

# The economic regulation of railway networks: A worldwide survey

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## 1. Introduction and aims

In the field of transport, the presence of vertical integration between infrastructure and services, the complexity of the networks, the relationship between state intervention and privatization tendencies together with the historical and political context make regulation a very difficult task. The inherent monopolistic nature of rail infrastructure is characterized by indivisibilities and economies of scale and scope; hence, regulation is needed to prevent monopoly exploitation, to reduce asymmetry of information, to guarantee non-discriminatory access to any essential facilities and to monitor performance of service provider (OECD, 2005; ECMT, 2005).

This paper aims at presenting different approaches to the problem posed by the natural monopoly of railways infrastructure through the in depth analysis of a sample of 20 countries. The paper follows a previous one focused on the highway sector (Beria et al., 2015), based on the same concept and structure. The paper is structured as follows. Section 2 briefly recalls the previous comparative studies on this topic. Section 3 introduces the three parts of the desk survey carried out and the countries analyzed. Section 4 compares the various network management models, Section 5 discusses the main regulatory aspects, and Section 6 focuses on the regulatory institutions. Finally conclusions are drawn.

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## 2. Existing comparative studies

Extensive researches have been done in the field of railways regulation. In terms of comparative studies, there are many researches which analyze the pros and cons of railways reforms, ranging from a single-country case study to international benchmarking. Here we will recall some of them, in particular referring to cross-country comparisons of regulatory models.

Nash (2008) provides an analysis of the EU railway policy evidencing its limits and merits together with the development of three organisational models among EU countries. In a further work, Nash et al. (2013), examining the subsidy levels and trends in passenger and freight traffic in Germany, Britain and Sweden, point out the absence of elements to support the view that “the reform process has worked better in the other two countries than in Germany”. Pittman (2013) discusses the reform of the former Soviet Railways evidencing the strong role of both the governments and the incumbent. Gómez-Ibáñez and de Rus (2006) review several scholars’ contribution concerning the experiences with railway reforms in Europe, North America and Latin America. Two approaches to introduce competition in the sector are in particular analyzed, namely the debates on unbundling and on privatization. The issue of vertical separation is also discussed in OECD (2013), together with the frameworks resulting from railway reforms in a sample of countries, and in Roland Berger (2012) which also looks at the optimal setup of a rail system and the main lessons learned considering a sample of countries outside Europe. Beria et al. (2012) describe and assess the regulatory frameworks in four European countries focusing in particular on the actual level of liberalization and its implications. Finger and Rosa (2012) presenting the railway systems in six European countries focus on their institutional approaches and the main regulatory issues. Thompson and Kohon (2012) discuss the history and analyze the approaches and the outcomes observed in Latin America and North America, while Campos (2001) focuses on the rail restructuring processes in Brazil and Mexico. In a series of World Bank studies, comparisons among countries with an increasing private participation in railways are provided in order to review the outcomes of those processes. In particular, Sharp (2005) focuses on the performance of railway concessions in Latin America, Williams et al. (2005) discuss the outcomes in Australia and New Zealand while Bullock (2005) shows the results in Africa. In general, these three studies evidence the positive results in particular for freight railways, underlining also the problems posed by concession schemes. CER (2011) presents experts’ contributions on reforms within their country, recalling the steps of the reforms, how they have been implemented, their successes together with their limits.

Among the single-country cases, Link (2012), provides an analysis of the outcomes of the German model with a focus on unbundling, public infrastructure financing and access charge regulation together with the problems that have slowed the process. Alexandersson and Rigas (2013) recall the Swedish deregulation process together with other European railway reforms showing the impact of market opening and other structural changes in the sector. In the following paragraphs, we will contribute to the debate by means of a systematic comparison of 20 countries.

## 3. The framework of the survey and the sample

We built a database on railway regulation including 20 countries<sup>1</sup> from all continents. The database is structured in three parts, focused on:

1. general and quantitative aspects of railway infrastructure;
2. specific regulatory aspects, namely the current regulatory framework;
3. regulatory bodies, namely *who* regulates the sector.

The desk activity focused mainly on academic documents and institutional data (e.g. governmental websites, national agencies reports, etc.). Moreover, for most of the countries, at the end of the process the information collected have been reviewed by a national expert. The countries have been selected considering the role and importance of the railway network, their economic relevance and peculiar regulatory features, their geographical location and, in some cases, the availability of information. We gathered data for the following countries (Fig. 1): Australia, Austria, Brazil, Canada, Chile, China, France, Germany, Great Britain, Hungary, Italy, India, Japan, Mexico, Russia, Spain, South Africa, Sweden, Turkey and United States. Therefore, the sample includes the largest countries in terms of economic power, population (55% of the world population) and extension of the railway networks. Urban and suburban railway networks have not been taken into account.

Australia, Russia, United States, Canada and China have been chosen due to their extensive networks, the role of the freight sector and their weight in the world’s economy. India, has been included for the same reasons and because of the current status of its railways which, until now, have not undergone any major reform thus it will face relevant challenges in the next future. South Africa represents the most dynamic economy in its continent and its rail network is essential to connect ports to urban and industrial hinterlands. Brazil, Chile and Turkey show an increasing role as global players and railways can contribute to this successful path. Finally, Japan and the European countries have been selected due to their peculiar and different railway history that shows a wide diversity of options used by governments to reform their rail sector.

<sup>1</sup> It must be noticed that some countries could have ongoing processes thus the reform process may need more time to show its effects.



Fig. 1. Countries analyzed.

## 4. General aspects

### 4.1. Characteristics of the sample

In all the main countries, the largest part of the railway network was built in the second part of the 19th and the first half of the 20th century. After the Second World War parts of the network were closed because of declining traffic and increasing costs. In 1964 Japan opened its first high speed rail line for passengers while in Europe the first high speed line opened in Italy in 1977 and other European countries (particularly France and later Spain) followed and gained leadership in the following decades. China opened its first high speed line in 2003 and now has the longest network in the world (around 8500 km of tracks). The total length of the networks (Fig. 2) in the surveyed countries amounts to about 817,000 km, United States, China and Russia have the longest ones. In terms of number of network operators, the United States, due to its freight-dominated market with many vertically integrated companies, ranks first followed by China (where joint venture scheme increased the number of network operators), Germany and Italy owing to their high number of local railways.

Demand values amount to 2.920 billion passenger-km and 9.642 billion ton-km. The shares of freight traffic, measured in tonkm/(tonkm + paxkm), vary extensively among the sample ranging from less than 10% in Japan, to 20–30% in south-western passenger-dominated European countries to the higher values of Austria, Hungary, Germany (due partly to their geographical location in the middle of Europe) and Sweden. In the remaining countries of the sample, freight volumes constitute more than 70% (Fig. 3), reflecting the history of the network which, in many cases, was originally built to serve mining areas.

### 4.2. Network management models

A first element considered in the analysis is the approach toward the monopoly problem entailed by the management of railway infrastructure (Gomez-Ibanez, 2009). The traditional model is that of direct provision through a branch of the state (an agency or a ministry), either national or local (e.g. regions). Alternatively, networks can be managed by companies (totally or partially public, or private), usually under a concession scheme. Finally, some cases of private ownership (i.e. not conceded) exist. The national company/agency model applies to about half of the railway networks surveyed while the private provision model to more than one third (Fig. 4).

After being built and operated for a few decades by private operators, almost all the railway networks in Europe were nationalized in the first decades of the 20th century. There has been only one attempt to privatize the network, and it occurred in Great Britain in the mid nineties (Tyrrall, 2004; Glaister, 2006). However, after a few years of private management, Network Rail took again control of the track in the form of a “not for dividend company, still nominally private but dependent on government to guarantee its debts”<sup>2</sup> (Nash et al., 2013). In Sweden and Spain the track manager is an agency,

<sup>2</sup> On 1 September 2014 following a statistical change by the Office for National Statistics, Network Rail was reclassified as a public sector body.

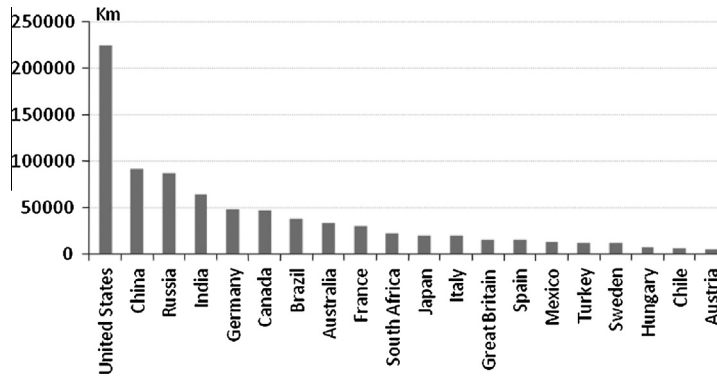


Fig. 2. Length of the networks [km] analyzed. Source: our elaboration.

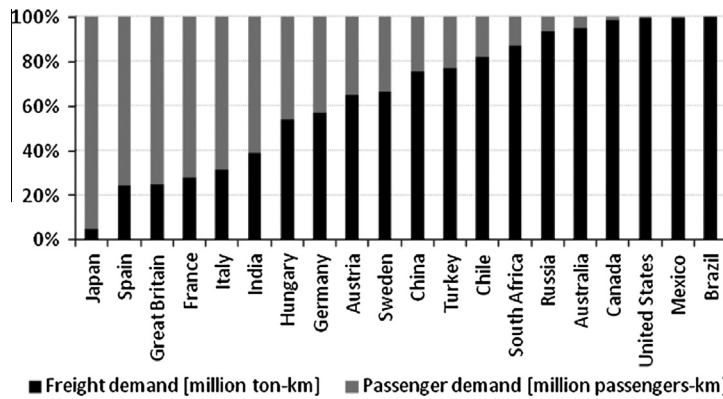
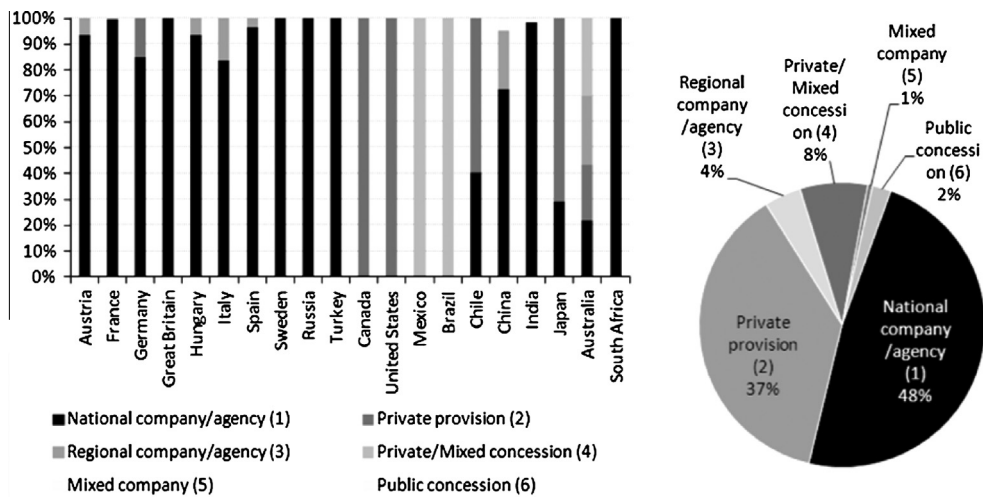


Fig. 3. Mix of railway traffic in terms of [tonkm/(tonkm + paxkm)]. Source: our elaborations.



(1 - 3) Company or public body controlled by national or local government that manages the infrastructure with no limitation in time (or very long concession)

(2 - 5) Private or public-private company that owns and manages the infrastructure with no limitation in time

(4 - 6) Private or public-private or state owned company that manages the infrastructure for a defined period

Fig. 4. Mix of railway networks management models [% of extension per country and total]. Source: our elaborations.

**Table 1**

Concessions: typology, duration and awarding mechanism (Source: our elaboration).

	Typology	Extension	Duration [years]	Tendering
Italy: national Network	Public	16.700	60	No
France – Great Britain: Eurotunnel	Private	50	99	Yes
France – Spain: LGV Perpignan–Figueres	Private	45	53	Yes
Mexico: national network	Private/mixed	12.997	50	Yes
Brazil: national network	Private	28.692	30	Yes
Brasil: future concessions	Mixed	10.000	35	Yes
India: Koncan Railway Corporation	Public	738	10	No
India: Kutch Railway Company	Mixed	301	32	No
Australia: Aurizon	Private	1.900	99	No
Australia: Brookfield rail	Private	4.400	49	No
Australia: John Holland Railway	Private	5.800	10	No
Australia: Genesee & Wyoming Australia	Private	3.100	50	Yes
Other cases		No or perpetual concession		

part of the State, while in the other European countries analyzed the network is managed by a separate Government owned company (Fig. 4). About 20% of the network is managed by local companies different from the national operator in Italy (all public) and Germany (mainly private). Only in the last decade, both in Russia and China, the management of railways has been separated from the government function and a government owned national company has been formed. In China, prior to 2013, the Ministry of Railways (MOR) managed more than 80% of the railway network and acted as the industry regulator. The 2013 structural reforms (Bordie et al., 2014) dissolved the MOR and moved policy and planning functions to the Ministry of Transport and Communications, and rail administration to the newly formed State Railway Administration (SRA). China Railway Corporation (CRC), was established to take over all commercial and operational functions including the management and maintenance of the national rail network (Hong, 2013). Moreover, in the last decades vertically integrated Joint Ventures entities based on public private partnerships (PPPs) are playing an increasing role as a result of the Ministry of Railway's intention to diversify rail infrastructure financing (Roland Berger, 2012). Australia has a highly heterogeneous situation with national companies, local companies/agencies, private concession and private provision, each accounting for about one-fourth of the network. For the most part, the railway networks in the United States and Canada are freight-dominated so they are owned and operated by private freight companies with a few exceptions of state or municipally owned track. According to Pittman (2013), this organizational model results in a "competition over particular pairs of origins and destinations (so-called *parallel competition*) and/or to and from particular origins and destinations (*source competition*)". In Chile, the reforms introduced in the nineties resulted in a peculiar structure. On the one hand the vertically integrated Northern Railroad was privatized including rolling stock and essential facilities without open-access clauses. On the other hand, for the rest of the network (Southern Railroad) a freight concession was established with freight services auctioned for 20 years to the private sector while the government keeps control of the essential facilities and still operates passengers services (Soto, 2010). A relevant presence of private subjects managing the infrastructure is also found in the passenger-dominated railways of Japan. In Brazil the railway network has been franchised through 12 concessions for a period of 30 years (extendable for a further 30) to private freight operators as a result of the liquidation of the former state owned national railway company (Estache et al., 2001). A similar pattern occurred in Mexico where the privatization process resulted in three regionally distinct concessions for the infrastructure (lasting 50 years) awarded to three (now two) vertically integrated companies which also included the right of exclusive train operation on the infrastructure for the first 30 years. Moreover, a terminal concession equally shared between the three companies and the government was created to provide competitively-neutral access to all operators into the large Mexico City market (ITF, 2014).

Concession schemes are increasingly used, not only to transfer managerial responsibility from the public to the private sector, but also to realize new infrastructure. This is the case of Eurotunnel's concession or the Perpignan–Figueres line between France and Spain, won by the specially formed TP Ferro consortium. A peculiar scheme is foreseen in Brazil where, for the next 30 years, the federal government foresees 12 construction and operation concessions for new railway projects totaling 10,000 km. Valec, the federal railway construction agency, will buy the capacity on these new routes and then sell it to shippers, independent freight operators and freight concessionaires (Railway Gazette, 2012). Finally, a couple of concessions have been awarded in India lasting respectively 10 years (to a public company) and 32 years (to a mixed company), while four concessions have been awarded to private companies in Australia lasting from 10 to 99 years. Italy is the only case (Table 1), among the ones considered, where the government owned infrastructure manager, Rete Ferroviaria Italiana (RFI), has a concession to manage the asset. Nonetheless, as a result of the structural changes of the national railway group occurred at the end of the nineties, the ownership of the network was transferred to the network operator (RFI, 2013). Therefore, RFI has a concession to manage the network despite being the owner of the asset. In the other countries, the networks are directly run by public operators without any concession, or by private subjects that have also built the network or got it through a concession.

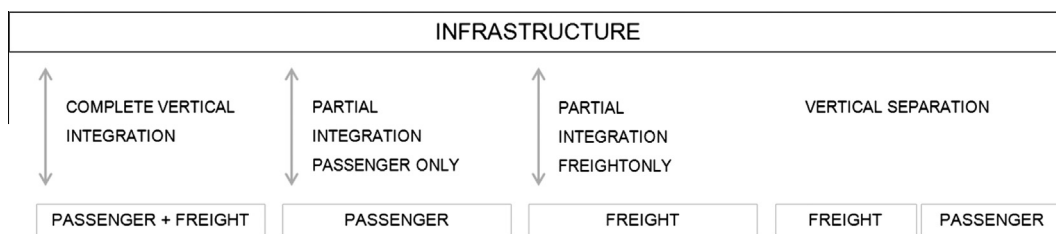


Fig. 5. Degree of vertical separation between infrastructure and services.

## 5. Regulatory issues

### 5.1. Separation between network and services

In an industry with complex dynamics between infrastructure and services, a crucial aspect is that of vertical separation. The degree of complementarity and common ownership of tracks and trains shape the costs and the organization of rail networks, but also provides an indication on the propensity to open the market whereas a liberalization process is ongoing (like in Europe). Although many scholars agree that vertical separation improves intra-rail competition (Emmanuel and Crozet, 2014), literature does not have yet a clear and shared view on the effects of the unbundling on costs (Link, 2012). Some authors (Kim and Kim, 2001; Shires et al., 1999) have shown that vertical separation is preferable to vertical integration in terms of cost reduction, while others (Bitzan, 2003; Jensen and Stelling, 2007) have shown the opposite. CER (2012) evidences how context characteristics (in particular traffic density) influence the effectiveness of the organizational model in terms of its impact on costs.

Out of a total of 46 network infrastructure operators included in the survey, 18 are vertically integrated companies (or groups of companies) managing both infrastructure and passengers/freight services and the others have some forms of vertical separation (Fig. 5).

The rationale of railway reforms in Europe foresees a distinction between infrastructure management and railway operations by separating accounting systems thus requiring different organisational entities<sup>3</sup> (European Commission, 2013a). Different models have emerged (Nash, 2008), namely complete separation of infrastructure from operations, separation of key powers of infrastructure operation and a holding company structure where infrastructure and train operations are part of the same holding company, but as separate divisions. Among the countries surveyed, the first model is applied in Great Britain, Sweden, Spain and in the case of the new line between France and Spain, the second one in France and Hungary while the so called German holding model is also applied in Italy and Austria. In France there is an artificial separation between SNCF (the railway operator) and RFF (the infrastructure manager) since the former performs network maintenance under management agreements with RFF through its subsidiary SNCF Infra (Emmanuel and Crozet, 2014). In Russia a series of reforms are progressively changing the framework. The management of railways has been separated from the government function through the creation of the government-owned Russian Railways Public Corporation (RZD), managing 99% of the network,<sup>4</sup> moreover subsidiary companies were set up and RZD property was transferred to them in preparation for a sale to the private sector. The first result has been the privatization of the freight railway subsidiary (Freight One), but long-term plans foresee an increasing role of private subjects also in the passenger sector (Roland Berger, 2012). In Japan, the 1987 reform introduced the model of horizontal separation through the split of the former public operator into six vertically integrated passenger companies (three private and three public) and a single freight company owned by the government that uses the network of the passengers companies (Kurosaki and Kawata, 2013). In Turkey a modernization programme has been introduced in 2013 in order to reorganise the vertically integrated railway company through the separation between infrastructure, passenger and freight operations. Two different entities will be established, the government owned railway infrastructure operator (National Railway Institution) and a joint stock company (TCDD Tasimacilik A.S) providing train services (Yilmaz and Ciner, 2014). In China and India all companies are vertically integrated with the governments strictly overseeing all the aspects of the sector. In the United States, Canada, Australia (two companies) and South Africa,<sup>5</sup> a vertically integrated company (infrastructure and freight services) hosts on its network also a very limited passengers service provided by a separate company (usually public owned). In the United States there is also the exception of the Northeast Corridor where this scheme is reversed: the passenger operator, Amtrak, is the owner of the network and charges access fees to private freight operators (Thompson and Kohon, 2012). This management scheme is also present in Japan, Southern Chile, and two state owned companies in Australia where vertically integrated passenger companies allocate a low share of the network capacity to freight operators.

<sup>3</sup> In particular the legislation requires that essential functions such as allocation of rail capacity, infrastructure charging and licensing must be separated from services operation to guarantee fair access to the market.

<sup>4</sup> Five different companies manage the rest of the network.

<sup>5</sup> This is the case of the national freight operator Transnet Freight.

## 5.2. Access to the network

In the traditional vertically integrated model, the same company provides services and manages the network while, in case of separation (even only formal), the track manager must allow the use of its tracks to any operator, under the payment of a charge to cover costs. The World Bank (2014) identifies two kinds of access regime: the *mandated track access regimes* which grants access to the whole (open access) or part of the network, and the *voluntary track access regimes* which requires a voluntary decision of the infrastructure manager (in compliance with the national legislation) to access the network.

Open access is problematic especially if the track manager also provides services as conflicts of interest may rise. In this case a sound economic regulation is deeply needed in order to guarantee a level playing field to all operators. As for freight services, open access is now common in all Western European countries, this is also the case of the largest part of the Australian network where railways reforms identified three ways (voluntary undertaking, certification and declaration) for third party operators to gain infrastructure access. As described by Fagan (2007), with the voluntary undertaking method, the owner of rail infrastructure proposes access rates, terms, and conditions for Australia Competition and Consumer Commission (ACCC) approval. Once approved, the owner can negotiate actual rates with rail operators. The certification method allows States to propose an access regime while the third approach involves a declaration for service made to the NCC (National Competition Council), then operators negotiate access rates with the service provider or, if no agreement is reached, through arbitration by the ACCC (Fagan, 2007). An open access regime will also be adopted for the new lines that will be built in Brazil (where currently track access is limited to certain routes, networks or specific operators). Moreover, there are a few cases where access is open at the normative level (such as Canada, the Southern part of the railway network in Chile and Turkey), while currently it is only formal. In Canada, according to the Canada Transportation Act, a railway company may apply to the national Transportation Agency for “the right to use the whole or any portion of the right-of-way, tracks, terminals, stations or station grounds of any other railway company” however a 2002 decision of the same Agency stated that “a statutory running right is an *exceptional remedy* that can be granted only if there is evidence of market abuse or market failure” (CTA, 2002). In Chile where the freight services have been conceded to a single operator, so far only another company has entered the market even if the regulatory scheme nominally allows new operators to enter (Kohon, 2013).

In the United States, nearly one-fourth of “Class I”<sup>6</sup> networks have more than a single operator under a *trackage right* regime; this agreement limits the access to the infrastructure only to its members (Thompson and Kohon, 2012). Another form of deal between operators is through the *haulage rights* where the owner of the railroad operates trains for another railroad in exchange of a fee. In Mexico the concession title generally grants the concessionaire exclusive operating rights over the lines involved in the concession, however *trackage rights* over specified lines of other concessionaires could be also included in the concession title (Allen, 2001). Also in Brazil vertically integrated operators are required to enter into reciprocal switching or, when this is not possible, they must quote unbundled rates and provide connecting service for joint hauls.

In the case of passenger services, open access for domestic services is already legally granted only in some European countries (Sweden, Great Britain, Italy, Germany, Austria, Hungary in the sample) and most of the Australian network.<sup>7</sup> Excepting for Italy, Czech Republic (not included in the sample) and Austria, where some private competitors of the former public monopolist hold a significant market share on the main network (on high speed in Italy), effective competition *in the market* is very limited or absent in the rest of the continent. In Sweden around 10% of the *profitable* intercity passenger are provided by private companies (OECD, 2013). In Germany, excepting for few routes operated by competitors, Deutsche Bahn still dominates the long-distance passenger segment (Bundesnetzagentur, 2013) where, since 2013, also coaches services are starting playing an important role. Finally, Spain is going to open the high-speed rail market to competition in the next future. In Great Britain operators are required to pass the *not primarily abstractive* (NPA) test before being granted access rights. The NPA test is passed if the new services are deemed not to be primarily abstractive of the incumbent franchisee’s revenue.

In each of the previous countries the market share of non-subsidized railway undertakings is lower than 5%. In France only the international market is opened to competition. Along the cross Channel connecting France and Great Britain rail market entry is possible at a normative level but until 2013 competition has remained closed *de facto* by the delay/refusal of standard rolling stock authorization (House of Commons Transport Committee, 2013).

No actual competition is present in Australia where only a private passenger operator provides long-distance interstate services. Finally in Japan, companies run some through trains into each other’s regions with track access fees agreed on a commercial basis, free of regulation (Boodoo, 2012).

## 5.3. Pricing method

In case of open access, or in any case of separation between infrastructure and services, track charges are applied by the network manager to the operators. These fees may have totally different purposes, not only cost recovery (this could be the case of privately owned rails), but also other goals such as internalization of social costs, congestion and scarcity control, support rail services or help on track competition (for example fixing charges below industrial costs). Infrastructure charges

<sup>6</sup> Railroad having annual carrier operating revenues of \$250 million or more after adjusting for inflation using the Railroad Freight Price Index developed by the Bureau of Labor Statistics.

<sup>7</sup> International cabotage is allowed in all EU since 2010 thanks to the 3rd railway package.

account for a significant proportion of the costs of a railway operator (Arrigo and Di Foggia, 2013a) thus they represent a crucial element to effectively boost competition. According to the European Commission (2013b), excessive infrastructure access charges may discourage new railway operators from entering the market. EU rules require track access charges to be set on the basis of direct costs, namely the cost directly incurred as a result of operating a train service (Directive 2012/34/EU).

A crucial element of the railway sector is the historical massive transfer of government subsidies both on the infrastructure (network maintenance or development, operating expenses) and service sides (public service obligations). The existence of positive externalities (pollution, congestion, economic and social aspects, etc.) is the principle historically used to justify these subsidies.

In most of the countries surveyed, in particular the European ones (Dehornoy, 2011; NERA, 2004; Perkins, 2005; Arrigo and Di Foggia, 2013b), public funds represent the main source for infrastructure investment<sup>8</sup> while access charges finance the majority of operations and maintenance costs. The intensity of the subsidies changes according to country specific transport policy and differences in market structures.<sup>9</sup>

Therefore pricing principle on which the different charging systems are based could vary. In Italy, according to the Transport Authority (ART, 2014), access charges on the high speed network should include not only operating costs but also the annual amount of the financial burden incurred by the network operator for investments on the high speed network not covered by government grants. On the other hand, on the traditional network, access fees cover only operating costs while maintenance costs are covered through government transfers (RFI, 2013). In Germany track access charging policy aims to recover a high proportion of railway infrastructure costs from train operating companies after receipt grants (ECMT, 2005; Calvo and de Ona, 2012). A similar approach is applied also in Hungary, Russia and on the Interstate network in Australia, where track fees cover a (generally small) part of the investments costs which are mainly funded through public funds. In Great Britain two types of track access charges are applied, the first one covers estimated infrastructure wear and tear cost while the second one is set to recover some fixed costs in the form of mark-up which are paid only by franchised passenger operators and freight operators (Bentley, 2014). In Austria, Chile (Southern Railroad), and Japan (freight services), track fee are based on operating costs while Sweden is the only country which includes environmental/accident costs in its charging methodology (Nash et al., 2013). In Canada and in the United States prices are set at full costs in case of voluntary agreements between freight companies while the public passenger companies (Amtrak in the United States and VIA in Canada) pay only for operating costs. Within the Australian state networks, charges vary between a lower bound that covers marginal costs and an upper bound that provides for recovery of long-term variable costs and rate of return on investment (Fagan, 2007). Finally, among the European countries surveyed, Great Britain, France, Italy, Germany, and Austria apply mark ups to take into account categories such as the time of the day or the presence of bottleneck, but generally they are not based on real industrial costs.

#### 5.4. Other regulatory features

Infrastructure providers are generally not subject to an ex-ante regulation aimed at obtaining efficiency in costs and consequently in the charges applied to the train operators. Charges are usually defined by the infrastructure manager itself or in accordance with the Ministry or another public agency. The license, as in the case of Network Rail in Great Britain, or a contract usually specifies a set of conditions under which the manager must operate the network. Among the countries surveyed, in Great Britain the Office of Rail Regulation reviews access charges and outputs of the infrastructure operator every five years according to a hybrid revenue/price form of incentive based regulation (FRC, 2013). Price-cap has been proposed but not yet applied in Germany (Link, 2012). Here, network operators are obliged to provide a minimum package of infrastructure access which includes services such as timetabling and traction and to provide and publish transparent and non-discriminatory rules for using infrastructure (Beria et al., 2012). Prices of services provided by vertically integrated operators (private provision or concession) are not usually regulated either. In Brazil concession contracts define the maximum price to be charged: ceilings vary according to the length of the haul, type of product and the geographic region served, in principle tariffs should be above the railroad's long run variable cost (Estache et al., 2001). In the United States, the *Staggers Act* in 1980 freed railways companies from controls terms, rates, tariffs and services (Thompson and Kohon, 2012). As pointed out by Cunningham and Jenkins (1997), regulatory intervention in the USA is possible only: (1) to remedy monopoly pricing for service from the origin to the destination or (2) to remedy or prevent anticompetitive conduct regarding joint services. As in the United States, in Mexico rates are defined by the concessionaires below a maximum which has to be registered with the Ministry of Transportation; it is required that rates are applied in a non-discriminatory way (Allen, 2001). A similar scheme is applied in Japan (Mizutani, 2012) where, the vertically integrated operators are regulated through

<sup>8</sup> European Commission (2014) estimates for European countries €34.5 billion investments in 2012 for the whole rail network (including high-speed). Concerning the conventional networks, these investments cover maintenance (29%), enhancement (36%) and renewal (35%) of the infrastructure. In the US the High Speed Intercity Passenger Rail Program funded, in 2009 and 2010, \$10.1 billion investments on the passengers rail network while private freight railroad funds the majority of the investments on their networks. In Russia, both the upgrading of existing railways (3 trillion roubles) and the construction of new lines (4.2 trillion roubles) will be funded mainly through public transfers according to the railway program up to 2030.

<sup>9</sup> Context characteristics (demand, modal alternatives, location peculiarities as the presence of mining areas) condition the attractiveness (for private subjects) and potentiality of a project, influencing its capacity to recover the costs through the fares.



**Table 2**

Network manager, safety and economic regulators (Source: our elaboration).

Country	Network manager (national network)	Safety regulator	Economic regulator
Australia	Multiple	Office of the National Rail Safety Regulator (ONRSR)	Multiple
Austria	ÖBB Infrastruktur AG	Bundesministerium für Verkehr, Innovation und Technologie (BMVIT)	Schienen – Control GmbH
Brazil	Multiple	n.a.	Agência Nacional de Transportes Terrestres
Canada	Canadian National + Canadian Pacific	Transport Canada	Canadian Transportation Agency
Chile	Southern Railroad and Northern Railroad	Ministerio de Transportes y Telecomunicaciones	Ministerio de Transportes y Telecomunicaciones
China	China Railway Corporation	Ministry of Communication + State Railway Administration	Ministry of Communication + State Railway Administration
France	Réseau Ferré de France	Etablissement Public de Sécurité Ferroviaire	Autorité de régulation des activités ferroviaires
Germany	DB Netz	Eisenbahn – Bundesamt	Bundesnetz Agentur
Great Britain	Network Rail	Office of Rail Regulation	Office of Rail Regulation
Hungary	MÁV Start	National Transport Authority – Department for Railway	National Transport Authority, Rail Capacity Allocation Office
Italy	Rete Ferroviaria Italiana	Agenzia Nazionale per la Sicurezza delle Ferrovie	Autorità di Regolazione dei Trasporti
India	Indian Railways	Chief Commissioner of Railway Safety	None: direct control of the ministry
Japan	Multiple	Ministry of Land, Infrastructure, Transport and Tourism	Ministry of Land, Infrastructure, Transport and Tourism
Mexico	Multiple	Ministry of Communication and Transportation	Ministry of Communication and Transportation
Russia	Rossijskie Železnye Dorogi	Federal Agency for Railway Transport	Federal Tariff Service – Department for transport regulation
Spain	Administrador de Infraestructuras Ferroviarias	Ministerio de Fomento Dirección General de Infraestructuras Ferroviarias	Comité de Regulación Ferroviaria
South Africa	Transnet	Railway Safety Regulator	n.a.
Sweden	Trafikverket	Transportstyrelsen	Transportstyrelsen
Turkey	Türkiye Cumhuriyeti Devlet Demiryolları	n.a.	n.a.
United States	Multiple	Federal Railroad Administration	Surface Transportation Board

yardstick competition scheme.<sup>10</sup> Based on the empirical results of Mizutani and Nakamura (1997), this form of indirect competition seems to have worked to some degree. In Canada there is no regulated maximum to what a railway can charge in its published freight tariffs or in confidential contracts while in South Africa the fares of Transnet group result from cross-subsidies between ports and rail services (Truen, 2008).

## 6. Regulatory institutions

As shown above, regulation may be needed to award concessions, set charges level and structure, manage conflicts, monitor costs of operation and in general to create a level playing field which ensures fair competition. Different forms of regulatory institutions exist, with various degrees of independency and with different sets of goals.

Depending on the national legislation, regulatory tasks could be assigned to separate institutions (Table 2). In France, Italy, Germany and Spain safety regulation, economic regulation, slot allocation and infrastructure management, are split among three different institutions, and a similar pattern occurs in Russia. In Britain and Sweden the economic regulator also regulates safety procedures while in Hungary allocation of capacity together with the definition of network access charges are carried out by the Rail Capacity Allocation Office (VPE) while regulatory and safety issues are handled in one organization (National Transport Authority) but independently from each other.

In China, the dissolution of the Ministry of Railways has ensured that policy making and regulation are now separated from asset ownership and service delivery (Bordie et al., 2014) with the Ministry of Communication and the State Railway Administration entrusted with regulatory powers (Zhongxi and Jianxiang, 2013). In Brazil the regulatory institution mainly supervises concession contracts and the transport of passengers and cargo while in Japan, Chile and Mexico regulatory tasks are currently carried out by their respective Ministries of Transport. In South Africa the only regulator currently operational is the Railway Safety Inspectorate with a number of different entities overseeing all the other issues of the sector (Truen, 2008). Unlike the majority of countries considered, India has so far refrained from major reform to its railway sector where the Ministry of Railways continues to operate the state-owned monopoly, Indian Railways (Bordie et al., 2014), acting also as industry regulator, except for safety oversight and railway rates appeals (World Bank, 2011). Finally Australia differs

<sup>10</sup> It is a virtual form of competition between similar regulated firms where the price the regulated firm receives depends on the costs of identical firms (Shleifer, 1985).

from the other countries surveyed in that it has more than one competent economic regulator<sup>11</sup> assessing access arrangements and arbitrating disputes among operators.

Concerning the nature of the regulator, eight are governmental and nine independent institutions, the same distribution applies to the sector overseen by the authority; in particular for the majority of countries the institution oversees all transport sectors while for the remaining ones it is focused on a specific transport mode.

## 7. Conclusion and further research

Declining traffic volumes, increasing inter-modal competition and historical inefficiencies of the sector have entailed the need for rail market reforms over the last decades. The survey evidenced how these reforms have structured the current frameworks for a sample of countries. In general, the role played by the governments in the infrastructure sector is still dominant. Nonetheless, the private sector, now highly involved in concession schemes or owning the network in few but important countries, has historically played an important role contributing to keep alive the infrastructure in areas with low or declining passengers demand, in particular freight operators. Excepting for Northern America and Latin America, Japan and Australia, the management of the national network is still largely in the hands of public subjects. Vertical integration between network and services is still present in many countries, in particular for national network. Vertical separation is often only formal since the ownership of both infrastructure and service is the same. In Northern America, South Africa and Australia (part of the network) a vertically integrated company manages the infrastructure and provides freight services, charging a separate (usually public) company providing passengers services for the use of the network. In Japan this scheme is reversed since vertically integrated passenger companies allocate minor shares of the network capacity to the freight operator. Access to the network is quite different among the countries analyzed, differing between freight and passengers services. Overall, open access for freight services is generally allowed while different degrees of freedom exist in setting agreements between operators for trackage and haulage rights. In the case of passenger services, domestic open access is legally granted in some European countries but effective competition in the market has been very limited until now evidencing the great deterring role of the incumbent.

Pricing methods differ among the countries, ranging from full cost recovery to social marginal cost pricing: where government companies manage the network, the share of investment costs recovered through track fees is generally very low due to massive subsidies received by the infrastructure manager. Excepting for Sweden, environmental external costs are not taken into account in setting prices. Some kind of price differentiation depending on time of the day and/or on the presence of bottlenecks is applied in Europe. In terms of regulatory issues, a license, or a contract, usually specifies the conditions that the infrastructure manager has to follow. Infrastructure providers are generally not subject to an ex-ante regulation and structured regulatory mechanisms are rarely applied. Finally, different roles have been conceived for the regulatory institutions, however, to date, their duties seem quite limited at least in terms of economic regulation.

The reforms introduced in the last decades have modified the historical railway framework as a result of the country specific approach to public policy, geographical context, transport system, economic situation, business and regulatory environment. Many issues remain open such as the optimal configuration concerning the unbundling between network and services, the pricing regimes, and the concession schemes.

Further researches are needed in order to provide empirical evidences concerning the results of the reforms taking into account all the dimensions (country characteristics, management, technology, regulation in terms of safety, work contracts, rail market, etc.) that can explain differences between performance indicators across countries.

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<sup>11</sup> Australian Competition and Consumer Commission for the main parts of the Australian interstate network, Essential Services Commission (State of Victoria), Queensland Competition Authority, Independent Pricing and Regulatory Tribunal of New South Wales, Economic Regulation Authority (Western Australia).

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