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A model of internal and external competition in a High Speed Rail line

Óscar Álvarez-SanJaime [a], Pedro Cantos-Sanchez [b,*], Rafael Moner-Colonques [b], Jose J. Sempere-Monerris [c,d]

[a] Department of Economic Analysis and IEI, University of Valencia, Campus del Tarongers, 46022 Valencia, Spain
[b] Department of Economic Analysis and ERI-CES, University of Valencia, Campus del Tarongers, 46022 Valencia, Spain
[c] Department of Economic Analysis and ERI-CES, University of Valencia, Valencia, Spain
[d] CORE-UCL, Lovain-la-Neuve, Belgium

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ABSTRACT

This paper is a contribution to evaluate structural and behavioral changes in railway passenger markets. The novel elements of our analysis are the following: (i) the consideration of inter-modal and intra-modal competition, (ii) the presence of public and private operators, and (iii) endogenous service frequency. After calibrating the model using actual data from two Spanish High Speed Rail lines, simulation exercises allow us to conclude the following. Privatization, whether entry occurs or not, would prompt an increase in prices and a reduction in the number of train services, eventually leading to welfare decreases, as compared with a regime where the incumbent rail operator remained public. Entry is found to be welfare improving only when it generates large increases in traffic. Otherwise welfare losses would materialize even though entry raised some efficiency gains.

1. Introduction

In the last 20 years many countries have invested large amounts of resources in new High Speed Rail (HSR) lines. These new services have notably changed the modal market shares and conditions in the routes where these services have been implemented. In particular, Preston (2009) reports that in Europe there were 5600 km of high speed lines in operation in 2008. Using data from Union Internationale des Chemins de Fer (UIC) reports, forecasts indicate that by 2025 China will have 9138 km of high speed lines in place or planned, followed by Spain (7105), France (6654), Japan (6073) and Germany (3658). However, the economic crisis is provoking a dramatic change, and some of these planned investments are being reconsidered. Then it is not only necessary to make a more precise assessment of the whole costs and benefits, but also to consider which competition regime allows for a more efficient exploitation of the HSR lines.

In the context of passenger transport markets, this paper is a contribution to evaluate structural and behavioral changes in a strategic setting that takes into account (i) both inter-modal and intra-modal competition, (ii) the presence of public and private operators, and (iii) endogenous service frequency. Our analysis offers a useful framework to advise firms' decisions and policymakers regarding the privatization and on-track competition in HSR lines.

European authorities have always been persuaded that the railway can solve part of the severe mobility problems within the European Union (EU), proposing the opening of the market and establishing a system founded on service competition. There is the presumption that a more competitive market will favor access by new operators which will ultimately lead to improvements in the supply of services and allow the sector to pick up higher market shares. EU legislative initiatives, started in the year 2000, advanced in the gradual liberalization of the market and tried to revitalize a sector with unsustainable financial deficits and high inefficiencies (that create a true bottleneck for the development of the EU internal market). Unfortunately, legislative efforts have only translated into modest traffic gains in railway and market disequilibrium persists (installed capacity is far larger than potential demand in many corridors). Hence the Commission has adopted a general approach to correct for market distortions as well as for the existence of suboptimal organizational structures. It has recently approved the 4th Railways Package (2014) which, among other things, aims at promoting changes in the organization of the industry, and at removing barriers to competition. The

* Corresponding author.
E-mail addresses: oscar.alvarez@uv.es (Ó. Álvarez-SanJaime), pedro.cantos@uv.es (P. Cantos-Sanchez), rafael.moner@uv.es (R. Moner-Colonques), jose.j.sempere@uv.es (J.J. Sempere-Monerris).

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evaluation of measures along these lines has been formally addressed in the literature.[1] Scholars conclude that horizontal reforms (through franchising systems and entry of new operators) have generically improved the efficiency levels, but vertical separation has not produced the same conclusive results.

In June 2012, the Spanish Government announced plans to boost the liberalization process in the rail system. The reform includes the separation of the main and public rail operator (RENFE) into four entities: freight, long distance and commercial services, commuter and regional services and maintenance, repairing and hire of rolling stock. However the most innovative measure is the proposal to introduce private equity and private operators in the passenger rail system, starting with the HSR lines. This policy of "competition in the market" has hardly been undertaken in the European rail passenger market.

We develop an imperfect competition model where strategic interaction among the different transport operators will be taken into account in a differentiated products long distance route. The departing situation considers inter-modal competition between air and rail transport. It is assumed that transport operators compete in prices and frequencies, and a two-stage game is modeled to capture this competition.[2] Private regimes will be defined when all transport operators maximize profits, while mixed regimes will be considered when the incumbent rail operator is a public firm that maximizes a social welfare function, subject to a break-even constraint.[3] Thus a move from private to mixed regimes will be considered as a behavioral change in the market, while entry will be regarded as a structural change. After entry, the setting is one with both internal and external competition in the HSR services. Once the formal analysis has been presented, the model is calibrated for the Spanish HSR services between Madrid–Valencia and Madrid–Sevilla using the available data on elasticities, prices, traffic levels, and marginal operating costs. That is, we use the available data to construct compatible values for the unknown parameters of the model. We may subsequently make simulations on how behavioral and structural changes affect market conditions, regarding industry profitability, consumer surplus and social welfare.

The main results of our paper can be summarized as follows. We find that the mixed duopoly regime matches very well with the existing situation in the routes studied. Taking it as a benchmark, the comparison with the private duopoly regime entails a behavioral change that results in higher prices and fewer train services, hence consumers are worse off, and a welfare decrease. The structural change brought about by the entry of a new rail operator is found to be socially beneficial only when it entails very large increases in rail traffic demand, which improves upon the mixed duopoly regime. It must be noted that such welfare gains are larger when the incumbent rail operator remains public relative to the private regime; this is because the latter again entails higher prices and fewer services, which is detrimental for users. However, the consideration of more plausible scenarios regarding the demand increase shows that entry is not necessarily leading to welfare increases. Finally, simulations predict that there are no welfare improvements even with efficiency gains when demand increases are modest. These results lead us to conclude that on-track competition can be justified in welfare terms only in limited conditions, and emphasize the role of a welfare maximizing operator whose presence turns out beneficial for users.

Related literature: Transport operators compete both in price and non-price characteristics, such as frequency of service, reliability and travel time. There is an extensive literature that has examined various aspects of intra-modal competition in the airline industry.[4] In relation with competition in the non-price dimension, Schipper et al. (2007) emphasize that the frequency of service has a primary effect on welfare. They develop a two-stage duopoly where first two airline carriers choose frequency and then compete in prices. The model is calibrated using actual data for the Amsterdam–Maastricht route, a monopoly for the sample period, to illustrate that the effect of frequency on own price is positive. Their simulation entry results show that welfare gains are expected, although aggregate profits go down this is more than compensated by the increase in consumer surplus.

There are fewer works that study internal competition within the rail passenger markets. Preston et al. (1999) estimate a demand–cost model based on a specific software, the PRAISE model, designed to predict the effect of competition between operators by simulating the decisions of a sample of individuals. Johnson and Whelan (2003) and Glass (2003) also elaborate a demand–cost model to assess potential on-track competition within the rail market in UK. Their main result is that only scenarios of cream skimming and fare and cost reductions are generally feasible with competition.

A recent paper by Johnson and Nash (2012) uses an improved version of the PRAISE software to model open access competition on an HSR international route. They obtain that on-track competition has benefits to users in terms of fares and services, but there is a larger loss of profitability for the industry, resulting in a social welfare decrease. Particularly, entry is only feasible if it leads to a notable cost reduction and additional traffic is generated. Their findings take us back to whether it would be better to franchise the services instead of allowing the entry of a new operator.

Franchising systems have been typical to increase competition in the passenger rail market (see Preston, 2008, for a good review of the British experience and Nash et al., 2013, for a description of the pros and cons of the Swedish, German and British liberalization processes). However, the introduction of "competition in the market" has been much more common in the freight market with relatively poor results, except for the United Kingdom (where entrants have taken a market share close to 50% in 2008). In the rest of the European countries the market share captured by the entrants has been very modest, resulting in an average figure of 16% for the EU16 (Drew and Nash, 2011).

Occasionally there have been some experiences of entry of rail operators in the passenger market. These are the rail lines connecting London with Birmingham, Peterborough and Cambridge. But this on-track competition has occurred between companies offering services of different qualities, usually an inter-city operator and a regional or commuter operator, with the latter offering slower and less comfortable services at lower fares. Johnson and Nash (2012) put forward the beneficial effects derived from lower cost operators, in particular, if they use their

[1] Asmild et al. (2009), Friebel et al. (2010), and Cantos-Sánchez et al. (2010) evaluate the impacts on productivity and efficiency of the rail system of all these measures. Also, Lalive and Schmutzler (2008) examine the effects of a German law passed in 1993 regarding changes in the procurement of regional passenger transport.

[2] The development of high speed technology has made air and train transport more substitutable in the eyes of travelers. Travel times are closer and the train leaves passengers in the city center, who also value frequency of service. Exploring the potential for on-track competition must incorporate these features in a framework with both intra and inter-modal competition.

[3] Mixed oligopolies have been analyzed as a mechanism to control the performance of the private firm or to favor a better result in terms of social welfare with respect to private oligopolies (see de Fraja and del Bono, 1990), for a survey and (Cantos-Sánchez and Moner-Colonques, 2006), for an application to differentiated transport markets).

[4] See e.g. Morrison and Winston (1995) on US markets and Schipper et al. (2002) on EU markets regarding studies on airline liberalization with a more empirical orientation. Brueckner and Flores-Fillol (2007) examine schedule competition in a duopolistic airline market. Zhang and Czerny (2012) provide an excellent survey on several aspects of competition in the airline industry.