MEASURING CONDUCT AND COST PARAMETERS IN THE SPANISH AIRLINE MARKET

Xavier Fageda

July 2005

Address for correspondence: Department of Economic Policy (University of Barcelona). Av. Diagonal 690. 08034 Barcelona (Spain). E-mail: xfageda@ub.edu Tel.(0034) 934021947 Fax: (0034) 934024573

ABSTRACT:

This paper develops a model of airline competition. The model is based on a demand and pricing equation system, which is estimated for the Spanish airline market. The empirical implementation of the equation system relies on a simultaneous rather than a consecutive procedure. I test the explanatory power of alternative oligopoly models with capacity constraints. In addition, I analyze the degree of density economies. Results show that Spanish airlines conduct is less competitive than the *Cournot* solution. I also find evidence that thin routes can be considered as natural monopolies.

JEL classification: D43, L13, L93, C30

Keywords: Oligopoly, Air Transportation, Multiple Equation Models

I. Introduction

Worldwide, the liberalization of air transport services has been considered one of the most successful experiences in the wider process of regulatory reform. However, there is a consensus in the academic literature that benefits from liberalization depend fundamentally on competition in the markets where airlines compete: the air routes that link city pairs. There are three common features of European domestic markets that allow testing of hypotheses about market power under one strategic scenario. First, flag carriers dominate their domestic markets.[1] Second, airlines face exogenous capacity constraints from severe congestion at the main European airports. And third, the majority of routes in European domestic markets are short-haul routes, which leaves room for competition from other transport modes.

In this context, monopolies and asymmetric oligopolies are the two typical market structures that have emerged, and traffic density normally determines the competition framework on a route. Oligopoly with a dominant firm predominates in thick routes, whereas monopoly predominates over thin air routes.

---

[1] In Europe, the allocation of slots in airports is based on grandfather rights. Airlines that have traditionally made use of slots are their "owners". Thus, flag carriers, the airlines that had the monopoly (duopoly) in the provision of

With regard to oligopoly routes, it must be said that Kreps and Scheinkman (1983) show that equilibrium in a two-stage oligopoly competition model with endogenous capacity constraints and simultaneous price setting is equivalent to the traditional one-stage *Cournot* model. However, Deneckere and Kovenock (1992) find that oligopoly competition with exogenous capacity constraints can lead to an outcome less competitive than the *Cournot* model predicts, regardless of there is implicit or explicit collusion. In their model, the larger firm emerges as a natural price leader, and price setting becomes a leader-follower scheme. Although assuming *Cournot* competition in oligopoly airline markets has become standard in the literature, the European airline industry for domestic markets fits the assumptions of Deneckere and Kovenock's model.

With regard to monopoly routes, it must be said that density economies, where unit costs fall when route traffic increases, are accepted as an important feature in airline economics (Caves et al., 1984), and the degree of density economies determines whether thin routes should be considered natural monopolies. In such a case, Braeutigam (1989) suggests that one must evaluate whether some form of competition for the market, such as potential competition or intermodal competition, might guarantee an efficient allocation of resources.[2]

The primary objective of this paper is twofold. First, we test the explanatory power of the two alternative oligopoly models. And second, we examine density economies and the influence of competition for the market.

We deal with all these issues through an empirical model of airline competition that is estimated for the Spanish market in the period 2001-2002. At this point, it must be pointed out that the results of this study can be applied to the rest of the EU with some confidence because the Spanish domestic market is the largest in the European Union, as is shown in table 1. Indeed, the large size of the Spanish market allows us to claim that it is an upper bound in terms of competition opportunities in the European context.

Insert table 1 about here

A few facts about the Spanish air transport market are important to mention for our analysis. The main competitor for the Spanish flag carrier, Iberia, is Spanair, owned chiefly by the Scandinavian airline, SAS. The third competitor, Air Europa, is owned by a firm devoted to tourism. Iberia was privatized in a gradual process that finished in 2001, and British Airways is currently a major shareholder.[3] According to the General Directorate of Civil Aviation (Ministry

---

domestic (international) services in the regulation period, can use the majority of the slots in most airports within their national network.

[2] Indeed, air transport services were considered a paradigmatic example of the contestability hypothesis for their proponents (Baumol et al., 1982). Furthermore, ground transport modes should be able to compete with planes in short-haul routes.

[3] There is also Air Nostrum, a regional airline that operates as a franchise of Iberia. This airline does not have an independent pricing policy with respect to Iberia.

of Transports), the Spanish market is composed of about 100 routes, with Iberia maintaining a monopoly on half of them. In routes where Spanair and/or Air Europa offer services, Iberia's market share lies between 50 and 90 per cent. Additionally, the majority of Spanish routes have one endpoint at the airports of either Madrid or Barcelona. In the period considered, both airports were highly congested.

The remainder of this paper is organized as follows. The second section situates this study in the literature. In the third section, we develop a model of airline competition in a static framework. In the fourth section, we specify the data used in the empirical analysis. In the fifth section, we proceed to comment on the results of the estimation. Finally, the last section focuses on the implications of the results.

II. Literature review

One of the main advances of the New Empirical Industrial Organization (NEIO) framework is to provide econometric techniques to estimate conduct and cost parameters of firms, even when full data on costs is not available. In this way, the conjectural variations approach allows one to measure the market power of a firm or analyze the technology of an industry (Bresnahan, 1989). Although it has been criticized for capturing a dynamic concept in a static framework (Corts, 1999), the conjectural variations approach is still considered a useful tool to measure the degree of market power (Genesove and Mullin, 1998; Clay and Troesken, 2003)

In the case of the airline industry, there is an extensive empirical literature that analyses market power.[4] Nevertheless, there are very few studies that explicitly estimate the conduct parameters of airlines at the route level, and all of them look at the US domestic market. Brander and Zhang (1990, 1993), Oum et al. (1993) and Fisher and Kamerschen (2003) estimate such conduct parameters for a group of routes departing from Chicago and Atlanta airports respectively. The most common competitive scenario in such routes is a symmetric duopoly. Thus, it is not surprising that these studies find evidence that airline competition can be explained, on average, by a traditional *Cournot* model.

Moreover, these studies have two shortcomings. First, the estimation process is sequential so that they estimate (or assume) the price elasticity of demand in the first stage, and then they estimate the conjectural variations parameter at a second stage. This estimation process can be inconsistent where both parameters vary in a simultaneous way. Indeed, high mark-ups on costs may be a consequence of low price elasticities or of non-competitive conduct. Both causal factors

---

[4] Relevant contributions are due, among others, to Borenstein (1989), Evans and Kessides (1993), Marín (1995) and Berry et. al. (1996). A recent study for European domestic markets is due to Carlsson (2004)

can differ across markets. Thus when one factor gets fixed across markets, the estimates does not appropriately distinguish the contribution of each of the factors.

And second, assumptions to approximate route specific marginal costs are needed because cost data is not generally available at the route level. In particular, literature about airline conduct generally assumes constant marginal costs regardless of the level of route traffic density. Nevertheless, previous studies (Brueckner, Dyer and Spiller, 1992, Brueckner and Spiller, 1994) show that marginal costs can decrease.[5] As has been mentioned above, the existence of density economies on the supply side is generally accepted, and density economies, which involve decreasing average costs, can come from sharing out fixed costs between more units of output or from decreasing marginal costs (Tretheway and Oum, 1992). In this way, marginal costs can be understood as the sum of the cost of moving an additional passenger for a given capacity plus the cost of providing additional capacity. The first of these marginal cost components does not vary with route traffic density. However, the costs of providing additional capacity can be decreasing where adding capacity involves the use of bigger planes or higher service frequency. Efficiency generally increases with a plane's size, while increasing service frequency allows a higher annual utilisation of planes and the crew.[6] In fact, it is difficult to know whether these effects refer to average or marginal costs, but it is sensible to argue that the shape of an airline's marginal cost function should be tested empirically.

In this paper, we estimate conduct and cost parameters for the Spanish air transport market through a simultaneous estimation of demand and pricing equations. We use the information provided by routes in different competitive scenarios, taking into account the sensitivity of costs to traffic density. Given that the availability of data does not allow estimating parameters for each route, our estimation procedure distinguishes across routes according to the two main specific market characteristics: traffic density and distance.

III. The empirical model

Estimation of an empirical model in a NEIO framework requires assumptions both about demand and cost functions and concerning the nature of the oligopolistic interaction between firms. Such assumptions are made at the route level. Indeed, the use of the information contained in monopoly routes allows identification of the conduct parameter in oligopoly routes. Hence our

---

[5] Brueckner and Spiller (1994) also estimate the conduct parameter in a structural model, whose identification requires an ad hoc procedure for routes with several segments. They find that airlines behavior is relatively competitive in a sample of routes that excludes air services departing from airport hubs. Their model is not applicable to markets based fundamentally on short-haul services.

[6] A high service frequency also benefits travellers through a lower waiting time. Waiting time is the difference between the most preferred flight schedule by the traveller and the actual flight schedule.

interest lies in the equilibrium condition at the market level, which comes from the aggregation of the individual equilibrium conditions at the airline level.[7]

Typically, the estimation of a demand-supply equation system does not allow identification of conduct and cost parameters without additional assumptions. Our identification procedure takes as a reference the study of Parker and Roller (1997) of the US mobile telephone industry, where a semi-logarithmic demand function is assumed.[8]

Demand function (*Q*) at the route *k* in period *t* is expressed through a semi-logarithmic function that is derived from a gravity model:

$$\log(Q_{kt}) = a_{kt} + \alpha_k p_{kt} \qquad (1)$$

$$\text{where } a_{kt} = a_0 + a_1 log(pop_{kt}) + a_2\ log(inc_{kt}) + a_3 D^{island}_{k}\ \ and\ \alpha_k = \alpha_0 + \alpha_1 D^{intermodal}_{k}$$

The intercept term of the demand function includes variables for the mean values of population (*pop*) and income per capita (*inc*) of the route city pairs, which approximate its demographic and economic size. Additionally, it includes a dummy variable that takes value 1 for routes with an island as an endpoint (D^{island}) as the main "impedance" effect. This latter variable also captures traffic generation that comes from tourist activities.

Demand also depends on prices (*p*). It should be restrictive to assume that the price elasticity of demand does not vary across routes. Indeed, it can be expected that travelers are less sensitive to airline prices on routes where supply of other transport modes is not available or it is available with a much lower quality of service. Hence we include a dummy variable for intermodal competition ($D^{intermodal}$) that interacts with prices. This variable takes value 1 in routes with an island as an endpoint and/or in routes whose distance is more than 650 kilometers. In this way, it is generally assumed that ground transport modes are not able to compete with planes over distances of more than about 600 or 700 kilometers.

If we assume a quadratic total cost function, marginal costs (MC) at the route *k* in period *t* can be expressed as follows:

$$MC_{kt} = b_k + \beta Q_{mkt} \qquad \text{where } b_k = b_o + b_1 dist_k. \qquad (2)$$

---

[7] In the aggregation process, we assume cost symmetry across airlines. In fact, the Spanish flag carrier has a much higher market share than its rivals in the majority of oligopoly routes. In order to test the possible bias of assuming symmetry, we also estimate the equation system using flag carrier data exclusively.

[8] See Oum (1989) for an analysis of the soundness of semi-logarithmic functions in transport markets.

The intercept term of the marginal cost function includes a parameter (b_0) that captures the allocation of costs at the firm level. In addition, it includes a variable for distance (*dist*). This variable explains a great part of airline prices. For several reasons costs increase less proportionally than the kilometers flown. Long-haul routes involve higher average speeds, less intense consumption of fuel, and lower per kilometer charges for some fixed cost (such as airport fees). Finally, the sign of the parameter (β) associated with the mean number of passengers carried by airlines on the route (Q_{mkt}) determines the slope of marginal costs.

The equilibrium condition is the result of equating marginal cost and revenue functions. Indeed, we derive the following oligopoly supply relationship:

$$p_{kt} = MC_{kt} - \theta(1/\alpha_k) \tag{3}$$

where prices (p_{kt}) are expressed as a mark-up [$\theta(1/\alpha_k)$] on marginal costs (MC_{kt}). The mark-up is composed of the conduct parameter (θ) and the demand-price elasticity derived from the semi-logarithmic demand equation (α_k).

The empirical implementation of this model requires simultaneous estimation of equations (1) and (3) given equation (2). Thus, the equation system is:

$$log(Q_{kt}) = a_0 + log(pop_{kt}) + a_2\, log(inc_{kt}) + a_3 D^{island}_k + \alpha_0 p_{kt} + \alpha_1 D^{intermodal}_k p_{kt} + e^d_{kt} \tag{4}$$

$$p_{kt} = b_0 + b_1 dist_k + \beta Q_{mkt} - \theta(1/\alpha_k) + e^s_{kt} \tag{5}$$

where e^d_{kt} and e^s_{kt} are random error terms. The main parameters estimated are θ, which measures the average degree of collusion, and β that measures the amount of decreasing marginal costs. The value of θ should be ranked from 0 (prices equal to marginal costs) to 1 (prices set on a joint profit maximization setting). Under the Cournot assumption, θ would take a value equal to the inverse of the number of competitors. Thus, in our context, in cases where θ takes a value greater than 0.38, which is the inverse of the mean number of competitors in the oligopoly routes of our sample, conduct would be less competitive than predicted by a Cournot model. Our data does not allow testing explicitly whether the alternative competitive scenario, a price-leadership scheme, applies. However, rejection of the Cournot model would provide some empirical evidence for the predictions contained in the Deneckere and Kovenock´s model. Additionally, a negative value of β would be consistent with a hypothesis of decreasing marginal costs.

The functional form of the demand equation allows identification of the conduct and cost parameters. Indeed, the demand term is dropped from the mark-up expression because $\alpha_k = \partial log(Q_{kt})/\partial p_{kt}$ and so $\alpha_k = \partial Q_{kt}/\partial p_{kt}Q_{kt}$. Additionally our identification procedure relies on the assumption, which is discussed in the next section, that $\theta = 1$ in monopoly routes. Indeed, the supply relationship can be expressed as follows:[9]

$$p = b_0 + b_1 dist + \beta Q_m - D^M \alpha^{(-1)} - D^{NM} \theta^{NM} \alpha^{(-1)} + e^s_{kt}, \qquad (6)$$

where D^M and D^{NM} are dummy variables that refer to monopoly and oligopoly routes respectively. The intercept term (c_o) in monopoly routes is $c_o^M = b_0 - \alpha^{(-1)}$, whereas it is $c_o^{NM} = b_0$ in oligopoly routes. Rearranging terms, the pricing equation can be expressed as follows:

$$p = c_0 + b_1 dist + \beta Q_m + D^{NM} \gamma + e^s_{kt} \qquad (7)$$

where $\gamma = \alpha^{(-1)}(1-\theta^{NM})$, and $c_0 = b_0 - D^M \alpha^{(-1)}$, which cannot be identified.

An additional concern in the estimation of the conduct parameter θ^{NM} addresses the fact that such a conduct parameter should vary with the extent of competition from other transport modes. Indeed, airline behavior can be more collusive where other transport modes do not compete. Thus, we differentiate between two submarkets ($m=a,b$). A submarket based on peninsular routes with a distance of less than 650 kilometers ($m = a$) and a submarket based on routes with an island as an endpoint and/or routes whose distance is more than 650 kilometers ($m = b$). Thus, θ takes the following form:

$$\theta \left| \begin{array}{l} \theta^M = 1 \\ \theta_a^{NM} = \theta_o \\ \theta_b^{NM} = \theta_o + \theta_1 D^{intermodal} \end{array} \right. \qquad (8)$$

where $D^{intermodal}$ refers to a dummy variable that differentiates between both submarkets. Furthermore, it is also of interest to analyze not just the degree of market power and density economies but also the determinants of conduct and cost parameters. Indeed, airlines behavior should depend on market structure variables, such as concentration at the route and airport level, and on market characteristic variables, such as the intensity of tourist activity at the city-pair links.

---

[9] For simplicity, subindexes k and t are omitted.

In an alternative specification of the conduct parameter considered in (8), θ would take the following form:[10]

$$\theta \left| \begin{array}{l} \theta^{M} = 1 \\ \theta^{NM} = (\theta_{o} + \theta_{1}HH + \theta_{2}tour) \end{array} \right. \tag{9}$$

where *HH* is the concentration index of Hirschman-Herfindahl and *tour* is a variable for tourism intensity. We use two alternative measures of market concentration that are estimated separately. Concentration in terms of the number of passengers carried in the route (HH_{route}) and concentration in terms of the number of total departures in the corresponding airport (HH_{airp}). This formulation carries an endogeneity bias as long as concentration levels depend on the pricing choices of firms. However, this bias should be greatly diluted for airport concentration because pricing choices refer to the route level while airport concentration refers to all the routes departing from a given airport. We use data of the previous year in order to account for the possible endogeneity bias when testing the effects of route concentration. Finally, the variable for tourist activity is an index that is calculated according to the tariff share that the provinces of the route city pairs have regarding revenues from the Economic Activity Tax (IAE). The tariff of this tax depends on the number of rooms and the category of tourist establishments for each province.

Regarding the cost function, an alternative disaggregated specification to that considered in equation (2) is as follows:

$$MC_{kt} = b_{k} + \beta_{1}fq_{kt} + \beta_{2}equip_{kt} + \beta_{3}lf_{kt} + \delta D^{hub}{}_{k} \tag{10}$$

In this way, the number of passengers carried on a route comes from the product of service frequency (*fq*), size of the plane (*equip*) and load factor (*lf*). Additionally, the more efficient coordination of flights possible for Iberia (and to some extent Spanair) in Madrid airport, its main hub, could result in lower costs in routes departing from this airport. We approximate this possible effect through the use of a dummy variable (D^{hub}) that takes value 1 in routes departing from Madrid.

We must be cautious in the interpretation of the results of this latter model because we only consider the load factor as an endogenous cost variable, given that additional instruments are not

---

[10] In this case, the supply relationship is as follows: $p = c_{0} + b_{1}dist + \beta Q_{m} - D^{NM}\alpha^{(-1)}(\theta_{1}HH_{route} + \theta_{2}HH_{airp} + \theta_{3}tour) + e^{s}{}_{kt}$, where $c_0 = b_0 - \alpha^{(-1)} (D^{M} + D^{NM}\theta_{o})$. Thus, we cannot identify θ_{o}. Our goal here is not measuring the average degree of collusion but the influence of different market features on it.

available. Nevertheless, the endogeneity bias (if it exists) should be relatively weak regarding the size of the planes and service frequency. First, there are very few types of planes that are profitable over each distance. And second, service frequency depends on airport presence, which, in turn, depends on the slots that an airline controls. In this way, it must be recognized that European allocation rules for slots, where the main airports are congested, are very rigid. The latter argument also applies when analyzing the possible endogeneity bias of airport concentration

IV. Data

The sample used in the empirical analysis includes observations for the Spanish market of regular flights in the period 2001-2002 and is composed of 67 routes, with a similar number of monopoly and oligopoly routes. This group of routes represents all the routes of the Spanish market with a traffic density of more than 50,000 passengers per season and 55 per cent of routes with a traffic density between 10,000 and 50,000 passengers per season. The frequency of the data is semi-annual. Thus, we differentiate between the summer and winter, and we include dummy variables for season (*win01*, *sum02*) in all the equations.[11] In general terms, the structure of prices (in the full fare classes) and flight schedules of airlines vary between but not within seasons. Such inter-season variation is especially important in the Spanish case because this market is strongly oriented toward tourism.

Information about the total number of passengers carried by airlines has been obtained from the "Boletín de la Oferta por Tramos y Mercados del Programa de Vuelos Regulares," published by the General Directorate of Civil Aviation (Ministry of Transport). Service frequency and aircraft size data has been obtained from Official Airlines Guide (OAG) website. The round trip prices charged for each airline have been obtained from their respective websites. Data on frequency, aircraft size and prices have been obtained for a representative sample week of each season.

The population variable is the total mean population in a route's origin and destination provinces, following the census of the first of January published by the National Statistics Institute (INE). Data on the percentage of departures of each airline in origin and destination facilities have been obtained from the "Anuario Estadístico de Tráfico," published by Spanish Airports and Air Navigation (AENA) agency. The variable for tourist intensity has been obtained from the "Anuario Económico de España," published by the private financial entity "La Caixa".

---

[11] To this regard, it must be said that we consider the summer in 2001 as the baseline period, whereas data for the winter in 2002 is not available.

Demand data is restricted to non-stop services, without distinguishing between connecting and final traffic. Services with intermediate points in a market based fundamentally on short-haul routes have much higher demand inconvenience and higher costs than non-stops services. However, the possible network effect that arises from this type of traffic needs to be considered. Hence we also estimate the equation system for a subsample of routes departing from Madrid airport. This airport is the main hub of Iberia and Spanair and is in the geographic center of Spain. Thus, we can isolate the possible effect of services with intermediate points through this estimation because all domestic flights that depart from Madrid airport are direct flights.

In turn, our sample of routes includes a wide range of traffic densities. In this way, density economies can be exhausted when traffic density is very high and conduct can be more collusive in thinner routes as long as entrants have difficulty achieving a scale of operation large enough to be competitive. In order to account for these differences, we estimate the equation system for a subsample of routes with less than 200,000 passengers carried per season, which is the mean number of passengers carried in the full sample.

The fare class used to approximate the average prices charged by airlines presents special difficulties. First, a weighted distribution of passengers carried for the different fare classes paid is not available. If this distribution varies substantially across routes and airlines our results could be thrown off. The use of variables that are connected to route characteristics can help in controlling for these differences. In any case, the interpretation of the results should take this possible bias into account.

And second, we can distinguish between three different fare classes; the lowest fare class, the (unrestricted) economy class and the business class.[12] The lowest fare class and the business class can be understood respectively as a discount and mark-up on the economy class, so prices in the economy class can be considered a reference for all fare classes. In addition, the amount of that discount and mark-up is determined by demand, rather than cost, features. Hence the use of economy class prices would seem to be suitable in approximating the mark-up airlines try to charge on marginal costs. However, the majority of passengers obtain some discount when purchasing airfares. Thus, we use an average of prices in the lowest fare class and the economy class in order to have the closest available approximation to the mark-ups that airlines effectively charge on marginal costs.[13]

---

[12] There is a high variability in the prices charged by airlines in the lowest fare class. In order to account for this variability, we have obtained this data in homogeneous conditions for each airline. That is, data have been collected one month before travelling, the price refers to the first trip of the week and the return is on Sunday.

[13] It must be said that estimation results are reported using the simple average of prices across airlines. There are no significant changes if we use a weighted average of prices across airlines according to their market share.

Tables 2, 3 and 4 show the descriptive statistics and correlation matrices of the variables used in the empirical analysis.

Insert table 2 about here

Insert table 3 about here

Insert table 4 about here

V. Estimation and results

Our estimation procedure for identifying the conduct parameter in oligopoly routes relies on the information provided by monopoly routes. Indeed, we impose a conduct parameter of 1 in monopoly routes. To what extent is this assumption correct? It can be argued that competition for the market disciplines the behavior of monopolist firms. In order to tackle this question, we estimate the supply relationship for the subsample of Iberia's monopoly routes through the Two Stage Least Squares (TSLQ) estimator. The variables that capture competition for the market are, first, the dummy variable that distinguishes the possibility of intermodal competition ($D^{intermodal}$). And second, we include a dummy variable for potential competition ($D^{potential\ comp.}$) that takes value 1 in routes where Spanair and/or Air Europa offer services in each of the airports of the route but not on the route.

The results of the equation estimated (with the standard errors in parenthesis) are as follows[14]:

$$p_{kt} = \underset{(22.21)}{258.84} + \underset{(0.023)^{**}}{0.17}dist_k - \underset{(0.0001)^{**}}{0.0009}Q_{kt} - \underset{(8.30)}{2.42}D^{potential\ comp.} - \underset{(16.76)}{22.64}D^{intermodal} - \underset{(15.86)}{19.28}win01 + \underset{(36.79)^{*}}{36.79}sum02 + e^{s}_{kt}$$

$R^2 = 0.50$
Number of observations: 96
Note: Significance at the 1% (**), 5% (*).

Our results show that variables for competition for the market are not significant. Thus, we find some evidence against the Spanish air transport market as a contestable market[15] and indication of the weakness of other transport modes in competition with Iberia. We also find that density economies can be strong. Indeed, prices fall by about 2 per cent for every 10 per cent increase in route traffic.

---

[14] Instruments for the variable of demand are population and income per capita. We exclude the dummy variable for islands because very few monopoly routes have an island as an endpoint.

[15] Empirical studies for the US air transport market also tend to reject the contestability hypothesis. See, for example, Morrison and Winston (1987) or Whinston and Collins (1992). Pitelis and Schnell (2002) infer similar results in an analysis focused on European markets.

Of course, our finding of substantial density economies could mean that monopoly routes are natural monopolies because these routes show a low traffic density.[16] Furthermore, the imposition of value 1 in the conduct parameter of monopoly routes is correct to the extent that competition for the market does not play an important role. Additional data in the period 1997-2002 for our sample of monopoly routes also supports this argument. There have been new entries in 3 of the 37 monopoly routes in the winter season and in 7 of the 35 monopoly routes in the summer. All of these new entries were followed by the exit of the entrant the following year. Thus, it seems that Iberia is quite protected (and so should be able to charge effectively monopolistic prices) in a context characterized by increasing congestion in the main Spanish airports. Indeed, airport congestion along with density economies prevents entrants from developing a sufficient scale of operations to be competitive.[17]

It can be easily shown that our system of equations is identified because excluded exogenous variables from one equation in the system identify the other equations. It is common to estimate identified systems through some method based on the Instrumental Variables Technique. However, as we argued in the second section, estimation of the conduct parameters through a sequential rather than a simultaneous procedure could be inconsistent. Table 5 show the results of the demand and pricing equation system estimates, which refers to the equations (4) and (5) outlined in section 3, using both the Two Stage Least Square (2SLS) and Three Stage Least Squares (3SLS) estimators. Tables 6 and 7 show the results from different specifications of the equation system that are estimated. Table 8 shows the corresponding structural parameters that can be inferred from the estimates.

Insert table 5 about here

Insert table 6 about here

Insert table 7 about here

Insert table 8 about here

Comparing results from Specifications (1) and (2) in table 5, we can infer whether the estimation technique makes a difference in the results. The estimation of market power changes significantly when using a simultaneous (3SLS) rather than a consecutive (2SLS) procedure. Given that the 2SLS technique fixes the price-elasticity of demand across routes, we feel that in this case the 2SLS provides an overestimation of market power. Thus, our results show that one must be cautious in the interpretation of the results of a consecutive procedure.

---

[16] Indeed, the mean number of passengers carried for the full sample of routes is 200,000 passengers, while it is 50,000 passengers for the subsample of monopoly routes.

[17] It must be said that airlines also must develop a high scale of route operations in terms of quality because service frequency is the main determinant of such quality.

In specification (1), all the explanatory variables have the expected signs, except the variable for income per capita, which is not significant. Price elasticity of demand lies between -1.88 and -1.55. This result is consistent with previous studies, taking into account that we are not able to separate, in an appropriate way, leisure and business passengers.[18] We find evidence of decreasing marginal costs. In this way, an increase in the mean number of passengers of one standard deviation would result in average prices falling by about 25 euros. Although this price reduction seems small, it is the result of a conservative measure of density economies. Indeed, we are not able to capture how fixed costs are shared between more units of output, and so our results indicate that density economies can be substantial. In turn, we also find evidence of distance economies such that costs increase less than proportionally to kilometers flown. The estimated elasticity of 0.35 is similar to the result obtained in Brueckner and Spiller (1994) but lower than the estimates in Oum et al. (1993). The conduct parameter estimate, which is larger than 0.60, shows that the market power of Spanish airlines is strong. In particular, their behavior is less competitive than predicted by a *Cournot* model but more competitive than the joint profit maximization case. The lack of significant differences between the two submarkets analysed suggests that the possibility of intermodal competition does not influence airline behavior.

In specification (3), we estimate the equation system for a subsample of routes originating at Madrid airport [19] in order to identify any network effect that could distort results in model (1). Although results are not substantially different from specification (1), conduct seems to be slightly more collusive for this subsample of routes. A possible explanation of this result is that Iberia can charge higher mark-ups on routes departing from its main hub and rivals take advantage of the environment by charging also higher prices.

In specification (4), we estimate the equation system for a subsample of routes with less than 200,000 passengers in order to determine whether low traffic density routes have different conduct and cost parameters. The fare reduction from an increase in route traffic is slightly larger than in model (1) and conduct is much more collusive. However, we reject the joint profit maximization hypothesis.

In specification (5), we estimate the equation system including market specific variables in the pricing equation as possible determinants of airlines behavior. Such specification refers to the alternative expression of the conduct parameter outlined in section 3 in equation (9). We find that conduct is slightly more collusive in tourist oriented routes. This result could be explained by the fact that most tourist routes have an island as an endpoint. We also find that market

---

[18] See Oum et al. (1992).

[19] We do not differentiate between submarkets according to the opportunities of intermodal competition in this specification because the number of observations is scarce.

concentration, both at the airport and route level, greatly influences airline conduct. Given that market shares at the route level are fundamentally determined by airport presence, it seems that concentration at the airport level is a major determinant of airline behavior.

In specification (6), we estimate the equation system including different cost variables in the pricing equation. This specification relates to the alternative expression of the marginal cost function outlined in section 3 in equation (10). We find that bigger planes play a larger part than higher service frequency in cost-reducing effects. However, high service frequency (which depends fundamentally on airport presence) does have a cost reducing effect for passengers because it is a major determinant of service quality. The variables for load factor and the hub effect are not significant.[20]

In the aggregation process of the individual equilibrium conditions, we make the assumption of symmetry across airlines. In specification (7), we use data of Iberia exclusively in order to assess whether this assumption could distort our results. In this model, we estimate the residual (inverse) demand function of Iberia through a similar procedure to that developed in Baker and Bresnahan (1988). The residual demand function is understood as the relationship between prices and output of a firm, given the possible reaction of rivals. In our model, this function can be estimated including a variable for excess of capacity (*excess*) of Iberia's rivals, which is the difference between the supply of seats and the number of passengers carried by Spanair and Air Europa. This variable shows a high correlation with the variable for Iberia's demand, which explains why both variables are not significant. However, the main interest of this model is to estimate the conduct parameter for Iberia and to compare it with results in specification (1) that refer to the average for Spanish airlines. We find that the conduct of Iberia is more collusive than that of the average for Spanish airlines. In fact, Iberia's behavior approaches the joint profit maximization hypothesis.[21]

Given that our conduct parameter identification is based on the information provided by monopoly routes, we are not able to identify it for Spanair and Air Europa.[22] Although assertions about the relationship between the airlines cannot be explicitly tested, it is sensible to claim that Iberia is the airline that really has market power, while its rivals behave as followers. The good

---

[20] It must be said that airlines normally operate with an average load factor that lies between 60 and 70 per cent. High load factors reduce average costs but at the same time reduce the probability of capturing last minute travellers who are price insensitive.

[21] It must be taken into account that we make the implicit assumption $b_0^{NM} = b_0^{M}$ in previous estimates (eg; the intercept term of the marginal cost function is equal in oligopoly and monopoly routes). This assumption could involve an underestimation of market power in oligopoly routes to the extent that $b_0^{NM} < b_0^{M}$.

[22] Spanair does not offer exclusively services in any route and Air Europa has the monopoly in a reduced group of routes characterised by a very low and fluctuating traffic. We consider that it would be biased to identify the conduct parameter for Spanair and Air Europa using data of Iberia's monopoly routes.

financial performance of Iberia since 1999, in contrast to many other airlines, also supports this argument.

VI. Concluding remarks

In this paper, we analyze Spanish airline behavior in monopoly and oligopoly strategic scenarios. Cost and demand information that provides a representative sample of routes are used to estimate demand and pricing equations.

Our results show that inferences about market power can differ substantially when using a consecutive rather than a simultaneous procedure. In order to accurately disentangle the contribution of price-demand elasticities and behavioral parameters on mark-ups, a simultaneous estimation seems to be more appropriate.

A well-known result in the industrial organization literature is that oligopoly competition in markets characterized by endogenous capacity constraints leads to *Cournot* outcomes. With regard to the airline industry, previous empirical studies of air transport competition find that, on average, airlines compete *à la Cournot*. However, the most frequent oligopoly setting in those studies is a symmetric duopoly. Deneckere and Kovenock (1992) show that oligopoly competition in a market with exogenous capacity constraints and a natural leader in prices can lead to an equilibrium less competitive than the *Cournot* solution, regardless of whether any form of collusion exists. European domestic airline markets for the period analyzed seem to meet the assumptions of the model of Deneckere and Kovenock. Our findings could be capturing the prediction of such model, taking into account that the Spanish market appears to be a representative market in the European context.

Indeed, we find evidence that the conduct of Spanish airlines in oligopoly routes is less competitive than predicted by a *Cournot* model. In addition to this, airport concentration arises as a relevant determinant of airline mark-ups. The results of our analysis also show that density economies are substantial. Thus, routes with low traffic densities can be considered as natural monopolies. Furthermore, the two main forms of competition for the market in the air transport industry, potential competition or intermodal competition, do not seem to impose a disciplining effect on airline behavior.

The existence of a natural monopoly in thin routes along with generally non-competitive conduct among airlines in thick routes could justify an economic regulation process in the former case and a more proactive competition policy in the latter case. Regardless of the suitability of these two policy measures, we claim that the improvement of competition conditions in the Spanish market requires a more balanced allocation of new available airport slots. In this way, the capacity constraints that create airport congestion will likely be alleviated by the plan to double the capacity of the main airports of the Spanish network. In turn, given that a high proportion of monopoly routes are short-haul routes, it could be desirable to promote intermodal competition.

Acknowledgments

The author would like to thank Germà Bel, Joan Ramon Borrell, Javier Campos, Antón Costas, Ginés de Rus, Pedro Marín, Anna Matas, Robin Lindsey and Gustavo Nombela for their useful suggestions. The usual disclaimer applies.

References

- Baker, J.B. and T.F. Bresnahan (1988) 'Estimating the Residual Demand Curve Facing a Single Firm', *International Journal of Industrial Organization*, 6, 283-300.
- Baumol, W. J., J.C. Panzar and R.D. Willig (1982) *Contestable Markets and the Theory of Industrial Structure*. New York: Harcourt Brace Jovanovich.
- Berry, S., M. Carnall and P. Spiller (1996) 'Airline Hubs: Costs, Markups and the Implications of Customer Heterogeneity', *NBER Working Paper*, 5561, 1-38.
- Borenstein, S. (1989) 'Hubs and High Fares: Dominance and Market Power in the U.S Airline Industry', *Rand Journal of Economics*, 20, 344-365.
- Braeutigam, R.R. (1989) Optimal Policies for Natural Monopolies, in Schmalensee, R. and R.D. Willig, eds, *Handbook of Industrial Organization*. Amsterdam: North Holland, pp. 1290-1346.
- Brander, J. A and A. Zhang (1993) 'Dynamic Oligopoly Behavior in the Airline Industry', *International Journal of Industrial Organization*, 11, 407-433.
- Brander, J.A and A. Zhang (1990) 'A Market Conduct in the Airline Industry: An Empirical Investigation', *Rand Journal of Economics*, 21, 567-583.
- Bresnahan, T. F. (1989) Empirical Studies in Industries with Market Power, in Schmalensee, R. and R.D. Willig, eds, *Handbook of Industrial Organization*. Amsterdam: North Holland, pp. 1011-1057.
- Brueckner, J.K and P. Spiller (1994), 'Economies of Traffic Density in the Deregulated Airline Industry', *Journal of Law and Economics*, 37, 379-415.
- Brueckner, J.K., N. Dyer and P. Spiller (1992) 'Fare Determination in Airline Hub-and-Spoke Networks', *Rand Journal of Economics*, 23, 309-333.
- Carlsson, F. (2004) 'Prices and Departures in European Domestic Aviation Markets', *Review of Industrial Organization*, 24, 37-49.

- Caves, D.W, L.R. Christensen and M.W. Tretheway (1984) 'Economies of Density versus Economies of Scale: Why trunk and locals service airline costs differ', *Rand Journal of Economics*, 15, 471-489.
- Clay, K. and W. Troesken (2003) 'Further Tests of Static Oligopoly Models: Whiskey, 1882-1898', *The Journal of Industrial Economics*, 51, 151-166.
- Corts, K. S. (1999) 'Conduct Parameters and the Measurement of Market Power', *Journal of Econometrics*, 88, 227-250.
- Deneckere, R. J. and D. Kovenock (1992) 'Price Leadership', *Review of Economic Studies*, 59, 143-162.
- Evans, W.N. and I. Kessides (1993) 'Localized Market Power in the U.S. Airline Industry', *The Review of Economics and Statistics*, 75, 66-75.
- Fisher, T. and D.R. Kamerschen (2003) 'Price-Cost Margins in the U.S Airline Industry using a Conjectural Variation Approach', *Journal of Transport Economics and Policy*, 37, 227-259.
- Genesove, D. and W.P. Mullin (1998) ' Testing Static Oligopoly Models: Conduct and Cost in the Sugar Industry, 1890-1914', *Rand Journal of Economics*, 29, 355-377.
- Kreps, D. and J. Scheinkman (1983) 'Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes', *Bell Journal of Economics*, 14, 326-337.
- Marín, P.L. (1995) 'Competition in European Aviation: Pricing Policy and Market Structure', *Journal of Industrial Economics*, 16, 141-159.
- Morrison, S. and C. Winston (1987) 'Empirical Implications and Tests of the Contestability Hypothesis', *Journal of Law and Economics*, 30, 53-66.
- Oum, T.H. (1989) 'Alternative Demand Models and Their Elasticity Estimates', *Journal of Transport Economics and Policy*, 23, 163-187.
- Oum, T.H, W.G. Waters and Y.J. Say (1992) 'Concepts of Price Elasticities of Transport Demand and Recent Empirical Estimates', *Journal of Transport Economics and Policy*, 26, 139-154.
- Oum, T.H, A. Zhang and Y. Zhang (1993) 'Interfirm Rivalry and Firm-Specific Price Elasticities in Deregulated Airline Markets', *Journal of Transports Economic and Policy*, 27, 171-192.
- Parker, P. M. and L.H. Roller (1997) 'Collusive Conduct in Duopolies: Multimarket Contact and Cross-Ownership in the Mobile Telephone Industry', *Rand Journal of Economics*, 28, 304-322.
- Pitelis, C. N. and M. C. A Schnell (2002) 'Barriers to Mobility in Europe's Civil Aviation Markets: Theory and New Evidence', *Review of Industrial Organization*, 20, 127-150.

- Tretheway, M. and T. H. Oum (1992) *Airline Economics: Foundations for Strategy and Policy*. Vancouver: The Centre for Transportation Studies (University of British Columbia).
- Whinston, M. and S.C. Collins (1992) 'Entry and Competitive Structure in Deregulated Airline Markets: an Event Study Analysis of People Express', *Rand Journal of Economics*, 23, 445-462.

Table 1. Number of annual passengers carried in EU air markets. 2002

Market	Passengers (10^3)
Spain	29,022
France	27,021
United Kingdom	22,617
Italy	22,527
Germany	20,402
Sweden	7,445
Portugal	2,930
Finland	2,766

Source: Eurostat

Table 2. Descriptive statistics

Variable	Mean	Standard deviation	Minimum value	Maximum value
prices (euros)	281.63	95.82	120.84	530
demand (number of passengers)	204,044	322,423	2,662	2,413,967
population (number of inhabitants)	2,756,264	788,071	841,668	5,216,635
income (euros)	18,297	1,837	14,153	22,376
distance (kilometres)	650	510	131	2,190
num. competitors	1.81	0.88	1	3

D^{island}	0.31	0.46	0	1
$D^{intermodal}$	0.48	0.50	0	1
frequency (number of weekly flights)	46	60	3	445
equip (seats)	106.82	42.58	50	209
load factor (percentatge)	0.64	0.10	0.21	0.85
HH_{route}	0.76	0.25	0.335	1
$HH_{airport}$	0.47	0.11	0.34	0.74
tourism	1.84	2.30	0.26	7.46
D^{hub}	0.42	0.49	0	1

Table 3. Correlation Matrix (demand equation)

	demand	**prices**	**population**	**income**	**D^{island}**	**D^{cim}**
Demand	1					
Prices	-0.24	1				
population	0.16	-0.11	1			
income	0.28	-0.29	0.16	1		
D^{island}	0.1	0.09	0.14	0.28	1	
$D^{intermodal}$	-0.01	0.29	-0.06	-0.08	0.70	1

Table 4. Correlation Matrix (pricing equation)

	demand	**prices**	**Dist.**	**freq.**	**D^{nm}**	**equip.**	**load factor**	**HH_{route}**	**$HH_{airport}$**	**tour.**	**D^{hub}**	**$D^{intermod.}$**
Demand	1											
Prices	-0.21	1										
Distance	0.01	0.78	1									
Frequency	0.93	-0.37	-0.14	1								
D^{nm}	0.46	-0.23	0.17	0.47	1							
Equipment	0.53	0.09	0.46	0.41	0.61	1						
load factor	0.22	0.24	0.40	0.14	0.26	0.47	1					
HH_{route}	-0.50	0.11	-0.21	-0.50	0.93	-0.60	-0.28	1				
$HH_{airport}$	-0.27	0.38	0.22	-0.34	0.54	-0.28	-0.06	0.55	1			
Tourism	0.22	-0.06	0.18	0.22	0.51	0.33	0.34	-0.63	-0.34	1		
D^{hub}	0.33	-0.10	0.06	0.29	0.26	0.35	0.10	-0.26	0.07	0.06	1	
$D^{intermodal}$	-0.01	0.32	0.47	-0.06	0.25	0.31	0.39	-0.32	-0.26	0.57	-0.26	1

Table 5. System equation estimates

	(1) **Full sample** **(Baseline model)** **3SLS**	**(2)** **Full sample** **(Baseline model)** **2SLS**
<u>Demand equation</u>		
prices (*p*)	-0.0067(0.0014)**	-0.0072(0.0012)**
$D^{intermodal}*p$	0.0012 (0.0008)	0.0020 (0.0008)*
population (*pop*)	2.00 (0.29)**	1.91 (0.20)**
income (*inc*)	-0.60 (0.89)	0.23 (0.78)
D^{island}	1.27 (0.25)**	0.93 (0.26)**
winter01	-0.53 (0.18)**	-0.53 (0.18)**
summer02	0.13 (0.18)	0.08 (0.17)
Intercept	-10.71 (8.39)	-17.54 (7.40)
R^2	0.46	0.47
χ^2 (joint sig.)	154.84**	27.30**

<u>Pricing equation</u>		
demand (*Q_m*)	-0.24e-3 (0.8e-4)**	-0.31e-3 (0.9e-4)**
distance (*dist*)	0.15 (0.007)**	0.15 (0.006)**
D^{nm}	-53.16 (12.68)**	-24.92 (11.92)*
$D^{intermodal}$*D^{nm}	1.28 (11.84)	-12.90 (8.95)
winter01	-25.21 (9.18)**	-26.70 (9.68)**
summer02	19.94 (8.76)*	22.66 (8.95)*
Intercept	233.23 (9.92)**	227.50 (11.63)**
Num. observations	190	190
R^2	0.74	0.74
χ^2 (joint sig.)	550.49**	145.02**

Note 1: Standard errors in parentheses

Note 2: Significance at the 1% (**), 5% (*), 10% (+)

Note 3: Test of joint significance refers to the F test for the 2SLS estimation

Table 6. System equation estimates (3SLQ)

	(3) Subsample (Routes with origin in Madrid)	**(4) Subsample (Routes with < 200000 pax)**	**(5a) Full sample (Conduct Determinants)**	**(5b) Full sample (Conduct Determinants)**
<u>Demand equation</u>				
prices (*p*)	-0.005 (0.0021)**	-0.0037(0.0013)**	-0.0051 (0.0010)**	-0.0049 (0.0010)**
$D^{intermodal}$*p	-	0.0014 (0.0007)*	-	-
population (*pop*)	6.61 (1.02)**	0.81 (0.23)**	2.05 (0.22)**	2.04 (0.22)**
income (*inc*)	-0.97 (1.51)	0.57 (0.88)	-0.91 (0.90)	-0.76 (0.90)
D^{island}	1.57 (0.36)**	0.73 (0.26)**	1.48 (0.19)**	1.46 (0.19)**
winter01	-0.70 (0.26)**	-0.16 (0.18)	-0.53 (0.18)**	-0.52 (0.18)**
summer02	0.04 (0.28)	0.13 (0.19)	0.13 (0.18)	0.11 (0.18)
Intercept	-76.23 (20.82)**	-6.08 (8.34)	-8.89 (8.59)	-10.27 (8.63)
R^2	0.54	0.26	0.45	0.44
χ^2 (joint sig.)	86.38**	40.36**	141.54**	138.68**

Pricing equation				
demand (Q_m)	-0.12e-3(0.4e-4)**	-0.63e-3 (0.2e-3)**	-0.24e-3 (0.7e-4)**	-0.26e-3 (0.7e-4)**
distance (*dist*)	0.14 (0.009)**	0.16 (0.009)**	0.16 (0.007)**	0.15 (0.007)**
D^{nm}	-41.64 (11.48)**	-50.95 (17.51)**	-	-
$D^{intermodal}*D^{nm}$	-	-8.08 (19.57)	-	-
Tourism (*tour*)	-	-	-3.48 (1.68)*	-4.80 (1.58)**
$HH_{airport}$	-	-	-69.08 (17.87)**	-
HH_{route}	-	-	-	-58.84 (16.26)**
winter01	-26.23 (12.02)*	-21.07 (10.86)$^{+}$	-23.94 (8.74)**	-24.76 (8.79)**
summer02	22.13 (11.79)$^{+}$	28.16 (11.17)*	21.83 (8.37)**	20.84 (8.48)*
Intercept	214.68 (12.53)**	241.52 (18.47)**	225.35 (9.76)**	229.11 (9.73)**
Num. observations	79	132	190	190
R^2	0.79	0.73	0.75	0.75
χ^2 (joint sig.)	296.68**	351.31**	557.71**	576.48**

Note 1: Standard errors in parentheses
Note 2: Significance at the 1% (**), 5% (*), 10% ($^{+}$)

Table 7. System equation estimates (3SLQ)

	(6) **Full sample (Cost Determinants)**	**(7)** **Full sample (Iberia's Residual demand)**
Demand equation (Q)		
Prices (*p*)	-0.0087 (0.0013)**	-0.0066 (0.014)**
$D^{intermodal}*p$	0.0019 (0.0007)*	0.0014 (0.0008)$^{+}$
Population (*pop*)	1.97 (0.21)**	2.02 (0.21)**
Income (*inc*)	-0.51 (0.91)	-0.71 (0.89)
D^{island}	1.16 (0.26)**	0.64 (0.25)*
winter01	-0.55 (0.17)**	-0.51 (0.17)**
summer02	0.15 (0.18)	0.14 (0.17)
Intercept	-10.71 (8.50)	-10.19 (8.34)

R^2 **χ^2 (joint sig.)**	0.45 174.66**	0.46 140.63**
Pricing equation (*p*)		
demand (Q_m)	-	-0.3e-4 (0.1e-3)
distance (*dist*)	0.17 (0.08)**	0.14 (0.01)**
D^{nm}	-17.98 (20.90)	-34.11 (13.53)*
$D^{intermodal}*D^{nm}$	-11.15 (26.65)	0.76 (14.53)
frequency (*fq*)	-0.26 (0.09)**	-
equipment (*equip*)	-0.98 (0.28)**	-
load factor (*lf*)	259.05 (316.58)	-
D^{hub}	1.94 (9.08)	-
excess	-	-0.00018 (0.3e-3)
winter01	-13.95 (11.29)**	-27.06 (10.13)**
summer02	23.17 (10.39)*	13.50 (9.33)
Intercept	136.68 (168.41)	222.10 (10.29)**
Num. observations **R^2** **χ^2 (joint sig.)**	190 0.71 437.23	190 0.69 421.68**

Note 1: Standard errors in parentheses
Note 2: Significance at the 1% (**), 5% (*), 10% ($^{+}$)

Table 8. Estimated structural parameters
(Evaluated at sample means)

	(1)	(2)	(3)	(4)	(5a)	(5b)	(6)	(7)
Demand equation								
$\eta_{\alpha(a)}$	-1.88**	-2.02**	-1.44**	-1.10**	-1.45**	-1.38**	-2.45**	-1.86**
$\eta_{\alpha(b)}$	-1.55**	-1.47**	-	-0.66**	-	-	-1.91**	-1.46**
Pricing equation								
η_{β}	-0.08**	-0.10**	-0.06**	-0.10**	-0.08**	-0.08**	-	-0.014
η_{dist}	0.35**	0.35**	0.36**	0.34**	0.36**	0.35**	0.37**	0.33**
θ_a	0.64**	0.82**	0.77**	0.81**	-	-	0.84**	0.78**
θ_b	0.70**	0.80**	-	0.87**	-	-	0.80**	0.83**
Test $\theta_a = \theta_b$	0.61	0.66	-	0.56	-	-	0.04	0.35
tour (θ_2)	-		-	-	0.017*	0.023**	-	-
$HH_{airp}^{nm}(\theta_1)$	-		-	-	0.36**	-	-	-
$HH_{route}^{nm}(\theta_1)$	-		-	-	-	0.28**	-	-
Test *Cournot* (θ_a)	5.73*	4.37*	20.84**	20.84**	-	-	6.56*	15.29**
Test Collusion (θ_a)	10.37**	26.23**	4.03*	4.03*	-	-	0.76	4.89*
Test *Cournot* (θ_b)	23.21**	62.86**	-	54.76**	-	-	19.19**	24.36**
Test Collusion (θ_b)	16.94**	13.65**	-	3.99*	-	-	4.25*	3.59^{+}

Note 1: η_{α}: Price elasticity of demand. η_{β}: Price elasticity with respect to traffic. η_{dist}: Price elasticity with respect to distance.

Note 2: Subindex *a* refers to the submarket based on peninsular routes where distance is less than 650 kilometres, whereas subindex *b* refers to the submarket based on routes with an island as an endpoint and/or routes where distance is more than 650 kilometres. In specification (2) subindex *a* refers to the whole market

Note 3: *Cournot* test; $\theta = 0.38$ (which is the inverse of the mean number of competitors in oligopoly routes). Collusion test; $\theta = 1$

Note 4: Significance at the 1% (**), 5% (*),10% ($^{+}$)