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APPLICATION TO ROUTES FROM GRAN CANARIA**

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De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

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PRICE DIFFERENCES BETWEEN DOMESTIC AND INTERNATIONAL AIR MARKETS: AN EMPIRICAL APPLICATION TO ROUTES FROM GRAN CANARIA

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Abstract

Some countries in European Union use air traveller's subsidization policies to improve internal cohesion. Since 1989 Spain has implemented discount on fares to residents in regions far away mainland Spain (Canary Islands and Balearic) that nowadays (2011) are at 50% of final prices. Although this scheme *a priori* benefits consumers through lowering prices of flights to the mainland, we have examined whether subsidy incidence confirms this gain. Using a own elaborated data base for all routes from Gran Canaria we estimate a pricing equation using as explanatory factors variables related to airline characteristics, market structure and demand shifters at the route level. Our results show that there is a sort of price discrimination that may be against European Union rules because such is related to the nationality of passengers. Indeed, passengers from Spanish cities that fly to Gran Canaria and who are non-residents in the island are paying higher prices than passengers that come to the island from other European destinations.

Keywords: Air transport, discounts, prices

JEL Classification: L93, H2, L13.

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1. Introduction

The use of subsidies in air transport markets is a common public policy in Europe. In this regard, the benefits of liberalization through competition may have not reached thin and/or peripheral routes. Taken into account that density economies are unequivocal in the airline industry¹, air services in thin routes may be monopolized by one airline. In fact, there is even the risk that no air services are provided in routes departing from small communities.

Regardless of the level of traffic, the provision of air services may be crucial for the economic development of remote communities. Indeed, the needs of mobility of people and goods in these communities must be usually met by planes. Transport services from other modes like trains, cars or ships may not be competitive in routes departing from remote communities. Even in the case that an airline finds profitable to offer services in remote regions, its pricing behaviour will not be conditioned by intermodal competition.

Governments in Europe deal with the provision of air services in thin or peripheral routes by offering subsidies to the airlines or passengers, and/or by establishing public service obligations (PSO hereafter) on the airlines operating in certain routes.²

In this regard, one of the most used policies to support air services in peripheral regions is to apply price discounts to residents living in those peripheral regions. This is common practice in countries like France, Italy, Portugal, Spain and the United Kingdom.

In Spain, the government established a discount on fares paid by residents living in Canary or Balearic Islands. The discount scheme was first set in 1989 but has been progressively increased. Currently, residents in the islands have a discount of the 50% on the price charged by airlines in domestic routes that link the islands with other islands and the mainland. This scheme of price discounts has been justified by governments to compensate for the elevated costs of

¹ Density economies are defined in airline economics as the decrease in average costs when airlines increase the amount of traffic in the routes. The decrease in average costs comes from using bigger aircrafts at higher load factors.

² See Cabrera et al (2011) for a review of the European policy practice.

Canary and Balearic Islands insularity and to improve the connection between the islands with mainland Spain.

As theory of tax incidence develops, price transmission of tax (or subsidies) is generally related to demand and supply elasticity and to market structure in the market. Models of tax incidence in perfect competition and in monopoly have been developed, but academic literature has not reached a satisfactory theory when markets operate under an oligopoly structure.³

Our analysis is based on the estimation of a pricing equation. We use as explanatory factors of prices variables related to airline characteristics, market structure and demand shifters at the route level. The main focus of the paper is on an additional variable that distinguishes national and international destinations. We argue that price differences between national and international routes may be explained by the application of discounts in national routes.

In this way, our aim is to examine whether airlines charge higher fare in routes where some passengers (residents in Gran Canaria) benefit from discounts. In such a case, the price discount policy would work in practice as a subsidy to the airline instead of a subsidy to some type of passengers.

Previous studies on the effects of discounts on fares has focused on a sample of domestic markets (Calzada and Fageda, 2010, Cabrera et al., 2011). Our analysis provides the following contributions. Firstly, we take advantage of data concerning all routes departing from the airport of Gran Canaria including national and international destinations, so it is not a sample as it is usual in related papers. And secondly, we can compare differences between national and international routes. Hence, our analysis has implications not only for the impact of discounts on prices but also for price discrimination according to the nationality of the passenger.

We claim that our empirical strategy provides a test of the effects of the discount policy and hence we can derive further empirical evidence of this policy applied to a remote region. Furthermore, we can also identify the influence of airline characteristics like the business model (ie; low cost) or airport presence because we are dealing with data at the airline route-level.

³ See Stiglitz (2002), Economics of the public sector.

After this Introduction, section 2 summarizes academic literature related on air transport and subsidies. Section 3 describes the sources and contents of data base constructed. Section 4 develops empirical strategy and estimation results, and section 5 concludes with some economic policy recommendations.

2. Literature review

Several papers have examined the influence of market structure on prices charges by airlines at the route level (Evans and Kessides, 1993; Berry et al., 1996; Fageda, 2006). All these studies find a strong causal relationship between prices and the level of competition in the route, stressing the advantages that dominant airlines may obtain in the considered routes.

However, a small number of papers have dealt with the effects of public subsidies on airline fares. Billete du Villemeur (2004) addressed the issue of competition, stating that although deregulation has been taking place in air transport markets, many connections are still operated by a single operator on domestic markets, particularly in Europe. This leads to a concern for the consequences of the regulation of prices, including the effects of price regulation on quality of services provided. This author argues that both aspects must be considered together and propose an efficient mechanism for the optimal regulation of air transport services.

Williams and Pagliari (2004) reviews the use of public service obligations in the European Union. They conclude that there were major inconsistencies in the approach to social air services provision across EU and probably mobility and accessibility were not enhanced. Williams (2005) showed some mechanisms to improve the use of airline's subsidy in EU. The use of Low Cost Carriers was one of them. For the US, Matisziw et al. (2011) find evidence that there is room to improve the essential air service program in terms of costs and communities' accessibility.

Nolan et al (2005) analyze various schemes of public intervention on air transport markets in order to attract air service in small markets. They developed a theoretical comparison of three schemes in relation to their effects on producer and consumer surplus: lump sum, subsidy per seat, protected

route or more recent practices as revenue guarantees for air service providers. Authors concluded that latter reduces agency problems of adverse selection and regulatory capture as opposed to more traditional subsidy methods.

In a different perspective, Santana (2009) used panel data to model the cost of a set of European and US regional airlines in the period 1991-2002. This author studies whether public service obligations and US's Essential Air Service Program have effects on cost structure and economic performance of those carriers. She concludes that PSO system has increased the cost of European regional airlines in this market.

There are two papers that are closely linked to our work. Calzada and Fageda (2010) examine the effects of the PSO and discount to residents on prices, demand and frequencies using data of domestic routes for the period 2001-2009. Their empirical analysis is based on the comparison between domestic routes within the mainland (not affected by price discount policies or public service obligations), routes that link the mainland with the islands (affected by price discounts) and intra-island routes (affected by discounts and public service obligations). They show that the discounts applied to residents of the islands have led to an increase of fares but they do not find a clear effect of subsidies on frequencies. On the contrary, public services obligations seem to be a much more effective policy to contain prices and increase frequencies.

Another paper closely linked to this work is done by Cabrera et al (2011). They carry out an analysis of the efficiency of subsidies granted to air transport passengers in ultra peripheral European areas under a territorial equity policy. Using detailed data for a specific route between Gran Canaria and Barcelona, authors study the change in national policy of discount on prices, which goes from 33% to 50% of discount on final price. Their econometrical results also conclude that price discounts increases final prices on this route.

We also expect to obtain the result that price discounts lead to higher fares charged by airlines in the route. Indeed, price discounts should increase the demand of islands residents and makes them less elastic to prices (Calzada and Fageda, 2010).

In our context, we expect that the price-elasticity of demand of travellers from mainland Spain or other European countries should be high. In these cases, the purpose of the trip is usually tourism. On the contrary, the price-elasticity of demand of travellers who lives in Gran Canaria could be lower since tourism should be less often the main motivation of the trip. Regardless of the purpose of the trip, we claim that the discount policy may reduce the elasticity of demand of residents in Gran Canaria in domestic routes. This could be a major explanation of the higher prices that airlines may charge in national in comparison to international routes.

3. Methodology and data

We claim that our sample of routes have homogeneous conditions to provide a clear test of the effects of residents' discounts on airline fares in remote regions. All routes depart from the same origin airport, Gran Canaria. Gran Canaria airport has three important characteristics. First, it is located in a major tourist destination (more than 2.4 million tourists at 2010). Second, all routes departing from Gran Canaria to continental Europe are relatively long routes where intermodal competition is never possible. This is true both for national and international routes. Finally, any airline has a dominant role in this airport.

Hence, our analysis puts the attention on peripheral routes but not necessarily thin routes because several routes departing from Gran Canaria may generate a high amount of traffic. Note that we are dealing with long-haul routes with a high proportion of leisure passengers. As any national airline does not play a dominant role in this airport, competition may not be necessarily softer in national than in international routes.

Given these homogeneous conditions in our set of routes, we argue that one of the major explanations in the differences in the prices that airlines charge in national and international routes must be related to the discounts policy. Recall that our price regressions include control variables related to both airline and route characteristics.

As we have aforementioned, our database is based on routes with origin in the Spanish island of Gran Canaria, where residents benefit of discounts in

national routes. The unit of observation is at the level of the airlines operating in each route. We include all European destinations from the island, both national and international, with non-stop scheduled flights in the period 2009-2010. In particular the database was constructed by collecting data of two different seasons (winter 2009 and summer 2010), to control potential seasonal effects. Overall, we have data for 60 routes that account for 133 observations.

Note that we have excluded from our sample intra-Canarian routes because these routes have very specific characteristics in relation to the rest of routes that have the airport of Gran Canaria as origin. These routes are very-short haul routes served with regional aircrafts and high flight frequency. These excluded routes are subject to public services obligations and airlines operating there must meet the imposed price caps and frequency floors.

Statistical data on airlines prices are quite difficult to obtain in Spain (and in Europe). We have collected those data on prices from each airline webpage with the following conditions. Prices are for direct flights between Gran Canaria and the destination city. Data have been obtained from airline web sites using a homogeneous process in a sample week for the two considered periods. Information has been collected one month before travelling; the price refers to the cheapest fare in the first trip of the week (and the return is on Sunday).

Data of frequencies of each airline have been collected for the same sample week as data for prices. This information has been obtained from the website of the Official Airlines guide.

We have been able to obtain data on the total number of passengers in the route and the number of destinations of the airline in the route through the website of the Spanish airport operator (AENA).

Data of distance have been collected from the website of webflyer.com. Finally, data on the population and Gross Domestic Product per capita at the level of NUTS 3 and data on the number of tourists in the destination at the NUTS 2 level have been obtained from the Spanish Statistics Institute and Eurostat.

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

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

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

1. $\text{Number_destinations}_{it}$: number of destinations offered by airline i at season t from Gran Canaria's airport.

This variable is aimed to capture the activity of the airline in the origin airport of our sample. We expect a negative sign in the coefficient associated to this variable. An airline may save costs with a higher number of routes operated in the airport. Indeed, this may allow sharing the fixed costs with a higher amount of passengers. Additionally, the utilisation of the planes and the crew may be also more intense.

Since the seminal paper of Borenstein (1989), several papers have found evidence of a hub premium effect. Hence, airlines with a high presence in the origin airport may charge higher prices through the exploitation of market power. However, Berry et al. (1996) also emphasizes that an airline may also take benefit from a dominant position in an airport through cost savings.

In fact, data show that any airline does not have a dominant position in the airport of Gran Canaria. Furthermore, the proportion of leisure passengers is high and Gran Canaria airport is not a hub. In our context, we expect that the cost effect may be more relevant than the hub-premium effect.

2. $D_i^{\text{Low Cost}}$: variable that takes value 1 if the airline i is a Low-Cost Carrier. We define low-cost carriers as those airlines that only offer a single-fare class in their whole network of routes.

We expect a negative sign in the coefficient associated to this variable. As it is well known in the literature of airline economics, low-cost carriers are able to operate with lower costs per seat than other types of airlines like charter airlines or regional airlines. At least part of these lower costs should be transferred to passengers through lower fares. In fact, the existing literature finds that the entry of a low-cost carrier on a route exerts downward pressure on fares (see

for example Dresner et al., 1996; Morrison, 2001; Goolsbee and Syverson, 2008; or Fageda and Fernández, 2009).

3. D_k^{National} : variable that takes value 1 if route k is a national destination. As we mention above, this variable is the main focus of our analysis.

After controlling for several airline and route characteristics, we claim that a major explanation of price differences between national and international destinations should be explained by the discount policy that is applied in national destinations.

Hence, we expect a positive sign in the coefficient associated to this variable. Price discounts may imply higher demand of the residents in the islands to domestic destinations and their elasticity of demand may be lower in those routes as well. This may lead airlines to charge higher prices in national destinations.

4. D_t^{Summer} : variable that takes value 1 if period t is summer season.

We expect a positive sign in the coefficient associated to this variable. Taken into account that we are dealing with a tourist destination, travellers should be willing to pay a higher price in the summer season.

5. Distance_k : air distance from Gran Canaria to the destination city.

Route length is a major determinant of airline costs and 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 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 in the route k in the period t .

The expected sign of this variable is *a priori* ambiguous. Airlines may save costs through the exploitation of density economies in thicker routes. However, the mark-up over costs could be also higher in thicker routes due to the exploitation of market power.

7. HHI_{kt} : Concentration index of Herfindahl-Hirschmann. It is calculated as the sum of the squares of shares of the airlines operating in the route k at period t . The airlines shares are expressed in terms of weekly frequencies.

We expect a positive sign in the coefficient associated to this variable. A higher value of the concentration index implies that competition is softer and so prices could be higher.

In at least one of the two seasons there were 30 airlines offering non-stop flights from Gran Canaria. In the winter season there were 51 European destinations with direct flights and there were 60 in summer. Table 1 includes descriptive statistics. A total of 133 observations have been included in our database, where each observation is data by route and by airline. Average prices for all routes in our sample are 287€, with a weekly frequency of 4.6 flights. Average passengers by route are 85,943. Market share by route is 0.69, although market share at airport is quite reduced (0.03). Thus, route competition is generally soft but any airline does not have a dominant position in the airport. The average distance is 2.867 kms. Taking into account that the route with the minimum length in our sample has 1.385 kms, we can claim that our analysis focuses on long-haul routes.

Table 1. Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Price _{ik}	287.13	189.27	30.15	1069.1
Pax _k	85943.32	186199.1	2266	824629
Share _{ik} (route)	0.69	0.32	0.02	1
Share _{ik} (airport)	0.03	0.01	0.0002	0.053
HHI _k	0.71	0.30	0.22	1
Number of destinations _i	7.31	4.81	1	17
Low Cost _i	0.61	0.49	0	1
Distance _k	2867.75	771.69	1385.30	4961.26

Source: Own elaboration.

National destinations represent the 14% of total destinations. Madrid and Barcelona are the densest national destinations, while cities from United Kingdom and Germany are the most frequent international destinations. Table 2

includes average data by national and international routes. This table shows differences between two types of routes: national ones are cheaper in terms of total prices, but we do not see substantial differences in terms of prices per kilometre. We also see that national routes are much denser and shorter. Furthermore, airline competition seems to be stronger in the national routes because the mean airline market share and the Herfindhal-Hirschmann index (HHI) is lower. Nevertheless, Low Cost Carriers represent 72% of observations for international routes, while they represent 31% of observations for national routes. In any case, note that we must implement a multivariate empirical analysis to identify in a thorough way price differences between national and international air routes.

Table 2. 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.

Correlation matrix among variables is included on Table 3. The variable for demand shows a strong correlation with the variables of population, concentration index, distance and the binary variable for national destinations. This may impose some multicollineality problem that distorts the individual identification of variables. However, the analysis of results from the regressions shows that this multicollineality problem only has a statistical effect when we jointly include the variables of demand and concentration as regressors.

Table 3. Correlation matrix of the variables used in the empirical analysis

	Price	Pax	Dest.	Pop	GDPp c	Tourist	D ^{lowcost}	Dist.	HHI	D ^{national}
Price	1									
Pax	-0.21	1								
Dest.	-0.39	-0.01	1							
Pop	-0.31	0.52	-0.07	1						
GDPpc	0.34	-0.03	-0.20	-0.08	1					
Tourist	0.08	-0.25	0.26	-0.10	-0.34	1				
D ^{lowcost}	-0.27	-0.16	0.51	-0.10	-0.08	0.46	1			
Distance	0.54	-0.42	-0.03	-0.35	0.49	0.49	0.23	1		
HHI	0.11	-0.46	0.19	-0.52	-0.01	0.16	0.16	0.31	1	
D ^{national}	-0.38	0.48	-0.06	0.37	-0.37	-0.55	-0.37	-0.87	-0.38	1

Source: Own elaboration

4. Results

There may be a simultaneous determination of the variables of demand and concentration index. Hence, the estimation is made using the Two-Stage Least Square estimator (2SLS). Note also that the variables of concentration and demand are highly correlated so the individual identification of these two variables could get distorted if they are jointly included as regressors of equation (1).

Hence, we estimate different especifications of equation (1):

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

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

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

The use of the Two-State Least Squares estimator requires the use of instruments that must be correlated with the instrumented variables and they should not be endogenous. In this regard, we include the following variables as instruments of the variables of demand and concentration:

1. Population_k: Population at the destination k in 2009.
2. GDP_{kt}: Nominal Gross Domestic Product per capita at the destination k in 2009.
3. Tourists (*tourists_k*): Number of tourists at destination region k in 2009.

Table 4 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 and they indicate the exogeneity of the instruments.

Table 4. Pricing equation estimates (2SLS)

Expl. Variables	Model (1)	Model (2)	Model (3)
Number_destinations _i	-10.53 (2.38)***	-13.04 (2.33)***	-9.65 (7.29)
D _i ^{Low Cost}	-90.10 (26.58)***	-79.97 (26.46)***	-93.73 (38.32)**
D _k ^{National}	147.47 (60.37)**	139.35 (65.07)**	149.31 (59.17)**
D _t ^{Summer}	98.61 (22.20)***	84.05 (22.00)***	103.78 (48.28)***
Distance _k	0.19 (0.04)***	0.19 (0.05)***	0.19 (0.05)***
Demand _k	-0.0003 (0.0001)***	-	-0.000 (0.0009)
HHI _k	-	186.31 (54.78)***	-66.11 (533.98)
Constant	-192.17 (142.87)***	-343.67 (152.89)**	-138.58 (503.92)
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: *** 1%, ** 5%, *10% significance test.

Note 2: Standard errors among brackets.

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

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

The coefficient associated to the dummy variable for the summer season is positive and statistically significant. This result confirms that an important

proportion of passengers are willing to pay higher prices in the summer season to fly to a destination with a high attractiveness in terms of tourism.

As expected, the coefficient associated to the variable of distance is positive and statistically significant but the coefficient is lower than one. This result confirms the existence of distance economies that implies that costs increases less than proportionally with the kilometres flown.

Concerning the variables of demand and concentration, recall that they are highly correlated. Indeed, the level of competition is highly dependent on the amount of traffic that can generate the route. When we estimate both variables separately, we find the expected result. Airlines charge lower prices in routes with higher demand because they can exploit density economies. Furthermore, airlines charge higher prices in routes with higher levels of concentration because competition is softer.

When we jointly consider the variables of demand and route concentration in the estimation of the pricing equation, both variables are not statistically significant. The high correlation between both variables poses a problem of multicollineality and hence we can't identify the individual influence of each variable. In any case, this problem of multicollineality does not distort results for the rest of explanatory variables except the coefficient associated to the variable of number of destinations that maintains the sign but not the statistical significance.

Finally, the coefficient associated to 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 in domestic than in international routes. After controlling for several factors like distance, demand, intensity of competition and airline attributes, domestic passengers pay about 140 euros more than international passengers. Our empirical result confirms that obtained by Calzada and Fageda (2010) and Cabrera et al. (2011) in analyses that focus on Spanish domestic routes.

As we mention above, we claim that the price differences between prices charged by airlines in national destinations in comparison to international destinations could be related to the fact that residents in Gran Canaria enjoy of

important discounts just to fly to national destinations. The lower elasticity of demand of this group of travellers may allow airlines to charge higher prices. This lower elasticity could be related to the purpose of the trip but discounts may also imply that the travellers that benefit from these subsidies have a lower elasticity of demand.

5. Conclusions

This paper has estimated a pricing equation to examine differences that airlines charge in national and international routes. We have used data from routes that have as origin the airport of Gran Canaria for the period 2009-2010.

Controlling for airline characteristics, route features and market structure variables, we find that airlines charge higher prices in national routes. A major difference between national and international routes is that residents in Gran Canaria take benefit of a 50% price discount when they fly to national destinations. We argue that these discounts may be a major explanation of the higher prices that airlines charge in national air routes.

From our results, we can infer that national passengers that are not residents in the islands are paying high prices in comparison to international passengers. Overall, it is not clear whether the discount policy is an appropriate policy to sustain air services in routes from remote regions, at least when the levels of traffic are not particularly low.

We can see a sort of cross-subsidiation between national passengers (from non-residents to residents in the islands). Additionally, given that airlines are charging high prices in routes with discounts then we can infer that the discount policy works in practice like a subsidy to the airline instead to a subsidy to some group of travellers.

Furthermore, there is a sort of price discrimination that may be against European Union rules because such price discrimination is related to the nationality of passengers. Indeed, passengers from Spanish cities that fly to Gran Canaria and who are non-residents in the island are paying higher prices than passengers that come to the island from other European destinations.

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