

**Assessing Competition by means of Pricing Equations: Domestic Codesharing
in US Airlines**

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This paper proposes the use of pricing equations to uncover the type of pricing interaction which is taking place on a market. We apply the method to shed light about the pricing practices by codesharing partners in the domestic flights of US airlines and to determine their welfare effects.

Price equations have a rich tradition in industrial organization analysis. It started with their use by Griliches (1961) in the hedonic approach to pricing under product differentiation. They play a key role in the specification of an industry equilibrium to be estimated as in Berry, Levinsohn and Pakes (1995) and many other exercises of this type. In this paper we explore the extension of ideas and techniques of the recent advances in the analysis of markets to a framework which addresses the role of pricing equations for the identification of firms' behavior. We specify and estimate pricing equations which nest the unobservable marginal cost and the margins established by firms. A flexible discrete choice demand framework is used to give a minimum of structure to the price effects. Margins are shown to be a behavior-specific function of the firm expected demand price effects and firms' market shares. By specifying alternative behaviors, we end with a set of price equations which embody alternative margins which depend on observed shares. We derive a semiparametric specification to simultaneously estimate own and cross elasticities and test for behavior.

The paper develops and estimates a model of code-sharing, a particular form of collaboration between two airlines in a particular flight, with one company as marketer of the flight and the other as operator. This arrangement is common in the US domestic Airline Industry and widespread internationally. The question is how this arrangement affects costs

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and prices in the industry, a timely question because of the questions raised among the regulators about the meaning of these practices and their welfare consequences. The basic framework draws on the modeling of airline competition in the recent paper by Berry and Jia (2010) and on the modeling of codesharing by Shen (2011). But it goes beyond these papers in the modeling and testing of the companies' pricing behavior. A model of code-sharing is developed, which avoids the simplistic contrast between the extreme behaviors of collusion and competition.

Markets are defined as directional city pairs. Products are defined by the specific marketing company and the offered flight modality (non-stop, with connections, code-shared or not). The characteristic of being a "code-shared flight" is included both as an argument in the utility function and the cost function. Buying a codeshare flight is then allowed to impact the consumer level of satisfaction. And the tickets sold on a codeshared flight are similarly allowed to imply a different unit cost for the marketing company. Companies compete as Bertrand competitors, but each one is assumed to internalize the cross price effects of its different products as well as of the flights that code-share. In this way the paper aims at assessing three different things: if code-sharing influences the utility that consumers get from the flight, if code-sharing impacts the cost of the flight and third, but not the least, if pricing across companies is consistent with the internalization of these traits and the treatment of the code-shared products as products belonging to the own product set.

In this way it emerges a sort of price discrimination model, in which pricing follows the rules of the relative elasticities and costs. Code-shared products turn out to be more elastic and subject to economies of code-sharing, what determines a cheaper price. But this is the result of a sensible price maximization strategy, which also conveys that the other prices are going to be higher and implies some level of collaboration between firms. This framework may be used to assess the welfare effects according to the utility and pricing effects of code-sharing. The basic analysis is conditional on the set of products existing in the market, but a few simulations bring into it the impact of codesharing throughout the enlargement of the variety of products, helping to establish bounds for the full welfare effects.

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