JOINT TRANSPORT RESEARCH CENTRE

Discussion Paper No. 2009-18
December 2009

Interurban Passenger Transport: Economic Assessment of Major Infrastructure Projects

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Las Palmas, July 2009

ACKNOWLEDGEMENTS

The author is indebted to Kurt Van Dender for useful comments and suggestions, to Jorge Valido for his work as research assistant and to Carlos Huesa and José Luis Pertierra for providing data and information on some intercity bus concessions affected by the introduction of high-speed rail. The use of the AENA database for air traffic is also gratefully acknowledged.

ABSTRACT

The future of interurban public transport will be significantly affected by public sector decisions concerning investment in infrastructure, particularly the construction of new high-speed rail lines in medium-distance corridors where cars, buses, airplanes and conventional trains are the competing modes of transport. The distribution of traffic between the alternative modes of transport depends on the generalized prices, which fundamentally consist of costs, time and government's pricing decisions. High-speed rail investment, financed by national governments and supranational institutions such as the European Union (EU), has drastically changed the previous equilibrium in the affected corridors. This paper discusses the economic rationale for allocating public money to the construction of high-speed rail infrastructure and how the present institutional design affects the selection of projects by national and regional governments, with deep long-term effects in these corridors and beyond.

Keywords: infrastructure, incentives, project evaluation, high speed rail, intermodal competition.

1. INTRODUCTION

This paper addresses a crucial issue for the future of interurban passenger transport networks, i.e. the influence of public decisions on large infrastructure investments that will change the present equilibrium in intercity transport. It will focus mainly on the massive investment in high-speed rail (HSR) infrastructure that some national governments and supranational organisations, such as the European Commission, are helping to make through direct investment or by co-financing national projects under very favourable conditions.

The future of interurban transport is expected to be dominated by strict budget constraints and the introduction of efficiency-oriented policies affecting pricing and investment decisions, such as the application of polluter-pays and user-pays principles and the planning of infrastructure on a strict economic basis. The ultimate objective is to have an "integrated and sustainable transport system" that promotes economic growth and social cohesion (European Commission, 2009).

Investment in infrastructure requires significant public funds. The type of assets invested in transport infrastructure are essentially irreversible and subject to cost and demand uncertainty, so the optimal timing is a key economic issue, since the investment decision can be delayed in most cases (Dixit and Pindyck, 1994). These characteristics give a significant value to the option to invest, which is in the hands of governments that own the land or can expropriate it. In the case of intercity transport, most of the corridors are already in operation and investments in large projects, such as high-speed rail infrastructure, can be viewed as a change in the generalized cost of travelling (time and cost savings, reliability, comfort and safety, etc.) with respect to the situation prevailing *without* project (de Rus and Nash, 2007; de Rus, 2008).

Infrastructure and services do not follow the same long-term planning criteria. Private service operators, including car owners, decide how much and when to invest in new capacity, and this also includes technology. Private airlines decide which type of aircraft to buy depending on their demand expectations and business strategies. There is strong evidence that the competitive air transport industry works reasonably well (Morrison and Winston, 1995; 2005). This is also true of bus transport, at least under a concession regime (Nash, 1993; Mackie and Preston, 1996; Preston, 2004).

On the other hand, roads, airports, ports and railway tracks and stations ultimately belong to the public sector (with some exceptions), and although many crucial transport decisions are in the hands of private operators subject to market discipline, the public sector can heavily influence future modal split and the configuration of transport networks through investment, pricing and regulatory decisions affecting capacity.

This is the case with high-speed passenger trains operating largely within the public sector both in the areas of infrastructure and services. The construction of new lines in the European Union (EU), China's announcement that it intends to spend $162 billion to expand its railway system and the decision of the US government to include HSR passenger services as a centrepiece of national transport policy has given a new endorsement to this technology that may promote the expansion of railways in intercity transport.

From an economic perspective, the question is quite simple: is HSR socially worth it? And the obvious answer is: it depends. HSR is a rail technology that allows trains to travel faster than cars, buses and conventional trains, but more slowly than commercial aviation. Like any other technology, HSR is not inherently good or bad. Its social value resides in its ability to solve transport problems that are significant enough to justify its opportunity cost. Cost-benefit analysis can help answer this crucial question, but we do not need to go any further to maintain that the economic case for HSR investment depends on the prevailing conditions in the intercity corridor where the construction of the new line is planned, in particular the level of demand, the degree of congestion, value of time, expected time savings from diverted traffic, generated traffic and the net external effects.

The context in which the social appraisal of projects is carried out cannot be ignored in the economic analysis of major infrastructure projects. The institutional design is a key element for understanding public decision-making when different levels of governments are involved, as it is the case in the EU or generally when the national and regional governments of the same country do not necessarily share the same objectives, particularly with regard to where public investment should be made.

This paper addresses these long-term planning and assessment issues which affect the future of interurban transport. In Section 2, the long-term challenges in intercity transport are considered, by looking at the differences between the alternative modes of transport in medium-distance corridors where air, rail and road compete and where public investment decisions concerning infrastructure deeply affect market equilibrium. In Section 3 we discuss the conditions under which public investment in HSR infrastructure can be socially worthwhile. In Section 4, the incentives associated with national or supranational funding are considered, showing the relevance of the institutional design affecting the funding of large infrastructure projects. Finally, conclusions are drawn in Section 5.

2. LONG-TERM PLANNING FOR INTERURBAN PASSENGER TRANSPORT

Medium-distance intercity corridors (around 500 km) with road, air and rail transport in open competition have a modal split equilibrium that is very sensitive to small changes in the generalized prices of the alternative modes of transport. The differences between these modes of transport are quite obvious, but they have several things in common. On the supply side, they all need infrastructure to provide services combining vehicles, labour and energy under private or public ownership, and with infrastructure and operations vertically integrated or unbundled; and on the demand side, they all involve a transport service carrying passengers who have to pay different generalized prices in terms of money, time, quality and safety.

Air, maritime and road transport are vertically unbundled and different operators use a common infrastructure, sometimes with free access and sometimes with payment of an access fee (toll, price, tariff, etc.). Usually the operators are private and the infrastructure is public or privately operated under a concession contract. Road, air and maritime transport services are vertically separated from the infrastructure operator, and railways are unbundled in some cases and vertically integrated *de facto* in the case of high-speed trains operated by a single firm with the exclusive use of dedicated infrastructure. Buses and cars share the same roads, competing airlines share airports and high-speed rail is technically operated as a single business, even if, from an organizational standpoint, the maintenance and operation of the infrastructure are separated from service operations.

HSR has other advantages over airlines beyond vertical integration (with subsidized prices), reflecting some structural differences. Airports and airlines would still serve a large number of markets using the same airport capacity, and it is not clear that airport congestion management would be better with vertical integration. The HSR advantage in this case is that capacity is used to serve a very small number of markets (O-D pairs), and this makes it possible to reach very high levels of reliability.

These differences on the supply side have significant impacts on the demand side. The vertical integration of infrastructure and operation in the case of HSR is a significant advantage with respect to air transport in terms of the generalized costs of travel. HSR is more reliable than air transport, and access and waiting time much less cumbersome. Airport and airlines managers do not necessarily have the same objectives and, as a matter of fact, the generalized cost advantage of HSR lies outside the travel-time segment of the trip. In the case of roads, the differences are even clearer. Road infrastructure and operations are vertically separated. In contrast with the single operator of HSR, there are many users driving their own cars with free access (sometimes paying a toll) to a limited-capacity infrastructure. Road transport has the advantage of reducing access and waiting time to almost nothing and the cost disadvantage appears in the travel-time segment.

Investment in HSR changes the equilibrium in the interurban corridor through its impact on the generalized price of rail travel. Compared with conventional rail, HSR services barely affect access, egress and waiting time. The main impact is on travel time with a magnitude depending on the prevailing operating conditions of the conventional rail (one hour or more when conventional trains run at 100 km/h, but around half an hour when the operating speed is 160 km, over a distance of 450 km (Steer Davies Gleave, 2004). Road passengers travelling medium distances benefit from travel-time reductions but lose in terms of access, egress and waiting time. The comparison of the generalized costs of HSR and air shows a contrasting picture with respect to road. HSR is competitive over medium distances, but loses its competitive edge for long distances (Campos and Gagnepain, 2009).

Time savings are not the only consequence of HSR investment. The reduction in the generalized cost of travel generates new trips, and the diverting of traffic from other modes of transport may contribute to the reduction of congestion, accidents and environmental externalities. Unfortunately, the net impact on the alternative modes is not necessarily positive. The reduction of congestion is one effect on those who continue to use the previous mode of transport, but the reduction of operations in response to lower demand volumes affects negatively the adjustment to travel preferences of those users.

Before we discuss the benefits of HSR and the social value of channelling public funds to develop it, it is helpful to see the dominant trends concerning the future of interurban passenger transport. An "integrated and sustainable transport system" is the declared objective of most transport programs all over the world. It is far from evident what that objective means. It can include different actual transport policies with different degrees of public intervention, particularly with regard to investment decisions and pricing.

The development of a transport network is the result of the interplay of private and public decisions within a context of sometimes unpredictable changes in society and particularly in the economy. For long-term planning purposes, it is worth looking at the discussion of future trends in European transport by the Focus Groups for the European Commission in connection with the development of the White Paper on transport policy (European Commission, 2009) looking 40 years ahead. We are not interested here in some of the predictions, which are impossible to verify at present. Nevertheless, it is very informative to find out how they understand transport issues and what their public policy recommendation is insofar as this vision informs European transport policy[1].

The present context is one of tighter budget constraints, a situation that is going to worsen in the future given the present economic recession and growing public deficits. Increased ageing and the growing dependency rate, on one hand, and the need to devote more funds to repairing, upgrading and renewing existing infrastructure, on the other, will reduce the funds available for the transport sector and users will have to pay more than in the recent past, both for the internalization of externalities and cost recovery.

The following summarizes some of their positions on infrastructure and pricing policies:

- The importance of transport for economic development, the growth of transport demand and the need to maintain and upgrade existing capacity as well as constructing new capacity require direct charging for transport services. Both the user-pays and the polluter-pays principle will have to be translated into practical pricing decisions.

- Tighter budget constraints and the introduction of user charging will promote private participation. Private operators will assist in the construction and operation of transport infrastructure. The regulatory framework is crucial in order to provide the right incentives to get the best results from private participation.

- Planning of infrastructure plays a decisive role in ensuring coherent and uniform development at the European level. The construction of new infrastructure should be conditional upon the existence of real needs, as determined by the economic appraisal of projects.

– Infrastructure design should facilitate the use of environmentally-friendly energy resources and be integrated with land planning and transport solutions. Co-modality should be encouraged through a common and integrated ticketing system, common terminals and platforms, etc.

– Economic efficiency requires that prices reflect all costs. External costs have to be internalized and this has an impact in the short run by promoting an efficient use of existing infrastructure, and in the long run by providing long-term signals to investors that will gradually transform the transport system. Pricing is more effective in changing modal split than other policies.

– The efficient use of the network can be achieved through liberalization, which facilitates market entry and reduces administrative barriers. This would be especially helpful in the case of railways. Regulations to correct market failure should be designed to remove the considerable barriers to a level playing field in the transport sector (especially in the context of intermodal and international competition).

In a situation of intermodal competition with road, air and rail transport fighting for customers, it is useful to analyse how HSR investment responds to these long-term objectives.

3. HIGH-SPEED RAIL INVESTMENT AS AN IMPROVEMENT IN INTERURBAN TRANSPORT

In a given corridor, a HSR project has total infrastructure costs equal to *I* in the base year, and thanks to the supply of high-speed trains using this infrastructure, social benefits (net of annual maintenance and operating costs), denoted by *B*, are generated in the first year of operation. These net benefits grow annually at a rate of *g*. The infrastructure has a lifespan of *T* years and the discount rate is equal to *i*. Within this framework and assuming that *i* is greater that *g*, investment is socially worthwhile if the following condition is satisfied:

$$B\left[1-(1+g)^{T}(1+i)^{-T}\right](i-g)^{-1} > I \quad (1)$$

Two key values in expression (1) are the rates *g* and *i*. Expression (1) simplifies to (2) when the project lasts forever:

$$B(i-g)^{-1} > I \quad (2)$$

Let us simplify and assume that condition (2) is satisfied or, alternatively, that the growth rate of net benefits is higher than the social discount rate $(g > i)$. In both cases the net present value is positive, though in the second case any positive value of *B* is compatible with a positive NPV. In practical terms, this last case translates into a very favourable case for HSR investment, as the net present value is positive even starting with a low demand volume.[2] In this case of exponential growth of net benefits, a positive net present value is not a sufficient condition to accept the project. The question “is HSR socially worthwhile?” cannot be answered without addressing the problem of optimal timing.

Even disregarding the additional benefits of relevant information which reveals when the investment is postponed, we have to address the question of optimal timing. Unless the benefits of the first year are greater than the opportunity cost of the investment, it is better to delay the investment decision even if the net present value is positive. Ignoring for simplicity the net benefit in year T+1, it is socially worthwhile to invest in HSR when:[3]

$$B > Ii \quad (3)$$

For a given social discount rate condition (3) is satisfied if the first year's net social benefits of introducing HSR in a corridor offset the opportunity cost of allocating I to this project rather than to other social needs. In expression (3), B accounts for the net social benefits in the first year, and this basically includes the time savings obtained by diverting traffic to the new mode, the benefits of generated traffic, the increase in quality and safety, the reduction in congestion, accidents and other negative externalities in alternative modes of transport, the release of additional capacity for other kinds of traffic (e.g. rail freight and long distance in airports) and the change in the operating and maintenance costs of moving the volume of passengers in the corridor because of the project (excluding the investment costs).

These net benefits in the first year depend heavily on the specific characteristics of the corridor and how the new line affects the generalized cost of travel. In order to offset the investment opportunity costs, a significant volume of demand is required in the corridor to offset the high cost of the investment. The cost of constructing one kilometre of HSR infrastructure ranges from 12 to 40 million euros, with an average of 18 euros, and these values do not include planning and land costs and main stations. The costs are quite sensitive to the terrain characteristics and the need to cross high-density urban areas (Campos and de Rus, 2009).

The benefits in the first year of operation are very sensitive to the ability of high-speed trains to divert traffic from highly congested modes of transport. The introduction of a HSR line in a 500 km corridor with an uncongested road and good air transport connexions is hard to justify unless several conditions are met: a high volume of demand shifting from the other modes of transport, a significant reduction in total trip time, the generation of new demand, the reduction of negative externalities and a high willingness to pay for these benefits.

The expected time saving (and its composition) obtained with a HSR project is very sensitive to the original transport mode in which passengers were travelling previously. A passenger shifting from road to HSR saves travel time but increases access, egress and waiting time. On the other hand, a passenger shifting from air transport to HSR increases his travel time and saves access, egress and waiting time.[4] The passenger shifts if the HSR generalised price is lower than in the original mode, and this can happen, even if the total trip time increases, when the HSR fare is low enough to offset the longer trip (de Rus, 2008).

The existence of network externalities is another alleged direct benefit of HSR (see Adler *et al*., 2007). Undoubtedly, a dense HSR network offers more possibilities to rail travellers than a less developed one. Nevertheless, we are sceptical of the economic significance of this effect. We do not argue against the idea that networks are more valuable than disjointed links. The point is that when there are network effects it should be included in the benefits at a route level already discussed. Although rail passengers gain when the wider origin-destination menu is in a denser network, the utility of a specific traveller who is travelling from A to B does not increase with the number of passengers unless the frequency increases, and this effect (a sort of Mohring effect) is captured at a line level.

Time savings come from diverted traffic. Generated traffic increases total travel time but produces benefits insofar as the passengers are willing to pay the generalized cost of travel. Diverted traffic has other intermodal effects beyond the ones already described. These effects are the indirect effects of HSR on passengers who continue to use their original transport mode.

Indirect effects are the impact of HSR on secondary markets, whose products are complements to or substitutes for the primary market. For simplicity's sake, we are focusing on the alternative modes of transport affected by the introduction of HSR. Are users of the alternative modes better off with HSR? What about the producers? It is important to distinguish here between transfers and real resource changes. We have already seen the direct benefits that society gains from the introduction of HSR, but users who remain attached to their former modes of transport may be affected positively or negatively depending whether there are distortions on these modes of transport. The same is applicable to other economic agents.

The critical issue is whether price is higher or lower than marginal social cost in the alternative mode of transport. When the price is below the marginal cost in the original transport mode, the diversion of traffic to the new transport mode benefits society.[5] This could happen because suboptimal congestion, or pollution, is reduced. However, the opposite might occur, and the indirect effect could be negative when the price is above the marginal cost, for example, if the reduction of demand in the original transport mode forces the operators to reduce the level of service, thereby increasing the generalized cost of travel.

The key point is whether the original transport mode was optimally priced. Although it has been argued that the reduction of road and airport congestion is a positive effect of HSR, this is only the case if there is a lack of optimal pricing. When road and airport congestion charges internalise the external marginal costs, there are no indirect benefits from the change in modal split. This can be viewed from another perspective. The justification of HSR investment based on indirect intermodal effects should be first compared with a "do something" approach, consisting of the introduction of optimal pricing (user and polluter-pays principles).

It should also be mentioned that, given for example the impossibility of road pricing, a second-best case for HSR investment, based on indirect intermodal effects, requires significant effects of diverted traffic on the pre-existing traffic conditions in the corridor. This means the combination of significant distortion, high demand volume in the corridor and sufficiently high cross-elasticity of demand in the alternative mode with respect to the change in the generalised cost.

The assumption that the price is equal to the social marginal cost means that the loss of traffic by conventional modes of transport does not affect the utility of those who continue to use these modes of transport, nor the welfare of producers or workers in these modes. This would mean that operators are indifferent to a 50 per cent loss in patronage, or workers to losing their jobs, because in both cases they are receiving the exact amount of their opportunity costs. There are many reasons to abandon this assumption, one of which is the existence of unemployment, but we will concentrate here on how the reduction of demand in air and bus transport affects user's utility when the operators respond to lower demand by reducing the service level.

Figures 1 to 10 and Tables 1 to 4 (see Annex) show how the introduction of HSR in some corridors reduced demand for airlines and bus operators and how the airline industry responded by adjusting the supply to the external shock in demand. There is a remarkable difference between the effects of the reduction of service in both modes of transport. Bus operators cannot change their basic regulated timetables because they operate under a concession contract. Although they cut the level of service when demand diminishes, the reduction in supply does not affect frequencies since the suppressed services leave at the same time as approved in the basic regulated timetable. However, it can be argued that although users are barely affected by the short-term adjustment of bus operators, financial difficulties will emerge later in contract renegotiations or when concessions expire. This means that users and/or taxpayers (or workers) will have to pay for the adjustment in the medium-term.[6]

Airlines operate in open competition so the short-term adjustment to the external shock in demand produced by the introduction of HSR services is a reduction in the number of operations. This affects frequencies, firstly because the reduction in demand is substantially higher; secondly, because airlines are not subject to public service obligations and so the adjustment is legally feasible; and thirdly, because of the nature of flight operations (slots required for take-off and landing), frequencies are necessarily affected when services are cut. The reduction in the number of flights per hour increases total travel time when passengers arrive randomly, or decreases utility when they choose their flight in advance within a less attractive timetable.

Finally, it should be stressed that intermodal competition is based on the generalized price of travel. Modal choice may be affected by the competitive advantage of each mode of transport, but the comparative advantage can reflect two completely different facts in this case. It may, for example, reflect a technological advantage with respect to the trip length, but it may also be explained by the charging policy in use. The impact on market share in medium distance-corridors may be substantial depending on whether the government charges variable costs or aims for full cost recovery, or something in between, depending on the severity of budget constraints.[7]

The final equilibrium in medium-distance (or even in short-distance) corridors will not only be the result of the free interaction of supply and demand. Governments will have a strong influence on the final modal split because the construction of public infrastructure is critical in transport, and particularly in the case of HSR. Once the HSR infrastructure is built the short-run marginal cost is considerably lower than the average cost (see Campos and de Rus, 2009, Campos *et al*., 2009) and the crucial question is whether society is willing to pay the total costs (including capacity) of a new mode of transport in the light of the actual travelling conditions in a particular corridor and the alternatives available for improving the present situation.

4. FUNDING OF TRANSPORT INFRASTRUCTURE AND ITS EFFECTS ON PROJECT SELECTION

The construction of a high-speed rail network is an expensive task. It is an investment that has the following characteristics: it is large-scale, irreversible and costly. The decision to invest public funds in the construction of HSR lines is subject to cost, and especially, demand uncertainty. The irreversible nature of the decision and the profound impact on equilibrium in the corridor where the new project is to be built makes the economic appraisal of the project quite relevant. It is therefore judicious to examine how institutional design affects the final choice in the allocation of public money in interurban corridors.

National and supranational governments are supporting the implementation of this new rail transport technology with public funds. To understand the impact of this public support on the investment decision, it is useful to distinguish two levels in the process of funding major infrastructure projects. The first relates to the institutional design, in which supranational and national governments (or national and regional governments) agree on the projects to be financed. The second is related to the selection of contracts for the construction and operation of the infrastructure. This level includes the relationship between the national (or regional) government benefitting from the project and the operator(s) responsible for the construction and operation of the project.[8]

The co-financing system in the EU is the so-called "funding-gap" method consisting of a type of cost-plus financing mechanism in which the difference between the investment costs and the discounted revenues (net of operating costs) of the project are partially covered by the supranational organisation. The European Commission finances a percentage (the co-funding rate) of this financial gap. The incentive embedded in this mechanism is perverse, since the subsidy increases with total investment costs and decreases with net revenues. This financing mechanism penalizes the internalization of externalities and congestion, leads to excessive demand and biases the capacity size and the choice of technology.

Let us suppose that a country facing a problem of capacity in its transport network is considering mutually exclusive projects, including the construction of a new HSR line that can apply for financial support from a supranational agency. The country is governed by a politician, who must decide upon the main characteristics of the project (let us say HSR or upgraded conventional train), make a cost-benefit analysis and then present these elements to the supranational planner in order to obtain the funds for construction of the infrastructure.

The effects of the present system of co-financing in the EU, or any other system in which a national government pays for the infrastructure in the national budget and the regional government decides which type of project is to be financed, can be modeled as follows (de Rus and Socorro, 2009). Assume that there are only two periods. During the first period, the new rail infrastructure is constructed. During the second period, the citizens of the country use it. The real construction costs are paid by the national government. We know that actual costs do not necessarily coincide with the minimum investment cost. To minimize construction costs requires an effort on the part of the politician, which has a cost for him.

It is not uncommon for national governments to be better informed than the supranational agency about the transport problem and the set of alternatives available and therefore about the minimum investment cost required to solve the problem. For this reason, we assume that the supranational planner cannot observe (or verify) either the minimum investment cost, or the effort exerted by the politician in order to be efficient. Moreover, the national government has to decide on the price to be charged for the use of the new infrastructure and consequently the number of users. There are also operating and maintenance costs, which are privately known, and in many cases there are different technologies and/or capacity sizes with significant cost differences.[9]

Once we abandon the idea of a benevolent supranational planner with perfect information and assume that the utility function of the politician depends on his own private income (only obtained if the politician is governing the country), we can explain more fully some of the evidence concerning the national government's decisions on expensive infrastructure.[10] The higher the welfare of voters in the second period, the higher the probability of re-election. The welfare of voters in the second period is the sum of their consumer surplus and the value of social expenditures.

The fixed costs/total cost ratio in HSR projects can be 50 per cent or higher (Campos *et al*., 2009), so these projects are always candidates for supranational funding. In a world of perfect information, the supranational agency would maximize social welfare by forcing the national government to exert the maximum level of effort, thereby minimizing project costs and introducing marginal social cost pricing. In the real world, efforts and marginal costs are not observable and the behaviour of the national government will respond to the incentives of the financing mechanism.

With the present funding gap mechanism (as with any other cost-plus financing system), it is costly to be efficient. Governments have no incentive to minimize investment costs or to introduce optimal pricing. There is a bias in favour of expensive, latest technology mega-projects and pricing will depart from user-pays or polluter-pays principles, since the higher the price for the use of the new national infrastructure, the lower the consumer surplus of voters will be, and the lower the probability of re-election. Consequently, the politician will choose maximum number of users and will not charge for the external costs.

The evidence supports these conclusions. It is remarkable that member countries have promoted the construction of some HSR lines when the demand was too low to pass a strict cost-benefit analysis as well as other transport infrastructure such as roads or ports. An *ex post* evaluation of a sample of projects co-financed by the Cohesion Fund in the period 1993-2002 concludes that national governments have been focusing primarily on timely commitment of the available funding, paying less attention to the technical content and economic priority of projects (ECORYS Transport, 2005). The evaluations generally fail to assess the quantitative contribution of the project to the declared objectives. Problem descriptions and analyses are sometimes lacking.

Moreover, it was generally impossible to determine whether projects were technically sound, and this deficiency led to problems such as improper designs; technical changes after the project was approved but before construction was started; late changes to design/tender dossiers; late beginning of implementation; cost overruns due to additional activities for the contractor, who was then in a good position to claim additional costs; longer implementation periods than foreseen; and too many requests for extension of the implementation period. The document concludes that “the evaluators have found only pragmatic criteria for the co-financing rate. In addition some basic dilemmas exist between general policy objectives and the rules applied for calculation of the co-financing rate. In particular the polluter-pays principle is only partially adopted since increasing user charges is discouraged by the present system of determining the co-financing rate” (ECORYS Transport, 2005).

These disappointing results are not completely unexpected. As we have already discussed, national governments are in general better informed than supranational planners about the costs and benefits of the infrastructure projects to be constructed in their own regions, and they do not necessarily share the same objectives. Governments may have incentives to manipulate project evaluation in order to obtain more funds from the supranational planner. In a context of asymmetric information and different objectives, the relationship between national governments and supranational planners cannot be modelled in a conventional cost-benefit analysis framework.

The existence of information asymmetries and conflicting interests requires a different approach in which incentives are explicitly accounted for. Florio (2006) proposes to move away from the current low-powered incentive EU co-financing mechanism, essentially a partial reimbursement of investment cost scheme, towards a more incentive-based system.

As argued in de Rus and Socorro (2009), a fixed-price financing mechanism may provide the necessary incentives to reduce costs and charge the socially optimal price. Moreover, with the funding-gap method, cost-benefit analysis is simply a bureaucratic requirement to enable national governments to obtain supranational funds. However, with the fixed-price financing mechanism, cost-benefit analysis is a very useful tool for governments to allocate the supranational funds in the most efficient way.

The fixed-price mechanism, in this context, is an *ex ante* fixed quantity of external funding unrelated to costs and revenue. The idea of the fixed-quantity financing mechanism is to make national governments responsible for insufficient revenues and cost inefficiencies, since they receive a fixed amount of funding and are the residual claimants for effort. The incentive to introduce optimal pricing is now high as the costs of inefficient pricing are also suffered by the politician.

It is worth stressing that by giving national governments an *ex ante* fixed amount of funds, the European Commission loses its influence on the selection of projects. This is not the position of the European Commission, which establishes infrastructure investment priorities for the member countries. An intermediate solution is to replace the funding-gap method with an alternative financing scheme based on *ex ante* fixed-quantity funding linked to generic objectives such as investing in "accessibility" or "minimizing the total social cost of transport" in selected corridors, a mechanism that should be dissociated in any case from costs and revenues and the selection of any specific technology. The risk of building socially unprofitable HSR lines would be dissociated from the co-financing mechanism, since the selection of the most expensive (and perhaps inappropriate) project will now have a completely different opportunity cost for national governments.

5. CONCLUSIONS

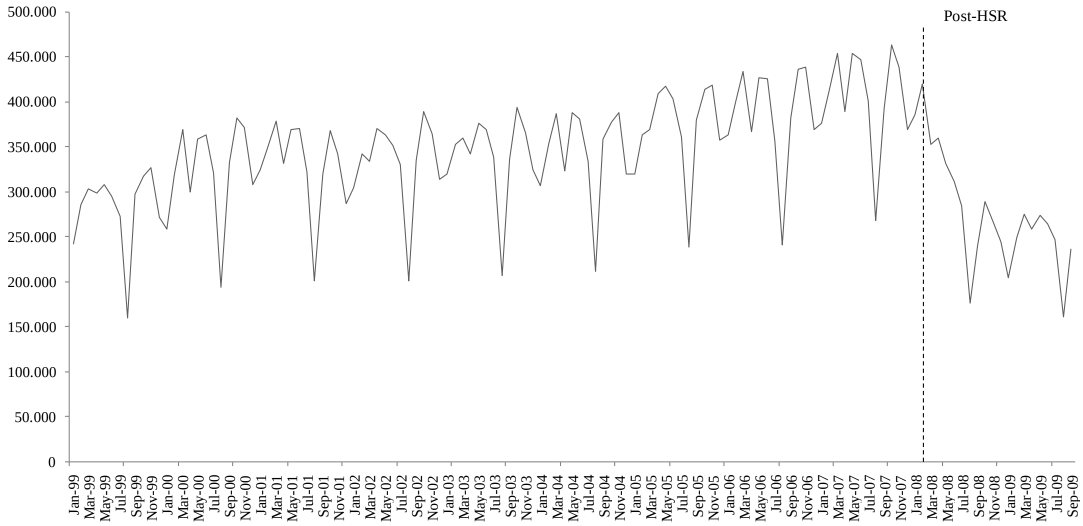
The future of interurban transport will be determined by the interaction of consumer preferences, technological developments and the availability of resources to meet mobility needs. Competition between firms and modes of transport, subject to the minimum regulation required both to internalize externalities and guarantee a basic level of accessibility, will shape transport networks in the years to come. However, public intervention is not confined to price regulation or equity issues in transport. Public infrastructure construction can exert a remarkable influence on the future form of interurban transport corridors.

The high-speed rail investment decisions taken and the subsequent infrastructure pricing policies set by the public sector have a profound impact on the allocation of resources in the transport sector and the rest of the economy. It seems obvious that high-speed rail infrastructure is an appropriate option for some corridors but a very expensive one in low-traffic areas where the alternative modes of transport can satisfy demand at much lower cost.

The challenge is to design an institutional framework that helps to find the best options for society, beyond the special interests of industry groups and politicians. To reinforce the use of cost-benefit analysis as a requirement for approving new infrastructure is clearly insufficient. Because of asymmetries of information and conflicting interests, there is a need for a new incentive mechanism that will help overcome the current situation in which the member country-supranational government relationship (or that of regional and national governments) creates a bias in favour of the most expensive and modern technology over more efficient and less expensive solutions, new construction over maintenance and upgrading, and free access over the introduction of efficient pricing based on the polluter-pays and user-pays principle.

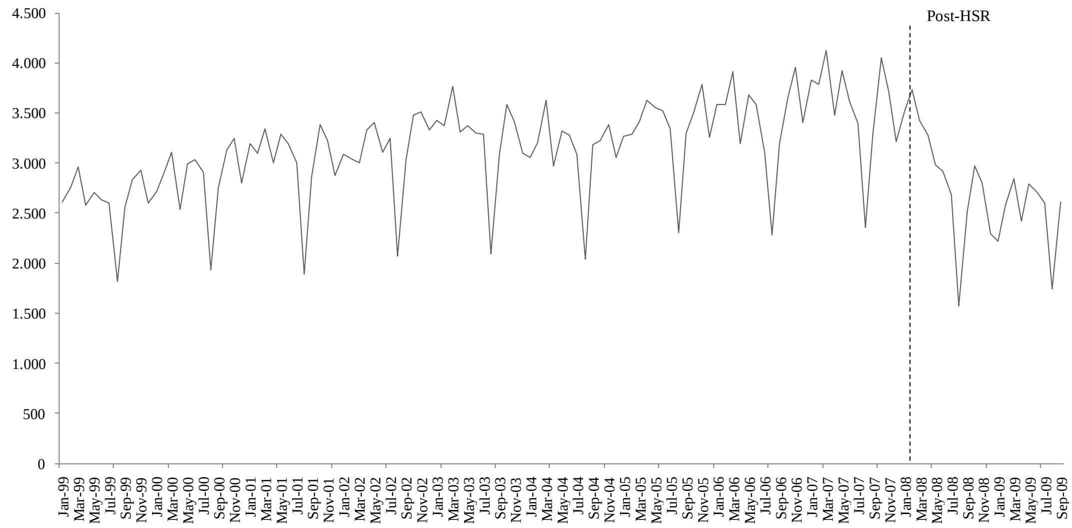
ANNEX

Figure 1. **Madrid-Barcelona air passenger-trips per month**



Source: built from data in www.aena.es

Figure 2. **Madrid-Barcelona commercial flights per month**



Source: built from data in www.aena.es

Table 1. **Madrid-Barcelona (passengers-trips)**

Variable	Coefficient	Std. Error	t-Statistic
T	1064	65**	16.26046
D1	-2914	9522	-0.306032
D2	36026	9520**	3.784228
D3	64210	9543**	6.728295
D4	38762	9540**	4.063172
D5	66535	9537**	6.976728
D6	57925	9534**	6.075548
D7	19253	9532*	2.019896
D8	-100908	9530**	-10.58831
D9	20683	9529*	2.170561
D10	68821	9742**	7.064316
D11	56634	9741**	5.813673
HSR	-150368	6914**	-21.74971
C	260965	7932**	32.90185

T: month; D1-D11: monthly dummies; HSR: dummy for High Speed Rail.

R-squared: 0.901392; Adjusted R-squared: 0.890245; Durbin-Watson stat: 1.032179;
*,** significant at the 5 or 1 per cent level.

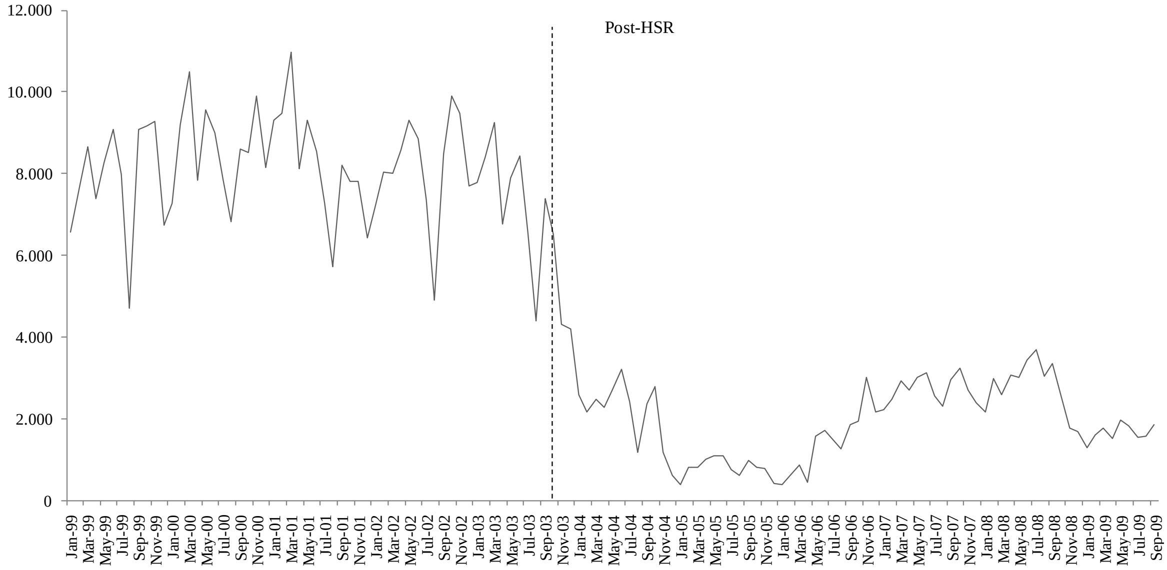
Table 2. **Madrid-Barcelona (commercial flights)**

Variable	Coefficient	Std. Error	t-Statistic
T	8	0.55**	15.06314
D1	177	80*	2.212122
D2	244	80**	3.042595
D3	526	80**	6.557876
D4	174	80*	2.173615
D5	375	80**	4.673040
D6	263	80**	3.287075
D7	106	80	1.321722
D8	-917	80**	-11.43899
D9	11	80	0.131378
D10	406	82**	4.954149
D11	412	82**	5.027874
HSR	-1037	58**	-17.84494
C	2550	67**	38.23676

T: month; D1-D11: monthly dummies; HSR: dummy for High Speed Rail.

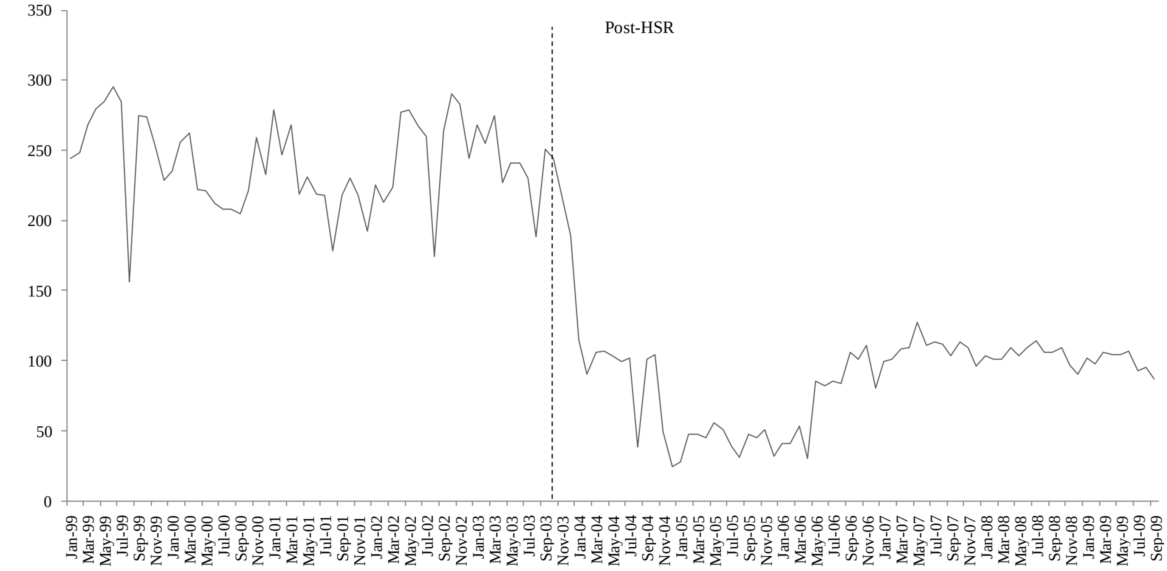
R-squared: 0.880377; Adjusted R-squared: 0.866855; Durbin-Watson stat: 1.100381;
*,** significant at the 5 or 1 per cent level.

Figure 3. **Madrid-Zaragoza air passenger-trips per month**



Source: built from data in www.aena.es

Figure 4. **Madrid-Zaragoza commercial flights per month**



Source: built from data in www.aena.es

Table 3. **Madrid-Zaragoza (passenger-trips)**

Variable	Coefficient	Std. Error	t-Statistic
T	-1	5	-0.232599
D1	-87	475	-0.183369
D2	482	475	1.015930
D3	970	475*	2.043228
D4	139	475	0.293170
D5	872	475	1.837054
D6	928	475	1.954525
D7	129	475	0.270871
D8	-1049	475*	-2.206355
D9	644	476	1.354009
D10	1269	486*	2.612176
D11	972	486*	2.002266
HSR	-5973	381**	-15.67043
C	7706	388**	19.86720

T: month; D1-D11: monthly dummies; HSR: dummy for High Speed Rail.

R-squared: 0.899041; Adjusted R-squared 0.887629; Durbin-Watson stat: 0.843296;
*,** significant at the 5 or 1 per cent level.

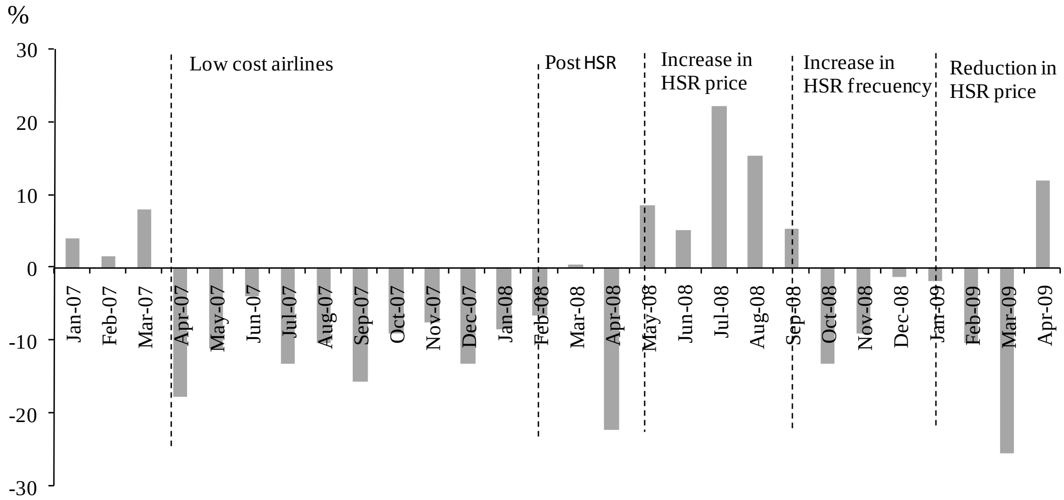
Table 4. **Madrid-Zaragoza (commercial flights)**

Variable	Coefficient	Std. Error	t-Statistic
T	0.098	0.16	0.598539
D1	9	15	0.597563
D2	5	15	0.341518
D3	16	15	1.054459
D4	8	15	0.518867
D5	17	15	1.142293
D6	14	15	0.885964
D7	9	15	0.605989
D8	-25	15	-1.638183
D9	11	15	0.687313
D10	32	16*	2.069965
D11	24	16	1.546399
HSR	-157	12**	-12.75281
C	228	12**	18.27449

T: month; D1-D11: monthly dummies; HSR: dummy for High Speed Rail.

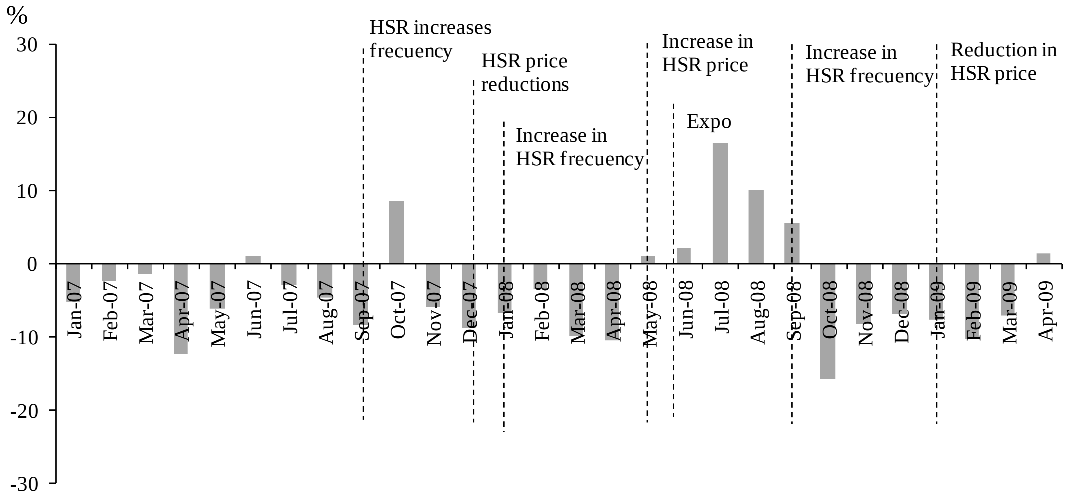
R-squared: 0.839659; Adjusted R-squared: 0.821534; Durbin-Watson stat: 0.626277; *,** significant at the 5 or 1 per cent level.

Figure 5. **Madrid-Barcelona (scheduled bus services)**
Changes in demand per month (base year: 2006)



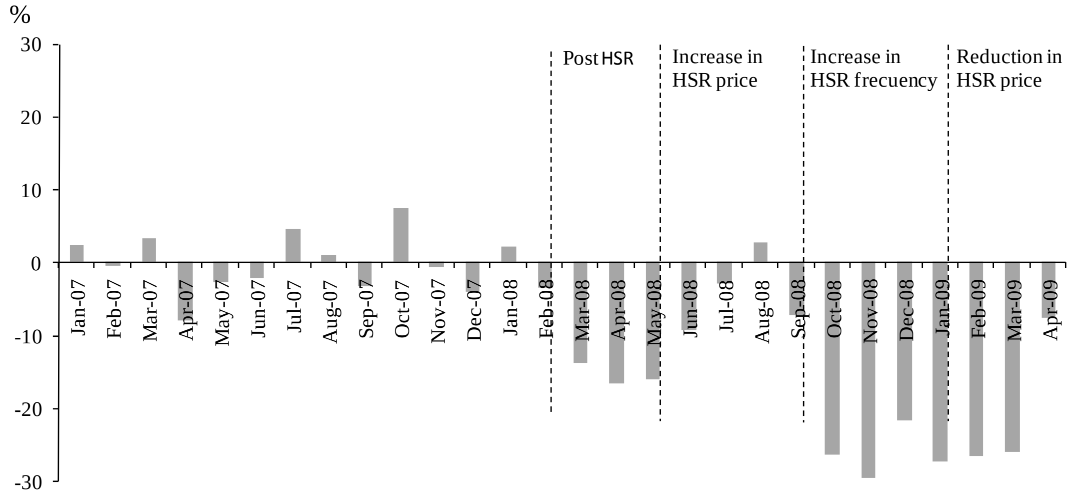
Source: built from data provided by FENEBUS.

Figure 6. **Madrid-Zaragoza (scheduled bus services)**
Changes in demand per month (base year: 2006)



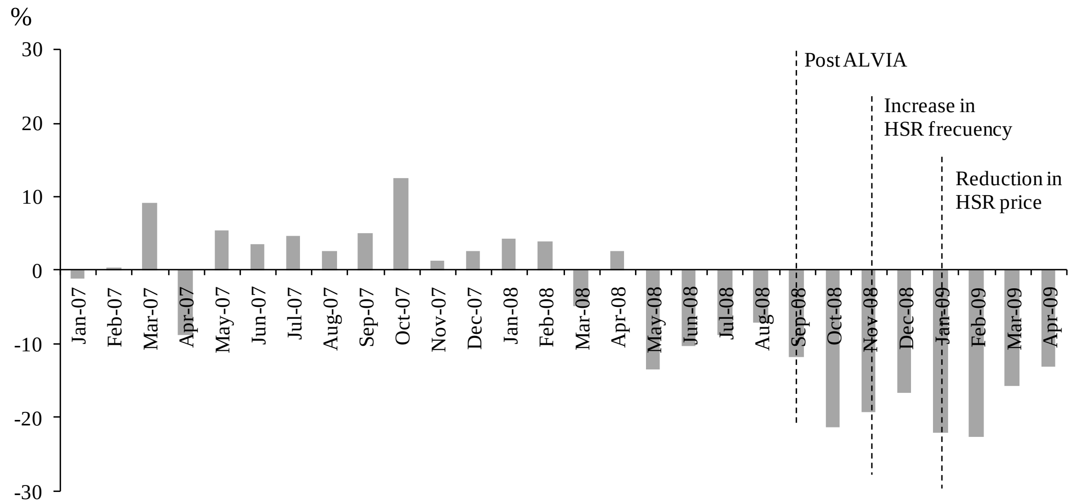
Source: built from data provided by FENEBUS.

Figure 7. **Zaragoza-Barcelona (scheduled bus services)**
Changes in demand per month (base year: 2006)



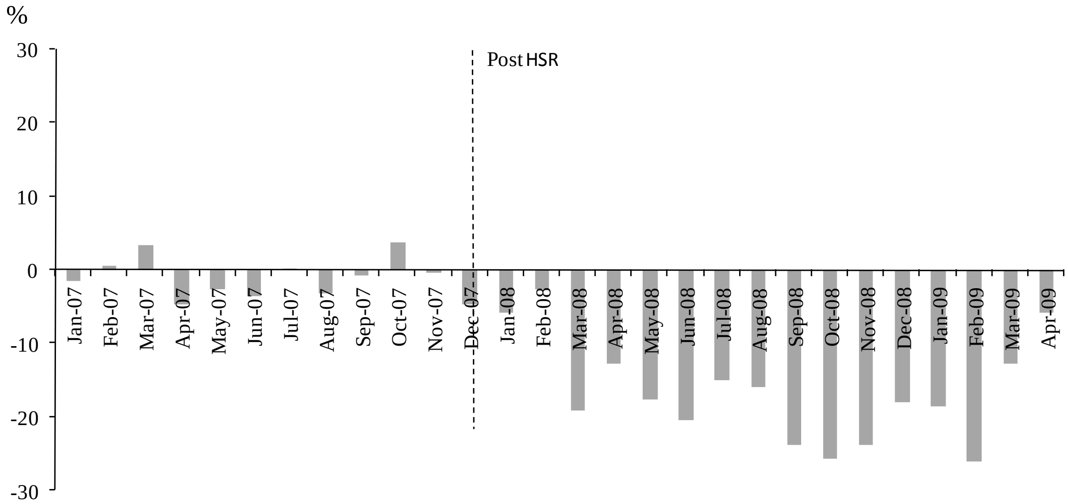
Source: built from data provided by FENEBUS.

Figure 8. **Madrid-León (scheduled bus services)**
Changes in demand per month (base year: 2006)



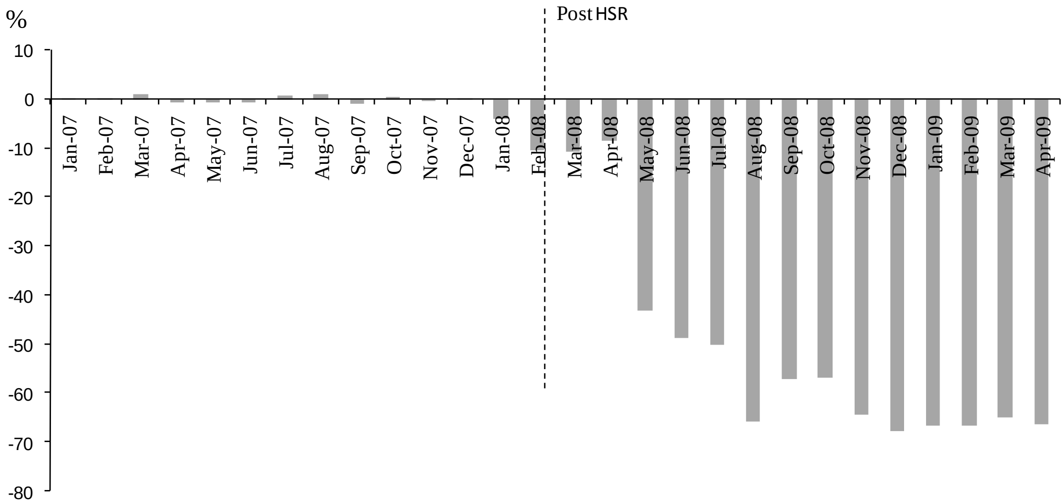
Source: built from data provided by FENEBUS.

Figure 9. **Madrid-Valladolid (scheduled bus services)**
Changes in demand per month (base year: 2006)



Source: built from data provided by FENEBUS.

Figure 10. **Lleida-Barcelona (scheduled bus services)**
Changes in demand per month (base year: 2006)



Source: built from data provided by FENEBUS.

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NOTES

1. Transport policy priorities have changed over the past decades. In the 1960s, the emphasis was on network and capacity expansion; from the 1970s onward, efficiency was more important than new construction; from the 1980s onward, the negative externalities of transport emerged strongly; in the 1990s, the focus was on the potential of new technologies for network improvement (Vreeker and Nijkamp, 2005).

2. It is not unusual for the construction of HSR in low demand corridors to be defended on the basis of optimistic traffic projections.

3. With a NPV>0 and in the case of "accept-reject".

4. An explanation of the time (and quality) advantage of HSR over air transport is contingent on differences in security procedures, and it should not be taken for granted that these differences will remain as they are.

5. We assume that the price is equal to, or greater than, the marginal cost in the new transport mode.

6. This argument can be extended to conventional rail services negatively affected by the introduction of HSR.

7. We shall not discuss here which type of pricing criteria should be followed. For a discussion of the justification of short-run *vs* long-run marginal cost pricing in transport, see Rothengatter (2003) and Nash (2003). The effects on HSR prices when infrastructure investment costs are included in prices can be seen in de Rus (2008).

8. This second level has been widely analysed in the economic literature (Laffont and Tirole, 1993; Bajari and Tadelis, 2001; Guasch, 2004; Olsen and Osmundsen, 2005).

9. Cost overruns are common in large infrastructure projects and it has been shown that the deviation is not only explained by unforeseen events (Flyvbjerg *et al.*, 2003).

10. The implementation of the user-pays and the polluter-pays principles and the reduction of public expenditure have significant political costs (Sobel, 1998). Downs (1957), Niskanen (1971) and Becker (1983), have often assumed that legislators attempt to maximize electoral support. Even if re-election may not be the primary factor motivating their legislative behavior, it is still true that legislators react in predictable ways to the electoral costs and benefits of their choices. Thus, legislators will favour actions that increase the probability of their being re-elected over decisions that lower it (Sobel, 1998; Robinson and Torvik, 2005).