RAIL INFRASTRUCTURE PRICING FOR INTERCITY PASSENGER SERVICES IN EUROPE: POSSIBLE IMPACTS ON THE RAILWAYS COMPETITIVE FRAMEWORK

Rosário Macário
CESUR, Instituto Superior Técnico, Universidade Técnica de Lisboa
TIS.PT, Consultores em Transportes Inovação e Sistemas

P.F. Teixeira
CENIT-Center for Innovation in Transport, Technical University of Catalonia (UPC) Barcelona

M. Sánchez-Borrà
CENIT-Center for Innovation in Transport, Technical University of Catalonia (UPC) Barcelona

A. López-Pita
CENIT-Center for Innovation in Transport, Technical University of Catalonia (UPC) Barcelona

C. Casas Esplugas
CENIT-Center for Innovation in Transport, Technical University of Catalonia (UPC) Barcelona

ABSTRACT

At the beginning of the 90's, the European Union initiated a railways reform with the aim to face the decline of railway transport, as well as to increase railway competitiveness and interoperability at European scale. The First Railway Package of this reform focused on the split between infrastructure management and operation and, therefore, on the establishment of pricing systems. Due to lack of straight definition, the application of the Directives on infrastructure charges in the different European countries has given rise to a large spectrum of charging systems. It is a direct consequence of the differences in the charging philosophies (MC –marginal cost, MC+ - marginal cost with mark-ups, FC –Full Cost recovery, etc.), the charging types (single tariff, two-parts tariff) and the parameters (or variables) chosen for defining the amount of the charge in each particular case.

This paper analyses the rail infrastructure charges in 23 European countries from the point of view of the parameters used for defining them. The analysis deepens the knowledge of qualitative differences between these countries' pricing structure. Furthermore, it analyses its consequences in the total amount of the charge to be paid by passenger services running through links considered to be the best national railways relations in each one of the countries studied. Concerning the qualitative analysis, forty-six different types of variables were identified for the whole of the systems analysed. With regard to the quantitative field,

calculations reveal that infrastructure charges range from 14,6 €/train-km to 0,6 €/train-km for “comparable” national links.

The last part of this paper discusses the weight of those fares for the use of infrastructure for intercity rail passenger services with regard to its competitor mode. Results from an analysis of 100 national and international links allow drawing some conclusions on the possible impacts of railway infrastructure pricing on the railways competitive framework in Europe.

INTRODUCTION

The European railways are currently in a transitory stage, which should lead them to the complete liberalization of the sector, characterized by a non-discriminatory system. This transitory stage is marked by the introduction of rail infrastructure pricing systems aimed at controlling the operation of Railway Undertakings making use of the infrastructure managed by Infrastructure Managers.

This paper analyses qualitatively and quantitatively the charging schemes introduced in 23 European countries with the aim to conclude on how the current situation with regard to charging can have an influence on the development of the European high speed railways network. These 23 countries comprise the EU countries (with the exception of Cyprus, Malta, Greece and Ireland), plus Switzerland and Norway.

The paper is structured so that it presents, firstly, a brief summary on the railway infrastructure pricing framework in Europe, as well as on the current charging schemes. Secondly, it deepens the knowledge of qualitative differences between the pricing structures of 23 European countries and analyses their consequences in the total amount of the charge to be paid by passenger services running through high quality national railways relations. Finally, it discusses the weight of these tolls for the use of infrastructure for intercity rail passenger services with regard to its competitor mode, and draws some conclusions on the possible impacts of railway infrastructure pricing on the railways competitive framework in Europe.

CURRENT CHARGING SCHEMES. LARGE SPECTRUM OF POSSIBLE PRACTICES

In the nineties the EU initiated a new era in the railway field. This new era could be called the “era of community legislation”, since it is characterized by the definition of the so called “Railway Packages”.

The main objectives of the First Railway Package (appeared in 2001 and consisting of Directives 2001/12/EC, 2001/13/EC and 2001/14/EC), are to improve competition, to create more and better international rail freight services, and to improve the efficient use of infrastructure capacity; all this by means of a compulsory split, at least in the accounts, between infrastructure and operation management (European Parliament, 2001), and the introduction of a charging scheme.

The introduction of a charging scheme is aimed at regulating the use by operators of the rail network managed by infrastructure managers. Directive 2001/14/EC provides details on principles for setting charges. However, the definition of principles is not accompanied by a straight definition on how they should be implemented. Therefore, the application of the directive on infrastructure charges in the different European countries has given rise to a large spectrum of charging systems. It is a direct consequence of the differences in the charging philosophies, the nature of the charging regime (nature of the tariff) and the parameters chosen for defining the amount of the charge in each particular case.

A survey performed by ECMT (2005) showed the existence of the abovementioned variety of charging systems, derived from the choice of charging principles and charging regimes by the different IMs.

It is undeniable that the charging philosophy adopted as well as the nature of the tariff applied have an influence on the definition of the rail infrastructure charges currently applied in Europe. Nevertheless, on a qualitative level, it is the parameters used to justify the amount that will be charged to operators that gives us more information. Furthermore, the parameters chosen differ from one country to another to such an extent, that it can be affirmed that there exists no couple of European countries applying exactly the same parameters.

Given the importance of the choice of the parameters used for the rail infrastructure pricing, and the lack of studies on the subject, this paper deepens the knowledge of qualitative differences between 23 European countries' pricing structure and analyses their consequences in the total amount of the charge to be paid by passenger services running through high quality national railways links.

QUALITATIVE DIFFERENCES BETWEEN THE PRICING STRUCTURES OF 23 EUROPEAN COUNTRIES

In order to carry out a qualitative analysis on the pricing structures applied in the 23 European countries selected, some work had to be done beforehand, namely the creation of a database on infrastructure charging systems for the geographical framework in study. This database was created with the aim of having a tool allowing synthesizing and systematizing all the information on rail infrastructure charging, for a later qualitative analysis. Information was obtained from published network statements for the year 2006, or 2005 when a later version was not available.

The synthesis and the systematization of the information of all the countries analyzed allowed defining, for the European framework:

- The variables used for rail infrastructure charging in Europe
- The categories in which the variables/parameters of the concepts charged can be classified
- The concepts charged

The definition of the variables was done for 20 out of the 23 countries analysed. The three countries excluded, namely Estonia, Hungary and Lithuania, had either still not published a network statement or such a document was only available in the official language of the country. The analysis of the data allowed to identify 46 variables (see table 1) for the set of countries studied. These variables were identified for the minimum necessary services for running a passenger train. That is to say, possible variables defining ancillary services, complementary services, additional services and other services such as, for instance, heating and air-conditioning are not included in this list. These 46 variables are, in certain cases, measuring units; in other cases, they represent more qualitative aspects, such as the type of traffic (distinction between passenger traffic and the traffic of goods) and the timetable period, among others.

Table 1: Variables used by the European railway charging systems

CLASSES OF VARIABLES	SUB-CLASSES OF VARIABLES	VARIABLES
Type of infrastructure used	Network	- Category/Type of line/Network - Admissible load on rail - Speed of the section
	Specificities	- Concrete relations - Special infrastructure (bridges,....)
	Stations	- Station category - Distinction departing trains, arrival, ….
Type of allocation requested	Slot	- Type of slot requested - Slot - Slot-km
	Traffic	- Transport contract (number of trips requested) - Level of traffic (number of train-km/year)
	Time period	- Annual period - Time period - Nocturnal period
	Duration of the reservation	- Year
	Transport	- Special transport conditions - Level of running priority - According to the number of people and per trip
Type of service	Actors	- Rail Undertaking (RU)/Type of railway undertaking
	Field	- Geographical zone/Charging zone - Type of traffic (distinction passengers/freight) - Domestic/International/Regional/High speed…
Type of rolling stock used	Train characteristics / caused wear	- Type of train - According to mobility/type of traction unit - Train speed - Use of titling technology - Train's weight - Number of pantographs of the train - Number of bodies/boxes of the train
Service offered (runs)	Route	- Km covered (Total length) - Train-km - Seat-km - Tonne-km or Gross tonne-km - Number of trains/Movement of trains
	Stops at stations	- Stop/Stations/Arrival or departure at a station - Minutes (at a station/node) - Number of passengers
	Performance indicator	- Performance regime/Delay/Minutes - Saturation, temporary and local bottlenecks - Traffic density
Type of traction	Type of traction	- Electric/diesel traction
	Consumption (measuring units used)	- KWh consumed - Electric train-km - Diesel liters consumed - Day

The 46 variables identified were grouped in six categories (see table 1), relating to:

- The type of infrastructure used: it groups charging variables that define the network, that characterise the track or the stations, or that relate to network specificities, such as the existence of railway bridges.
- The type of allocation requested: this category is composed of charging variables related to slots, the traffic expected, the time period, the duration of the reservation and the characteristics of transport.
- The type of service: it includes variables that refer to the actors involved or the service domain.
- The type of rolling stock used: it groups charging variables that characterize trains and the wear and tear they cause.
- The service offered (runs): it includes variables relating to the circulation itself.
- The type of traction: it groups variables referring to the type of traction and the energy consumption.

With regard to the concepts charged, an analysis of the network statements allowed to see that infrastructure charges defined or collected by IMs are received under eight different concepts, namely:

- Access
- Capacity reservation
- Train movement
- Energy/electricity
- Information
- Maintenance
- Security
- Congestion

It is on the basis of these concepts that IM try to cover a part or the totality of their total infrastructure expenditures, according to the charging philosophy adopted. All the concepts presented are not taken into consideration by all IM. Indeed, some of them have chosen to perceive infrastructure charges using the least number of possible concepts (such is the case of Finland). On the contrary, some other countries opted for a broader variety of concepts. Nevertheless, attention has to be drawn to the fact that in no case the number of concepts considered is higher than 4.

Figure 1 shows the relative weight of the different charging concepts that intervene in the railway charging system of some European countries, in the case of the best national intercity passenger links of the countries where it is possible to clearly separate the charge attributed to each concept. The total amount of charges takes into consideration only the minimum charges indispensable to be able to run a train. Common patterns can be distinguished (even if the differences between countries are evident). Indeed, the most part of the amount of charges perceived by IM are perceived under the concepts of access, capacity reservation and train movement.

The authors tried to find a connection between the 46 variables identified and the concepts charged. Table 2 presents, for each one of the 20 national charging systems analyzed, the number of variables used for calculating the charge attributed to each concept. According to the results of the analysis there seems to be a greater level of precision, i.e. a higher number of variables, for those concepts for which the charge is more important in terms of money.

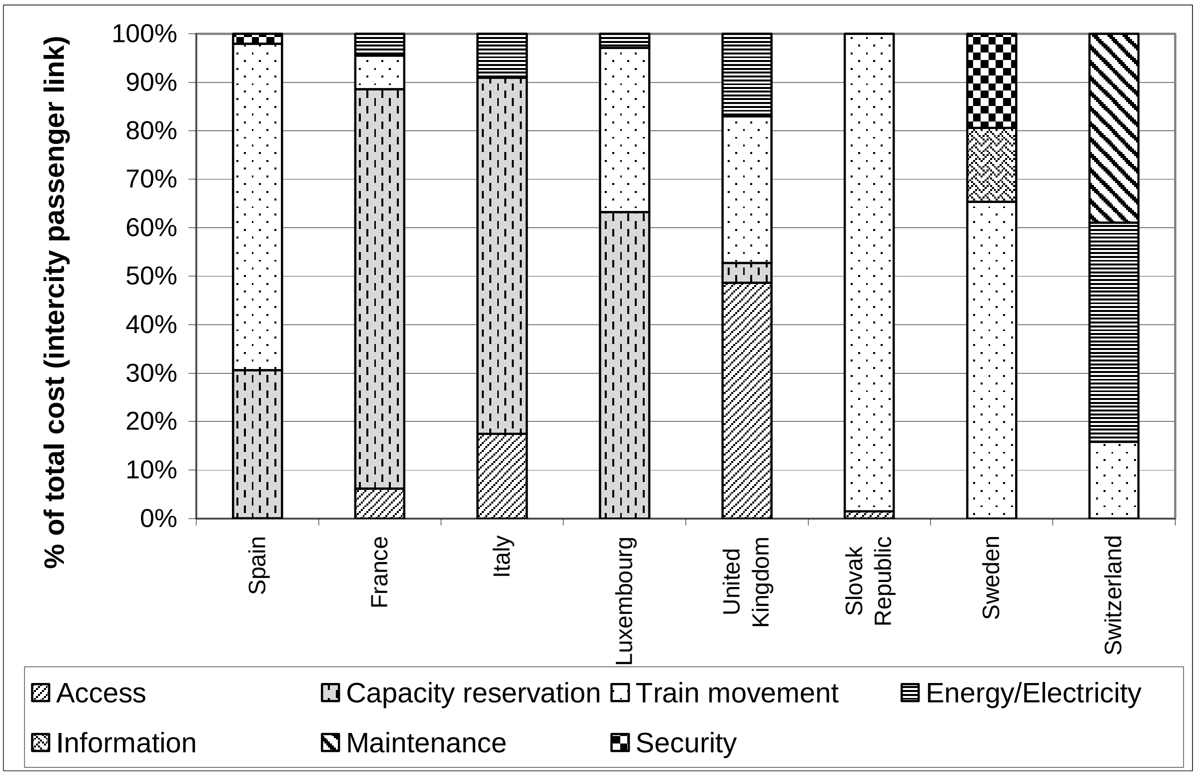

Figure 1: Relative weight of the charging concepts that intervene in the railway charging system of some European countries.

Table 2: Number of variables used in each European country for the calculation of the charge attributed to each concept

COUNTRIES / CHARGING CONCEPTS	Germany	Austria	Belgium	Denmark	Spain	Finland	France	Italy	Latvia	Luxembourg	Norway	Holland	Poland	Portugal	United Kingdom	Slovak Republic	Slovenia	Sweden	Switzerland	Czech Republic
Access	0	0	9	4	2	0	1	2	0	0	0	5	0	0	3	3	0	0	0	0
Capacity Reservation	0	0	0	4	5	0	3	1	0	1	0	0	0	0	2	0	0	0	0	0
Trains Movement	7	8	10	5	9	3	3	12	5	5	6	1	6	4	1	5	6	4	6	6
Traction Energy Used	0	0	0	0	0	0	3	3	0	7	0	0	0	0	3	0	0	3	5	0
Information Provided	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Maintenance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Security	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Congestion	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Total number of concepts charged	**1**	**2**	**2**	**3**	**4**	**1**	**4**	**4**	**1**	**4**	**1**	**2**	**1**	**1**	**4**	**2**	**1**	**4**	**3**	**1**

Table 3: Number of variables used in the different European charging systems, according to the categories (classes of variables) previously defined

COUNTRIES / CLASSES OF VARIABLES	Germany	Austria	Belgium	Denmark	Spain	Finland	France	Italy	Latvia	Luxembourg	Norway	Holland	Poland	Portugal	United	Slovak Republic	Slovenia	Sweden	Switzerland	Czech Republic
Type of infrastructure used	1	2	4	2	3	0	1	3	1	0	1	1	1	1	0	1	2	1	2	1
Type of allocation requested	2	0	2	1	5	0	1	2	0	2	1	0	0	0	1	1	1	0	1	0
Type of service	2	1	1	1	1	1	2	2	2	1	1	1	1	1	3	1	1	1	2	1
Type of rolling stock used	2	1	0	0	0	0	0	3	0	4	0	0	3	0	1	0	1	1	0	1
Service offered (circulation)	0	5	3	2	4	1	1	3	1	5	3	3	1	1	1	3	1	1	3	2
Type of traction	0	0	0	0	0	1	1	0	1	1	0	1	0	1	2	0	0	2	1	1
TOTAL number of variables considered	**7**	**9**	**10**	**6**	**13**	**3**	**6**	**13**	**5**	**13**	**6**	**6**	**6**	**4**	**8**	**6**	**6**	**6**	**9**	**6**
Number of classes of variables considered	**4**	**4**	**4**	**4**	**4**	**3**	**5**	**5**	**4**	**5**	**4**	**4**	**4**	**4**	**5**	**4**	**5**	**5**	**5**	**5**

Finally, the number of classes of variables considered for the calculation of charges was analyzed (see table 3) in order to have an order of magnitude of the conceptual coverage degree of each pricing system. Out of the 46 variables identified for the rail charging European framework, the most part of the countries use between 6 and 13 variables, which can be grouped in 4-5 categories (out of the 6 categories defined).

PRACTICAL RESULTS OF CHARGING HETEROGENEITY REGARDING PASSENGER INTERCITY SERVICES

In the precedent section we saw that important qualitative differences do exist between the current European rail infrastructure charging systems. This section analyses to what extent these differences have an impact on the economic level, i.e. if big differences between the tolls to be paid by a train covering a given national European high-quality link and another one exist.

According to previous works (ECMT, 2005), values for infrastructure charges in different European countries can vary widely from less than 0,5€ per train-km to up to 4€ per train-km, in the case of passenger services. However, values for particular time periods or specific lines (such as high-speed lines) might give rise to much higher charging values, as discussed by Crozet (2004).

Since average values are somehow difficult to compare, given the particularities of each network, a study on the infrastructure charge in a specific and comparable origin-destination link for each country was developed. The criterion adopted was to choose the best intercity passenger link (in terms of commercial speed) in each country, which corresponds in many cases to the most relevant intercity link of the country. Figure 2 shows the national links selected for comparison in this study.

1	Austria	Wien – Salzburg
2	Belgium	Bruxelles – Liège
3	Czech Republic	Praha – Brno
4	Denmark	København – Esbjerg
5	Estonia	Tallin – Narva
6	Finland	Helsinki – Turku
7	France	Paris– Lyon
8	Germany	Frankfurt – Köln
9	Hungary	Budapest – Debrecen
10	Italy	Roma – Firenze
11	Latvia	Riga – Rezekne
12	Lithuania	Vilnius – Šiauliai – Klaipeda
13	Luxembourg	Belgian border – French border
14	Netherlands	Amsterdam – Maastricht
15	Norway	Oslo – Trondheim
16	Poland	Warszawa – Katowice
17	Portugal	Lisboa – Porto
18	Slovak Republic	Bratislava – Zilina – Poprad Tatry
19	Slovenia	Ljubljana – Maribor
20	Spain	Madrid – Sevilla
21	Sweden	Göteborg – Stockholm
22	Switzerland	Genève – Lausanne – Berne – Zurich
23	United Kingdom	London – Newcastle

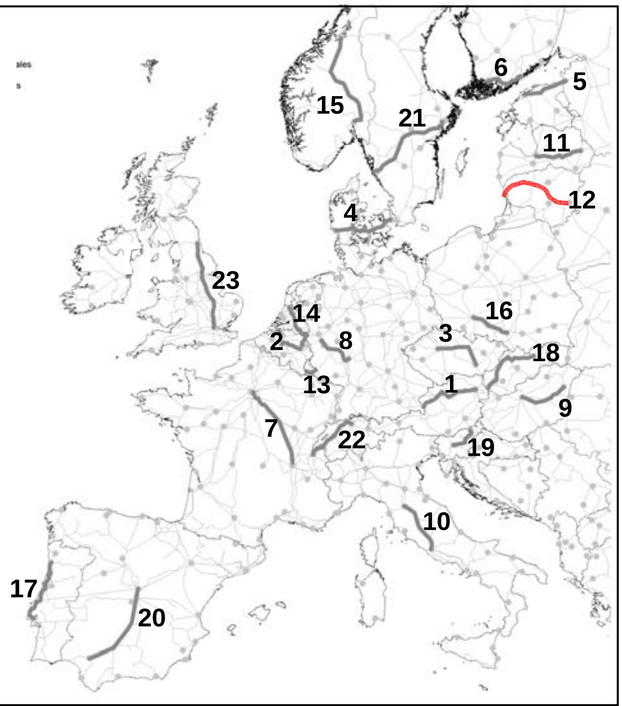

Figure 2: List of the national links selected to compare infrastructure charges for an intercity passenger train in Europe.

Hypothesis and assumptions on how to calculate the tolls were the following ones for all the links analyzed:

- Hypothesis on vehicle characteristics: train equivalent to a French high-speed train TGV Duplex, with single composition, 500 seats and a total weight of 430 ton.
- Hypothesis on stops: only terminals were considered, i.e. intermediate stops were not taken into account in order to ease the charges calculation procedure.
- Timetable considered: rail infrastructure charges were calculated as the average of both outward and comeback journeys (taking place at 8 a.m. and at 6 p.m., respectively) in order to take into consideration timetable periods with different charging values, where such differentiation exists.

The results obtained (see figure 3) confirm the existence of a very important variation on the amount of infrastructure charges to be paid on comparable European high-quality passenger links.

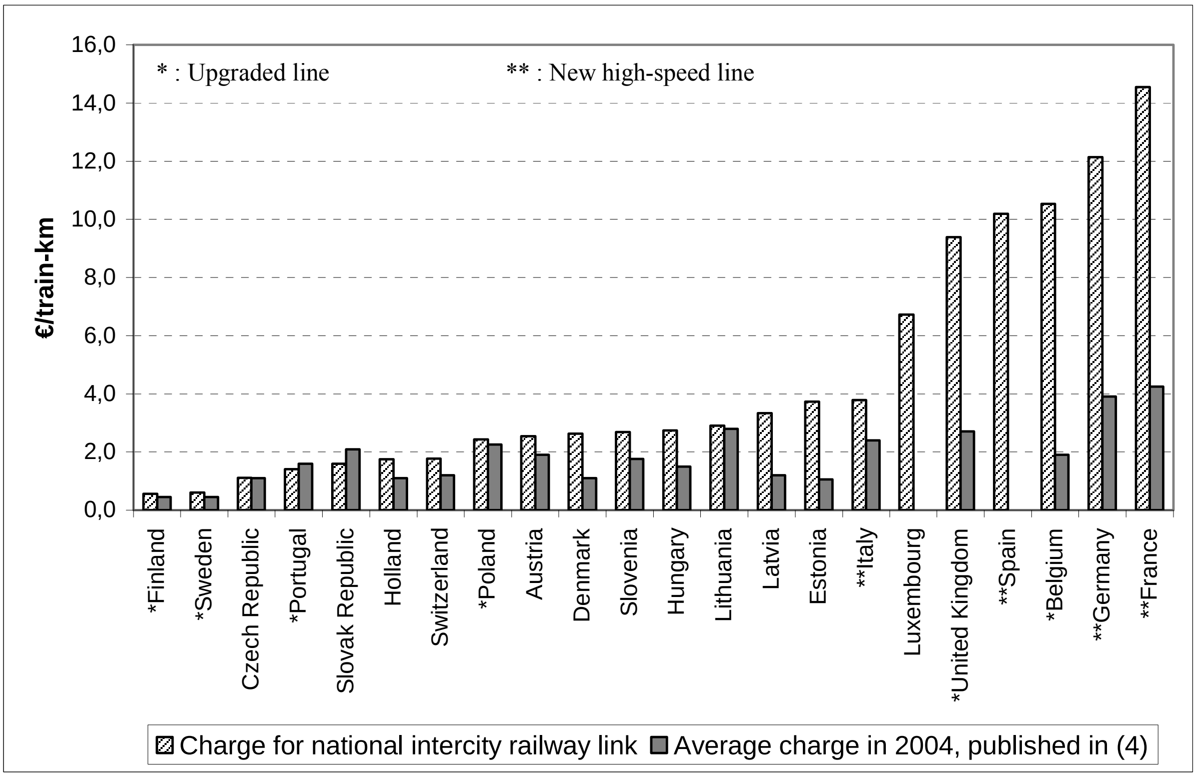

Figure 3: Charges for the use of infrastructure for the best national intercity passenger links in the European countries studied (comparison with average charges published in (4)).

Quantitatively, the following remarks can be made:

- For an intercity train running on a conventional line, charges vary from 1,1€/train-km in the Czech Republic to 3,7€ in Estonia, or even to 6,7€/train-km in a small section in Luxembourg.
- For an intercity train running on an upgraded line, the charge varies from 0,6€/train-km in Sweden to 9,4€/train-km in the United Kingdom. These variations are observed even if both links have an equivalent commercial speed of 150 km/h.
- For an intercity train running on a high-speed line, charges vary from 3,8€/train-km in Italy to 14,6€/train-km in France.

When comparing these results (obtained for 20 national links of reference with 2005-2006 values) with average access charges (including passenger trains, freight trains and trains running on every type of line) published by ECMT (2005), considerable differences can be observed (see figure 3). These differences are higher for the links where the calculated charges are the highest, which are at the same time the links with better service performances in terms of commercial speed. The existence of these differences justifies the interest of having chosen equivalent services to be able to really "compare" infrastructure charges heterogeneities.

One of the reasons that could explain the fact that infrastructure charges are higher for trains running on new lines than for those running on conventional lines is, probably, the quality of the performances offered by such a service. Indeed, new lines are more expensive than the rest of lines, but they offer in return the possibility of reaching more important commercial speeds. Concerning the connection between speed and rail charges for the different types of infrastructure, from figure 4 it can be affirmed that:

- It is difficult to establish a link between commercial speed and the toll for conventional lines, possibly because of the great variability in the coverage rate of the total cost of these charges.
- The toll for new lines seems to be more sensible to an increase of commercial speed.
- Upgraded lines are less sensible than new lines to an increment of commercial speed. Furthermore, infrastructure charges are notably lower for conventional lines, for a commercial speed close to the one offered by new lines.

To get deeper into the analysis, the study was enlarged, evaluating 100 representative national and international links all over Europe (most relevant O/Ds), covering the geographical area shown in figure 4.

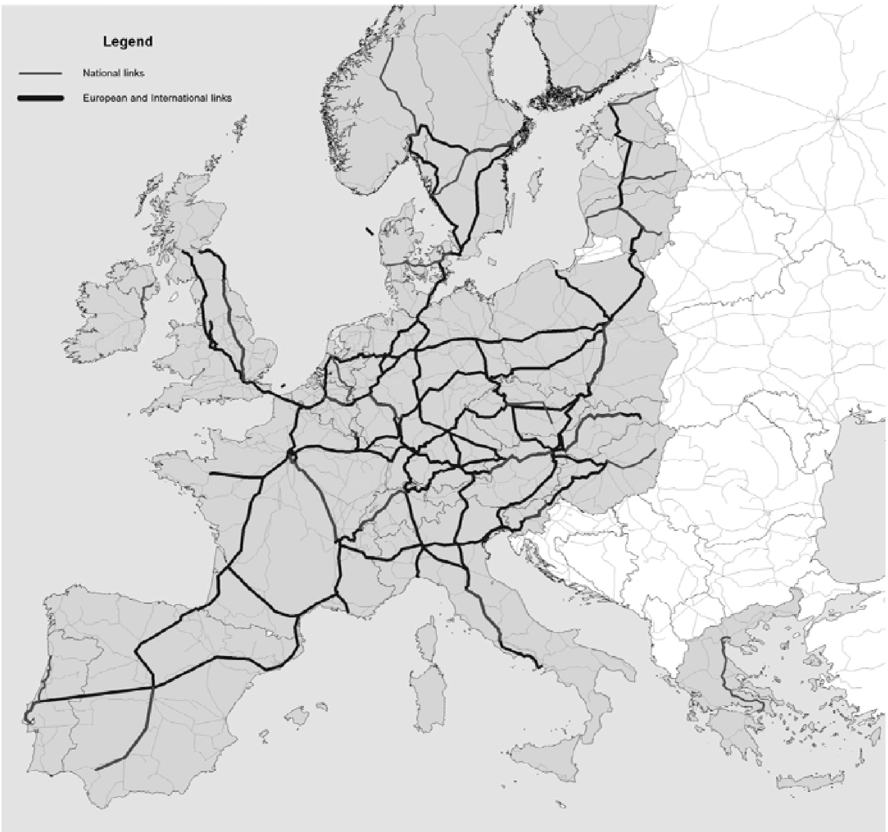

Figure 4: National and international links selected to compare infrastructure charges in Europe (total of 100 O/Ds)

Results on the correlation between the resulting infrastructure charge and commercial speed of the links analyzed are shown in figure 4.

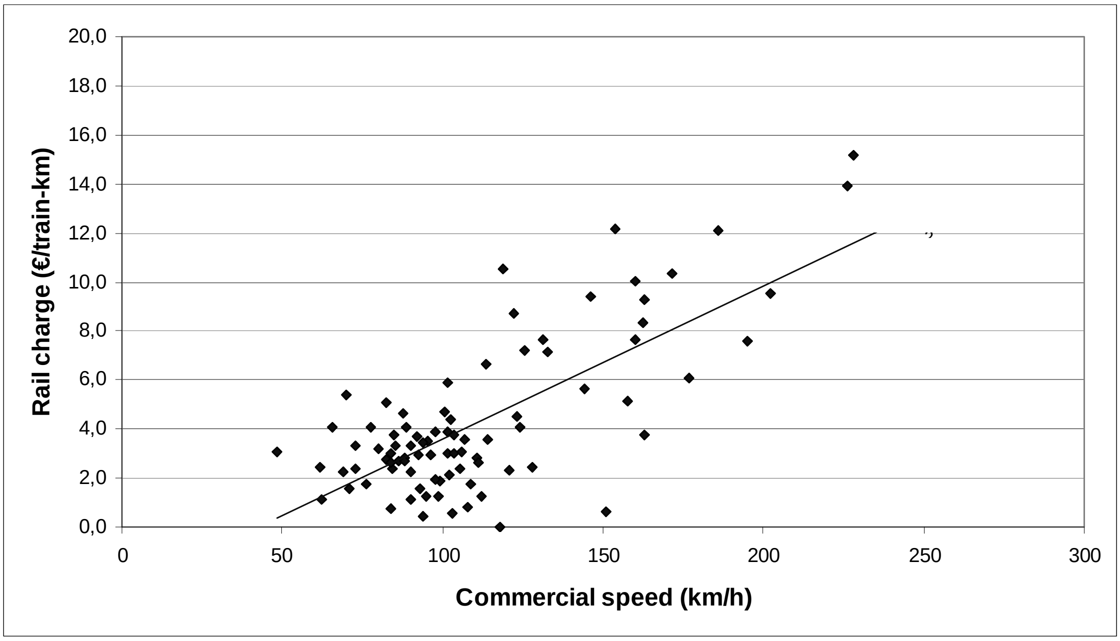

Figure 4: Railway charges (in €/train-km) with regard to the commercial speed (in km/h) in 100 European national and international links

Results confirm the difficulty to find a direct correlation between infrastructure charges and one of the relevant factors of quality: the commercial speed of the link. However, for links with commercial speeds over 130 km/h it can be deduced a tendency to find increased tolls for increasing speeds.

WEIGHT OF INFRASTRUCTURE CHARGES FOR INTERCITY RAIL PASSENGER SERVICES WITH REGARD TO THE AIR MODE

In order to analyze the possible impacts on the railways competitive framework of the heterogeneity of infrastructure charges presented in the precedent section, the authors compared the ratio charges/revenues for the rail mode with the same ratio for the air mode of the selected national passenger links. Coach services were excluded from the comparison, since the amount of the ratio for this mode of transport is negligible compared with the values for the other modes.

The calculation of the ratio required the establishment of new assumptions, concerning the calculation of revenues for both rail and air modes. The hypotheses adopted were the following ones:

- Capacity of the vehicles: 500 seats for the train (TGV Duplex); 150 seats for the airplane (A320).
- Load factor: 65% for the train; 70% for the airplane.
- Tariffs: 2nd class tariff, obtained considering the returning ticket, for the train; tourist tariff (selling prices available one week before the travelling day), obtained considering the returning ticket, for the airplane.

These hypotheses were verified with research and sensitivity analysis.

The comparison of the ratios charges/revenues for the rail and the air modes is presented in table 4 (only for links with commercial speeds over 100km/h). It can be observed that:

- There exists a huge variation of the toll/revenues values for the railway mode with regard to the air mode
- The ratio toll / revenue for rail mode can vary from 1% up to 45%, while for air mode it can go from 7% to up to 60%
- The toll / revenue rate tend to be higher for the rail mode comparing to air mode when the commercial speed allowed by the infrastructure is higher (i.e. when its capability for competing is increased). In other words, considering the characteristics of the infrastructure one can note that in new infrastructures, which allow the runs of high-speed trains, railways have tolls/revenues ratios higher than those for the air mode for a same link.

Table 4: Comparison of the railways (% toll/revenues) ratio against airways (% toll/revenues) ratio

Range of commercial speed	Relation	Rail % toll/revenues(*)	Air % toll/revenues(*)	$\frac{(\%\ \text{toll/revenues})_{rail}}{(\%\ \text{toll/revenues})_{air}}$
From 100 to 150 km/h	Wien-Nürnberg	8,7%	63,1%	14%
	Paris - Roma	27,6%	6,9%	398%
	Warszawa – Berlin	22,9%	12,5%	183%
	Warszawa - Wroclaw	32,5%	17,7%	183%
	Amsterdam - Berlin	10,3%	20,6%	50%
	Madrid - Bruxelles	8,9%	6,8%	130%
	Zürich - Warszawa	8,6%	16,4%	52%
	Paris – Strasbourg	13,6%	25,4%	54%
	Warszawa - Poznan	19,4%	37,5%	52%
	Genève-Zurich	4,3%	25,1%	17%
	München-Stockholm	7,9%	6,6%	121%
	Lisboa-Porto	8,2%	16,4%	50%
	Paris – Hannover	16,8%	10,3%	163%
	Firenze – Milano	15,9%	45,8%	35%
	Oslo-Trondheim	0,0%	17,7%	0%
	Athinai-Thessaloniki	0,0%	23,3%	0%
	London - Edinburgh	12,2%	22,1%	55%
	Hamburg –Wien	12,9%	61,3%	21%
	Madrid-Barcelona	29,9%	46,8%	64%
	Warszawa-Katowice	13,6%	30,2%	45%
	Paris – Amsterdam	17,7%	12,9%	138%
	Barcelona – Séville	39,2%	26,7%	147%
	Hannover-Frankfurt	11,0%	40,7%	27%
	London-Newcastle	10,8%	18,5%	58%
From 150 km/h	Göteborg-Stockholm	1,0%	53,1%	2%
	Paris - Rennes	22,6%	17,2%	131%
	Paris – Genève	32,9%	24,0%	137%
	Rome-Florence	13,8%	43,3%	32%
	London - Bruxelles	33,8%	15,5%	219%
	Paris – Bordeaux	22,0%	19,4%	114%
	Lyon – Marseille	25,2%	22,5%	112%
	Madrid-Séville	28,2%	12,6%	225%
	Paris-Lyon	44,1%	27,4%	161%
	Paris – Marseille	41,9%	18,4%	228%

This facts and the important ratio of toll on total revenues for high-speed services (up to more than 40%) makes think that rail pricing systems and principles might have an important impact on the way high-speed railway can face air mode in some corridors, particularly for distances (lengths) over 600 to 1000 km. The infrastructure charge weight is therefore a key issue regarding the on-going development of the high-speed network and the feasibility of international high-speed services in Europe.

One possibility to overcome the penalty suffered by railway services (when distances tend to make it more difficult to overcome the competition of air mode) is to establish pricing schemes in which the mark-ups are not only established for each section of a given line, but also based on the origin/destination of the service (i.e. closer to a Ramsey pricing scheme). As an example, the use of the Paris-Lyon corridor would not cost the same for a Paris-Lyon route than for a direct service Paris-Marseille or Lille-Marseille.

CONCLUSIONS AND CURRENT RESEARCH

The experience on the application of the first railway infrastructure pricing systems in Europe confirms that they stand out for their complexity. Indeed, very important differences exist both in the nature and the number of parameters used by IM to define the amount of toll (as it has been mentioned, in the European framework 46 variables have been identified for the charging of rail infrastructure).

A quantitative analysis showed that rail charges range from 3,8 €/train-km to 14,6 €/train-km for new railway lines in Europe. These differences can be even higher for international links, since the development of international services could also be penalized by the definition of the time periods (peak hour, normal hour, off-peak hour), or the application of access charges in some countries, among other factors. Furthermore, different charging schemes over an international corridor can cause a dilemma: on the construction of a new international link, when applying different pricing philosophies and cost recovery principles on two different countries the result is that the State Budget of one country will be financing a greater part of the social and economical benefits of the international link.

Regarding the weight of infrastructure toll on total revenues from railway undertakings it can also vary widely from 1% to up to 45%.

Finally, regarding at the competition between intercity rail passenger services comparing to air mode, it was found that, although infrastructure charges tend to be lower on absolute value, railway charges weight on total revenues tend to be higher than those found for the air mode in links where commercial speeds are higher than 150 km/h (e.g. links where travel times becomes competing regarding air mode).

To improve the attractiveness of high-speed intercity services (particularly in international links in Europe) when competing with the air mode in large distances, a possible way is to introduce a variation on the charges on a given high-speed section depending on the origin/destination of the train that uses the infrastructure.

ACKNOWLEDGMENTS

The authors would like to thank the support and collaboration on the study performed of the International Union of Railways (UIC) specifically of I. Barrón and M. Leboeuf, as well as the collaboration of J.P. Arduin and J. Ni from the Transportation Research Institute (TRI).

REFERENCES

Adif (2005). Declaración sobre la red. January 2005 edition.

Adif (2005). Declaración sobre la red. Anexos. January 2005 edition.

AEA (2005). Traffic figures. European airline traffic. Association of European Airlines, August, September, 21 October, 30 November, 22 December 2005.

AEA (2006). Traffic figures. European airline traffic. Association of European Airlines, 28 February 2006, 4 April 2006, 25 April 2006, 6 June 2006, 6 July 2006.

AENA (2005). Guía de tarifas. Aeropuertos españoles y navegación aérea 2005. January 2005.

AŽP - Public agency of rail transport of republic of Slovenia (2005). Annex 3/2. Survey maps of railway lines and stations. Edition de décembre 2005.

Banedanmark (2005). Network Statement 2006. May 2005 edition.

BV – Banverket. Network Statement Part 1(2) (20060108–20060619 (T05.2)).

CFL – Société Nationale des Chemins de Fer Luxembourgeois (2005). Document de Référence du Réseau 2006.

Crozet, Y. (2004). European railway infrastructure: towards a convergence of infrastructure charging? International Journal of Transport Management **2**, 2004, pp.5–15.

DB Netz AG (2005). Network Statement. DB Netz AG Marketing/Distribution.

ECMT -European Conference of Ministers of Transport (2005). Railway Reform and Charges for the Use of Infrastructure. OECD publishing, 130pp., ISBN 928210351X, OECD code 752005081P1, November 2005.

European Parliament (2001). Directive 2001/12/EC of the European Parliament and of the Council of 26 February 2001 amending Council Directive 91/440/EEC on the development of the Community's railways.

Finnish Railway Administration, Traffic System Department (2004), Finnish Network Statement 2006. Publications of Finnish Railway Administration. F2/2004. Helsinki, 2004. ISBN 952-445-110-7, ISSN 1459-3831.

INFRABEL (2006). Document de Référence du Réseau 2005-2006. DRR 2006 – version du 2006-01-09.

JBV – Jernbaneverket (2004). Network Statement 2006. Edition de décembre 2004.

LDZ – Latvijas Dzelzcelsh (2005). Network Statement 2006. Public usage railway infrastructure manager. Edition de Juin 2005.

NEA et al. (2005). European railways administrations, institutions and legislation (ERAIL). Final Report. Country monographs. Part A & Part B. Transport research and Training, the Netherlands, June 2005.

Network Rail (2004). Network Rail, Operating planning. Network Statement (Summer 2004, Autumm 2004 and 2005 Timetables. Version 1.4, décembre 2004.

ÖBB Infrastruktur Betrieb (2006). Network Statement 2006. Structure and Contents. Edition de Janvier 2006.

ÖBB Infrastruktur Betrieb (2004). Track access. Product Catalogue 2005. Appendix 3 to the Track Access Contract.

Office of Rail Regulation, ORR (2003A). Railways Act 1993. Access charges review 2003. Notice: Track access charges – Values of"RI" and "AG". March 2003 edition.

Office of Rail Regulation, ORR (2003B). Track usage price list. December 2003 edition.

Office of Rail Regulation, ORR (2003C). Appendix Q: Traction electricity price list. December 2003 edition.

Office of Rail Regulation, ORR (2003D). List of Capacity Charges Rates. December 2003 edition.

Office of Rail Regulation ORR (2003E). Schedule of CC terms. December 2003 edition.

Office of Rail Regulation, ORR (2004A). Schedule 7: Track Charges. April 2004 edition.

Office of Rail Regulation, ORR (2004B). Access charges reciew 2003: Regulator's approval of Network Rail's proposed financing arrangements. March 2004 edition.

Opodo (2006). Web page, URL www.opodo.fr

Oresundsbron (2006). Web page, URL http://osb.oeresundsbron.dk

PKP Polskie Linie Kolejowe S.A. (2005A). Cennik na rok 2006. December 2005 edition.

PKP Polskie Linie Kolejowe S.A. (2005B). Załącznik nr 1 do "Cennika na rok 2006. Stawki jednostkowe opłat za usługi podstawowe udost_pniania linii kolejowych PKP Polskie Linie Kolejowe S.A.", December 2005 edition.

ProRail B.V. (2005). Network Statement 2006. June 2005 edition.

REFER EP (2005). Network Statement 2005. 1st Addenda. April 2005 edition.

RFF (2004). Document de référence du réseau ferré national. Horaire de service 2006. 16 December 2004 edition.

RFI – Rete Ferroviaria Italiana SpA (2004). Network Statement. December 2004 edition.

SBB –Schweizerische Bundesbahn (2005). Catalogue de prestations Infrastructure 2006.

SZDC (2004). Railway Infrastructure Administration, state organization, hereby issues the Network Statement. Ref. no. 6461/04-OŘ.

ŽSR – Železnice SR, Railways of the Slovak Republic (2005). Network Statement. Approved by Director General of the Railways of the Slovak Republic. Ref. No. 1430/O410.