Alternative regimes of airport privatization

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There is an extensive literature devoted to the economic analysis of airports and airline markets. The review by Zhang and Czerny (2012) offers a wide and updated description of the most relevant research on this issue. Recently, the Spanish government has announced the privatization of AENA, the entity that groups and owns the whole system of public airports in Spain. Many questions have sprung related with the implications of this process. Should this process be undertaken for the whole airport network, or should it be undertaken only for a group of airports? If only for a group, which one? What will be the implications of this process in terms of prices, frequencies and surplus for the passengers and the industry?

Our objective is to move forward the literature on airport pricing and privatization. Some papers (Zhang and Zhang, 2003, Basso, 2008, and Czerny, 2012) show that, in general, the private airport charges will be higher than the social maximizing charges. Extensions incorporating hub-spoke networks have been considered, for instance the papers by Pels and Verhoef (2004), Brueckner (2004) and Flores-Fillol (2010). More recently, Lin (2013) analyzes the implications of a privatization process in a network structure with one congested hub and two linked local airports. Also, Haskel et al. (2013) study the impact on joint ownership of airports in a model of upstream airports and downstream airlines with varying countervailing power and pricing structures. The recent survey paper by d’Alfonso and Nastasi (2014) explicitly addresses the vertical relations between airports and carriers. These authors discuss, in particular, that the nature of contracts may (or may not) be beneficial for passengers depending on the intensity of competition between airlines.

Our model is based on a hub-spoke structure, as presented in Figure 1. There are three airports, two of them are public and located in a given country, A and H, and the third, B, is located elsewhere. Thus, there are two types of routes, a domestic or local one that connects A and H plus an international route connecting H and B. In this network two novel features with respect to the received literature are introduced: i) the structure of the airline market in the domestic route is a monopoly whereas that in the international route is a duopoly, and ii) airlines compete in prices and number of flights taking into account any complementarities between routes.
We shall characterize the equilibrium outcome of three stage games where airports choose landing/take off fees before airlines choose the number of flights and, then prices. This framework allows us to analyze various privatization regimes. In particular, either A and H are privatized, or just one of them is. The reallocation of traffic induced by a particular ownership, due to changes in the landing/take off fees, will finally determine which privatization regime is socially desirable from a domestic viewpoint and delivers higher government revenues.

The theoretical model is based on a typical representative consumer approach of product differentiation, where three different utility functions for the three types of market are considered:

\[ U_d = \alpha d q_d - 0.5 q_d q_d \]

where \( U_d \) is the utility function of passengers in the local market from A to H, \( q_d \) stands for the number of passengers in this market and \( \alpha_d = a + v n_d \), this meaning that passengers benefit from more flights denoted by \( n_d \) in the local market.

\[ U_i = \alpha_{i1} q_{i1} + \alpha_{i2} q_{i2} - 0.5 (q_{i1} q_{i1} + q_{i2} q_{i2}) - dq_{i1} q_{i2} \]

where \( U_i \) stands for the utility of passengers who board at H to fly to B and not coming from A, \( q_{i1} \) and \( q_{i2} \) stand for the number of these passengers who travel respectively by company 1 and 2, \( \alpha_{i1} = a + v n_1 \), \( \alpha_{i2} = a + v n_2 \), being \( n_1 \) and \( n_2 \) the number of flights between H and B offered by company 1 and 2 respectively. And finally:

\[ U_l = \alpha_{l1} q_{l1} + \alpha_{l2} q_{l2} - 0.5 (q_{l1} q_{l1} + q_{l2} q_{l2}) - dq_{l1} q_{l2} \]

where \( U_l \) denotes the utility of passengers who board at H to fly to B coming from airport A, \( q_{l1} \) and \( q_{l2} \) stand for the number of these passengers who travel respectively by company 1 and 2, \( \alpha_{l1} = 2 a + v (\lambda n_d + (1-\lambda) n_1) \), \( \alpha_{l2} = 2 a + v (\lambda n_d + (1-\lambda) n_2) \), where \( \lambda \) belongs to \([0,1]\) and weights the relative importance to these passengers of the local and international number of flights.

These expressions allow us to obtain the demand equations for the three markets. Regarding airline operating costs, there is a constant marginal cost per passenger plus the aeronautical costs paid to airports. We may write the profits functions for the three airlines in the market as follows:
\[ \pi_d = p_d (q_d + q_{1d} + q_{2d}) - c n_d^2 - (f_a + f_h) n_d \]
\[ \pi_1 = p_{11} (q_{11} + q_{12}) - c n_1^2 - (f_h + f_b) n_1 \]
\[ \pi_2 = (p_{i2} - c)(q_{i2} + q_{i3}) - c n_2^2 - (f_h + f_b) n_2 \]

Where \( f_a, f_b \) and \( f_h \) are the fees charged by airports A, B and H, respectively. To obtain well-behaved solutions, we assume convex costs in the provision of flights by the airlines. The profits function for airports A and H are the following:

\[ \pi_A = (f_a - t) n_d - K_a \]
\[ \pi_H = (f_h - t) (n_d + n_1 + n_2) - K_h \]

where \( t \) are the airport marginal costs and \( K_a \) and \( K_h \) denote the airport fixed costs for airports A and H respectively. Therefore, once direct demand equations are obtained, a three-stage game will be solved:

- Airports A and H set infrastructure fees that are charged per flight.
- The domestic airline and the airlines 1 and 2 set the number of flights for each route.
- The domestic airline and the airlines 1 and 2 compete in prices.

As a benchmark case we solve the game when airports A and H set infrastructure marginal pricing. Next three different scenarios will be analyzed: i) global privatization of A and H, and ii) either partial privatization of A or H.

References


