# THEORETICAL AND VIABLE CHARGING MODELS FOR RAILWAY INFRASTRUCTURE ACCESS: AN EUROPEAN SURVEY

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**Abstract**
This paper examines the pricing models for the use of the railway infrastructure in some European countries. A regulatory environment shall guarantee fair access to essential facilities, specifically in presence of vertically related markets and the existence of an essential facility provided only by one firm. This paper considers two pricing models classified according different principles: the model of marginal cost and the model of full cost. Given that the effective traffic does not influence the relevant fixed costs of the networks, managers will have expected curves of marginal cost firmly under the curves of average cost, and as a result, the current trade-off between the optimal use of the network and the optimal coverage of the costs. This paper states that countries where a marginal cost model is in use, the railway system has a smaller impact on public spending.

**Keywords**: Single market, access charges, infrastructure, transport economics, competition, Europe.

## 1. INTRODUCTION

One of the key purposes of infrastructure charges has been stated as being to endorse fair competition trough the efficient use of the infrastructure (Matthews *et al.*, 2009). Thus, an important component of policies aimed at promoting competition is a regulatory environment that may guarantee fair access to essential facilities. Specifically in presence of vertically related markets (the production or supply of final goods or services involves different activities from “upstream” to “downstream” that are linked to each other) and the existence of an essential facility provided only by one firm (Valletti & Estache, 1998). The policy of the European Commission indicates that charges for rail infrastructure should be related to the costs actually incurred, define incentives for more efficient use of the infrastructure, avoid discriminating against users, and allow public authorities to verify compliance with these objectives (Macário *et at.*, 2010). Theoretical models can be classified according to two different principles: the model of marginal



ISSN
2067- 2462

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cost (MC) and the model of full cost (FC). The MC model shows that unit fares reflect the additional cost a manager has to pay to host an additional train on the existing line. The FC model requires that the unit rates tend to average costs, and consequently the total rates shall go for the full coverage of operating costs. So, if we abide to the criterion of the MC, the unit charge will be below of the average cost, whereas the equivalence between average cost and unit charge is a necessary condition for a full cost recovery. If we adopt the FC principle, on the other hand, the unit charge will be higher than the marginal cost, giving origin to an allocative inefficiency and it will represent a relevant obstacle to the entry of the potential new operators. From the second half of the 90s there was the introduction of the access charges for the new EU members; the experience of those EU states has been showing how their approach has been a reasonable compromise between two aims: charging systems whose first priority was favouring an efficient use of networks and, as second aim, having an adequate level of coverage of the costs of the operator. The Scandinavian states, which were mostly faithful to such first priority, applied – and still apply nowadays – the MC criterion, thanks to which the network costs can be covered at 90 or even 95% through public funds. On the other hand, the FC model (access charges aimed at guaranteeing a high degree of coverage of the network management costs) has multiple counter indications: firstly, since it highly distanced from the marginal cost, it leads to negative effects in terms of allocative efficiency, discouraging a more intensive use of the network, and representing an entry obstacle to the new operators. Secondly, high access fares overload the balance sheets of the incumbent train transport societies, forcing States to give more substantial subsidies, with the justification of the public service obligation (as in the subsided public transport), even if PSO definition is wide, as reported in Regulation 1370/2007 "*PSO means a requirement defined or determined by a competent authority in order to ensure public passenger transport services in the general interest that an operator, if it were considering its own commercial interests, would not assume or would not assume to the same extent or under the same conditions without reward*". As a matter of fact some States simply reiterate the abstract definition contained in Regulation 1370/2007, or set out strategic objectives relating to continuity, regularity, environmental objectives, quality, accessibility and reasonable price (DLA PIPER, 2010). This kind of transferrals, when not awarded through invitations to tender open to all train operators (like in Britain and Scandinavia), represent a relevant alteration in the competition. In the end, it must be considered that State subsidies to the infrastructure manager are at beneficial to the entire train system, with no alteration of the competition, subsidies to a private operator – generally the dominant one, of State property – who is not clearly separated from the manager of the network, does create asymmetries with other competitors. A policy of high access charge to network risks, in many cases, of becoming an instrument to obstacle or avoid competition. If it is highly



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

improbable that, through the FC model, minor subsidies to the manager of the network will find compensations in more subsidies to the dominant operator of the transport service, one should ask himself which would be the trade-off for such compensations. If the infrastructure manager asks one extra Euro per train km as toll (compared to a benchmark country or to the EU average), what will the paying dominant operator receive from his government as extra? Unfortunately the available data (partial and not of easy comparison) do not allow a certain and univocal answer. Nonetheless, it can be argued with reasonable belief that Northern European countries, the Scandinavian countries in particular, by using the MC criterion, have operational costs inferior to the EU average costs, too. These reduced costs allow the manager of the networks to have public subsidies per network km, which are inferior to the average EU subsidies, even though the access charges are reduced. It can be stated, therefore, that in Scandinavian countries the small revenues from tolls are not funded from higher public spending, with a relevant benefit for the entire train sector.

## 2. BACKGROUND AND RELATED LITERATURE

In the specification of an essential facilities doctrine, OECD (1996) describes when the owner of an essential facility is mandated to provide access to that facility at a reasonable price. The concept of essential facilities requires the existence of two markets – upstream and downstream. Normally, one firm is active in both markets and other firms operates or wish to enter in the downstream market. EU rules, (European Commission, 2013), require track access charges to be set on the basis of marginal costs – the cost directly incurred as a result of operating a train service, specifically (i) charges for scarcity, although where a section of track is defined as having a scarcity problem, the infrastructure manager must examine proposals to relieve that scarcity, and undertake them unless they are shown, on the basis of cost benefit analysis, not to be worthwhile. (ii) Environmental costs, but only where these are levied on other modes. Otherwise, any differentiation of charges according to environmental costs may not raise the overall level of charges. (iii) Recovery of the costs of specific investments where these are worthwhile and could not otherwise be funded. (iv) Discounts but only where justified by costs; large operators may not use their market power to get discounts. (v) Reservation charges for scarce capacity, which must be paid whether the capacity is used or not. (vi) Non-discriminatory mark-ups but these must not exclude segments of traffic which could cover direct cost (Sánchez-Borràz, Nash, Abrantes, & López-Pita, 2010). Rail infrastructure is a natural monopoly and an essential facility required to provide transport services. In this case, regulation follows two aims: (1) to avoid discriminatory behaviour of the incumbent which would prevent competitors from market entry, (2) to control access charges for efficiency and to provide efficiency incentives which cannot be generated by the market due to its



ISSN 2067- 2462

monopolistic feature (Link, 2013). As an exception for specific investment projects only, higher charges can be set on the basis of the long-term costs of such projects, (European Commission, 2013). European Commission Directives 2001/12/EC and 2001/14/EC define a general framework for the establishment of charges for the rail infrastructure; however, enormous difficulties have arisen in calculating marginal costs and allocating the full costs of the infrastructure to cost drivers (Macário *et at.*, 2010). Szekely (2009) sheds a light on the transformation schemes in Europe so that it would be possible for countries to set up better policies to manage their efforts. The expenses of rail infrastructure costs are partly covered by the European governments and partly by the infrastructure managers through the infrastructure charges that operators pay to them for rendering services in the infrastructure they manage. Calvo & De Oña (2012) study a series of national charging systems and compare track usage costs and the charges that infrastructure managers apply to recover those costs. Provided that a common feature among all countries is the small portion of costs recovered via charges, they also examines the pricing levels applied to railway services in order to study the coherence between national charging systems and the charging principle on which they are based. They state that, generally speaking, the countries that adopt a full cost system recover more costs than those that adopt a marginal cost system.

The work of Holvad (2006) aims to provide an overview of railway reforms in Europe which at EU level was initiated by Directive 91/440, he also focuses on the background to the reform process, the legislative initiatives as set out in EC Directives and the implementation of the EC Directives in the EU Member States (Holvad, 2009). By the same token Beria et at., (2012) provide an analysis of the relationship between the State and the rail companies, network access conditions by operators, slot allocating and pricing schemes and how public service obligations are defined, financed and regulated. Nash (2010) underscores that whilst the emphasis of European Union rail legislation to date has been on freight, measures such as separation of infrastructure from operations, infrastructure charging regimes and regulation have major implications for the passenger sector. Despite differences between charging systems for high-speed lines, important mark-ups above marginal costs are applied by all the systems analysed and that common features between them can be established (Sánchez-Borràs & López-Pita, 2011). Batisse (2003) highlights that railways around the world have been undergoing different styles of reform at different speeds for the last few decades, Sanchez et at., (2010) analyse sixteen countries in Europe, even IBM (2006, 2010) provides information on the liberalisation processes. Growitsch & Wetzel, (2009). conduct an efficiency analysis to investigate the performance of European railways with a particular focus on economies of vertical integration and conclude that for a majority of European railways economies of scope exist. In the work of Harrod (2013) the question of



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

pricing train paths for "open access" railway networks in North America is discussed and an auction process is suggested as necessary to maintain transparency in the contracting process. De Rus & Socorro (2012) analyse the consequences of access pricing on infrastructure investment and intermodal competition and find that the optimal access price to be charged for the use of a particular infrastructure depends on the existence of intermodal substitution or complementarity with other transport modes and infrastructures. Lijesen et at., (2005) assess costs and benefits of structural changes in Dutch railways implemented in the late 1990s, Alexandersson *et al*., (2012) describe Sweden's recent reforms to open the railway passenger markets to entry, and address critical issues for the success of the reforms, Pittman (2004) underscores that among the policies just now coming into practice are two that are standard in railways restructuring in other countries: the provision of access to the infrastructure by independent train operating companies, and assurances of non-discriminatory access terms for such companies. To this extent it is worthwhile to remember that the policy has required structural changes, including the separation of infrastructure from operations at least to separate divisions, transparent and non discriminatory infrastructure charges and allocation of capacity (Nash, 2010). Lang et at., (2010) analyse how the regulatory agency will socially optimal set the charges that operators have to pay to the infrastructure manager for access to the tracks and how these charges change with increased competition in the railway market.

## 3. FRAMEWORK AND THEORETICAL MODELS

Vidaud & de Tilière (2010) underscore that pricing theory for the use of the railway infrastructure is a deeply discussed topic. Marginal cost pricing represents the additional cost caused by operating an additional train. It is supposed to be the optimal model if there are no budgetary constrains and no distortion from other markets/transport modes. The OECD differentiates two different practices in order to consider market distortion and constrains such as budgetary ones: social marginal cost with mark-ups (CM+) and full cost recovery after receipt of grants (CF-). Another differentiation is short run marginal cost (SRMC) where not all the fixed cost will be recovered based on the additional operating and maintenance cost caused by an additional operating train and long run marginal cost LRMC which include the capital costs of increasing capacity to accommodate an increase output (Railcalc 2007). Instead, Ramsey pricing aims to maximize social welfare under profit constraints. It considers rail infrastructure product as a monopoly. The mark-up should then be the inverse to the price elasticity of demand. Short run average costs are the result of the total cost of all the proposed services divided by the number of services. They can be split in fixed cost and variable costs. Average cost pricing is a method which sets the price of a product by adding a percentage profit mark-up to the average cost or



ISSN 2067- 2462

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unit cost (Railcalc 2007). Link & Maibach, (1999) highlight that according to the concept of Social Marginal Cost Pricing, only the cost caused by an additional traffic unit have to be considered for pricing issues. In the short run, fixed costs are regarded as sunk costs. In regard to the estimation of infrastructure costs, marginal costs and average costs differ considerably. Thus, a key issue is to elaborate a transparent distinction between fixed and variable costs. With respect to infrastructure costs, discriminate access pricing schemes – types of infrastructure and types of vehicles – are supposed to be most appropriate. Since it is difficult to compare marginal infrastructure costs with respective revenues, the authors deal with the cost side only even if revenues are important. Railtrack (1999) has undertaken specific research for the structure of rail access charges and estimate marginal costs of maintaining and renewing assets and indicate that the proportion of the investigated costs of Railtrack is around 10-15%. NERA (1998) suggests which cost elements are relevant for deriving short-run marginal costs: additional track wear and tear, traction current, signal operation costs, train planning costs, management and administration costs, costs of disruption caused to other train services. The NERA study mentions that these costs are likely to amount for only 10% to 20% of total rail infrastructure costs. Macário & Marques (2007) are aimed at developing a best practice guide on compliance of rail infrastructure charges with the rules of directive 2001/14/EC. The authors suggest that the link between accounting and charging must be understood by IM, requiring the adoption of a business logic that secures that cost drivers are well identified and controllable. In terms of cost categorisation, it is desirable to maintain a clear distinction of infrastructure-related cost categories supported by common definitions, regarding cost items depreciation, upgrading, renewals, maintenance and management/operation. Such a detailed categorisation should be combined with the adoption of accounting cost centres acting as building blocks defined at bottom levels of the physical and organisational infrastructure setting. Also it is useful to underscore how infrastructure costs can be represented. To this extent ECORYS & CE Delft. (2005) state that total infrastructure costs consist of capital costs (concerning depreciation and interest of previous investments, renewals and non-yearly maintenance) and running costs. Starting point for the calculation of costs are the investment, renewal, maintenance and operational expenditures. Furthermore expenditures and costs can be divided into a variable part (influenced by transport volume) and a fixed part (not influenced by transport volume).

According to ECORYS & CE Delft (2005), infrastructure expenditures can be classified according to (i) the asset approach, defining the following types of expenditures: investment, renewal, maintenance and operational and (ii) according to the usage: fixed and variable. infrastructure costs. The periodic (yearly) value for the use of infrastructure assets, consist of (i) capital costs: yearly depreciation costs concerning investments, renewals and maintenance of infrastructure assets and yearly interest



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

expenditures) and (ii) running costs: yearly recurring (other) maintenance and operational expenditures. Starting from their classification, let be *C* any expenditure component, *slC* the serving life, *r* the discount, the annual capital cost if computed as follows:

$$accC_1^n = C * \frac{r}{(1-(1+r))^{-slC}} \quad [1]$$

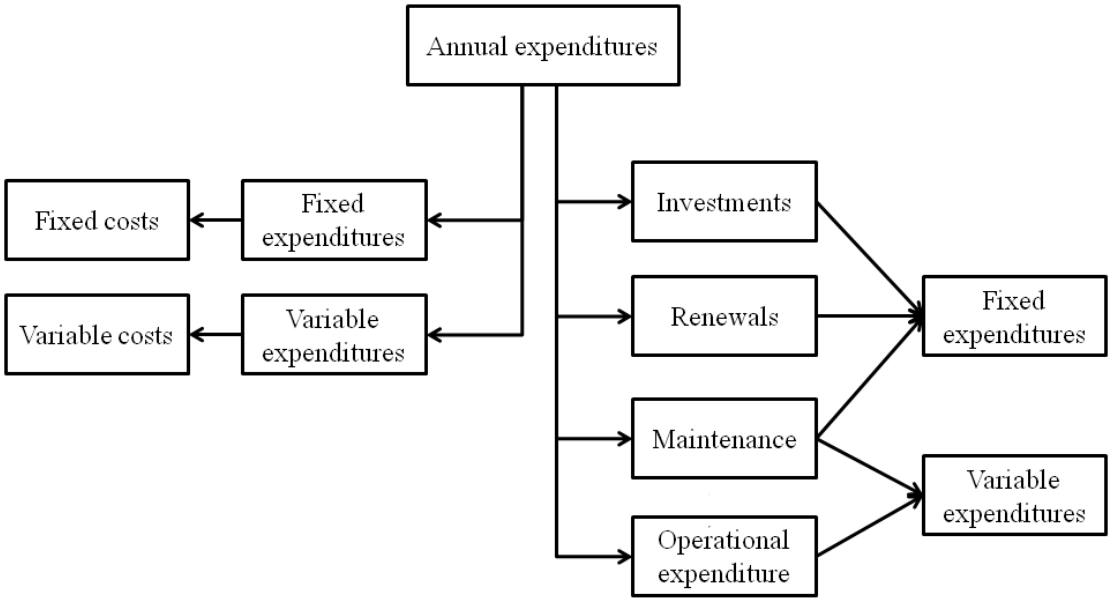


*FIGURE 1: TOTAL COSTS*

Source: ECORYS & CE Delft. (2005 p. 40)

The MC model shows that unit charges reflect the additional cost a manager has to pay to host an additional train on the existing line. The FC model requires that the unit rates tend to average costs, and consequently the total rates shall go for the full coverage of operating costs. The MC model shows that unit charges reflect the additional cost a manager has to pay to host an additional train on the existing line. The FC model requires that the unit rates tend to average costs, and consequently the total rates shall go for the full coverage of operating costs (sic). Scandinavian countries (to have a complete analysis of the Scandinavian cases and because of the Norwegian peculiarity, we include Norway in the analysis), Great Britain and the Netherlands adopted the first model, whereas Belgium, France, Spain (just for high speed lines), Germany and Italy adopted the second model. Out of the original 15 EU countries, it was decided to ignore Luxembourg, Ireland and Greece, because their geographical and train line characteristics were not reputed significant. Portugal and Austria were also excluded because of their lack of high speed train lines and their lack of peculiarities in their pricing systems compared to the remaining countries.



ISSN 2067- 2462

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## 4. COMPARISON OF ACCESS PRICING

Nowadays infrastructures are increasingly positioned as commercial economic sectors, accordingly competition is introduced and the liberalisation defines fundamental change in the governance of infrastructure with consequences for the operations and performance (Finger & Kunneke, 2011). Potential competitors often require access to essential (bottleneck) network facilities (Kessides, 2004). Szekely (2009) sheds a light on the transformation schemes in Europe so that it would be possible for countries to set up better policies to manage their efforts. The work of Holvad (2006) aims to provide an overview of railway reforms in Europe which at EU level was initiated by Directive 91/440. Nash (2010) underscores that measures such as separation of infrastructure from operations, infrastructure charging regimes and regulation have major implications for the passenger sector. Sánchez-Borràs et al., (2010) examine rail access charges for high speed trains on new high speed lines in Europe and the impact these have on the market position of high speed rail. They examine the latest evidence on the marginal infrastructure and external costs of high speed rail. Wheat & Smith (2008) estimate marginal track maintenance cost in Britain. Andersson & Ögren (2007) state that in order to achieve a competitive transport sector, infrastructure charges in the European Union should be based on short-run marginal costs. Freebairn, (1998) assesses marginal cost, average cost, Ramsey prices and multipart tariff rules for access pricing. Access problems arise when the provision of a complete service to end users requires the combination of two or more inputs, one of which is non-competitive, i.e., a monopoly (OECD, 2004). The context for the reassessment of the infrastructure access charge is very different from one member state to another. Excessive access charges mean higher prices for rail companies when using the infrastructure. The paths in Figure 2 delineate a simplified case. Mc =cf the marginal cost of offering the service, D demand, p price and a the charge. It is clear that access charge impacts on the service prices of both companies (this in turn negatively impacts on final demand). As infrastructure charges account for a significant part of the cost of a railway operator, the level of the charge is crucial for establishing competition on the rail network.

It is now appropriate to appraise the railway system regulatory assets provided that at least three main situation may occur: vertical separation/unbundling with liberalisation, vertical integration with liberalisation and a vertically integrated monopoly without liberalisation. Valletti & Estache (1998) highlight that in order to provide one unit of final good, downstream firms need one unit of the upstream input. This input is produced by the owner at a unit cost, the infrastructure owner also incurs fixed costs while the users are charged a unit access charge. If firms in the competitive sector are similar, the price charged to final users ends up equal to the marginal cost of each firm. Valletti & Estache (1998)



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

suggest that the best solution is to follow a marginal rule. The access price should be set equal to the marginal cost of production.

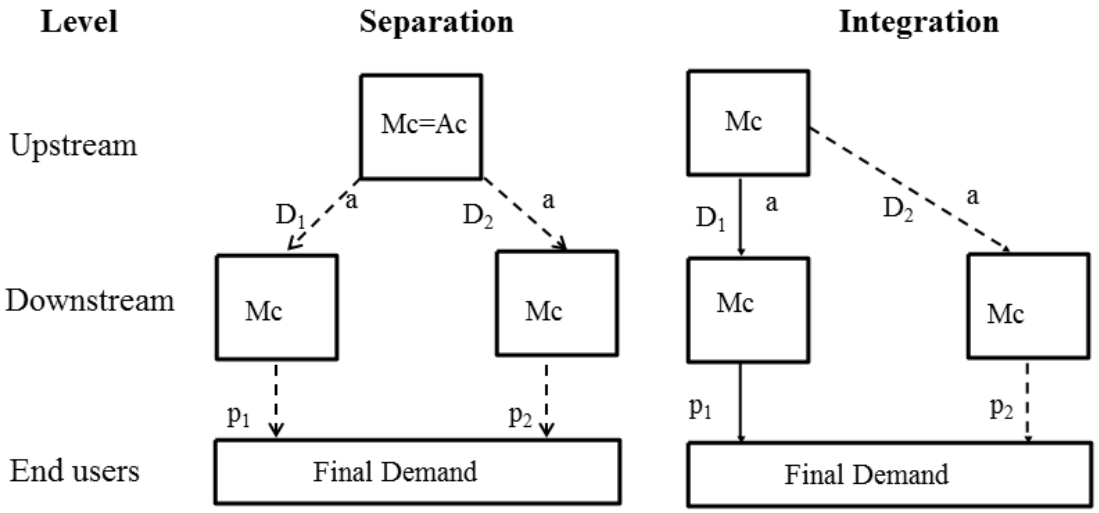


*FIGURE 2: COMPANIES AND INFRASTRUCTURE MANAGERS*
Source: own elaboration

The access pricing issue is also complex in vertically integrated industries. There is a danger that the incumbent will set access charges in order to limit the entrance. However, one shall consider that too low access charges may drive inefficient entry. There is, in fact, some evidence that operator reactions to access charges are important, according to Matthews et al., (2009) infrastructure charges might affect operator's behaviour, in terms of their use of the infrastructure and the way they operate their services, moreover rail infrastructure charges could impact on the final price. Valletti & Estache (1998) conclude that first best solution is marginal cost access charges regardless the market structure. Being the owner unit cost of production co and fixed cost F. the charge is a. If c are the unit costs other than the unit access charge, the final price equals p = a + c. Without any distortions a = co and, the final price would be p = co + c. We are aimed at observing in particular who is the regulator of the sector, its level of independence from the government, the infrastructure manager and the train operators, the adequacy of its regulatory powers and of its powers of protection against the competitors. Furthermore, it will be judged whether the infrastructure manager is sufficiently independent from the incumbent train operator. Those listed above are the minimum conditions to assure transparency and a lack of discrimination in pricing models. Table 1 gives the evaluations to the above listed conditions, basing the OECD-EMCT (2008) study.



ISSN
2067- 2462

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*TABLE 1 – REGULATOR AND INFRASTRUCTURE MANAGER INDEPENDENCE*

| | Independent regulator | Regulator with sufficient control powers | Infrastructure manager independent from railway operator | Evaluation |
|---|---|---|---|---|
| Sweden | YES | YES | YES | +++ |
| Netherlands | YES | YES | YES | +++ |
| UK | YES | YES | YES | +++ |
| Finland | YES | NO | YES | + |
| Germany | YES | YES | NO | + |
| Denmark | NO | NO | YES | - |
| Belgium | NO | YES | NO | - |
| Spain | NO | NO | YES | - |
| France | NO | NO | NO | --- |
| Italy | NO | NO | NO | --- |

*"NO" if the Commission reported the problem to the country; 'YES' means lack of problems*
Source: Own elaboration on OECD-ECMT 2008.

*TABLE 2 – AVERAGE KM COST FOR THE USE OF THE TRAIN NETWORK (EURO PER TRAIN KM) (1)*

| | Freight train (1200t) | Regional train (300t) | Intercity trains (600t) | HST (600t) Routes 2° categ. (1) | HST (600t) Routes 1° categ. (2) |
|---|---|---|---|---|---|
| Sweden | | | 1.1 | 1.1 | (*) |
| Norway | *2.1* | 0 | 0 | 3.8 | (*) |
| Finland | 2.2 | 0.4 | 0.8 | 3.8 | (*) |
| Denmark | | | | (*) | (*) |
| - w/o use of Link (3) | 0.6 | 0.6 | 0.6 | | |
| *- with use of Link (4)* | *4.1* | *3.9* | *3.9* | | |
| The Netherlands | 3 | 1.3 | 1.9 | (*) | (5) |
| Great Britain (6) | 3.8 | 0.8 | 2.4 | 4.1 | (7) |
| **Average Northern Europe (8)** | **1.7** | **0.6** | **0.9** | **2.9** | **(9)** |
| Belgium | 2 | 2.6 | 6.7 | (*) | *9* |
| Germany | 2.6 | 3.7 | 4.4 | (n.a.) | *11* |
| Spain | 0.4 | 0.5 | 1 | (*) | *10.8* |
| France | 1.3 | 3.4 | 3.1 | *8.3* | *13.7* |
| Italy | 2.5 | 2.6 | 2.9 | (*) | *13.4* |
| **Average Centre-South Europe (8)** | **1.7** | **2.6** | **3.6** | **8.3** | **11.6** |

Source: elaboration of the present study on the data of info statements about the network.
(1) Routes with maximum speed of at least 200 km/h, (2) Routes with maximum speed of at least 250 km/h., (3) Routes w/o use of the Great Belt and of the Oresund Link, (4) Paths longer than 300 km, including the crossing of the Great Belt and of the Oresund Lin, (5) Charge being introduced, (6) The cost indicated is relative to the circulation of trains and it doesn't consider the fixed part of the fare, which is due from the regional companies in franchising, no matter of their network use, and it is generally State subsidized, (7) In the UK the only high-speed route of 1st category (London-Eurotunnel) is not of Network Rail property, (8) Average not weighed (For Northern Europe, Denmark is included in the hypothesis w/o the use of Links), (9) In the group of Northern countries there are not high-speed routes of 1st category. (*) There aren't any routes classified in this type in the country taken in consideration.



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

As it can be observed, Sweden, the Netherlands and the United Kingdom have a positively assessed market asset. There's a prevalence of positive evaluations in the cases of Finland and Germany (one issue out of three), a prevalence of negative evaluations for Denmark, Belgium and Spain (two issues out of the possible three), whereas the tricky cases from the asset point of view are France and Italy (three issues out of three).

Table 2 gives the average cost per train km, calculated in the analysis chapters of the case countries of this study. The data are based on the charges in force in the current year, obtained from the information prospects of the infrastructure managers.

The values in the table differ with the train type considered (freight, local, intercity, high-speed of 2nd category, high-speed of 1st category) and, in the same category, they differs according to the 11 countries considered. However, the latter can be separated into 2 groups, according to the charge criterion.

*Marginal and full cost.*

Marginal cost pricing is advocated with the aim of encouraging efficient use of the railway network (Bernardinoa, Hřebíčekb, & Marquesc, 2010). However, the authors underline that railways tend to show economies of density and consequently the marginal cost of extra network utilization is below the average cost. For this reason, according to the authors, full cost recovery cannot be achieved through (simple) marginal cost pricing. Two alternative pricing principles are therefore applied: marginal cost pricing with mark-up (MC+) and the pricing to recover full cost less government grants (FC-). Both MC+ and FC- are aimed at full cost recovery less government grants; however the MC+ approach, being based on marginal cost pricing, is viewed as less distorting in terms of incentives (Bernardinoa, Hřebíčekb, & Marquesc, 2010). There are, however, doubts on whether "the cost that is directly incurred as a result of operating the train service" in the Railway-recast, really means marginal social cost (Jansson & Lang, 2013). In this paper The first group (*MC countries or MC+)* includes the four Scandinavian countries, the Netherlands, and Great Britain.

The charges of the different type of transport are established through the principle of marginal cost, with occasional mark-ups in the event of routes of new construction (or for other reasons). The different costs per type of train reflect the different weights of trains and would tend to decrease or disappear in case the calculations were per ton km (the study supposed per each country a model of regional train of 300 gross tons, an intercity train or high-speed train of 600 tons and a freight train of 1200 tons).The charges being established at the marginal cost, the unit cost will be reduced: the average cost of the 6



ISSN 2067- 2462

countries is not higher than 1€ for a train of 600 tons. Finally, in case of routes of new construction, generally high-speed routes of 2nd category, a charge increase is generally applied, whose amount is reduced when considering the absolute value. The average of mark-up is of 2€ per train km, 3€ in Finland and almost 4€ in Norway (country in which the normal charge for passenger trains is 0). In Sweden, unlike the other countries, the increase aimed at recover the money for the building of the Oresund Link (0.40€ per train km), is applied to all passenger trains using the Swedish network, whether they use or not the Link.

The second group (FC-) includes the remaining five countries of Central and Southern Europe: Belgium, Germany, France, Spain (when considering the high-speed routes, because for the normal routes, Spain is similar to the Northern countries) and Italy, see Arrigo & Di Foggia (2013) for a focus. In these countries, the charging systems tend to favour the freight transports because the increases usually charged on the passenger transports are not applied. Consequently, in this group the average cost of the freight train is not too different from the countries before considered. On the other hand, passenger trains using non high-speed networks have an average cost per km which is four times higher than the one of Northern countries. This difference is understandable when considering that the FC- countries aim at covering a wider part of the network costs. Such aim is achieved by not using the MC criterion or considering just some elements of cost as marginal unlike in Northern Europe (see the French and Italian cases). Given the difference of route categories, there is no comparison with northern countries when passenger trains using high-speed networks are considered: in the north, routes are of 2nd category (speed of at least 200 km/h), whereas in the other countries routes are of 1st category (speed of at least 250 km/h). In any case, the average cost per km on these routes appears to be higher than the price levels in force on the normal routes of the same countries, from a minimum of 11€ (Germany and Spain) to a maximum of 14€ (France and Italy). France, who has high-speed fares differentiated according to the hour and to the different intensity of traffic, is the EU country with the highest average cost per km and it has a minimum difference with Italy in terms of price. Nonetheless, if the average cost is expressed as Purchasing Parity Power (PPP) and not in nominal Euros, the ranking of the two countries turns upside down, because France has higher general levels of prices, and Italy is at the first place in the EU ranking of the network use cost with 12,9€ per km against 12,3 € of France. The average charge levels for the high-speed network use in the main EU countries are represented in Table 3.



ISSN 2067- 2462

*TABLE 3 – ACCESS CHARGES OF THE HIGH-SPEED NETWORK PER KM IN 2011 (€ AND PPP)*

| Country | euro | ppp |
|---|---|---|
| Italy | 13.4 (11.4)* | 12.9 |
| France | 13.7 | 12.3 |
| Spain | 10.8 | 11.2 |
| Germany | 11.0 | 10.6 |
| Belgium | 9.0 | 8.1 |

Source: Elaboration of data in the present study and of Eurostat (for PPP). *The table refers to 2011 data, so later modification are not included e.g. 15% discount in Italy.

Because the analysis has distinctively differentiate between two groups/models of countries – the Northern European (featured by an independent regularization of the train system, a neat separation between the infrastructure manager and the dominant operator of the train system, and a generalised adoption of the MC model), and continental European (FC- model, grades of separation between the manager of the market and the operator, and between network and services), it is suitable to complete the framework with a test of the results obtained in those two groups in the period following the adoption of the EU regulation issued in the first half of the 90s. Pursuing such aim, Table 4 gives the modal share of passenger train service, calculated by passenger km of train transports, divided by the passenger km of all the surface transports (private road transport and collective road and train transport) in 1997 and in 2009. Furthermore 2009 was the last year in which the data from the Directorate-General for Mobility and Transport of the EU Commission, were available, whereas 1997 was the last year in which the effects of the train regulations adopted in the first half of that decade were still not evident. As it can be observed form the Table 4, in 1997 the two groups of countries had a modal share of train transport quite similar: 6% averagely for the Northern European group (Norway was not included as it didn't join the EU), and 6.2% for the continental one. In 2009 the average modal share was pretty different: in the Northern European countries the value raised at 8%, with an increase of two share points compared to the starting year, of which a half share point (equal to one quarter) can be attributed to the increase of traffic produced by high-speed services. On the other hand, in the second group of countries, the average increase of the modal share was of 1 share point, whereas the contribute of the sole increase of high-speed services was of 1.8 points. It can be stated, therefore, that the whole of the different factors of the high-speed development - among which the efficiency of the actualised reforms – the quality of the introduced regulation, the orientation to the market and to the liberalisation contributed to the train modal share increase of 1.5 share points in the countries who adopted the first model. The



ISSN 2067- 2462

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different orientation in the second model led instead to an increase 0.8 share points smaller, in contrast with the expectations of the development of high-speed services.

*TABLE 4 – MODAL SHARE OF PASSENGER RAIL TRANSPORTATION (1)*

| | | | Modal share variation | |
|---|---|---|---|---|
| | 1997 | 2009 | 2009/1997 | 2009/1997 (HS traffic) |
| Sweden | 5.7 | 9.3 | 3.6 | 1.4 |
| Finland | 5.3 | 5.1 | -0.2 | 0.2 |
| Denmark | 6.3 | 9.4 | 3.1 | 0 |
| The Netherlands | 7.8 | 9.3 | 1.5 | 0.5 |
| Great Britain | 4.8 | 6.8 | 2 | 0.1 |
| **Average Northern Europe** | **6** | **8** | **2** | **0.5** |
| Belgium | 6.1 | 7.4 | 1.3 | 0.1 |
| Germany | 7.1 | 7.9 | 0.8 | 1 |
| Spain | 4 | 5.3 | 1.3 | 2.5 |
| France | 7.6 | 9.9 | 2.3 | 2.3 |
| Italy | 6.3 | 5.6 | -0.7 | 3.4 |
| **Average Centre-South Europe** | **6.2** | **7.2** | **1** | **1.8** |

Calculated as ratio between passengers train km of all round transportation.
Source: elaboration on EU Transport in figures, Statistical pocketbook 2000 and 2011.

## 5. DISCUSSIONS

The This study has underlined the successful cases of Scandinavian countries (Sweden, Finland, Norway and Denmark) and of Great Britain, countries in which the regulation model has been judged as exemplary from the European Commission because of the independence of the regulator from the local government and the actors of the system (rail operators and infrastructure management) and because, in almost all cases, there was an adequate separation between the manager of the network and the service operators also when considering the issue of ownership. The charge systems adopted are included in the MC model, by which a infrastructure manager has the right to demand to rail companies charges reflecting exclusively the extra costs generated from the train movement, which can include the external costs (in particular the environmental costs) produced by the company. Mark-up finalised at covering the network's fixed costs and possible costs for future investments are admitted with moderation, on the condition that they will not result dissuasive for the potential users. The countries mentioned previously are also featured for their highest European per capita demand in passenger rail transport, as well as for their high train modal share (Sweden, the Netherlands, Denmark) or for an



Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
2067- 2462

increasing share in time after a long phase of decline (Great Britain). Other countries, such as Germany, France and Belgium, prefer to recover the total costs of the infrastructure manager through an average charge which will be closer to the average cost. Their aim is getting close to the 'full cost' through the fares and they pursue it once the public subsidies is included (FC- criterion). Despite this access charge model aims at guaranteeing a high level of total management costs recovery, it shows several counter indications. First of all, it leads to negative effects in terms of allocative efficiency, dissuading from a more intensive use of the network, due to the big difference from the marginal cost. Secondly, in all the cases examined, the model is far from guaranteeing a full or wide coverage of the exercise costs of the network. It could be possible just in a hypothetical situation of static demand, where the unit costs were higher.

Nonetheless, with the increase of burdens, the demand would decrease consistently (except in the hypothesis of State subsidies to the train service companies), avoiding the counterbalance of the costs. The objective incapacity of recovering the network costs through charges is the fundamental reason for which European infrastructure managers are generally State-owned. Even more, it is not possible to think that network investments could be rewarding according to the market logic. In the current framework, high network access charges would not ease rail companies' entrance and incomes, since states would be asked to give more consistent subsidies, but destined only to the incumbent operators. Minor subsidies to the infrastructure manager would indeed become further costs for rail operators which should be compensated either by higher fares applied to clients – encouraging a static demand – or more subsidies to the operator of the service. In the second hypothesis – which is the most likely – there's a high risk of favouring the incumbent operator rather than others already working or new entries. Indeed, subsidies to the infrastructure manager are at the advantage of all the rail system and, in a non-discriminatory way, to the operators using it. Subsidies to the service are instead in favour of one operator – the dominant one – usually of State property and in many cases integrated with the infrastructure manager. The risk before mentioned has a high probability to happen upon 3 conditions: (i) the incumbent operator is of State property, as the infrastructure manager, (ii) the infrastructure manager and the incumbent operator are a State property, of one or a group of businesses, and functionally integrated inside this/those business. Consequently, the possible charge levels are not influent on the balance sheet; (iii) the subsided rail services are appointed with no open competitive exam, or the exam is not approved and monitored by an independent regulator. In such a way, there's a regulatory risk for new operators, a limit to the growth of the offer. Even though there's the possibility to use legal instruments available in antitrust bodies against power abuses, the effectiveness of an ex-post sanction operation is not minor of an ex-ante regulatory operation. In the antitrust defaults, a competitor



ISSN 2067- 2462

has, in any case, obstacles in his activities, whereas an ex-post monetary sanction may not work as an adequate deterrent: i) though high in its absolute value, a monetary sanction can represent a minimal share of the turnover as well as of the margins of a big operator; ii) in case of State-property businesses, sanctions would be paid by the community and not using the expected profits.

## 6. CONCLUSIONS

In this paper we have examined the pricing models for the use of the railway infrastructure in some European countries considering theoretical models classified according to two different principle: the model of marginal cost (MC) and the model of full cost (FC). An important component of policies to promote competition is a regulatory environment guaranteeing that competitors have access to essential facilities. Specifically in presence of vertically related markets (the production or supply of final goods or services involves different activities from "upstream" to "downstream" that are linked to each other) and the existence of an essential facility provided only by one firm (Valletti & Estache, 1998). In this context some targets are identified. First comes an economically efficient use of the infrastructure, so to avoid both situations of over employment/congestion (and their relative costs), and situations of underemployment, because of excessively high charges, which would result in a non-economical network use and would not encourage the rail operators. Second comes an efficient management and use of the network from a technical point of view, so to minimise wastes, mistakes and delays which would prevent and/or make more expensive the punctual execution of the rail activity (e.g. circulation delays caused by the manager and the rail operator). Third comes an efficient promotion also between rail companies, so not to support non-efficient operators because of the tariff model chosen. Fourth comes a transparent access charges system, through a clear identification of the structure, their measurements, stable tariff criteria over time, so to allow single operators to objectively establish their activity programmes and the relative economic assessments. Fifth comes the coverage of a share – higher or smaller – of the total business costs from the manager. We conclude stating that reduced access charges represent the best incentive for an intensive use of the network from the existing operators – incumbents – as well as from the new ones – entrants. This is a mandatory condition to completing the single European railway area and to foster European competitiveness and growth. At the same time, it may contribute to reduce burdens for public spending. In fact subsidies to rail sector are relatively high – and have been increasing – if compared with other sectors.





ISSN
2067- 2462

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mrp.ase.ro
Management Research and Practice
Volume 6 Issue 2 / June 2014
ISSN
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