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Access pricing, infrastructure investment and intermodal competition

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ABSTRACT

This paper considers the existence of a given transport infrastructure and analyzes the optimal conditions for investing in a complementary or rival new infrastructure. The model allows us to identify some key variables to be considered in cost–benefit analysis and highlights the importance of socially optimal access pricing in relation to investment decisions. The socially optimal conditions for investment depend on, among others, the cross-effects between different modes of transport, the volume of demand, the construction cost of the new infrastructure, and the restrictions faced by the regulator.

1. Introduction

This paper considers the existence of a given transport infrastructure and analyzes the optimal conditions for investing in a complementary or substitute new infrastructure. In particular, we focus on transport modes that are characterized by an unbundled vertical structure, in which transport infrastructure is owned by an entity (public or private) that allows downstream firms to use it in order to provide transport services to final consumers. This is the case, for example, of airports or railways.

Public investments in high-speed rail (HSR) infrastructure and airports serve as an excellent case for the analysis of access pricing,[1] investment and intermodal competition. Intermodal competition refers to the provision of transport services by alternative modes. However, for the sake of generality, in this paper, we consider both the case of substitutability and complementarity in the services provided by the different modes of transport.

On the one hand, airlines and HSR may be considered as substitutes in short and medium length routes. Even though several authors set different thresholds on the distance for which the HSR loses its advantage over aircraft (Pavaux, 1994; Buchanan and Partners, 1995; Janic, 2003; De Rus and Nombela, 2007; Vickerman, 2009), most authors agree that the HSR is no longer competitive for distances above 800 km in length (Commission for Integrated Transport, 2004; Givoni and Banister, 2007).

On the other hand, some authors argue that airlines and HSR may be also considered as complements (Givoni, 2005; Givoni and Banister, 2006; Socorro and Viecens, 2013). In this context, Socorro and Viecens (2013) find some intermodal

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[1] Access pricing are charges levied for the use of the transport infrastructure.

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agreements between airlines and railways in Europe. Among all cases, AIRail – the joint venture between Lufthansa, Deutsche Bahn and Fraport – is considered the most advanced intermodal product available to travelers in Europe (Steer Davies Gleave, 2006). AIRail connects Frankfurt airport with Stuttgart and with Cologne. Passengers purchase a single ticket for the entire trip by plane and HSR, and they pick up their luggage at the final destination.

In all cases, either substitutes or complements, access pricing for the use of each infrastructure is crucial. In this paper, we analyze the socially optimal access prices to be charged for the use of airports and the HSR infrastructure with and without budget constraint. This corresponds to either public or regulated private transport infrastructures.

Access pricing for the use of a particular public transport infrastructure is often, in Europe, performed by independent agencies that analyze the specific characteristics of such an infrastructure and take access pricing decisions independently. The Office of Rail Regulation, for example, is the independent safety and economic regulator for Britain's railways and the Civil Aviation Authority has as its prime focus to ensure that the airports at Heathrow, Gatwick and Stansted do not exploit their potential market power. There is no relation between the decisions of both agencies.

Moreover, ECMT (2005) brings evidence on what rail access pricing policy is actually followed by different European countries. In response to a questionnaire, European countries described themselves as following either social marginal cost pricing (with state compensation for the difference between the corresponding revenue and total financial cost), an access pricing policy consisting of collecting the full financial cost minus subsidies, or an access pricing policy consisting of mark-ups to social marginal cost. According to Sánchez-Borràs et al. (2010), France and Spain apply mark ups to social marginal cost, while Germany, Italy and Belgium follow an access pricing policy consisting of collecting the full financial cost minus subsidies.

Rail access pricing in all these countries is set taking into account the specific costs of the rail infrastructure and disregarding the existence of other transport infrastructures. In this paper, we show that if consumers consider that the services provided by the different transport modes are either substitutes or complements, the socially optimal access price for the use of each public infrastructure cannot be set independently. Moreover, we illustrate with an empirical example the consequences of disregarding the degree of complementarity and substitutability between transport modes on optimal access pricing and investment decisions.

There are several papers in the literature analyzing access pricing and capacity investment in facilities with vertical structure.[2] In particular, some recent papers have applied this setting in the analysis of airports, including the analysis of a non-competing airport (Brueckner, 2002; Fu et al., 2006; Zhang and Zhang, 2006), complementary airports (Pels and Verhoef, 2004; Brueckner, 2005; Basso, 2008; Mantin, 2012), or an airport competing with other airports or transport facilities (Basso and Zhang, 2007). Thus, access pricing has been already analyzed either in the case of substitutes or complementary transport facilities.[3]

However, in this paper we consider a model that allows for both, imperfect substitutability or complementarity. In particular, we consider a representative consumer that maximizes a quadratic and strictly concave utility function as proposed by Dixit (1979) and Singh and Vives (1984). This approach allows us to obtain linear demand functions for transport service operators in each transport infrastructure.[4] To our knowledge, this is the first paper that uses this approach to analyze socially optimal access pricing and investment in a context of several transport infrastructures. In particular, we analyze how socially optimal access pricing is affected by the degree of complementarity or substitutability between modes, or even more important, the conditions under which a new complementary or rival facility should be constructed. This paper uses an industrial organization approach, providing a methodology to identify some key elements to be considered in cost–benefit analysis, and empirically illustrating the importance and sensitivity of the results to the parameters and restrictions faced by the regulator.

We consider a dynamic model in which different agents sequentially choose their actions. In the first period, a benevolent regulator must decide whether or not to construct a new transport infrastructure, taking into account that there already exists a substitute or complementary transport infrastructure. In the second period, the regulator must decide the access price to be charged to private operators for the use of public infrastructures. We distinguish between a welfare-maximizing regulator (first best approach) and a budget-constrained welfare-maximizing regulator, that is, a regulator that maximizes social welfare but must achieve financial breakeven (second best approach). Given the access prices, in the next period private operators set ticket prices. Finally, given the ticket prices, consumers decide how often they will use each transport mode, where the modes are considered as imperfect substitutes or complements.

Transport infrastructure usually involves significant amounts of public funds and the investment is, essentially, irreversible. The decision of constructing a new infrastructure not only requires the project to have a positive net present value compared with an alternative in which optimal access pricing is not applied, but also to increase the social welfare compared to the situation in which the infrastructure is not constructed and socially optimal access pricing is used. In this sense, if the regulator is not subject to any budget constraint we show that the new infrastructure is more likely to be constructed

[2] For a general review on access pricing see, for example, Laffont and Tirole (1994), Vickers (1995), or Armstrong (2002). For a general review on the relationship between access pricing and private incentives to invest see, for example, Gans and Williams (1999), Gans (2001), or Valletti (2003).

[3] See also Van der Weijde et al. (2013) for a model of perfect substitutes between rail and road or De Borger et al. (2008) for a model of toll and capacity choices on transport networks with either parallel competition (substitutes) or serial competition (complements).

[4] This approach has been extensively used in the transport literature (see, for example, Lin (2004), Oum and Fu (2007), Flores-Fillol and Moner-Colonques (2007), Clark et al. (2009), Socorro and Betancor (2010), or Clark et al., 2011). Socorro and Viecens (2013) also use this approach to analyze the potentials of airline and HSR integration. Fu et al. (2006) use it to analyze how access pricing in an airport affects downstream airline competition. However, they just consider one infrastructure and they do not focus on optimal access pricing.