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XAVIER FAGEDA,
JUAN LUIS JIMÉNEZ
JORDI PERDIGUERO

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Xavier Fageda
Juan Luis Jiménez*
Jordi Perdiguero**

Abstract

Competition in airline markets may be tough. In this context, network carriers have two alternative strategies to compete with low-cost carriers. First, they may establish a low-cost subsidiary. Second, they may try to reduce costs using the main brand. This paper examines a successful strategy of the first type implemented by Iberia in the Spanish domestic market. Our analysis of data and the estimation of a pricing equation show that Iberia has been able to charge lower prices than rivals with its low-cost subsidiary. The pricing policy of the Spanish network carrier has been particularly aggressive in less dense routes and shorter routes.

Keywords: Airlines, competition, low-cost carriers.
J.E.L. Classification: L13, L59, L71

Corresponding author: Xavier Fageda. Department of Economics Policy. Research Group on Governments and Markets (GIM-IREA). Universitat de Barcelona Av. Diagonal 690. 08034. Barcelona. E-mail: xfageda@ub.edu, Tel. +34934039721.

* Departamento de Análisis Económico Aplicado. Grupo de Economía de las Infraestructuras y el Transporte (EIT). Universidad de Las Palmas de Gran Canaria. Facultad de CC.EE. y EE. Despacho D. 2-12. Campus de Tafira. 35017. Las Palmas. E-mail: jljimenez@daea.ulpgc.es

** Department of Economics Policy. Research Group on Governments and Markets (GIM-IREA). Universitat de Barcelona Av. Diagonal 690. 08034. Barcelona. E-mail: jordi.perdiguero@ub.edu

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1. Introduction

The liberalization of air transport markets in the USA, Europe, and other countries has implied an increase in airline competition on many routes. This increase in competition has been particularly spurred by the success of low-cost airlines.

In Europe, low-cost airlines like Ryanair, EasyJet, and many others have become major players on short-haul routes. While the biggest low-cost carriers (LCCs) like Ryanair and EasyJet are performing quite well in their competition with network carriers, it is not so clear whether smaller LCCs are really able to compete with former flag carriers. Note that some former flag carriers have created low-cost subsidiaries to be cost competitive on short-haul routes with point-to-point services in competition with other LCCs. Recent examples of this strategy in Europe are KLM with Transavia, Lufthansa with Germanwings, and SAS with Snowflakes. In this paper, we analyse a successful strategy of this kind implemented by Iberia with Clickair in competition with a Spanish LCC, Vueling.

In 2006 Iberia, the former Spanish flag carrier, started to implement a new business plan that led to a concentration of operations in its main hub, the airport of Madrid-Barajas. Another measure of the business plan of Iberia was to create a new low-cost airline, Clickair, with the operating base in the airport of Barcelona-El Prat. Recall that both Madrid and Barcelona airports are among the ten largest airports in Europe according to passenger traffic.

With the slots and resources of Iberia, Clickair achieved soon the largest market share at Barcelona airport. One of the likely motivations of the birth of Clickair was to compete with another Spanish low-cost airline, Vueling, which was becoming a serious competitor of Iberia in the Spanish domestic market.[1] In 2009, Clickair and Vueling have merged and have taken the brand name of Vueling. In the new Vueling, Iberia is the major shareholder.

Our empirical analysis focuses on one case where a network airline has been successful in competing with another low-cost airline through a low-cost subsidiary. This paper

[1] Another possible motivation for the creation of Clickair by Iberia was to impose an entry barrier to other network carriers like Lufthansa or Air France, just in case they wanted to develop hub-and-spoke operations in a large airport like Barcelona close to Madrid. With a big LCC like Clickair, the profitability of the spokes (the short-haul flights that should feed the long haul flights) could be affected. This additional possible motivation for the creation of Clickair is beyond the scope of this paper.

examines the successful strategy of Iberia by analysing price rivalry on Spanish domestic routes departing from Barcelona airport. We use data from the period from 2003 to 2009.

The aim of this paper is twofold. First, we want to identify which type of routes may take more benefit from price-rivalry between Clickair and Vueling, including route characteristics like traffic density or distance and airline attributes like market shares. Second, we want to assess whether the succesful strategy of Iberia is associated with predatory behaviour.

The remainder of the paper is organized as follows. In the second section, we review the literature more closely related to our work. In the third section, we explain the data that are used in the empirical analysis. In the fourth section, we examine in detail figures about price rivalry in the Spanish market. In the fifth section, we estimate equations at the route level to explain the determinants of both mean prices and the prices of Iberia (and partners) in relation to its rivals. The last section is devoted to concluding remarks.

2. Literature review

One of the clear effects of the liberalization of the airline industry has been the decrease in airfares due to the increase in competition (Goetz and Vowles, 2009). In this regard, the relationship between airfares and competition has received a great deal of attention in the empirical literature on air transportation.

Since the seminal paper of Borenstein (1989), several works have examined the influence of market characteristics like route concentration or airport dominance on airline fares. With the methodology of the pricing equation, the success of LCCs as new entrants has been particularly well documented in the USA. In this market, Southwest has become the airline with the largest market share. Several papers have documented that legacy carriers cut fares on those routes affected by the actual or potential entry of Southwest. Among these works, we can mention those by Dresner et al. (1996), Morrison (2001), or Vowles (2000, 2006). From these studies, it seems clear that the entry of an LCC, most notably Southwest, on a route has as a general consequence a reduction in mean prices at the route level.

The effects of the success of LCC in Europe using a pricing equation have also been analysed in some studies.[2] Alderighi et al. (2004), Fageda and Fernández (2009) and

[2] See Dobruszkes (2009) for a recent analysis of the geography of LCCs in Europe. For the effects of Low-Cost Carrier on fares and their pricing strategies, see Malighetti et al (2009).

Gaggero and Piga (2010) examine the effect on prices of the presence of low-cost carriers in routes of Italy, Spain and United Kingdom, respectively. As in the US case, they also find that prices on the route are lower when an LCC has started operations there.

To this point, we claim that there is more sparse attention paid to which circumstances may allow a legacy carrier (or a network airline)[3] to charge lower prices than its low-cost rivals once these airlines have entered the route.

It is clear that LCCs have exploited several cost advantages on short-haul routes (Graham and Vowles, 2006; Graham et al, 2006). First, low-cost airlines have been able to achieve a high utilization of the plane and the crew. Second, they have lower labour costs due to a weaker involvement of unions. Third, they have a simpler management model. The simpler management model comes from the focus on point-to-point services, the use of a unique type of plane, a unique single fare-class, and no free frills on board. Some LCCs like Southwest or Ryanair have also enjoyed lower charges from the use of secondary airports.

In this regard, Graham and Vowles (2006) state two alternative strategies for network carriers to compete with LCCs. First, network carriers may establish low-cost subsidiaries in what authors call the "carriers within carriers strategy". Second, they may try to reduce costs by competing against LCCs with the main brand. These strategies may be aimed at responding to the actual entry of LCCs or pre-empting the possible entry of LCCs.

In this context, there is an increasing convergence of the business models of network airlines and LCCs on short-haul routes. For example, most network airlines do not provide frills for free on short haul routes; they are eliminating the business fare class on some routes or simplifying the yield management system. In many cases, they are also establishing franchises with regional airlines that use smaller aircrafts. However, it is more difficult for network airlines to reduce labour costs or simplify some aspects of management like distribution practices. For these latter reasons, it could make sense for a network airline to compete with LCCs through the establishment of a low-cost subsidiary that fully adopts the low-cost model.

However, Graham and Vowles (2006) undertake an extensive examination of the establishment of low-cost subsidiaries by network carriers around the world and do not find clear evidence that this strategy has been successful. In an analysis focused on the US experience, Morrell (2005) obtains the same conclusion.

[3] The term network airline could be more appropriate in Europe.

The difficulties in effectively separating the network operations from the low-cost subsidiary may lead to a cannibalization and dilution of the main brand. Furthermore, network carriers may find it difficult to differentiate the pay-scales of employees due to activism of unions.

Otherwise, a succesful establishment of low-cost subsidiaries by network carriers may be associated with predatory behaviour. In this regard, Goetz (2002) mentions several complaints of new entrants about predatory behaviour by incumbent airlines in the US domestic market in the nineties. Predatory behaviour implies that incumbent airlines cut fares to similar or lower levels than the new rivals and increase frequencies. In the period of price rivalry, the larger incumbent airline is able to lose money, but it will increase prices and reduce frequencies once the new entrant has been forced to exit the market[4]. While predatory behaviour is prohibited by antitrust authorities, Goetz (2002) documents some cases like the behaviour of American airlines after the entry of Vanguard airlines on routes departing from Dallas-Forth Worth airport. Ecker and West (2006) mention a predatory case ruled against Lufthansa in competition with a charter airline, Germania, on routes from Frankfurt and Berlin.

The difficulties of antitrust authorities in distinguishing predatory behaviour from sound price competition likely indicate that incumbent airlines may follow this illegal behaviour. In any case, predatory behaviour by incumbents is a very important issue when considering competition in airline markets.

3. Data

Here we explain the data used in the empirical analysis. Our dataset is based on 25 domestic routes departing from Barcelona airport. The considered time period goes from the summer of 2003 to the summer of 2009. The frequency of the data is semi-annual so that we differentiate between the summer and winter season.

We can find several types of airlines that operate in the considered routes. The former flag carrier, Iberia, is a network carrier that is member of Oneworld. Two smaller carriers with some features of network carriers, Spanair and Air Europa, are members of Star Alliance and SkyTeam, respectively. Finally, Clickair is a low-cost carrier that was created as

[4] As Motta 2004 points out: "yet, although rare, there are circumstances where a dominant firm might set low prices with an anti-competitive goal: forcing a rival out of the industry or pre-empting a potential entrant". This can be a good definition of predatory behaviour.

a subsidiary of Iberia, and Vueling was an independent low-cost carrier until the merger with Clickair in 2009. Since then, Vueling is a subsidiary of Iberia.

Our data for prices refer to the lowest mean round trip price charged by airlines offering services weighted by their corresponding market share. We collect price data for a sample week following these homogeneous rules. Price data refer to the city pair link that has as its origin the city with the largest airport. Additionally, the data were collected one month before travelling, the price refers to the first trip of the week, and the return is on Sunday. We impose these conditions on all the routes and airlines, taking into account that our multivariate analysis exploits the variability of data across routes.

Data on departures of each airline on each route have been collected in the same sample week for the information available for prices. Furthermore, we have also used data on annual departures of each airline in Spanish airports.

The variable of demand at the route level refers to the total number of passengers carried by airlines on the route, including direct and connecting traffic. Variables that are highly correlated with the demand at the route level are the following: 1) Population: Mean population in the route's origin and destination provinces (NUTS 3). 2) Gross domestic product per capita (GDPc): Mean gross domestic product per capita in the route's origin and destination regions (NUTS 2). 3) Tourism (Tour): Number of tourists per capita in the destination region (NUTS 2).[5]

Finally, the variable of distance is computed as the number of kilometres that need to be flown between the origin and the destination airport of the route.

Various sources were used in terms of data collection. Data on prices come from airlines' websites, while data on departures of each airline on each route have been obtained from the Official Airlines Guide (OAG) website. Furthermore, information about annual departures of each airline in Spanish airports and information about demand at the route level have been collected from the website of the airport operator: *Aeropuertos Españoles y Navegación Aérea* (Spanish Airports and Air Navigation, AENA). Data of population and gross domestic product per capita of the route's origin and destination provinces and

[5] NUTS is the statistical measure used by Eurostat to define regions. The NUTS classification divides up the economic territory of the Member States. The objective is to harmonize the statistical system of geographical areas across European Union countries. Hence, NUTS 2 should refer to areas with a range of population between 800,000 and 3,000,000 inhabitants. In practice, the statistical territorial units are defined in terms of the existing administrative units in the Member States and do not necessarily meet that population range. For Spain, NUTS 2 are "Comunidades Autónomas" and NUTS 3 are "provincias".

regions have been obtained from the National Statistics Institute (INE), while data of tourists per capita have been obtained from the Institute of Touristic Studies (IET). Finally, data of distance have been collected from the WebFlyer site.

Figures 1 and 2 provide descriptive information for the 25 routes that we consider in the empirical analysis. These two figures shows that route traffic density is particularly high on routes to the largest Spanish cities (Madrid, Sevilla, Bilbao) with the exception of Valencia, which is too close to Barcelona, and is also particularly high on routes to major tourist destinations like Palma de Mallorca or Málaga. Iberia (and its partners, Clickair before 2009 and Vueling after that date) has a high market share on these dense routes of our sample (except Sevilla) but also on thin routes like those to Valladolid, León, or Valencia.

4. Price rivalry in the Spanish airline market

Table 1 shows some data of route characteristics like traffic density, distance, or the intensity of competition that are useful to examine for our purposes. First, it is worth mentioning the high diversity of the considered routes at least in terms of route traffic density and distance. For example, our analysis covers one of the densest routes in the world, the route Barcelona–Madrid, with more than 2 million passengers per season (six months) and 400 frequencies. This dense route is mainly oriented to business passengers. There are also other dense (but tourist oriented) routes like the one that links Barcelona with Palma de Mallorca with more than 800,000 passengers per season and 150 weekly frequencies. In contrast, our sample of routes also include very thin routes like those that link Barcelona with San Sebastián or Santander, with less than 40,000 passengers per season.

Table 1. Descriptive statistics by route. Mean values for the period 2003-2009

Route from Barcelona	Traffic density (passengers)	Traffic density (frequency)	Distance	Average competitors	Year entrance Clickair	Year entrance Vueling
Alicante (ALC)	185,735	40	404	1,7	2007, W	2006, S
Almería (LEI)	47,053	22	632	1	-	-
Bilbao (BIO)	284,997	54	467	2,5	2007, W	2004, W
Gran Canaria (LPA)	143,066	24	2170	3,1	2007, W	2009, S
Granada (GRX)	140,871	27	681	1,9	2007, S	2006, S
Ibiza (IBZ)	388,828	75	276	3,2	2007, S	2004, S
Jerez (XRY)	54,111	12	866	1,5	2007, S	2007, S
La Coruña (LCG)	99,980	22	888	1,7	2007, S	2009, S
León (LEN)	21,293	14	784	1,5	-	-
Madrid (MAD)	2,078,867	401	484	3,9	-	2004,W
Málaga (AGP)	375,289	65	765	2,7	-	2005, S
Menorca (MAH)	299,772	69	241	3,2	2007, S	2005, S
Oviedo (OVD)	128,999	32	712	1,5	2007, W	2009, S
Mallorca (PMI)	825,286	155	203	4,5	2007, W	2004, S
Pamplona (PNA)	37,204	21	348	1	-	-
San Sebastián (EAS)	38,061	20	392	1	-	-
Santander (SDR)	36,289	20	539	1	-	-
Santiago (SCQ)	145,837	29	893	2,2	2007, S	2006, S
Sevilla (SVQ)	491,737	82	810	3,3	2007, S	2004, W
Tenerife (TFN/TFS)	217,118	33	2190	3,2	2007, W	2009, S
Valencia (VLC)	84,461	30	296	1,4	-	-
Valladolid (VLL)	43,310	28	579	1,2	-	-
Vigo (VGO)	104,889	23	893	1,7	2007, S	2009, S
Vitoria (VIT)	7,045	4	433	1	-	-
Zaragoza (ZAZ)	7,533	4	264	1	-	-

Note: W refers to the winter season and S refers to the summer season.
Source: Own elaboration.

In terms of distances, planes from routes to the Canary Islands must fly more than 2,000 kilometres. In contrast, intermodal competition from trains and cars may be strong for routes of less than 300 kilometres to Valencia or Zaragoza, and also for the route to Madrid where high-speed train services have operated since 2008. In addition to this, we can differentiate among three types of routes according to the competition scenario in the period considered. First, we have six thin routes that are always monopoly routes (Almeria, Pamplona, San Sebastián, Santander, Vitoria, and Zaragoza).[6] There are other two thin routes (León and Valladolid) where a regional airline, Lagun Air, provides some frequencies in some of the seasons of our analysis.

Second, we have nine routes that have moved from monopoly to oligopoly in the considered period. On five of these routes (Alicante, Granada, Jerez, Santiago, and Sevilla) the move has been a consequence of the entry of a low-cost airline, Vueling. In some cases,

[6] On the latter two routes, there are no flights in some of the considered periods.

it has taken place with the entry of a network airline, Spanair, as well. On the other four routes (A Coruña, Oviedo, Valencia, and Vigo) the move to competition is due to the entry of Spanair.

Third, we have eight dense routes that are oligopoly routes on all the periods that we consider (Bilbao, Gran Canaria, Ibiza, Madrid, Málaga, Menorca, Palma de Mallorca, and Tenerife). Vueling has been present from 2004 or 2005 on all these routes except the long-haul ones from Barcelona to the Canary Islands.

Note that Clickair started operations in Barcelona airport in 2007, while the new Vueling that is the result of the merger between Clickair and Vueling started operations in mid-2009.

Figures 3 and 4 indicate the evolution of the prices of each airline in terms of mean price per kilometre and the coefficient of variation of its prices in the period. Each point on the figure indicates the position of each airline in terms of its mean price and its coefficient of variation for the period that is put in brackets. We use arrows to indicate the evolution of prices of Iberia and subsidiaries over time. Figure 3 first shows how prices of Iberia evolves with the move from a monopoly to an oligopoly scenario, and then how its prices evolve when Iberia become an LCC under the brand of Clickair. It also shows how prices of Iberia evolves when Clickair merge with Vueling. In Figure 4, we observe how prices of Iberia evolve when it becomes an LCC under the brand of Clickair in routes that are always oligopoly routes.[7] Finally, it also shows how prices of Iberia evolves when Clickair merge with Vueling. Letters in boldface make reference to the summer season.

For the clarity of the exposition, we select some representative routes that depict a general pattern for the rest of the routes. We distinguish between two sets of routes as explained above: first, routes that moved from a monopoly to an oligopoly scenario, and second, routes that have always been oligopolistic ones[8].

Figure 3 shows the evolution of prices of representative routes that moved from monopoly to oligopoly. It can be seen that Iberia cuts fares when other airlines enter the route. However, Iberia is not always able to charge lower prices than rivals, especially lower

[7] Figures for the rest of the routes are available upon request from the authors.

[8] We understand as monopoly a route where only one airline is offering services, whereas in an oligopoly two or more airlines are offering services in the route. Although the Spanish airline market is liberalized (see Fageda, 2006), there are several routes operated by a single firm acting as a monopolist, generally Iberia. In other routes, depending mainly on traffic density, more airlines are operating, while Iberia and Spanair are those that have greater market share. Among other variables, the number of airlines operating in the route affects the pricing of firms, as we will see below.

prices than Vueling. Once Iberia is substituted by Clickair, then Clickair reduces prices in relation to Iberia and tends to charge similar prices to its cheapest rival.

From Figure 3, some evidence of predatory behaviour can also be inferred. Indeed, Vueling has charged higher prices since the merger (in the summer of 2009) than Vueling and Clickair did before their merger (before the summer of 2009).

Three of the four routes presented in Figure 3 show a pattern of prices that seems to fit with predatory pricing behavior. For the route Barcelona-Alicante, Iberia lowers its prices by 27.6% to compete with Spanair, and later Iberia with its low-cost subsidiary reduces prices to compete with Vueling by 54.3%. Once the merger occurs and Vueling is under the control of Iberia, this airline increases prices by 67.7%. A similar price pattern is observed in the case of the route Barcelona-Seville, where Iberia lowers its prices by 40.9% and 19.3% when compete with Spanair and Vueling respectively, and raise prices by 93.9% after the merger. Finally, the route Barcelona-Santiago de Compostela presents price declines with the entry of Spanair and Vueling of 29.8% and 22.6%, and an increase of 80.9% when Iberia controls Vueling. Therefore, in these three routes, the price behavior of Iberia and its low-cost subsidiary could fit into a predatory pricing behavior: continuous price reductions until the competitor is removed from the market (in this case Vueling) and then it increases prices significantly. However, given that we just have data for one period after the merger, we must be cautious in claiming that Iberia has followed a predatory behaviour.

Another aspect that can be seen in Figure 3 is the positive relationship between the market share of Iberia and its ability to put the lowest price in the market in several routes. A good example is the Barcelona-Alicante route where Iberia has on average more than 50 percent market share and get the price below the other competitors. Other routes with this pattern are: Barcelona-Valencia and Barcelona-La Coruña. However, Iberia fails to put the price below its rivals in other routes where it does not reach 50% of the market share, as it can be seen in the route Barcelona-Sevilla of figure 3, or in the route Barcelona-Granada and Barcelona-Jerez. However, the relationship between the market share of Iberia and its ability to fix the lowest prices is not entirely clear in this statistical approach since other routes show a different price pattern like Barcelona-Oviedo or Barcelona-Vigo. In Section 5 we confirm that exists a positive relationship between the market share of Iberia and its ability to put the lowest price in the market by estimating an equation that relates prices with market shares, after controlling by several control variables.

Figure 4 shows the evolution of prices of representative routes that are always oligopoly routes. First, we must turn our attention to the route Barcelona–Madrid, which has special features in our context. The route Barcelona–Madrid is one of the densest in the world and is the only route in our sample where connecting traffic plays an important role. Traffic for the rest of the routes refers mainly to point-to-point services since indirect flights are clearly bad substitutes for non-stop flights when considering short-haul routes. However, Barcelona is the most important spoke for Iberia in order to feed its hub, Madrid–Barajas.

This fact explains that the route Barcelona–Madrid is the only one departing from Barcelona where Iberia remains operating without the brand Clickair in the considered period. Iberia continues to operate this route with high-frequency air shuttle services. Note also that this route has suffered from strong intermodal competition since 2008 when high-speed train services began operating with great success. Taking this into account, Iberia charges higher prices than its rivals, but the new Vueling charged very low prices in the summer of 2009 (after the merger with Clickair). Thus, Iberia currently operates on the densest route of the Spanish domestic market with two differentiated services: 1) a high quality and high frequency service as Iberia, and 2) a low price service as Vueling.

Second, the pattern of prices of Iberia and Clickair on routes that are always oligopoly routes is similar to the previous analysis for routes that moved from monopoly to oligopoly. For routes that are always oligopoly routes, Clickair charges lower prices than Iberia. However, the price setting of Clickair seems to be less aggressive than for previous routes shown in Figure 3. Indeed, Clickair may be charging lower or higher prices than rivals. Exceptions are the routes to Menorca and Ibiza (the latter is shown in Figure 3), where Clickair is as aggressive in its pricing as in the previous analysis. Note also that after the merger with Clickair, Vueling charges higher prices than the merging firms.

Again we can found price strategies that fit with predatory pricing behavior on some oligopoly routes. The entry of Vueling induces Clickair to lower their prices 49.8% in the route Barcelona-Ibiza, 39.1% in the route Barcelona-Bilbao, 16.9% in the route Barcelona-Malaga and 38.6% in the route Barcelona-Menorca. However, when Vueling is acquired by Iberia, this airline increases prices at a much higher percentage (69.1%, 45.4%, 93.5% and 53% respectively). Therefore, the price strategy followed by Iberia seems to fit into a pattern of predatory pricing, because it lowers prices until its main rival is removed from the market and then increases prices significantly.

In the case of oligopoly routes, we can also observe the positive relationship between the market share of Iberia and its ability to set the lowest market price. This relationship can be seen on the routes Barcelona-Ibiza, Barcelona-Málaga and Barcelona-Gran Canaria, where Iberia does not reach 50% of market share and is not able to put the lowest price. This same pattern is observed in the route Barcelona-Menorca and Barcelona-Tenerife. As we mentioned above, this relationship is tested econometrically in a multivariate equation model in Section 5.

In this vein, we estimate a pricing equation in the following section that examines the factors that explain the differential of prices between Iberia (and subsidiaries) and its rivals. We want to identify whether route characteristics (traffic density, distance) and airline attributes (market share) play a role in explaining the pricing strategy of Iberia.

5. The empirical model

Here we estimate a pricing equation for domestic routes departing from Barcelona airport. We consider both mean prices (in nominal euros) at the route level and price differentials between Iberia and rivals. In this regard, we make two different regressions with two different purposes. In the first regression, the dependent variable is the mean market prices at the route level, and all the routes in our sample are considered. In the second regression, the dependent variable is the price differential between Iberia and the rest of the airlines that compete on the routes of our sample. In this second regression, we must focus our attention on oligopoly routes.

We use the same explanatory variables in both regressions. First, we consider variables that may influence airlines' costs at the route revel: route distance and route traffic density. Second, we consider variables that have to do with the intensity of competition: the shares of the airlines and a dummy variable that takes a value of 1 when Iberia operates in the market as a LCC. Finally, we include a dummy variable that takes the value 1 in the summer season, which is the period from 26 April to 26 October. This latter variable is aimed at capturing differences between the summer and winter seasons.

Next, we explain the goals in the estimation of each regression and the signs expected of the different explanatory variables.

- The equation on mean market prices

This equation is aimed at examining the influence of variables like competition or rivalry between LCCs on the mean prices charged on the route. In this regard, we estimate the following pricing equation for the route *k* at period *t*:

$$p_{kt}^{mean} = b_0 + b_1 Q_{kt} + b_2 dist_k + b_3 HHI_{kt} + b_4 D_{kt}^{Iberia_LowCost} + b_5 D_{kt}^{summer} + e_{kt} \quad [1]$$

where the dependent variable is the mean prices weighted by the market share of each airline. These are the explanatory variables and their expected sign:

1) Route traffic density (*Q*): The expected sign of the coefficient of this variable is ambiguous. More route traffic density may imply a better exploitation of density economics but higher demand levels may also lead airlines to charge higher mark-ups over costs.

2) Distance (*dist*): Distance is a major determinant of the costs that an airline must afford when providing services on a route. Note also that intermodal competition should be more relevant on shorter routes. Thus, the sign of the coefficient of this variable should be positive.

3) Route concentration (*HHI*): Index of Herfindahl-Hirschman at the route level. The concentration index is calculated in terms of the share of airlines' departures on the route. This variable will allow us to measure the influence of the intensity of competition on prices charged by airlines. In the case where less competition increases the prices charged by airlines, the sign of the coefficient associated with this variable should be positive.

4) $D^{Iberia_LowCost}$: This variable captures the influence on prices of the Iberia strategy to developing a LCC subsidiary to compete with rivals. We expect a negative sign for this variable because price rivalry between LCCs should imply lower prices.

- The equation on price differentials between Iberia and the cheapest rival in the route.

With this equation, we want to examine which route characteristics determine the ability of Iberia to charge lower (or higher) prices than its rivals. The equation to estimate on this matter for the route *k* at period *t* is as follows:

$$p_{kt}^{\text{differential_Iberia}} = c_0 + c_1 Q_{kt} + c_2 dist_k + c_3 \text{Share_Iberia}_{kt} + c_4 D_{kt}^{\text{Iberia_LowCost}} + c_5 D^{\text{summer}} + e_{kt} \quad [2]$$

Note that the dependent variable is the price differential between Iberia and the cheapest route competitor. Thus, this dependent variable may take positive or negative values. In this regard, a negative coefficient of an explanatory variable will imply that the higher the value of this explanatory variable, the higher the ability of Iberia to charge lower prices than its rivals. In contrast, a positive coefficient of an explanatory variable means that Iberia may not be charging lower prices than its rivals when the value of this variable is high. These are the explanatory variables of Equation (2) and the expected sign:

1) Route traffic density (*Q*): The expected sign of the coefficient of this variable is positive. Price rivalry between Iberia and other route competitors may be softer on thick routes. Indeed, Iberia may find it does not need to be agressive in prices on routes with higher route traffic density. On those routes, there may be room for several airlines to obtain profits.

2) Distance (*dist*): The expected sign of the coefficient of this variable is not clear. Distance will be a major determinant of prices in absolute values. Thus, differences in prices between airlines should be higher in absolute values on longer routes but this may mean Iberia has lower or higher prices in comparison to rivals. In addition to this, intermodal competition on shorter routes implies that prices charged by other modes like trains or buses have an effect on the price strategy of Iberia.

3) Share of Iberia: This is the share of Iberia in terms of frequencies over total frequencies on the route per period. The expected sign of the coefficient of this variable is not clear.

On the one hand, a higher market share implies that the network carrier is able to exploit cost economies more efficiently due to a higher utilization of the planes and the crew or sharing fixed costs between a large number of passengers. Note also that a higher frequency may mean demand is higher (more than proportionally to the capacity offered on the route) since a higher frequency may be more convenient for the passenger. Indeed, a higher frequency reduces the schedule delay cost, that is, the difference between the preferred time for departure and the actual time of departure. Then, a higher frequency may help the airline to have higher load factors.

On the other hand, a higher market share may imply that the network carrier has a higher market power on the route. An airline with market power is able to charge higher prices in comparison to marginal costs.

If the cost effect dominates, then Iberia would charge lower prices when it has a higher market share on the route. In contrast, if the market power effect dominates then Iberia would charge higher prices when it has a higher market share on the route.

4) $D^{Iberia_LowCost}$: We expect a negative sign for this variable because Iberia should be able to charge lower prices when it operates the route through its low-cost subsidiary than when it operates the route with the main brand. Note that as a LCC, Iberia may reduce some costs such as those related to simpler management procedures (no business class, one single type of plane, no connecting traffic, etc.) and may especially have lower labour costs since the new LCC is less conditioned by worker unions.

Note that in both regressions we include a dummy variable to account for differences across seasons, as mentioned above.

- Results and discussion

Table 2 shows the descriptive statistics of the variables used in the empirical analysis. Taking the mean data for the whole period, it seems that Iberia charges higher prices than its rivals. However, this mean number does not allow the change in the pricing strategy of Iberia after the entry of a new LCC in the market to be identified.

Table 2. Summary of descriptive statistics

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value
Market price	193.40	104.72	54.82	620.44
Price differential (Iberia in relation to the cheapest rival)	20.36	84.70	-190.8	430
Market share Iberia (route)	0.48	0.15	0.14	0.86
Total Traffic	265,699.6	433,320.7	5,460	2,514,338
Concentration Index (route)	0.65	0.28	0.25	1
Distance	706.96	495.73	203	2,190
$D^{Iberia_Lowcost}$	0.23	0.43	0	1
D^{summer}	0.54	0.23	0	1

We estimate the pricing equation using the Two-Stage Least Squares estimator (2SLS-IV) since two explanatory variables, demand and route concentration, may be endogenous. Indeed, a simultaneous determination of prices and demand may take place and entry patterns on a route will also be influenced by prices charged for that route. We use the following instruments for the demand variable computed for the mean value at both route

endpoints: population, gross domestic product per capita, and tourism intensity. The instrument for route concentration is concentration at the airport level. Table 3 shows the results of our estimates.

Table 3. Estimates of the pricing equation (2SLS)

	Dependent variable	
Explanatory variables	**Mean market prices. All routes (1)**	**Price differentials (Iberia in relation to the cheapest rival). Oligopoly routes (2)**
Market share Iberia (route)	-	-93.18 (44.73)**
Concentration Index (route)	116.36 (27.72)***	-
Total Traffic (*Q*)	1.08e-06 (9.36e-06)	0.000014 (7.92e-06)*
Distance	0.11 (0.01)***	0.04 (0.01)***
$D^{Iberia_LowCost}$	-31.75 (9.22)***	-63.76 (12.34)***
D^{summer}	80.24 (8.58)***	5.76 (10.94)
Intercept	0.50 (23.61)	50.02 (27.61)*
Number observations	305	185
R^2	0.48	0.27
F-test (Joint sign.)	47.73***	11.24***

Note 1: *** 1%, ** 5%, *10% significance test.
Note 2: Instruments for total traffic and concentration index (route): population, GDP per capita, tourism intensity, concentration index (airport)

Concerning the estimation of Equation (1), which has as dependent variable the mean market price at the route level, we find that prices increase when market concentration is higher. This means that less competition leads to higher prices, as expected. In addition to this, route traffic does not seem to have a clear effect on prices. On thick routes, the possible exploitation of density economies may be compensated by higher mark-ups over costs. In addition to this, prices are higher on longer routes as expected. Prices also seem to be higher in the summer season.

Importantly, we find that prices are lower when Iberia operates on the route as a LCC. If we compute the impact of this effect in terms of elasticities, we can see that the entry of Iberia as a LCC implies an average reduction in prices of about 31.75 euros.

Taking this into account, the results of Equation (2) are also significant. Recall that Equation (2) uses as dependent variable the price differential of Iberia in relation to its cheapest rival. Results from this equation indicate that the move of Iberia from a traditional carrier to a LCC has meant that this airline is able to charge lower average prices than its

rivals by about 63.38 euros. These numbers are quite high and may provide some additional evidence of the predatory behaviour of the former Spanish flag carrier on routes departing from Barcelona airport. Indeed, Iberia with its low-cost subsidiary may have been charging very low prices to provoke the exit of the market of its main rival, Vueling. Indeed, the profitability of Vueling worsened dramatically after the entry of Clickair in many of the routes where Vueling was also operating as well. Hence, the only choice available for Vueling was likely to merge with Clickair. As we mention in the previous section, prices of the low-cost subsidiary of Iberia have increased substantially after the merger with Vueling.

Note also that the ability of Iberia to charge lower prices than its rivals increases when this airline has a higher market share. As we mention above, a higher market share may imply that the network carrier is able to exploit cost economies more efficiently due to a higher utilization of the planes and the crew, sharing fixed costs between a large number of passengers or due to the fact that a higher frequency may help the airline to have higher load factors. On the contrary, a higher market share may imply that the network carrier has a higher market power on the route so that it charges higher mark-ups over marginal costs. From our results, it seems that the cost effect seems to overcome the market power effect. Indeed, Iberia may charge low prices on routes where it has a high market share due to the better exploitation of cost economies.

Finally, the pricing policy of the former Spanish flag carrier seems to be more relaxed on longer routes. Note that intermodal competition is also present on short-haul routes, so price rivalry may be especially intense on these routes. We also find that Iberia is less aggressive in prices on routes with higher traffic density. There does seem to be more room for several airlines operating on thick routes.

To sum up, previous analyses about the establishment of low-cost subsidiaries by network carriers do not find clear evidence that this strategy has been successful. On the contrary, our empirical analysis focuses on one case where a network airline has been successful in competing with a LCC through a low-cost subsidiary, Iberia with Clickair in the Spanish domestic market. Two caveats must be mentioned for our results.

First, our analysis may be useful to examine the competition between the subsidiary of a network carrier and a relatively small LCC. It is likely that the results would be different if the network carrier was competing with one of the biggest LCCs in Europe like Ryanair or EasyJet.

Second, the Spanish network carrier has been able to fully differentiate from the low-cost subsidiary because it has a dominant position in two of the largest airports in Europe, Madrid and Barcelona, which are relatively close to each other. Indeed, the network operations of Iberia are concentrated in Madrid airport and low-cost activities are concentrated in Barcelona airport.

From our analysis, we also find some evidence that the Spanish network airline may have followed a predatory behaviour.

6. Concluding remarks

In Europe, LCCs are achieving high and increasing market shares on most of domestic and intra-European routes. As a result, network airlines are forced to adopt some of the management practices developed by LCCs like avoiding free frills on board, eliminating the business class, or increasing the utilization of planes and crew. A further step for network airlines may be to create low-cost subsidiaries that compete in the same conditions as their low-cost rivals.

In this paper, we have examined a successful strategy of this kind that has been developed by the former Spanish flag carrier, Iberia, on routes departing from Barcelona airport.

Our analysis reveals that Iberia created a low-cost subsidiary (Clickair) to enable it to compete with a serious low-cost competitor in the Spanish market (Vueling). While operating as Iberia, the former Spanish flag carrier was not always able to charge lower prices than rivals. With Clickair, Iberia has charged very low prices. In this regard, our data show that the head-to-head competition between Clickair and Vueling had as a consequence a substantial reduction in prices on the routes in which they both were operating.

However, there does seem to be a substantial increase in prices of the subsidiary of Iberia after the merger of Clickair and Vueling. This could provide some evidence of predatory behaviour, which is generally considered a practice against competition laws. In this regard, the European Commission approved the merger between Clickair and Vueling only with the condition to transfer slots in some routes to other airlines (case Nº COMP/M.5364 – Iberia/Vueling/Clickair). Likely, the assessment of mergers should also include the use of predatory practices by the firm that acquires its rival.

The estimation of the pricing equation indicates that the pricing strategy of Iberia is especially aggressive in prices in the sense that it charges considerably less than average prices in the following circumstances. First, Iberia charges lower prices when it has a high market share on the route. Hence, only network airlines that have a strong position in the market may be able to compete with low-cost airlines. Second, as expected, Iberia substantially reduces prices when it operates the route through a low-cost subsidiary. Finally, the pricing policy of Iberia seems to be more aggressive on short-haul routes and thin routes. In the short-term, short-haul routes and thin routes may have benefited from price rivalry between airlines. With the elimination of a serious competitor, it is not clear whether Iberia (and partners) will keep charging low prices.

It is clear that a key factor in the success of Iberia's strategy has been its dominant position in two of the largest airports in Europe. Indeed, Iberia has concentrated network operations in Madrid airport and low-cost operations in Barcelona airport. In this regard, note that airports in Spain are managed on a centralized basis so that any decision of the manager for a particular Spanish airport takes into account the impact of this decision in the rest of Spanish airports. This could explain that the Spanish airport operator did not intervene in the transfer of slots from Iberia to Clickair although Iberia was a very important but not the unique shareholder of Clickair. It is not clear if the airport manager of Barcelona airport would have allowed so easily the substitution of a network carrier by a low-cost carrier in case that airport management was made on a individualized basis.

Finally, note that we cannot conclude that the examined pricing strategy of a network carrier would be successful if the rivals were major LCCs like Ryanair or EasyJet instead of a domestic LCC. Our analysis seems to indicate that it is likely that only big LCCs will be able to compete with network airlines in short-haul markets. If this is true, there could be further consolidation and increases in concentration in the airline industry. This tendency is clear when considering network airlines as demonstrated by the mergers of Air France with KLM and Lufthansa with Swiss and the expected merger of British Airways with Iberia. In the LCC arena, the leading players may even take a growing role as well.

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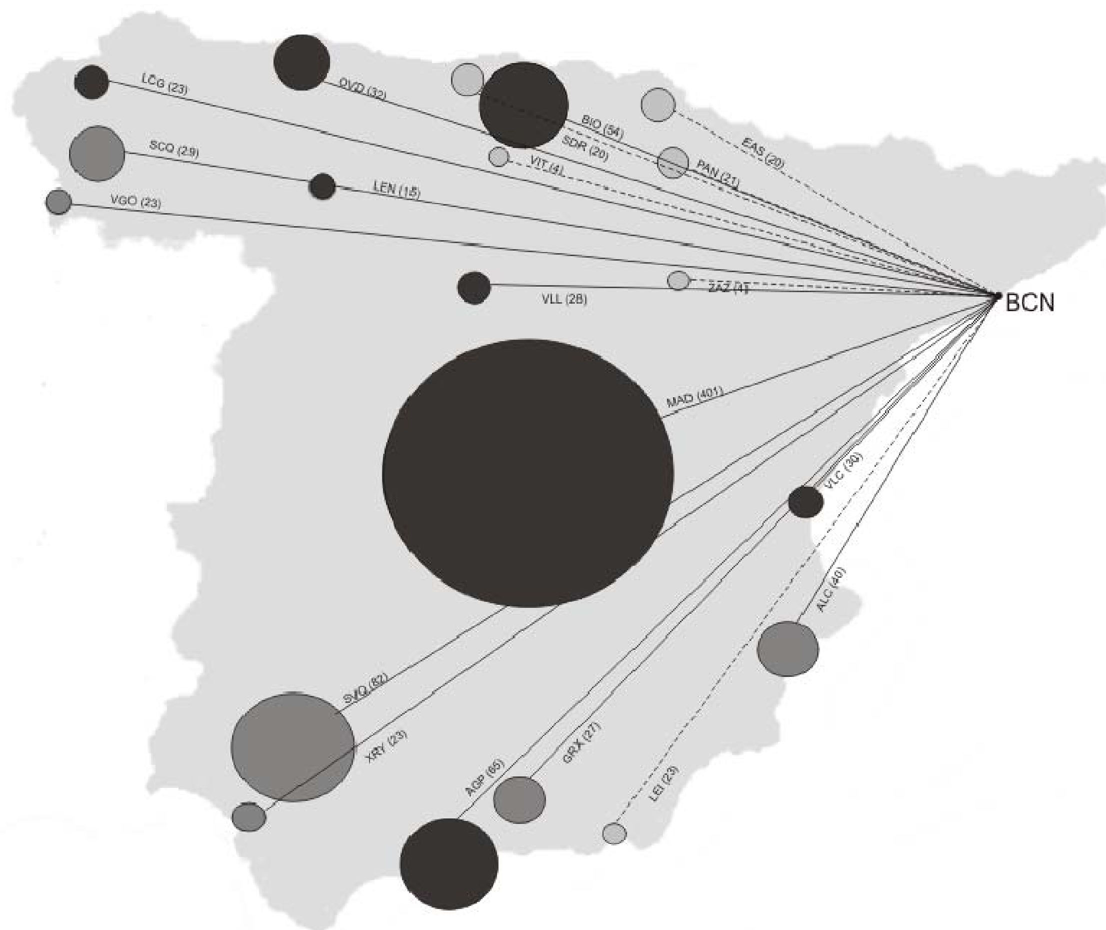
FIGURES

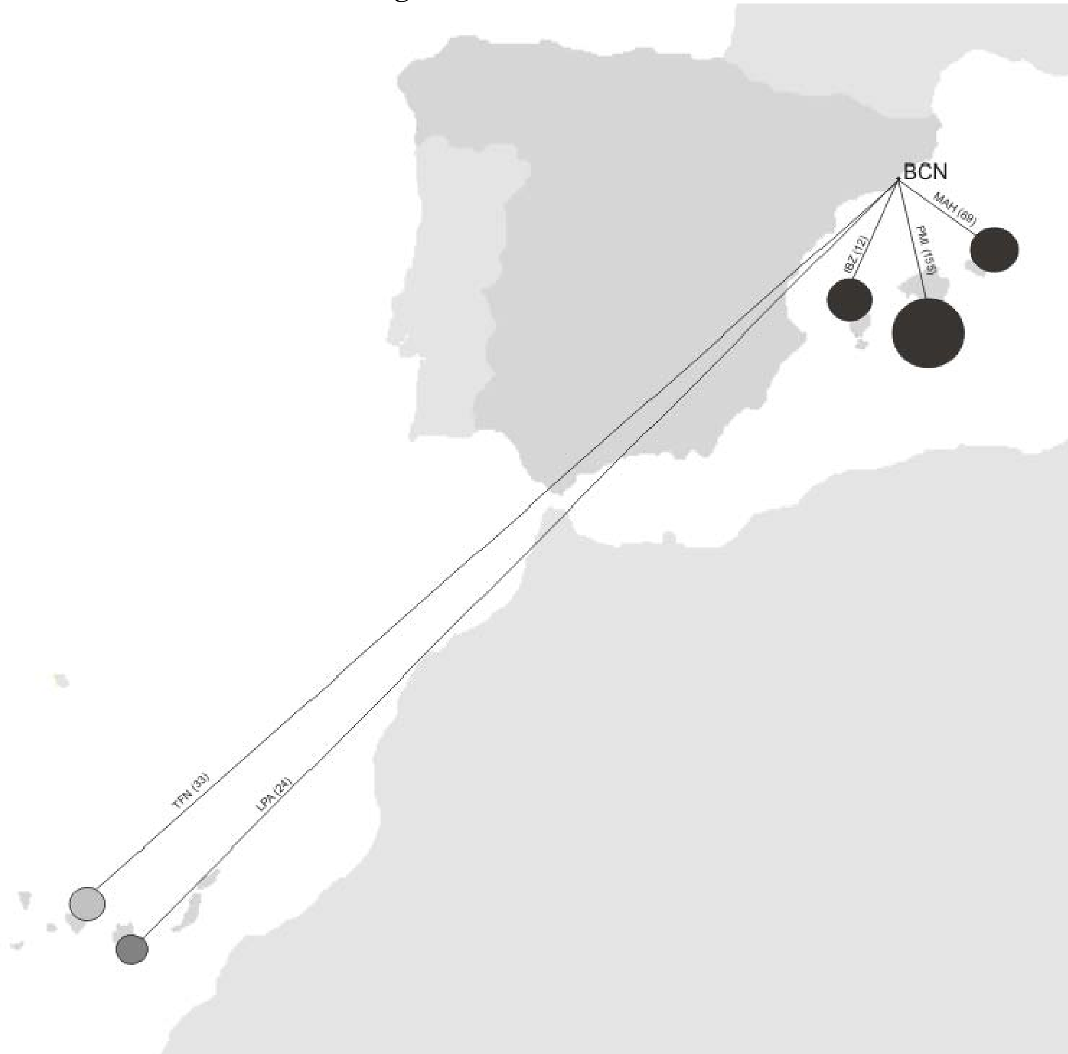
Figure 1: Mainland routes



Iberia share < 25%   25%< Iberia share <50%   Iberia share >50%

Note: Dashed lines are monopoly routes. The diameter of each circle shows the relative amount of passengers on route. Frequency is included among brackets.
Source: Own elaboration.

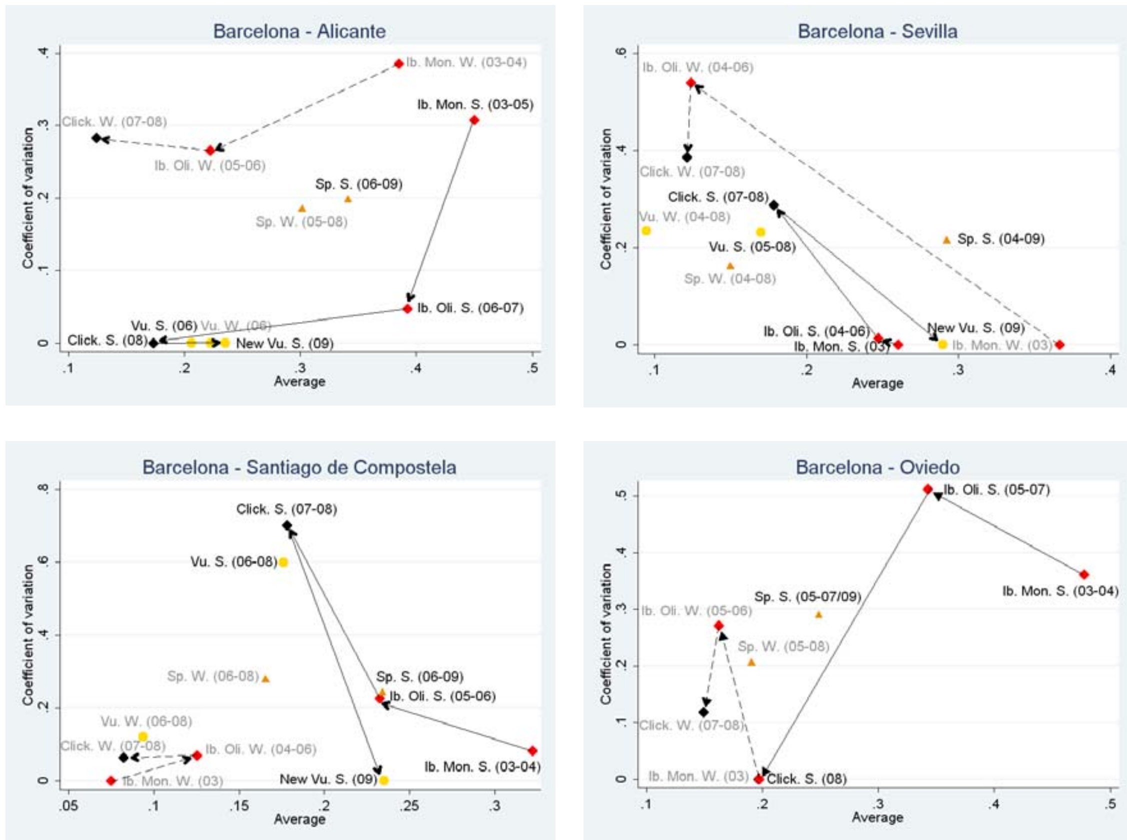
Figure 2: Island routes



Iberia share < 25% | 25%< Iberia share <50% | Iberia share >50%

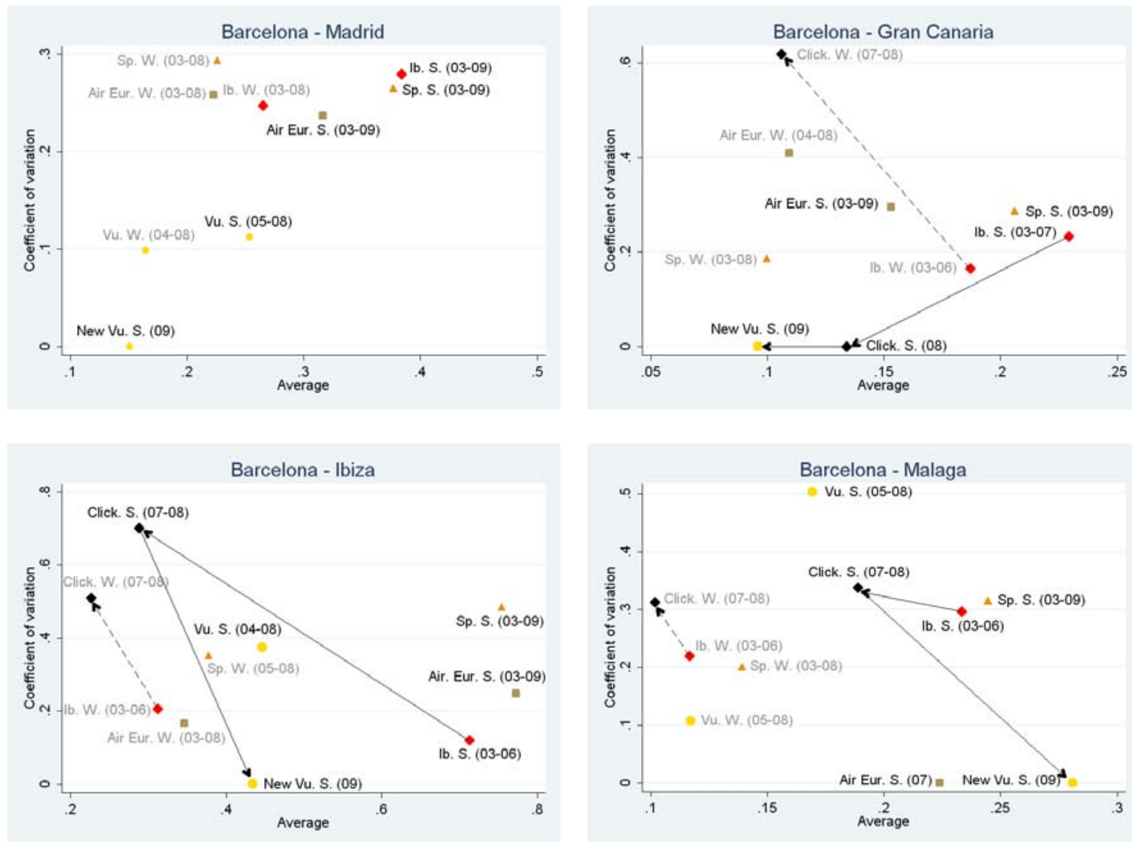
Note: The diameter of each circle shows the relative amount of passengers on route. Frequency is included among brackets.
Source: Own elaboration.

Figure 3. Representative routes that move from monopoly to oligopoly



Note: In the horizontal axis, we show average prices per kilometre. In the vertical axis, we show the coefficient of variation of prices. Note that in brackets, it is indicated the period for which data for each airline is calculated. S refers to the summer season and W refers to the winter season.
Source: Own elaboration.

Figure 4. Representative oligopoly routes in the considered period



Note: In the horizontal axis, we show average prices per kilometre. In the vertical axis, we show the coefficient of variation of prices. Note that in brackets, it is indicated the period for which data for each airline is calculated. S refers to the summer season and W refers to the winter season

Source: Own elaboration.

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