



## Determinants of commercial revenues at airports: Lessons learned from Spanish regional airports<sup>☆</sup>

José I. Castillo-Manzano\*

Facultad de Ciencias Económicas y Empresariales, University of Seville, Avda. Ramón y Cajal, 1, 41018 Seville, Spain

### ARTICLE INFO

#### Article history:

Received 16 December 2008

Accepted 18 August 2009

#### Keywords:

Airport management

Non-aeronautical revenues

Consumer and shopping behavior

Bivariate probit

### ABSTRACT

This paper examines the implications of passenger consumer behavior at airports, focusing specifically on the likelihood of merchandise being purchased at airport stores and food/beverages being consumed at airport catering facilities. Our results are of relevance to airport managers and local tourism policy managers. The variables that determine the amount spent once the passenger has made the decision to consume at the airport are also analyzed. A sample of over 20 000 passengers at seven different regional airports was used in our study.

© 2009 Elsevier Ltd. All rights reserved.

### 1. Introduction

Non-aeronautical activities in general and terminal retail in particular, have been part of airport management for six decades. Nevertheless, these activities have grown significantly from the nineteen-nineties on (Francis, Fidato, & Humphreys, 2003; Francis, Humphreys, & Ison, 2004; Graham, 2009; Morrison, 2009), to the point that they are essential to many airports' profitability (Torres, Domínguez, Valdés, & Aza, 2005). In other words, the percentage of total airport revenues represented by non-aeronautical or commercial revenues has not stopped growing, and may reach 90 percent (Zhang & Zhang, 1997). For this reason, studies of the factors that help maximize commercial, or non-aeronautical, revenues are becoming a major topic of interest for airport management (as well as for airline management, see Huang & Kuai, 2006), even though until the middle of this decade they remained "[a]n under researched and poorly illustrated area of study" (Geuens, Vantomme, & Brengman, 2004).

The maximization of non-aeronautical revenues is being studied both from a theoretical viewpoint—analytically (Zhang & Zhang, 1997) and graphically (McLay & Reynolds-Feigham, 2006; Starkie, 2002,)—and from an applied perspective (Geuens et al., 2004; Hsu & Chao, 2005; Torres et al., 2005). Table 1 provides an overview

of studies on commercial revenues at airports and passenger shopping behavior, and their main conclusions.

Whereas the various theoretical treatments conclude that the airport should maximize the mathematical function that describes the joint aeronautical and commercial revenues, applied treatments seek to identify those variables that would allow such a joint revenues function to be constructed. According to Echevarne (2008), in order for an airport to be able to develop a successful retailing strategy, it therefore needs to know what use the different groups of passengers make of the airport's commercial offerings.

The growing importance of non-aeronautical revenues for airport management can be partially attributed to the following reasons. First, there are hundreds of under-used airports (over 200 in Europe alone according to Francis et al., 2004) that increasingly must guarantee their own financial sustainability and long-term profits (European Commission, 2004; Papatheodorou & Lei, 2006). Consequently, they have a need to seek new ways of generating revenues (Francis et al., 2004) such as commercial activities, which are playing an ever-greater role in the eyes of airport management staff (see Torres et al., 2005 on the situation in Spain, and Graham, 2008, Jarach, 2001, Parker, 1999 and Zhang & Zhang, 1997 for a global perspective). In short, one could argue that a cross-subsidy model is being transformed into an intra-airport cross-subsidy system. In the former, cash drain from loss-making airports was covered by subsidies from government organizations (Scheers, 2001), which were drawn from the profits made by hubs. In the latter model, commercial revenues should help to offset any possible losses from aeronautical activities.

Secondly, airports have seen the income they derive from aeronautical activities decline as a result of intense competition within the airline industry (Freathy, 2004). The pressure from airlines on airport

<sup>☆</sup> The author would like to express his gratitude to AENA (The Spanish Public Authority for Airports and Aerial Navigation) for the human and financial resources that it provided for this study. The author is also grateful to Steve Page, the anonymous reviewers, Germà Bel, Diego J. Pedregal, Javier J. Pérez and Rafael Echevarne for very helpful comments.

\* Tel.: +34 954 55 67 27.

E-mail address: [jignacio@us.es](mailto:jignacio@us.es)

**Table 1**  
Overview of studies on commercial revenues at airports.

Authors	Place	Data (passengers and airports)	Methodology	Main conclusions
Zhang and Zhang (1997)	Theoretical study	0 passengers – 0 airports	A social welfare model	It is important to consider commercial and aeronautical operations jointly and some cross-subsidy between them is socially desirable.
Kim and Shin (2001)	Korea	0 passengers – 0 airports (12 Korean experts)	Expert panel survey	Location, price level, brand name and image, product quality and service level are the most important characteristics of concession operation for both profit maximization and customer satisfaction.
Geuens et al. (2004)	Belgium	236 passengers – 1 airport	Principal Component Analyses with Varimax rotation	Men are more likely to belong to “apathetic shoppers” or “mood shoppers”, while more females belong to “shopping lovers”. Travel capacity (tourist or business) does not determine shopper type/behavior.
Torres et al. (2005)	Spain	997 passengers – 1 airport	A non-parametric approach	Vacationers spend more than business travelers. A clear relationship exists between consumption in the commercial area and the length of stay. The level of consumption, however, is independent of the waiting time.
Hsu and Chao (2005)	Taiwan	0 passengers – 1 airport	Mathematical programming	Total commercial revenues can be maximized by locating the stores with more concession revenue in the more accessible positions.
Papatheodorou and Lei (2006)	United Kingdom	0 passengers – 21 airports	Panel data econometric analysis	Full-service carriers and charter airlines have a significant, if not higher, contribution to non-aeronautical airport revenue than LCCS.
Huang and Kuai (2006)	Taiwan	654 passengers – NA airport	Mean tests	The typical in-flight shopper is different from a typical air passenger. He/she is older and earns more money, is more impulsive, more brand conscious and price conscious, and less risk perceptive than non-shoppers.
Appold and Kasarda (2006)	USA	0 passengers – 75 airports	Econometric	The single largest effect of passenger demography on retail sales in the US is the number of passengers, which is beyond the control of most airport operators. Food service has the highest demand and specialty retail is justified only on major air intersections.
Echevarne (2008) and Entwistle (2007)	Worldwide? (All the examples are from the UK.)	NA passengers – NA airport (Confidential data from Pragma Consulting)	NA	Passengers are increasingly arriving earlier in order to shop. Only 5 percent of passengers consider shops to be an inconvenience. Over 60 percent of passengers plan to use shops and/or cafes. Eighty-five percent of passengers want shops easily accessible from the departure lounge.
Tovar and Martin-Cejas (in press)	Spain	0 passengers – 23 airports	Parametric Input Distance Function (DEA)	Spanish airports with well-developed commercial activities are also more efficient than those that do not diversify revenue sources.
Graham (2009 and 2008)	Worldwide	General information about large number of airports	Comparative assessment of data	Leisure charter passengers are good shoppers. Young leisure passengers who travel several times a year are high spenders. LCC passengers are good users of F&B. Transfer passengers are unlikely to make use of facilities. Foreigners who have high duties and taxes are favorites for buying tax-free products. For Manchester Airport: an airport shopaholic is typically a young female on charter holiday; business and elderly male passengers are unlikely shoppers.

charges has increased in recent years, (Graham, 2009, 2008), particularly from the low-cost carrier (LCC) sector (Graham, 2009), the development of which has made airports more dependent on non-aeronautical revenues (Francis et al., 2004). Airlines therefore demand that the airports themselves adopt cost-cutting and efficiency-saving measures (Doganis, 2006; Graham, 2008) in order to be able to offer them smaller airport charges (Francis et al., 2003, 2004; Halpern & Niskala, 2008). Managers have to calculate the viability of these demands while taking into consideration any potential commercial revenues from the influx of new passengers that might compensate for such losses (Francis et al., 2004; Graham, 2008). Dependence is even greater for smaller secondary airports, such as some of those included in this study, whose creation or survival are linked to the very existence of these LCCs (Dobruszkes, 2006).

The passenger therefore becomes a shared customer of both airlines and airports, as a result of which the latter strike up

increasingly complex commercial relationships with travelers (Francis et al., 2004; Gillen & Lall, 2004; McLay & Reynolds-Feigham, 2006). As traffic increases, so the airport becomes a more sophisticated market, a mall, where the commercial angle takes on greater weight with an ever-greater number of products and services on offer for an ever broader range of consumers (Jarach, 2001; Geuens et al., 2004) from passengers to visitors (meeters, greeters, farewellers or air transport enthusiasts) to the workers at the airport and in the surrounding areas (Geuens et al., 2004; Graham, 2008; Mocica Brilha, 2008). These consumers have different shopping motivations (Echevarne, 2008; Geuens et al., 2004; Graham, 2008) and needs (Graham, 2008). An airport manager must understand its mix of customers and plan facilities to match their needs and motivations as closely as possible (Graham, 2009).

The result, academically speaking, is that there is a demand for further research (Francis et al., 2003, 2004; Geuens et al., 2004;

**Table 2**  
Survey technical data.

Airport		Alicante	Bilbao	Seville	Valencia	Santiago	Valladolid	Zaragoza
Airport traffic in 2007		9 120 819	4 277 610	4 507 152	5 929 916	2 050 121	512 929	512 184
Information gathering	Questionnaire		Available in 12 languages			Available in 6 languages	Available in 5 languages	Available in 4 languages
	General	Departing passengers > 15 years of age.						
Sampling (before weighting)	Sample size	2420	3182	4140	4965	3497	1042	1137
	Sampling method	Stratified by traffic segments in which a selection of flights was made for each route and a group of passenger participants was selected by means of systematic sampling.						
	Sampling error <sup>a</sup>	±2%	±1.7%	±1.5%	±1.4%	±1.5%	±2.7%	±2.5%
	Number of waves	1						
Field work	Time period	22–28 Sept.	4–10 May	6–12 June	12–18 July	28 June - 4 July	15–21 June	15–21 June
	Location	Departure lounges.						
	Timetable	Mon–Sun. Shifts were conducted from 6am–10pm, with these times being extended in times of high traffic						
	Year	2006	2007	2006	2006	2006	2005	2006

<sup>a</sup>  $\pm$ Error =  $k\sqrt{(N-n)/(N-1)}\sqrt{pq/n}$ , where:  $N$  = population size;  $n$  = sample size;  $p = q = 0.5$  complementary probabilities of the answer to an event at the point of greatest indeterminacy;  $k$  = parameter for the level of answer to an event, where  $k = 2$  for a 95.45% confidence level.

Papatheodorou & Lei, 2006) and for the creation of systems or models with the greatest possible number of variables (Geuens et al., 2004) that might allow passenger consumption behavior at airports to be better understood. The conclusions of such research are useful both for airport managers (Graham, 2009; Kim & Shin, 2001) and for regional economists and local tourism policy managers (Papatheodorou & Lei, 2006).

This paper analyzes the factors that influence a passenger's decision to make a purchase at an airport store or to consume food/beverages at a catering facility during his/her stay at a Spanish regional airport. Furthermore, it examines what affects the amount spent once the passenger has decided to make a purchase or to visit a catering facility. An attempt will also be made to answer a number of no less important questions, such as: do low-cost carrier passengers spend more at airport catering facilities due to the fact that there are no meals on board (Francis et al., 2003; Graham, 2008; Gillen & Lall, 2004)? Or, is it true that LCCs carry poorer quality tourists in terms of consumer willingness to spend (Bieger & Wittmer, 2006)? Are women more predisposed towards shopping at the airport (Geuens et al., 2004)? Is the waiting time prior to embarking a relevant factor (Torres et al., 2005)? Are Business Class passengers an attractive target due to their tendency to make last-minute purchases (Papatheodorou & Lei, 2006)? What effects does carrying a currency different from the one used at a traveler's place of origin have on his/her airport spending behavior (Graham, 2008; Geuens et al., 2004; Kim & Shin, 2001)? Do passengers on international flights spend more (Francis et al., 2004; Kim & Shin, 2001; Starkie, 2002)? What effect does the social custom (Kim & Shin, 2001) of accompanying a passenger to the airport to see him/her off have (Graham, 2008)? And, how is the shopping behavior of passengers affected by the existence at the airport of duty-free shops offering tax-free products for non-Eurozone international flights passengers, and the Travel Value system with very competitive prices for all other international passengers (Geuens et al., 2004; Kim & Shin, 2001)?

## 2. Data

One of this paper's strengths is its broad database, which is greater than other similar studies both in terms of number of passengers and number of variables included (Dresner, 2006; Geuens et al., 2004; Huang & Kuai, 2006; Torres et al., 2005). The database is composed of 20 383 passengers who were interviewed in departure lounges at seven different secondary airports in Spain. Thirty-two different variables (three dependent and 29 explanatory) were available in their entirety for 20 125 of the passengers. The main features of AENA (The Spanish Public Airport Authority) survey campaigns conducted during the 2005–2007 period from which the databases were constructed are

listed in Table 2. As with similar databases, each observation is weighted according to the total number of passengers on the flight so that the sample can be expanded to the total population (see Dresner, 2006 for a full explanation of this kind of weighting).

## 3. Methodology

A bivariate probit model was used to analyze the factors that condition passenger decisions to make a purchase in a store or consume food or a beverage in a catering establishment during their stays at a secondary airport. This model category is specially designed for cases where two questions with very closely linked binary answers need to be answered. It is appropriate when everything seems to point to their being influenced by the same factors, with the result that both dependent variables vary as one.

The bivariate probit formula is:

$$L = \sum w_i \ln \Phi_2(q_1(X_i\beta)^\beta, q_2(Z_i\gamma)^\gamma, \rho_i^*) \quad (1)$$

$$q_1 = \begin{cases} 1 & \text{if } y_1 \neq 0 \\ -1 & \text{if } y_1 = 0 \end{cases} \quad q_2 = \begin{cases} 1 & \text{if } y_2 \neq 0 \\ -1 & \text{if } y_2 = 0 \end{cases}$$

where  $\Phi_2$  is the cumulative bivariate normal distribution function,<sup>1</sup> and  $w_i$  is the previously-explained weighting. In our case, the sample's broad base means that we do not have to adopt any assumptions *a priori* and thus  $X_i = Z_i$  for the variables which deal with features that vary from one passenger to another. However, the limited number of airports – seven–forces us to use different variables for the characteristics of the commercial offerings in order to avoid issues with multicollinearity. Table 3 shows the explanatory independent variables grouped in different categories and their descriptive statistics.

The purpose of using these variables is to respond to the questions set out in the introduction. In general terms, the first two categories of variables, *Socio-demographic factors and Education and employment status*, are aimed at contrasting and completing airport shopper socio-demographic profiles provided in earlier works (Geuens et al., 2004; Graham, 2008 and, indirectly, in Huang & Kuai, 2006). Secondly, an attempt will be made to observe the basic hypothesis regarding the way in which purchasing power influences shopping and consumer behavior. Although we do not have data regarding passengers' income level, we do, nonetheless, have two very near proxies, education and employment status.

The third category of variables, *Trip category*, examines the influence that features of the trip taken have, from company type to

<sup>1</sup>  $[\varepsilon_1, \varepsilon_2] \sim (\text{BVN})[0, 0, v_i \text{ cluster}, v_i \text{ cluster}, \rho]$   
 $\rho_i = q_1 q_2 \rho \quad E(\varepsilon_1) = E(\varepsilon_2) = 0 \quad \text{Var}(\varepsilon_1) = \text{Var}(\varepsilon_2) = v_i \text{ cluster} \quad \text{Cov}(\varepsilon_1, \varepsilon_2) = \rho$

**Table 3**  
Independent variables and their descriptive statistics.

Name	Explanation	No. obs.	Mean	Max	Min	Median	Stand. dv.
<b>a) Socio-demographic factors.</b>							
<b>a.1. Sex.</b>	1 if male; 0, if female.	10953	0.537	1	0	1	0.498
<b>a.2. Age.</b>	1 = under 30; 2 = 31–49; 3 = 50–64; 4 = 65 or older.	–	1.985	4	1	4	0.825
<b>a.3. Non-Spanish.</b>	1 if passenger is not Spanish; 0, otherwise.	6106	0.300	1	0	0	0.458
<b>a.4. Euro.</b>	1 if currency of passenger's country is not the Euro, 0 otherwise.	1787	0.088	1	0	0	0.283
<b>a.4. Frequent flyer.</b>	Number of flights taken by passenger in previous twelve months: 1 = 0 flights; 2 = 1–3 flights; 3 = 4–12 flights; and 4 = more than 12 flights.	–	2.433	4	1	2	1.003
<b>b) Education and employment status: Base category, unemployed.</b>							
<b>b.1. Education.</b>	1 = no formal or only primary education; 2 = completed secondary education; and 3 = holds university diploma.	–	2.505	3	1	3	0.670
<b>b.2. Employment status:</b>	Homemaker. 1 if passenger is a homemaker; 0, otherwise.	648	0.032	1	0	0	0.175
Base category includes unemployed.	Self-employed. 1 if passenger is non-salaried, self-employed; 0, otherwise.	3419	0.168	1	0	0	0.374
	Salaried worker. 1 if passenger is a salaried worker, 0 otherwise.	11895	0.584	1	0	1	0.493
	Retired. 1 if passenger is retired; 0, otherwise.	1668	0.082	1	0	0	0.274
	Student. 1 if passenger is studying; 0, otherwise.	2209	0.108	1	0	0	0.311
<b>c) Trip category: Base category, VFR (Visiting Friends and Relatives) passenger on a domestic flight.</b>							
<b>c.1. Low-cost carrier.</b>	1 if passenger is flying by LCC; 0, otherwise.	6247	0.306	1	0	0	0.461
<b>c.2. Connecting flight.</b>	1 if passenger is connecting to another flight at the airport; 0, otherwise.	3090	0.152	1	0	0	0.359
<b>c.3. Destination.</b> Base category includes passengers on a domestic flight.	Eurozone. 1 if passenger is taking international flight with a final destination in a Eurozone country; 0, otherwise.	8782	0.431	1	0	0	0.495
	Non-Eurozone. 1 if passenger is taking international flight with a final destination outside the Eurozone; 0, otherwise.	804	0.039	1	0	0	0.195
<b>c.4. Purpose of trip.</b> Base category includes passengers visiting friends and relatives (VFR).	Vacation. 1 if vacation trip; 0, otherwise.	8987	0.441	1	0	0	0.497
	Business. 1 if business trip; 0, otherwise.	6312	0.310	1	0	0	0.462
<b>c.5. Waiting time before embarking.</b>	1 = up to 1 h; 2 = 1–2 h; 3 = 2–3 h; 4 = more than 3 h.	–	2.455	4	1	2	0.816
<b>d) Social Interaction:</b>							
<b>d.1. Group size.</b>	1 = traveling alone; 2 = 2 people; 3 = 3 people or more.	–	1.684	3	1	2	0.741
<b>d.2. Children.</b>	1 if traveling with children, 0 otherwise.	1581	0.078	1	0	0	0.267
<b>d.3. Seen off.</b>	1 if someone attended the passenger's departure from the airport, 0 otherwise.	5681	0.279	1	0	0	0.448
<b>e) Accessibility. Base category, passenger reaches airport by public transport.</b>							
<b>e.1. Taxi.</b>	1 if passenger reaches airport by taxi, 0 otherwise.	6171	0.303	1	0	0	0.459
<b>e.2. Hotel bus.</b>	1 if passenger gets to airport by courtesy bus provided by a hotel, 0 otherwise.	606	0.030	1	0	0	0.170
<b>e.3. Rent-a-car.</b>	1 if passenger arrived at the airport using a rented vehicle; 0, otherwise.	3825	0.188	1	0	0	0.390
<b>e.4. Private car.</b>	1 if passenger gets to airport by private car, 0 otherwise.	7699	0.378	1	0	0	0.485
<b>f) Airport commercial offer.</b>							
<b>f.1. Weekend.</b>	1 if the survey was taken on Saturday or Sunday; 0, otherwise.	5403	0.265	1	0	0	0.441
<b>f.2. Prior availability.</b>	From lesser to greater availability: 1 = Hotels, boarding houses and other pay accommodation; 2 = Home of friends or relatives; 3 = Passenger's own primary or other home.	–	1.649	3	1	1	0.818
<b>f.2. Catering offer.</b>	F&B (sq.m.)/total passengers during the week of the survey.	–	32.148	80.794	19.778	25.813	13.505
<b>f.3. Catering points-of-sale offer.</b>	F&B (number of points-of-sale)/total passengers during the week of the survey.	–	0.114	0.352	0.048	0.112	0.073
<b>f.4. Store offer.</b>	Stores (sq.m.)/departure passengers during the week of the survey.	–	19.037	30.716	0	18.798	6.793
<b>f.5. Duty-free offer.</b>	Duty-free (sq.m.)/departure passengers during the week of the survey.	–	7.722	15.411	0	7.667	3.886

motive, testing the numerous hypotheses that can be found on these in the academic literature (Echevarne, 2008; Francis et al., 2003; Graham, 2008; Gillen & Lall, 2004; Huang & Kuai, 2006; Papatheodorou & Lei, 2006; Torres et al., 2005). An attempt is made to offer a clear description of the effect had on the likelihood of purchasing and consuming, and the amount spent, by even those cases for which little consensus can be found in said literature, such as the negative effect of waiting time, for example (Graham, 2008; Torres et al., 2005).

The fourth category of variables, *Social interaction*, is designed to measure the influence of customs and social habits. Despite the consensus that exists on the influence of these factors (Graham, 2008; Geuens et al., 2004; Kim & Shin, 2001), they are not normally included in empirical studies as data on them is not usually

available (Echevarne, 2008; Entwistle, 2007; Geuens et al., 2004; Huang & Kuai, 2006; Torres et al., 2005).

The means of transport that the passenger uses to get to the airport is also included. These dummy variables are a proxy of both the level of expenditure that the passenger is willing to accept to guarantee his/her comfort during the trip and, more indirectly, the passenger's level of income. A number of variables that could, *a priori*, condition shopping and F&B consumption behavior are also included: that fact that it is a day at the weekend, when usually people spend more in shops and restaurants; and the *Prior availability* variable, which aims to measure probable product, and food and beverage availability to passengers prior to their departure for the airport.

Finally, a number of variables are included designed to measure the effect of the quality of the retail offer at airports on purchasing

decisions, such as the existence of duty-free shops, for example (Graham, 2008; Kim & Shin, 2001).

Subsequently, a log-linear regression will be used to examine the factor(s) that are linked to the total amount spent.

With:

$$w_i \ln y_i = \beta_0 + \sum_{j=1}^{29} \beta_j w_j x_{ij} + u_i$$

where  $u_i \sim (0, v_i \text{ cluster})$

$$V_{\text{cluster}} = (X'X)^{-1} \sum_{k=1}^7 u'_k u_k (X'X)^{-1} \quad (2)$$

$$u_k = \sum_{i \text{ cluster}} e_i x_i$$

where  $\ln y_i$  is the logarithm of the amount spent by passengers during their stay at the airport in Euros as of 2006. Only passengers who have made a real purchase at an airport store or/and have consumed food/beverages at a catering facility will be taken into account for this analysis.

Moreover, the variance for both models, (1) and (2), is robust to heteroskedasticity and is clustered by airport of origin. The features of each individual airport are thus taken into account beyond the explanatory variables.

#### 4. Results

Table 4 shows estimated results for (1) and (2). Firstly, regarding the bivariate probit estimation (columns 2 and 3 of Table 4), the

**Table 4**  
Results.

Variable	Consume	Purchase	Expenditure
Sex	0.0111 (0.0247)	-0.0025 (0.0190)	0.0025 (0.0125)
Age	-0.0542 (0.0216)**	-0.0581 (0.0138)***	-0.0210 (0.0281)
Non-Spanish	-0.0460 (0.0523)	0.1592 (0.0387)***	0.3546 (0.0440)***
Euro	0.1557 (0.0409)***	0.0213 (0.0556)	-0.0400 (0.0428)
Education	-0.0232 (0.0254)	0.0162 (0.0143)	-0.0259 (0.0200)
Homemaker	-0.0259 (0.0599)	-0.2182 (0.1231)*	-0.1233 (0.1048)
Self-employed	0.1069 (0.0708)	0.0245 (0.0963)	0.0357 (0.0612)
Salaried worker	0.0929 (0.0859)	-0.0040 (0.0703)	-0.0348 (0.036)
Retired	0.0214 (0.0801)	-0.0444 (0.0943)	-0.1032 (0.0749)
Student	-0.1320 (0.0992)	-0.2884 (0.0487)***	-0.3179 (0.0945)**
Low-cost company	0.0071 (0.0231)	0.0597 (0.0454)	-0.0713 (0.0121)***
Connecting flight	-0.0763 (0.0647)	-0.1797 (0.0872)**	-0.1200 (0.0461)**
Eurozone international destination	0.0125 (0.0399)	0.0823 (0.0375)**	0.1386 (0.0368)***
Non-Eurozone international destin.	-0.0363 (0.0607)	-0.0666 (0.0788)	0.0104 (0.0767)
Vacation	0.1735 (0.0497)***	0.1053 (0.0526)**	0.0953 (0.0581)
Business	0.0464 (0.0369)	-0.0504 (0.0515)	0.0411 (0.0675)
Group size	0.0524 (0.0166)***	0.0018 (0.0239)	0.0845 (0.0325)**
Children	0.0579 (0.0231)**	0.1764 (0.0543)***	-0.6959 (0.0819)***
Seen off	0.0600 (0.0187)***	0.0548 (0.0388)	0.1519 (0.0361)***
Taxi	-0.0064 (0.0626)	0.1399 (0.0526)***	0.0861 (0.0662)
Hotel courtesy bus	-0.0999 (0.0478)**	0.0785 (0.0229)***	0.1452 (0.0422)**
Rent-a-car	-0.0129 (0.0673)	0.0644 (0.0933)	0.1488 (0.1238)
Private car	-0.0218 (0.0767)	0.0523 (0.0279)*	-0.0103 (0.1148)
Waiting time	0.2597 (0.0123)***	0.1886 (0.0183)***	0.1370 (0.0119)***
Weekend	-0.0173 (0.0308)	-0.0165 (0.0296)	-0.0009 (0.0265)
Prior availability of purchase options	-0.0264 (0.0203)	0.0000 (0.0198)	0.0330 (0.0197)
Frequent flyer	0.0569 (0.0145)***	0.0876 (0.0424)**	0.0303 (0.0300)
F&B (stores)/total passengers	0.7270 (0.6663)		-0.7077 (0.5116)
F&B (sq.m.)/total passengers	-0.0047 (0.0038)		
Stores (sq.m.)/departure passengers		-0.0063 (0.0093)	
Duty-free (sq.m.)/depart. passengers		0.0255 (0.0118)**	0.0429 (0.0063)***
No. observations (before weighting)	20125		10544
Wald Test (without cluster robust)	2298247.41***		
Pseudo log-likelihood	-31553441		
Rho	0.3921		
Likelihood-ratio test of Rho = 0	$1.4 \times 10^{-6}$ ***		
R-squared			0.183
Root MSE			1.07

Note: Standard errors in brackets: robust to heteroskedasticity and clustered by airport of origin. One, two and three asterisks indicate coefficient significance at the 10 percent, 5 percent and 1 percent levels, respectively.

Likelihood-Ratio Test shows that Rho ( $\rho$ ) is significantly different from 0 at the 99 percent confidence level. This therefore confirms the hypothesis that both decisions, namely making a purchase and consuming food/beverages at the airport, are closely linked, justifying the choice of the bivariate probit model. Furthermore, we identified ten significant variables (six at 99 percent, two at 95 percent and, finally, two slightly significant at 90 percent) to explain the decision to consume food/beverages and 13 (seven at 99 percent, four at 95 percent and two at 90 percent) to explain the ultimate purchasing decision. Of these variables, six are common, albeit with different levels of significance, which again justifies the choice of the bivariate probit model; specifically, the passenger is on vacation; s/he is accompanied by children; s/he is a frequent flyer; waiting time prior to embarking; age; and the fact that the passenger has arrived by courtesy bus.

Meanwhile, Table 5 shows marginal effects of the bivariate probit model estimation and the semi-elasticities of the log-linear estimation for all variables that are significantly different from zero.

#### 5. Discussion

One of the factors that explain both decisions, namely both consuming food/beverages and making a purchase, is waiting time prior to embarking, and this correlation has a significance level of 99 percent in both cases. This would seem to confirm earlier studies, such as Torres et al. (2005). Making a purchase would seem to alleviate the boredom of waiting, and moreover the longer the waiting

**Table 5**  
Marginal effects and semi-elasticities.

Variable	Marginal effects (%)		Semi-elasticities (%)
	Consume	Purchase	Expenditure
Age			
31–49	–2.14	–1.92	
50–64	–4.28	–3.83	
>65	–6.43	–5.75	
Non-Spanish		5.27	35.46
Euro	6.19		
Housewife		–6.71	
Student		–8.75	–31.79
Low-cost company			–7.13
Transfer		–5.66	–12.00
Eurozone international destin.		2.71	13.86
Vacation	6.85	3.47	
Group size			
2 members	2.07		8.45
3 members or more	4.14		16.90
Children	2.30	6.07	–69.59
Seen off	2.38		15.19
Taxi		4.70	
Hotel bus	–3.92	2.64	14.52
Private car		1.73	
Waiting time			
>1 h	10.27	6.22	13.70
>2 h	20.53	12.44	27.40
>3 h	30.80	18.66	41.11
Frequent flyer			
1–3 trips	2.25	2.89	
4–12 trips	4.49	5.78	
>12 trips	6.74	8.67	
Duty-free (sq.m.)/ departure passengers		0.84	4.29

time, the greater the physiological necessity for passengers to satisfy their need to eat/drink. Therefore, it should come as no surprise that once the decision has been made to make a purchase or spend money, the expenditure should increase as the waiting time increases. Thus, if the waiting time exceeds an hour, there is a ten percent increase in the likelihood of consuming some food/beverage and a six percent increase in the chance of making a purchase. Once the decision has been made to spend money, the amount will increase over time. In an extreme case, should the waiting time exceed 3 h, the likelihood of food/beverages being consumed and a purchase being made increases by 31 and 19 percent, respectively, and the amount spent increases by almost 41 percent.

Management aiming to maximize non-aeronautical revenues should seek to minimize the time the passenger is engaged (checking in, security checks, movement between terminals, etc.) in order to allow the major means of leveraging an increase in revenues of this type to come into play. In other words, the leisure time that passengers have at their disposal inside the airport facilities should be maximized. It is clear that this would lead to passengers who use said airport frequently to systematically arrive there later and later, which means that commercial revenues from same would not increase.<sup>2</sup> But, whatever the case, income from passengers who occasionally use the airport or even from those that use it frequently but are more averse to risk (which in this case means any unforeseen occurrence which could lead to them missing their plane) would compensate for this policy.

Another important common factor is whether passengers are frequent flyers, i.e. whether they are accustomed to airport environments and feel at ease in such facilities. Taking more than 12

flights annually increases the likelihood of a purchase being made by over 8.5 percent and that of food/beverages being consumed by almost seven percent. The same factor, feeling at ease, would justify the high negative significance of the age factor, both in terms of making a purchasing decision and of consuming food/beverages. In the same way, elderly passengers might be less at ease in airport environments where the latest technology, with a preponderance of 'help-yourself' sales formats (vending-machines and self-service, both in food outlets and in stores), minimizes interactions with salespeople. Elderly passengers might also be less inclined to leave the areas nearest to their departure gates, which would be consistent with the hypothesis that passengers prefer to shop near their departure gates in order to mitigate their nervousness (Geuens et al., 2004). Once the decision to make a purchase and/or to consume food/beverages has been made, however, neither of these two factors, being a frequent flyer or age, seems to impact the amount spent.

Consequently, good airport management should aim to develop comfortable and convenient environments that facilitate shopping and eating/drinking experiences for infrequent flyers while at the same time paying special attention to the requirements of the elderly. Moreover, these results show that commercial revenues at airports would increase more significantly if any increase in traffic were based on a greater number of trips with the same number of passengers rather than on an increase in passenger numbers alone.

The hypothesis that being on vacation increases the likelihood of passengers to make a purchase or to consume food/beverages is confirmed, by almost 3.5 percent and seven percent, respectively. The average expenditure of these passengers is therefore greater than that of business passengers and VFRs. Once they have made the decision to consume, however, their spending behavior is similar to the average of those who make purchases.

We found no evidence to support the hypothesis that business passengers are more likely to make last-minute purchases at the airport since they have to devote their time away from the airport to work-related activities (see Papatheodorou & Lei, 2006).

Traveling with children increases the likelihood of making a purchase by almost six percent and of consuming food/beverages by over two percent. However, once the decision has been made to do so, this factor is also the greatest curb on the amount spent, which is reduced by over 69 percent. It would seem that traveling with children means small purchases have to be made to keep them entertained or satisfy their physiological needs, but it is a disincentive to buying top range goods and eating at the airport's best catering establishments.

Non-common criteria accounting for an increased likelihood of consuming food/beverages at an airport catering establishment included the following: the passenger's currency is not the Euro; the number of people in the passenger group is large; and the fact that someone accompanies the passenger to see him/her off, all of which are significant to 99 percent. The last two elements suggest that social, rather than economic or cultural reasons may play an important role in explaining the consumption of food/beverages. Moreover, both factors, namely the number of people in the group and the passenger being accompanied to the airport, have a positive impact on the amount spent. The first of these, namely the number of group members, would seem to confirm the widespread hypothesis in the hospitality industry that people in a group consume more on average in any catering establishment than if they are alone. In our case, two passengers traveling together would consume almost 8.5 percent more on average, whereas if there were three or more individuals in the group, consumption would go up on average by 17 percent.

The second factor, namely the passenger being accompanied to the airport, confirms the social habit of having something to eat/drink with the accompanying individual and, in all probability, paying for them (as the 15 percent increase in the amount spent would suggest).

<sup>2</sup> Despite the fact that this revenue might even increase if the trends indicated by Echevarne (2008) are realized and, in general, passengers "[A]re increasingly arriving earlier (at the airport) in order to shop".

The optimal charge for short-term parking (one or 2 h) at airports should therefore be examined with the knowledge that individuals who are accompanying departing passengers are likely to consume food/beverages if they can park their vehicle and enter the airport.

It has traditionally been considered (see Graham, 2008; Geuens et al., 2004; Kim & Shin, 2001) that one of the reasons for spending money at airports is to dispose of all foreign currency before returning to one's country of origin. In our case, this group would include those passengers whose home currency is not the Euro. The greater likelihood of consuming food/beverages in catering establishments (over six percent) would seem to confirm this hypothesis. Nevertheless, the lack of significance of the same variable to explain both the likelihood of making a purchase in stores and the amount spent introduces subtle differences. It seems these passengers are induced to spend only the loose change they have left over on something to eat/drink, but not the paper currency. The latter may be kept for future trips to Eurozone destinations, whether to Spain or elsewhere, or travelers will exchange them back into their local currency, possibly even at the airport's own currency exchange facility.

With regard to the likelihood of consuming food/beverages, perhaps the most difficult result to explain is the fact that the passenger's arrival at the airport on a courtesy bus provided by the hotel where s/he has been staying should exert a negative impact. In Spain, hotel courtesy buses are generally provided by hotels near the airport (which are common at hubs, but less so at the seven regional airports chosen for this study) or by luxury hotels. This means that the number of observations we have for this type of behavior is not very high, 606 observations in total, the lowest of all the categories in the analysis. Furthermore, 51 percent of these observations are from just one airport, Alicante, whose main target groups are the Mediterranean sun and beach tourists. This may be linked with the presence of numerous popular beach hotels, which generally have very generous maintenance systems for visitors that range from half-board to "all in." This might mean that their guests arrive at the airport with all their physiological needs already covered.

Another notable fact is the lack of significance of all of the variables that could be considered proxies for passenger income levels (employment status, education<sup>3</sup> and, more indirectly, even the means of transport used to reach the airport) to account for expenditure on food/beverages. It would seem that, along with the aforementioned social reasons, the likelihood of a purchase at a catering establishment can be justified only by a physiological and instantaneous need for food or drink, and not by economic means. However, we note that flying in itself is also an indirect indicator of income, and it is reasonable to assume that nearly all passengers would at least have sufficient income to pay for a drink from a vending machine or for food at the airport's cheapest restaurant.

Yet it is the income-related and not the social criteria that help us to explain the likelihood that the passenger will make a purchase.

<sup>3</sup> Unfortunately, as independent international studies constantly show (see the annual report of the OECD's Program for International Student Assessment or the Academic Ranking of World Universities compiled by Shanghai Jiao Tong University, for secondary and university education, respectively), the Spanish education system is of poor quality compared to countries with similar income levels. The result of this is that Spain is one of the OECD countries where there is the smallest difference between the salaried income of university graduates and non-graduates. In order to check that this anomaly was not distorting the non-significance of the "Education" variable, models (1) and (2) were re-estimated reducing the sample to foreigners (6106 passengers), the majority of whom are from countries which are in a much better position in said studies (such as the United Kingdom, France or Germany). The new results are very similar to those of the overall sample for all the variables, which confirms the robustness and international validity of the conclusions, and the "Education" variable remains non-significant. These results are available from the author upon request.

A negative significance can therefore be seen if the passenger is a student or a homemaker. As an indirect indicator, a positive significance is noted for all the means of transport to reach the airport other than public transport and rent-a-car. The latter can be considered to be the cheapest form of non-public transportation for traveling long distances. Using a type of transport other than public transport may be an indicator of the passenger being prepared to pay more in order to make the trip more comfortable and convenient, and such a mindset would include making purchases at the airport.

Students represent the group that spends least at airports: not only do they have a lower likelihood of making a purchase, almost nine percent to be precise, but if they do eventually spend some money, the amount is 32 percent less than the average passenger.

Unlike students, non-Spanish passengers should be a priority target for airport managers. This group is not only over five percent more likely to make purchases, but when they do so, the amount they spend is 35 percent higher than domestic travelers. Moreover, apart from the feeling of the 'exotic' discovery that is associated with purchases in a foreign country, our data seems to confirm the hypothesis of Geuens et al. (2004), namely that airport stores provide important added value for foreign tourists. Reference is made to the ever-more prominent delicatessen stores found in Spanish airports, the increased availability of authentic Spanish products, and the higher quality of service that can be found in an airport. Service improvements may include the availability of retail staff who speak other languages, something that it is not easy to find in a country like Spain, which has one of the lowest rates of bilingualism of all developed countries.

Meanwhile, passengers flying to an international European destination (mostly the westernmost countries in the Eurozone and the United Kingdom) have an almost three percent greater likelihood of making a store purchase and an almost 14 percent increment in the amount spent. As we have already corrected for the non-Spanish passenger variable, our results may be unduly impacted by purchases of products such as alcohol and cigarettes, which are generally not subject to such high rates of taxation in Spain as in the rest of Europe.

As was found in previous studies (see Graham, 2008), connecting to another flight has a negative effect both on the likelihood that passengers will make a purchase and on the amount spent, at almost six percent and 12 percent respectively. It would seem that tiredness at a journey mid-point does not favor airport spending.

The small number of airports considered in the study, only seven, led us to be extremely prudent with the significance of the variables that define the characteristics of their commercial offerings. Regardless, and independently of the way in which the commercial offering variables are defined and of which of these are included in the regressions, great robustness can be found in the statistical relevance of the variable that measures the existence and size of the duty-free stores (or travel value stores for Eurozone passengers) found at five of the seven airports included in the study.<sup>4</sup>

With the size of the stores corrected according to the number of departing passengers, the results show that they stimulate both the amount spent, by over four percent, and, to a lesser extent, the

<sup>4</sup> All the duty-free stores in Spain currently belong to a single company, ALDEASA ([www.aldeasa.com](http://www.aldeasa.com)), which also runs a large number of stores in museums and other places of special tourist interest (palaces, cathedrals and bullrings). ALDEASA is a multinational company operating in 51 airports, 29 of which are outside Spain (from the United Kingdom to Kuwait), with a turnover of almost 1700 million euros in sales. After the concept of duty-free or tax-free was abolished in 1999 for flights between EU countries, these stores embarked on a very aggressive system of special offers under the concept of Travel Value (see Geuens et al., 2004 and Graham, 2008, on the adaptation of European airports and their stores to this change). Passengers were thus able to continue having access to lower prices for their airport purchases for certain goods, such as perfume and cosmetics in general, and wines and liquor.

likelihood of a purchase being made, by almost one percent. This is confirmation of earlier studies (Graham, 2008; Kim & Shin, 2001) on the importance of this category of stores as a major source of concession revenues.

Also of note is the lack of significance of the passenger using an LCC when determining the likelihood of making a purchase or consuming food/beverages. Moreover, once they have decided to spend money, LCC passengers spend seven percent less than those who fly with a traditional carrier. These results would seem to refute the belief (see Francis et al., 2003 and Gillen & Lall, 2004) that LCC-oriented airports need more catering establishments, as no-frills passengers generally receive no on-board food and drink. At the same time, our results contradict the notion that an LCC-centered airport can be an old hangar with virtually no passenger service. We note that LCC passengers exhibit behavior and needs that are very similar to those using traditional airlines.

Finally, the lack of significance of the gender variable across all three regressions should also be highlighted, and this would seem to refute any notion of sex-related differences in airport consumer behavior. This would go against earlier academic studies, such as Geuens et al. (2004), or airport reports, such as that of Manchester Airport (Graham, 2008), which showed that women are more likely to fall into the category of *shopping lovers* at the airport. Even the negative (albeit low) significance of the homemaker variable for shopping attracts attention. A homemaker has greater knowledge of how much products cost and where they can be bought more cheaply, and is therefore even less likely to make a purchase at an airport than the base category, namely someone who is unemployed.

## 6. Conclusions

As was stated in the introduction, there is a growing tendency in airport management all round the world to optimize commercial revenues. In recent years, this tendency has generated academic demand for further research on this topic that might allow passenger consumption behavior at airports to be better understood.

From a wholly empirical point-of-view this study manages to both build upon and contrast conclusions in earlier works (see Table 1) regarding factors that influence a passenger's decision to make a purchase at an airport store or to consume food/beverages at a catering facility during his/her stay at a Spanish regional airport. Furthermore, it examines what affects the amount spent once the passenger has decided to make a purchase or to visit a catering facility.

The ample size of the sample, over 20 000 real passengers, means fairly robust results can be obtained for these issues. Many of these results are consistent with the literature. Nevertheless, even in these cases we go a step further and seek to clarify the nature of the relationship by quantifying the marginal effects and semi-elasticities on the three issues in question. The following can be included in this category: the positive effects of waiting time prior to embarking, the fact that the motive for the trip is a vacation, that the passenger is a foreigner, or the negative effects of being a transfer passenger.

Along with the analysis of these variables, certain social factors that are not frequently found in studies of this type are analyzed, specifically, group size, the presence of farewellers and the complex and very significant influence of children, who, while increasing the likelihood of a purchase or a consumption being made by the passenger, drastically reduce the amount spent.

Moreover, the results show us that many of the beliefs that circulate in the industry on this topic have no empirical basis at Spanish airports, at least, when corrections are made for other factors and a wide range of variables is included in the models. Among these factors, the following can be highlighted: the sexist view that women consume more; business passengers' last-minute

consumptions at airports; the over-valued effect of the passenger's own currency being different, and the significant differences in LCC passenger behavior. There is the same likelihood that LCC passengers will make a purchase or a consumption but when they do decide to make an expenditure, the amount they spend is seven percent less.

In general terms, the results as a whole show us that, to all appearances, apart from social reasons, the likelihood of a purchase at a catering establishment can be justified only by a physiological and instantaneous need for food or drink, and not by passengers' economic means. Yet it is the income-related and not the social criteria that help us to explain the likelihood of the passenger making a purchase. In this regard, the usefulness of using, amongst other variables (such as being Student or Homemaker), means of transport to the airport as a proxy both for income level and, especially, for the level of expenditure that the passenger is willing to make in order to ensure his/her comfort during the trip, is clearly apparent.

In other regards, despite the fact that it is a higher number than the average in earlier studies, the small size of the sample of airports – only seven – has meant that the influence of the variables that measure the airport's commercial offerings and their interaction with the remaining variables considered, could not be studied in greater detail. These are aspects on which there is still a lack of academic literature today because of the difficulties mentioned.

Despite this, it has nevertheless been possible to record the appeal of duty-free stores and their wide and cosmopolitan range, even at Spanish regional airports, where most flights are domestic or fly to international destinations in the Eurozone, which means that since 1999 they have been outside the duty-free system.

Finally, the results are analyzed together with the possible implications they have for airport management. Two of these that can be highlighted are the need to create more commercially-friendly airports to make the experience less demanding for infrequent passengers, those with children and the elderly, and the usefulness of applying special short-term (1–2 h) parking rates as a stimulus for commercial revenues. In short, the use of adapting the classic strategies used in malls and shopping centers for airports, which could be done more rapidly if airports were to employ professional retail managers, as Graham (2008) suggests.

## References

- Appold, S. J., & Kasarda, J. D. (2006). The appropriate scale of US airport retail activities. *Journal of Air Transport Management*, 12, 277–287.
- Bieger, T., & Wittmer, A. (2006). Air transport and tourism – perspectives and challenges for destinations, airlines and governments. *Journal of Air Transport Management*, 12, 40–46.
- Dobruszkes, F. (2006). An analysis of European low-cost airlines and their networks. *Journal of Transport Geography*, 14, 249–264.
- Doganis, R. (2006). *The airline business* (2nd ed.). Oxon: Routledge.
- Dresner, M. (2006). Leisure versus business passengers: similarities, differences, and implications. *Journal of Air Transport Management*, 12, 28–32.
- Echevarne, R. (2008). The impact of attracting Low Cost Carriers to airports. In A. Graham, A. Papatheodouru, & P. Forsyth (Eds.), *Aviation and tourism* (pp. 177–192). Hampshire: Ashgate Publishing.
- Entwistle, M. (2007). Customer Service and airport retail: stimulate passenger spending. *Journal of Airport Management*, 1, 151–157.
- European Commission. (2004). *The commission's decision on charleroi airport promotes the activities of low-cost airlines and regional development*. IP/04/157. Brussels: European Commission.
- Francis, G., Fidato, A., & Humphreys, I. (2003). Airport airline interaction: the impact of low cost carriers on two European airports. *Journal of Air Transport Management*, 9, 267–273.
- Francis, G., Humphreys, I., & Ison, S. (2004). Airports' perspectives on the growth of low-cost airlines and the remodeling of the airport–airline relationship. *Tourism Management*, 25, 507–514.
- Freathy, P. (2004). The commercialisation of European airports: successful strategies in a decade of turbulence? *Journal of Air Transport Management*, 10, 191–197.
- Geuens, M., Vantomme, D., & Brengman, M. (2004). Developing a typology of airport shoppers. *Tourism Management*, 25, 615–622.



- Gillen, D., & Lall, A. (2004). Competitive advantage of low-cost carriers: some implications for airports. *Journal of Air Transport Management*, 10, 41–50.
- Graham, A. (2008). *Managing airports: An international perspective* (3rd ed.). Oxford: Butterworth Heinemann-Elsevier.
- Graham, A. (2009). How important are commercial revenues to today's airports? *Journal of Air Transport Management*, 15, 106–111.
- Halpern, N., & Niskala, J. (2008). Airport marketing and tourism in remote destinations: exploiting the potential in Europe's Northern Periphery. In A. Graham, A. Papatheodourou, & P. Forsyth (Eds.), *Aviation and tourism* (pp. 193–208). Hampshire: Ashgate Publishing.
- Hsu, C. I., & Chao, C. C. (2005). Space allocation for commercial activities at international passenger terminals. *Transportation Research Part E: Logistics and Transportation Review*, 41, 29–51.
- Huang, W. H., & Kuai, L. (2006). The in-flight shopper. *Journal of Air Transport Management*, 12, 207–211.
- Jarach, D. (2001). The evolution of airport management practices: towards a multi-point, multi-service, marketing-driven firm. *Journal of Air Transport Management*, 7, 119–125.
- Kim, H. B., & Shin, J. H. (2001). A contextual investigation of the operation and management of airport concessions. *Tourism Management*, 22, 149–155.
- McLay, P., & Reynolds-Feighan, A. (2006). Competition between airport terminals: the issues facing Dublin Airport. *Transportation Research Part A: Policy and Practice*, 40, 181–203.
- Mocica Brilha, N. (2008). Airport requirements for leisure travelers. In A. Graham, A. Papatheodourou, & P. Forsyth (Eds.), *Aviation and tourism* (pp. 167–176). Hampshire: Ashgate Publishing.
- Morrison, W. G. (2009). Real estate, factory outlets and bricks: a note on non-aeronautical activities at commercial airports. *Journal of Air Transport Management*, 15, 112–115.
- Papatheodorou, A., & Lei, Z. (2006). Leisure travel in Europe and airline business models: a study of regional airports in Great Britain. *Journal of Air Transport Management*, 12, 47–52.
- Parker, D. (1999). The performance of BAA before and after privatisation. *Journal of Transport Economics and Policy*, 33, 133–146.
- Scheers, J. (2001). Attracting investors to European regional airports: what are the prerequisites? *International Airport Review*, 5, 55–63.
- Starkie, D. (2002). Airport regulation and competition. *Journal of Air Transport Management*, 8, 63–72.
- Torres, E., Domínguez, J. S., Valdés, L., & Aza, R. (2005). Passenger waiting time in an airport and expenditure carried out in the commercial area. *Journal of Air Transport Management*, 11, 363–367.
- Tovar, B., & Martín-Cejas, R. R. Are outsourcing and non-aeronautical revenues important drivers in the efficiency of Spanish airports? *Journal of Air Transport Management*, 15, 217–220.
- Zhang, A., & Zhang, Y. (1997). Concession revenue and optimal airport pricing. *Transportation Research Part E: Logistics and Transportation Review*, 33, 287–296.