Rail Capacity Management

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'Rail Capacity Management'

Rail has a key role to play in making transport more efficient and sustainable in the EU and elsewhere. However, increasing passenger and cargo volumes require investment in infrastructure, and also more efficient track capacity management. This issue of Network Industries Quarterly focuses on the capacity dimension of railway infrastructure, and in particular on how to increase capacity for both passenger and freight railway undertakings (RUs), as availability of reliable railway infrastructure capacity is a condition for the much-needed modal shift from road (and air) to rail. Needless to say, capacity management takes place in a situation of growing competition for track and it is necessary to ensure non-discriminatory treatment of competing RUs when it comes to track availability and usage. Somewhat paradoxically, this gives the infrastructure manager (IM) an important and more active role than was previously the case, and at the same time requires an independent regulator to not only supervise non-discrimination but also ensure that the IM stays within its legal mandate, not to mention the fact that capacity needs to be planned, financed and built well ahead of time.

In his contribution entitled *Regulating active infrastructure management in railways*, Juan Montero shows the growing importance of infrastructure managers in capacity management, and also the need to ensure that they act in the public interest.

Dariush Kowsar and Alain Quinet's paper on *Capacity Management as a cost-effective way to boost Rail Traffic in Europe* shows how a combination of careful planning and digitalisation can contribute to more efficient investment, improved network utilisation and overall lower costs of the available capacity.

Paolo Beria explores the relationship between *Track access charges and capacity management*. More precisely, he argues for including capacity pricing elements such as track access charges and illustrates this with the example of Italian high-speed railways.

Martin Aronsson addresses the issue of *Flexibility in the railway capacity allocation process* and argues for some slack in the capacity allocation planning process as capacity usage by train operating companies can never be fully planned ahead of time.

Matthias Finger
Publication Director

dossier

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Train Access Charges and Capacity Management

Paolo Beria[1]

Introduction

We are used to considering pricing as one of the tools available to manage the capacity of a service in the case of excessive demand, although it is politically difficult to apply. Road pricing is used to reduce excessive demand for congested roads through the imposition of a surcharge, as opposed to more conventional but intrinsically inefficient bans. In this case, pricing has to do with the concept of externality. However, capacity pricing can also be applied for other purposes, for example to extract willingness to pay and increase the margin for the producer. For example, this is the case of airline 'fast track' options.

When we move to rail transport, capacity pricing becomes even more complicated because it overlaps with infrastructure managers' cost covering under natural monopoly conditions. Moreover, one must consider *what is priced*, an externality, compensation for an extra cost or simply the quality and scarcity of a route.

In this contribution I explore the inclusion of capacity pricing principles in train access charges (TACs). The following section briefly overviews pricing principles in Europe, followed by a discussion of *what is priced*, on which depends the viability and effectiveness of the measure. Finally, I conclude with a relevant case, namely the Italian TAC system and management of the saturated HS backbone.

Overview of rail pricing principles in Europe

The panorama of European track access charges is quite varied although they all originate from a common normative framework: Directive 91/440/EC, on the separation between infrastructure managers (IMs) and railway undertakings (RUs), and Directive 2012/34/EU, also known as the Recast, governing rail-charging systems.

Directive 91/440/EC conceives access charging as a way to recover infrastructure costs, but also to incentivise the optimal use and provision of infrastructure (IRG-Rail, 2020), for example using less damaging rolling stock or to manage scarce capacity. The minimum TAC *must* cover the direct costs caused by the single train (and thus depending on energy, weight etc.), but a broader definition allows covering all eligible costs, including amortisation of investments, with markups (Figure 1). Needless to say, the access charges must be net of the subsidies that the IM receives from the state or local authorities to support its functions and investments.

The TAC applied, therefore, is a result of a complex equilibrium among various factors:

- the direct costs, depending on the train and the route;
- the presence of mark-ups, reflecting the *ability to pay* of the train or specific aims;
- the inclusion or not of IM investments, both functional and upgrades (e.g. amortisation of new lines);
- the traffic: the more a network is utilised, the lower the unit charge;
- the size of subsidies: the more the subsidies, the lower the unit charge.

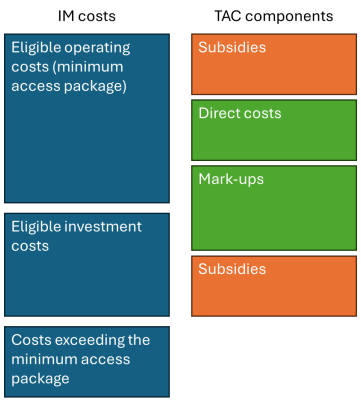

Figure 1. Schematisation of Directive 2012/34/EU pricing principles.

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Given all these degrees of freedom, the resulting European picture is extremely mixed (Figure 2). The highest average charges for passenger trains are found in France, followed by Spain and the UK, all ranging between 1.5 and 2 times the continental average. The reason for such high charges lies in the inclusion of a larger part of the investments and related financial costs in the boundary of eligible costs, and also in excessive network or inefficiency (Crozet, 2018). At the bottom of the ranking, we have Central and Eastern European countries, but also the Nordic ones, the latter due to high subsidisation and the former group also to lower costs. In the middle are Central and Western countries (Germany, Italy, Austria etc.) with more balanced levels of subsidies and high traffic density. In some cases, the average TAC is far from that applied to specific train categories subject to different mark-ups. So, for example, in France market-driven trains (mainly HS ones) pay more than 3 times more than public service obligation (PSO) trains, while in Spain this difference is irrelevant.

TACs, overall, are designed to cover a state-defined[2] share of the costs of the network. However, the level they are set at can pursue other aims, including capacity management, as will be discussed in the following section.

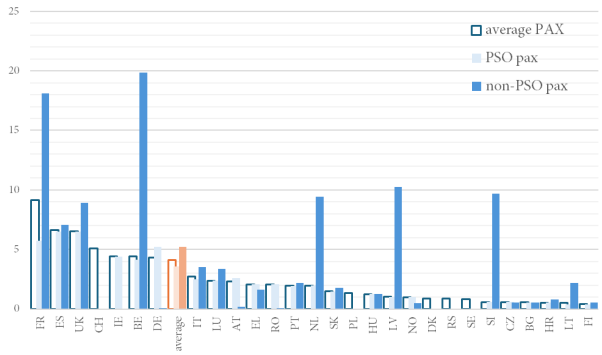

Figure 2. Average TAC for passengers services paid by Rus (excluding subsidies). Source: IRG_rail, 2023

What is (or should) be priced by TACs?

If we exclude highway concessions, when a road is priced the aim is generally to reduce an externality that is an uncompensated cost generated by the users. The fact that prices do not correctly reflect social costs causes excessive use of the infrastructure and a degradation of its speed, which is a welfare loss.

In rail, the relatively simple inverse relationship between flow and speed does not hold. Typically, the problem is not an excess of trains per se but that they run at different speeds, which reduces, sometimes dramatically, the number of available routes. A line used by trains with regular speed allows more trains/hour and reduces delays. In the long run, a well-structured timetable may even prevent the need for expensive line upgrades.

The causes of such 'heterotachy' (speed differences) are various. A common one is the use of different rolling stock (old vs. new, slow vs. high acceleration, cargo vs. passengers etc.). In addition, the timetable principles may have a role. Regular ('takt') timetables intrinsically maximise capacity, while services too concentrated around peak hours go in the opposite direction. In addition, train services are intrinsically different. On mainlines regional trains calling at many stations must share the track with long-distance or even high-speed trains, not to mention cargo. What is 'bad' from the point of view of the timetable and capacity is good for customers' needs.

If we aim to use TACs as a form of capacity pricing, we must first clearly define the actual aim:

cost covering: the charge compensates the capacity reduction due to the use of that particular route, which translates into fewer trains/km and consequently higher average costs;

optimisation: to induce the RU not to ask for a socially sub-optimal path, not to use inadequate rolling stock or to use a non-saturated line, etc.

quality: the charge is a markup to cover full costs, proportional to the *ability to pay* of the train;

internalisation: the charge is collected and used to compensate other RUs that obtain sub-optimal solutions due to the route (for example with discounts);

selection: the charge aims to exclude trains with lower *ability to pay* when the capacity is not sufficient to cater for demand.

According to the aim, the form and size of the pricing can be very different. For example, if the aim is to correctly cover costs (point a), the TAC would be proportional to the capacity reduction caused by a single route.[3] Instead, if the

2 Explicitly, but sometimes implicitly defined by the subsidies available.

3 An example may help. If a line can host 100 trains/day and costs 1M€ (average 1000€/train), a single slot reducing capacity to 90 trains/day should be priced according to the capacity consumed: 10% of total costs vs. 1% of the other slots.

aim is to induce a RU to use a secondary line instead of the mainline (point e), the charge will primarily depend on the difference in revenues and costs of the RU on the two alternate paths, not of the network. In conclusion, there is not *one single charge*, but the charge depends on its capacity-related aim and the possible aims are many and heterogeneous.

A final element to consider is how much pricing is an incisive tool to achieve the capacity management aims, in absolute terms and with respect to other approaches, such as one based on *command-and-control* principles, grandfathered rights, catalogues, auctions, etc. There are two factors to consider: the proportion of the TAC of the RU's total costs and the available alternatives. When TACs are low, the effect of pricing is probably limited, and also in cases where there are no alternatives (for example routes) that the RU can choose to respond to pricing. In countries where TACs are high and account for a significant share of operating expenses, such as France and Spain, the effect of a discount or of a surcharge can be greater.

In the next section I discuss in more detail the case of Italy, where part of the HS line has reached its capacity and implementing capacity charging has recently been suggested by the Regulation Authority (Annex A to regulation ART/11/2023).

The Italian case

Italy is considered one of the most interesting cases of rail liberalisation, as it is the country where head-on competition in the HS market segment has been most pervasive. The entry of Italo/NTV in 2012 and the energetic response of the incumbent Trenitalia have reduced prices (Beria et al., 2022), increased demand and created a network that now covers most of the country's mainlines and is not limited to HS ones. However, the most distinctive characteristic of the Italian case is probably the *focus of competition*: not prices or product innovation but frequency and capacity (Beria et al., 2023). The two players, in fact, are engaged in a sort of 'frequency war' (as opposed to a 'price war' as observed in Czechia (Tomeš et al, 2016)), which today consists in having trains connecting Milan and Rome every 10' or less all day long and Venice/Verona and Rome nearly as often. The consequence of this frequency war is that the central Florence-Rome section of the HS Turin-Naples line, where trains from Milan/Turin, Venice and Verona overlap and share the tracks with some PSO trains, is saturated.

There are not many solutions and they are not simple: building more tracks, forcing PSO trains onto a much slower line or trying to optimise the available capacity, for example by forcing or convincing the two competitors to use double-composition or double-decker trains. This last solution, which is broadly used in France and Germany, is just apparently simple: apart from technical issues, the two opponents are engaged in a strategic game where no one is willing to give up frequency because of the competition, even if double composition trains would theoretically be cost-effective.

The current TAC scheme (for 2016-2021 but extended until 2023 due to the COVID crisis) consists in two components of the minimum access package. Part A prices the direct costs and depends on train characteristics and infrastructure consumption. Part B is the mark-up to guarantee full cost coverage and depends on a classification of trains in terms of their presumed *ability to pay*. The segment priced more is the 'Open Access Premium' that includes all market-driven trains at least partially using lines classified as HS, in contrast to 'Open Access Basic,' which includes fully conventional market-driven trains. Other groups are PSO trains, national and regional ones and cargo, all of which have significantly lower Part B charges. Each group is further divided into sub-groups, again responding to different expected *abilities to pay*.

In the previous scheme, which was active between 2001 and 2017, capacity issues were only marginally present and they aimed at disincentivising heterotachy with a coefficient, surcharging trains whose route was excessively different from the other routes in the timetable. This surcharge can be classified as type b) of the previous list: disincentivising inefficient timetables.

The new pricing for the period 2024-2028 is currently being defined and is ruled by regulation ART/11/2023, which explicitly requires externalities (Part C) to be priced in addition to the *efficient total costs* fully covered by Part A and Part B. The Part C is the sum of five different components:

C1: scarcity pricing on specific lines and periods

C2: environmental costs

C3: incentive to equip trains with the ETCS signalling system

C4: discount for local authorities that finance infrastructure upgrades

C5 (-): compensation for suboptimal travel time during route allocation.

C1 and C5 are the components related to capacity. C1 has been introduced in response to the capacity shortage on the HS lines but it can be applied anywhere in the network that is *declared to be saturated or with limited capacity*. C1 will be applied experimentally in 2024 and officially applied from 2025. It explicitly aims to induce RUs' to behave more efficiently and is not a 'fine' for inefficient use of capacity. Application of it is now limited to the saturated part of the HS network and excludes the urban nodes, where it is impossible to define an 'optimal speed' due to the coexistence of different train categories.

The C1 surcharge is based on the difference between the optimal line speed and the actual speed requested by the RU. All routes exceeding the optimal travel time and a tolerance threshold (e.g. 15.5 minutes from Orte to Settebagni on the Florence-Rome line) are overpriced by a share of the TAC of the routes inhibited by the irregular one. The amounts of C1 for the first experimental year on the four sections to which it is applied are reported in Table 1.

Table 1. Amount of the C1 component experimentally applied in 2024. Values in the draft regulation, not yet confirmed (RFI, 2023).

Section	Optimal speed	Length of the section	C1 = *f*(speed difference)
1°Biv.Orte Sud - BV/PC Settebagni	250 km/h	48 km	13-26€/km
PM Rovezzano - 1°B.Valdarno N.	250 km/h	18 km	27-54€/km
1°B.Valdarno N. - Bivio Orte Sud	250 km/h	170 km	5.7-11.4 €/km
Milano Rogoredo - Bivio/PC Meleg	250 km/h	14 km	18-36 €/km

The other TAC component is C5. Unlike C1, C5 is a negative toll, i.e. it compensates RUs for an excessive speed reduction imposed by the IM for various reasons, including regularity buffers in defining the route. The proposed compensation is 6 €/minute exceeding the optimal path time and it is aimed at compensating the extra costs for crews.

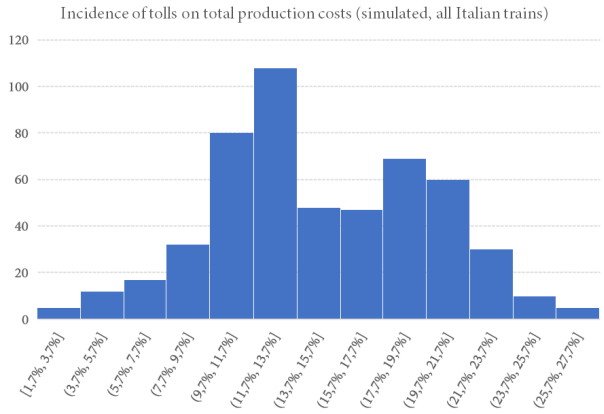

Figure 3. Weight of TAC (Part A and Part B) on estimated operating costs including energy. The observations are the number of lines with similar routes. Source: Beria (2023).

An important element is the effective ability of the C1 surcharge to shift or reduce the demand for routes on congested lines. Figure 3 shows the share of TACs (in the previous regulatory period) in estimated total operating costs, including energy for all Italian passenger services. The amount and distribution of the new TACs is not yet known in detail (the pricing is currently under consultation), but if they remain in the range of the previous ones, their weight will be around 20-25% for HS trains and 10-15% for PSO trains.

For example, for a Venice-Rome route hypothetically operated at 180 km/h, a speed lower than the optimal one on the HS Florence-Rome section, the C1 would come to 2025 €/train (the lower bound of the range). This surcharge represents an additional 16-18% cost with respect to current cost estimates (OPEX excluding TAC about 17-20€/km), or more if operated with cheaper rolling stock. A regional train, the lower speed of which would occupy more fast routes, would pay more than 4000 €/train. It is hard to say if these amounts are actually able to induce companies to change rolling stock or route requests, but the surcharge is far from negligible and it adds to the costs of slower trains. For this reason, it is likely that they may be effective in inducing more frugal requests and limiting the problem of capacity saturation.

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