Computers in Human Behavior 29 (2013) 2431–2437

Contents lists available at SciVerse ScienceDirect

Computers in Human Behavior

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

Check-in services and passenger behaviour: Self service technologies in airport systems

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ARTICLE INFO

Article history:
Available online 20 June 2013

Keywords:
Self service technologies
Passenger behaviour
Airport management
Discrete choice model
Multinomial logit

ABSTRACT

The need for airports to optimise space and the need for airlines to bring down their operating costs favours the use of self-service technologies in services provided to passengers and at check-in, specifically. Checking in online and at kiosks in the airport is gaining ground on the use of the airline check-in desk. The objective of this paper is to analyse the socio-demographic factors or flight characteristics that influence a passenger's choice of check-in from the various options available. For this a multinomial logit is used and applied to an extensive sample of almost 20,000 passengers, of whom 43% were foreigners, at five Spanish airports. The factors that determine the choice of check-in mode include the passenger's age and level of education, the reason for making the journey, waiting time and the type of airline. The universal use of the new technologies in airport management, and the broad cosmopolitan sample mean that the conclusions can be easily extrapolated to other airport systems.

1. Introduction

Information communication technologies (ICTs) and self service technologies (SSTs) haven exploded onto the tourist industry (Ma, Buhalis, & Song, 2003; Oh, Jeong, & Baloglu, 2013) and air transport (Buhalis, 2004; Castillo-Manzano & López-Valpuesta, 2010) scene. Following a commonly accepted definition, self service technologies are technological interfaces that enable customers to produce a service without a service employee's involvement (see Meuter, Ostrom, Roundtree, & Bitner, 2000 and Lin & Hsieh, 2007 for general definitions of SSTs and Colonia-Willner, 2004 and Saleem, Beaudry, & Croteau, 2011 for an analysis of SSTs in specific fields, banking and libraries, respectively). The use of SSTs delivers benefits both for the companies providing the service and for the people consuming it. From the company's point-of-view, the use of SSTs can drive up productivity and efficiency (Dabholkar, 1996; Gelderman, Ghijsen, & van Diemen, 2011; Liljander, Gillberg, Gummerus, & van Riel, 2006; Meuter, Ostrom, Bitner, & Roundtree, 2003), reduce or avoid high labour costs (Beatson, Lee, & Coote, 2007; Lin & Hsieh, 2007) and favours the creation of competitive niches and differentiation (Oh et al., 2013). At the same time, SSTs turn the customers into co-producers of the service (Gelderman et al., 2011) and thus provide them with the benefits of convenience, ubiquitous availability, time, and money savings (Cunningham, Young, & Gerlach, 2008). They also raise the number of possibilities, with new channels for product attention and access (Liljander et al., 2006), more payment choices and greater privacy, control and entertainment than with the traditional system (Lee, Fairhurst, & Cho, 2013).

In the air transport market, passengers can use SSTs to reserve and pay for tickets online, check-in over the Internet or mobile phones, pick up boarding passes at airport kiosks, and receive flight updates on mobile devices (Lin & Hsieh, 2011). As they continue on their journeys, they can go to tourism information kiosks, use self-service systems in dining facilities and also check themselves into their hotels using the self check-in, and automated hotel check-out (Oh et al., 2013). This enables passengers to benefit from major time savings (Chang & Yang, 2008; Lu, Choi, & Tseng, 2011), though just by how much logically depends on the speed and the failure rate of the SSTs (Kokkinou & Cranage, 2013).

Not only the passengers, but also the other actors in the air transport market, airlines and airports, can benefit from the use of SSTs. On the one hand, airlines are looking for new ways to cut operating costs (Liljander et al., 2006), especially after the arrival of the low cost carriers (LCCs), which has led to huge competition between airlines on cost reductions. This has, in turn, resulted in an increased use of the new technologies. The introduction of SSTs is therefore a key point on airlines' agendas (Liljander et al., 2006) and their use for ticketing (Castillo-Manzano & López-Valpuesta, 2010), check-in, and baggage drop-off processes represents an opportunity to improve throughput (Snowdon et al., 2000). Most major airlines have invested in installing self-service technologies

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http://dx.doi.org/10.1016/j.chb.2013.05.030

not only to bring down costs and improve services for the consumer, but also with the aim of constructing an image of maintaining a leading position in electronic service (Chang & Yang, 2008).

Meanwhile airports have had to contend with a change in their management model in recent decades. The function that managers have to optimise involves an increasing number of objectives that can frequently be at odds with each other. The pressure that airlines, especially the LCCs, put them under to drop their fees should be highlighted (Francis, Fidato, & Humphreys, 2003). This leads to the non-over sizing of airports to reign in both the fixed costs of building infrastructure and, logically, maintenance costs. However, at the same time the fall in the expected amount of air travel revenue means that on a day-to-day basis non-air travel revenue that comes from airport concessions for the most part (mainly stores, catering establishments and travel agent's, rent-a-car and shuttle company offices) needs to be maximised. And this in turn means that the space given over to these types of establishments also needs to be maximised, turning airports into veritable malls (Castillo-Manzano, 2010).

Developing the SSTs, specifically those for check-in through kiosks or over the Internet, can reconcile the aims of both airlines and airports while at the same time enabling passengers to reduce the amount of time they spend waiting in queues at the check-in desk. In short, cutting down the number of check-in desks and personnel can result in a considerable reduction in costs for airlines (Chang & Yang, 2008; Lu et al., 2011) while allowing airports to design smaller airports and/or with more space (Chang & Yang, 2008) and generate greater volumes of air travel revenue.

However, implementing SSTs can be a risky business for the service distribution company in any activity. Firstly because it represents a substantial investment in terms of both time and money (Beatson et al., 2007; Chang & Yang, 2008), innovation in organisational operation and even changes in its competitive mode (Chang & Yang, 2008). And secondly, because the success of the initiative depends significantly on passengers accepting the SSTs. According to Holguín-Veras and Preziosi (2011), it is often risky to assume that a technology will be accepted and used by society, regardless of how beneficial it seems to be. Replacing desks with online check-in or kiosks might create apprehension in those who lack sufficient experience with the technology (Liljander et al., 2006) or technology anxiety (Meuter et al., 2003), and at the same time means a reduction in personal interaction, which is a highly-valued part of company loyalty (Oh et al., 2013).

The success of the joint airport-airline strategy to extend these new types of check-in (online or kiosks) therefore requires our improved knowledge of the passenger profile to include their acceptance or rejection of SSTs. Despite the rapid increase of the use of SSTs, the literature on factors influencing customers' use of SSTs is limited according to various authors (Gelderman et al., 2011; Lin & Hsieh, 2007; Meuter et al., 2003).

Our objective is, therefore, to analyse the socio-demographic factors and also the flight and airport characteristics that influence a passenger's choice of check-in options. Three choices are specifically considered: receiving personal attention from an airline employee at an airport check-in desk or using SSTs, whether through online check-in or by using the kiosks located in airports. For this we use a multinomial logit to find the substitution rate between the three check-in types, desk, online and kiosks). The model and the conclusions drawn could be of use for airport and airline management en cualquier lugar del mundo when making costly investments in SSTs and when designing passenger awareness and information campaigns to extend the use of online or kiosk check-in.

2. Data and methodology

For this study, we use data collected through surveys conducted by the Spanish Public Airport Authority (AENA) in summer, 2010. The key characteristics of AENA's survey campaigns are listed in Table 1 (see Castillo-Manzano, López-Valpuesta, & Gonzalez-Laxe, 2013 for another application for this database). In contrast to the limited sample sizes in other studies that analyse the use of SSTs for check-in (Chang & Yang, 2008; Gelderman et al., 2011; Lu, Chou, & Ling, 2009 and Lu et al., 2011) our research uses a database of almost 20,000 passengers, 19,426 to be precise, who were interviewed in the departure lounges at five different Spanish airports, namely, Alicante, Santiago de Compostela, Seville, Tenerife Sur and Valencia. The small average sampling error of ±1.60% should also be highlighted, along with the high number of travellers from other countries, specifically 8374, most of them from other European Union countries, mainly France, Germany and the United Kingdom.

This paper clearly overcomes the barriers of the typical local case study and seeks to address the main trends and factors that influence the check-in process. The breadth of the sample and the large number of travellers of multiple nationalities, together with the widespread use of SSTs for check-in at airports worldwide (to be specific, according to International Air Transport Association (IATA) (2012) data, there are over 5000 kiosks in operation at some 200 airports in different areas of the world), enable the conclusions that were drawn to be generalised.

Finally, as with similar databases, each observation was weighted according to the total number of passengers on the flight so that the sample could be expanded to the total population; see Dresner (2006) for an explanation of the weighting methodology.

Another of the study's strengths is the wide range of explanatory variables used, 36 to be exact. This enables us to provide a highly detailed profile of the passengers who use each of the different check-in methods and thus try to determine future trends.

It should also be emphasised that we analyse three check-in modes as we consider it necessary to distinguish between the

Table 1
Survey of technical data.

Airport		Santiago	Alicante	Seville	Tenerife Sur	Valencia
Airport traffic in 2010		2,172,869	9,382,931	4,224,718	7,358,986	4,934,268
Information gathering	Questionnaire	Available in six languages		Available in five languages		
Sampling	General	Departing passengers > 15 years of age. Minors have been guestimated.				
	Sample size (before weighting)	3530	3202	6027	3092	3540
	Sampling method	Stratified by traffic segments in which a selection of flights was made for each route, and a group of passengers was selected by means of systematic sampling.				
	Sampling error	±1.6%	±1.7%	±1.2%	±1.8%	±1.7%
Field work	Location	Departure lounges				
	Time period	30 June-6 July	22–28 July	10–16 July	9–16 de July	12–18 July
	Timetable	Monday–Sunday. Shifts were conducted from 6am to 10 pm, with times extended in cases of high traffic				
	Year	2010				

two types of SST, online and kiosk. The usefulness of this distinction, for airlines especially, has been stated by Lu et al. (2009) and by Liljander et al. (2006), who consider that airlines prefer online check-into kiosks because maintenance is cheaper and availability is not restricted to the airport.

A multinomial logit model was used to analyse the factors that define the profile of passengers who use each of the three check-in types, i.e., desk, online and by kiosk. The multinomial logit model is used when the dependent variable is not ordinal but rather consists of more than two categories, as well as when there are case-specific independent variables only (see Cameron & Trivedi, 2009). According to Greene (2003), the multinomial logit probability formula for passenger i when he or she chooses purchase channel j for three category outcomes and frequency weights is:

$$P_{ij} = Pr(y_i = j) = \begin{cases} 1/1 + \sum_{m=2}^{3} e^{(x_i \beta_m)}, & \text{if } j = 1 \\ E^{(x_i \beta_m)}/1 + \sum_{m=2}^{3} e^{(x_i \beta_m)}, & \text{if } j \neq 1 \end{cases} \quad (1)$$

Note that x_i is the row vector of the values observed for passenger i in the case-specific independent variables and β_m is the coefficient vector for outcome m.

As in binary-outcome models, in multinomial models only the sign of the coefficient has a direct interpretation. In order to facilitate interpretation of the results, odds ratios or relative-risk ratios are usually used for all the explanatory variables; see Castillo-Manzano and López-Valpuesta (2010) for a recent analysis of these ratios with regard to categorical variables, and Cameron and Trivedi (2009) and Long and Freese (2006), for a more general description of their econometric implementation. The relative probability or odds ratio of choosing alternative j rather than alternative 1, also called the base outcome, is given by $\frac{Pr(y_i = j)}{Pr(y_i = 1)} = e^{x_i \beta_j}$.

Therefore, the odds ratio or relative-risk ratio of choosing alternative j over alternative i for a one-unit change in x_{im} is then:

$$\frac{e^{\beta_{1j} x_{i1} + \cdots + \beta_{mj}(x_{im}+1) + \cdots + \beta_{kj} x_{ik}}}{e^{\beta_{1j} x_{i1} + \cdots + \beta_{mj} x_{im} + \cdots + \beta_{kj} x_{ik}}} = e^{jm} \quad (2)$$

However, multinomial logit coefficients and odds ratios only allow us to study the substitutability relations between options set in pairs, that is, the relation between each option and the base category. In order to overcome this focus on pair-wise oppositions we calculate the marginal effects across all considered options. This way, we can study the effects of variation in each one of the independent variables along three possible categories (that is, desk, online or kiosk). This would thus enable us to obtain a direct substitutability relation between the three check-in channels. According to Cameron and Trivedi (2009), the marginal effects at the mean (MEMs) for the multinomial logit model are:

$$\frac{\delta p_{ij}}{\delta \bar{x}} = p_{ij}(\beta_j - \bar{\beta}_i) \quad (3)$$

Note that $\bar{\beta}_i = \sum_l p_{il} \beta_l$ a probability-weighted average of β_l.

To summarise, a calculation has been done (see Table 3) of the increase (Δ) or decrease (∇) in the likelihood that the passenger will choose one of the analysed check-in methods as a result of a change in each of the 36 explanatory variables used. Also, despite the wide-ranging set of explanatory variables used, a quite strict correction for heteroscedasticity of clusters by airport of origin has been included with the aim of avoiding any problems caused by omitted variables due to any specific characteristics of the airports under study.

Table 2 shows the case-specific independent variables, and their descriptive statistics used to estimate the probability of passenger i choosing check-in channel j.

3. Results

Table 3 shows the marginal effects obtained for the 36 explanatory variables used. Twenty-four of these present a statistically significant marginal effect for at least one of the check-in methods. A total of 48 significant marginal effects were obtained and enable us to provide a good picture of the user of each check-in type.

4. Discussion

Firstly, time is working on the side of self check-in systems and against traditional desks, as it is the youngest users who are most in favour of the former. To be precise, a passenger of less than 30 years of age is 11.5% more likely to choose self check-in online than passengers over 65 years old. Other studies, such as Lu et al. (2011), arrive at this same conclusion and state that younger passengers prefer self-service check-into conventional check-in. Castillo-Manzano and López-Valpuesta (2010) also find that older people prefer the human touch when it comes to air ticket purchase. This finding is also consistent with the many studies that analyse the difficulties that the elderly encounter with the new technologies in general (Barnard, Bradley, Hodgson, & Lloyd, 2013; Wagner, Hassanein, & Head, 2010) and with the analysis of age-related barriers to the adoption of online products and services (Chattaraman, Kwon, & Gilbert, 2012), for example.

Other socio-demographic factors, such as gender or level of education, can also have an impact. As did Lu et al. (2011), we also find that female passengers prefer self-service check-in, specifically via kiosks in our case. A high level of education would also seem to facilitate access to the new technologies and, therefore, to self check-in. Passengers with a university degree once more present an 11.5% greater likelihood of opting for auto online check-in. This is especially important if it is borne in mind that airports are the natural environment of university graduates, as shown in Table 2 (the median of the Education variable is 3, i.e., holding a university degree, and the mean is 2.46).

Our findings would not seem to corroborate those of Meuter et al. (2003) regarding income level not having any effect on the use of SSTs (see also Akman & Mishra, 2010 with an example of another empirical analysis which shows no income level-related differences in internet use). We have included a series of variables in our study that can act as direct and indirect proxies of passengers' income levels, such as level of education and employment status. Indirect proxies include whether the passenger travels to the airport by courtesy bus or has stayed in a hotel rather than some other type of residence (such as a first or second home, or at the home of a friend or relative). In such cases, a preference is shown for the use of the check-in desk. Of all the variables, the courtesy bus variable is once more implicit of the concept of comfort, as many of these buses, especially at the airports of Alicante, Tenerife Sur and Valencia, cater for package tours organised by tour-operators for groups on sun and sand holidays. In other words, the passengers travel together as a group and it is the tour-operator, generally with its own check-in desks, that both facilitates check-in at the desk and, on many occasions, makes it compulsory by not permitting self check-in for these types of tourist packages.

With respect to transport, it is important to highlight the positive relationship that seems to exist between the self check-in systems, especially the online system, and the choice of the mode of transport with the best value for money, i.e., the light railway or underground. This is demonstrated by the fact that there is a clear 12% fall in the likelihood that public rail transport users will choose the desk as their check-in method.

At the same time there do not seem to be huge differences in the reason for making the journey except, some, albeit slight, pref-

Table 2
Description of explanatory variables.

Variable		Explanation	No. obs.	Mean	Median	Stand. dev.
Male		1 if male, 0 if female	10,177	0.524	1	0.499
Age		1 < 30; 2 = 31–49; 3 = 50–64; 4 > 65	–	1.999	2	0.821
Spanish		1 if passenger is Spanish, 0 if passenger is foreign	11,052	0.569	1	0.495
Education		1 = no formal or only primary education; 2 = completed secondary education; and 3 = holds university degree	–	2.462	3	0.652
Frequent flier		1 no flights; 2 1 to 3 flights; 3 4 to 12 flights; 4 More than 12 flights	–	2.332	2	0.960
Reason for travel	Business	1 if flight is for business reasons, 0, otherwise	4082	0.210	0	0.407
Base category: vacation passenger	Vacation	1 if flight is for a vacation, 0, otherwise	9721	0.500	1	0.500
Airline	Spanish low-cost carrier. (LCC)	1 if passenger is flying on an LCC; 0, otherwise	12,071	0.621	1	0.485
Base category: traditional airline	International low-cost carrier	1 if passenger is flying on an international LCC; 0, otherwise	8937	0.460	0	0.498
	Charter	1 if passenger is flying on a charter airline, 0, otherwise	1254	0.065	0	0.246
Connecting flight		1 if passenger is connecting to another flight at the airport, 0, if flying no further	2349	0.121	0	0.326
Destination	Eurozone international destination	1 if passenger is taking an international flight with a final destination in a Eurozone country, 0, otherwise	9935	0.511	1	0.500
Base category: domestic flight	Non-Eurozone international destination	1 if passenger is taking an international flight with a final destination outside the Eurozone, 0, otherwise	810	0.042	0	0.200
Directly from the airline		1 if passenger has purchased his ticket directly from the airline at an office, by phone or over the Internet, with no intermediation, 0, otherwise	10,034	0.517	1	0.500
Phone		1 if passenger has purchased his ticket by phone, 0, otherwise	1175	0.060	0	0.238
Internet		1 if passenger has purchased his ticket over the Internet, 0, otherwise	13,723	0.706	1	0.455
Length of stay (LOS)	One-day trip	Same day return	1344	0.070	0	0.255
Base category: passengers who travel 7–14 days	Up to a week	2 = 2–7 days;	11,188	0.581	1	0.493
	Long-term trip	15 or more days	2913	0.151	0	0.358
Waiting time prior to boarding		1 < 1 h; 2 = 1–2 h; 3 = 2–3 h; 4 > 3 h	–	2.649	3	0.815
Weekend		1 if the survey was taken on a Saturday or Sunday, 0, otherwise	5516	0.284	0	0.451
Accessibility	Taxi	1 if passenger has travelled to the airport by taxi, 0, otherwise	4513	0.232	0	0.422
Base category: private vehicle	Courtesy bus	1 if passenger has travelled to the airport by courtesy bus, 0, otherwise., 0, otherwise	2002	0.103	0	0.304
	Rent-a-car	1 if passenger has travelled to the airport by rental car, 0, otherwise	1916	0.099	0	0.298
	Public bus	1 if passenger has travelled to the airport by public bus, 0, otherwise	2113	0.109	0	0.311
	Public rail transport	1 if passenger has travelled to the airport by light railway or underground, 0, otherwise	976	0.050	0	0.218
Group size		1 = travelling alone; 2 = 2 people; 3 = 3 or more people	–	1.747	2	0.763
Children		1 if passenger is flying with children, 0, otherwise	2164	0.111	0	0.315
Accompaniment	Work	1 if passenger is travelling with work colleagues, 0, otherwise	706	0.036	0	0.187
	Friends	1 if passenger is travelling with friends, 0, otherwise	1932	0.099	0	0.299
	Family	1 if passenger is travelling with family, 0, otherwise	8066	0.415	0	0.493
Hotel		1 if passenger was staying in a hotel prior to travelling to the airport, 0, otherwise	6559	0.338	0	0.473
Airport traffic		Thousands of passengers per week at each airport at the time that the surveys were taken	–	51.258	44.979	25.429
Expenditure at the airport		Euros spent by passengers at stores and catering establishments	–	7.100	2	14.300
Purchase		1 if the passenger makes a purchase, 0, otherwise	4748	0.244	0	0.430
Food and drink		1 if the passenger purchases food or drink, 0, otherwise	8961	0.461	0	0.499

Table 3
Results: marginal effects at the mean (%).

Variable		Desk	Online	Kiosk
Male		Δ0.048% (0.983)	Δ0.271% (0.932)	∇0.319% (0.152)**
Age		Δ3.618%(1.474)**	∇3.847%(1.393)***	Δ0.229%(0.169)
Spanish		∇3.19%(2.57)	Δ4.21%(2.332)*	∇1.02%(0.43)**
Education		∇3.598%(1.271)***	Δ5.181%(0.834)***	∇1.583%(1.076)
Frequent flier		∇5.523%(0.413)***	Δ4.738%(0.41)***	Δ0.786%(0.211)***
Reason for travel	Business	Δ1.102%(0.608)*	∇1.172%(0.685)*	Δ0.07%(0.659)
Base category: vacation passenger	Vacation	Δ1.945%(2.18)	∇1.287%(1.898)	∇0.658%(0.536)
Airline	Spanish low-cost carrier (LCC)	∇3.275%(6.577)	Δ8.422%(7.01)	∇5.148%(1.742)***
Base category: traditional airline	International low-cost carrier	∇21.915%(6.093)***	Δ23.365%(5.504)***	∇1.45%(1.244)
	Charter	∇1.713%(2.94)	Δ4.767%(3.104)	∇3.053%(0.467)***
Connecting flight		Δ6.167%(3.336)*	∇5.612%(3.249)*	∇0.555%(0.31)*
Destination	Eurozone international destination	Δ2.018%(2.943)	∇2.198%(2.809)	Δ0.180%(0.344)
Base category: domestic flight	Non-Eurozone international destination	∇0.705%(2.624)	∇1.565%(2.896)	Δ2.27%(0.651)***
Directly from the airline		∇11.262%(3.969)***	Δ11.431%(3.745)***	∇0.17%(0.811)
Phone		∇9.313%(4.393)**	Δ10.638%(4.249)**	∇0.133%(0.548)*
Internet		∇22.708%(1.7)***	Δ24.093%(1.806)***	∇13.851%(0.612)**
Length of stay (LOS)	One-day trip	∇22.832%(5.104)***	Δ23.332%(5.79)***	∇0.500%(1.174)
Base category: passengers who travel 7–14 days	Up to a week	∇4.132%(2.651)	Δ4.265%(2.825)	∇0.133%(0.494)
	Long-term trip	Δ3.063%(1.018)***	∇3.388%(1.178)***	Δ0.236%(0.319)
Waiting time prior to boarding		Δ2.6%(1.368)*	∇2.974%(1.178)**	Δ0.375%(0.483)
Weekend		Δ2.185%(0.95)**	∇0.664%(1.634)	∇1.521%(0.712)**
Accessibility	Taxi	Δ2.895%(3.015)	∇3.433%(2.867)	Δ0.538%(0.38)
Base category: private vehicle	Courtesy bus	Δ15.44%(1.747)***	∇16.571%(1.953)***	Δ1.131%(1.873)
	Rent-a-car	Δ0.108%(2.364)	∇0.614%(1.855)	Δ0.506%(0.805)
	Public bus	∇0.506%(1.745)	Δ1.424%(0.900)	∇0.917%(0.962)
	Public rail transport	∇11.904%(3.362)***	Δ9.784%(2.765)***	Δ2.12%(1.568)
Group size		Δ1.590%(1.919)	∇0.694%(2.561)	∇0.896%(0.901)
Children		Δ4.777%(5.077)	∇3.628%(4.092)	∇1.150%(1.361)
Accompaniment	Work	∇1.839%(5.152)	Δ3.253%(4.698)	∇1.413%(0.837)*
	Friends	∇6.056%(3.366)*	Δ6.446%(3.077)**	∇0.390%(0.769)
	Family	Δ0.267%(3.01)	Δ0.242%(2.625)	∇0.509%(0.907)
Hotel		Δ1.871%(0.802)**	∇1.048%(0.772)	∇0.823%(0.202)***
Airport traffic		∇0.002%(0.072)	Δ0.014%(0.08)	∇0.012%(0.028)
Expenditure at the airport		∇0.015%(0.017)	Δ0.006%(0.018)	Δ0.009%(0.009)
Purchase		Δ3.668%(0.836)***	∇2.865%(1.066)***	∇0.803%(0.33)**
Food and drink		Δ1.061%(2.615)	∇1.051%(2.638)	∇0.010%(0.22)
Log pseudo likelihood			−4346626.7	
Wald Chi2 without clusters (*p*-value)			2706.78 (0.000)	
Pseudo R2			0.210	

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

erence for the traditional check-in desk shown by business travellers, possibly due to the fact that in such cases they also pay the business class fare, with all the privileges that entails, including not having to wait for long periods of time in queues at the desks, as they have specific desks available to them. In this case the prior literature comes to different conclusions as it considers that non-business passengers are those that use the desks more and require greater assistance (Dresner, 2006), whereas business passengers tend to use self-service kiosks or web check-in (Lu et al., 2011).

Our findings clearly show that frequent fliers opt for the self check-in, either online or at a kiosk, and there is therefore a decrease in the likelihood of their using the check-in desks. A passenger with over 12 flights per year is almost 17% less likely to use the desk than the occasional flyer who has taken no other flight in the same year. This finding can be justified by the greater familiarity of these passengers with the airport environment and supports the findings by Lu et al. (2011), but contrasts with the findings of Chang and Yang (2008), for whom frequent flyers were found to prefer check-in desks as long as there are no long queues waiting. The lack of familiarity with the airport setting could also have an impact when a passenger is in a foreign airport. According to Table 3, in cases like this passengers are more likely to use the kiosks as they work in a more or less standardised way in all countries and will generally allow them to select their own languages. Foreigners tend to use the self check-in on the web before arriving at the airport less, however. This last finding is logical as these are passengers who are far from their homes or workplaces, which makes it difficult for them to print out boarding passes. However, with time new developments are expected in this last finding thanks to the significant advances made in the ICTs and the SSTs since summer 2010, when the surveys were carried out, which would facilitate self check-in before arriving at the airport, even if the passenger is not inside the country. The first thing that stands out is the expanding use of the internet through wireless devices, such as laptops and PDAs (Serif & Ghinea, 2008), and, more recently, through smart phones and handheld tablet devices (Barnard et al., 2013; Zhong, 2013). Secondly, it is easier to access free or low-cost WiFi hotspots in dense public places (Leroy et al., 2011). To this must be added the development of mobile applications (Bellman, Potter, Treleaven-Hassard, Robinson, & Varan, 2011; Benbunan-Fich & Benbunan, 2007) that the airlines have adapted to facilitate self check-in. Kiosks are losing ground as a result of all these technological advances while smartphones and websites will foreseeably be the dominant channels for passenger processing beyond 2015 (International Air Transport Association (IATA), 2012).

One interesting topic is the influence that the type of airline has. We have differentiated between two types of LCC in our model, Spanish LCCs and International LCCs, not so much on the basis of the airlines' nationalities, but their management models. To be

precise, the Spanish LCC category almost entirely corresponds to Vueling, whose passengers present behaviour that is very similar to that of traditional airlines. Meanwhile, the international LCC category basically includes airlines like easyJet and, above all, Ryanair, which dominate the category. These are airlines that strictly adhere to a low cost carrier model that is clearly different from what had existed in the air transport market before they arrived. By differentiating between these two cases it can be seen that LCCs *per se* do not condition self check-in online, as is shown by the fact that the Spanish LCC variable is not significant while the international LCC variable is. It is evident that the service offered by the latter penalises passengers who do not check-in online before arriving at the airport – this is the case of Ryanair, which charges a surcharge of 60€ each way for issuing boarding passes at the check-in desk – and as they do not provide many kiosks check-in is mostly done online. It is not, therefore, that LCC passengers behave differently, but that they react naturally to an obvious economic stimulus.

In fact, the results provide us with an almost perfectly clear profile of the user that will most likely use the self check-in on the web. These users are passengers on a strict LCC (Δ23.365%), that have purchased their tickets directly from the airline (Δ11.431%) via the airline's website (Δ24.093%) – which is practically compulsory for this airline category – and are returning on the same day (Δ23.332%) and therefore have little luggage. The likelihood that they will use the online self check-in system rises by 82% compared to passengers of traditional airlines or less strict LCCs, who purchase their tickets at a travel agent's and go on trips lasting one or two weeks.

There is a conspicuous positive correlation between self check-in online and travelling with friends, which clearly penalises check-in desks. It might seem *a priori* that a group of passengers might prefer to check in at a desk given that it makes it easier to choose where to sit. This is the very same conclusion that Lu et al. (2011) came to, as they considered that passengers who travel with fewer companions tend to use self-service kiosks or web check-in. However, our results show that the Internet self check-in model is perfectly compatible with group travel, even when the people travelling together do not live together. This finding is supported by the lack of statistical significance of the group size variable, i.e., the total number of people travelling together has no effect on the check-in method used.

The airline desk can also be seen to clearly correlate with a greater waiting time before boarding. This is logical and confirms the intuition that might have been had *a priori* that people who use self check-in arrive at the airport nearer boarding time and therefore have a lower generalised journey cost as they reduce the time that their trip consumes. In fact, if a passenger has to bear over 4 h of waiting time the likelihood that he or she has checked in via the Internet falls by 9%. According to some authors, the savings in terms of time (Meuter et al., 2000) and the long queues at desks (Gelderman et al., 2011) are factors that determine the use of SSTs. So determining are they that, for Gelderman et al. (2011), when the two queues (desk and kiosk) appear to be equally long, the passenger probably joins the queue of the personalised check-in.

Finally, it seems that there is no great direct difference between the way that passengers check-in and their ability to generate non-air travel revenue at the airport through the purchase of goods and food and drink. The basic variable, which is the amount of money spent, therefore remains unaffected, although there does seem to be a slight change in the way that non-air travel revenue is generated. Specifically, it seems that passengers who make purchases in airport stores are almost 4% more likely to have checked in at a desk before doing so.

5. Conclusions

If the future of airlines and airports lies with freeing up space and making costs savings, the use of SSTs for checking in has to be a joint commitment that requires knowledge of the passenger profile, whether of the passenger that already opts for this check-in mode or the one who has still not made the jump to the new technologies. Using the largest sample to date, this study provides a profile of the main characteristics of users of the different check-in modes and its conclusions can easily be extrapolated to the hinterland of any modern airport. This enables us to see, for example, how, of all the many other factors that have been described, the users of check-in desks – the antithesis of SSTs – are more often occasional travellers who take flights with stopovers for business reasons and fly on traditional airlines or not overly aggressive LCCs, who spend long periods of time away from home (and therefore take a fair amount of luggage with them), and travel to the airport from a hotel by courtesy bus.

In other respects, the findings of the study show that the lack of trust shown by passengers who do not opt for SSTs could be driven by their own lack of technological expertise (less well-educated passengers) or by their need for interaction (older passengers). This lack of trust can be overcome by airlines offering some kind of personal assistance. This could be in the form of airline staff present in the kiosk area, which would boost passengers' trust in SST use (Gelderman et al., 2011), or by putting phones in the kiosks themselves so that passengers can obtain help without leaving their private information exposed on the screen (Dabholkar & Spaid, 2012). Campaigns or advertisements will also obviously be required for these passengers in order that they might familiarise themselves with these new types of check-in, and also training or education programmes (Meuter et al., 2003).

One fundamental aspect for airlines will be their ability to put across the advantages of these new types of check-in (kiosks and online) compared to the traditional check-in desks. One of the most evident advantages is the convenience of not having to stand in the queues that usually form at the check-in desks and the shortened waiting time. Avoiding queues is something that is so highly appreciated by passengers that some airports are even looking at this idea for security checks for registered frequent fliers. For these reasons, the absence or reduction of these advantages in time savings would explain certain findings in this study, where the passengers opt to a greater extent for the check-in desk, such as the business traveller (who have their own check-in desks if, as consistent with their category, they are flying in business class) or travelling at weekends (in a more relaxed and less congested atmosphere and, therefore, with shorter queues).

Despite all this, if passengers do not perceive the advantages of using the kiosks and the online check-in service, or the airlines and airports are not capable of putting these advantages across through information campaigns, there are always incentives (Chang & Yang, 2008; Liljander et al., 2006; Meuter et al., 2003). These incentives could be positive, in the form of extra air miles, for example (Liljander et al., 2006), or negative, in which case the simplest way would be hefty economic penalisation for passengers who use traditional desks, as has already been mooted by Ryanair. Other proposals suggest a gradual reduction in the number of traditional check-in desks and the intentional creation of queues (Chang & Yang, 2008), or replacing all the desks with self-check-in, as has already been done in some airports (Reinders, Dabholkar, & Frambach, 2008).

In any case, there are three trends that will shape the future. Firstly, technological development will mean that SSTs will play an even more important role in the future than they do currently (Beatson et al., 2007). Secondly, the spread of the strict low-cost

model, even among traditional airlines, is currently leading to a change in passenger behaviour, and will continue to do so in the future: passengers will be forced to "do it yourself" right from the beginning of their journeys. And finally, it is the young who are the most committed to using the new technologies and to using the SSTs for check-in, and this is confirmed by the findings of this article. For all these reasons, checking in online or at kiosks will be an option that passengers will increasingly use, and even more so if some way can be found around the restrictions that exist regarding the checking in of luggage or for flights on other airline companies.

Acknowledgements

The authors are grateful to prof. Robert Tennyson for their helpful comments. The authors would also like to express their gratitude to AENA and the Spanish Ministry of Economy and Competitiveness (ECO2012-36973) for their support.

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