Comfort (more leg room)	20.37
Frequency	5.08
Reliability: level 0 to level 1	
Trip motive: work/business	39.83
Trip motive: other	39.14
Reliability: level 0 to level 2	
Trip motive: work/business	31.01
Trip motive: other	34.38

We note that the willingness to pay for one additional flight per day is about 5 euros. Hence, the subjective value of increased daily flight frequency is far less, in an economic sense, than the subjective value of improvement in attributes such as reliability or comfort.

5 Conclusions

The McFadden Discrete Choice Model is an informative tool about consumer preferences over different attributes across competing alternatives, including in environments where revealed preferences do not take us far. Obviously, this is the case of airline services in the Ponta Delgada – Lisbon corridor where there are no data which can be used in a revealed preferences exercise. Thus, a stated preferences exercise was conducted to reveal consumer preferences. Being armed with such knowledge on consumer preferences is a must if one is interested in implementing social welfare maximizing policies. This is certainly the case in heavily regulated markets, such as the Azorean case, where air transport is regulated as a public service obligation within the EU framework for remote regions.

The main results were as expected from utility theory and some willingness to pay measures are quite high, in an economic sense, such as regarding punctuality (reliability) and comfort. However, some other willingness to pay measures were found to be revealingly low. This is the case of willingness to pay for increases in daily flight frequency: about five euros. This result is somewhat puzzling considering that the Ponta Delgada - Lisbon corridor is the most important corridor servicing the Azores and that quite often flights are fully booked and waiting lists several day long. Taken at face value, this anecdotal evidence on waiting lists suggests that flight frequency is a binding constraint and that passengers would be willing to pay a sizeable amount to have such constraint relaxed. It turns out not to be the case.

Instead, our result suggests that passengers do not perceive flight availability as a bidding constraint. In addition, this result should be upward biased in the sense that we did not interview a random sample of the population but people who were actually flying, and, hence, everything else the same, more willing to pay for increased flight availability. However, it should be noted that this result does not imply that there is no demand for extra flights. It is logically coherent with a scenario of a highly elastic demand. It simply suggests that there is no demand for more flights at increased cost. But there may be demand for more flights at given or lower prices.

We also note that this result may be influenced by the interviewee's own judgement about his ability to secure a flight through, say, planning in advance. As Kahneman

(2003) argues, individuals, in general, are prone to over estimate their own ability in a number of settings. It is also quite interesting to note that the willingness to pay for avoiding penalties for changing tickets is quite low: less than one euro. Pereira et al (2005) find similar results to ours to the Funchal - Lisbon route. Like us, in their study willingness to pay measures seem lower for attributes arguably perceived as *endogenous* from the interviewee's perspective, in the sense that the interviewee may believe that he may act in a way to avoid penalties, secure flights and so on.

Airline regulators and operators alike should take heed of these results to root their policies and operations in deep, structural consumer preferences parameters.

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