Institut de Recerca en Economia Aplicada Regional i Pública
Research Institute of Applied Economics

Document de Treball 2012/07 21 pàg
Working Paper 2012/07 21 pag.

"Price differences between domestic and international air markets: an empirical application to routes from Gran Canaria"

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Abstract

In this paper we examine whether airline prices on national routes are higher than those charged on international routes. Drawing on a database prepared specifically for this study, we estimate a pricing equation for all routes originating from Gran Canaria (Canary Islands, Spain), differentiating between national and international routes. A key difference between these two route types is that island residents benefit from discounts on domestic flights. When controlling for variables related to airline characteristics, market structure and demand, we find that national passengers who are non-residents on the islands are paying higher prices than international passengers.

JEL classification: L93, H2, L13.
***Keywords*:** Air transport, discounts, prices.

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1. Introduction

Governments in Europe deal with the provision of air services on thin or peripheral routes by offering subsidies to the airlines or passengers.[1] In Spain, the government has established a 50% discount on fares paid by residents of the Canary or Balearic Islands on domestic routes linking these islands with other islands and/or the mainland.

This paper draws on data for routes departing from Gran Canaria airport, including all national and international destinations. The main goal is to determine whether price differences on these routes are specifically attributable to the application of discounts on national routes. Our analysis is based on the estimation of a pricing equation that includes explanatory variables related to airline characteristics, market structure and demand.

2. Data

The unit of observation is at the level of the airlines operating on each route. We include all European destinations from the island, both national and international, linked by non-stop scheduled flights in the period 2009-2010. The database was constructed with data from two specific seasons (winter 2009 and summer 2010) so as to control for any potential seasonal effects. In one of the seasons 30 airlines offered non-stop flights from Gran Canaria. In the winter season 51 European destinations were connected by a direct flight, while in the summer this number rose to 60. A total of 133 observations (route and airline) are included in our database.

Note that we exclude intra-Canarian routes from our sample because they present very specific characteristics in relation to the rest of routes that have the airport of Gran Canaria as their origin. These excluded routes are short-haul routes, have a high flight frequency and are served by regional aircrafts. They are, moreover, subject to public service obligations and airlines operating these routes must meet the imposed price caps and frequency floors.

[1] See Williams (2004) and Williams and Pagliari (2005) for a review of the use of public service obligations in the European Union and Santana (2009) for an analysis on whether public service obligations have any effects on airline costs.

Statistical data on airline prices are difficult to obtain in Spain (and in Europe). We therefore collected the price data required from each airline's webpage according to the following specifications. The prices included are for direct flights between Gran Canaria and the city of destination. The data were obtained from airline web sites employing a homogeneous process in one sample week for each of the two seasons under consideration. Information was collected one month before travelling and the price refers to the cheapest fare for the first trip scheduled in the week (the return being on the following Sunday). The average price for all the routes in our sample is 287€.

Flight frequency data for each airline were collected for the same sample week as that for which price data were taken. This information was obtained from the website of the Official Airline Guide. The mean weekly frequency offered by the airlines making up our sample of routes was 4.6 flights. In terms of the percentage of total frequencies, the mean share of airlines operating on the route was 0.69, while the mean share of airlines operating at the airport was considerably less (0.03). Thus, route competition is generally weak but no one airline has a dominant position in the airport.

We obtained data on total passenger numbers on each route from the website of the Spanish airport operator (AENA). The average number of passengers per route was 85,943 per season. Distance data were collected from the website of webflyer.com. The average distance of the routes in our sample was 2,867 km. Given that the shortest route was 1,385 km, our analysis focuses on long-haul routes. Finally, data on the population and the gross domestic product per capita at the level of NUTS 3 and data on the number of tourists at the point of destination at the NUTS 2 level were obtained from the Spanish Statistics Institute and Eurostat.

National destinations represent 14% of total destinations. Madrid and Barcelona are the most frequently served national destinations, while cities in the United Kingdom and Germany are the most frequent international destinations. Table 1 includes average data by national and international routes. This table shows the differences between the two route types. Thus, national routes are cheaper in terms of overall price, but no substantial difference exists in terms of price per kilometre. National routes are also much denser and shorter. Furthermore, airline competition seems to be stronger on these national routes because the mean airline market share and the Herfindahl-Hirschman index (HHI) are lower. However, low-cost carriers represent 72% of observations on international routes but 31% of observations for national routes.

Insert table 1

Nevertheless, note that a multivariate empirical analysis is required to identify price differences between national and international air routes.

3. The empirical model

Our empirical analysis is based on the estimation of the following pricing equation for airline *i* on route *k* in season *t*:

$$\begin{aligned}\text{Price}_{ikt} &= \alpha_0 + \alpha_1 \text{Number\_destinations}_{it} + \alpha_2 D_i^{LowCost} + \alpha_3 D_k^{National} \\ &+ \alpha_4 D_t^{Summer} + \alpha_5 \text{Distance}_k + \alpha_6 \text{Demand}_{kt} + \alpha_7 HHI_{kt} + \varepsilon_{ikt}\end{aligned} \quad (1)$$

The explanatory variables included in the estimation of the pricing equation are the following:

1. $\text{Number\_destinations}_{it}$: number of destinations from Gran Canaria airport offered by airline *i* in season *t.*

We expect a negative sign in the coefficient of this variable that seeks to capture the activity of the airline at the airport of origin (Gran Canaria). In other words, an airline could cut costs by offering a higher number of routes from this airport as it would be able to share the fixed costs among a higher number of passengers. In addition, its planes and crew could be employed more intensely.

Several papers report evidence of a hub premium effect, whereby airlines with a considerable presence in the airport of origin can charge higher prices by exploiting their market power. However, given that our data show that no single airline occupies a dominant position at the Gran Canaria airport, the hub premium effect should not be especially relevant here. Additionally, the proportion of leisure passengers is high and Gran Canaria airport is not a hub. Overall, we expect the cost effect to be of greater relevance than that of the hub premium.

2. $D_i^{Low\ Cost}$: a variable that takes a value of 1 if airline *i* is a low-cost carrier, where such a carrier is defined as an airline that offers a single fare class across its network of routes.

We expect a negative sign in the coefficient of this variable. As described in the literature of airline economics and management, low-cost carriers are able to operate with lower costs per seat than other types of carrier, such as charter or regional airlines, and a part of these cost savings should be transferred to passengers through lower fares.

3. $D_k^{National}$: a variable that takes a value of 1 if route *k* has a national destination. As indicated above, this variable is the primary focus of our analysis.

After controlling for several characteristics specific to the airlines and routes, we expect the price differences between national and international destinations to be largely explained by the discount policy applied to national destinations. Hence, we expect a positive sign in the coefficient of this variable. The price discounts might mean greater demand among island residents for domestic destinations and, moreover, the price elasticity of demand may well be lower on these routes. This might lead airlines to charge higher prices on routes with national destinations.[2]

4. D_t^{Summer}: a variable that takes a value of 1 if period *t* falls within the summer season.

We expect a positive sign in the coefficient of this variable. If we consider that Gran Canaria is a tourist destination, travellers will presumably be willing to pay a higher price during the summer season.

5. $Distance_k$: air distance from Gran Canaria to point of destination.

Route length is a major determinant of airline costs and the sign of its coefficient in the price equation is expected to be positive and lower than one. This means that the increase in costs is less than proportional to the increase in the number of kilometres

[2] Calzada and Fageda (forthcoming) show that Spain's discount policy has resulted in a demand increase and a lower price elasticity of demand among the islands' residents.

flown. Long-haul routes involve higher average speeds, less intense consumption of fuel, and lower airport charges per kilometre.

6. $Demand_{kt}$: total number of passengers on route *k* in period *t*.

The expected sign of this variable is *a priori* ambiguous. Airlines may make cost savings by exploiting economies of density on thicker routes; however, the mark-up on costs may also be higher on thicker routes due to the exploitation of market power.

7. HHI_{kt}: The Herfindahl-Hirschman index of concentration is calculated as the sum of the squares of shares of the airlines operating on route *k* in period *t*. The airlines' shares are expressed in terms of weekly frequencies.

We expect a positive sign in the coefficient of this variable. A high concentration index implies that competition is not so great and so prices might be higher.

Recall that the focus of our analysis is the identification of differences in the prices charged by airlines on national and international routes. To this end, we have sought to ensure that our sample of routes presents conditions that are largely homogenous so as to constitute an accurate test of the effects of resident discounts on airline fares in remote regions.

All the routes considered depart from the same airport of origin on the island of Gran Canaria, where the island's residents benefit from price discounts on national routes. The airport presents three major characteristics. First, it services a major tourist destination that received more than 2.4 million tourists in 2010. Hence, our analysis focuses its attention on peripheral, though not necessarily thin, routes since several routes departing from Gran Canaria can generate a high volume of traffic.

Second, all routes departing from Gran Canaria to continental Europe are relatively long routes on which intermodal competition is not a viable possibility. Thus, we are dealing with long-haul routes with a high proportion of leisure passengers. This is true both of national and international routes. Third, and finally, no one airline enjoys a position of dominance at the airport.

Given the homogeneous conditions for the set of routes considered, a potential explanation for the differences in the prices charged by airlines on national and international routes may be related to the discount policy.

4. Results

As the variables of demand and those of the concentration index may be simultaneously determined, the estimation is made using the two-stage least squares estimator. Note also that the variables of concentration and demand are highly correlated so the individual identification of these two variables might be distorted if they are jointly included as regressors in equation (1). Hence, we estimate different specifications of equation (1):

i) A specification that includes the demand variable as a regressor but not the concentration index.

ii) A specification that includes the concentration variable as a regressor but not that of demand.

iii) A specification that includes both the variables of demand and concentration as regressors.

The use of the two-stage least squares estimator requires the use of instruments that must be correlated with the variables instrumented and which are not endogenous. To this end, we include the following variables as instruments of the demand and concentration variables:

1. Population_k: Population at destination *k* in 2009.
2. GDP_{kt}: Nominal gross domestic product per capita at destination *k* in 2009.
3. Tourists ($tourists_k$): Number of tourists in destination region *k* in 2009.

Table 2 shows the results of the estimation of the pricing equation. The overall explanatory power of the model is reasonably good with an R^2 close to 0.50. The instrument suitability tests, the partial R^2 of the first stage regression and the Hansen J test of the possible endogeneity of the instruments show a high correlation between the variables instrumented and the instruments themselves and are indicative of the exogeneity of the latter.

Insert table 2

The results of the explanatory variables are in line with our expectations. The coefficient of the variable of the number of destinations offered by the airlines is negative and statistically significant (except in the model that jointly considers the influence of the demand and concentration variables). Thus, airlines operating several routes from the airport of origin may charge lower prices as their costs are likely to be lower.

The coefficient of the dummy variable for low-cost carriers is negative and statistically significant. As expected, low-cost carriers charge lower prices than other airline carriers.

The coefficient associated with the summer season dummy variable is positive and statistically significant. This result confirms that a high proportion of passengers are willing to pay more in the summer season to fly to what is considered an attractive tourist destination.

As expected, the coefficient associated with the distance variable is positive and statistically significant but the value of the coefficient is less than one. This result confirms the existence of distance economies, from which we conclude that airline costs increase at a rate that is less than proportional to the number of kilometres flown.

Recall that the demand and concentration variables are highly correlated. Indeed, the level of competition is highly dependent on the amount of traffic that the route can generate. When we estimate the two variables separately, we obtain the expected result. Airlines charge lower prices on routes for which demand is higher as they are able to exploit economies of density. Furthermore, they charge higher prices on routes with greater levels of concentration since competition is not as strong.

When demand and route concentration are considered jointly in the estimation of the pricing equation, neither of the variables is statistically significant. The high correlation between the two variables poses a problem of multicollineality and so we cannot identify the individual influence of each. Yet, this problem of multicollineality does not distort the results of the remaining explanatory variables with the exception of the coefficient associated with the number of destinations, which maintains its negative sign but is no longer statistically significant.

Finally, the coefficient associated with the binary variable for national destinations is positive and statistically significant in the three models that we estimate. In terms of elasticities, prices are about 50% higher on domestic routes than they are on international routes. After controlling for several factors, including distance, demand, intensity of competition and airline attributes, domestic passengers appear to pay about 140 euros more than the sum paid by international passengers. Our empirical result confirms those obtained by Calzada and Fageda (forthcoming) and Cabrera et al. (2011) in their analyses of Spanish domestic routes.

As discussed above, the differences in the prices charged by airlines on national and international routes could be related to the fact that the residents of Gran Canaria enjoy significant discounts on flights to national destinations. The lower elasticity of demand of this group of travellers would seem to allow airlines to charge higher prices. This lower elasticity might be related to the purposes underlying the journey to the Spanish mainland, but the discounts would appear to imply that travellers who benefit from such subsidies have a lower elasticity of demand.

5. Conclusions

This paper has estimated a pricing equation to examine differences in the prices charged by airlines on national and international routes. Our study has drawn on data from routes originating at Gran Canaria airport for the period 2009-2010.

When controlling for airline characteristics, route features and market structure variables, we find that airlines charge higher prices on national routes. A key difference between national and international routes is that residents in Gran Canaria benefit from a 50% price discount when flying to national destinations. These discounts, therefore, may well account for the higher prices charged by airlines on national air routes.

From our results, it can be inferred that Spanish nationals who are non-residents in the islands are paying higher prices than those being paid by international passengers. Overall, it remains unclear as to whether the discount policy is appropriate for sustaining air services on routes from remote regions, at least when traffic levels are not especially low.

What is witnessed is a type of cross-subsidisation from non-resident national passengers to national island residents. Moreover, given that airlines are charging relatively high prices on discounted routes then it can also be inferred that in practice the discount policy serves to subsidize the airlines rather than a specific group of passengers.

Finally, it would appear that contrary to European Union regulations the airlines practices constitute a form of price discrimination centred on the nationality of passengers. Indeed, national passengers who are non-residents on the islands are paying higher prices than international passengers.

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Table 1. Comparison average data on national-international routes

Variable	National routes	International routes
$Price_{ik}$	178.00 (105.21)	329.74 (197.9)
Price per km_{ik}	0.0990 (0.057)	0.0987 (0.051)
Pax_k	229980 (307286)	29074 (24019)
$Share_{ik}$ (route)	0.48 (0.34)	0.78 (0.28)
$Share_{ik}$ (airport)	0.04 (0.01)	0.01 (0.01)
HHI_k	0.52 (0.30)	0.78 (0.26)
Number of $destinations_i$	6.7 (3.6)	7.5 (5.2)
Low $Cost_i$	0.31 (0.47)	0.72 (0.44)
$Distance_k$	1828.1 (298.7)	3277.6 (445.04)

Source: Own elaboration. Standard deviation among brackets.

Table 2. Pricing equation estimates (2SLS)

Expl. Variables	Model (1)	Model (2)	Model (3)
$Number\_destinations_i$	-10.53*	-13.04*	-9.65
$D_i^{Low\ Cost}$	-90.10*	-79.97*	-93.73**
$D_k^{National}$	147.47**	139.35**	149.31**
D_t^{Summer}	98.61*	84.05*	103.78*
$Distance_k$	0.19*	0.19*	0.19*
$Demand_k$	-0.0003*	-	-0.000
HHI_k	-	186.31*	-66.11
Constant	-192.17*	-343.67**	-138.58
Observations	133	133	133
F test	16.20*	19.61*	12.62*
R^2	0.48	0.49	0.44
Hansen J-test	1.68	2.18	1.23
Partial R^2 (Excluded instruments)	0.23	0.25	0.22 (demand)/0.25 (HHI)

Note 1: *** 10%, ** 5%, *1% significance test.

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