



**Can Supranational Infrastructure Regulation
Compensate for National Institutional Weaknesses ?**

Emmanuelle Auriol
Toulouse School of Economics

Antonio Estache
SBS-EM, ECARES, Université libre de Bruxelles

Liam Wren-Lewis
Paris School of Economics

March 2017

ECARES working paper 2017-11

Can supranational infrastructure regulation compensate for national institutional weaknesses?^a

Emmanuelle Auriol^b

Antonio Estache^c

Liam Wren-Lewis^d

March 2017

Revised June 2017

Abstract

We study the impact of institutional characteristics of national and supranational regulation on the effectiveness of both types of regulation. We focus on four institutional dimensions: regulatory capacity, accountability, commitment and fiscal capacity. We show how supranational regulation may reduce or worsen the challenges imposed by national institutional weaknesses. The analysis allows an identification of the costs and benefits of supranational regulation in very diversified institutional contexts. It also explains why some desirable changes from a global welfare perspective are unlikely to take place unless the losers of market integration are somehow compensated when national regulation is unlikely to do so as a result of some of its weaknesses.

^a The authors are grateful to the participants of the conference « Les nouvelles frontières de l'État », which was held in Paris the 24th of January 2017 for their constructive comments and remarks. They are also grateful to an anonymous referee, as well as the editor of the Revue, for thoughtful comments and helpful suggestions. All remaining errors are ours.

^b Emmanuelle Auriol is with Toulouse School of Economics, emmanuelle.auriol@tse-fr.eu

^c Antonio Estache is with ECARES at ULB, aestache@gmail.com

^d Liam Wren-Lewis is with Paris School of Economics, liamwrenlewis@gmail.com

1. Introduction

Infrastructure regulation has traditionally been conceived as a national or local policy. The increased scope for international trade in infrastructure services, observed in the last 20 years, has induced the case for their regulation at a supranational level. This is because, when regulated services cross borders, local regulatory decisions, have non-local impacts. For instance, when Spain decided to stop subsidizing renewable energies, the price of electricity in France increased. When Belgium, France or Germany closes its nuclear plants, it impacts the electricity markets in many other countries. More broadly, without coordination, differences in the national regulation of infrastructure services may alter comparative advantages and risks allocation across countries and result in production and distribution location arbitrations (e.g. Crampes (2014) or Albrecht (2014) in the context of the EU energy policies). This can penalize both users and producers, as already pointed out in the fiscal federalism literature on tax or environmental competition (e.g. Oates 2005). Differences in national regulation can also reduce the incentive for new cross-border investments, a major issue at a time when concerns for climate change are leading to major transformations in the nature and composition of the infrastructure capital stock.⁵

As a result of the growing policy concerns for regulatory spillovers, the academic literature on the interactions between regulation and international markets has been growing over time. But it is quite heterogeneous. It has a long record in political science (e.g. Eckert 2011, Majone 1997 or Thatcher 2011) and among legal scholars (e.g. Sandholtz and Stone Sweet 2012). It has also been implicit in the early models of multiple principals and multiples agents (Faure-Grimaud, Martimort and Laffont 1999, Martimort 1996a, 1996b, Laffont and Martimort 1997, 1998a, 1998b, 1999, 2001). Supranational dimensions of regulation only started to appear explicitly in the design of regulation in agency models in the mid to late 1990s. This has led to a wide range of non-standard results that contributed to make the case for a supranational supervision of a wide range of activities requiring some form of regulation.

The formal economic modeling of regulation in a supranational context may have started with Brainard and Martimort (1996, 1997). They focused on the strategic effect of export subsidies in an integrated market under asymmetric information between the regulator and the national firms. Their result explained why there may be local tolerance for market power on behalf of local consumers' welfare when the related inefficiencies can be exported to foreign consumers. They implicitly started to point to some of the distributional issues supranational regulation needs to address. Combes, Caillaud, and Jullien (1997) showed that the existence of international interactions may influence the optimal choice of regulatory instruments. For instance, it may be optimal to allow for quantity subsidies, rejecting the common criticism of state aids in less focused models. Calzolari (2004) looked at the interaction between the policies of different national regulators when they have to deal with a single multinational firm operating in two different countries. He shows that multinational firm can relatively easily benefit from a lack of coordination between the various national regulators, hinting already at the relevance of the weaknesses of national regulators when making a case for a supranational regulator. Biancini (2011) added the importance of a positive cost of public funds for the optimal regulation of national firms in a common market. She showed that, for market integration to be welfare improving, the fiscal costs of regulation have to be lower than the efficiency gains achieved through integration. She also provided arguments to temper the enthusiasm for supranational regulation by showing that cost

⁵ As argued by von Hirschhausen et al (2012), cross-country incomparability of regulation includes a wide range of very basic regulatory design characteristics such as differences in methodologies used to calculate the allowed revenue.

correlations and ex-ante technological risks can impact its effectiveness. Finally, Auriol and Biancini (2015) looked at the risks of underinvestment in costly interconnection when networks can cover various countries. Their results also make the case, in a world of benevolent national regulators with national monopolists, for a supranational regulator. It is needed to facilitate welfare gains from integration when costs differences between these monopolists are sufficiently strong.

Overall, this research showed that there are many instances in which supranational regulation may make sense but it also demonstrated, often implicitly, the relevance of institutional weaknesses for the optimal design of regulation. How well the unexpected effects of increased trade in infrastructure services in countries with different regulatory preferences and constraints can be addressed depends on the ability and willingness of national regulators to coordinate. And they occasionally allow for transitional subsidies. Moreover, this literature also implies that many policy interventions are easier to implement for a supranational agency. It is less subject to perverse incentives than the national agencies, which are required to coordinate multiple internal and external concerns. It is then a better alternative to international negotiations between national regulators and ministries of the various countries concerned.

This is not to say that supranational regulation is easy to implement and differences in regulatory preferences and institutional designs may matter. Negotiation can be hard and reveal differences in commitment to supranational regulation as a solution to the joint planning and coordination efforts. The recent debates surrounding the sovereignty of countries in the context of the Comprehensive Economic and Trade Agreement (CETA) signed by Canada and the European Union, and of the ongoing negotiation of a Transatlantic Trade and Investment Partnership (TTIP) between the European Union and the United States, illustrate the tensions associated with the efforts to increase the role of supranational regulation when national preferences are heterogeneous.

In this context, concerns for the consequences of a *de-facto* supra-national regulation defined by international arbitration courts as a substitute to national regulation has made the top of the agenda of many policymakers. This is what the public unhappiness over the inclusion of investor-state dispute settlement clauses designed to protect international players from the risks of local institutional weaknesses is all about. It highlights the possibility that national regulatory preferences, could be superseded by regulatory rulings decided by judges without a credible mandate to take into account differences in preferences. The concerns for the possible capture of supranational judges stemming from the differences in budgets or technical capacity available to large operators lobbying the supranational agencies as compared to those available to users and other stakeholders illustrate some of the limitations of supranational regulation. In many countries, the risks of supranational regulation could thus be stronger than its potential payoffs.

This suggests that the regulatory challenge produced by international trade in infrastructure services is not only about reconciling differences in political preferences. It also has to rely on a conceptualization of the implementation challenges to identify the nature and the importance of the trade-offs. The institutional structures supporting supranational regulation can often be weaker than national structures in various ways. They depend on the commitment of multiple national governments or agencies to the coordination of some dimensions of regulatory policy. They imply multiple levels of explicit or implicit agency issues.

In this paper, we document the importance of institutional characterizations of national and supranational regulation (SNR). In particular, we focus on four institutional dimensions that tend to drive the optimal regulatory policy in infrastructure: regulatory capacity,

accountability, commitment and fiscal capacity. Estache and Wren-Lewis (2009) have shown their relevance in the context of the optimal design of national policies. This paper highlights the extent to which the supranational dimensions sometimes may reduce or worsen the challenges imposed by national institutional weaknesses.⁶ It allows a better appreciation of the costs and benefits of supranational regulation in very diversified institutional contexts. It also explains why some changes desirable from a global welfare perspective are unlikely to take place unless the losers of market integration are compensated when national regulation is unlikely to be able to do so as a result of some of its weaknesses.

The paper is organized as follows. In section 2, we describe the nature of national institutional constraints that drive of regulatory outcomes in the contexts of a simple model of regulation in an isolated country. Section 3 then surveys the various ways in which supranational regulation may mitigate these problems. Section 4 considers the challenges for supranational regulation that these institutional limitations present, as well as the ways in which it may worsen them. Section 5 concludes.

2. Supranational consequences of national institutional weaknesses

Trying to deal with the national regulatory preferences and institutional characteristics clearly adds to the complexity of managing information asymmetries in a supranational context. We rely here on a broad definition of institutional weaknesses. To highlight the main drivers of the optimal choice of regulation in a multi-country context, the key aspects of institutional weaknesses affecting regulation can be grouped into four broad limitations: (i) limited regulatory capacity, (ii) limited commitment ability, (iii) limited accountability and (iv) limited fiscal capacity.⁷ Before considering the relationship between these weaknesses and supranational regulation, we briefly discuss the impact of these limitations on standard welfare drivers at the country specific level.

In order to do so, it is useful to rely on a common basic model of utility regulation in which the regulator and the government are separate actors. We use it to highlight how the various forms of institutional weakness can impact the optimal choice of regulation even ignoring the supranational dimensions. This initial simple model is now standard in the field.⁸ It focuses on a monopolist producing a quantity q of a good for domestic consumption. Its cost function is $C(q) = (\beta - e)q - F$, where β is a firm-specific characteristic representing its underlying cost, e is an effort level that decreases the marginal cost and F is a fixed cost. β represents costs that are outside of the firm's control, such as factor prices or technology. The model is binary in that the firm is either low-cost, $\beta = \underline{\beta}$ (occurring with probability ν) or high-cost, $\beta = \bar{\beta}$ (occurring with probability $1-\nu$). e is the part of the marginal cost that is controllable by the firm. For example, the manager may be able to reduce costs by purchasing from the cheapest supplier or by reducing mistakes. Exerting an effort level of e causes the firm a disutility of $\psi(e)$ ($\psi' > 0, \psi'' > 0, \psi''' \geq 0$).

The monopoly's revenue from sales is qp , where p is the price level. In addition to this revenue, the monopoly receives a transfer from the government.⁹ This transfer takes the form

As argued by von Hirschhausen et al (2012), cross-country incomparability of regulation includes a wide range of very basic regulatory design characteristics such as differences in methodologies used to calculate the allowed revenue. sidering telecoms and electricity regulation in the EU, draws relevant lessons from the economics of federalism.

⁷ See Estache and Wren-Lewis (2009) for a justification of this classification in a national context.

⁸ See Laffont and Tirole (1993) or Armstrong and Sappington (2007) for detailed expositions of these models.

⁹ See Laffont and Tirole (1993, p.145-155) for details of how the model changes when transfers are removed. Generally, when prices must be used to generate the revenue here provided by transfers there will be a loss of efficiency. This may however be mitigated if the firm can use two-part tariffs rather than linear prices.

of a lump sum, t , which may be positive (i.e., a subsidy) or negative (i.e., a tax). The monopoly's profit is then $U = qp - (\beta - e)q - F - \psi(e) + t$. U is also the 'rent' the firm receives from being the monopoly supplier. The monopoly has a participation constraint (PC) such that its rent must be no less than 0, i.e.

$$(1) \quad U(\bar{\beta}) \geq 0 \text{ and } (2) \quad U(\underline{\beta}) \geq 0$$

We define $e(\beta)$ and $q(\beta)$ as the effort levels and quantities produced as a function of β .¹⁰ Consumers' gross surplus from consuming a quantity q of the good is

$$(3) \quad S(q) = \int_0^q P(q') dq'$$

where $P(q)$ is the inverse demand function of a normal good ($S' > 0$, $S'' < 0$). Taxpayers also need to be accounted for as they pay taxes to fund the transfer to the monopoly. Raising an amount t in taxes costs $(1 + \lambda)t$, where $\lambda > 0$ is the opportunity cost of public funds. Hence the net surplus of consumers plus the surplus of taxpayers is $V = S(q) - qp - (1 + \lambda)t$. It implies that if the monopoly can be taxed it yields a social surplus valued at $(1 + \lambda)t$. By virtue of equation (2), we have that $p = P(q) = S'(q)$. We assume that both p and q are public information and that the government sets one of these variables directly. The other is then determined by the consumer market.

We assume here that F is common knowledge. We also assume that the government can observe marginal cost $c = \beta - e$ but they do not observe the components of this cost – i.e. they do not observe β and e . The contract between the government and the firm can therefore specify the price the firm should sell at, the marginal cost level it should obtain and the transfer from the government to the firm.

Suppose the government is unaware of the value of β . From the revelation principle, there is no loss of generality in restricting the analysis to direct revelation mechanisms which specify for each message from the firm, the transfer, the final marginal cost and the price that will occur. In order for the firm to be willing to accept the contract designed for their type, such a mechanism must satisfy the PCs in **Error! Reference source not found.** and (2) as well as the incentive compatibility constraints (ICC):

$$(4) \quad U(\underline{\beta}) \geq U(\bar{\beta}) + \Phi(e(\bar{\beta})) \text{ and } (5) \quad U(\bar{\beta}) \geq U(\underline{\beta}) - \Phi(e(\underline{\beta})) + \Delta\beta$$

Here $\Delta\beta = \bar{\beta} - \underline{\beta}$ and $\Phi(e) = \psi(e) - \psi(e - \Delta\beta)$, i.e. the difference between the costs of the high-type and the low-type exerting a given effort level. These ICC make sure that neither type of firm wishes to pretend to be the other type – i.e. they will reveal their type truthfully. It is useful to note that $\Phi'(e) > 0$, since $\psi'' > 0$, i.e. the marginal cost of exerting effort at a given cost level is greater for the high-cost firm than the low-cost firm.

As usual, when there is an asymmetry of information so that the regulator does not observe the β s, the binding constraints will be the PC of the high-cost firm in (1) and the ICC of the low-cost firm (4). Moreover, if inequality **Error! Reference source not found.** holds, then $U(\underline{\beta})$ is greater than $U(\bar{\beta})$, and hence we need only to be concerned with ensuring $U(\bar{\beta}) \geq 0$. The only potentially binding conditions are, thus, (1) and

¹⁰ Hence $e(\underline{\beta})$ is equivalent to \underline{e} , $e(\bar{\beta})$ is equivalent to \bar{e} , etc, in the notation of Laffont and Tirole (1993).

Error! Reference source not found. Given that the government does not wish to give rents to the firm, both of these conditions will bind, since through changing the transfers to the firm the government can set the firm's rents as low as possible. We therefore have that while the high-cost firm will receive no rent, the low-cost firm will receive a rent $U(\underline{\beta}) = \Phi(e(\bar{\beta}))$. This is the usual firm's "information rent", which is received as a result of the firm holding more information than the government. Since this rent effectively comes out of public funds (either directly through subsidies or through reduced taxes), its net cost to society is $\lambda\Phi(e(\bar{\beta}))$.

The national regulator is mandated by the government to cut the asymmetry of information by learning the value of β . The regulator is endowed with an information technology that yields a private signal r that may give information about the firm's cost. With probability ξ the firm's cost is revealed to the regulator ($r = \beta$) and with probability $1 - \xi$ he receives no information ($r = \emptyset$). We assume that the signal the regulator receives is 'hard' information. This means that the regulator cannot report that the firm is of a particular type unless it has received a signal revealing this to be true. However, it can hide information and report that the signal is \emptyset even if this was not the case. In other words, the signal can be hidden but it cannot be faked.

The firm is assumed to observe both the regulator's signal and his report to the government. The firm can corrupt the information process by contracting on the regulator's report and make dependent transfers. Transfers between the regulator and the firm are costly because illegal, i.e. there may be costs undertaken to hide the transfer and/or a penalty if the parties are caught. Hence for any bribe given by the firm, the regulator only enjoys a fraction k of the bribe, where $k \in (0, 1)$. k here represents the ease with which bribes can be made, i.e. a higher value of k means that there are fewer costs involved.

If the government wishes to prevent collusion from occurring, it can do so by paying an incentive payment of $s = k\Phi(e(\bar{\beta}))$ every time the regulator reports that $r = \underline{\beta}$. Since this costs society $\lambda k\Phi(e(\bar{\beta}))$, it will always be optimal for the government to prevent collusion. Indeed the social cost of the firm's information rent is $\lambda\Phi(e(\bar{\beta}))$ and $k < 1$.¹¹ So preventing collusion costs $\lambda k\Phi(e(\bar{\beta}))$ and yields a benefit of $\lambda\Phi(e(\bar{\beta}))$.

Departing, now, from the Laffont and Tirole (1993) model, we assume the government can be captured. Hence the non-benevolent government aims to maximize the following social welfare function:

$$(6) \quad W = \gamma U + V$$

where $1 + \lambda > \gamma > 1$,¹² with γ representing the *capture of decisions*. Since the government is the decision maker, this directly distorts its choices : it cares less about the distortion caused by taxes to pay for the firm's rent, or alternatively if the regulated firm is profitable about the taxes that can be levied on its profits. Substituting in the appropriate functions and rearranging gives: $W = S(q) + \lambda pq - (1 + \lambda)[(\beta - e)q + \psi(e) + F] - (1 + \lambda - \gamma)U$

The government then sets quantities and effort levels to maximize expected welfare. In all cases, quantities will be set such that the price mark-up reflects the cost of public funds, i.e.

¹¹ See chapter 11 of Laffont and Tirole (1993) for further details.

¹² If $1 + \lambda < \gamma$ then the model becomes uninteresting as the government simply transfers all of consumers wealth to the firm through taxation.

$$(7) \quad \frac{p - (\beta - e)}{p} = \frac{\lambda}{1 + \lambda \eta}, \text{ where } \eta \text{ is the elasticity of demand.}$$

The government can also indirectly set the firm's effort level by promising to reimburse an appropriate fraction of the firm's costs. If the government is informed (because the regulator has truthfully reported its signal), then it will set effort levels to be efficient, i.e. $q = \psi'(e)$. The government achieves such effort levels by making the transfer to the firm independent of the firm's cost, which gives the firm the efficient incentives when it comes to exerting effort.

The government will also set such an efficient effort level for the low cost firm in the case where it has had to extract cost information from the firm through the revelation mechanism discussed earlier. However, the government will not set an efficient effort level for the high-cost firm. This is because, as shown earlier, the information rent paid to the low-cost firm is a function of the high-cost firm's effort, i.e. $U(\underline{\beta}) = \Phi(e(\bar{\beta}))$. The government therefore reduces the effort exerted by the high-cost firm in order to decrease this expected rent. In particular, we will have

$$(8) \quad \psi'(e(\bar{\beta})) = q(\bar{\beta}) - \frac{1}{1 + \lambda} \frac{v}{1 - v} \left[\lambda + \frac{\xi}{1 - \xi} \lambda k + 1 - \gamma \right] \Phi'(e(\bar{\beta}))$$

This result can be understood as follows. In the basic LT model, the optimal effort for the high cost firm is obtained by setting $\xi = \gamma = 0$ in (8). The rent that the low-cost firm receives is costly to society since it comes through higher distortive taxation, and hence the government will wish to reduce it. Furthermore, a larger potential rent for the firm increases the size of the incentive payment the government pays the regulator, and hence this is a further reason to decrease the low cost firm's rent. However, when the government is captured by the industry, which here is represented by a positive value of γ , it is more inclined to abandon rents to the industry, and therefore distorts less the effort of the high-cost firm.

In order to reduce the rent, the government reduces the amount the low cost firm would gain by mimicking the high cost firm. The government does this by reducing the effort level it requires of the high cost firm and the transfer it receives, which correspondingly reduces the output produced by the high-cost firm. This, therefore, reduces the number of units over which the low-cost firm can exercise its cost-advantage by mimicking the high cost firm.¹³ When the level of regulatory capture, γ , increases, the distortion on the high cost firm is reduced so that the rent of the low cost firm increases.

We can now discuss the four institutional weaknesses outlined above and how they relate to the various variables in equation (8).

Limited regulatory capacity. In the model above, an improvement in regulatory capacity is simulated through a higher value of ξ , the probability that the regulator is informed. Social welfare is increasing in ξ . If it increases, the regulator is more likely to observe the firm's underlying cost β . This increases expected welfare in two ways. First, welfare is higher in the case where β is observed than when it is not, since here there is no asymmetric information and hence the low-cost firm receives no information rent whilst the high-cost firm undertakes the efficient amount of effort. Second, even when β isn't observed, the government can be more confident that the firm is the high-cost type, and hence will offer a contract with a lower distortion for the high-cost type. This lower distortion will lead to more cost reduction by the

¹³ An alternative way to understand the result is that the transfer is reduced by an amount that makes the high-cost firm indifferent to the change, but it reduces the gain to the low-cost firm of mimicking since the marginal cost of effort is lower for the low-cost firm (i.e. $\Phi'(e(\bar{\beta})) > 0$).

high-cost type and, since the government is optimizing, this will outweigh the cost of the extra rent that goes to the low-cost type.

In practice, regulatory agencies are frequently underfunded, usually because their ability to self-finance is limited legally or because of a shortage of government revenue. Sometimes because funding is deliberately withheld by the government as a means of undermining the agency. The lack of resources prevents regulators from relying on suitably skilled staff or monitoring tools. Beyond the regulator itself, an underdeveloped auditing system and non-specialized judiciary can further limit implementation. The outcome is thus welfare reducing for society for two reasons. First, the regulator has to pay an information rent to the firm more frequently, which must be raised through costly taxation. Second, the government will reduce the efficiency of the high-cost firm further in order to reduce this rent.

Limited accountability. Limited accountability is fundamentally linked to the information flows between actors since it is through misuse of this information that much of the potential for collusion occurs. In our simple model, limited accountability can be expressed in at least two ways. Where accountability is lax, collusion between the government and various interest groups, including regulated firms, is more likely to occur. In the model, γ is the measure of the degree of government capture by the firm and this is one of the variables that can be used to approximate the effects of changes in the level of accountability. Social welfare is decreasing in γ . If γ increases as a result of an international agreement, the government places a higher weight on the firm's profits than the standard utilitarian social welfare and its accountability to users is decreased. This leads the governments to offer contracts more high-powered than optimal. In particular, the high-cost firms will face stronger incentives to reduce their costs – this increases efficiency directly, but the benefit is outweighed by the need to give the low-cost firms a larger information rent. The net effect from an uneven distribution of preferences between firms and consumers, limiting the accountability to consumers in relative terms as a result of a trade in service agreement, is thus unclear. It depends on the cost characteristics of the firms.

The other variable of interest in the context of an assessment of the impact of supranational regulation on accountability is k since it measures the ease with which the firm can bribe the regulator. This variable k is likely to fall if supranational regulation increases the cost of bribing and social welfare is thus decreasing in k .¹⁴ A smaller k makes side transfers more costly, leading to two positive effects. First, since the regulator can't effectively receive such a high bribe from the firm, the government can give a smaller transfer to the regulator when she reports information that damages the firm. This reduces the cost for society due to the cost of raising public funds λ . Second, since the cost of paying the regulator is $k\lambda\Phi(e(\bar{\beta}))$, a decrease in k decreases the government's motivation to reduce the information rent. This increases the effort exerted by the high-cost firm, and hence leads to a decrease in costs and hence prices.

Limited commitment. Investment in utilities is particularly vulnerable to government lack of commitment because governments are always involved in their operation and the investment is long-lived and non-transferable. Furthermore, if governments cannot commit to enforce contracts, then many of the gains that could be reaped at the initial tendering point will be lost in future renegotiations. To explore this problem in the model, we can add investment in the following way. Suppose that, rather than β being given completely exogenously, the firm can influence its value by undertaking investment I before β is revealed. This investment

¹⁴ For various reasons, we might feel that a model where corruption never occurs is a somewhat unsatisfactory one. However, this model can easily be adapted to include both corruption and anti-corruption measures.

increases the probability that the firm will be a low cost type, i.e. $v = v(I)$ ($v' > 0, v'' < 0$).¹⁵ If the government is able to commit to reimburse a chosen level of investment then they will set $v'(I) = 1 / [U(\underline{\beta}) - U(\bar{\beta}) + V(\underline{\beta}) - V(\bar{\beta})]$, where $V(\beta)$ is consumers and taxpayers surplus. Optimal investment increases as the benefits of having a low-cost firm increase. However, if the government cannot commit to the firm at the investment stage, then the firm will only take into account its private benefits of investing. We will then have $v'(I) = 1 / [U(\underline{\beta}) - U(\bar{\beta})]$, confirming that the inability to commit will produce under-investment.

Limited fiscal capacity. It is common to observe a limited ability of governments to finance investment or regulation, especially so since the financial crisis of 2008. This is a growing concern, in particular when poverty levels are high and limit the users' ability to pay for their utilities services. In the model above, limited fiscal capacity is captured by the variable λ . A greater value of λ damages social surplus from trade since the quantity produced is lower and the price higher, as demonstrated in equation (7). Moreover, the information rent paid to the firm is more costly to society and this in turn leads to larger distortion in effort as shown in (8).

Consumers' surplus is decreasing in λ for two reasons. First, to mitigate the cost of public transfers to the regulated firm, the government will ensure higher prices that reduce the subsidy going to the firm, and possibly even to generate profits that can then be taxed. In the limit (i.e., when λ goes to infinity) the government behaves like a private monopoly, but with a higher cost function than the laissez-faire monopoly, because of the situation of asymmetric information. For the users of the regulated services this is worse than laissez-faire. Second, the government will reduce the power of incentives given to the high-cost firm to reduce the information rent, increasing costs and hence further increasing prices.

It is worth noting that if the consumers' surplus is monotone with λ , the total social surplus, which includes the surplus of the taxpayers is non-monotone in λ . Indeed, Auriol and Picard (2009) shows that the total social welfare is U-shape in λ . It initially decreases when λ increases because for the low value of λ the regulator put a relatively high weight on the consumers' surplus compared to subsidies/taxes. When the weight λ increases public transfers become costlier and the regulator starts to distort prices to the detriment of consumers. This initially decreases the social welfare (i.e., when the weight put on consumers is still high enough). For the large value of λ the regulator focuses on transfers (the objective function is tilted towards the taxpayers). When λ increases the price in (7) converges to the laissez-faire monopoly price. The government becomes predatory and the value of the rents it extracts from the consumers is weighted by λ . The social surplus then increases with λ .

In the following section, we consider the extent to which supranational regulation may provide opportunities to mitigate the consequences of the various sources of national institutional weaknesses: excess rents (limited regulatory capacity, accountability or fiscal capacity), insufficient efforts (limited accountability), underinvestment (limited commitment) and inequity (fiscal constraints). Where possible, we extend the model outlined above to demonstrate where each solution may play a role.

¹⁵ This component is taken from Laffont and Tirole (1993) since investment isn't modeled in Laffont (2005).

3. Opportunities of supranational regulation

One of the main hope of supranational regulation is its ability to, at least partially, offset the impact of the main national institutional weaknesses. It is important however to check its actual effect for each of the various types of weaknesses.

Regulatory capacity. In debates over national regulatory structure, the point has frequently been made that there are 'economies of scale' in regulatory expertise. Generally, a lack of skilled human resources is likely to result in the creation of fewer regulatory agencies. By pooling resources, a regulator is more likely to be able to afford the professionals required to process the information it receives. Moreover, experts will be able to share their knowledge more easily. At the national level, this has manifested itself in the tendency for advisors to recommend multisector agencies in developing countries and centralized, rather than decentralized (i.e., local), regulation in technically challenging sectors such as telecommunication and electricity. This argument can readily be extended to supranational regulation (see Kessides, Noll, and Benjamin 2010, for example). Whilst undertaking all regulation at the regional level is likely to be unrealistic, a regional regulator may be the best place to assign the most technically complex tasks. Another mechanism may be to simply use regional bodies as a means to develop informal or formal networks amongst national regulators to share experiences. This is now quite common in all infrastructure sectors.

As for the difficulty in obtaining information from the regulated firm(s) when capacity is limited, a supranational regulator may help in coordinating this information across countries, possibly through a formal benchmarking process. This may create a sort of yardstick competition, whereby national regulators can assess the performance of the firm(s) they regulate in light of the information they have received from other regulated firms in other countries. This use of correlation between information across countries can hence be used to mitigate a lack of regulatory capacity whether national firms compete directly or otherwise.¹⁶ For example, suppose that there are two countries (A and B) that regulate domestic firms according to the model described in the previous section. Moreover, suppose that β_A and β_B are perfectly correlated but ξ_A and ξ_B are independent. If the regulators share information (either amongst themselves or via a supranational regulator), then the probability of them being informed is now $1 - (1 - \xi_A)(1 - \xi_B) = \xi_A + \xi_B - \xi_A\xi_B$, which is greater than both ξ_A and ξ_B . As discussed above, a higher value of ξ is equivalent to an increase in regulatory capacity, and hence improves social welfare in both countries.

To implement some form of yardstick competition at the regional/international level requires that the technologies used in the different countries included to build the benchmark are comparable. A way in which supranational regulators may help mitigate national lack of regulatory capacity is through the use of common standards. As suggested by Auriol and Benaim (2000) when they looked at standardization in decentralized economies, centralized intervention is useful when decentralized decision units display aversion to incompatibility. Their results, however point to a limitation of the use of top-down standardization. Indeed, in cases of tolerance or neutrality to incompatibility, decentralized standard choices are often optimal. Global welfare might be lower in this case with common standards imposed by a supranational agency, as bureaucracies are unlikely to pick the best standard. To reap the informational benefit of the existence of common standards, the supranational agency should push/help at the industry level for standards harmonization, rather than directly setting them.

¹⁶ Laffont and N'Guessan (1999) for example model competition as an increase in ξ , while Laffont and Pouyet (2004) consider there likely to be informational externalities between regions.

Accountability: One argument put forward by the literature on federalism on the payoff to decentralization in terms of accountability is that centralized regulation diminishes the lobbying power of local firms.¹⁷ This may be because firms find coordinating on capture more difficult in a less concentrated market. Furthermore, Boehm and Olaya (2006) argue that regulation at the local level is likely to lead to more frequent interactions, encouraging capture. It is easy to extend this logic to the case of supranational regulation and argue that national firms will find capturing a regional regulator more difficult than capturing national regulators. To see this in the model above, let us suppose that γ_i , the degree to which the government values a firm's profits, is a function of the amount of lobbying/bribing that the firm undertakes. In particular, suppose $\gamma_i = \gamma(b_i)$, where b_i is the cost to the firm of lobbying, which is chosen by the firm, and $\gamma(\cdot)$ is increasing and concave. As we saw above, the firm's expected rent $U_i(\gamma_i)$ is increasing in γ_i , since a higher level of capture results in the government reducing the firm's potential rent loss. Hence, if there is national regulation, the firm will choose a level of lobbying such that:

$$(9) \quad \gamma_i'(b_i)U_i'(\gamma_i(b_i)) = 1$$

We assume that the LHS of this equation is decreasing and takes a value greater than 1 when $b_i = 0$ in order to have a unique level of capture in equilibrium.

Now suppose that regulation is undertaken at the supranational level where there are N countries (and hence N firms). Assuming that the countries are identical and that the supranational regulator values them equally, he will optimize the following social welfare function

$$(10) \quad W = \sum_{i=1}^N (V_i + \gamma_i U_i)$$

From this equation, if the supranational regulator is to set a single policy for the entire region, we can see that the firm's rent will now be $U_i \left(\sum_{i=1}^N \gamma_i / N \right)$. Hence, setting γ_i optimally gives

$$\gamma_i'(b_i)U_i' \left(\sum_{i=1}^N \gamma_i / N \right) = N. \text{ If all countries are symmetric, in equilibrium } \gamma_i = \gamma_j \text{ for all } i, j.$$

Hence we arrive at the solution $\gamma'(b)U_i'(\gamma(b)) = N$. Comparing this with equation (9) suggests that the amount of lobbying each firm does is much lower as the LHS in (9) is decreasing (since both $\gamma(\cdot)$ and $U_i(\cdot)$ are increasing and concave). This is because each firm attempts to free-ride on other firm's lobbying, and does not take into account the benefit that lobbying has on other firms. Of course, this assumes that firms cannot collude with other – if so, there would be no such free-riding. Indeed, market integration can sometimes provoke firm exit, producing concentrated markets where collusion is a threat.

A second way in which the case for a supranational agency can be made stems from the payoffs associated with an increase in the number of agencies. Consider the regulatory need to retrieve information on firms' performance. Since this is often at the base of how much the firm is allowed to charge or how much it is subsidized, firms have a strong incentive to bribe regulators into keeping this information hidden.

However, Laffont and Martimort (1999) show that this risk can be mitigated if information is collected by more than one agency, since each regulator may ignore the externality it imposes

¹⁷ See, for example, Bardhan and Mookherjee (2006) or Trillas (2010b)

on the others by revealing this information. To see this effect in our model, suppose that in place of there being one technology that may reveal the costs of the firm, there are two - r_1 and r_2 - with the stochastic structure of the signals given by:

$$\begin{aligned}\xi_{11} &= P(r_1 = r_2 = \beta) \\ \xi_{12} &= P(r_1 = \beta \text{ and } r_2 = \emptyset) \\ \xi_{21} &= P(r_1 = \emptyset \text{ and } r_2 = \beta) \\ \xi_{22} &= P(r_1 = r_2 = \emptyset)\end{aligned}$$

The case where both technologies are operated by a single regulator is equivalent to the model above with $\xi = \xi_{11} + \xi_{12} + \xi_{21}$. As we have shown, in order to prevent collusion in this case the government will be required to give an incentive payment of $k\Phi(e(\bar{\beta}))$ with probability $v\xi = v(\xi_{11} + \xi_{12} + \xi_{21})$. Now suppose that two different regulators collect these two signals. If each regulator is unaware of the signal the other receives and if they cannot collude with each other, in equilibrium, each regulator expects the other to report their signal truthfully.¹⁸ In this type of contract, the government asks each regulator to announce the two signals r_1 and r_2 . Consider a potential collusion-proof equilibrium where each regulator reports truthfully the signal. If both regulators receive informative signals, then they will each be unable to collude with the firm, since the firm will anticipate the other will tell the truth and hence be unwilling to pay any bribe. Therefore, the government just needs to give incentive payments to the regulatory agencies when only one reports an informative signal. In particular, it will pay $k\Phi(e(\bar{\beta}))$ to agency i if $r_i = \beta$ and $r_j = \emptyset$. Since this only occurs with probability $v(\xi_{12} + \xi_{21})$ the cost of collusion has been reduced.¹⁹

Overall, the model shows that two regulators collecting the information may be better than one, since when both are informed they each ignore the externality they effect on the other by revealing the information. Moreover, Estache and Martimort (2000) argue that, if different supervisors are instead not aware of the information the other receives, separation is still likely to reduce capture. Since each supervisor is now only partially informed, their ability to extract bribes from the firm is reduced.

If the supranational regulator is restricted to only obtain information on the efficiency of the national regulators, it may still improve accountability but through a different mechanism. By demanding that national regulators produce information on their actions, the supranational regulator can act for transparency. This is another form of yardstick competition, applied at the regulators actions. If citizens and governments can compare the performance of their regulator with that of other countries, their national regulators may be made accountable. In the model above, for example, information on v or ξ on neighboring countries may make it harder for the regulator to hide information over the long term.

Commitment. In theory, short termism in regulation implementation linked to local political cycles may be easier to minimize with an independent supranational regulatory structure. In particular, it may be easier to ensure the independence of a supranational regulator, a solution

¹⁸ This model is from Chapter 8 of Laffont (2005). Of course, limited accountability is also likely to make inter-agency collusion more probable. See Laffont and Meleu (1997) for an analysis.

¹⁹ See chapter 8 of Laffont (2005), which is based on Laffont and Meleu (2001), for further comparative statics. Linked to this idea is the effect decentralization has on collusion, which is considered in Laffont and Pouyet (2004).

to problems of commitment that is commonly advised by regulatory practitioners. One possible reason that independent regulation may increase commitment is that the regulator and the government may hold different objective functions. If the regulator is biased towards the firm ($\gamma > 1$) and is given control over regulatory policy, this regulator will then be less keen to renegotiate than the government since he will care less about impacting the firm's profit one way or another beyond the established rules of the game as defined by regulation. A regulator with this objective function is likely to make investment decision easier, as risks levels will be lower and incentives will be more powerful. This means $U(\underline{\beta}) - U(\bar{\beta})$ will be larger in the basic model.

We can apply exactly the same logic to the creation of a supranational regulatory agency. Indeed, one might even consider the possibility of choosing the regulator's objective in such a way more reasonable with a supranational body, since they are perhaps less likely to be career civil servants or political appointees with political concerns and instead be industry professionals who have greater concerns for their professional reputation. This is roughly the implicit argument built in the adoption of international arbitration courts for instance. It has also been used in the discussions of the growth of the supranational regulatory state in Europe.²⁰

Second, regardless of its objective function, the creation of a supranational regulator may provide an extra veto in regulatory decisions. Levy and Spiller (1994, 1996) argue that the ability of a system to commit to time inconsistent regulatory policies depends on the number of independent actors required to change a decision. Generally, a separation of powers improves commitment because future renegotiation is more costly when there are many non-cooperating principals that have to agree to a renegotiation.²¹ As argued by Kessides, Noll, and Benjamin (2010), "internationalization of regulation creates institutions that can be changed only by mutual agreement among several nations so that political change in one nation is insufficient to cause a radical change in regulatory accountability unless a new government is willing to sacrifice all of the other benefits that arise from regional economic cooperation". The set up cost is the toughest challenge in this view of the world.

Even if a supranational agency does not have the potential to veto a renegotiation, it may still be able to improve commitment when it can function as a referee. Its position as an international actor who is likely to be relatively well informed places it in a good position to be involved in any disputes between countries or firms. The literature on incomplete contracts suggests that efficiency may be retained even when commitment is not possible if the parties can at least fix ex ante their respective bargaining powers and default positions for future renegotiations.²² In regulatory contracts, this is usually achieved through an arbitration process managed by an expert panel. The ideal situation is to mandate a regional rather than a national bias in the evaluations. But this is, of course, quite politically sensitive.

Fiscal capacity. One of the main aims of processes such as the integration of electricity markets is to take advantage of economies of scale. Supranational regulation may define the coordination between countries and reduce the potentially inefficient duplication of infrastructure that would occur if countries acted independently. A direct fiscal payoff should be a mitigation of fiscal constraints for governments, since they can undertake more efficient

²⁰ Sandholtz and Stone Sweet (2012) argue that in policy areas dealing with high levels of cross-border transactions, there is a greater supply of EU-level rules. They also point out that this was matched by an increase in the number of related interest groups based in Brussels.

²¹ Olsen and Torsvik (1993) and Martimort (1999) give models showing that opportunistic renegotiation is decreased when there are several regulators.

²² See, for example, Aghion, Dewatripont, and Rey (1994).

investment in infrastructure. This is particularly the case for regional public goods aggregated under a 'best-shot' technology, such as ports, airport hubs or major telecommunications cables.²³ In our simple model, this means that each firm paid a fixed cost F as part of its cost function. Hence, even if the two firms were identical, less public funds would be spent if one country purchased its electricity from the other and shut down production in its own country.

In a similar way, the integration of regional infrastructure regionalization may rebalance investments such that countries invest more efficiently through comparative advantage. Electricity integration, for example, may enable investment in electricity generation to be focused in those countries that have the greatest returns. In the model above, this might occur for example when $\beta_A = \underline{\beta}$ and $\beta_B = \bar{\beta}$, since in this case Country B would prefer to import from Country A. This then frees up fiscal space in other countries to invest in domestic transmission and distribution networks (see Auriol and Biancini 2015).

Finally, the creation of supranational regulation may create opportunities for new funding instruments that may direct extra financing into the infrastructure sector. Though donors have taken time to adapt to funding regional, rather than national projects, they are increasingly seeing funding regional public goods as part of their remit. In the long term, donors are likely to see several advantages in lending to a regional organization which, as outlined above, may not be subject to the similar problems of capacity, commitment and accountability that plague national institutions. Indeed, as regional organizations become more developed, the advantages outlined above may help to encourage further private financing. This potential combination of extra donor resources and private finance would then help to improve fiscal capacity.

4. Why supranational regulation is not always an improvement

This section focused on the possible risks associated with the decision to rely on supranational regulation when national institutions are weak. Supranational regulators themselves may indeed be constrained as a result of weaknesses in national institutions. In many cases, supranational regulation may actually inflate the consequences of the national institutional weakness. The following explains how this can happen for each of the four types of institutional weaknesses discussed so far.

Limited regulatory capacity: When national regulators do not have sufficient capacity to extract information from the monopoly they regulate and use such information efficiently, international competition amongst regulated firms managed at the supranational level might help close the information gaps as discussed in section 3. However, the introduction of international competition adds new layers of complexity to the task of regulation.²⁴ For instance, the supranational regulator may be involved in reducing market power and setting access prices, which are far from straightforward issues.

In the electricity or telecoms sectors, market power can significantly undermine the benefits of competition. For instance, Bunn and Zachmann (2010) show that international interconnection of electricity networks may reduce consumer welfare if a dominant domestic firm can use the interconnection to exercise its market power. Theoretically, the regulator may be able to counter such market power through using access prices to subsidize firms that have relatively little market power (Laffont 2005). However, the complexity involved in calculating market power is high, and hence allowing such subsidies when capacity is low

²³ see Sandler (2004) for a definition of various types of aggregator

²⁴This echoes the Williamsonian notion of "selective intervention" in the theory of the firm, which offers a way to understand how a bigger organization fails to replicate what more decentralized ones reach.

may give the regulator too much discretion that may then be misused.²⁵ In a developing country context, a further worry of creating supranational regulatory agencies is that it may spread the little regulatory capacity that exists in the region even more thinly. This emphasizes the danger of using the logic outlined in the previous section that draws parallels from the decentralization/centralization debate. Clearly replacing national regulators with a single central regulator would take advantage of the increasing returns to scale in expertise, but such replacement is likely to be impossible in a context where national sovereignty is at stake. National governments are likely to be unwilling to significantly trim their national regulatory agencies, and hence increases in regulatory capacity at the supranational level may entail decreases in national regulatory capacity.

A more general problem may arise from specific design of information gathering processes. In the many instances in which information is collected at a national or more local level, transferring regulatory capacity to supranational regulators may interfere. Additional incentive issues may arise. For instance, if national regulators remain responsible for producing information but delegate some decision making to the supranational regulator, this may decrease their incentive to retrieve reliable information. Since information flows are so crucial in the regulatory process, such incentives need to be considered when capacity is limited.

To see this effect in the model above, suppose that the probability the regulator is informed ξ_i is a function of effort exerted at a national level at a cost z_i , i.e. $\xi_i = \xi(z_i)$, with $\xi'(z_i) > 0, \xi''(z_i) < 0$. To keep things simple, suppose that there is no capture and hence the rent that the firm receives does not depend on ξ_i . In this case, the regulator chooses z_i to reduce the expected rent paid to the firm, $\underline{U}(1-\nu)(1-\xi(z_i))$. Hence, it will choose z^N to be such that $-\underline{U}(1-\nu)\xi'(z^N) = 1$. Now suppose that information is shared with another regulator in the way described in the previous section. In this case, the expected rent to be paid is $\underline{U}(1-\nu)(1-\xi(z_i))(1-\xi(z_j))$. Hence each regulator will choose a value of z_i that solves the equation $-\underline{U}(1-\nu)\xi'(z^S)(1-\xi(z^S)) = 1$. It is therefore clear that less information is gathered when information is shared, $z^S < z^N$, and hence it may even be the case that the overall probability of being informed falls.

Limited accountability: As mentioned earlier, at the national level, one solution to the risk of capture is to involve multiple principals with conflicting aims in order to counter the ability of any individual principal to capture the regulator. An example sometimes advocated by practitioners is to include both the executive and the legislative branches in the regulator's appointment and to involve actors such as the judiciary in any appeals process.²⁶ At the supranational level, however, a lack of effective supranational legislature or judiciary may present risks on those occasions when differences between national executives do not provide sufficient accountability. This risk is likely to be particularly great when a minority of countries has a large sway over the decisions of the supranational regulator, as is likely to be the case when countries sizes are very heterogeneous. Furthermore, an extension of models used to analyze decentralization (e.g. Seabright 1996) would argue that governments are more accountable at the national levels since supranational agencies usually do not face electoral pressure for policy in a particular country. Similarly, we may worry that any

²⁵ One way around this problem would be to create closer links between regulatory agencies and anti-trust agencies when these exist.

²⁶ For other models describing the risks and benefits of multiple principals see, for example, Martimort (1996).

supranational body will be relatively unresponsive to the concerns of any particular country, reducing accountability.

The transfer of power to the supranational level may also worsen the accountability of national regulators. If it is unclear who is responsible for particular regulatory decisions, then it is harder for citizens to exert pressure at the appropriate level (Sand-Zantman, 2004). The risk is that governments or regulatory agencies can blame performance failures on supranational policy and in so doing decrease the accountability of national bodies. It is therefore very important that the division of powers between national and supranational regulators is as clear and simple as possible.

A further way in which supranational agencies may fail is when national regulators collude with the national firm by hiding information from a supranational regulator or pushing for decisions that favor the national firm over consumers. This is because the national government has an incentive to increase the market share of domestic firms since they provide jobs and tax revenue – an incentive that is likely to be even stronger if institutional limitations already encourage capture.²⁷

In the model above for example, suppose that two identical countries regulate a single firm, such that if the firm receives an information rent (whether through transfers or prices), it is split evenly between the two countries budgets. Moreover, suppose that profits are not split evenly between the two countries, but that a disproportionate share $\alpha > 1/2$ of the firm's profits accrue in Country A. Then if, $\alpha > (1 + \lambda)/2$, Country A would actually favor the firm receiving an information rent, and will hence collude with the firm to hide information from any regulator. More generally, there may clearly be conflicts of interest between countries when regulators set Ramsey markups, since costs and benefits are unlikely to be shared evenly. In the EU, Glachant and Lévêque (2009) document how promotion of the interests of national champions has limited the extent of market integration in Europe in the electricity sector. Auriol and Biancini (2015) propose a theoretical analysis of this problem. Since market integration in power industry is imperfect (i.e., it is neither political, nor fiscal), governments focus on their own national welfare and are biased in favor of their national (often partially public) firms. In the absence of legitimate supranational regulation, the countries' competition for market share limits the benefit of integration and prevents them from efficiently using the stock of existing infrastructure. Due to these coordination losses, the difference in countries' generation costs must be large enough for a regional power pool to enhance welfare. Cost complementarities in generation are indeed the main engine of integration in electricity markets.

Limited commitment: Since optimal regulatory policy is often time inconsistent, commitment needs to be achieved through institutions that constrain actors from behaving opportunistically. As argued by Levy and Spiller (1996), the optimal institutional setup to do this is likely to be different across countries and a regulatory process that increases commitment must be compatible with the country's institutional structure. An independent regulatory agency will work less well in a country where there is little tradition of bureaucratic autonomy. Here, if the legislator is fairly independent of the executive, specific legislation may instead increase commitment.

Heterogeneity across countries in the optimal institutional setup is likely to pose additional problems when we move to the supranational level. As discussed in the literature on federalism, centralization is likely to result in more homogeneity across localities (Oates 2005). This can be seen in the case of regionalization of infrastructure, where often

²⁷ Such problems are tackled in the context of decentralization in Bardhan and Mookherjee (2006).

supranational institutions encourage a particular market structure or regulatory system. The British regulatory agency model has, for instance, largely inspired many of the institutional recommendations made at the EU level and inspired many of the EU level agencies. If supranational bodies encourage uniformity in national regulatory structures, then this is likely to worsen problems of limited commitment in those countries where such a structure is unsuitable. This effect may therefore undermine the potentially positive effects of market integration on commitment previously discussed.

Even if countries are fairly homogenous, the move to supranational regulation is likely to cause changes that may require contracts (explicit or implicit) to be renegotiated. Opening up such negotiation may invalidate previous commitments that have been made on topics such as price levels. This may then provide and prove an opportunity for either the government or the firm to take advantage, depending on who has greatest bargaining power. For example, if international competition is to be introduced, this will almost certainly require a renegotiation of price caps or subsidies. It is therefore crucial when thinking about moving to a supranational framework that policy makers bear in mind that the optimal form of regionalization is unlikely to be that which would be chosen were all participating countries starting from scratch.

The creation of supranational agencies may also worsen commitment problems if they had previously been solved through mechanisms that are not replicated at the supranational level. For example, an independent regulatory agency may improve commitment through having a sufficiently pro-industry bias, perhaps as the result of domestic lobbying or the revolving door.²⁸ Alternatively, as argued by Trillas (2010a and b), more local regulators may use regulatory policy to achieve other objectives that as a side effect increases commitment. For example, if national regulators are concerned about the profits of national firms because shareholders are based domestically, then this may give them an incentive to reward investment, while a supranational regulator might not reward it. Both of these examples would lead to an increase in γ that, as shown previously, may work as an aid to mitigating the commitment problem.

There are therefore several reasons why regionalization of infrastructure and its regulation may worsen problems of commitment. Moreover, limited commitment may significantly impact upon the success of supranational regulation. As Estevadeordal, et al. (2004) point out, regional goods require countries to commit to providing them simultaneously. If countries' ability to commit is limited, there may be a temptation at a later point to free ride.²⁹ If countries cannot commit to financing and supporting supranational regulation in the future, this is likely to undermine a supranational regulators ability to carry out long term reforms.

Limited commitment will also have implications for international trade in infrastructure. For example, Wren-Lewis (2010) shows that, when long-term commitment to trade is not possible, countries will under-invest in sectors that make them dependent on trade, e.g. potential electricity exporters will under-invest in generation whilst potential importers under-invest in distribution. Similarly, Auriol and Biancini (2015) show that there is a major risk of underinvestment in infrastructures constituting a public good, such as interconnection or transportation facilities, in power market integration in developing countries. In the absence of a strong commitment mechanism between the different countries willing to

²⁸ See for instance Evans, Levine, and Trillas (2008) for models in this category. Victor and Heller (2007) argue that in practice limited commitment has led to the rise of 'dual firms' that mitigate a lack of commitment by keeping close ties to the public sector.

²⁹ This will be particularly problematic for public goods that use a summation aggregator - see Sandler (2006) for a discussion of the various types of aggregator.

constitute a power pool, the investment level in the public good components of the network is always suboptimal. Free-riding behavior reduces incentives to invest, and business stealing reduces the capacity to finance new investment, especially in the importing country.

Limited fiscal capacity: Supranational projects often rely on supranational agencies for funding (e.g., the European Investment Bank and all the development banks). These agencies can help to improve the project credit ratings and hence encourage private investors to fund the project. So far, the track record of these agencies in financing these projects is mixed and relatively little private funding goes to these projects.³⁰ Many of the projects ultimately end up relying on national funding which is often constrained and reliant on highly distortionary taxes. Supranational sponsorship certainly buys time and spread costs over time, but it does not solve the core issue of the failure to meet the participation constraints for many, if not most, of the socially desirable multi-country projects. When the fiscal constraints are binding, as argued in Gasmi, Laffont, and Sharkey (2000), it may be optimal to rely on international cross-subsidies. But this has also proven to be quite politically sensitive in many parts of the world, providing evidence of the limited ability of supranational regulation to deliver on the financing side. And having to do so in an open world with many privatized firms with complex cross-ownership structures does not make this any easier.

International competition may actually make this more difficult as it may also encourage governments to promote national champions. A direct result may be that countries subsidize (or under-tax) domestic firms in order for them to gain competitive advantage. As shown by Biancini (2011), when fiscal inefficiency is high, this may mean international competition overall decreases welfare. For example, suppose we have linear demand in both countries, such that $q = d - p$. In this case, without international competition, firms in both countries produce such that

$$(11) \quad q = \frac{1 + \lambda}{1 + 2\lambda} (d - c)$$

However, now suppose that two national companies can enter each other's market and compete in quantities (i.e. Cournot-style competition). If the two countries are symmetric, then in equilibrium no trade takes place. However, as shown by Biancini (2011), quantities will be set according to the equation

$$(12) \quad q = \frac{2 + 2\lambda}{2 + 3\lambda} (d - c)$$

Comparing this equation to (11), we can see that the quantity produced is higher as a result of competition. This is due to the 'business-stealing' effect of each country wishing to favour their own firm, and prevent the other firm from entering their market. Such an effect reduces welfare, since the extra quantity produced is not worth the extra government funding required to produce it. Moreover, Biancini (2011) also finds that the welfare loss is increasing in the level of fiscal inefficiency. Supranational regulation may find it difficult to prevent such behavior since there are many legitimate reasons for governments to subsidize and tax differently firms in infrastructure sectors.

5. Conclusion

Ultimately, as for so many policy issues, there is enough evidence to be able to argue that there are both benefits and costs associated with the decision to rely on supranational

³⁰ Most of the supranational projects are new infrastructure assets ("greenfield") which involve construction before revenues are established and private institutional investors tend to prefer low-risk infrastructure projects already operating and generating revenue and profits ("brownfield").

regulation as a complement or substitute to national regulation. The current optimistic bias in favor of supranational regulation needs to be toned down to account for limitations predicted by both experience and theory.

The ability of supranational regulators to design, implement and enforce rules, and processes that support the rules, is strongly constrained by national institutional limitations. There are many instances in which relying on a supranational agency will help minimize or offset the negative consequences of institutional weaknesses. These have been used quite extensively to justify a wide range of new institutions (e.g. European regulatory agencies) or contractual arrangements (International dispute settlement courts). But the failures of many of these solutions should not come as a surprise. Conceptually, there are indeed just as many predictable situations in which these supranational institutions are likely to fail to mitigate undesirable outcomes, including some in which they will make things worse.

The creation of a new institution is unlikely to erase institutional weaknesses when there is so much heterogeneity in preferences, skills, political credibility and transparency among countries expected to work with each other on multi-countries projects and policies. Modeling these differences demonstrates that the risks of mis-targeting regulatory decisions are more predictable than politicians and bureaucrats are sometimes willing to consider. And there is plenty of empirical evidence of failed contracts, of underinvestment or overinvestment in international trade in services validating the case to moderate the excesses of enthusiasm for supranational regulation as an all-purpose solution to national institutional weaknesses or differences.

References

- Aghion, P., M. Dewatripont, and P. Rey, 1994. "Renegotiation design with unverifiable information." *Econometrica*, 62(2): 257-82.
- Albrecht, J., 2014, in "Do European climate and energy policies threaten to postpone the energy transition?" in A. Estache, *The Next Generation of Economic Issues in Energy Policy in Europe*, CEPR, London, 45-64
- Armstrong, M. and D. E. M. Sappington, 2007. "Recent developments in the theory of regulation," in *Handbook of industrial organization*, ed. Mark Armstrong and Robert Porter: North Holland.
- Auriol, E. and M. Benaim, 2000. "Standardization in Decentralized Economies", *American Economic Review*, vol. 90: 550–570.
- Auriol, E. and P. Picard, 2009, "Infrastructure and Public Utilities Privatization in Developing Countries", *World Bank Economic Review*, 23(1):77-100
- Auriol, E. and S. Biancini, 2015. "Powering Up Developing Countries through Integration?," *World Bank Economic Review*, World Bank Group, vol. 29(1): 1-40.
- Bardhan, P.K. and D. Mookherjee, 2006. "Decentralisation and accountability in infrastructure delivery in developing countries." *The Economic Journal*, 116(508): 101-27.
- Biancini, S., 2011. "Market Integration with Regulated National Champions: Winners, Losers, and Cooperation, in ", C. Gollier, O. Falck, and L. Woessmann, ed. *Industrial Policy for National Champions*, MIT Press.
- Boehm, F. and J. Olaya, 2006. "Corruption in public contracting auctions: The role of transparency in bidding processes." *Annals of Public and Cooperative Economics*, 77(4): 431-52.
- Brainard, S.L. and D. Martimort, 1996. Strategic trade policy design with asymmetric information and public contracts. *Review of Economic Studies*, 63(1):81–105
- Brainard, S.L. and D. Martimort, 1997 Strategic trade policy with incompletely informed policymakers. *Journal of International Economics*, 42(1):33–65
- Bunn, D. and G. Zachmann, "Inefficient arbitrage in inter-regional electricity transmission." *Journal of Regulatory Economics*, 37(3): 243-65.
- Calzolari, G., 2004. "Incentive regulation of multinational enterprises", *International Economic Review*, 45(1):257.
- Combes, P.P., B. Caillaud, and B. Jullien, 1997. "Common market with regulated firms". *Annales d'Economie et Statistique*, 47.
- Crampes, C. , 2014, "The EU's "Three 20s": Environmental or Industrial Policy?" in A. Estache (ed.), *The Next Generation of Economic Issues in Energy Policy in Europe*, CEPR, London, 15-44
- Eckert, S., 2011, "European Regulatory Governance" in: D. Levi-Faur, ed. *Handbook of the Politics of Regulation*, Cheltenham: Edward Elgar Publishing, 513-524.
- Estache, A. and D. Martimort, 2000. "Transactions costs, politics, regulatory institutions, and regulatory outcomes," in *Regulatory policy in Latin America: Post-privatization realities*, ed. Luigi Manzetti, 49-82. Coral Gables: North-South Center Press.
- Estache, A. and L. Wren-Lewis, 2009. "Toward a theory of regulation for developing countries: Following Jean-Jacques Laffont's lead." *Journal of Economic Literature*, 47: 729-70.

Estevadeordal, A., B. Frantz, and T. R. Nguyen. 2004. *Regional public goods: From theory to practice*. [Washington, DC]: Inter-American Development Bank [SI]: Asian Development Bank.

Evans, J., P. Levine, and F. Trillas, 2008. "Lobbies, delegation and the under-investment problem in regulation." *International Journal of Industrial Organization*, 26(1): 17-40.

Faure-Grimaud, A., J.J. Laffont and D. Martimort, 1999, "The Endogenous Transaction Costs of Delegated Auditing", *European Economic Review*, 43(4-6) , 1039-1048.

Gasmi, F., J.-J. Laffont, and W. Sharkey. 2000. "Competition, universal service and telecommunications policy in developing countries." *Information Economics and Policy*, 12(3): 221-48.

Glachant, J.-M. and F. Lévêque. 2009. *Electricity reform in europe : Towards a single energy market*. Cheltenham, UK ; Northampton, MA: Edward Elgar.

Kessides, I. N., R. G. Noll, and N. C. Benjamin, 2010. "Regionalizing Reform in West Africa", *World Economics*, Vol.11(3): 79-108, July–September

Laffont, J.-J., 2005. *Regulation and development*. Cambridge: Cambridge University Press.

Laffont, J.J. and D. Martimort, 1997, "Collusion under Asymmetric Information", *Econometrica*, 65(4), 875-911.

Laffont, J.J. and D. Martimort , 1998a, "Collusion and Delegation", *Rand Journal of Economics*,29(2) , 280-305.

Laffont, J.J.. And D. Martimort, 1998b, "Transaction Costs, Institutional Design and the Separation of Powers", *European Economic Review*, 42(3-5), 673-684.

Laffont, J.J. and D. Martimort, 1999, "Separation of Regulators against Collusive Behavior", *Rand Journal of Economics*, 30(2) , 232-262.

Laffont, J.J. and D. Martimort, 2002, *The Theory of Incentives: The Principal-Agent Model*, Princeton University Press

Laffont, J.-J. and M. Meleu. 1997. "Reciprocal supervision, collusion and organizational design." *The Scandinavian Journal of Economics*, 99(4): 519-40.

Laffont, J.-J. and T. N'Guessan. 1999. "Competition and corruption in an agency relationship." *Journal of Development Economics*, 60: 271-95.

Laffont, J.-J. and J. Pouyet. 2004. "The subsidiarity bias in regulation." *Journal of Public Economics*, 88(1-2): 255-83.

Laffont, J.-J. and J. Tirole. 1993. *A theory of incentives in procurement and regulation*. Cambridge, Mass ; London: MIT Press.

Levy, B. and P.T. Spiller. 1996. *Regulations, institutions, and commitment : Comparative studies of telecommunications*. Cambridge: Cambridge University Press.

Majone, G., 1997, "The new European agencies: regulation by information", *Journal of European Public Policy*, 4 (2): 262-275.

Martimort, D. 1996a. "The multiprincipal nature of government." *European Economic Review*, 40(3-5): 673-85.

Martimort, D. 1996b, "Exclusive Dealing, Common Agency and Multiprincipals Incentive Theory", *Rand Journal of Economics*, 27(1), 1-31.

Martimort, D., 1999a, "The Life Cycle of Regulatory Agencies: Dynamic Capture and Transaction Costs", *Review of Economic Studies*, 66(4), 929-947.

Martimort, D. 1999b. "Renegotiation design with multiple regulators." *Journal of Economic Theory*, 88(2): 261-93.

Oates, W. E. 2005. "Toward A Second-Generation Theory of Fiscal Federalism" *International Tax and Public Finance*, 12, 349–373, 2005

Olsen, T.E. and G.. Torsvik. 1993. "The ratchet effect in common agency: Implications for regulation and privatization." *Journal of Law, Economics and Organization*, 9(1): 136-58.

Sand-Zantman, W. 2004. "Economic integration and political accountability." *European Economic Review*, 48(5), 1001-1025.

Sandholtz, W. and Stone Sweet, A., 2012. Neo-functionalism and supranational governance. E. Jones, A. Menon, and S. Weatherill, ed., *The Oxford Handbook of the European Union*, pp.18-33.

Sandler, T. 2004. "Demand and institutions for regional public goods," in *Regional public goods: From theory to practice*, 11.

Sandler, T. 2006. "Regional public goods and international organizations." *The Review of International Organizations*, 1(1): 5-25.

Seabright, P. 1996. "Accountability and decentralisation in government: An incomplete contracts model." *European Economic Review*, 40(1): 61-89.

Thatcher, M., 2011. "The creation of European regulatory agencies and its limits: a comparative analysis of European delegation", *Journal of European Public Policy*, 18 (6). pp. 790-809

Trillas, F. 2010a. "Electricity and telecoms reforms in the EU: Insights from the economics of federalism." *Utilities Policy*, 18(2): 66-76.

Trillas, F., 2010b. "Network industries and regulatory jurisdiction," IESE Research Papers D/859, IESE Business School.

Von Hirschhausen C., S. Ruester, C.Marcantonini, X. He, J. Egerer and J. Glachant 2012. 'EU Involvement in Electricity and Natural Gas Transmission Grid Tarification', Think Report Topic 6, available at www.eui.eu/Projects/THINK/Documents/Thinktopic/ThinkTopic6.pdf

Williamson Oliver E. (1985), *The Economic Institutions of Capitalism: Firms, Markets and Vertical Contracting*, New York: Free Press.

Wren-Lewis, L. 2010. "Hold-up problems in international electricity trade.", mimeo, PSE

Zachmann, G. 2013. 'Electricity infrastructure: More border crossings or a borderless Europe?', Policy Contribution 2013/05, Bruegel³¹