

HOW DO CONSUMERS VALUE AIRLINE SERVICES ATTRIBUTES? A STATED PREFERENCES DISCRETE CHOICE MODEL APPROACH

Pedro Telhado Pereira^{*}, *António Almeida*^{**}, *António Gomes de Menezes*^{***},
José Cabral Vieira^{****}

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We implement a stated preferences choice game and estimate a conditional logit model to learn the determinants of airline choice and to quantify consumers' willingness to pay for airline services attributes such as flight frequency, punctuality warranties and comfort in the Portuguese air corridor between Madeira and Oporto; the third and second most important Portuguese airports, respectively. We show that our stated preferences discrete choice model exercise is a cost effective way for airline marketing managers to elicit consumer preferences and willingness to pay measures which are quite valuable to make airline operations more effective.

* Pedro Telhado Pereira, Full Professor of Economics, University of Madeira and CEEApIA, Department of Management and Economics, Campus Universitário da Penteadá, Funchal, Portugal, Tel. +351-291705043, Tax. +351-291705040, E-mail: ppereira@uma.pt.

** António Almeida, Assistant Professor in Economics, University of Madeira and CEEApIA, Department of Management and Economics, Campus Universitário da Penteadá, Funchal, Portugal, Tel. +351-291705043, Tax. +351-291705040, E-mail: amma@uma.pt.

*** António Gomes de Menezes (corresponding author), Assistant Professor of Economics, University of the Azores and CEEApIA, Department of Economics and Management, Rua da Mãe de Deus, 9501-801, Ponta Delgada, Portugal, Tel. +351-296650084, Fax. +351-296650083, E-mail: menezesa@notes.uac.pt.

**** José Cabral Vieira, Associate Professor of Economics, University of the Azores and CEEApIA, Department of Economics and Management, Rua da Mãe de Deus, 9501-801, Ponta Delgada, Portugal, Tel. +351-296650084, Fax. +351-296650083, E-mail: josevieira@notes.uac.pt

1. INTRODUCTION

This paper implements a stated preferences choice game and estimates a conditional logit model in order to learn the determinants of airline choice and to quantify consumers' willingness to pay for airline services attributes in the Portuguese air corridor between Madeira (Funchal Airport) and Oporto (also known as Porto); the third and second most important airports in Portugal, respectively. We argue that our methodology is an effective way to elicit consumer preferences, and thus, to provide airline companies and regulators alike much needed information about consumer preferences.

In the recent years, there has been a growing interest in eliciting consumer preferences through stated preferences methods. Eliciting consumer preferences is quite important in a vast number of situations: public officials must know what their constituents value; marketing managers care to know what consumers are willing to pay for products and services; and so on. Consumer preferences can be elicited using either revealed preferences (RP) data or stated preferences (SP) data. Revealed preferences data are drawn from the past behaviour of consumers, as observed in market situations, where consumers make real choices. Stated preferences data are obtained through surveys, that is, stated preferences choice games, where consumers state their preferences when faced with choices which may or may not mimic real case scenarios. Hence, stated preferences choice games are quite powerful in the sense that they may be used to elicit consumer preferences in situations where one is interested in hypothetical scenarios or there are just no relevant real market situations to construct revealed preferences data. In fact, it is often the case that marketing managers want to learn about consumer preferences regarding products or services through surveys, and thus, avoid an actual trial and error learning process which may be costly in case initial guesses prove to be wrong. Moreover, it has been shown that stated preferences discrete choice models deliver accurate forecasts of consumer behaviour (see Verhoef and Franses (2003) and references therein).

Hence, it should come as no surprise that stated preferences data have been applied in a vast and growing number of fields. Stated preferences data have long been popular in economics, especially in environmental economics, where valuation of non-marketed goods, such as a given landscape, is quite important for policy making (see Bateman and Willis (2001) for a critical survey), and in transport economics, where one is often interested in eliciting consumer preferences for hypothetical transport modes or infrastructures (see, for instance, Fowkes (2000) for a detailed account of how stated preferences

methods have been applied in transport economics). Louvière et al. (2000) provide an excellent survey of the methodological aspects and applications of stated choice methods.

Stated preferences discrete choice models are popular in part because they may be combined with econometric methods to deliver the willingness to pay measures for products or services attributes which may be interpreted in light of the microeconomic utility theory. In fact, economists routinely use a number of stated preferences discrete choice models in order to estimate the willingness to pay measures in a variety of situations (see McFadden and Train (2000) for an authoritative study on the econometrics of such models).

More recently, the popularity of stated preferences discrete choice models has grown rapidly in a number of fields outside mainstream economics, namely in marketing science. Franses and Paap (2001) provide an excellent survey of discrete choice models which may be applied with stated preferences data in marketing research and identify a wide spectrum of marketing and consumer research applications. While a survey of such applications is beyond the scope of this paper, we do note that stated preferences discrete choice models have been successfully applied in consumer research and marketing science.

For instance, Onyango et al. (2004) measure consumer preferences for genetically modified foods, not yet available in the marketplace, using stated preferences techniques and both Brower and Bateman (2005) and Merino (2003) rationalize the growing popularity of stated preferences discrete choice models in the health sector, an area where one is keen on eliciting consumer preferences regarding products and services not available in the marketplace, such as new drugs and health plans. Verhoef and Franses (2003) pursue a novel line of research and combine revealed preferences data with stated preferences data to investigate how adding stated preferences data to revealed preferences data results in better forecasts of consumer behaviour.

Our paper contributes at an empirical level to this burgeoning literature - applying stated preferences discrete choice models to elicit consumer preferences, valuable to marketing managers - by studying consumer preferences for airline services attributes in the air corridor between Madeira and Oporto. We focus on airline services attributes for, at least, two reasons. First, it may be difficult for airline companies to change their services attributes. For instance, changing daily flight frequencies is obviously a costly enterprise. Therefore, it is quite valuable for airline companies to know consumers' willingness to pay for an additional daily flight without having to actually

provide it, as it would be the case under a revealed preferences data collection strategy. Even for a given flight schedule, it may be quite costly for airline companies to change services attributes, such as the space between seats. Hence, we provide information which may be used by airline companies to improve the efficacy of their operations at a very low cost in the sense that a sound knowledge of consumer preferences may enable marketing managers to establish better pricing policies that simultaneously increase profits and consumer surplus. Second, airline services are critical to the economic and social development of a peripheral and insular region such as Madeira. Thus, it comes as no surprise that airline operators who operate regular flights to Madeira are subject to a stringent set of regulations on how they may operate. Therefore, regulators are naturally interested in learning about consumer preferences regarding airline services attributes in order to promote regulations that take into account consumers' welfare. Moreover, in the recent years, there has been a massive public investment effort in the airport infrastructure in Madeira, namely in the airport of Madeira. If one is interested in maximizing the social return from such an investment, then one should pay heed to consumer preferences regarding the services that make use of such a publicly funded infrastructure.

We implement a stated preferences choice game which, to be brief, asks airline passengers to choose between competing alternative airlines that differ, in a trade-off sense, and in several attributes, such as ticket cost, penalties for changing tickets, punctuality warranties, comfort, and so on. 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 is consistent with the utility theory (see Merino (2003) and Hanley et al. (2001)). We follow, among others, Ben-Akiva and Lerman (1985), Wardman (1988), Burriss and Pendalya (2002), Cao and Mokhtarian (2005a, 2005b) who argue that individuals adapt their travel-related strategies according to a number of objective and subjective influences, and hence, we control for individual characteristics. Given the high statistical quality of our results and their rich informative managerial content, on the one hand, and the cost of implementing our study, on the other hand, we conclude that our stated preferences choice experiment is an effective way for airline companies to elicit consumer preferences, and concomitantly, to improve the efficacy of their operations.

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

2. DATA

2.1. The Stated Preferences Choice Game

Our stated preferences choice game was implemented through questionnaires ministered at Funchal Airport, near the boarding gate, after the security checkpoint. A total of 325 questionnaires were presented from June 20th to June 27th, 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 Funchal to Oporto were interviewed, to make sure that they were familiar with the questions asked. Moreover, people who were travelling 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 three 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 according to dimensions, illustrated by Figure 1.

The design of the stated choice game, and in particular, the number of attributes and levels considered, obeyed the following criteria. On the one hand, we are interested in eliciting consumers' preferences for quite an informative set of attributes, in the sense that the attributes considered provide an accurate description of the services being analyzed (and concomitantly, provide enough degrees of freedom for marketing strategists and regulators to act upon) and are well understood by the interviewees. On the other hand, the set of attributes and levels considered must be commensurate with the cognitive ability of the interviewees in understanding the questions asked. In a nutshell, we selected the most pertinent attributes, given the status quo in the regular flights between Funchal and Oporto, on the one hand, and what is observed elsewhere in mature routes in Europe, on the other (see Street et al. (2005) for more on how to construct choice sets).

Variable	Levels	Definition
<i>Price</i>	1	P + 20%
	2	P
	3	P – 20%
<i>Penalty for changes in the ticket</i>	First Class 0	30%
	First Class 1	10%
	First Class 2	0%
	Economy 0	100%
	Economy 1	50%
	Economy 2	30%
<i>Food</i>	First Class 0	Cold sandwiches + drink
	First Class 1	Hot meal + drink
	First Class 2	À la carte
	Economy 0	No food
	Economy 1	Cold sandwiches + drink
	Economy 2	Hot meal + drink
<i>Comfort</i>	0	Small space between seats
	1	Wide space between seats
<i>Frequency</i>	0	2 flights per day
	1	4 flights per day
	2	6 flights per day
<i>Reliability (punctuality warranties)</i>	0	No compensation for delay
	1	Free ticket for the same trip
	2	Full reimbursement

Figure 1. Levels of attributes

Hence, we included in our choice game the following attributes: Price paid; Penalties for changes in the tickets; Food service on board; Comfort level on board; Daily flight frequency; and Reliability (punctuality warranties). P stands for the reported one-way ticket cost. i.e. the actual (printed on the ticket at hand) cost paid in Euros and may vary between + and – 20%, as variations beyond this interval are not likely to be observed. Penalties for changing tickets vary with the ticket fare and may range from as low as 0% (no penalty for the most expensive ticket, labelled as First Class 2) to 100% (completely lose the ticket, for the cheapest Economy fare, labelled as Economy 0). Food service on board varies with the ticket fare, in a self explanatory way. Comfort on board is measured by leg room, as is the practice in the civil aviation industry. The frequency of daily flights is a continuous variable which ranges from as low as two daily flights (the status quo) to as much as six daily flights. An increased daily frequency is perceived as a service quality enhancement – namely, with

other attributes being constant, the customer needs may be better served in this way. Reliability is measured as punctuality warranties, which range from no compensation for delay up to full ticket reimbursement. The critical level of delay is 15 minutes. This benchmark for punctuality follows standard practice in the literature and is observed in airline reports on performance¹. The following figure is a 'print screen' of WinMint v. 2.1 (in Portuguese), the software used to randomly generate the game menus.

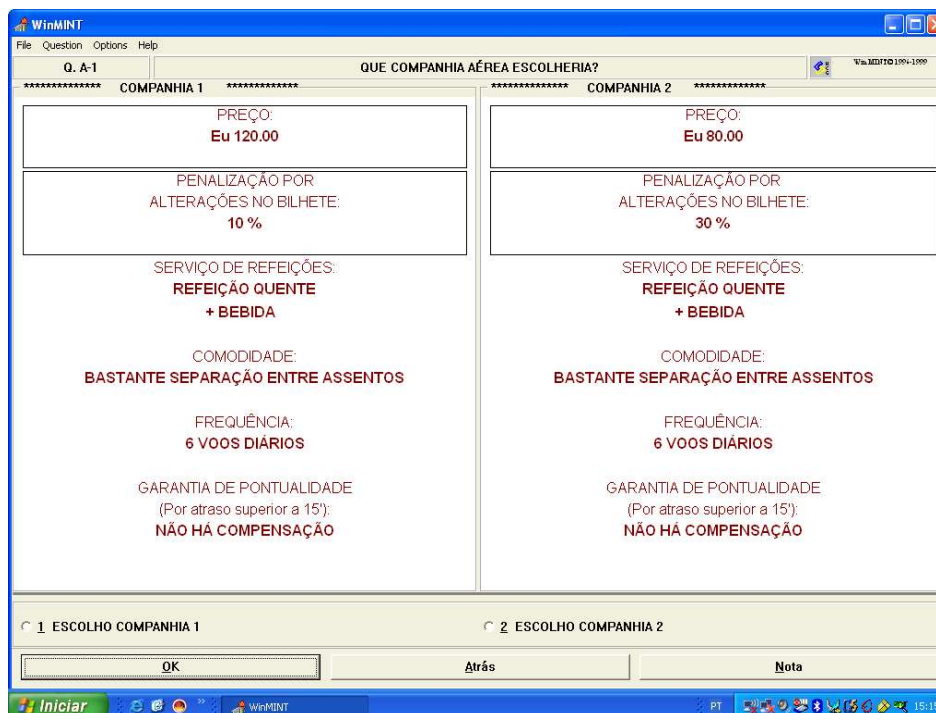


Figure 2. 'Print screen' of stated preferences choice game

The stated preferences choice game presented the passengers with a choice between two virtual airlines (none of which dominated the other in all dimensions), in the sense that all the games considered had trade-offs built-in. For instance, and without loss of generality, a cheaper fare may involve no food service on board whatsoever, whereas a more expensive flight might entail more generous punctuality warranties or higher daily frequencies. Each of the

¹ Source: International Air Transport Association (<http://www.iata.org>).

325 individuals interviewed played the game 10 times, which produced 3250 observations.

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

While we did collect extensive information about individual characteristics, we preserve on space and describe our sample in a succinct manner below. Table 1 summarizes some of the continuous variables in the data set:

Table 1. Descriptive Statistics

Variable	N	Mean	S. Dev.	Median
<i>Price (€)</i>	325	113.1	29.8	100.8
<i>Monthly Gross Household Income (€)</i>	325	2879.8	3979.2	2000.5
<i>Monthly Net Personal Income (€)</i>	325	1360.4	1637.3	1000.1
<i>Age (years)</i>	325	37.5	13.4	32

The mean reported the one-way ticket cost as € 113.1. In addition, we note that most interviewees were male and flew with TAP (86%), the Portuguese flag carrier, in a domestic flight with no connection. Many interviewees, 47%, bought the tickets one week or less in advance of the departure day. The travel agency was the mode of purchasing the ticket chosen by 75% of the individuals.

While 75% of the interviewees paid for their own tickets, 18% of the interviewees had their tickets paid by their companies. A slight majority, 58%, of the interviewees had some sort of frequent flyer program. Perhaps not surprisingly, many interviewees held a university degree, 60%, since being at the boarding gate is not a random event across the overall Portuguese population. While 26% of the interviewees were travelling for work-related reasons, about 61% of the interviewees were tourists.

3. MODEL

3.1. Benchmark Model

The econometric work carried out in the paper is based on the random utility theory (see McFadden (1973, 1974), Greene (2003) or Train (2003)), briefly described below. Assume that the random utility of alternative j for an individual q , U_{jq} , is given by:

$$U_{jq} = V_{jq} + \varepsilon_{jq}. \quad (1)$$

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):

$$V_{jq} + \varepsilon_{jq} \geq V_{iq} + \varepsilon_{iq} \Leftrightarrow \varepsilon_{iq} - \varepsilon_{jq} \leq V_{jq} - V_{iq}, \quad \forall j \neq i.$$

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

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

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

$$P_{jq} = \frac{e^{V_{jq}}}{\sum_{i=1}^N e^{V_{iq}}}, \quad (3)$$

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. Microeconomic Model

We estimate a conditional logit model since we have 10 observations (games) per individual and, therefore, control for individual fixed effects. The estimation was carried out with STATA 8. As usual, in the literature (Espino et al. (2003), Fowkes and Wardman (1998), Fowkes (2000), and Louvière et al.

(2000)), we estimate two alternative specifications of the conditional indirect utility, as described below. In Model 1, we do not consider interactions between attributes, and the conditional indirect utility reads:

$$V_j = \theta_C C + \theta_P P + \theta_{F_1} F_1 + \theta_{F_2} F_2 + \theta_{LR} LR + \theta_{Fr} Fr + \theta_{R_1} R_1 + \theta_{R_2} R_2, j = 1, 2. \quad (4)$$

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

$$V_j = \theta_C C + (\theta_P + \theta_{PW} W) P + (\theta_{F_1} + \theta_{F_1 First} First) F_1 + (\theta_{F_2} + \theta_{F_2 First} First) F_2 + \theta_{LR} LR + \theta_{Fr} Fr + (\theta_{R_1} + \theta_{R_1 W} W) R_1 + (\theta_{R_2} + \theta_{R_2 W} W) R_2, j = 1, 2. \quad (5)$$

Table 2 provides a list of variables definitions.

Table 2. Definitions of variables

Variable	Meaning
<i>C</i>	travel cost (euros for one-way ticket)
<i>P</i>	penalty for changes in the ticket
<i>F₁</i>	binary variable equal to 1 if food level equals 1 (see Figure 1)
<i>F₂</i>	binary variable equal to 1 if food level equals 2 (see Figure 1)
<i>LR</i>	binary variable equal to 1 if comfort level equals 1 (more leg room)
<i>Fr</i>	daily flight frequency (continuous variable)
<i>R₁</i>	binary variable equal to 1 if reliability level equals 1 (see Figure 1)
<i>R₂</i>	binary variable equal to 1 if reliability level equals 2 (see Figure 1)
<i>First</i>	binary variable equal to 1 if fare is First Class
<i>W</i>	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) measures for improvements. For continuous variables, the subjective value of attribute q_{kj} reads:

$$WTP_{q_{kj}}^j = \frac{dI}{dq_{kj}} = -\frac{\frac{\partial V_j}{\partial I}}{\frac{\partial V_j}{\partial c_j}} = -\frac{\frac{\partial q_{kj}}{\partial I}}{\frac{\partial q_{kj}}{\partial c_j}} = -\frac{dc_j}{dq_{kj}}, \quad (6)$$

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: $WTP_{q_{kj}}^j = \frac{V_j^1 - V_j^0}{\frac{\partial V_j}{\partial I}}$, 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, where we display the determinants of airline choice (t-statistics in parentheses). The signs are as expected from the utility theory 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)	-0.0259*** (-17.32)	-0.0259*** (-17.28)
Penalty (θ_p)	-0.0091*** (-6.15)	-0.0092*** (-5.52)
Food 1 (θ_{F1})	0.3149*** (4.62)	0.3097*** (4.35)
Food 2 (θ_{F2})	0.3742*** (5.15)	0.4063*** (5.40)
Leg Room (θ_{LR})	0.4465*** (7.62)	0.4446*** (7.58)
Frequency (θ_{Fr})	0.1440*** (7.91)	0.1441*** (7.91)
Reliability 1 (θ_{R1})	0.9893*** (14.11)	1.0694*** (13.26)
Reliability 2 (θ_{R2})	0.9205*** (12.52)	0.9808*** (11.91)
Food 1*First ($\theta_{F1,First}$)		0.0207 (0.08)
Food 2*First ($\theta_{F2,First}$)		-0.0390 (-0.17)
Penalty*Work (θ_{PW})		-0.0005 (0.84)
Reliability 1*Work ($\theta_{R,W}$)		-0.2936* (-1.95)
Reliability 2*Work ($\theta_{R,W}$)		-0.2331 (-1.66)
Log-L(θ)	-3700	-3696
Log-L(0)	-3890	-3889
Number of observations	3250	3250

*** p<0.001; ** p<0.005; * p<0.01

We note that our conditional logit model is able to unveil the determinants of airline choice in a quite precise manner: the t-statistics are quite high, in both models, with the notable exception of the interaction terms. In order to obtain a feel for the economic importance of these results, we compute the willingness to pay measures, as presented in Tables 4 and 5.

Table 4. Willingness to Pay (WTP) measures for Model 1

Event	WTP (euros)
<i>Penalty for changes in the ticket</i>	0.35
<i>Food: level 0 to level 1</i>	12.13
<i>Food: level 0 to level 2</i>	14.42
<i>Comfort (more leg room)</i>	17.20
<i>Frequency (one more flight per day)</i>	5.55
<i>Reliability: level 0 to level 1</i>	38.13
<i>Reliability: level 0 to level 2</i>	35.48

Given that the sample mean cost of a one-way ticket is about € 113, we find that the willingness to pay measures is quite high. In particular, the willingness to pay to improve reliability, that is, to enjoy punctuality warranties (from level 0 - of no compensation for flight delays - to 1 - free ticket for the same trip if delay is more than 15 minutes) is about € 38 or 33% of the sample mean of the reported one-way ticket cost. Similarly, the willingness to pay to improve reliability from level 0 to level 2 (money refund if delay is more than 15 minutes) is also quite high: about € 35.

Apparently, comfort is quite valuable: the willingness to pay to have some more leg room is more than € 17 or 15% of the sample mean of a one-way ticket cost. The willingness to pay to have a meal during the flight is about € 12 for a cold sandwich and about € 14 for a hot meal and drink. The willingness to pay measures do not change substantially when we consider interactions between trip attributes (Model 2), as shown in Table 5.

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

Table 5. Willingness to Pay Measures for Model 2

Event	WTP (euros)
<i>Penalty for changes in the ticket</i>	
Trip motive: work/business	0.33
Trip motive: other	0.36
<i>Food: level 0 to level 1</i>	
First class	8.74
Economy class	11.95
<i>Food: level 0 to level 2</i>	
First class	14.17
Economy class	15.68
<i>Comfort (more leg room)</i>	17.16
<i>Frequency</i>	5.56
<i>Reliability: level 0 to level 1</i>	
Trip motive: work/business	29.93
Trip motive: other	41.27
<i>Reliability: level 0 to level 2</i>	
Trip motive: work/business	28.85
Trip motive: other	37.85

5. CONCLUSIONS

This study estimated a stated preference discrete choice model in order to elicit consumer preferences for airline services attributes. The main results were as expected from the utility theory, and some willingness to pay measures were quite high, in an economic sense, such as regarding punctuality warranties and comfort. The results are of high statistical quality and provide information useful for airline marketing managers who are interested in learning not only about how passengers choose between competing airlines but also about quantifying passengers' willingness to pay for different services attributes. With a sound knowledge of consumer preferences, marketing managers may establish better pricing policies which enhance simultaneously profits and consumer satisfaction. It is obviously the case that our methodology could have been applied to other products or services. We note that it took only one week for our team of three interviewers to collect the data on 325 passengers. The total cost of our field work was slightly less than € 1.000. Hence, our dataset was constructed at a very low cost. We also note that we controlled for a large number of individual characteristics. Therefore, it would have been trivial to carry out other exercises, not pursued here for the sake of parsimony, to learn more about how individual characteristics, such as age, income, working status, student status, and so on, affect airline choice determinants and the willingness to pay measures. For instance, we could have run the regressions only for

passengers travelling for work-related purposes. We conclude, hence, that our methodology is a cost effective way for marketing managers to gather microeconomic evidence on the determinants of airline choice and the willingness to pay measures consistent with the microeconomic utility theory without having to resort to costly, time-consuming, revealed preferences data collection strategies. Finally, we note that our empirical strategy is especially interesting if consumer preferences change quickly over time or competition keeps changing its profile, and hence, revealed preferences data drawn from past consumer behaviour in previous settings may not be appropriate to draw inference about future consumer behaviour. This certainly seems to be the case of the fast pace changing airline sector.

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DISKRETNI MODEL IZBORA ISKAZANIH PREFERENCIJA**

Sažetak

U ovom se radu, uz pomoć igre iskazanih preferencija i kondicionalnog logističkog modela, analiziraju odrednice izbora zračne kompanije i kvantificira spremnost potrošača za plaćanje atributa usluge zračnog prometa, kao što su učestalost broja letova, garancija točnog dolaska i komfor. Istraživanje je provedeno na uzorku putnika u portugalskom zračnom koridoru između Madeire i Oporta (treće, odnosno druge po važnosti portugalske zračne luke). Kao rezultat se pokazuje da je promatrani diskretni model izbora iskazanih preferencija troškovno učinkovit pristup za marketinške menadžere zračnih kompanija, koji žele otkriti preferencije korisnika i njihovu spremnost za plaćanje različitih odrednica usluge.