Journal of Transport Geography 42 (2015) 166–174

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

Competition and cooperation between high-speed rail and air transportation services in Europe

Daniel Albalate *, Germà Bel, Xavier Fageda

Dep. Política Econòmica, Universitat de Barcelona, Avd Diagonal 690, 08034 Barcelona, Spain

ARTICLE INFO

Keywords:
High-speed rail
Airlines
Competition
Cooperation

ABSTRACT

New high-speed rail (HSR) lines may have an enormous influence on the provision of air services. The attention has been devoted to competition between both transportation modes but in some cases HSR services may also have an intermodal complementary role with air transportation. By taking a supply oriented empirical analysis, we study the impact of HSR on air service frequencies and seats offered by airlines in large European countries. We emphasize the distinction between routes with and without a hub airport as an endpoint and we also examine the influence of the location of the HSR station. We generally find direct competition between HSR and airlines, but we also provide some evidence that HSR can provide feeding services to long haul air services in hub airports, particularly in hub airports with HRS stations.

1. Introduction

High-speed rail (HSR) growth has led to major changes in the supply of interurban transportation in those countries that have extended their HSR networks and services. One of the main impacts has been the replacement of demand for other modes, most notably air transportation – HSR's main competitor, owing to the characteristics of the two services and their respective generalized costs. An extensive literature on the intermodal interaction of HSR and air services has developed, focused mainly on competition between the modes, while studies of their complementarities are much rarer. Our paper seeks to contribute to this literature, first, by providing relevant new evidence of the effects of HSR–air competition; and, second, by furthering our understanding of potential complementarities between the two services.

Demographics and mobility (including urban structures and economic and commercial patterns) along with supply features (including travel time, access to city centers, cost and frequencies) are all major determinants of the competitiveness of HSR (see González-Savignat, 2004; Dobruszkes, 2011; Albalate and Bel, 2012). The study of the fierce intermodal competition between air and HSR transportation is (as shown in the next section) an emerging area of research; however, little attention has been devoted to their intermodal complementarities. Exceptions include Givoni and Banister (2006), who highlight the potential integration of the two modes, with airlines using railway services as additional spokes in their network of services from a hub airport to complement and substitute for existing aircraft services. Similarly, Clewlow et al. (2012) suggest HSR might serve as a complementary mode to relieve congestion at airports by providing short-haul services in support of longer-haul airline services. They conclude that HSR lines appear to serve as successful feeders for international air traffic at Frankfurt Airport and at Paris-Charles de Gaulle (Paris-CDG). Grimme (2006) also illustrates cooperation by analyzing the case of AIRail, an integrated ticketing and baggage handling service offered by Deutsche Bahn (rail operator), Lufthansa (air carrier) and Fraport (airport). However, all in all, the scope for cooperation remains largely unexplored.

The intermodal complementarities of HSR and air transportation have been considered a primary transportation policy goal in France since 1995 and have recently been strengthened with the enactment of a national environment program, "Grenelle II". This 2010 program seeks – among other objectives – to promote HSR access and commuting to major airports. The policy framework facilitates the emergence of new cooperative experiences of code share, single ticketing and one-stop baggage check agreements between airlines and SNCF – the French railway operator (see Mell, 2013).

Here we undertake a supply-oriented analysis, as we empirically study the impact of HSR on air service frequencies and the number of seats offered by airlines in Europe. More specifically, we focus on the impact of HSR on national air routes in the four

* Corresponding author. Tel.: +34 934021946.
E-mail addresses: albalate@ub.edu (D. Albalate), gbel@ub.edu (G. Bel), xfageda@ub.edu (X. Fageda).

http://dx.doi.org/10.1016/j.jtrangeo.2014.07.003
0966-6923/

European countries with the longest HSR networks. In addition to examining the competitive role of HSR, we also seek to identify the potential for intermodal cooperation. In this regard, we provide new evidence of the disparate effects of HSR on air transportation, depending on an airport's characteristics.

In the next section we review the empirical literature on intermodal interaction between HSR and air transportation. We then present our empirical methodology and the main data used in our analysis, followed by our empirical results. Finally, we discuss our main findings and their policy implications.

2. Intermodal competition and cooperation between HSR and air transportation

The literature consistently shows that the competitiveness of HSR is highly dependent on route distance – seemingly more efficient on medium-distance routes than on short- or long-haul routes (Janic, 1993; Capon et al., 2003; IATA Air Transport Consultancy Services, 2003; GAO, 2009). However, given the heterogeneous speeds of high-speed services, route distance would appear simply to be an imperfect proxy of travel time, the definitive determinant of competitive advantage.

HSR undermines alternative modes because of its ability to capture a relatively large market share, with passengers being attracted away from airlines, primarily, over medium distances (see Román et al., 2007; Martín and Nombela, 2008).[1] In Japan (pioneering HSR since 1964) a rapid fall in airline transportation was noted after the extension of the HSR network. According to Taniguchi (1992), HSR was more competitive over distances of less than 438 miles because of higher frequency services, cheaper fares, the proximity to city centers and service reliability and safety. In fact, the market share of the *Shinkansen* is always greater than that of airlines on routes of less than 600 miles in Japan (Albalate and Bel, 2012). The distance between main cities, the city structure and the ability to exploit scale and density economies, which can be translated into a lower generalized cost of transportation, seem to account for the overwhelming superiority of Japanese HSR services.

Likewise, the European Commission (1996) has provided data on changes in modal shares following the introduction of HSR on some European routes, and has shown how air traffic suffered the most marked impact. On the Paris–Lyon route, for instance, the air traffic share fell from 31% to 7% between 1981 and 1984.[2] Klein (1997) evaluated the impact of the *TGV-Atlantique* on modal competition, finding that air travel recorded a sharp reduction in journeys between 90 and 180 min of duration, while it recovered competitiveness for distances beyond this time interval.

In the case of the Madrid–Seville route, the share of air traffic fell from 40% to 13% between 1991 and 1994 (European Commission, 1996; Park and Ha, 2006). More recently, in 2009, the Spanish *AVE* enjoyed 85% of the market share on the Madrid–Seville route, more than 70% on the Madrid–Malaga route, and around 50% on the Madrid–Barcelona line in 2009, in detriment, above all, to the airplane (Albalate and Bel, 2012). This superiority decreases with route distance given that its share becomes more modest on routes over 400 miles. Thus, the *AVE* only enjoys 30% of the market share of seats on the Barcelona–Seville route (though most of these seats are not used from point of origin to final destination – i.e., BCN-Seville, but rather to intermediate destinations between the two cities). This is attributable to the longer HSR journey time (twice that of the plane), the more expensive fare and by the limited frequency of the service. The continuous extension of the HSR network in Spain has allowed new studies to be made of the response of airlines. Jiménez and Betancor (2012), among others, report that new HSR connections have reduced the number of air transport operations by 17%.

In the case of Germany, Ellwanger and Wilckens (1993) identified an initial increase in rail market share of 11% following the introduction of HSR services between Frankfurt and Cologne, with air transportation suffering the most passenger losses. By contrast, Dobruszkes (2011) found that the flag carrier airline Lufthansa increased its services after the entry into service of the Cologne–Frankfurt line. However, it was later forced to reduce its flight frequencies with the inauguration of the HSR line between Cologne and Munich, despite this being a service that stops at several stations en route and the fact that the service is not high speed for the whole journey.

In Korea the two main airlines providing services between Seoul and the country's other main cities anticipated the arrival of HSR and drastically reduced the frequency of their flights in 2004. For example, between Seoul and Daegu the number of monthly air departures fell from 517 to 293 prior to the entry of HSR and 2 months after the entry they were down to just 183 (Suh et al., 2005). These figures are consistent with those of Park and Ha (2006). Similarly, in Taiwan, the market share held by air services between Taipei and Kaohsiung fell from 24% to 13% following the introduction of HSR services (see Cheng, 2010).

Intermodal competition not only effects market share, it is also responsible for reducing air fares. The Steer Davies Gleave report (2006) undertaken for the European Commission identifies sharp reductions in air fares attributable to competing HSR services, to the extent that they might fall below corresponding rail fares. Yang and Zhang (2012) also find that air fares decrease in rail speed when the marginal cost of HSR is not very high.

In spite of the competitive pressure exerted by HSR, the greater presence of low-cost carriers in the airline market provides the latter with more protection from the competition of HSR services. Indeed, Antes et al. (2004) report that the competitive pressure of low-cost carriers has obliged both air and rail transport to reconsider their pricing strategies. In Japan, for instance, the airline industry has effectively only been able to grow with the emergence of low-cost carriers following the liberalization of air transport (Albalate and Bel, 2012). Steer Davies Gleave (2006) acknowledges that competition between HSR and air transportation is not so straightforward when air services are operated by low-cost carriers. Similarly, Behrens and Pels (2012) show that although HSR is a competitor for both conventional and low-cost carriers, some conventional airlines have pulled out of the London–Paris passenger market.

The pressure of competition and its consequences seem to mitigate in the long run, especially once the market has adjusted to the entrance of the HSR competitor. Vickerman (1997) monitored the modal change provided by HSR in France and found that the increase in rail passengers was confined almost exclusively to the first years of HSR operations, becoming much more moderate thereafter. Similarly, Behrens and Pels (2012) consider that the evidence for the large market share gained by Eurostar on the London–Paris route, and the withdrawal of alternative air services, indicates that competition will certainly decline in the long run. These circumstances may boost the market power of HSR given that rail operators can increase their prices to maximize profits without losing a significant market share (Steer Davies Gleave, 2006).

[1] The absorption of what were frequent air passengers has been more significant than that of new, induced passenger traffic, which has been much lower than expected. For instance, 50% of the traffic on the Madrid–Seville route (de Rus and Inglada, 1997) and 20% on the Madrid–Barcelona route (Coto-Millán et al., 2007) were expected to be induced. In practice, new, induced traffic has amounted to 26% in the first case and 9% in the second (PWC, 2010). This is consistent with data elsewhere and as reported in Preston (2013).

[2] Bonnafous (1987) reports an even more pronounced fall from 48% to 17% on this route between 1980 and 1985.