Introduction: Economic regulation of transport infrastructure, theory and practices

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1. Introduction

The application of regulation concepts is increasingly penetrating the transport sector, worldwide. State provision is increasingly questioned, as well as the permanence of unregulated monopolistic markets. Of course, the degree of effectiveness and deepness of such process is various, depending on the starting point and of the ideological orientation of governments.

This process is, obviously, more advanced on the services side, that are not natural monopolies: many countries foresee tenders for some or all rail and local transport services, the entire air and cargo sectors have been liberalised in large regions, unbundling processes and privatisations of the former national companies are ongoing. The process, in the counterpart of infrastructures, tends instead to be less developed, especially in some networks. Theory is often derived by other network sectors (Laffont and Tirole, 1993; Alexander and Harris, 2005; Guthrie, 2006), but its actual transfer to the transport sector is not obvious and, generally speaking, extremely complex. Practical applications, also in the most advanced cases (like highway concessions, pricing rules for rail access charges, airport pricing), are scarcely systematised and generally unknown outside each country. In fact, very few comparative studies exist on current real world regulatory practises,[1] and fewer proposing quantitative comparisons and measurements of the effectiveness of regulatory practises.

The purpose of this special issue is to contribute to fill this gap, by collecting ten studies relative to all kinds of transport infrastructure, except urban mass transit. In general, for each mode, we collected one contribution providing a general comparative overview of regulation over a sample of countries, and one or more relevant single-country cases. In addition, a couple of papers deal with cross-mode topics, namely pricing and Public–Private Partnerships (PPPs in the following). Given the nature of regulatory problems, the solutions has to be based both on solid theory, and at the same time profoundly dependent on real world conditions of application. This special issue tried to cover both dimensions, thanks to both theory and case studies.

In this introduction, we will recall the main issues related to infrastructure regulation that will be developed by the included papers. On the background, we discuss also some further issues of general nature, that our authors partially faced and partially left open to further research: PPPs, pricing, and the relationship between regulation, investment and assessment.

[1] See for example Fayard and Bousquet (2001), Ragazzi and Rothengatter (2005) and Engel et al. (2003) in the motorway sector. Rail comparisons are more and some are quoted below.

2. Infrastructure regulation within the transport modes

The airport sector regulation is presented in this issue by Adler et al. (in this issue). Surely, the airport sector is where the research on the effectiveness of regulatory mechanisms is more explored in quantitative terms. The authors provide us with a sample of airports coming from twelve countries, all subject to variants of price-cap regulation. These mechanisms include pure price caps as well as hybrid price caps combined with other incentives and investment obligations. The main finding is that incentive regulation is superior in terms of allocative efficiency than cost-plus regulation.

Defilippi (in this issue) provides us with one specific case of price-cap regulation, namely Lima's airport. He finds spaces of discretion in the applied price-cap, which caused controversies. The case shows how a careful ex-ante planning of concession contracts could save costly ex-post renegotiations, in particular in the estimation of the cost of capital, and that transparency can improve the acceptance of regulatory decisions.

The regulation of the port sector is far less homogeneous than the airport sector. Ferrari et al. (in this issue), analyse the situation of European ports and of the concession models in particular. The European context lacks of a general legislative framework, which translates in many different national types of regulation, and situations of inefficiency. The port sector, interestingly, is the one where labour regulation influences more the overall regulatory framework, and not the opposite.

The motorway sector is analysed in this issue by three different papers. Beria et al. (in this issue) provide a comprehensive contextualisation of the regulation of the main motorway networks worldwide. A sample of 21 countries compares the general regulatory environment, the specific rules (such as pricing method or price-cap adoption) and the regulatory institutions. Similarly to the port sector, motorways are regulated very differently around the world, ranging from free public motorways, to privately owned toll roads and to the concession models.

Two more papers analyse respectively the cases of France's and China's motorways. Both countries are relevant for the understanding of the regulatory mechanisms. France, representing the case of a "mature" network, is analysed by Bonnafous (in this issue) in terms of the privatisation process and of the competition

stimulated by it. The Chinese case, by Xu and Grant Muller (in this issue), tells us about a more recent network and about the regulation, which allowed a rapid building process, driven both by public and private investments.

Finally, some papers deal with rail. Differently from other modes, rail regulation has been analysed from many perspectives, also including some comparative and general studies (Eisenkopf et al., 2006; Beria et al., 2012; Alexandersson, 2009; Nash et al., 2013; Finger, 2014): the implementation of regulation, liberal-isation and privatisation cases, tendering theory and examples, access charges and unbundling strategies, etc. The paper included, by Bošković and Bugarinović (in this issue), gives an insight to a less studied area, namely South Eastern Europe. In particular, they deal with the issue of unaligned harmonisation process of rela-tively small and scarcely integrated networks.

3. Pricing

Pricing is a core topic in infrastructure regulation, linked both to transport policies and to the remuneration of investments, but very mode-specific.

Beria et al. (in this issue), provide an overview of highway tolls applied in some twenty-one countries, especially in terms of cost coverage. But tolls do not determine only the financial feasibility of road investments, entailing also important side effects in the transport networks. Rouhani et al. (in this issue), simulate a road network and its flows, and empirically test the effect of different pricing schemes in terms of welfare and profit maximisation. They find that a pricing system – whose primary purpose is to finance an infrastructure expansion – may cause surplus losses, for ex-ample because of negative spillover effects.

The effect of rail charges, instead, always goes beyond finance and transport policy dimensions, and may influence the actual level of competition on the network. Finally, pricing is central also in airport regulation, as Adler et al. (in this issue) clearly analysed. Also in this sector, pricing is a tool to obtain allocative and productive efficiency, but also to drive quality and provide long run investment coverage.

On the background remains the issue, still at stake, of the different pricing criteria applied across modes, ranging from average cost pricing applied to many motorway and airport infrastructures, to the lack of tolls on other roads and to the various pricing levels (always well below average cost pricing) of rail infrastructures. Not to mention the profound difference with the scarcely found (but often proposed) cases of social marginal cost pricing. The research should also deepen the relation between pricing and the dimension of network concessions: the larger a concession, the easier is the self-funding of network extensions if spread to all users is allowed. This determines, again, distortions that do not depend on the economic characteristics of the infrastructure, but only on the way it is exogenously regulated.

4. Public–Private Partnerships

The involvement of private parties in transport infrastructure delivery became more and more common since the end of the Nineties. Its rationale was twofold: basically, to face the declining availability of public funds, and secondly, to obtain extra (societal) benefits thanks to the direct deployment of privates' capabilities, for example technological and managerial. However, experience showed that PPP models are hardly justified if no actual extra benefits exist, because discount rates applied are higher than with public procurement and because further costs rise (Roumboutsos and Macario, 2013), typically amortising and risk premiums. Also in this issue, Macario et al. (in this issue) discuss of PPPs pitfalls and problems referring to the regulation applied in some EU countries and bring specific evidences from Portuguese experi-ences. In particular, they often find overestimation of demand, which calls for contracts renegotiations or forces the State to compensate the concessionaire's losses. One of the causes lays in the multiplicity of parties involved in the concession process, which tends to deresponsabilise them.

The risk allocation is central. The apparently intuitive fact that the risk must be borne by the party more capable to manage it, does not have always correspondence in reality. Not assuming inexperience or misfortune as a credible explanation (the seminal work of Flyvbjerg et al., 2003, already effectively documented), the true causes of mismatch should be better understood. Most likely, opportunistic behaviours and information asymmetries from the regulator, in many cases, may play a central role.

5. Regulation and investment behaviour: under- and over-investment

Traditionally, transport economic regulation deals with efficiency of transport provision in terms of costs and prices, and tries to avoid the rise of monopoly rents or other market distortions. However, ordinary techniques such as price-cap or tenders are not specifically designed to regulate infrastructures in presence of investments. Consequently, these generally remain outside of the core of the regulatory process. Other regimes, such as rate of return regulation (RoR in the following), are based on the quantity of the capital invested, but their limits, such as the risk of over-investment, are well known (Gómez-Ibáñez, 2009).

This mismatch between the regulatory tools and the crucial aspect of investment needs further deepening. Regulatory practice should consider more explicitly the investments, which represent a significant part of the problem of economic regulation in the transport sector, both for existing and newly built systems. Regulatory tools must also consider that regulated parties may strategically use regulatory rules (or the lack of them) at their advantage. This is the case well developed by Albalate et al. (in this issue). They find in biased regulatory mechanisms the cause of oversupply of transport infrastructures in Spain, in particular in the neutralisation of risks for private investors whose cost cover-age is guaranteed. In addition, they infer the original cause of the bias in the existence of short-term political goals, as previously pointed out, for example, also by Newbery (1998) and Kopp (2006).

The forms of oversupply are various and not limited to an excess of network extension in a country. Also not only network capacity could be excessive (highway lanes expansion, rail doublings, unjustified airport terminal dimension, etc.), but there could be cases of overdesign or "gold-plating" (choice of materials, monumentality, etc.). At the opposite side, regulation may also drive to underinvestment. Literature already faced this, especially from a theoretical viewpoint. Newbery (1998) finds RoR regulation to be, in general, more vulnerable to opportunistic behaviours than price regulation (typically price-cap). Helm and Thompson (1991) summarise what theory of price-cap says about invest-ment: long run optimal investments are achieved with a series of smaller investments in the shorter regulatory lags. However, this tends to be not true in practice. Gómez-Ibáñez (2009) recalls that the price-cap mechanism does not promote long-term invest-ments including the ones promoting efficiency, but only the short-term ones, unless the regulator introduces appropriate in-centivising mechanisms. Conversely, RoR regulation is a potential source of "gold-plating" and overinvestment in general (Gómez-Ibáñez, 2009). Also Guthrie (2006) shows that investment

behaviour of firms subject to regulation is altered by the allocation of risk between their shareholders and the customers. This generally causes underinvestment because the risks associated with investments tend to be high, at least compared to RoR schemes.

However, Forsyth (2008) overcomes the general belief that the incentive regulation tools tend to cause underinvestment, while RoR regulation pushes overinvestment. Cases of overinvestment are found, and are also theoretically explainable, even in presence of price-cap regulation (Starkie, 2006; Beria and Ponti, 2009). Similarly, underinvestment can rise also under private firms RoR schemes if allowed returns are too low (Helm and Thompson, 1991).

In conclusion, some further effort is needed in the direction of better understanding and modelling the possible behaviours of regulated firms according to regulatory strategies, since too simple schemes may not work properly. In particular, an equilibrium between the conflicting goals of regulating prices and profits, and promoting efficient investments (Forsyth, 2008). We try here to outline a possible scheme, left to further developments.

First of all, behaviours differ according to the type of investment and on the subject bearing the risk. If the demand risk is totally left on the regulator, we can have underinvestment if public budget is insufficient or, more likely, overinvestment, if political purposes prevail (as for Albalate et al., in this issue).

If the risk is left to the concessionaire, it tends to realise autonomously only the investments that generate profits even at fixed fares. We call these investments "endogenous":

1. cost saving investments (e.g. automatic highway gates vs. manual collection);
2. in case of insufficient capacity, or in case of extension of an existing segment of a network, if revenues from new users are sufficient to repay the investment;
3. in case of congestion, if better travel conditions attract sufficient new demand.

In these cases one must avoid overregulation, except a skimming of long-term profits. It must however be verified also if the infrastructure expansion (e.g. a new segment of a network) can be independently built and managed by another concessionaire instead of extending the existing concession. In general, in fact, if no significant economies of scale exist, smaller concessions are better than larger ones due to inferior political clout.

In all other cases, the investment can be defined as "exogenous", i.e. to be promoted by the regulator by changing the given regulatory conditions. The ways to allow for exogenous investments[2] are various, as described for example by Bonnafous (in this issue):

1. lump sum subsidies to cover all or part of the investment;
2. extension of concession period or take-over compensation (also in Laurino et al., 2010);
3. allowing tariff increases above the current level, if the users' willingness to pay (WtP in the following) for reduced travel time (in case of released congestion) or for improved travel quality, is sufficient to repay the investment;

To the contrary, if the users' WTP is insufficient to repay the investment and the public purse cannot subsidy the investment, there is some risk of underinvestment, i.e. a socially desirable infrastructure is not built because of regulatory (and financial) limits. But this is probably the case only in presence of extremely high external benefits, as otherwise the low total WtP of the users matches with low social utility of the investment.

Letting the concessionaire rise tariffs to finance infrastructural investments is however risky, as may rather drive to overinvestment. This happens when demand is inelastic to fares, for example because no alternatives exist, and a monopolist provider can exploit the demand WtP above the level of efficiency. Similarly, also the extension of concessions may deresponsabilise the concessionaire choices and maximise investments to be repaid in the far future.

6. Regulation and assessment

As already mentioned, the evaluation of public choices remains crucial, also from a regulatory point of view. The fact that an investment is feasible thanks to a contractual extension (in length or in the fare level), does not mean that the regulator must authorise any investment, just because it comes without a direct public expenditure. Gold plating and oversupply must be avoided anyway, whatever is the source of funds. Surely, the practice of economic assessment through cost-benefit analysis must be more widespread both when the Treasury pays for the investment and in cases when the users are assumed to take the burden.

Contributions in this field are still scant. For example, Vickerman (2009) brings to our attention how regulatory regimes influence (or distort) also appraisal results, and ultimately decisions, and thus should be explicitly considered in the assessment. Also Bonnafous (in this issue) discusses a case in which the socio-economic assessment is interfaced with the regulation of toll level, thus influencing the definition of investment priorities of the franchised highways.

7. Conclusion: regulation between theory and practice

As we tried to show in this introduction and as will be clear when reading the papers, the study of regulation cannot limit to theory, which instead must be the interpretative key for the real world cases. With this respect, a relevant area needing extensive further analysis is the "capture" mechanism, well present in the regulatory practice.

In principle, there is no technical obstacles for a ministry, or any other public body, to acquire in the market the technical skills needed for a sound regulation activity, without any bureaucratic duplication. However, independent regulation is needed if we assume the hypothesis of captured decision makers, as the "public choice" theory of Buchanan and Tullock and their followers showed. While it is scanty present up to now, it is probably an indispensable tool in order to improve the existing decision mechanisms, otherwise distorted by "capture" issues.

[2] Which must be previously assessed in terms of costs and benefits.

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