Rail access charges and internal competition in the High Speed Trains

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In the last twenty years many countries have invested big amounts of resources in new High Speed Rail lines. It is necessary not only to do a strong accurate and precise assessment of the whole costs and benefits, but also to introduce better management systems to allow a more efficient of the HSR lines. In July 2012, the Spanish Government announced plans to introduce private capital and private operators in the passenger rail system. These changes try to get a more competitive framework for the rail market. Our paper will analyze how track fees affect competition in the rail market under several competitive regimes.

Few existing works consider the internal competition within the rail passenger markets. Preston et al. (1999) and Johnson and Whelan (2003) estimate a demand-cost model where they simulate different ways of competition. Ivaldi and Vives (2008) elaborate a simulation model, based on game theory, to analyze inter and intra-modal competition in the transport industry. They focus on the changes in the market shares and the impacts on users from different changes in the structural market conditions. Finally, Adler et al (2010) modeled competition between rail and air on a number of Trans European Network corridors where investment in high speed rail is either underway or proposed, using a game theory model to compute Nash equilibria.

In other transport modes there are some interesting papers that have analyzed the implications of airport pricing (see Zhang and Czerny, 2012). Private or public airport pricing affect the industry in different ways, resulting in private prices-higher than those from a social point of view. Recently Haskel et al (2013) have analyzed the effects of the airport charges under different market structures, like different degrees of concentration in the airlines market, the effect of countervailing power or different goals in the airport management.

Our paper will develop a model of imperfect competition where a high speed rail service (HSR) is competing with another mode of transport. In a first scenario we will define a duopoly situation, where there is only one HSR operator competing with another transport mode (air or road). We distinguish two initial situations: firstly, we will assume that the ownership of the infrastructure and rail operation remains integrated (integrated regime), and a second scenario where rail and infrastructure operations are separated (separated regime). In this scenario, we will suppose that the rail operator chooses the prices and the levels of frequencies, and that track fees are settled by the infrastructure manager.

Once the model is solved under the aforementioned scenarios, we allow for entry of a new rail operator. Then the model is solved again to analyze the impacts on the market variables (prices, frequencies and track fees), industry profitability and consumer surplus.

The theoretical model for the duopoly scenario is based on a typical representative consumer approach of product differentiation:

\[ U = y + aQ_r + cQ_c - \frac{1}{2}(b_rQ_r^2 + b_cQ_c^2 + 2dQ_rQ_c) \]
Where subscript \( r \) stands for rail transport and \( c \) for transport by car, and \( a = a_r + v_r n_r \), where \( a_r \) is the maximum willingness to pay for travelling by rail, \( n_r \) denotes the frequency of rail transport, and \( v_r \) stands for the marginal utility to the user for having an additional rail scheduled.

Maximization of \( U \) subject to the corresponding budget constraint yields a system of inverse demand functions, and by inverting the system, the direct demand equations can be easily obtained. Then, given the generalized price \( (p_r) \) for car transport, we solve the model assuming that the rail operator maximizes profits, and we obtain the levels for rail prices, frequencies and track fees. The model will be solved in the vertical scenario regime and in the separated vertical scenario. We employ a simplified cost function for the train operating costs, as follows:

\[
C_r = (c_r + f_r) n_r
\]

where \( c_r \) are the operating costs of a high speed train, and \( f_r \) is the track access fee.

In the integrated regime, there is a monopoly situation where the profits function for the integrated rail operator will be: \( \Pi_r = p_r Q_r - c_r n_r - F \), where \( F \) stands for the amortization costs of the HSR infrastructure. While in the separated regime, rail operations and infrastructure activities are separated, and then there is one profit function for the rail operator: \( \pi_{ri} = p_i Q_i - C_r \), and another one for the rail infrastructure owner: \( \pi_{ri} = f_i n_r - F \).

Once we solve the aforementioned regimes, consider the introduction a new rail operator within the HSR services to obtain the demand equations:

\[
U = y + a_1 Q_{r1} + a_2 Q_{r2} + c Q_c - \frac{1}{2} (b_1 Q_{r1}^2 + b_2 Q_{r2}^2 + b_c Q_c^2) - d(Q_{r1} Q_c + Q_{r2} Q_c + Q_{r1} Q_{r2})
\]

A further scenario is considered, the separated regime with entry of a new operator. Now there are two rail operators (labeled 1 and 2) and a rail infrastructure owner (I). The profit function for each rail operator will be:

\[
\Pi_{ri} = p_{ri} Q_{ri} - (c_{ri} + f_r) n_{ri} - F, \text{ where } i=1, 2
\]

And the profit for the rail infrastructure owner:

\[
\Pi_{ri} = f_i (n_{r1} + n_{r2}) - F
\]

We will assume that the same fee is charged to both operators (no price discrimination across operators). We are interested on how the new scenario compares with the previously analyzed in terms of prices, frequencies, consumer surplus and welfare. An interesting extension we are undertaking is to consider different objective functions for the rail infrastructure manager, for instance, social welfare maximization, or to maximize the infrastructure use. Finally we conclude the paper with a simulation exercise using recent information regarding out to different HSR services in Spain: Madrid-Seville, Madrid-Barcelona and Madrid-Valencia. In order to run this simulation we employ data for current traffic, prices for both modes and train frequencies for each mode of transport.
References


