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# Strategic formation and welfare effects of airline-high speed rail agreements

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ABSTRACT

Policy makers encourage airline-high speed rail (HSR) cooperation to promote intermodal passenger transport. We study the strategic formation of airline-HSR partnerships (depending on sunk costs and firms' bargaining power) and their effects on consumer surplus and social welfare. We assume that airline-HSR agreements serve to offer a bundle of domestic HSR and international air services. In a capacity purchase (CP) agreement, the airline buys train seats to sell the bundle, whereas in a joint venture (JV) agreement firms create a distinct business unit. We find that both agreements increase traffic in the network, and thereby may not reduce congestion at hub airports. We provide antitrust authorities with a simple two-tier test for the CP agreement to improve consumer surplus. Contrary to airline-HSR mergers, the JV agreement benefits consumers independent of hub congestion and mode substitution. Simulation results show that, in case of cooperation, public agencies should prefer firms to create a JV, unless the related sunk costs are far greater than the costs of the CP agreement.



## 1. Introduction

Over the last twenty years, there has been increasing evidence of cooperation between airlines and high-speed rail (HSR) operators, with many intermodal agreements signed worldwide. Most agreements relate to international connecting passengers.[1] Indeed, air transport and HSR services can be complements on long-haul routes served by connecting flights through a hub airport. If HSR is an effective substitute for either of these flights, then connecting passengers may combine air and HSR services. Airline-HSR agreements have received strong political support in Europe, where a major policy goal is promoting passenger transport intermodality (EC, 2006; Eurocontrol, 2005).

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[1] Examples of partnerships signed in Asia, US, and the EU include: *Air-Rail Service* between China Railway High-Speed and China Eastern Airlines at Shangai International Airport; *Acela Express* between Amtrak and United Airlines at Newark International Airport; *AIRail Service* between Deutsche Bahn and Lufthansa at Frankfurt Airport; *Rail&Fly Portugal* between Comboios de Portugal and TAP Portugal at Lisbon and Porto airports; *TGVAir* between SNCF and Air France at Paris Charles De Gaulle (CDG) Airport; and *AIR&RAIL* between Thalys and Air France at CDG Airport.

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Congestion at hub airports is one of the main reasons for intermodal cooperation.[2] Airlines can divert part of the short-haul traffic to HSR, thereby making the relevant slots available for routes that are more profitable (Givoni and Banister, 2006).[3] In turn, HSR operators benefit from cooperation in that it increases their load factor and market share on short-haul routes (Givoni and Dobruszkes, 2013).

On the other hand, the impact of airline-HSR agreements on passengers' well-being is not clear-cut. Actually, intermodal cooperation increases product variety, but raises competition concerns as long as it involves coordinated pricing. Even with limited or no price coordination between transport operators, one should consider the role of congestion at hub airports. If a hub airport is capacity constrained then traffic volumes, and thereby consumer surplus, in each relevant market are affected by the airline's decision on how to allocate scarce slots among markets. Despite the relevance of airline-HSR agreements, competition authorities have so far devoted little attention to evaluating the effects of these agreements on passengers.

In this paper, we study the strategic formation of airline-HSR agreements, depending on the sunk costs necessary to make cooperation effective and on transport operators' bargaining power in negotiating agreements. Furthermore, we study the impact of airline-HSR agreements, first on traffic volumes in the transportation network and on the level of congestion at the hub airport, and then on consumer surplus and social welfare, depending on the hub capacity and on mode substitution between air and HSR services.

In doing so, we fill two important gaps in the academic literature (see Section 2 for a review). First, the literature considers a scenario of full-scale cooperation that resembles an airline-HSR merger, and ignores transport operators' incentives to join the alliance. Second, the literature finds that the welfare gains from an airline-HSR merger are driven by firms' profits rather than consumer surplus. This is not surprising insofar as a merger involves coordinated pricing in all relevant markets. In this framework, antitrust agencies would hardly approve the merger. In reality, airline-HSR cooperation does not involve a merger, which is hard to implement in practice (Xia et al., 2018), and we are not aware of any signed agreement that entails full coordination on the prices charged.

Thus, the issue at stake is, if price coordination in all markets is difficult to achieve, and would benefit firms to the detriment of consumers, are there any other forms of airline-HSR cooperation that largely improve consumer surplus, and thus remove antitrust concerns?

We propose two such forms of cooperation, a capacity purchase (hereafter, CP), or 'vertical' agreement, and a joint venture (hereafter, JV), or 'horizontal' agreement. In a CP agreement, the HSR operator sells seats on the train to the airline at a cost, and then the airline provides international connecting passengers with the combined airline-HSR service.[4] In a JV agreement, firms create a distinct business unit to offer the combined airline-HSR service in the connecting market. We assume that the combined transportation service is the only source of profit for the JV entity.

After signing an agreement, transport operators are able to offer a bundle of domestic HSR and international air services that passengers perceive as a substitute for the connecting flight. We posit that airlines and HSR operators have to undertake lumpy investments to make cooperation effective.[5] When signing the agreement, they have to share the related sunk costs. Clearly, an agreement is incentive-compatible as long as each transport operator achieves benefits in excess of the (relevant share of) sunk costs. In this sense, complementarity between transportation modes derives from compatibility, and compatibility is a strategic decision.

We summarize the main results as follows. First, we find that both CP and JV agreements increase traffic volumes in the connecting market and in the whole network. Although the airline substitutes some feeding flights for HSR rides in the connecting market, it uses the capacity made available at the hub airport to meet new demand. Thus, contrary to common wisdom, airline-HSR agreements do not necessarily reduce, but may even increase congestion at hub airports. We also find that such agreements may increase traffic in overlapping markets, thereby alleviating competition concerns.

Second, we find that intermodal agreements generally benefit consumers, even if hub airports are congested. This is in contrast to airline-HSR integration, which is almost exclusively in the firms' interest. More precisely, a CP agreement improves consumer surplus, unless transportation modes are very weak substitutes and the congested hub is of moderate size. In such a case, the HSR operator sets the wholesale price per train seat to induce the airline to allocate hub capacity to the multimodal trip. Despite airline-HSR passengers may benefit from the agreement, there is a stronger negative effect on passengers in the remaining markets, where traffic volumes decrease. On the other hand, the JV agreement improves passenger

[2] Due to severe constraints to capacity expansion, airport slots are a scarce resource. The European Commission pursues the optimal allocation and use of slots to foster competition and improve quality of air transport services. In this framework, Avenali *et al.* (2015) study an incentive pricing mechanism to manage scarce capacity at congested hubs, while Rassenti *et al.* (1982) and Avenali (2009) propose general auction formats to induce efficient allocation of complementary/substitute resources affected by growing scarcity.

[3] For instance, in the case of the *AIRail Service* provided by Deutsche Bahn and Lufthansa, intermodal passengers can use either HSR or air services on the Frankfurt-Stuttgart route, but only HSR services on the Frankfurt-Cologne route.

[4] For instance, according to the *AIR&RAIL* agreement with Thalys, Air France forecasts and confirms traffic volumes to Thalys on an annual basis to book one or two carriages per journey (it can also book additional seats on an ad-hoc basis, subject to availability on trains). Then, Air France handles the intermodal service, which is included in the Air France booking system, and is available to passengers who travel from/to Brussels-Midi Railways Station and CDG Airport.

[5] Eurocontrol (2005) lists some critical barriers to intermodal transport, such as costly investments for deploying infrastructures, a limited actors' willingness to coordinate or collaborate and, in some countries, a relatively poor passengers' perception of rail transport. Consider the mentioned *AIR&RAIL* agreement. Thalys has adapted the schedule of trains to match Air France departure/arrival timetables. It has also introduced dedicated luggage hold and integrated ticketing for Air France passengers at the Brussels check-in counter (see Eurocontrol, 2005, for further examples).