Transportation Research Part A 191 (2025) 104329

Contents lists available at ScienceDirect

Transportation Research Part A

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

Passengers' perception of airlines' services: Addressing systematic and random variation in tastes

Luigi dell'Olio [b,*], Laura Eboli [a], Maria Pia Fotino [a], Gabriella Mazzulla [a]

[a] University of Calabria, Department of Civil Engineering, P. Bucci, Cubo 46/B Rende, 87036, Italy
[b] Universidad de Cantabria, Departamento de Transportes y Tecnologia de Proyectos y Procesos Avda. de los Castros, 44 Santander, 39005, Spain

ARTICLE INFO

Keywords:
Systematic variation in taste
Random Parameter Logit
Stated Preference Survey Air Transport
Quality of Service

ABSTRACT

This paper investigates heterogeneities in passengers' perceptions of airlines' services considering systematic and random variations in users' tastes. For this purpose, an efficient design of a stated preference survey is carried out, where attributes related to the in-flight travel and to the passenger's experience before and after the flight are considered. A Random Parameter Multinomial Logit model is estimated with the obtained data, which also considers systematic variations in user tastes. The obtained results show that most of the parameters associated with the considered variables fit better to a normal or uniform distribution, and that part of their variance can be explained by interacting these variables with other variables such as gender, age, travel frequency or income level.

The proposed model allows conclusions to be drawn and marketing policies to be implemented that directly aim at certain user segments, in addition to comprehensively explaining passenger behaviour by showing their preferences.

1. Introduction

Assessing the quality of air transport service is a task of fundamental importance to offer a high-quality service (Espino et al., 2008; Martín et al., 2007) that can attract more travellers (Bellizzi et al., 2020a, 2020b; de Oña et al., 2013). As an example, concerning people travelling for leisure, Seetanah et al. (2020) found that tourists' satisfaction with the quality of airport services at a destination is linked to their intention to revisit. The study highlights the vital importance of tourists' experience with airport services.

The variables that affect the perception of the quality of airport services can vary depending on the context and the perspective of the involved stakeholders (Mendoza-Arango et al., 2020). Bezerra and Gomes (2016) emphasized the complexity of measuring and analysing passengers' perceptions of airport service quality due to the complexity of the airport service environment. The study suggests that generic scales for perceived service quality might not cover some particularities of the passenger experience. However, some of the commonly identified variables are: efficiency and effectiveness of airport operations, such as check-in, security, boarding, and baggage handling; physical facilities, including terminal design, cleanliness, and comfort; staff service quality, such as friendliness, professionalism, and responsiveness; availability and quality of amenities, such as food and beverage, retail and shopping, lounges, and Wi-Fi; safety and security measures, including screening procedures and emergency response capabilities.

To this end, it is necessary to consider the different stages of the trip, which must include both the traveller's experience at the transportation terminals and the traveller's experience during the flight. Therefore, a methodology was designed to identify the

* Corresponding author.
E-mail address: luigi.dellolio@unican.es (L. dell'Olio).

https://doi.org/10.1016/j.tra.2024.104329

Available online 19 November 2024

variables mostly affecting the desired quality of the users of air transport services (dell'Olio et al., 2018, 2011). An efficient design of a Stated Preference (SP) survey was carried out using a non-labelled design that allows comparing alternative scenarios where some attributes related to the quality of the service vary in a timely manner. The data were collected on a sample of students and workers of a university campus placed in the southern Italy. The collected data were modelled using a Multinomial Logit model that considers systematic variations in users' tastes (MNL-VT), which was used as a base model for estimating a Random Parameter Logit model that considers systematic and random variations in tastes (RPL-VT). In this paper we present only the RPL-VT, since, as expected, this model improves significantly the MNL-VT by considering random parameters and allowing to take into account the panel data effect that is not possible to consider in a classical MNL model. The main objective of the work is to investigate heterogeneities in passengers' perceptions. To this aim, interaction variables representing passengers' characteristics were introduced in the proposed model (e.g. gender, income, age). The differentiation among users can concern many features such as socio-economic characteristics, or travel habits and attitudes. In the literature, there are not many studies investigating how different categories of passengers perceive air transport service quality, based on the use of SP data (Bellizzi et al., 2020a). Similar considerations can be made also referring to other methodological approaches adopted for investigating service quality, as the Structural Equation Modelling (SEM) approach. As an example, (Allen et al., 2020) stated that they did not find any study that applied an SEM approach to airport service quality data proposing an analysis of differentiated perceptions about the service according to users' characteristics and for this reason, they proposed a SEM-MIMIC ordinal Probit model for capturing the heterogeneity in perceptions of air transport passengers and identifying groups of passengers with similar assessments of the services. A useful literature review of the various methodological approaches of data collection and analysis of air transport service quality from the passengers' point of view is reported in Eboli et al. (2022).

Our work introduces several original elements that distinguish it from the existing studies discussed in the following literature review section. A relevant element concerns the kinds of variables introduced in the model, which are both more traditionally investigated such as times and costs of the service, but also more qualitative service aspects, such as comfort on board or cabin crew service, which have been less analysed as regards times and costs. Another important element of this study regards the introduction of interactions between passengers' characteristics and service aspects, which have been little investigated in the air transport service quality literature, especially referring to stated preferences. Definitively, interacting service quality aspects with passengers' characteristics makes the proposed work an interesting contribution to the literature of the sector. The contribution of the paper is also practical. First, the proposed model allows identifying the most important service aspects for the users, which are the aspects on which airlines should invest more to satisfy their passengers. Secondly, the introduction of passengers' characteristics in the analysis can be useful in practical terms for investigating on the differences in preferences of the various users' categories, with the final aim of identifying different market strategies for groups of users.

The rest of the article is structured as follows: first, a state of the art on the main introduced variables and on the variation of their perception in the population is proposed. The methodological approach is then explained, followed by an explanation and discussion of the models proposed. Finally, the main conclusions are drawn.

2. Literature review

2.1. Air transport service quality attributes: During the operations, before and after the trip

The perception of the quality of airport and airline services is a complex issue that involves multiple variables (Benedict and Emmanuel, 2021; Law and Law, 2017; Lubbe et al., 2011; Munoz et al., 2019; Sandada and Matibiri, 2016). The scientific literature provides several studies investigating this issue. As an example, Fodness and Murray (2007) conducted an empirical investigation into passengers' expectations for airport service quality. The study identified variables, clarified basic concepts, and generated a conceptual model of airport service quality expectations. Hutchinson et al. (2013) explored the most frequently mentioned attributes of airport service quality and distinguished key drivers for passenger satisfaction/dissatisfaction in the airport context. The study found that the most important factors for passenger satisfaction were airport staff, security, and baggage handling. Lubbe et al. (2011) applied the airport service quality model in South Africa and found that the model was a useful tool for measuring and improving airport service quality.

Due to the complexity of air transport system and the existence of several aspects characterizing the quality of airport and airline services, the quality perceived during the trip (in-flight) can be conveniently separated from the quality perceived during the operations before and after the trip. The first one is affected by on board services, and the other two by airport services and their timeliness.

The quality of the services provided during the flight is critical to passengers' overall travel experience. It is characterized by many aspects such as: in-flight entertainment (Bakır et al., 2020); seating comfort including legroom, seat width, and recline (Kremser et al., 2012); in-flight meals including the variety of food options available (Han et al., 2019); flight crew service quality in terms of their friendliness, professionalism, and responsiveness (Babbar and Koufteros, 2008); cleanliness and hygiene of the cabin, lavatories, and other areas of the aircraft (Nolich et al., 2019; Piccarozzi et al., 2021; Repace, 2004); flight duration (Curtis et al., 2012).

Many literature studies revealed that quality of in-flight service is an important factor that can influence airline users' perception of airline service quality. As an example, An and Noh (2009) found that in-flight service quality had a significant impact on airline customer satisfaction and loyalty. The study suggests that airline companies need to focus on improving in-flight service quality to increase customer satisfaction and loyalty. Similarly, Etemad-Sajadi and Bohrer (2019) investigated the impact of service recovery output/process on airline passenger satisfaction and loyalty. The study found that airline passengers' perception of service recovery output/process had a significant impact on their satisfaction and loyalty. The study suggests that airline companies need to focus on improving their service recovery output/process to increase passenger satisfaction and loyalty.

While the services provided during the flight are managed by airlines, many aspects characterizing the services experienced during the phases before and after the flight are managed by the airport operators. In Eboli et al. (2022) an exhaustive literature review of the studies analysing air transport service quality is proposed, where a differentiation between the various categories of attributes is highlighted, and the various aspects affecting the different phases of the travel experience are described.

More specifically, the quality of services provided before a flight is affected by variables that depend on many different aspects such as: check-in process (the efficiency and effectiveness of the check-in process, including speed, convenience, availability of self-check-in options); security procedures (efficiency and effectiveness of the security screening process, including speed and ease of the process); terminal facilities (the quality and cleanliness of terminal facilities, including seating areas, restrooms, and retail and dining options); airport accessibility (the ease of access to the airport, including transportation options, parking facilities, proximity to accommodation); airport staff service quality (in terms of friendliness, professionalism, responsiveness).

Finally, the quality of services provided after a flight is affected by variables that depend on: baggage claim process (the efficiency and effectiveness of the baggage claim process, including speed, convenience, and the condition of baggage upon arrival); customs and immigration procedures; ground transportation (the availability and convenience of ground transportation options, including taxis, rental cars, public transportation); terminal facilities (the quality and cleanliness of terminal facilities, including restrooms, retail and dining options, waiting areas); staff service quality.

2.2. Air transport service quality: Impact of COVID-19 pandemic

Although this paper analyses a context antecedent to the COVID-19 pandemic, a brief mention of the studies referring to pandemic is in order. In fact, travel behaviour has undergone significant changes during and post the COVID-19 pandemic, with a notable impact on air travel. Studies have shown a substantial decrease in the intention to travel by air during the pandemic, even among individuals who previously preferred air travel (Kim and Sohn, 2022). Factors such as cleanliness and terminal hygiene have become crucial considerations for passengers, with the effect size of terminal cleanliness on passenger satisfaction increasing significantly in the post-COVID-19 period (Bakır et al., 2022). Similarly, Ma et al., (2022) discovered that passengers with positive perceptions of cleanliness of airports had a higher degree of satisfaction and might be more willing to travel by air in the future. Additionally, the pandemic has influenced travellers' decision-making processes, with health considerations playing a more prominent role in choosing transportation modes during and after the pandemic (Mancinelli et al., 2022). Airports have faced challenges in adapting to the new travel landscape. Research has highlighted the importance of understanding passenger satisfaction and user experience at airports, especially in the context of the COVID-19 pandemic (Tuchen et al., 2020). Chen et al., (2022) identified business travellers' preferences during the COVID-19 pandemic across different regions. They discovered that heterogeneity among travellers is consistent with the different pandemic control policies across regions. As an example, passengers in mainland China and Hong Kong were much more supportive to health control measures and to replace business travel with online meetings.

2.3. Air transport service quality: Heterogeneity among air passengers

Service quality does not depend solely on the several factors characterizing the service, but also on the heterogeneity that exists between different types of users. On the whole, the perception of quality can be affected by different kinds of variables. A first category refers to passengers' demographic and psychographic characteristics, such as age, gender, nationality, travel purpose, and past travel. Also, passengers' perceptions of an airline's brand image can affect the perception of service quality, as well as passengers' cultural differences. Finally, the perception of the overall quality is affected by the various service quality dimensions; in fact, passengers may place different levels of importance on different service quality dimensions, such as reliability, responsiveness, empathy, assurance, and tangibles, leading to heterogeneity in the perception of airport service quality.

According to Andreassen (1994), customer satisfaction is influenced by expectations and perceived service quality, which can vary widely based on individual preferences and experiences. Chee et al. (2020) found that user perceptions of service quality attributes can affect their willingness-to-pay for automated vehicle services. Feitosa et al., (2016) analysed the perception of users of a physical activity program in Brazil and found that their satisfaction with the provision of services and perception of changes linked to quality of life varied based on individual experiences.

In the transportation field, de Oña et al. (2015) investigated heterogeneity in perceptions of service quality among groups of railway passengers. The study found that different groups of passengers had different perceptions of service quality, with business travellers placing more importance on reliability and punctuality, while leisure travellers placed more importance on comfort and cleanliness.

Overall, research suggests that heterogeneity in user perception of the quality of service is a complex and multifaceted issue that requires a nuanced understanding of individual preferences and experiences. Different groups of users may have different priorities and expectations, and service providers need to take these differences into account when designing and delivering services. In the field of air transport, there are also some attempts to investigate how different categories of passengers perceive service quality. The differentiation among users can concern many features such as socio-economic characteristics, or travel habits and attitudes. There are not many studies introducing this kind of variables for exploring heterogeneity. As an example, Adler et al. (2005) proposed models including the effects on itinerary choices of airline, airport, aircraft type, fare, access time, flight time, scheduled arrival time, and on-time performance. The empirical results demonstrate the importance of explicitly accounting for traveller preference heterogeneities by using segmentation by trip purpose, interaction effects involving frequent flier status, and random parameter specifications. Also the study by Coldren and Koppelman (2005) represents an important contribution to the literature by proposing estimate aggregate

hybrid ordered generalized extreme value (OGEV) models to capture inter-itinerary competition. A limitation of the studies by Adler et al. (2005) and Coldren and Koppelman (2005) study is that they did not incorporate the full effects of demographics and trip characteristics on the sensitivity to service attributes (e.g. gender, income, employment, group travel, frequency of travel). One of the first attempts of explicitly introducing this kind of variables was proposed by Warburg et al. (2006), who calibrated logit models of itinerary choice for business travel. They verified that a simple multinomial logit model with comprehensive consideration of demographic/trip interactions provides as good a fit as a mixed multinomial logit model without demographic/trip interactions. Successively, Espino et al. (2008) introduced two socio-economic variables in mixed logit models calibrated on the basis of SP data: trip motive and fare class. Marcucci and Gatta, (2011) also proposed the use of SP data for estimating the importance of different attributes that determine origin airport choice, and in another work they investigated the heterogeneity of users in airport choice analysis (Marcucci and Gatta, 2012). The same authors discovered a negative impact of parking charges on airport choice probability (Evangelinos et al., 2021). Wen and Lai (2010) proposed a latent class model with travellers' demographic and trip characteristics in the segment membership, which allowed for distinguishing segments in terms of service attributes of airlines and for testing the impact of socioeconomic and trip variables on segment membership.

A series of studies focused on passengers' characteristics linked to the habit of travelling, such as paying the ticket or ~~a~~ belonging to a Frequent Flyer Program (FFP), as the study proposed by Martín et al. (2011). Curtis et al. (2012) found that familiarity with airline service quality could breed contempt. The study suggests that airline users who frequently travel may have higher expectations for in-flight service quality and may be more critical of any shortcomings. Wen et al. (2014) introduced the frequent flyer membership variable in a factor-analytic specification incorporated into the generalized nested logit model to gain insights into passenger service perceptions through positioning analysis of closely competing airlines.

Our proposal has elements of innovation as regards the above-mentioned papers. More specifically, the less recent studies introducing passengers' characteristics based the analysis on traditional service characteristics such as times and costs, as Warburg et al. (2006) who introduced in the analysis attributes such as fare, flight time, on time performance and access time, among others. Our studies, instead, propose the interaction of passengers' characteristics with more qualitative service aspects, such as comfort on board in terms of seat or temperature, cleanliness, courtesy on cabin crew, in addition to the peculiar characteristics of the service as times and costs. On the other hand, Espino et al. (2008) introduced some qualitative attributes such as comfort and quality of food, but they investigated only trip features rather than passengers' characteristics (i.e. trip purpose and the class on board). Finally, the study by Wen and Lai (2010) has a certain similarity to our study in terms of kind of attributes introduced in the stated choice experiment and variables introduced in the model. In fact, they also introduced service quality attributes like comfort of seats or cabin crew service and socio-economic characteristics such as income, gender, age. Anyway, their scope of introducing passengers' features was to discover latent groups of passengers characterized by similar perceptions of the various service aspects, while our scope is verifying how passengers' perceptions about service quality attributes vary as regards specific passengers' characteristics.

3. Method and materials

3.1. Sample survey

A sample survey was conducted to the students and workers of the University of Calabria, a university campus placed in the south of Italy, near the city of Cosenza, in the Calabria region. The Calabria region is served by three airports, but only one is international: the Lamezia Terme International Airport. Its position is strategic because, being in the middle of Calabria, it corresponds to a point of convergence of traffic for important cities of the region (Catanzaro, Vibo Valentia and Cosenza). It is connected to the main Calabrian cities by road links and railway. The university campus is attended by students and workers of the whole Calabria region, so the sample could be considered as representative of the entire Calabrian population. A limited number of students and workers reside in different regions, yet live in the area where the university is located and travel by air using Lamezia Terme airport. We decided to propose the survey to the University students and workers because of the opportunity to reach the whole population thanks to the availability of the institutional email address. Specifically, the data were collected through online surveys in a period ranging from March to July 2019. We contacted about 29,000 people among students, professors, researchers, administrative and technical staff, in the respect of the ethics guidelines of the University of Calabria to guarantee protection of anonymity and confidentiality. They were requested to complete a questionnaire about their last trip by air anonymously. The first part of the questionnaire collects passengers' opinions about the services relating to the flight described by the respondent. Specifically, users are requested to evaluate the overall

Table 1
Frequency distributions of the sample's socio-economic characteristics and travel habits.

Passenger's socio-economic characteristics	
Gender	male (60.0 %), female (38.7 %), no response (1.3 %)
Age (years)	18–25 (60.2 %), 26–30 (17.5 %), 31–40 (6.7 %), 41–50 (7.2 %), 51–60 (6.0 %), >65 (2.5 %)
Occupation	technical and administrative staff (8.8 %), professors and researchers (10.8 %), students (80.4 %)
Monthly income (Euros)	< 1,000€ (17.0 %), 1,000€-2,000€ (35.2 %), 2,000€-3,000€ (16.5 %), 3,000€-5,000€ (13.2 %), > 5,000€ (18.1 %)
Education level	lower-secondary (3 %), upper-secondary (54.2 %), degree (21.9 %), master degree (11.6 %), PhD (9.2 %)
Travel purpose	work (10.4 %), study (10.1 %), health care (4.0 %), visiting to relative and friends (27.0 %), holiday (40.3 %), participating at events (6.9 %), other (1.3 %)

experience, and the various service aspects regarding their experience during, before, and after the flight according to a verbal and a numerical scale. In the second part of the questionnaire, users answered an SP experiment, described in the following section. A total of 1,907 users completed the questionnaire. Table 1 shows the main socio-economic characteristics and travel habits of the sample. More than 60 % of respondents are between 18 and 25 years old, followed by people between 26 and 30 years old (17.5 %). More than a half of the sample has the upper-secondary education, more than 20 % a degree, and about 20 % a master degree or a PhD. Indeed, as regards the occupation, the major part of the sample is composed of students (80.4 %), followed by professors and researchers (10.8 %), and then by technical and administrative staff (8.8 %). As regards the monthly income, the highest percentage is registered for the income between 1,000 € and 2,000 €, while the other income classes show similar percentages.

Regarding travel purpose, 40 % of users travel for holiday, about 20 % for work or study, 27 % for visiting relative or friends, and the rest for other purposes. 40 % of respondents travel through a direct flight, and almost 80 % by low-cost airlines. Finally, the interviewees referred mainly to flights that originated and had destination within the Italian national territory, in fact 69.1 % are short-haul flights (duration less than 2 h), 25.6 % are medium-haul flights (duration between 2 and 6 h), and the remaining 5.3 % are long-haul flights (duration more than 6 h).

3.2. SP experiment

The main part of the questionnaire consisted of the proposal of SP choice exercises. In addition, information regarding the trip and the personal characteristics of the passengers was included.

The methodological approach adopted for investigating passengers' perceptions about the various aspects characterizing air transport service and differences in users' perceptions is based on the use of SP. To study heterogeneities in passengers' perceptions of airlines' services considering systematic and random variations in users' tastes, an efficient design of an SP survey is carried out, where attributes related to the in-flight travel and to the passenger's experience before and after the flight are considered.

SP surveys have been used in the transportation field to understand individuals' preferences for non-market goods and services (Louviere et al., 2000; Rose and Bliemer, 2009). These surveys have been used to evaluate airline passenger preferences and priorities for airline services (Whitaker et al., 2005; Rose et al., 2005).

To identify the attributes to be included in the SP experiment, an extensive review of the state of the art was carried out, and focus groups and surveys were conducted with experts in the field. The selection of the attributes and the evaluation scales started from a deep study of the literature and the analysis of the airline questionnaires. The levels of variation of the attributes have been chosen for proposing to the interviewees as realistic as possible choice alternatives. After choosing the attributes and their levels of variation, a panel of experts was contacted to collect suggestions. Specifically, we decided to send the draft of the questionnaire to a panel of experts, to collect suggestions and impressions from people specialized in the research field object of study. The panel was composed of 30 experts including academics, researchers and employees in transport companies. In general, the feedback from the panel of experts was positive. After the refinement of the questionnaire based on the comments received from the panel of experts, a pilot survey was launched: a sample of 41 passengers was contacted by e-mail to fill out the questionnaire (Bellizzi et al., 2020c). The final questionnaire was transcribed in "Google Forms". The questions were grouped into two macro-groups: before and after the flight; during the flight. The questions could refer to long-haul flights (if the duration was greater than 6 h), medium-haul flights (if the duration was between 2 and 6 h) or short-haul flights (if the duration was less than 2 h).

The attributes reported in Table 2 were identified for the phases before and after the flight that reflect the service at the terminal.

The in-flight travel attributes are shown in Table 3.

To combine the various attributes and levels an efficient design was effected. Table 2 and 3 identify the levels chosen for the efficient design (Hensher et al., 2015; Rose and Bliemer, 2009) of the SP survey (Louviere et al., 2000; Rose and Bliemer, 2009). Survey efficient design is an important aspect of survey research that aims to balance statistical efficiency and respondent burden to minimize the overall error in the survey responses (Johnson et al., 2010). Efficient survey design can help to reduce the cost of data collection and improve the precision of survey estimates (Smith and Lundy, 2011). Researchers usually employ orthogonal arrays or D-optimal designs with little or no attribute overlap in stated choice surveys. However, simplifying the choice task by using a design with more overlap can provide advantages over standard minimum-overlap methods.

In Fig. 1, we show two examples of cards, as a result of the SP survey. The first one refers to a short-haul flight and contains before and after the flight attributes (Fig. 1a); the second one concerns a medium-haul flight and focuses on in-flight travel attributes.

To respondents who travelled more than six months before the interview, 24 choice experiments were proposed (12 choice experiments "before and after the flight" and 12 choice experiments "during the flight"). We considered that they had travelled by plane

Table 2
Before and after the flight attributes.

Attribute	Levels
Waiting time at check-in (min)	0 (online check-in); 5; 20
Time spent for boarding operations (min)	15; 60; 120
Terminal-aircraft transfer mode	on foot; jet bridge; shuttle bus
Delay of flight departure (min)	0; 20; 60
Time spent for luggage delivery (min)	0 (no luggage to claim); 10; 30
Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

Table 3
In-flight travel attributes.

Attribute	Levels
Available space on board	less than enough; enough; more than enough
Temperature on board	too warm; adequate; too cold
Cleanliness on board	clean enough; quite dirty
Courtesy of cabin crew	kind enough; quite rude
Services on board	not fully adequate; adequate; fully adequate
Cost of the ticket (€)	20; 60; 180; 360; 720; 1440

	A	B
	O	O
Waiting time at check-in	20 minutes	5 minutes
Time spent for boarding operations	20 minutes	40 minutes
Terminal-aircraft transfer mode	on foot	jet bridge
Delay of flight departure	0 minutes	60 minutes
Time spent for luggage delivery	0 minutes (no luggage)	30 minutes
Cost of the ticket	60 €	20 €

(a)

	A	B
	O	O
Space available on board	more than enough	Enough
Temperature on board	Adequate	too cold
Cleanliness on board	clean enough	quite dirty
Courtesy of cabin crew	quite rude	kind enough
Services on board	Adequate	fully adequate
Cost of the ticket (€)	180 €	180 €

(b)

Fig. 1. Examples of the SP choice experiments containing before and after the flight attributes (a) and in-flight attributes (b).

more than six months before participating in the survey and they would not have a vivid memory of the experience for providing their opinions about the various attributes characterizing the service. Therefore, they did not answer the first part of the questionnaire, and they had the time to complete 24 choice experiments. On the other hand, to the passengers who had made a trip by plane no more than six months before participating in the survey, we decided to submit the entire questionnaire consisting of: the first part including the evaluation of the various service attributes concerning the flight, and the SP with only 8 choice experiments (4 choice experiments "before and after the flight" and 4 choice experiments "during the flight"), where each block of 8 experiments was randomly selected. The experiments are mixed between the various types of flight (long-haul flights, medium-haul flights or short-haul flights).

3.3. Models

In this paper, we estimate an MNL-VT and an RPL-VT. The RPL-VT model is obtained from the MNL-VT model assuming that some of the parameters considered in the MNL-VT model follow a probability distribution with a given mean and standard deviation. The distribution of such random parameters is considered continuous in the sampled population (Coppola et al., 2021). For an RPL-VT model the utility function can be written as follows:

$$V_{nsj} = \beta_n' x_{nsj}$$

where:

$$\beta_n = \beta + \Delta z_n + \Gamma v_n$$

where x_{nsj} represents the generic attribute of alternative j in choice situation s for individual n, z_n is the characteristic of the individual that influences the mean of the user's taste parameter and v_n is the random variable with mean 0, unit variance and zero covariance.

In other words, Δz_n represents the observed heterogeneity among user tastes and Γv_n the unobserved one. β, Δ and Γ are the parameters to be estimated, being β the constants, Δ the parameters associated to the variables considered and Γ the non-zero elements of the lower triangular Cholesky matrix.

In the model presented below, in order to explain part of the unobserved heterogeneity, interactions of the variables considered with the main socioeconomic variables are introduced.

These models consist of comparing the unlabelled alternatives A and B of the different scenarios posed to the respondents as shown in Fig. 1. The utility functions associated with options A and B include the variables listed in Table 4, and their associated parameters can be fixed or follow a probability distribution. The variables were deducted from the attributes identified for designing the SP experiment (reported in Tables 1 and 2), and the value of each variable is derived from the levels associated to each attribute.

It is assumed that the perception of the variables having levels expressed in a unit of measure such as "Waiting time at check-in", "Time spent for boarding operations", "Delay of flight departure", "Time spent for luggage delivery" and "Cost of the ticket" follows a normal distribution in the population; on the other hand, the rest of the variables (associated to dummy variables) follow a uniform distribution in the population.

To consider systematic variations in tastes, the interaction variables reported in Table 5 were introduced.

As we can observe from Table 5, socio-economic variables such as age, gender, income, country, professional condition have been considered, together with travel habits such as frequency of travelling.

It should be emphasized that the RPL-VT model considers panel effects in the responses repeated by the same respondents, and this improves the prediction of the model because it allows considering the correlation between the responses of the same users.

4. Results and discussion

Table 6 shows the results of the two proposed models. A first consideration is that the MNL-VT tends to underestimate the weight of the parameters in absolute value as regards the RPL-VT model. In fact, all the parameters estimated in the RPL-VT model are equal to or larger in absolute value than the MNL-VT parameters.

Considering the RPL-VT model, if we focus on the variables that are measured using the same unit of measurement such as time in minutes, we can compare the parameters associated with "Waiting time at check-in", "Time spent for boarding operations", "Delay of flight departure" and "Time spent for luggage delivery" variables. Specifically, it is observed that "Waiting time at check-in" weighs more than "Time spent for luggage delivery", which in turn weighs more than "Time spent for boarding operations" and "Delay of flight departure". This indicates that the initial and final phases of the trip when the traveller checks in or picks up the suitcase are the phases in which it is most important trying to improve the service if we want to obtain an improvement in the quality perceived by the users. Possible delays in aircraft departure or boarding time have a much lower impact, but they are also important to be considered. Although "Time spent for boarding operations" is statistically significant, it has a much lower weight than other variables measured with the same unit, such as the waiting time at check-in.

Apart from the cost of the airline ticket, which clearly has a negative effect, and it is very statistically significant as we expected, the other considered variables are dummy variables whose weight/effect we can broadly compare. Among these, the four variables that are valued most negatively are: "Terminal-aircraft transfer mode (on foot)" rather than using the jet bridge or the shuttle bus, and "Available space on board (less than enough)", which are characteristics of low-cost flights; "Temperature on board (too cold)";

Table 4
Model variables: service quality attributes.

Variable	Unit of measure	Values
Waiting time at check-in	Minutes	0; 5; 20
Time spent for boarding operations	Minutes	15; 60; 120
Terminal-aircraft transfer mode (on foot)	–	1 (yes); 0 (no)
Terminal-aircraft transfer mode (shuttle bus)	–	1 (yes); 0 (no)
Delay of flight departure	Minutes	0; 20; 60
Time spent for luggage delivery	Minutes	0; 10; 30
Available space on board (more than enough)	–	1 (yes); 0 (no)
Available space on board (less than enough)	–	1 (yes); 0 (no)
Temperature on board (too cold)	–	1 (yes); 0 (no)
Temperature on board (too warm)	–	1 (yes); 0 (no)
Cleanliness on board	–	1(clean enough); 0(quite dirty)
Courtesy of cabin crew	–	1(kind enough); 0(quite rude)
Services on board (fully adequate quality)	–	1 (yes); 0 (no)
Services on board (adequate quality)	–	1 (yes); 0 (no)
Cost of the ticket	Euros	20; 60; 180; 360; 720; 1440

Table 5
Model variables: passengers' characteristics (interaction variables).

Variable	Assumed values
Age	Age18-25 = 1 if 18<=Age < 25, 0 otherwise; Age26-30 = 1 if 26<=Age < 30, 0 otherwise; Age31-40 = 1 if 31<=Age < 40, 0 otherwise; Age41-50 = 1 if 41<=Age < 50, 0 otherwise; Age51-60 = 1 if 51<=Age < 60, 0 otherwise; Age61 = 1 if Age > 60, 0 otherwise
Gender	Male = 1 if Male, 0 otherwise; Female = 1 if Female, 0 otherwise; NoGender = 1 if Not classified, 0 otherwise
Country	Italy = 1 if country is Italy, 0 otherwise; NoItalyCountry = 1 if country is outside Italy, 0 otherwise; NoCountry = 1 if there isn't answer, 0 otherwise
Region	Calabria = 1 if region is Calabria, 0 otherwise; NoCalabriaRegion = 1 if region is other region of Italy, 0 otherwise; NoItalyRegion = 1 if region is outside Italy, 0 otherwise; NoRegion = 1 if there is not answer, 0 otherwise
Province	Catanzaro = 1 if province is Catanzaro, 0 otherwise; Cosenza = 1 if province is Cosenza, 0 otherwise; Crotone = 1 if province is Crotone, 0 otherwise; ReggioCalabria = 1 if province is Reggio Calabria, 0 otherwise; ViboValentia = 1 if province is Vibo Valentia, 0 otherwise; NoCalabriaProvince = 1 if province is in other region of Italy, 0 otherwise; NoItalyProvince = 1 if province is outside Italy, 0 otherwise; NoProvince = 1 if there is nott answer, 0 otherwise
Study	SecShool1 = 1 if the qualification is 1st degree secondary school, 0 otherwise; SecShool2 = 1 if the qualification is 2nd degree secondary school, 0 otherwise; Bachelor = 1 if the qualification is Bachelor's degree, 0 otherwise; Master = 1 if the qualification is 2nd level degree, 0 otherwise; PhD = 1 if the qualification is PhD, 0 otherwise
Profession	Profession1 = 1 if the profession is Manager/officer, Technical staff, Administrative staff, Contract staff, Professor of I or II band, Researcher, 0 otherwise; Profession2 = 1 if the profession is Adjunct Professor, Research Fellow, PhD Student, Worker Student, Collaborator and Language Interpreter, Unemployed, Other, 0 otherwise; Student = 1 if the profession is Student, 0 otherwise
Income	Income1000€ = 1 if Income < 1000€, 0 otherwise; Income 2000€ = 1 if 1000€<= Income < 2000€, 0 otherwise; Income 3000€ = 1 if 2000€<= Income < 3000€, 0 otherwise; Income 5000€ = 1 if 3000€<= Income < 5000€, 0 otherwise; Income + 5000€ = 1 if Income > 5000€, 0 otherwise
Frequency	FrequencyWeek = 1 if travel frequency is several times a week, 0 otherwise; FrequencyMonth = 1 if travel frequency is several times a month, 0 otherwise; FrequencyYear = 1 if travel frequency is several times a year, 0 otherwise; Frequency1Year = 1 if travel frequency is at least once a year, 0 otherwise; FrequencyRarely = 1 if travel frequency is sporadically, 0 otherwise

Table 6
Model results.

Variables		MNL-VT		RPL-VT				
Principal effects	Interacting variable	Parameter	z	Parameter	z	P>|z|	95 % Confidence Interval	
Waiting time at check-in	–	−0.234***	−14.81	−0.233***	−13.84	0.0000	−0.2661	−0.2001
N Waiting time at check-in				0.035***	6.76	0.0000	0.0248	0.0451
Waiting time at check-in	Age18-25	−0.017***	−3.89	−0.020***	−3.81	0.0001	−0.0308	−0.0099
Waiting time at check-in	Age31-40	−0.025***	−2.94	−0.026***	−2.58	0.0097	−0.0460	−0.0063
Waiting time at check-in	Frequency1Year	−0.237***	−3.46	−0.232***	−3.08	0.0020	−0.3799	−0.0846
Delay of flight departure	–	−0.017***	−3.56	−0.019***	−3.20	0.0014	−0.0305	−0.0073
N Delay of flight departure				0.009***	8.28	0.0000	0.0072	0.0116
Delay of flight departure	Income1000€	0.003***	2.89	0.005***	3.01	0.0026	0.0016	0.0077
Delay of flight departure	Italy	−0.014***	−2.77	−0.017***	−2.87	0.0041	−0.0285	−0.0054
Cost of the ticket	–	−0.006***	−47.06	−0.008***	−33.65	0.0000	−0.0088	−0.0078
N Cost of the ticket				0.006***	22.67	0.0000	0.0053	0.0063
Terminal-aircraft transfer mode (on foot)	–	−1.541***	−25.88	−1.600***	−22.83	0.0000	−1.7354	−1.4610
U Terminal-aircraft transfer mode (on foot)				0.610***	4.56	0.0000	0.3480	0.8721
Terminal-aircraft transfer mode (on foot)	Female	−0.114**	−2.20	−0.135**	−2.10	0.0358	−0.2610	−0.0090
Available space on board (less than enough)	–	−0.975***	−36.87	−1.438***	−31.34	0.0000	−1.5274	−1.3476
U Available space on board (less than enough)				1.033***	11.00	0.0000	0.8493	1.2174
Temperature on board (too cold)	–	−0.999***	−36.46	−1.245***	−32.29	0.0000	−1.3209	−1.1697
U Temperature on board (too cold)				1.048***	12.38	0.0000	0.8819	1.2136
Temperature on board (too warm)	–	−1.320***	−45.25	−1.741***	−37.09	0.0000	−1.8334	−1.6493
U Temperature on board (too warm)				1.212***	13.63	0.0000	1.0376	1.3860
Cleanliness on board	–	1.668***	22.88	2.206***	14.36	0.0000	1.9046	2.5065
U Cleanliness on board				1.936***	6.63	0.0000	1.3633	2.5078
Cleanliness on board	Female	0.440***	6.90	0.647***	4.30	0.0000	0.3520	0.9426
Courtesy of cabin crew	–	0.386***	16.77	0.602***	17.66	0.0000	0.5351	0.6686
U Courtesy of cabin crew				0.844***	13.18	0.0000	0.7188	0.9698
Courtesy of cabin crew	Male	−0.084**	−2.32	−0.110**	−2.14	0.0322	−0.2103	−0.0093
Time spent for boarding operations	–	−0.041***	−33.31	−0.044***	−31.71	0.0000	−0.0468	−0.0414
Time spent for luggage delivery	–	−0.123***	−14.88	−0.122***	−13.94	0.0000	−0.1388	−0.1045
Time spent for luggage delivery	Frequency1Year	−0.117***	−3.06	−0.113***	−2.74	0.0062	−0.1938	−0.0321
Services on board (fully adequate quality)		0.565***	19.28	0.868***	20.94	0.0000	0.7864	0.9488
Services on board (fully adequate quality)	Catanzaro	0.153***	2.69	0.245***	3.29	0.0010	0.0989	0.3909
Services on board (fully adequate quality)	Student	−0.226***	−8.17	−0.273***	−8.25	0.0000	−0.3373	−0.2079
N° Observation		30,696		30,696				
Log likelihood function		−16591.43		−15967.75				
AIC/N		1083		1042				

***. **. * ==> Significance at 1 %, 5 %, 10 % level.
U = Uniform Distribution. N = Normal Distribution.

"Temperature on board (too warm)". It should be noted that feeling warm in the airplane is perceived almost 50 % more negatively than feeling cold, which clearly explains why on long-haul trips a tendency to maintain a low temperature is maintained and blankets are provided to travellers.

Among the variables that have a positive impact on the quality perceived by users, there are "Cleanliness on board", "Courtesy of cabin crew", and "Services on board (fully adequate quality)". Among them, the variable linked to cleanliness is the most important, followed by the variable relating to offered services and finally the courtesy of the cabin crew.

If we focus now on the systematic variations in tastes, we can draw some interesting considerations. We initially considered as interaction variables all the socio-economic characteristics, although only the following variables were found to be significant: "Age18-25"; "Age31-40"; "Frequency1Year"; "Income1000€"; "Italy" (meaning that the passenger is from Italy); "Female"; "Male"; "Catanzaro" (meaning that the passenger is from the regional capital); "Student". Looking at the variable linked to waiting time at check-in, we can see that its perception worsens for young users, aged between 18 and 25 and between 31 and 40 years old; we can also observe that users who travel less frequently tend to perceive the waiting time at check-in in a much more negative way. Less frequent users also highly penalize the baggage retrieval time. In both cases, for waiting time at check-in and time spent for luggage delivery, the penalization by less frequent users can double the weight of the parameter. This result is in line with the findings of the study by Warburg et al. (2006), according to which frequent travellers are more time-patient, less likely to be influenced by on-time performance, and more tolerant to connections than occasional travellers and travellers who do not check bags.

In relation to the variable linked to delay of flight, it is observed that low-income users perceive delays less negatively, but Italian users almost double the negative weight given to this variable.

Accessing from the terminal to the aircraft on foot, without using jet bridge or shuttle bus, is perceived more negatively if the accessing user is a woman.

Also cleanliness on board is considered more by women. This service aspect, together with the temperature on board, is the most valued by users in general. On the other hand, men give less importance than women to the courtesy of the cabin crew. Generally, women are more sensitive to more qualitative service aspects. On the contrary, men are more sensitive to fares, as found by Warburg et al. (2006).

The services on board have a more important weight for users from a specific geographical area (the province of Catanzaro) compared to the rest of the users; however, it has a higher weight for students.

If we consider the random variations, we can observe, as specified above, that the attributes linked to waiting time at check-in, delay of flight, and cost follow a normal distribution in the population. The standard deviation of the variable "Waiting time at check-in" is much larger than "Delay of flight departure", meaning that the perception of delay has much less dispersion in the population than the perception of waiting time at check-in. The rest of the parameters (associated to dummy variables) follow a uniform distribution in the population. The variable linked to cleanliness on board is the one with more dispersion in the population. This leads us to state that despite being the variable with the most relevant weight, its perception in the population is very variable, although on average it is very high. Other parameters with high dispersion are other qualitative variables, like cleanliness on board, and specifically the variables associated with the perception of temperature on board. Temperature on board (too warm) has more dispersion than Temperature on board (too cold), as expected.

The use of the normal or uniform distribution for certain parameters allows to associate random variations in user perceptions that may vary depending on the user. Furthermore, the use of such distributions entails the possibility that these parameters may have different signs for some users than expected, leading to incorrect predictions. Therefore, when using such distributions, it is important to carefully analyse the signs of the parameters to avoid incorrect signs of individual parameters for certain users (Hess et al., 2005). As suggested by Train (Train, 2009), we have attempted to calibrate the model by using a lognormal distribution for the attributes expressing times and cost, but the model did not provide successful results.

Due to the fact that we finally use the Normal distribution for time and cost, the percent coefficient distribution using z score was calculated (Train, 2009). For the attribute "waiting time at check-in", we obtained a percentage of 0 % of users for whom a decrease of waiting time would decrease the utility (confirming our expectations); on the other hand, a very low percentage of users (only 2 %) consider an increase of the delay at departure as a factor increasing the utility; finally, for 9 % of users monetary cost is an attribute increasing the utility. We retain that while the attributes expressed in terms of time are perceived as expected, the 9 % obtained for the monetary cost could suggest that for few people a flight with a high cost could be considered as a more convenient flight in terms of better services.

Furthermore, for a more careful analysis, all data that were above the 99th percentile and below the 1st percentile were removed to avoid including outliers in the subsequent analysis of willingness to pay.

It is important to specify that several models were estimated before arriving at the final model, using also the triangular and the log-normal distribution without obtaining better results.

5. Willingness to pay

For a better understanding of the phenomenon, the Willingness To Pay (WTP) has been estimated for some variables considered in the study, and specifically the variables expressed in terms of minutes (non-dummy variables): "Waiting Time at Check-in", "Delay of Flight Departure", "Time Spent for Boarding Operation", and "Time Spent for Luggage Delivery".

To calculate the WTP, the individual parameters were estimated from the probability distribution of each parameter. In order to mitigate the impact of extreme values on the analysis, a data truncation process was carried out. This process involved the removal of values above the 99th percentile and below the 1st percentile. In this way, the upper and lower extreme values were excluded, allowing

for a more robust analysis that is less susceptible to distortion caused by these outliers. After this process, approximately 100 observations were removed leaving 3,704 observations for estimation.

Table 7 shows the results of the WTP calculation, and Fig. 2 represents the variability of these values using a box and whisker plot. It displays the data quartiles (or percentiles) and averages values. The blue part represents the WTP values between the 25th and 75th sample percentile of the values and the line between these two values is the median.

The blue part represents the WTP values between the 25th and 75th sample percentile of the sample values, and the line between these two values is the median.

Analysing these results, more conclusions can be drawn from a simple analysis of the model results. Firstly, we can say that WTP of "Waiting Time at Check-in" and "Time Spent for Luggage Delivery", which represent the initial and final phases of the journey, are the two WTPs with the highest and most variable values (with more dispersion in the sample). This confirms that airlines must try to improve service times just in these phases of the journey, to improve customer satisfaction. The WTP for "Waiting Time at Check-in" has higher and more variable values compared to the WTP for "Time Spent for Luggage Delivery", although the most frequent values in the sample (median) are below the mean values in all four cases presented. This means that, although most of the values are concentrated around the median, the WTP is significantly higher for some specific users, and this makes the mean WTP value in all cases above the median. We can also conclude that the initial phase of the journey is much more important for users than the final part, since in the initial phase of the journey they are willing to pay more to reduce the "Waiting Time at Check-in". The intermediate phases of the journey are confirmed as less important for most of the users and WTPs in general have a much lower variability. It is found that users attach more importance to saving time for the Boarding Operation than to delays in Flight Departure.

As Bliemer and Rose (2013) comment, drawing different values for each distribution of the coefficients and computing the ratio, as in the previous case, does not take into account the uncertainty of the parameters (Hess et al., 2005). For this reason they advise to consider the Krinsky and Robb method (Krinsky and Robb, 1990, 1986) or the Delta method (Oehlert, 1992). In our case we have applied the Delta Method (Table 8) in order to compare the results. It can be seen that the average values obtained by applying this method are 20 % lower than those calculated with the previous method. The same observations we have made about the results of Table 7 apply to the values calculated with the Delta Method, although in the latter case it can be seen how the calculated values are more stable (see the standard deviation (SE) and the confidence intervals in Table 8) and it is also possible to assess the statistical significance of the different estimated WTPs.

6. Conclusions

In this paper, discrete choice models were proposed for determining the service aspects mostly influencing air passengers' preferences, and for investigating the heterogeneity among passengers as regards the perceptions about the various service aspects. The proposed approach can be useful for determining passengers' preferences for airlines and market segments for air travel.

The applicability of the proposed models was empirically based on data collected by a survey addressed to the workers and students at a university campus. More specifically, an SP experiment including service quality attributes relating to the phases before and after the flight (e.g. times for check-in, for boarding, for luggage delivery) and during the flight (e.g. cleanliness and comfort on board) have been used to evaluate airline services.

The calibrated models provided interesting results both in terms of weights derived for each service aspect and of interaction between the various service aspects with the passengers' characteristics.

Specifically, we discovered that the interactions were found to be significant in the model, and that the introduction of random parameters was successful. This suggests that considering a model with random parameters has been a wise decision, because it allows providing additional information that an MNL model is not able to provide.

The RPL-VT model gives information on the dispersion of the perception of the parameters in the population. It shows that users' opinions about service aspects linked to cleanliness on board, waiting time at check-in, and temperature on board are highly dispersed in the population, and their dispersion is of the order of magnitude of the mean value.

A very important conclusion is that users value significantly the time lost in the initial and final phases of the trip, but less the time that can be lost in the intermediate phases of the trip. This finding is also observable in terms of WTP, as we shown in the previous section. In fact, the WTPs linked to the waiting time at check-in and the time spent for luggage delivery are the highest and mostly variable in the sample. This conclusion provides useful indications on possible interventions for improving service quality. As an example, passengers are willing to pay 6 times more a reduction of check-in times and 3 times more of baggage retrieval times as regards a reduction of delays in aircraft departure or boarding operations. This fact could be interpreted considering that users perceive as more important the times lost during the phases more distant to the flight, as the time lost for luggage delivery, which is the last phase of the journey when passengers are probably more tired. This means that airlines should invest more in reducing the times of the initial and final phases of the journey than the intermediate phases. Another important consideration is that aircraft cleanliness is one of the most highly rated aspects. It is clearly difficult to conclude that it can affect the intention to fly, but on busy routes, it could influence users' choices.

The introduction of passengers' socio-economic characteristics and travel habits in the models revealed interesting evidence concerning differences in perceiving some service aspects among users. As an example, frequent passengers have a different perception of the attributes linked to the times spent for check-in or luggage delivery as regards less frequent passengers, who are less time-patient. On the other hand, women are more sensitive as regards more qualitative service aspects like cleanliness than men.

Air carriers can use these findings to improve their performance by targeting and positioning different segments to develop effective marketing and operational strategies toward airline passengers' preferences.

Table 7
Willingness to pay.

WTP (€/min)						
Variable	Mean	Deviation	Minimum	Maximum	Median	Cases
Waiting time at check-in	37.53	24.13	14.22	178.32	27.79	3,704
Delay of flight departure	5.23	3.40	0.90	22.43	3.84	3,704
Time spent for boarding operations	6.55	4.10	2.68	28.29	4.91	3,704
Time spent for luggage delivery	18.52	11.73	7.42	89.32	13.71	3,704

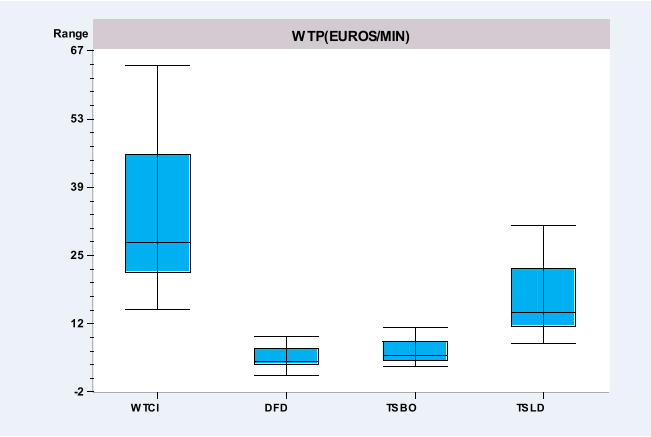

Fig. 2. WTP box and whisker plot.

Table 8
Willingness to pay calculated with Delta Method.

WTP (€/min)					
Variable	Mean	S.E.	z	Prob.	95 % Confidence Interval
Waiting time at check-in	30.1139***	1.99994	15.06	0.0000	26.1941–34.0337
Delay of flight departure	4.18457***	0.12379	33.80	0.0000	3.94194–4.42719
Time spent for boarding operations	5.29273***	0.20276	26.10	0.0000	4.89532–5.69013
Time spent for luggage delivery	14.7879***	1.06753	13.85	0.0000	12.6956–16.8802
N° Observation	30,696				

A conclusion is that despite the relevant results obtained in this study, there are several possibilities for further research on this topic. One could further investigate what accounts for the variability and dispersion in the perception of many of the random parameters considered to understand the problem more deeply, for example by considering whether the variability of these parameters is related to some latent factors.

Finally, one of the potential limitations of the work could be the sample, composed prevalently of students, who could represent a particular category of users, with certain preferences and tastes. According to this, a future development of the research could regard an extension of the survey to other groups of people, who could be reached for example through social networks.

CRediT authorship contribution statement

Luigi dell'Olio: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Laura Eboli:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Maria Pia Fotino:** Writing – original draft, Validation, Formal analysis, Data curation. **Gabriella Mazzulla:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Acknowledgment

The work was supported in part by: Grant PLEC2021-007824 funded by MICIU/AEI/10.13039/501100011033 and, by the European Union NextGenerationEU/PRTR.

References

Adler, T., Falzarano, C.S., Spitz, G., 2005. Modeling service trade-offs in air itinerary choices. https://doi.org/10.1177/0361198105191500103 1915, 20–26. doi: 10.1177/0361198105191500103.

Allen, J., Bellizzi, M.G., Eboli, L., Forciniti, C., Mazzulla, G., 2020. Service quality in a mid-sized air terminal: a SEM-MIMIC ordinal probit accounting for travel, sociodemographic, and user-type heterogeneity. J. Air Transp. Manag. 84, 101780. https://doi.org/10.1016/J.JAIRTRAMAN.2020.101780.

An, M., Noh, Y., 2009. Airline customer satisfaction and loyalty: impact of in-flight service quality. Serv. Bus. 3, 293–307. https://doi.org/10.1007/S11628-009-0068-4/FIGURES/3.

Andreassen, T.W., 1994. Satisfaction, loyalty and reputation as indicators of customer orientation in the public sector. Int. J. Public Sect. Manag. 7, 16–34. https://doi.org/10.1108/09513559410055206/FULL/XML.

Babbar, S., Koufteros, X., 2008. The human element in airline service quality: contact personnel and the customer. Int. J. Oper. Prod. Manag. 28, 804–830. https://doi.org/10.1108/01443570810895267/FULL/XML.

Bakır, M., Akan, S., Atalik, O., 2020. An evaluation for long-haul low-cost carriers using user-generated content. In: Handbook of Research on Social Media Applications for the Tourism and Hospitality Sector. IGI Global, Hershey, pp. 231–251. https://doi.org/10.4018/978-1-7998-1947-9.CH014.

Bakır, M., Akan, Ş., Özdemir, E., Nguyen, P.-H., Tsai, J., Pham, H.-A., 2022. How to achieve passenger satisfaction in the airport? Findings from regression analysis and necessary condition analysis approaches through online airport reviews. Sustainability. https://doi.org/10.3390/su14042151.

Bellizzi, M.G., dell'Olio, L., Eboli, L., Forciniti, C., Mazzulla, G., 2020a. Passengers' expectations on airlines' services: design of a stated preference survey and preliminary outcomes. Sustainability 12, 4707. https://doi.org/10.3390/su12114707.

Bellizzi, M.G., dell'Olio, L., Eboli, L., Mazzulla, G., 2020b. Heterogeneity in desired bus service quality from users' and potential users' perspective. Transp. Res. Part A Policy Pract. 132, 365–377. https://doi.org/10.1016/j.tra.2019.11.029.

Bellizzi, M.G., Eboli, L., Mazzulla, G., 2020c. An online survey for the quality assessment of airlines' services. Res. Transp. Bus. Manag. 37, 100515. https://doi.org/10.1016/J.RTBM.2020.100515.

Benedict, A.B., Emmanuel, G.A., 2021. Analysis of Cargo airline services quality in Cargo delivery In Nigeria. J. Econ. Manag. Trade 27, 37–47. https://doi.org/10.9734/JEMT/2021/V27I630350.

Bezerra, G.C.L., Gomes, C.F., 2016. Measuring airport service quality: a multidimensional approach. J. Air Transp. Manag. 53, 85–93. https://doi.org/10.1016/J.JAIRTRAMAN.2016.02.001.

Bliemer, M.C.J., Rose, J.M., 2013. Confidence intervals of willingness-to-pay for random coefficient logit models. Transp. Res. B Methodol. 58, 199–214. https://doi.org/10.1016/J.TRB.2013.09.010.

Chee, P.N.E., Susilo, Y.O., Wong, Y.D., Pernestål, A., 2020. Which factors affect willingness-to-pay for automated vehicle services? Evidence from public road deployment in Stockholm, Sweden. Eur. Transp. Res. Rev. 2020 (12), 1–17. https://doi.org/10.1186/S12544-020-00404-Y.

Chen, T., Fu, X., Hensher, D.A., Li, Z.C., Sze, N.N., 2022. Air travel choice, online meeting and passenger heterogeneity – An international study on travellers' preference during a pandemic. Transp. Res. Part A Policy Pract. 165, 439–453. https://doi.org/10.1016/J.TRA.2022.09.020.

Coldren, G.M., Koppelman, F.S., 2005. Modeling the competition among air-travel itinerary shares: GEV model development. Transp. Res. Part A Policy Pract. 39, 345–365. https://doi.org/10.1016/J.TRA.2004.12.001.

Coppola, P., Dell'Olio, L., Silvestri, F., 2021. Random-parameters behavioral models to investigate determinants of perceived safety in railway stations. J. Adv. Transp. 2021. https://doi.org/10.1155/2021/5530591.

Curtis, T., Rhoades, D.L., Jr., B.P.W., 2012a. Satisfaction with airline service quality: familiarity breeds contempt. Int. J. Aviat. Manag. 1, 242. doi: 10.1504/IJAM.2012.050472.

de Oña, J., de Oña, R., Eboli, L., Mazzulla, G., 2013. Perceived service quality in bus transit service: a structural equation approach. Transp. Policy (Oxf.) 29, 219–226. https://doi.org/10.1016/J.TRANPOL.2013.07.001.

de Oña, J., de Oña, R., Eboli, L., Mazzulla, G., 2015. Heterogeneity in perceptions of service quality among groups of railway passengers. https://doi.org/10.1080/15568318.2013.849318 9, 612–626. doi: 10.1080/15568318.2013.849318.

Dell'Olio, L., Ibeas, A., Cecin, P., 2011. The quality of service desired by public transport users. Transp. Policy (Oxf.) 18, 217–227. https://doi.org/10.1016/j.tranpol.2010.08.005.

Dell'Olio, L., Ibeas, Á., de Oña López, J., de Oña López, R., 2018. Public Transportation Quality of Service: Factors, Models, and Applications, 1st ed. Elsevier, Amsterdam, Oxford, Cambridge.

Eboli, L., Bellizzi, M.G., Mazzulla, G., 2022. A literature review of studies analysing air transport service quality from the passengers' point of view. Promet – Traffic Transp. 34, 253–269. https://doi.org/10.7307/PTT.V34I2.4020.

Espino, R., Martín, J.C., Román, C., 2008. Analyzing the effect of preference heterogeneity on willingness to pay for improving service quality in an airline choice context. Transp. Res. E Logist. Transp. Rev. 44, 593–606. https://doi.org/10.1016/J.TRE.2007.05.007.

Etemad-Sajadi, R., Bohrer, L., 2019. The impact of service recovery output/process on customer satisfaction and loyalty: the case of the airline industry. Tour. Hosp. Res. 19, 259–266. https://doi.org/10.1177/1467358417743080/ASSET/IMAGES/LARGE/10.1177_1467358417743080-FIG2.JPEG.

Evangelinos, C., Staub, N., Marcucci, E., Gatta, V., 2021. The impact of airport parking fees on the tourist's airport/airline choice behavior. J. Air Transp. Manag. 90, 101961. https://doi.org/10.1016/J.JAIRTRAMAN.2020.101961.

Feitosa, W., Guarda, F., Konrad, L., Goncalves, W., Martelli, P.J.de L., Júnior, J.L. do A.C. de A., 2016. Users' perception of actions, improvement in quality of life and satisfaction with the Academia da Cidade Program. Revista Brasileira De Atividade Física & Saúde 21. https://doi.org/10.12820/RBAFS.V.21N5P461-469.

Fodness, D., Murray, B., 2007. Passengers' expectations of airport service quality. J. Serv. Mark. 21, 492–506. https://doi.org/10.1108/08876040710824852/FULL/XML.

Han, H., Lee, K.S., Chua, B.L., Lee, S., Kim, W., 2019. Role of airline food quality, price reasonableness, image, satisfaction, and attachment in building re-flying intention. Int. J. Hosp. Manag. 80, 91–100. https://doi.org/10.1016/J.IJHM.2019.01.013.

Hensher, D.A., Rose, J.M., Greene, W.H., 2015. Applied Choice Analysis, Applied Choice Analysis. Cambridge University Press. doi: 10.1017/CBO9781316136232.

Hess, S., Bierlaire, M., Polak, J.W., 2005. Estimation of value of travel-time savings using mixed logit models. Transp. Res. Part A Policy Pract. 39, 221–236. https://doi.org/10.1016/J.TRA.2004.09.007.

Hutchinson, D., Bogicevic, V., Yang, W., Bilgihan, A., Bujisic, M., 2013. Airport service quality drivers of passenger satisfaction. Tour. Rev. 68, 3–18. https://doi.org/10.1108/TR-09-2013-0047/FULL/XML.

Johnson, F.R., Ozdemir, S., Phillips, K.A., 2010. Effects of simplifying choice tasks on estimates of taste heterogeneity in stated-choice surveys. Soc. Sci. Med. 70, 183–190. https://doi.org/10.1016/J.SOCSCIMED.2009.10.021.

Kim, M., Sohn, J., 2022. Passenger, airline, and policy responses to the COVID-19 crisis: the case of South Korea. J. Air Transp. Manag. https://doi.org/10.1016/j.jairtraman.2021.102144.

Kremser, F., Guenzkofer, F., Sedlmeier, C., Sabbah, O., Bengler, K., 2012. Aircraft seating comfort: the influence of seat pitch on passengers' well-being. Work 41, 4936–4942. https://doi.org/10.3233/WOR-2012-0789-4936.

Krinsky, I., Robb, A.L., 1986. On approximating the statistical properties of elasticities. Rev. Econ. Stat. 68, 715. https://doi.org/10.2307/1924536.

Krinsky, I., Robb, A.L., 1990. On approximating the statistical properties of elasticities: a correction. Rev. Econ. Stat. 72, 189. https://doi.org/10.2307/2109761.

Law, C., Law, C., 2017. The study of customer relationship management in Thai airline industry: a case of Thai travelers in Thailand. J. Airline Airp. Manag. 7, 13–42. https://doi.org/10.3926/jairm.86.

Louviere, J.J., Hensher, D.A., Swait, J.D., Adamowicz, W., 2000. Stated Choice Methods: Analysis and Applications, Stated Choice Methods. Cambridge University Press. doi: 10.1017/CBO9780511753831.

Lubbe, B., Douglas, A., Zambellis, J., 2011. An application of the airport service quality model in South Africa. J. Air Transp. Manag. 17, 224–227. https://doi.org/10.1016/J.JAIRTRAMAN.2010.08.001.

Ma, G., Ding, Y., Ma, J., 2022. The impact of airport physical environment on perceived safety and domestic travel intention of Chinese passengers during the COVID-19 pandemic: the mediating role of passenger satisfaction. Sustainability 14, 5628. https://doi.org/10.3390/SU14095628.
Mancinelli, E., Rizza, U., Canestrari, F., Graziani, A., Virgili, S., Passerini, G., 2022. New habits of travellers deriving from COVID-19 pandemic: a survey in ports and airports of the Adriatic region. Sustainability. https://doi.org/10.3390/su14148290.
Marcucci, E., Gatta, V., 2011. Regional airport choice: consumer behaviour and policy implications. J. Transp. Geogr. 19, 70–84. https://doi.org/10.1016/J.JTRANGEO.2009.10.001.
Marcucci, E., Gatta, V., 2012. Dissecting preference heterogeneity in consumer stated choices. Transp. Res. E Logist. Transp. Rev. 48, 331–339. https://doi.org/10.1016/J.TRE.2011.08.003.
Martín, J.C., Román, C., Espino, R., 2007. Willingness to pay for airline service quality. Transp. Rev. 28, 199–217. https://doi.org/10.1080/01441640701577007.
Martín, J.C., Román, C., Espino, R., 2011. Evaluating frequent flyer programs from the air passengers' perspective. J. Air Transp. Manag. 17, 364–368. https://doi.org/10.1016/J.JAIRTRAMAN.2011.02.008.
Mendoza-Arango, I.M., Echaniz, E., dell'Olio, L., Gutiérrez-González, E., 2020. Weighted variables using best-worst scaling in ordered logit models for public transit satisfaction. Sustainability 12, 5318. https://doi.org/10.3390/su12135318.
Munoz, C., Laniado, H., Córdoba, J., 2019. Modeling air travelers' experience based on service quality stages related to airline and airports. Mod. Appl. Sci. 13, 37. https://doi.org/10.5539/MAS.V13N11P37.
Nolich, M., Spoladore, D., Carciotti, S., Buqi, R., Sacco, M., 2019. Cabin as a home: a novel comfort optimization framework for IoT equipped smart environments and applications on cruise ships. Sensors 19, 1060. https://doi.org/10.3390/S19051060.
Oehlert, G.W., 1992. A note on the delta method. Am. Stat. 46, 27–29. https://doi.org/10.1080/00031305.1992.10475842.
Piccarozzi, M., Silvestri, C., Morganti, P., 2021. COVID-19 in management studies: a systematic literature review. Sustainability 13, 3791. https://doi.org/10.3390/SU13073791.
Repace, J., 2004. Flying the smoky skies: secondhand smoke exposure of flight attendants. Tob. Control 13, i8–i19. https://doi.org/10.1136/TC.2003.003111.
Rose, J.M., Bliemer, Mi.C.J., 2009. Constructing Efficient Stated Choice Experimental Designs. https://doi.org/10.1080/01441640902827623 29, 587–617. doi: 10.1080/01441640902827623.
Sandada, M., Matibiri, B., 2016. An investigation into the impact of service quality, frequent flier programs and safety perception on satisfaction and customer loyalty in the airline industry in Southern Africa. South East Eur. J. Econ. Bus. 11, 41–53. https://doi.org/10.1515/JEB-2016-0006.
Seetanah, B., Teeroovengadum, V., Nunkoo, R., 2020. Destination satisfaction and revisit intention of tourists: does the quality of airport services matter? J. Hosp. Tour. Res. 44, 134–148. https://doi.org/10.1177/1096348018798446/ASSET/IMAGES/LARGE/10.1177_1096348018798446-FIG2.JPEG.
Smith, S.J., Lundy, M.J., 2011. Improving the precision of design-based scallop drag surveys using adaptive allocation methods. https://doi.org/10.1139/f06-063 63, 1639–1646. doi: 10.1139/F06-063.
Train, K.E., 2009. Discrete choice methods with simulation, second edition, Discrete Choice Methods with Simulation, Second Edition. Cambridge University Press. doi: 10.1017/CBO9780511805271.
Tuchen, S., Arora, M., Blessing, L., 2020. Airport user experience unpacked: conceptualizing its potential in the face of COVID-19. J. Air Transp. Manag. https://doi.org/10.1016/j.jairtraman.2020.101919.
Warburg, V., Bhat, C., Adler, T., 2006. Modeling Demographic and Unobserved Heterogeneity in Air Passengers' Sensitivity to Service Attributes in Itinerary Choice. https://doi.org/10.1177/0361198106195100102 1951, 7–16. doi: 10.1177/0361198106195100102.
Wen, C.H., Chen, T.N., Fu, C., 2014. A factor-analytic generalized nested logit model for determining market position of airlines. Transp. Res. Part A Policy Pract. 62, 71–80. https://doi.org/10.1016/J.TRA.2014.02.001.
Wen, C.H., Lai, S.C., 2010. Latent class models of international air carrier choice. Transp. Res. E Logist. Transp. Rev. 46, 211–221. https://doi.org/10.1016/J.TRE.2009.08.004.
Whitaker, B., Terzis, G., Soong, E., Yeh, W., 2005. Stated preference as a tool to evaluate airline passenger preferences and priorities. Transp. Res. Rec. 1915, 55–61. https://doi.org/10.1177/0361981051915001107.