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ABSTRACT: This article starts by surveying the literature on economic federalism and relating it to network industries. Some new developments (which focus on the role of inter-jurisdictional externalities and multiple objectives) are then added and used to analyze regulatory arrangements in telecommunications and energy in the EU and the US. Although central or federal policy making is more focused and specialized and makes it difficult for more interest groups to organize, it is not clear that under all conditions central powers will not be associated with underinvestment. When technology makes the introduction of competition in some segments possible, the possibilities for organizing the institutional architecture of regulation expand.

Keywords: Regulation, federalism, network industries.

JEL Codes: L50, L94, L96, L97, K23, H77.

RESUMEN: Este artículo comienza por resumir la investigación sobre federalismo económico y relacionarla con las industrias de red. Algunos nuevos desarrollos (centrados en el rol de las externalidades inter-jurisdiccionales y la multiplicidad de objetivos) son a continuación añadidos y utilizados para analizar la regulación de la energía y las telecomunicaciones en Estados Unidos y la Unión Europea. Aunque la regulación central o federal es más focalizada y especializada y dificulta más la organización de los grupos de interés, no está claro de forma incondicional que los poderes centrales no vayan asociados a niveles demasiado bajos de inversión. Cuando la tecnología posibilita la introducción de competencia en algunos segmentos, las posibilidades de organizar la arquitectura institucional de la regulación se expanden.

Palabras Clave: Regulación, federalismo, industrias de red.

Clasificación JEL: L50, L94, L96, L97, K23, H77.

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1 Introduction

The allocation of regulatory tasks in network industries across the vertical structure of government has become a salient issue both in Europe and the US in the recent past. In the European Union, the new regulatory packages that are being debated include the creation of some form of pan-European telecommunications and energy regulators. At the same time, jurisdictional conflicts have intensified, such as in the regulatory holidays for next generation broadband discussion between Germany and the European Commission, or the jurisdictional controversy about the conditions for the failed takeover of Endesa by E-On between Spain and the European Commission. In the United States, the 1996 Telecommunications Act and technological developments such as the expansion of Internet and wireless telephony have blurred the distinction between interstate and intrastate issues, and (to use the words of a recent overview of US telecommunications¹) have marked the transition between an era of dual ("bright lines") federalism (where there was a clear distinction between the role of the states and the role of the FCC, the federal regulatory agency) to a more complex era of cooperative federalism (where the states and the FCC are jointly responsible for a number of tasks). In electricity, the Federal Energy Regulatory Commission tries to promote the creation of Regional Transmission Organizations that preside over the expansion of wholesale markets and coordinate the transmission of electricity over these markets, and more often than not the states resist such process. Additionally, federal and state agencies have overlapping or concurrent jurisdiction in energy merger cases; state agencies often invoke ill-defined "public interest" objectives that give them discretion to stop potentially efficiency-enhancing mergers (Wolak, 2007).

There is a well documented historical trend by which the regulation of utilities has moved up in the vertical chain of government, starting at the beginning of the XXth century from the local to the state level in the US² and other jurisdictions.³ However, in the US the bulk of regulation is still performed at the state level and has not moved much further up to the federal level, although the federal regulatory agencies created in the New Deal era have played an increasing role first regulating interstate issues and in the recent past promoting and actively overseeing liberalization. Meanwhile, significant intervention still persists at the local level, as illustrated by the role of municipal ownership of distribution utilities in the US (more than 100 US cities have a municipal utility) or Norway, or in the initiatives of local powers to promote broadband access to the Internet in many localities. Decentralized powers are under significant pressure to intervene in regulated network industries, at least for three reasons (see Troesken, 1996):

- (i) the physical deployment of networks depends on the rights of way for

¹Nuechterlein and Weiser (2006).

²See Troesken (1996).

³Although in most other jurisdictions, the move to the national-state level involved the creation of state owned (mostly, although not universally, especially in electricity) national vertically integrated firms.

which local powers are often naturally responsible;

(ii) regulatory policies are locally salient, and

(iii) interest groups find it relatively easy at the local level to organize to influence these policies in a variety of directions.

If local powers were responsible for most of these policies (for example, for setting regulated tariffs) they would face the typical commitment problem in the presence of sunk investments (see for example Levine et al., 2005 and references therein). For a number of reasons that will be explained in Section 3, local powers have a number of objectives when deciding to intervene in regulated industries. Central policies tend to be more focused than local policies, in the sense that they are subject to the influence of a lower number of interest groups and can afford to incur the costs of regulatory specialization, but may create too much homogeneity, and they are also subject to commitment issues. A key question then is how to organize regulation taking into account the constraints faced at each level of government.

Liberalization processes in the US and the EU add a further layer of complexity relative to monopoly regulation. As some authors have characterized the liberalization process in network industries as a "long and winding road,"⁴ no minor ingredient of such conditions is the relationship between the different government levels. If anything, the introduction of competition increases institutional diversity (see Moore, 2002), for example in electricity by introducing the role of system and market operators (which can be integrated in the same organization or not, and this organization can be integrated with a transmission company or not). Although the federal levels at both the US and the EU have promoted liberalization of competitive segments in different forms, there has been more variation in the extent to which US states or EU member-states have embraced the liberalization of electricity or telecommunications.

There are common trends and differences between the US and Europe's federalism experience in network industries that are worth exploring, as it is done in Section 4 below. Existing differences between the US and Europe may be due not so much to doctrine but to differences in underlying institutions (eg more sovereignty in European member states, larger role for the Courts in the US, more flexible markets in the US: see Kovacic, 2007, in the context of anti-trust). Aubert and Laffont (2002) argue that technology considerations and inherited institutions⁵ determine the location of regulatory decisions. This echoes the notion due to Spiller and his co-authors⁶ that the institutional endowment constrains the policies and decisions of specific regulators. The role of inertia in this field may be due to the fact that to select the set of policies that pertain to central government a higher degree of consensus is needed than to make choices

⁴Armstrong and Sappington (2006).

⁵Inman and Rubinfeld (1997) argue that the right degree of decentralization should have as objective not only economic efficiency, but also other objectives such as political participation or the representation of minorities. Aubert and Laffont (2002, p. 12): "Once an entity began to regulate an industry, the regulatory structure was slow to change. This is because regulation entails the power to create and distribute rents, and political and administrative bodies are reluctant to relinquish such power."

⁶See for example Spiller and Tommasi (2007).

within the selected group of policies. For example, in the EU unanimity between member states is usually required to introduce institutional changes. And the subsidiarity principle in the EU establishes that the burden of the proof is on central levels; in case of doubt, decentralization prevails.

The organization of government may not always coincide with market boundaries or with the boundaries of firms. As Woroch (1990) argues, "when multiple regulators are unavoidable, boundaries between them should divide areas and services that exhibit low cross-elasticities of demand and supply. Such "bright lines" have become less attainable with recent developments in telephony." And "how governments divide up the industrial landscape may be vastly different from how business choose to organize."

In some aspects of the economic analysis of regulatory institutions, sometimes regulation has been compared to monetary policy. For example, it has been suggested that the rationale for regulatory independence is similar (although not identical) to the rationale for Central Bank independence (see Levine et al., 2005). It would thus be tempting to suggest that both in the US and the EU the solution for the jurisdictional allocation of regulation should imitate the solution for monetary policy: allocate it to a federal agency. However, the jurisdictional allocation problem in regulation is vastly complicated by the vertical industrial structure of network industries, where different industry segments could operate at different optimal geographical sizes.

The relationship between regulation and investment is another key aspect of the debate. For example some commentators argue that too much regulatory diversity discourages investment because it introduces costs related to red tape and uncertainty.⁷ But others (such as Weingast and his co-authors in their theory of market preserving federalism reviewed in Section 2) argue that decentralization introduces a variety of veto points which stop the predatory tendencies associated to Leviathan and restricts the information and authority available to central powers, thereby contributing to reinforce commitment (not to expropriate investments). But decentralization as an attempt to reduce the role of state intervention (as advocated in the Reagan⁸ era) may have the problem of reducing the scope for good as well as for bad policies: as it is well known in the literature on reform in developing countries, the further veto points contributed by decentralization favor the status quo: this may be good if the status quo implies preserving the value of investments, but it may be bad if the status quo implies stopping a potentially welfare increasing market expansion or liberalization process. Both the new political economy of federalism and the experience of US electricity suggest that decentralization (at the state or member state level) is better at providing commitment for investment than at accommodating deregulation market reforms.

⁷On the costs of overlapping or duplicated regulation, see mentions to it by Kovacic (2007) and Spector (2007).

⁸Reagan launched his political career with a speech defending states rights in a location related to the movement for civil rights, according to Krugman (2007). This connected with a tradition, mentioned also by Bardhan and Mookherjee (1999), of using states rights as a way to defend state policies of racial discrimination.

There are not many academic contributions in economics to the federalism debate in the field of the regulation of network industries⁹ (although there are generic references to "regulation" in the federalism literature, such as in Oates, 1999 and Easterbrook, 1978), as compared to the literature on fiscal federalism or environmental policy. There are some informal discussions (Smith, 2000; Brennan, 2003; Seabright, 1998), some empirical work (Humplick and Estache, 1995), a few very general theoretical models that can be applied to any industry or policy (Seabright, 1996; Caillaud et al., 1996), and very few models applied to network industries (Laffont and Pouyet, 1994; Bardhan and Mookherjee, 2006; Woroch, 1990; and Lehman and Weismann, 2000).

Existing theories or empirical work on economic federalism, which are reviewed in the next Section, do not allow for a general conclusion in favour of a clear assignment of centralized or decentralized regulation, and the solutions may be country or sector specific. However, decisions on jurisdictional allocation of regulatory responsibilities are a matter of discussion both in the EU and in the US, and they would benefit from old and new considerations on economic federalism.

As an example, the National Regulatory Research Institute (NRRI)¹⁰ in the US suggests federalism principles that might underlie a potential new federal Telecommunications Act in the US. These may include:

a. State participation is desirable whenever a sound regulatory decision requires knowledge of local conditions, such as the locations for areas not served by rural broadband.

b. State participation is desirable when controversies are so numerous or time consuming as to be beyond the resources of the FCC. State commissions have, in the aggregate, far more fact-finding resources than the FCC.

c. State financial participation is desirable whenever it would advance a costly federal objective. For example, the courts and the Universal Service Joint Board have recognized the advantages of a state-federal partnership in universal service.

d. State enforcement of existing federal or state standards is desirable whenever it produces better results for retail or wholesale consumers. States are often the first point of contact for consumer complaints, and states ordinarily offer quicker and more effective responses to consumer complaints.

e. States are better able to respond to new problems where a single national policy would be premature. Early state actions regarding slamming and telephone number pooling, for example, guided subsequent FCC policies.

"Laboratory federalism" in case of uncertainty is one of the most convincing arguments¹¹ in favour of decentralization in network industries such as telecommunications and electricity where even expert economists disagree on what the exact attributes of reform should be. Joskow (2006) argues as follows on the

⁹There are interesting contributions to federalism in network industries from historians (Troesken, 1996), legal scholars (Weiser, 2001 and 2003) and political scientists (Teske, 2004).

¹⁰This is the research arm of the National Association of Regulatory Utility Commissioners (NARUC). See <http://nrri.org>.

¹¹Some caveats will be explained in Section 2 and the conclusions.

comparison between California and other states in electricity: "Interestingly, the New England states, New York, New Jersey and Pennsylvania had implemented very similar reforms at about the same time and experienced some of the same exogenous shocks to demand and fuel prices in 2000 and 2001. Yet they did not experience the same system meltdown as did California. So, there is something to learn as well comparing some of the more detailed aspects of the reforms in California with those in these other US states." However Joskow doubts that the right lessons have been learned from California, probably suggesting that the crisis was seen as an indictment of liberalization instead of as a guide to which mistakes should be avoided when restructuring electricity.

This article explores first to what extent the existing literature on economic (mainly fiscal) federalism is applicable to network industries. The conclusion of this exploration, presented at the end of the literature review in Section 2, is that many of these insights can be readily applied to these industries, but that some additions to the existing theory may shed further light on this jurisdictional allocation problem. The first of these additions is related to the conflicts of policies (for example between "industrial policy" and the control of market power) that pervade decision-making especially in decentralized administrations. There is then an attempt to sketch a basic model in Section 3 that captures this additional insight. The second addition concerns the relationship between central and local powers in developing structure regulation (in addition to behavioral regulation). In network industries, it is common that different levels of government have responsibilities in structural or behavioral regulation over different phases of the value chain. Three cases are studied in Section 4: in telecommunications, non-cooperative interaction between regulators and cooperative interaction; and in electricity overlapping responsibilities. Also in Section 4, some historical and empirical evidence is presented on the impact of jurisdiction allocation in both industries. Section 5 concludes and discusses limitations and ideas for future research.

2 Literature Review: What Are The Main Arguments and How Are They Related to Network Industries

The theoretical and empirical literature on economic federalism provides few clear cut prescriptions as to the appropriate jurisdictional location of regulatory decisions, although it contributes a variety of insights that may be useful in specific settings. In general, centralization performs better when there are jurisdictional spillovers and when there are coordination issues and product and "policy" economies of scale. Centralized decision making does not necessarily imply uniform decision making (as in electricity in the UK -except Northern Ireland), so in theory it can deal with heterogeneity, which in the absence of differentiated central policies would favour decentralization. Decentralization is also favoured when knowledge of local demand or cost (including political trans-

action costs) conditions is important. Moreover, the type of decentralization is often crucial in the arguments. Not surprisingly, the empirical evidence finds little overall significant evidence of decentralization dominating centralization or vice versa. Further details on the literature are given below, but the focus here is on how the arguments affect the regulation and other public policies related to network industries. The discussion is organized by starting with the traditional, "first generation" fiscal federalism studies, and next analyzing issues addressed by "second generation" studies, concerned by agency (informational asymmetries and accountability) and capture issues. The Section proceeds by discussing some empirical evidence, and providing some concluding thoughts about the literature review.

To consider how the existing literature on federalism¹² affects the regulation of network industries, it may be useful to keep in mind some characteristics of these industries:

- The basic technology of these industries presents sunk costs, scale economies, and naturally monopolistic segments.

- The services produced by network industries are universally consumed and are complementary of production and private consumption.

- Vertical relations among different industry segments are a key issue, especially if (necessarily imperfect) competition is introduced in some of them.

- Public intervention is made difficult by asymmetric information between firms and regulators, lobbying, commitment problems and technological complexity.

First generation fiscal federalism: regulatory competition, heterogeneity, scale and laboratory federalism

"Laboratory federalism" is the concept used to portray the situation where a number of decentralized jurisdictions experience with different options to solve the same problem in the face of uncertainty, so that all the decentralized units can learn, in an idea originally attributed to Justice Brandeis¹³ of the US Supreme Court. To some extent, this is what has happened with regulatory reform in the recent past: some jurisdictions have learned from others' experiences. For example, the California crisis in 2000 has influenced subsequent developments in US electricity, or the functional separation of the incumbent's wireline telecommunications broadband network in the UK has been taken as an example by the European Commission to promote a similar model in the rest of the EU. In a decentralized state where jurisdictions spontaneously engage in innovation, there will be too few innovations because of the public good nature of uncertainty reducing information.¹⁴ Of course, the federal level and

¹²For excellent surveys of the general literature on federalism, see Oates (1999) and Treisman (2007). Several definitions of federalism are provided by Riker (1964), Rubinfeld (1997), and Treisman (2007).

¹³Although Justice Brandeis of the US Supreme Court is usually credited with coming up with the idea of laboratory federalism in the 1930's, Oates (1999) cites Lord James Bryce as an earlier reference in 1888.

¹⁴Treisman (2007) argues that the degree of innovation contributed by the decentralized units will be lower than optimal because they pay the full costs of the innovative activities and will only reap part of the benefits. It would be better then to centrally organize the

the states can derive the wrong lessons from experiments: the interested parties will highlight those elements of the experiences that best suit their interests. As in any decision making public policy process, the outcome will depend on a number of political economy dimensions.

Competition between states to attract mobile factors may select good policies in equilibrium under some conditions; for example, competition between jurisdictions becomes less effective as the size of the legislating jurisdiction increases.¹⁵ The classical Tiebout (1959) model of fiscal competition is a revelation mechanism exercise where citizens reveal their preferences for local public goods by moving around localities that offer different combinations of taxation and public goods. Easterbrook (1983) translates the argument to general regulatory policies and argues that imposing the pre-eminence of federal anti-trust law on the states' regulatory decisions tends to constrain excessively the states' discretion, so that the final result is too intrusive regulation. Such intrusive regulation protects cartels in a way that makes them more sustainable than without the presence of regulatory action. By leaving more discretion to states so that other forms of regulatory action may be contemplated (including deregulation or competition for the market), regulatory competition may preserve the conditions that make the Tiebout model empirically plausible as long as spillovers are absent or of small magnitude, among which: existence of many possible regulatory alternatives; existence of many possible jurisdictions; mobility. Local, municipal regulation increases the benefits of regulatory competition because the jurisdictions are really many and mobility is higher than between states. Easterbrook concludes that "One need not think of states as laboratories, as Justice Brandeis did, to know that the pressures of exit and voice cause governments to search for laws that strike an adequate balance between favors to interest groups and benefits to other residents. The greatest threat to consumers' welfare is not states, and their competition, but a uniform national regimen that stifles the power of exit -that is, a monopoly of lawmaking." However, conditions are strong and Spector (2007) cites negative recent empirical results for the states competition theory based on the Tiebout model.

In most network industries, capital is fixed and sunk and therefore immobile. Hence the argument that capital mobility induces good regulatory policies cannot be made in the sense that the regulated industries' capital will not move as a result of bad policies. But in theory it can still be made in the indirect sense that other business (not in the regulated sector, but who use an input from a regulated industry) and individuals can move as a result of an environment of bad performance of the regulated sector caused by inefficient regulation. Inter-jurisdictional competition for mobile capital may however only favour initially rich regions if the initial heterogeneity is too high (see Treisman, 2007). If capital is more mobile than labour, and competition for capital takes place at

localized experiments.

¹⁵Casual empiricism reveals that it is precisely in large countries where sub-central units are large (US, Canada, Australia, Argentina, India) that regulation is decentralized (see also Beato and Laffont, 2002). This suggests that the jurisdictional competition rationale has not played an important role in the evolution of regulation in these countries.

least in part through low taxes, this may go to the detriment of services toward less mobile factors ("race to the bottom"), and if it is accompanied by lower regulatory standards in fields with negative externalities, it may unleash again a race to the bottom in the form of "beggar thy neighbour" policies. In regulation, as argued by Woroch (1990) for US telecommunications, "in their desire to attract new businesses and new citizens, regulators will compete with one another in terms of their policies. States could impose high access charges for interstate calls terminating in their state while showing favour to outgoing calls or intrastate traffic. This tendency could lead to beggar-thy-neighbor policies which can evolve into inefficient outcomes for all jurisdictions."

In vertical competition models (Treisman, 2007, ch. 6), different government layers taxing the same base yields "overgrazing": too high taxation and lower output than under one tax (in a similar argument to double marginalization in Industrial Organization). Equivalently, two tiers providing complementary infrastructure investments may provide too little if they do not cooperate. However, cooperation is difficult to enforce in all relevant dimensions, and if it is achieved in one dimension but not in others, cheating may go in the non-cooperative dimensions. Under lack of cooperation, increasing the revenues that accrue to the local powers may decrease its appetite for expropriation, but increase the predatory instincts of the central layer.

Inman and Rubinfeld (1997a,b) and Oates (1999, 2006) note that the conditions of the Tiebout model are not necessary for decentralization being superior to centralization. In his Decentralization Theorem, Oates establishes that if the benefits of accounting for heterogeneity outweigh the problems created by jurisdictional externalities and lack of scale, decentralization is a superior option. The optimal scale must take into account the costs of providing the service, the administrative costs of regulation and the communication costs between all the agents involved (see Treisman, 2007). The fixed administrative costs of regulation make it more likely that specialized regulatory functions will be developed the larger the population involved (see Mulligan and Shleifer, 2005). It can be argued that to achieve policy differentiation and tailor the size of projects to total costs and benefits, political decentralization is not needed, and local units of a central state can provide the local projects absent communication problems. However, even in the absence of these problems, political decentralization (locally chosen decision units) may act as a commitment device for the robustness of decentralization, as argued by Inman (2008). Treisman (2006) finds that political federalism is positively correlated with the proportion of decentralized over total country revenues or expenditures.

Oates (2002) distinguishes three different settings in environmental regulation that call for different organizations in the vertical structure of government:

- Pure public goods, where the impact on any jurisdiction depends on the sum of local productions; examples being global warming, research.

- Local public goods with no spillovers, where the impact on any jurisdiction depends on local production; the clearest example being garbage collection.

- Local public goods with spillovers, where public goods in one jurisdiction have some effect on neighbouring jurisdictions, the clearest example being en-

vironmental policies.

Pure public goods call for central responsibilities (although political feasibility and local information may make necessary some decentralized intervention, as in the European Trading System of polluting permits); local public goods call for decentralized intervention (although with capital mobility, if the "race to the bottom" is a reality, then uniform standards, which may be better established with some sort of central intervention, may be necessary; however, there is no race to the bottom under some circumstances, such as no constraints on the existence of instruments). In all these three cases, global uncertainty may make the flexibility of laboratory federalism valuable ("the states as a laboratory of democracy").

Klevorick (1996) includes competition policy as example of the sort of standards that some claim that may be necessary to establish uniformly if the race to the bottom occurs. The author however claims that the arguments both for the existence of such race and, even if it exists, the necessity of uniform standards, are not overwhelmingly convincing. In regulated industries, there is a potential role for centralized, even international powers in the setting of technical standards (see Gruber, 2004, on cellular telephony). A popular application of the "common standards" rationale is the argument that too many policies increase costs and uncertainty, thwarting investment.

Even when common policies that internalize spillovers are preferable, local units may cooperate on policies that maximize their joint payoff, without the need for a central power. Coasian cooperation of sub-central jurisdictions (making central jurisdictions unnecessary) is however possible only in very specific circumstances, as argued by Inman and Rubinfeld (1997a). Special districts in the sense of Frey and his co-authors can be interpreted as a version of Coasian cooperation, where specific agencies of different (optimal) sizes to deal with individual services are proposed, as opposed to all purpose institutions.¹⁶ The scale and specialization advantages of such institutions should be weighed against the problems related to the duplication of fixed costs, the interdependencies between different policies and the difficulties and costs of sustaining cooperation. Another meaning that has been given to *cooperative federalism*¹⁷ is the need to play complementary roles between the central and the local levels, for example the central level deciding on criteria or objectives and the local level being delegated the task of implementing the central guidelines and filling in the voids when the central prescriptions leave some issues open.

Second generation studies: Information, commitment and transaction costs

Arguments related to information can also go either way, depending on the

¹⁶See Eichenberger and Frey (2006) and Casella and Frey (1992). Examples of special districts of different sizes include citizen communities in Swiss cantons to manage electricity distribution; metropolitan transport authorities; organizations in Spain to manage water use and irrigation; regional electricity transmission organizations combined with wholesale power markets such as PJM in the U.S.; or large international organizations to deal with specific issues such as NATO.

¹⁷See Nuechterlein and Weiser (2006).

type of information. Economies of scale in expertise favor central policy allocation, but proximity to local conditions coupled to communication costs favor decentralized policy making. Exchange of information may be useful for purposes of yardstick competition, eg across disjoint similar jurisdictions in charge of regulating electricity distribution. Or there may be huge product market externalities as in electricity transmission which justify centralized regulation but still the informational (and political, for example to overcome resistance to investments) input of the local level be useful. The central regulator transferring his better information (due to scale economies in expertise) to the local ones, or the other way around (due to proximity to local conditions) emerge a priori as sound cooperation strategies. There may be no externalities in the product market but still there may be informational externalities, as in the Laffont and Pouyet (2004)¹⁸ model. Location of expertise and good information are key issues in modern regulation, both in the practice and the theory of it. Aubert and Laffont argue that (p. 20): "...This type of thinking favors decentralization when local information is good and explains the trend toward local decisionmaking for managing natural resources, such as water and forests. On the other hand, for health and specific environmental issues, local information may be weaker than that of the central government, which has better access to international information." In the US and the EU, the staff and other resources of state or member state commissions vary widely, and in general it is very doubtful that they can perform analyses of the same caliber as the federal agencies.

Analogies can and have been made between federalism and the role of decentralization in the theory of the firm and the market (see Hayek, 1948) and trends in firm models in the real world. Bigness at the central level introduces costs of planning in a similar way that there are costs of managing large companies (see Mookherjee, 2006). However, decentralization may inefficiently duplicate some fixed costs of regulation. Better information at the local level may allow for better design of incentive mechanisms at this level (see Tommasi and Weischelbaum, 2007). Oates (1999, p.1137) argues that "the vertical structure of government may have important implications for the way in which the public sector functions and its impact on the operation of a system of markets." Decentralization can be a way to delegate and avoid overload, as it was argued for example in the reform of European merger policy. Caillaud et al. (1996) present an interesting model where there is delegation, but still the central powers influence the bargaining relationship of better informed local regulators with firms by using transfers.

The analogy with the theory of the firm is also used by the proponents (Weingast and his co-authors) of "market preserving federalism": a commitment not to concentrate authority and information may play a similar role as committing not to fall in a ratchet effect in agency theory. Proponents of "market preserving federalism"¹⁹ argue (in a rather informal way) that under some

¹⁸This paper presents a brief, but useful, review of contract theory models related to decentralization issues. See references in Laffont and Pouyet (2004).

¹⁹Rose-Ackerman (1997) and Rubinfeld (1997) place this theory in the framework of the

conditions (decentralized "primary" regulatory responsibility; a single market for the whole federation; centralized monetary policy and absence of central bail-outs) a decentralized system preserves the growth of a market economy. As the Tiebout model, this theory is also based on the idea that local jurisdictions compete to attract mobile factors in an integrated and open market, but it adds to the static Tiebout model concerned with allocative efficiency, a focus on investment, economic growth and commitment, i.e., a dynamic component, and it includes the possibility that governments at any level are not benevolent but rent-seeking. Interestingly, the market preserving federalism theory, which has apparently emerged from a comparison between centralized and stagnant Russia with decentralized and booming China,²⁰ has in common to the "race to the bottom" theory that decentralization is associated to a small government, although each theory seems to attach a rather different value judgement to such smallness. In either case, though, the empirical evidence that would support the association between decentralization and small government is not conclusive. Rodden and Rose-Ackerman (1997) argue that the conditions stated by Weingast and his co-authors, which certainly would make federalism preserve markets, are very unlikely to be self-enforcing or even mutually compatible; for example, it is difficult that decentralization would avoid exacerbating inequalities, compromising the political sustainability of the compact, and it is difficult that a central state without relevant economic policy levers would be able to police a common market and avoid local protectionism.

More information is not always beneficial in dynamic settings, absent regulatory commitment. Qian and Weingast (1997) argue that reducing the information available to central powers reduces the temptation they have to expropriate investments. But Spector (2007) suggests that in some cases (indirect taxation in the EU) the local (national) powers may prefer to strategically delegate to central powers to avoid political criticism. For example, in the relationship between decentralization and macroeconomic management or reform, federalist structures create veto points that provide commitment, but also stall welfare-enhancing reforms (Rodden and Wibels, 2002). The order of reforms should then be: first reform at the national level, then decentralize to provide commitment (Treisman 1999).

Troesken (1996),²¹ in a detailed account of the history of the gas industry regulation in the city of Chicago (with some references also to the history of other US cities), argues that the move from local franchises to state regulation, which took place in the US under lobbying by regulated firms in the first decades of the XX Century, was rooted in the inability of local politicians to commit not to expropriate sunk investments. Local franchises evolved into a system of politicized and arbitrary local regulation after technological change triggered by the use of water gas caused the entry of new firms in the gas industry and a subsequent process of deregulated consolidation.

New Institutional Economics.

²⁰And also from the history of the US and England in the times of the Industrial Revolution, which seemed to have a more decentralized structure than today.

²¹I thank Pablo Spiller for calling my attention for this important reference.

State institutions would be more able to commit²² than local institutions because the ability of consumers to organize and exert political pressure ex post at the state level is relatively lower. Three reasons are given for this:

-Under state regulation, utility rates were decided by appointed commissions, whereas under local regulation they were decided mostly directly by the City Council (occasionally, experts were called, but their advice was not always heeded). Thus, under state regulation an additional systematic layer was created between consumers and decision makers, making more difficult the monitoring efforts of consumers.

-From a geographic point of view, consumers were fewer and more concentrated under local regulation,²³ which lowered the transaction costs of organizing as a lobby.

-Utility rates were a more salient issue at the local level than at the state level, where they had to compete for attention with many other issues. In local politics, as in the detailed account of local elections at the beginning of the XX Century in Chicago by Troesken (1996), reducing gas rates was an easy to understand topic, which was followed by the local media and used by career politicians to win votes.

These arguments are supported by event studies of the main legislative or municipal decisions, showing that the firms reacted negatively to events related to the affirmation of local authority and positively to events related to the affirmation of state authority. And also by a probit analysis of the votes of state legislators, showing that representatives of regions where gas was not deployed favored state regulation as a mechanism to commit not to expropriate the investments that were still needed (as opposed to representatives from regions where investments had already been deployed).

Troesken (1996, p. 89) reports that the vice president of the Pacific Gas and Electric Company argued that under municipal regulation, corporations were "at the mercy of as pitiless a pack of howling destroyers, as would the lonely traveller on the Siberian steppes be against the gaunt and hungry wolves." The company vice president advocated state regulation, in part, because state commissions would set rates in "calm deliberation and not in political heat."

The longevity of state regulation after its inception at the beginning of the XXth century would be evidence of this ability to commit. Jarrell (1978) argues that the move to state regulation from local franchises favoured regulated firms, because under local franchises the firms were constrained to competitive conditions due to a context similar to the one envisaged by Demsetz (1968) in his characterization of bidding for the monopolized field. Priest (1992) also

²²The higher profits of firms under state regulation than firms without state regulation found by Stigler and Friedland (1962) would then be evidence of state regulation yielding higher profits than local regulation, but not higher profits than deregulation.

²³It may be useful to compare the transaction costs of organizing utility consumers to the transaction costs of organizing the consumers of imported commodities, which are numerous and geographically dispersed (whereas producers are usually few and concentrated). Notice also that in modern regulated corporations, the managers are fewer and more concentrated than the dispersed owners, raising the potential for the operation of an autonomous lobby: the managers of regulated corporations themselves (see Trillas, 2004, and Bel and Trillas, 2005).

describes the transition from local franchises to state commission regulation, pointing out that the difference was mainly in the location rather than in the nature of regulation, since local franchises evolved over time to become administered contracts with some sort of regulatory intervention (interestingly, often through occasional delegation by local councils into "independent" or "expert" arbitrators or commissions as mentioned above). He also argues that the Demsetz model is not consistent with the context of local utility franchises because the local powers in the mid to late XIX Century did not own the infrastructure (which when the first franchises were allocated was basically non-existent) and did not have the ability to prevent entry. Then local franchises were equivalent to long term incomplete contracts between a party that contributed the rights of way on city streets, and a party that contributed expertise and sunk assets. Troesken (1996) also insists on some elements of continuity: utilities under local regulation were protected by constitutional constraints and state legislation, and actually some of the decisions by local regulators were overruled by the courts. Additionally, local authorities for example in Chicago did not stop mobilizing to go back to a system of local regulation after the establishment of state regulation. State regulation was however preferred to local regulation by producers (although their first best would have been deregulation) and state regulation was preferred to deregulation by consumers and local politicians (although their first best would have been local regulation). Teske (2004) associates both a strengthening of the Interstate Commerce Commission (ICC) and the development of strong state regulators to the strength of the Progressive movement in the US at the beginning of the XX century. Forty-five states established the Public Utility Commissions (PUCs) that still exist today between 1907 and 1922: these political jurisdictions evolved into regulatory boundaries although clearly the economics of natural monopoly firms do not necessarily dictate that firm or product boundaries match those of the states.²⁴

Second generation studies: Capture and accountability

Easterbrook (1983) dismisses the idea that capture at the state level is higher than at the federal level, as often suggested. He argues (footnote 52) that "it would be easier for interest groups to obtain protective legislation from states, because the coalitions needed to support the laws would be smaller. But because the detriments of the legislation would fall on a more concentrated group, and because it is easier to move away from local governments than from the United States, it is difficult to know whether interest groups in fact exercise more power at the local level than in Congress." Seabright (1996) argues that incomplete contracts considerations matter in this respect because if everything could be specified in a contract, decentralization would be irrelevant; it is because contracts are incomplete that accountability matters. Then using an incomplete contracting framework, he argues that central powers are less accountable because they do not face electoral pressures for decisions in one particular sub-central unit. Bardhan and Mookherjee (1999) explain however that the ef-

²⁴ Obviously, the states got their shapes for reasons that have nothing to do with the optimal size of regulated projects (see Stein, 2008).

fectiveness of capture at each level depend on specific political conditions that vary across jurisdictions. Marshaw and Rose-Ackerman (1984) argue that the support of producers to centralization or decentralization depends on the particular industry structures and on the specific results they may obtain. Rodden and Wibels (2002, footnote 12) argue that a key problem with informational arguments in favor of decentralization is that information-constrained voters might be more inclined to monitor the central government than local governments²⁵ and that shared or overlapping authority might make accountability more difficult. Shleifer and Vishny (1993) relate corruption incentives to the vertical structure of government. They argue that when central governments have a strong grip on the lower layers of government, corruption levels are lower because a double marginalization problem is avoided. Local corruption levels can be reduced, however, when political competition is strong.

Spector (2007) and Woroch (1990) discuss the possibility that decentralized levels have shorter time horizons. This may be related to citizen mobility or political volatility, which may vary across regions. For example, it can be argued that the EU Commission (EC) is more immune to political volatility than the US Federal government because the main political parties are by design represented in the EC.

Bardhan and Mookherjee (2006) compare two type of non-benevolence (bribes in centralization, electoral capture in decentralization) with a variety of instruments available (user fees or taxation) in the case of decentralization. Policy makers decide on the levels of service delivery for a segment where the only relevant costs are constant marginal costs (the fixed costs correspond to an exogenous upstream producer to whom deliverers buy). Results for each case are compared to a first and second best (with deadweight loss of taxation) in terms of efficiency, welfare (efficiency plus equity between two demand types for each region) and level of service delivery. User fee finance dominates decentralization with local taxation because voluntariness of local fee financing constraints the extent to which elites may be overprovided at the expense of non-elites. Decentralization with central grants may dominate centralization and user fees in specific cases.

Inman and Rubinfeld (1997b) provide an extensive and insightful review of the exemption from anti-trust legislation that the states often enjoy in the U.S. This exemption goes back to the US Supreme Court *Parker* case, where a policy decision by the state of California granted a cartel to producers of agricultural products overwhelmingly consumed outside of the state of California. Although Inman and Rubinfeld criticize this particular case for not taking spillovers into account, they claim that in many cases, in the absence of such spillovers, states policies should be exempted from antitrust legislation if they satisfy the condi-

²⁵If we take election turnout as a proxy for the amount of information that voters possess, in Europe this turnout is highest for national elections, lower for regional elections and lowest for European Parliament elections (other European offices, such as the European Commission and the European Council, are not directly elected). This suggests that whereas the national policies are better monitored than regional policies, European policies are the ones that are worst monitored.

tion that the policy is enacted under conditions of political participation. Then, a state-action doctrine can be invoked in those areas where there are not sufficient reasons to invoke the Supremacy Clause and the Commerce Clause of the US Constitution,²⁶ which are typically used to defend the preeminence of the federal level. The impressive work of these authors is however vulnerable to two criticisms: first, it focuses on a model of "bright lines" regulation, whereas many regulatory decisions are made by jurisdictions that share regulatory powers; second, the more recent literature (see for example Bardhan and Mookherjee, 1999, and Treisman, 2007) shows that it is not clear that more participation goes hand in hand with decentralized policies. Nevertheless, this work shows that political participation, together with economic efficiency, is a key element in the role of decentralized powers. A role for the federal level certainly persists in the case of pure (national) public goods or positive spillovers if states cooperation is precluded. In the case of negative externalities the situation is more complicated because universal agenda setting rules at the federal legislative may imply that a similar pattern of decisions is adopted at the federal and at the decentralized levels. In this case, federal intervention should be restricted to setting maximum levels of the externality. To improve the terms of the trade off between political participation and economic efficiency, a participation test should take into account the participation of states affected by spillovers. The authors argue that although almost all policies have jurisdictional externalities, these should be taken into account in the architecture of government only when they are significant, and that standards of significance similar to those used for market definition in anti-trust policy should be used (ie an impact of 5% difference). Interestingly, throughout their article, the authors argue that participation is best guaranteed by the legislative power²⁷ (through both well articulated policies and ex post mechanisms for monitoring), and not by regulatory agencies.²⁸ More generally, this study shows that it is valuable to go beyond the theories that only consider the demand side of policy making (like the Tiebout model or in part the market preserving federalism theory) to open the black box of the supply side, and analyze the whole range of incentives and constraints that

²⁶The Commerce Clause is part of the US Constitution, and it is positive in the sense that it prescribes that the federal level *can* intervene in interstate issues. The usually mentioned "dormant" or "negative" Commerce Clause is largely a court-developed doctrine about what the Commerce Clause did not say, and it is negative in the sense that it *restricts* states from discriminating against out-of-state residents (Inman and Rubinfeld, 1997, footnote 128, p. 1252).

²⁷In some occasions, state legislative input and stakeholders participation has not been enough to prevent regulatory failures. In the restructuring of electricity in California, the chair of the committee that drafted the legislation "rather than encouraging the usual behind-the-scenes negotiations of competing bills put forth by different interest groups, he held marathon public sessions in which all stakeholders had to work on a single bill together, often into the wee hours of the morning" (Blumstein et al., 2002). Inman and Rubinfeld (1997) argue that it is precisely the complexity of regulatory issues (such as arguably the optimal restructuring policy for electricity) that makes political participation more important, and that this is better achieved at decentralized levels.

²⁸For an opposite view, Moore (2002) argues that complexity and a higher discount rate would have made regulatory agencies better qualified than the legislator in designing electricity deregulation in California.

drive political and regulatory decisions.

Conclusions of the literature review, types of decentralization and empirical evidence

Regulation started at the local level, and stayed at that level (as in waste management, or bus transportation) unless there were economies of scale in operation (for example, derived from the need for interconnection), commitment advantages or expertise that demanded a higher level. However, many remnants of local intervention survived in the form of municipal utilities (see for example the map of California electricity area services in Section 4 below). Aubert and Laffont (2002) mention that it was often the firms themselves that demanded that regulation went beyond the local level because they were often under political extortion, hinting at little protection of sunk costs at local level, something extensively confirmed in the case study of the gas industry in Chicago by Troesken (1996) mentioned above. In the US most of this higher level regulation in the network industries stayed at the state level. This is as opposed to a tendency to centralization in general, and in particular in social, safety and environmental regulation, coinciding with the New Deal with a peak towards the middle of the XX Century in the US, according to Oates (1999). In other parts of the world public intervention in network industries also went beyond the local level, depending on the particular industry and the pre-existing institutional structure (see Aubert and Laffont, 2002).

Treisman (2002)²⁹ argues that different arguments in favour or against decentralization refer to different kinds of decentralization, for example the percentage of public expenditure allocated by non-central governments, the number of government tiers, the number of non-central tiers elected by voters or the participation of non-central tiers on central decisions. He then collects data on these different measures and computes the impact of these different types of decentralization on the quality of public services, including health, roads and water systems. The results are slightly more favourable to centralization than to decentralization. As opposed to the focus of these notes, however, he does not examine the impact of any type of decentralization on regulated sectors where private investment plays an important role. Humplick and Estache (1995) examine the impact of different measures of decentralization on the quality performance of road investment, electricity and water, without clear cut results. In the case of electricity they use a dummy variable for spatial decentralization for a cross section of countries, without giving many details on how this variable is computed (eg, does it mean that all relevant legislation and tariffs are at sub-central levels?). Beyond this, there is no more systematic empirical work to my knowledge on the impact of the jurisdictional allocation of regulation in network industries.

Many of the insights of the federalism literature can be readily applied to the network industries, but additions to the existing theory may shed further light on this jurisdiction allocation problem. Some of the insights that have

²⁹Oates (1999) summarizes empirical evidence on the relationship between decentralization and economic growth, concluding that the sign and significance of results change depending on the study.

already been developed are of special relevance to regulated industries, for example the importance of commitment not to expropriate investments; and the interaction of vertical relations in government and in network industries, where different institutional levels may take regulatory decisions that affect different segments in the value chain. Other insights need to be qualified, specialized and in some cases de-emphasized if they are to be applied to network industries in a meaningful way.

For example, the Tiebout model of fiscal or regulatory competition seems more applicable to small jurisdictions (the local level) than to the levels at which network industries are usually regulated (state, country or federal level), because one of the conditions for the efficiency properties of competition is that there are many jurisdictions and citizens and firms are unconstrained to move from one to the other. In the network industries, sunk costs imply that producers are completely immobile once they make their investments; residential consumers are in theory mobile, which could move policies toward their interests (and according to Troesken, 1996, it indeed seemed to have moved into that direction in the times of local regulation in the US), but in fact there is no systematic or casual empirical evidence showing that network industry regulation or policy is currently a fundamental motive for the moving decisions of citizens. In addition, immobile interests may use lobbying to influence decision-makers.

It can be argued that some business customers may take their location decisions based on the general regulatory environment or based on the public policies toward basic inputs such as energy and telecommunications infrastructure, but then it is not clear whether these business customers always have stronger preferences for lower prices or for higher network infrastructure prospective investment levels. Treisman (2007, ch. 4) mentions casual evidence that public utilities infrastructure and local airports have been used by local authorities to compete for mobile capital. But such competition for capital may favour only initially rich regions if heterogeneity is too high, or, if accompanied by subsidies or lower taxes, may go to the detriment of not necessarily inefficient policies that benefit less mobile factors, such as labour or poor residents. In the case of the Weingast market preserving federalism argument or the arguments that see decentralization as an additional mechanism to protect the status quo, the arguments could be valid at a very general level, but do not seem well suited to address specific policy issues in given industries.

Network industries present characteristics that are close to the type of goods that Oates (2002) qualifies as local public goods with spillovers. Policy innovation and tailoring seem the best arguments that can be applied to defend a role for subcentral powers in network industries. Scale economies and externalities seem the best arguments in favour of a role for the federal level. The difficulty lies in the definition and quantification of such spillovers. In telecommunications, regulated markets have so far been local, not national or international, although operators are usually national in scope. The relevant externalities there are network externalities (which must be dealt with non discriminating interconnection fees) and the desire of national operators and large business consumers to face similar business conditions across local territories. In electricity,

interjurisdictional spillovers are of a more direct nature: electricity transmission must optimally cross state and national borders and must be regulated. In addition, its interaction with wholesale markets must be dealt with in regional organized markets. Telecommunications and electricity, however, are clearly not public goods, but congestible networks.

Information, accountability and capture arguments do not tilt the balance in favour of loading more decentralized or federal structures with regulatory responsibilities, but offer insights into important conditions that jurisdiction allocation must meet for it to be effective. For example, if decentralized structures are to have a role, it must be in a framework that provides for limited discretion, political participation and transparency, in order to facilitate accountability.

There are important examples of "special districts"³⁰ in regulated industries, such as PJM in the US or the NordPool in Scandinavia and Northern Europe in electricity. In these cases, it seems that the benefits from tailoring the size of the jurisdiction to fit the real externalities or to produce some input or regulation at as close as possible to the minimum average cost, ie the perfect level of scale economies, outweighed the costs from not using existing institutions for which the fixed costs had already been sunk and for which there existed a history of democratic control.

Participation in central regulatory bodies (in a similar way that the länder participate in the Bundesbank or the US states in the Federal Reserve System, or Catalonia expects to participate in Spanish industry regulatory bodies according to the 2003 Statute of Autonomy) creates an additional veto point that favours commitment to investment but may limit efficiency enhancing reforms. In Spain, Catalan parties tried to influence central regulatory policy by using their leverage in Spanish politics to move the location of the central regulatory agency to the Catalan capital, Barcelona. The telecommunications regulatory agency (CMT) effectively moved in 2004 amidst an uproar from many of the original staff in Madrid, supported by local Madrid politicians; the former staff eventually negotiated very good conditions for staying in the central administration in Madrid if they did not want to move. Among the expected results from such a change of agency location one would expect this movement to influence the location of some offices of regulated firms in Barcelona, attracting business or at least the lobbying branch of businesses to Catalonia; an increase in the independence of the regulatory agency, making it more difficult for the central government to influence and monitor the agency; but at least a short term deterioration of the human capital of the agency as many of the former staff decided not to accompany the agency in its move to Barcelona (even if they were replaced by equally qualified staff, the latter would at least need a learning period and resources had to be spent on recruiting), which was probably damaging for an agency that had to analyze the competition conditions of a number of complex markets and potentially impose remedies under the rules of the EU telecommunications directives. However, a detailed analysis of these effects has not been undertaken.

³⁰See Eichenberger and Frey (2006).

Even if one is led to believe that the normative case for local or decentralized regulation of network industries is weak, the fact is that local and decentralized political powers do have a tendency and strong incentives to intervene in network industries. Then it is important to look at the implications of different sorts of interaction between different levels of government, eg the difference between cooperative federalism and dual or non-cooperative regulation. Then the challenge is to design institutions in such a way that decentralized jurisdictions have the motivation to exploit their advantages and do not undermine the provision of interjurisdictional collective goods (such as market integration or the exploitation of scale economies). One aspect that is missing in the academic analysis, but that is widely present in the role of decentralized powers, is the conflict of objectives in setting regulatory policy, for example the conflict between controlling market power and "industrial policy" or security of supply. This conflict of policies plays an important role in the basic model presented in the next Section.

3 A Basic Model

Although the main contributors to the literature on fiscal federalism claim that their tools can be applied to regulatory issues as well,³¹ in practice the tools have been mainly used to address issues of taxation and public expenditure,³² and also environmental regulation.³³ Easterbrook (1983) and Inman and Rubinfeld (1997b) deal with federalism in regulation, but their analyses seem better suited to address regulation of standards and norms such as professional regulation or other business restrictions, and although inspiring in many respects, do not address some important specificities of network industries such as sunk costs and the relations between vertical segments with different geographic scopes. Thus there is not much work on the regulatory federalism of network industries specifically (some exceptions being Bardhan and Mookherjee, 2006, and Laffont and Pouyet, 2004). In particular there is no work on the role of decentralization in the introduction of competition (or the interaction between competition and regulation) in some segments of network industries. One specificity addressed below in this Section is the interaction between policy conflict and investment incentives in such industries. In Section 4, competition in some segments is introduced.

In this basic model there are no information problems, and regulatory competition plays no disciplining role. The model also abstracts from laboratory fed-

³¹Oates (1999, footnote 26, p. 1136) specifically claims that "the analysis of "regulatory federalism" is, in principle, analogous to that of fiscal federalism. The same general principles concerning decentralization apply to fiscal and regulatory instruments."

³²The degree of decentralization is often assessed by the percentage of public expenditure allocated to lower tiers of government; this may give a distorted picture of decentralization if the regulation of key industries is very centralized, since public expenditure on regulatory activities is low.

³³See Oates (1999). There is also a well developed literature on the issue of regulatory competition concerning legislation on takeovers. See for example Bebchuck and Ferrell (2001).

eralism issues. There are conflicts of policy: local politicians or regulators may be concerned about the welfare of particular firms, input providers or groups of consumers. They may also be concerned about other issues that are not essential to central regulators, such as security of supply or inflation, both at the local level. This is different from the "bundling" of issues in Besley and Coate (2003), where there is one instrument for every issue and the regulatory issue is not salient for the electorate. Here we assume in a way that regulation is too salient (although not necessarily well understood), so salient that local governments want to achieve several objectives with regulatory policy. More is offered in the way of motivation of this assumption below.

There are two jurisdictions and potentially one central power that may take decisions that affect both jurisdictions. Initially, it is assumed that there is one firm in each jurisdiction, but in subsequent applications and extensions below it is possible to adapt the model so that the initial firms merge, or so that there is entry of new firms in local markets. A regulatory policy x_i (with $i = 1, 2$) can be set **locally** (x_i^L) **or centrally** (x_i^C). If $x_1 = x_2$, policies are said to be uniform (centralized policies may be uniform or not, and local policy makers may set policy at the same level in both countries). If $x_i^L = x_i^C$ policies are said to be equivalent. Local and central decision-makers have different objective functions. There is a firm decision (investment³⁴ in this basic model, but it could be a decision to merge or not with another firm as in subsection 5.2 below) prior to setting policy.³⁵ π_i and v_i are firm's profits and consumer surplus in country i .

In the remainder of this section it is assumed that no authority has commitment powers, so that investment is chosen by the firms before the (local and/or central) authority fixes policy.

3.1 Central regulation

There is one central regulator that fixes its part of policy x_i^C to maximize

$$\alpha [\pi_1 + \pi_2] + v_1 + v_2$$

subject to both firms willing to participate, where $\alpha > 0$ measures the degree to which the welfare of shareholders weighs in the central regulator objective function relative to consumers (a measure of capture by the regulated industry).

Having in mind the cases of the US and Europe, federal jurisdictions may differ in the scope for capture, and commitment powers at the centralized level. For example, casual evidence suggests that the central level is more capturable by businesses in the US than Europe, and that the EU Commission has recently developed a more populist approach vis-à-vis consumers and has been less able

³⁴Higher policy levels, when the policy is price, benefits investment, but in equilibrium with commitment, the prices may be lower, for example because costs are lower or demand higher (which lowers prices due to scale economies). See Levine et al. (2005) and Evans et al. (2008).

³⁵Bardhan and Mookherjee (2006) assume that the fixed cost of the utility producing the service is financed by the central government out of central taxes in both regimes; accordingly they ignore the costs of such financing when comparing the two regimes, and focus on how variable costs are financed.

to commit, because it is a new institution in search of popular legitimacy. In the US there is a quid-pro-quo between large firms and large political parties and in the recent decades the Supreme Court has adopted a more pro-business stance (see NYT 03/16/2008). Many companies have a US national scope and most companies do not, at least as yet, have a European scope, and there are no effective pan-European political parties; so the institutions of supply and demand for political action are absent or seminal in Europe. But the ability to recruit experts due to scale economies is probably similar.

Therefore, the central decision makers care about consumer and producer surplus, giving different weights to each, with the weights varying across central jurisdictions.

3.2 Decentralized regulation

National or local regulators care about their specific producers and consumers plus about some additional objective. Each of the two decentralized jurisdictions chooses policy with the objective of maximizing total surplus in the regulated industry plus some other objective with a (common across jurisdictions) weight θ .³⁶

$$\text{Max}_{x_i^L} x_i \pi_i + v_i + \theta \Omega_i$$

subject to a firm's participation constraint.

Hence the conflict of policies is located at the decentralized level. Of course, one can abstract from the difference in objective functions by assuming $\alpha = 1$ and $\theta = 0$, and focus on the role of externalities and the type of interaction (dual and separate sovereignty, overlapping jurisdiction, complementary jurisdiction) between regulatory jurisdictions.

Examples of the second objective may include³⁷:

-Favour some national or local input, eg local employment, local coal.

-Keep a management team in place with whom the political powers have implicit collusion contracts (for example, the government may develop rules and legislation to protect the firm against takeovers, in exchange for the use of the firm's cash flow to promote the politicians' objectives through investment in the media, sinecures for retired politicians, or political party financing).

³⁶ θ may represent an inverse measure of the transaction costs of lobbying of interest groups other than consumers and shareholders (for example, the management of an incumbent firm that want to keep their position in case of a takeover). These transaction costs are assumed to be lower at the local level, because collective action problems are lower at this level, there is less policy specialization and the mandates of agencies are vaguer. As it is sometimes said, at the local level all interested parties meet when they collect the children from the same school.

³⁷According to Joskow (2006), the privatization of state-owned utilities was meant to create high-power incentives but also "to make it more difficult for the state to use these enterprises to pursue costly political agendas." Note that the careful wording implies that after privatization the use of firms for a variety of objectives is not ruled out. "The components of these political agendas have included the use of state-owned monopolies for patronage employment, macroeconomic and redistributive policies, to favor domestic suppliers of fuel and equipment, and to funnel revenue to government budgets outside of the tax system."

-Keep domestic ownership of firms operating in the country (see Koehler, 2008, pointing out in particular that some countries seem to have a preference for the largest banking institution to be domestically owned, and finding that a bank operating in a country with less transparent and more prone to political intervention merger policy is less likely to be taken over by foreign institutions).

-Security of supply (used as argument by Spanish authorities to fend off the takeover attempt of Endesa by E.On).

-National security (used by US authorities to fend off takeover attempts of US ports by Asian funds).

-Avoid offshoring, although this could be more relevant for antitrust than for regulation of network industries, since it seems difficult that a company owning network assets can part away with these assets.

-Control local inflation in the short run (there are examples of this in Catalonia and Spain).

-Promote information society locally (be high in the broadband penetration rankings).

-Local health and safety or environmental concerns, which often jeopardize facility investments decided by national or regional reasons following legitimate national or regional goals.

-Promote national champions, ie large national firms that are able to compete at the international level (see Haufler and Nielsen, 2007).³⁸

-Promote prestige projects, the so called "white elephants."

Sometimes, objectives other than total (or consumer) surplus in the affected market are stated in vague terms, such as promote "competitiveness", where it is not always clear whether the term refers to a more competitive market, or to firms becoming more competitive for a given degree or intensity of competition in markets, or to the jurisdiction being competitive in attracting labour and capital.

Public policies in general and regulation in particular have fixed costs, implying that small jurisdictions will have less formal policies and regulations (see Mulligan and Shleifer, 2005, on the fixed costs of regulation and the reference on vague law in small jurisdictions). The diversity of objectives captures a similar idea to the idea of "taxation by regulation" expressed by Posner (1971), although the latter did neither emphasize that nor explain why this sort of "taxation" was more prevalent at the lower levels of government.³⁹ At higher

³⁸In Australia, France and the UK, antitrust regulators may consider the influence of a prospective merger on factors such as balance of payments, employment and regional development. See Head and Ries (1997, footnote 3, p. 1107). Neven and Röller (2000) show that when the relevant market encompasses all jurisdictions concerned, as would be the case in "global" industries, conflict will only arise if antitrust agencies pursue objectives that they are not supposed to pursue. Since conflicts arise frequently, these raises the suspicion that these other objectives indeed exist. This is so even when antitrust agencies are those of the US and the EU, where they are legally bound by quite "narrow" consumer welfare standards. These other objectives must weigh even more in national or sub-central jurisdictions where goals are more vaguely defined or even where other policy objectives are legally admitted.

³⁹In some specific issues, centralized structures may be reluctant to decentralize precisely because they undertake some form of taxation by regulation. For example, in Spain the central government quite singularly keeps the main local airports under a single organization,

levels there is more scope for policy specialization and the larger scale alleviates the conflict of policies (for example, if one input is scarce at local level, it may not be scarce in an integrated market). Also, diversity of objectives also derives from the sunk cost nature of investments in network industries coupled with local politics (see Troesken, 1996): local politicians have incentives to use sunk assets to satisfy local constituencies.

This kind of objectives that sometimes are expressed in vague terms give high discretion to local policy makers, for example in the objective to protect the "public interest" of state regulatory agencies that review electricity mergers in the US (see Wolak, 2007).⁴⁰ This vagueness is in the nature of public policy making and the transaction costs of politics, as explained in Dixit (1996).⁴¹

Notice that some of the examples may not be associated to higher profits, so it would not be captured by a decentralized version of α . In fact, objectives such as promoting national champions may actually turn out to be costly for the firm's shareholders.

Even if the reasons for having additional objectives remain theoretically unconvincing, the fact is that local regulators do seem to be less focused when setting regulatory policy. Here are three examples (one hypothetical but realistic, the other two factual):

-A mayor in a little village puts his fingers in every cake, because people reach him or her due to low political transaction costs, whereas at higher levels in the administrative hierarchy the transaction costs are higher and the fixed costs of specialization can be more easily amortized.

-Giving up instruments does not imply giving up objectives. Some instruments are available at the central level and not at decentralized levels. The EU controls inflation through the European Central Bank, but member states do not have specific instruments to control inflation, which does not mean that they are not concerned by the costs of inflation and try to leverage a variety of available instruments to control local inflation.

-In the US, federal regulatory agencies are specialized (FERC, FCC) whereas state regulatory agencies (PUCs) are multi-industry.

3.3 Firms, investment and externalities

In this basic model, one firm in each country decides an investment level at cost $C(I) = \frac{\varphi I_i^2}{2}$ prior to governments fixing policy. This investment has an

to cross-subsidize loss making small airports with the profits of large airports and possibly to achieve other geographic redistribution objectives.

⁴⁰Joskow (2006, p. 24): "In the US and some other countries (eg Spain), default service prices or tariffs have been used to support a number of objectives other than promoting a robust retail market. These include commitments that retail customers will receive an immediate and sustained price reduction of some magnitude, stranded cost recovery considerations, income redistribution goals and consumer protection goals."

⁴¹This may be related to the view expressed by Joskow (1974), of regulatory agencies as driven by a satisficing more than maximizing behaviour. This article observes that the statutes establishing most regulatory agencies are quite vague, and that the primary concern of regulatory agencies has been to keep nominal prices from increasing.

impact on the demand function or consumer valuation (eg, in telecommunications markets, upgrading the network allows people to subscribe to highly valued broadband services; upgrading a transmission electricity network accommodates demographic growth or new transport systems, such as high speed trains). In a unit demand framework, assume $\varphi = 1$ so that $\pi_i = x_i^C - \frac{I_i^2}{2}$, and $v_i = (I_i + tI_j) - x_i^C$, with $0 \leq t < 1$, a parameter reflecting the inter-jurisdictional externality. This captures the idea that the network in one jurisdiction may have higher value to consumers when the neighboring jurisdiction has a better network.

3.4 Analysis

Case A: Central Regulation

The regulatory decision vector (x_1^C, x_2^C) maximizes $\alpha [\pi_1 + \pi_2] + v_1 + v_2$. The solution $(x_1^C(I, t), x_2^C(I, t))$ is a function of the vector of investments $I = (I_1, I_2)$, the externality parameter t , and α . So the key thing is how investment and externalities relate to the ex post central regulator's objective function.

The central regulator fixes policy such that the ex post surplus of producers is α times that of consumers:

$$\Sigma x_i^C = \alpha [\Sigma I_i(1+t) - \Sigma x_i^C]$$

Therefore, $\Sigma x_i^C(1+\alpha) = \alpha \Sigma I_i(1+t)$ and $\Sigma x_i^C = \frac{\alpha \Sigma I_i(1+t)}{1+\alpha}$. Then at the investment decision stage the firms maximize (assuming no discounting) $\frac{\alpha \Sigma I_i(1+t)}{2(1+\alpha)} - \frac{I_i^2}{2}$ and

$$I_i^C = \frac{\alpha(1+t)}{2(1+\alpha)}.$$

Equilibrium investment increases with the level of spillovers and (non linearly) with the weight of producers in the central regulator's objective function:

$$\frac{\partial I_i^C}{\partial \alpha} = \frac{(t+1)}{2(\alpha+1)^2} > 0.$$

Case B: Local Regulation

In this case, externalities are not internalized and investment depends on the relationship between the second objective and investment. Ex post, the regulatory authority maximizes $\pi_i + v_i + \theta \Omega_i$ for a given level of investment, ie it maximizes $x_i^L + [(I_i + tI_j) - x_i^L] + \theta \Omega_i(x_i^L, I_i) = (I_i + tI_j) + \theta \Omega_i(x_i^L, I_i)$.

Then θ can be interpreted in Posner's terms as a measure of taxation by regulation which is politically attractive due to immobility of assets.

Policy and investment must be related to profit and consumer surplus in the same way as in the central regulation case, for the comparison to be meaningful. So given that the same weight is given to consumer surplus and profits at the local level, and given unit demand⁴² and the sunk nature of investments, the decentralized regulator actually sets policy to maximize the second objective. Assume $\Omega_i(x_i^L, I_i) = \mathbf{I}_i \ln \mathbf{x}_i^L - x_i^L$, ie the second objective is concave so that

⁴²So deadweight loss play no role in this basic analysis.

there is an interior⁴³ optimal policy *vis-à-vis* this second objective, and the regulatory decision and private investment are complements. For example, the local investments of a national champion will be a springboard for international expansion (or used to satisfy security of supply concerns, or the promotion of certain fuels and/or technologies in addition to short run consumer surplus) only if accompanied by high revenues in the current period.

Then the optimal local policy is $x_i^L = I_i$. At the investment decision stage, the firm anticipates this policy and decides investment to maximize $I_i - \frac{I_i^2}{2}$. The solution yields $I_i^L = 1$. This is higher than I_i^C if $1 > \frac{\alpha(1+t)}{2(1+\alpha)}$. In the case that $\alpha = 1$ and $t = 0$, $1 = I_i^L > I_i^C = \frac{1}{4}$. As t increases, I_i^C increases but it never reaches 1 (it never even reaches $1/2$) because t is bounded at 1. A similar logic applies for any positive value of α . For I_i^C to be higher than 1 it should be the case that $\alpha t > 2 + \alpha$, which is not possible because $t < 1$ by assumption. In this example, investment is higher when regulation is at the local level because the second objective is used as a commitment device.

The key thing here is how policy and/or investment potentially relate to the second objective. We want this relationship to be general enough to accommodate a variety of possibilities, but also tractable enough to allow for an interpretable and insightful solution of the model.

If we introduce an additional parameter $\gamma \in [0, 1]$ in the second objective, then $\Omega_i(x_i^L, I_i) = \gamma \mathbf{I}_i \ln \mathbf{x}_i^L - x_i^L$ and $x_i^L = \gamma I_i$. Then the firm chooses investment to maximize $\gamma I_i - \frac{I_i^2}{2}$. The solution yields $I_i^L = \gamma$, and, in equilibrium, $x_i^L = \gamma^2$. To the extent that γ varied across jurisdictions, the regulatory policy would vary across jurisdictions, although here γ is kept constant for simplicity. Then when $\alpha = 1$, $I_i^L = \gamma < \frac{1+t}{4} = I_i^C$ if $t > 4\gamma - 1$. That is, if the externality is high enough relative to γ , central regulation achieves higher investment than local regulation. Or, if we let α vary and fix the externality at some level, say $t = \frac{1}{2}$, then central regulation achieves higher investment than local regulation if

$$I_i^L = \gamma < \frac{3\alpha}{4\alpha + 4} = I_i^C,$$

which happens when $\alpha > \frac{4\gamma}{3-4\gamma}$, ie when the weight of profits in the central regulator's objective function is high enough relative to the degree to which the combination of the regulatory policy and investment impact on the second objective of local regulators. Policy makers may value investment directly in this second objective for example if the capital providers in network industries also contribute to this second objective. For example, in Catalonia, the main shareholder in gas, water, highways and telecommunications is "la Caixa," a large and very influential non-profit savings bank which captures the deposits

⁴³The second objective may also be interpreted as the reduced form of a number of several additional objectives, for example a combination of promoting national champions and keeping low inflation, in which case the intuition is that the regulatory policy (a regulated tariff, for example) must be not too high as to cause high inflation and not too low as to reduce the cash flow of expanding firms.

of a large fraction of the population and is involved in social activities as a result of its foundational nature.

The following examples illustrate the role played by parameter γ :

-In periods of high inflation, γ is low. The weight of objectives for which a high level of firm investment is needed is low relative to the weight given to the objective of keeping prices low to contribute to reduce the rate of increase of the overall price level. In this case, we expect investment under a local regime to suffer. In periods of low inflation, the opposite happens and γ increases.

-If the local policy makers have a concern for achieving some sectoral target such as scoring high in some measure of investment in renewable energy or the information society, then policy makers have a direct concern for investment. This investment was made in the previous period, but has a positive impact on the current period's second objective (it also has a positive impact on the current period's consumer surplus; policy makers may perceive ego rents for having a high reputation for respecting contracts) only when combined with a positive level of the current period regulatory instrument. High policy levels may mean higher firm cash flows which may be shared collusively between policy makers and managers; if the bargaining power of both colluding parties is intermediate, then some of the cash flow may be pocketed by stakeholders "in the normal way, giving them an incentive for investment" and some of the money may go to investment in the desired second objective. The exchange between stakeholders and policy makers goes along the following lines: "OK, I give money for your second objective, but you have to allow me to earn enough revenues so that I also get away with something."

If a more intertemporal perspective was taken, clearly the fact that the second objective of the local governments may change from time to time due to the global policy environment introduces an additional level of volatility that may be absent at the central level because of the more focused objective function at this level. This would increase the costs of investment reducing the relative attractiveness of the local regime.

The result that central powers not always facilitate better commitment echoes the arguments by Sah (1991) that authoritarian regimes may provide sometimes very good policies, but their variability is higher than more participatory regimes. A central agency in a government presided by Hugo Chavez may be very focused, but will probably have less commitment ability than a provincial unfocused agency.

Lack of commitment was assumed. Of course, if there is commitment and there are no other regulatory imperfections, there is no problem: everything could be regulated and markets would not be necessary. Some degree of imperfect commitment could be assumed (through some role for reputation or contracts) and the conclusions should have to be qualified accordingly.

One shortcoming of the present analysis is that regulatory decisions are treated as binary options (decided at central or decentralized level), whereas in practice different levels interact⁴⁴ in decisions that affect basically the same

⁴⁴Rodden (2005) argues that "authority over taxation, expenditures, borrowing, and policy

issue, for example decentralized bodies taking decisions subject to the constraint of some rule decided at the central level. Central policies constrain local policies as in Caillaud et al. (1996): one can distinguish three types of regulatory decisions, as in eg the vehicle inspections (objectives, rules, implementation). See for example Footnote 20 (p. 20) in Lehman and Weisman (2000): "The Supreme Court resolved the jurisdictional issue in that the FCC can promulgate national pricing rules, but it is still left to the states to actually set the price levels under those rules. Rodden (2005): "case studies and systematic attempts at cross-national data collection reveal that in most policy areas, at least two or three layers of government are jointly involved in funding, regulating and implementing policies in federal and unitary systems alike".

The conflict of policies at sub-central levels presents a dilemma between static and dynamic efficiency: although using only one instrument for several objectives is detrimental for allocative efficiency, for some of the objectives other than controlling market power this dilution of regulatory incentives may favour private investment, because there is less risk of expropriation; if regulatory responsibilities are allocated at the central level, ie without conflict of policies, sharper regulatory incentives mean that unless there is strong regulatory commitment the underinvestment risk may be higher. A key issue is how the second objective of local powers interacts with the regulated firm's investment. One possible role for the central powers is to alleviate the conflict of policies so that the allocative efficiency at the sub-central level is increased. For example, improving security of supply in energy at the EU level may alleviate the conflict of policies in the member states between controlling market power and guaranteeing security of supply.

4 Extensions and Applications to Telecommunications and Electricity

In this Section, the previous framework is extended and applied to network industries such as telecommunications and electricity (and energy in general, including gas) in the US and the EU which combine multiple jurisdiction regulation with some degree of competition. It is useful to start by mentioning important differences both between the US and the EU and between telecommunications and energy.

General differences between US and Europe include the following:

-Absence of state aid policy in the US, but some common environmental and social regulation.

-Absence of antitrust state policy in the US following" (see Inman and Rubinfeld, 1997).

-More sovereignty in the EU member states.

decisions is inherently murky, contested, and frequently renegotiated between governments, with federal constitutions analogized to the "incomplete contracts" of industrial organization theory."

-Regulation (both federal and states) is older in the US. It grew starting in the second half of the XIX century and reaching a peak with the New Deal in the 1930s as a product of the second industrial revolution and the growth of cities and business. Ideology and interest group action first, and economic crisis subsequently, combined to increase the role of government in the economy.⁴⁵

-The Federal Communications Commission (FCC) and the Federal Energy Regulatory Commission (FERC) grew up in a culture of dual federalism (under laws that attempted to clearly divide responsibilities), whereas European regulation started with a culture of cooperative federalism, where industry directives provided for a framework of shared responsibilities, at least in telecommunications.

-Unlike the FCC and FERC, state commissions usually are responsible for the regulation of a variety of industries. In Europe, there are separate national regulatory agencies for telecommunications and energy, with varying degrees of independence.

-Mutual recognition or host country rule are specific concepts that are used in Europe to portray a situation of regulatory competition (see Gual, 2007, and Baron, 1995). Market integration in specific industries is said to make a choice between these options or harmonization.

-The federal government in the US is partisan (although with divided government) whereas the federal government in Europe is multi-partisan and cooperative in the sense that it works by building consensus among member states. More generally, there is varying commitment ability across government levels and varying political volatility. Exit pressure (through mobility) also varies, for example individuals mobility higher in the US (although firms are also under renewed pressure to "move" incorporation or plants in Europe).

Differences between electricity and telecommunications include the following:

-In telecommunications the ability of technology to overcome jurisdictional borders is larger, but the "transmission" segment of the networks is competitive and mainly unregulated (although policy can affect these markets). The implication of this is that there is no need for a regulatory authority that has jurisdiction over this potentially very large segment of the market in telecoms, whereas the need exists for electricity, which creates additional tensions in this industry. Perhaps this helps explain why federal energy policy is less developed than federal telecommunications policy both in the US and the EU.

-Telecommunications seem to be in transition towards an imperfect competition model, where natural monopolies seem completely absent, which would call for basically an ex post competition policy model instead of ex ante regulation. Shelanski (2007) argues that this does not imply the absence of any type of ex ante regulation (for example, network interconnection should still be regulated in many cases, and some distributional and safety objectives should still be in place), and also it does not imply that competition policy should not be adapted to some specific features of telecommunications (for example, the absence of an essential facilities doctrine in the US Supreme Court jurisprudence should be

⁴⁵See North (1981, ch. 14).

taken into account to develop specific requirements to make sure that incumbent networks provide interconnection to entrants). In a similar way, in electricity competition policy should be adapted to the fact that the physical characteristics of electricity transmission (creating geographic areas of congestion) and low demand elasticity make the exercise of market power possible with low industry concentration levels at the wholesale level.

-In electricity, spillovers are concentrated in the transmission function and the link between generation and transmission (wholesale markets). Transmission is a natural monopoly and is regulated. And the link is regulated by also regulated system operators that may or may not be also in charge of operating the wholesale market itself and monitoring market power in it. Distribution is local but the voltage level at which distribution becomes transmission is unclear and it somehow arbitrarily varies across countries.

4.1 Telecommunications

4.1.1 Theoretical insights

In Woroch (1990), cooperative or one single regulation may be dominated by two regulators even though two regulators does not yield constrained efficiency. Then it may be useful to analyze, in particular contexts, whether regulatory interaction yields better results under cooperation or non-cooperation

Take an industry where there is a vertically integrated incumbent that faces the entry of n new firms, which must use some element of the incumbent's network at a regulated tariff a . Linear demand is assumed: $P = 1 - Q$. Regulators have an instrument of structural regulation, n , and an instrument of behavioral regulation, a .

At the retail level, firms compete imperfectly; the entrant faces no marginal retail cost, and the only cost for the entrants is the unit access price, a . Incumbent's operating costs are normalized to zero.

The analysis here looks at how the choice of n interacts with behavioral regulation. The choice of the number of access based entrants can be interpreted as a stance towards concentration in merger policy or as a policy to expand markets eg through network interconnection.

1) With Stackelberg retail competition, for given a , first the incumbent chooses its quantity q_1 , and next the followers simultaneously choose their quantity q_n .

By backward induction, the analysis must start by the entrants' decision. At this stage, an entrant's profit is $\Pi_n = (P(q_1, \Sigma q_n) - a)q_n$.

The Stackelberg quantities and prices of the retail game equilibrium are:

$$\begin{aligned} q_1^S &= \frac{1}{2} \\ q_n^S &= \frac{1-2a}{2+2n} \\ Q^S &= \frac{1}{2} + n \frac{1-2a}{2+2n} \\ p^S &= \frac{1}{2} - n \frac{1-2a}{2+2n} \end{aligned}$$

Then for given n and given a , the profits of the firms (incumbent and entrants, respectively) and the consumer surplus⁴⁶ are:

$$\begin{aligned}\pi_1^S(n, a) &= p^S q_1^S + a n q_n^S = \frac{1}{2} \left[\frac{1}{2} - n \frac{1-2a}{2+2n} \right] + a n \frac{1-2a}{2+2n} \\ \pi_n^S(n, a) &= (p^S - a) q_n^S = \left(\frac{1}{2} - n \frac{1-2a}{2+2n} - a \right) \frac{1-2a}{2+2n} \\ CS^S(n, a) &= \frac{1}{2} [Q^S(1 - p^S)] = \frac{1}{2} \left[\left(\frac{1}{2} + n \frac{1-2a}{2+2n} \right) \left(\frac{1}{2} - n \frac{1-2a}{2+2n} \right) \right]\end{aligned}$$

The following cases are analyzed:

-First case: a decided by the federal regulator, and n decided by the local regulator. Assume that the federal regulator cares about a weighted sum of all producers' and consumers' surplus; the local regulator, assuming entrants are foreign, cares about the sum of the incumbent's surplus and consumer surplus. Then under a "bright lines" regulatory model, both regulators non-cooperatively.

In this case, it can be shown that the access price in equilibrium is negative (to be interpreted as price below marginal cost, which has been assumed to be zero) and the equilibrium number of entrants is 1. Along the lines of Sarmento and Brandao (2006), it can further be shown that this case yields incumbent firm underinvestment, in case that an investment stage is added to the problem. That is because the access price is used to eliminate market power at the retail level, which reduces the incentives of the incumbent to invest. If (partial) deregulation implies disbanding one regulatory agency but not the other, as Woroch (1990) argues "market forces will adjust rates to attain marginal conditions for efficiency in the deregulated markets, but distortions will persist in regulated markets. As long as the industry falls short of achieving desired conditions in all markets, there is no guarantee that welfare will improve."

-Second Case: n decided by the federal regulator, and a decided by the local regulator. In this case, it can be shown that the optimal number of entrants is 0, because the federal regulator anticipates too high an access price to be set by the local regulator, who does not take into account the interests of the entrants.

- n and a decided cooperatively, also results in a zero number of entrants.

2) When retail competition is à la Cournot, quantities at the retail level are decided simultaneously. The reaction functions are

$$\begin{aligned}q_1(q_n) &= \frac{1-nq_n+a}{2} \\ q_n(q_1) &= \frac{1-q_1-a}{2+n} \\ q_n &= \frac{1-\frac{1-nq_n+a}{2}-a}{2+n}\end{aligned}$$

Since n cannot be negative, the only meaningful solution is $q_n^C = \frac{1-3a}{n+4}$. Then

$$q_1^C = \frac{1-n\frac{1-3a}{n+4}+a}{2} = \frac{2}{n+4} (a + an + 1); \quad Q^C = \frac{2an-a+3}{n+4}, \quad \text{and} \quad P^C = \frac{a+n-2an+1}{n+4}.$$

Profits and consumer surplus are:

$$\pi_1^C(n, a) = p^C q_1^C + a n q_n^C = \frac{1}{(n+4)^2} (-7a^2 n^2 - 14a^2 n + 2a^2 + 3an^2 + 4an + 4a + 2n + 2)$$

$$\pi_n^C(n, a) = (p^C - a) q_n^C = (3a - 1)^2 \frac{n+1}{(n+4)^2}$$

⁴⁶Given linear demand, this is simply the triangle area between the demand curve and the market price.

$$CS^C(n, a) = \frac{1}{2} [Q^C(1 - p^C)] = \frac{1}{2} \left[\frac{2an - a + 3}{n + 4} \left(1 - \frac{a + n - 2an + 1}{n + 4} \right) \right]$$

The non cooperative choice of n and a are as follows:

-First Case: a decided by the federal regulator, and n decided by the local regulator. The problem of the federal regulator is:

$$Max_a \{ \alpha [\pi_1^C(n, a) + n\pi_n^C(n, a)] + CS^C(n, a) \}$$

Under a solution of the federal regulator's problem, if for example $\alpha = 1$, then the reaction function of the regulator is $a(n) = \frac{3n^2 - 4n - 1}{8n^2 - 14n + 5}$.

The problem of the local regulator is:

$$Max_n \{ \pi_1^C(n, a) + CS^C(n, a) \}$$

Taking the first order conditions, the reaction function of the local regulator is $n(a) = \frac{5 - 23a}{8a - 2}$. For this to be a positive number, we need $\frac{5 - 23a}{8a - 2} > 0 \rightarrow \text{sign}\{5 - 23a\} = \text{sign}\{8a - 2\}$. But if $a = \frac{1}{k}$, then for $8a - 2 > 0$ we need $k < 4$, and for $5 - 23a$ we need $k > 23/5$, and both inequalities cannot hold at the same time.

We conclude that an interior Cournot equilibrium does not exist in this case.

-Second Case: n decided by the federal regulator, and a decided by the local regulator.

The problem of the federal regulator is:

$$Max_n \{ \alpha [\pi_1^C(n, a) + n\pi_n^C(n, a)] + CS^C(n, a) \}$$

From the first order condition, if $\alpha = 1$, then the reaction function of the central regulator using the second solution is $n(a) = \frac{3a + 8 + 8a - 9}{6a - 5 + 7a} = \frac{11a - 1}{13a - 5}$. This reaction function is negatively sloped:

$$\frac{\partial \frac{11a - 1}{13a - 5}}{\partial a} = -\frac{42}{(13a - 5)^2} < 0$$

Three points in this reaction function are:

$$a = \frac{1}{2} \rightarrow n = \frac{11\frac{1}{2} - 1}{13\frac{1}{2} - 5} = \frac{21}{17} = 1.2353$$

$$a = \frac{1}{3} \rightarrow n = \frac{11\frac{1}{3} - 1}{13\frac{1}{3} - 5} = \frac{31}{25} = 1.24$$

$$a = \frac{1}{4} \rightarrow n = \frac{11\frac{1}{4} - 1}{13\frac{1}{4} - 5} = \frac{41}{33} = 1.2424$$

The problem of the local regulator is:

$$Max_a \{ \pi_1^C(n, a) + CS^C(n, a) \}$$

The reaction function of the local regulator using the first order condition is $a(n) = \frac{10n + 3n^2 + 1}{32n + 10n^2 - 5}$, which is also negatively sloped:

$$\frac{\partial \frac{10n + 3n^2 + 1}{32n + 10n^2 - 5}}{\partial n} = -\frac{2}{(10n^2 + 32n - 5)^2} (2n^2 + 25n + 41) < 0$$

The number of firms and the access price are strategic substitutes, because both reaction functions are negatively sloped.

Three points in this reaction function are:

$$n = 1 \rightarrow a = \frac{10+3+1}{32+10-5} = \frac{14}{37} = 0.378\ 38$$

$$n = 2 \rightarrow a = \frac{20+12+1}{64+40-5} = \frac{1}{3} = 0.333\ 33$$

$$n = 3 \rightarrow a = \frac{30+27+1}{96+90-5} = \frac{58}{181} = 0.320\ 44$$

Looking at the examples, three points along each negatively sloped reaction function can be drawn and it can be seen that at the Cournot equilibrium $1 < n < 1.24$ and $0.33 < a < 0.378$. Hence the number of firms will be between 1 and 2 and the access price will be slightly higher than $1/3$.

The policies that maximize the joint payoffs maximize:

$$Max_{a,n} \left\{ \frac{(\alpha + 1)}{2} \pi_1^C(n, a) + \frac{n}{2} \pi_n^C(n, a) + CS^C(n, a) \right\}$$

The solution of this problem involves a negative access charge and a number of firms between 4 and 5, which would probably be unacceptable to the local regulator, who does not take into account the interests of the entrants.

Both in the US and the EU there has been a transition in the recent past from local (national or state) regulation of final prices of vertically integrated firms to central (European or federal) regulation of wholesale prices accompanied by deregulation of final prices. However, the deregulation of final prices has not been universal and local powers still have a saying in the conditions of retail markets. Then, applying the above model, it would be useful to analyze this case as a transition from **local regulation** to **complementary regulation** with a potential final disappearance of the local level.

In addition to the benefits of avoiding non cooperative decision making when there is interaction, cooperation has other obvious benefits which must be weighed against the transactional costs of cooperation. Some of the benefits are described by Bernstein (1955, p.247): "Cooperation between governments in enforcing regulations helps to plug loopholes in enforcement machinery and enables different governments to pool their information and sources of evidence about violations."

4.1.2 Allocation of Jurisdiction in US telecommunications

Starting with New York and Wisconsin in 1907, state Public Utility Commissions (PUCs) regulated telephone services before any federal intervention. Federal regulation of the telephone industry began in 1913 with the so called Kingsbury commitment, an agreement by the AT&T and the federal government that the industry would be a regulated monopoly, initially regulated by the Interstate Commerce Commission and after 1934 by the Federal Communications Commission (FCC)⁴⁷ when activities flow across states, and by the states when they do not (see Teske, 2004). For the half century between the

⁴⁷The FCC had a predecessor in the Federal Radio Commission, which was established in 1927. See Bernstein (1955).

1934 Telecommunications Act and the divestiture of ATT in the 1980s, there was a neat and basically non problematic separation of jurisdiction between the states (intrastate tariffs) and FCC (interstate tariffs).⁴⁸ The distinction between interstate and intrastate issues⁴⁹ goes back to the railways controversies of the XIXth Century and the creation of the Interstate Commerce Commission (the first federal regulatory commission, which was used as an administrative model when other regulatory commissions such as the FCC and the federal energy regulatory agency were created in the XXth Century).⁵⁰ The legal reasoning behind the traditional interstate and intrastate commerce split proceeded through trucking in the 1930s. Controversies increased in telecommunications with the introduction of competition first in long distance⁵¹ and in the nineties in local competition, especially as they affected common costs and access to infrastructure. In general, the FCC over this process pushed for deregulation and competition, while the states resisted the process or tried to micro-manage it to avoid losing the redistribution powers of the old regulatory system. A merger wave has accompanied the whole reform of the last years: the Bell regional companies have consolidated and vertically re-integrated. The Federal Communications Commission gained new powers relative to states' jurisdiction as a result of the 1996 Telecommunications Act,⁵² which left many aspects to be filled. Specifically, it was the agency in charge of authorizing the local companies entry in long distance, and it fixed the criteria for wholesale prices of local telephony, which were finally fixed by the states following these criteria.

In wireless telecommunications, prior to 1993, states had the power to regulate prices and terms of service (Parker and Röller, 1997, explain how the states used this power). The potential for competition was limited because the Federal Communications Commission had assigned radio spectrum for cellular communications to just two providers in each locality, one of which was the old Bell operating company.⁵³ It was a clear example of federal structural regulation and state behavioral regulation. But under the umbrella of an Omnibus

⁴⁸See Woroch (1990).

⁴⁹For example, Supreme Court jurisprudence allowed southern states to enforce racial segregation in intrastate trains but not in trains that crossed states borders (see Palmore, 1997).

⁵⁰There is a nice link between the distinction of interstate vs. intrastate and the "taxation by regulation" concept coined by Posner that was mentioned above. Kahn (2008) argues that when states can use local regulation to create a strategic advantage for local firms in an integrated market, then regulation should also be decided at the integrated level, in a similar way that nowadays there should be some global authority that fixes environmental, labor and safety standards, so that these are not used strategically by different nations to protect national interests in a globalized world.

⁵¹The acceleration of long distance competition was the result of the break-up of the Bell System. This acceleration introduced tensions in the system of cross-subsidies that allowed local residential rates to remain low. Cohen (1992) reports how the states reacted differently in setting local rates, depending on the relative weight of a number of interest groups and on several elements of the institutional and political structure of states (political majorities, degree of oversight of legislature over regulators, direct election of regulators).

⁵²Furchtgott-Roth (2006) criticizes a regime that allegedly affords too much power and discretion to the federal regulatory agency, relative to the Courts, the legislators and the states.

⁵³See Hahn et al. (2003).

Budget Reconciliation Act of 1993, Washington preempted state authority over rate and entry regulation in mobile telephony. The addition of more spectrum allocated through federally organized auctions along with technological improvements facilitated the assembly of six national service networks (some of which subsequently consolidated through mergers, but still leaving most US citizens with a choice of more than three cellular networks). Washington did leave states some authority to regulate mobile phone service under the general rubric of consumer protection. Some states have controversially used this authority, for example California in its Telecommunications Bill of Rights, which limits phone service providers' discretion in a wide range of activities, with the focus on disclosure of contract terms and redress in cases in which customers are not satisfied with service. Hahn et al. (2003) argue that the potential costs for the operators of these requirements imply that they "skate dangerously close to affecting wireless rates and terms -an area not covered by state regulation." They also make an interesting use of the arguments of externalities and capital mobility mentioned Sections 2 and 3 above against decentralized intervention: "The mobile communications industry, in ironic contrast to the people who use it, is not mobile. Providers of national service have a considerable stake in a strong presence in every state. Thus, while a state regulatory climate may affect the pace of local investment, one cannot depend on wireless communications providers facing onerous state rules to vote with their feet."

It is not clear the extent to which the states lost regulatory jurisdiction as a result of the 1996 Telecommunications Act. Crandall (2005) wrote, nine years after the law was introduced, that "local retail telephone rates, intrastate long-distance rates, carrier connection rates, and even high-speed business rates are still highly regulated in most states." Brennan (1996) identifies 22 issues on which the states have jurisdiction according to the Act, although one important piece of state regulation was preempted by the Act: the decision on local entry in telecommunications. Local powers (municipalities and counties) also kept jurisdiction on franchise conditions for Cable firms,⁵⁴ although they had already lost the responsibility of setting prices. Brennan (2001) argues that they should keep, through these franchise conditions, the ability to decide on open access for Internet Service Providers on the grounds that the involved markets are local and there are no relevant spillovers on the decision that one local jurisdiction takes. He adds the caveats that the decisions on open access or otherwise should be made separate from trying to use franchises to interfere with merger decisions, in order to avoid the hold up problem of a locality trying to capture the efficiency rents from a large, potentially national merger (in a similar way as it is explained below in the electricity section); and that the decisions on open access should not be used to ask the operators for in-kind compensations such as free institutional channels or other initiatives that have an impact on fiscal issues. The telecommunications companies started to provide video services competing

⁵⁴Nuechterlein and Weiser (2007, p. xxiii): "Since the dawn of cable television several decades ago, the states and thousands of local governments have played a critical role in deciding the terms on which cable companies can use public rights of way to provide multi-channel video services to end users."

with cable in the 2000s, and asked the FCC and Congress to pass national rules exempting them from local franchise conditions, on the argument that it would be too costly to negotiate with thousands of local authorities when there are scale economies in setting a programming platform and launching service at the national level. Some states such as Texas in 2005 gave these companies the relief that they were seeking at the national level.

Nuechterlein and Weiser (2007) have many references to federalism issues in their book on telecom regulation reform in the US. They explain how (chapter 2) experimentation by states, FCC and courts led to local competition provisions in the 1996 Act. In the 1996 Act (chapter 3), the FCC reserved for itself the right to validate the check list of conditions for the local incumbents to have their quarantines ended; the FCC created a federal universal service fund to cope with the unsustainability of cross-subsidies as a result of competition in selected segments (cherry-picking). Interestingly, they characterize two distinct periods in terms of the relationship between the FCC and the states:

- 1) Since the 1934 Communications Act until the Telecommunications Act of 1996, the system can be characterized as one mainly of dual jurisdiction: the FCC in charge of interstate issues, the states in charge of intrastate issues. This did not exclude some areas of cooperative federalism, as in the Joint Board that decided somehow arbitrarily that the proportion of joint costs that should be allocated to long distance interstate calls should be exactly 25%.

- 2) After 1996, the FCC and the states engaged more strongly in cooperative federalism in deciding the terms under which local telecommunications entrants should share the infrastructure of incumbents: the FCC would fix the rules under which these infrastructures would be used, and the states would implement these rules deciding the exact level of access charges. However, the dual jurisdiction model was kept in retail prices, by maintaining the jurisdiction of state commissions to fix local retail prices. Soon after the Act, the Supreme Court asserted the FCC jurisdiction in unbundling policies in the *Iowa Utilities Board* case, but after that a number of judicial decisions have much narrowed down the scope of unbundling requirements and the jurisdiction about them both by the FCC and the states.

According to NRRI (<http://nrri.org>), the research institute of public utility commissions, state utility commissions currently have a reduced role in telecommunications. In a call for research projects in their web page, they argue that "The portion of the industry subject to their jurisdiction has declined, as has their legal authority in many states. Whereas the regulator of 1980 needed skills to conduct cost-of-service cases, today those skills are much less relevant. More relevant skills today may be the ability to test for market power or to identify dated regulations that are doing more harm than good. The state commissioner's job is made more difficult because the FCC in many cases fails to give clear guidance. In some areas the FCC claims jurisdiction, but its follow through is not thorough. This leaves states uncertain of whether to involve themselves in problems that concern their local constituents but that may exceed state jurisdiction."

Legal scholars disagree on what should be the extent of US states involve-

ment in telecommunications regulation. Hoffinger (2003) notes that integrated market arguments (national business consumers would experience too high costs with different telecom regulation in every state) justify uniform regulatory criteria to avoid investment uncertainty; he notes that the 1996 Acts limits the states responsibilities to arbitrating between incumbents and entrants when negotiations between them do not end in agreement, in contrast to wide discretion to the FCC to fill the voids left by legislation; he concludes that the Act effectively removed telecoms regulation from the states, and it rightly did so according to him, since the states would be reluctant to engage into the rate rebalancing that is necessary to accommodate competition, and they would at the same time engage in a "race to the bottom" by trying to encourage as much entry as possible in the short run; he accepts a very specific role for the states beyond arbitration, in accountable (otherwise, it runs the risk of being biased to satisfy local political preferences) fact finding as an input to FCC decisions and participation in FCC policy design based on their experience or proximity. In contrast, Weiser (2001 and 2003) defends a role for the states in supplementing FCC floors or minimum standards, in a similar way as environmental regulation established since the 1970s, based on arguments of local tailoring and experimentation;⁵⁵ he argues that the role in arbitrating disputes gives the states "a key role in superintending" the federal regulatory program, and at the same time reorients the mission of regulators and courts from one of protecting end-users to one of arbitrating disputes among rival providers, and, in particular, overseeing access to and pricing of bottleneck facilities; he also argues that the states role should be constrained, beyond the floors established by the FCC and federal legislation, in the sense that they should implement federal and not other objectives; he mentions the *Erie* and *Chevron* doctrines, after two landmark judicial cases, according to which regulatory uniformity should be of less concern relative to experimentation and tailoring, and the Courts should defer to regulatory agencies following arguments or expertise in determining the rules in regulated industries, to defend a role for state regulatory agencies in cooperation with federal agencies. Weiser (2001) calls the 1996 Act as "perhaps the most ambitious cooperative federalism venture to date." Both legal scholars, however, seem to agree that the FCC failed to provide a clear vision of what should be the content of the relationship between state and federal regulation be.

Over the process of implementation of the 1996 Act, the entrants argued mostly for state discretion on unbundling decisions, which is consistent with the view that states favoured extensive unbundling of incumbents' network elements. However, at least in some occasions according to Weiser (2003), they also argued against state discretion on access pricing, probably reflecting the wide variation in local loop and other network elements prices that were set by the states.

⁵⁵The FCC accepted a role for experimentation in the unbundling or not of local sub-loops, before mandating a federal requirement to unbundle them, in an example that an initial flexibility may recede when the federal level learns and establishes that one approach is clearly superior. According to Teske (2004) the model of local competition promoted by the Act was itself based on the model of local competition experimented by the state of New York some years earlier.

Hoffinger (2003) explains that one of the entrants in local telephony, the AT&T, was initially against a strong role for the states in unbundling decisions, but changed its position after a new Chairman of the FCC (Michael Powell) signaled his position against too much unbundling.

Nuechterlein and Weiser (2007) argue that with the advent of cellular telephony or VOIP telephony, the regulatory role of the states will be very reduced, but will still exist at least to monitor the reliability of emergency services (number 911 in the US) and the efficacy of universal service programs. However, to the extent that physical networks will still cross local territories, local powers will probably also either claim a role, or be asked to provide a role, for example in providing information for geographically differentiate markets in broadband and to solve a collective action problem so that operators can share the use of rights of way and other physical infrastructure.⁵⁶

After the 1996 Telecommunications Act the federal level has been increasingly involved in Universal Service policies with the creation of a national Universal Service fund.⁵⁷ There is a potential role of states in better targetting universal service, which now benefits broad classes of citizens, with often little concern for poverty. The jurisdiction of this fund has been disputed by some states although there is a Joint Board between the FCC and the states on universal service.⁵⁸

The FCC has been accused of excessive discretion, increasing delay and decreasing certainty and humility (Nuechterlein and Weiser, 2007).

4.1.3 Allocation of Jurisdiction in EU telecommunications

For decades, the telecommunications markets in Europe were based on publicly owned vertically integrated national monopolies. The EC led the liberalization wave of the nineties, which was accompanied by (to different degrees) privatization of national incumbents. The EC has been very active in promoting competition and introduced a system of market analysis in which it monitors the efforts of the member states in ensuring compliance with liberalization directives. The EU institutions are currently discussing a third reform package in which the Commission proposes the creation of a pan-european telecommunications regulator and allows the member states to functionally separate the incumbent's infrastructure from its operation in retail markets.

Under the current system, the national regulatory authorities must analyze the competitive conditions of a number of markets and determine, under the supervision of the European Commission, whether there is significant market power in each of these markets. If the conclusion is yes, then the national regulatory authorities have discretion to impose remedies. The guidelines issued by

⁵⁶In a precedent of this, Weiser (2003) mentions the Utility Pole Attachment Act of 1978 as an example of cooperative federalism.

⁵⁷See Chiang et al. (2008).

⁵⁸There is a tradition of Joint Boards between the FCC and the states to analyze issues of common interest and reach agreements. As mentioned above, in the XXth Century one such agreement was on the contribution that long distance interstate calls' tariffs should make to funding common costs of the local network.

the European Authorities have heavily influenced a stance of national regulators in favour of access based competition and pricing of unbundled elements based on long run incremental costs (LRIC). Gual and Jodar (2007) provide a useful summary of the results achieved under the current system.

4.1.4 Empirical evidence on the impact of decentralization in telecommunications

Many subcentral jurisdictions (states, counties, municipalities) undertake initiatives to promote broadband. In some cases (eg city of Barcelona vs CMT, the Spanish regulator) this is challenged by national regulatory or antitrust authorities in Europe, but not in the US, where the state-action doctrine tends to prevail (see Inman and Rubinfeld, 1997). Treisman argues that when public investment (financed with taxes) in infrastructure is a complement to private mobile capital, decentralized jurisdiction may compete to attract capital by investing in infrastructure, and this may result in a higher level of infrastructure provided the initial conditions in the local jurisdictions are sufficiently homogeneous. Decentralization also makes it possible to use existing institutions (so that fixed administrative costs do not have to be duplicated) to differentiate regulation by geographic markets with different potential for platform based competition, and use existing institutions to help solve the collective action problem of the common use of physical infrastructures. However, others (Hoffinger, 2003; Hahn et al., 2003) argue that the convergent telecommunications industry is national in nature, and that local regulations introduce unnecessary costs to companies operating at a national or international level.

Table 1: Determinants of Broadband Performance (OLS)

Variable	linear	logarithmic
GDPcap	.0001322 (2.93)	.3492947 (2.84)
Centralization	-3.278021 (-1.72)	-.1318353 (-1.18)
Urbanicity	.0008007 (3.90)	.1439248 (2.17)
R²	0.4784	0.3415

Note: t-statistics in parentheses.

Table 1 reports the results of a cross section regression with 26 observations (those for which observations for all variables could be obtained) about the determinants of broadband performance, including the potential effect of the degree of fiscal centralization. Although fiscal centralization may not be necessarily correlated to regulatory centralization,⁵⁹ fiscally decentralized countries will have more incentives to undertake decentralized regulatory policies, or policies related to regulated industries that are decentralized, such as industrial policies.

⁵⁹For example, in Spain, in the last 10 years the degree of fiscal decentralization has increased very significantly, whereas the main regulatory responsibilities in airports, telecommunications or electricity remain centralized.

The measure of fiscal centralization used is the total central government expenditure divided by total general government expenditure (average 2000-2006).⁶⁰ This measure is obtained from the OECD data base, except for Australia, where the measure was not available and instead the most recent observation (1999) of the equivalent variable was obtained from the World Bank fiscal indicators database.

The measure of performance in broadband is a composite index of price, speed and penetration of broadband obtained from Atkinson et al. (2008). From these authors also comes a density measure, *urbanicity*, that multiplies the percentage of urban population and the average density of population of urban areas. Although Canada has a much lower population density than the US (3 vs 30 inhabitants per square km, it has a higher urbanicity index because the average density of urban areas is higher and the percentage of urban population is higher as well). The measure of gross domestic product per capita is the purchasing power parity measure in 2005 in dollars obtained from the United Nations Human Development indicators database.

As it can be seen from the results of the regression in Table 1 (the database can be seen in Appendix 1) there is no evidence that centralization has a positive impact on at least this segment of telecommunications performance. If anything, the impact is negative. In the linear specification, the relevant coefficient is negative and it is statistically significant at the 10% level. In the logarithmic specification, with a lower R^2 , the coefficient is negative but it is not statistically significant. The quantitative exercise does not say much about what should be the scope of state, regional and local policies. One possible example is differential geographic regulation in broadband markets (as proposed by the telecom reform document in Canada), but much more work needs to be done to extend this line of research.

Of course, the database on which table 1 is based is very small and the model is excessively simple. Several significant effects may be missing from the model. Also, the measure of decentralization is very generic and not necessarily related to regulatory policies. To obtain a more specific measure, in Table 2 we explore data from the European Commission to address a more specific decentralization issue, namely the degree to which the decentralization of control of the rights of way has a positive impact on broadband penetration. The details about sources and variable definitions can be seen in Appendix 2. The results show that, controlling for a number of factors that have been seen to be significant in previous work, the centralization of the rights of way in the European Union has a negative effect on broadband deployment.⁶¹ This suggests a role of local powers in assisting to solve the collective action problem of sharing common infrastructures and rights of way between competing platforms in broadband telecommunications.

⁶⁰For Japan, Korea, and New Zealand the average is 2000-2005.

⁶¹Distaso et al. (2006) found a non-significant effect of centralization of the rights of way with data only until 2004.

Table 2: Determinants of broadband penetration, EU countries, Fixed Effects Panel Data

Variable	Estimate	t-statistic
Intra	-.14036	-0.33
Inter	-1.3320	-3.66
Row1	-.36689	-2.43
Row2	-.2555	-1.28
Llul	.00004	0.35
Llp	-.01667	-6.59
Full unbundling	-.2297	-0.94
Bitstream	6.2244	11.99
Co-mingling	1.8540	6.56
GDPcap	2.8709	5.98
Density	-37.3307	2.65
R^2 (within)	0.8535	
R^2 (between)	0.0114	
R^2 (overall)	0.0323	

Note: the dependent variable is the percentage of household subscribers divided by the population

4.2 Electricity

4.2.1 Theoretical insights

We extend the framework in Section 3 here to analyze mergers in the electricity industry. A merger or acquisition (especially if it takes the form of a takeover) changes the objective function of policy makers because more light is projected into the industry, consumers and other stakeholders mobilize and this has a well documented impact on the potential (lower) wealth gains to be extracted from the transaction. The existing literature shows that mergers in regulated industries take longer to be completed and show a lower takeover success ratio than in other industries; there is also clear evidence that deregulation is usually accompanied by a takeover wave.

There is a small literature on the optimal allocation of merger authority in the vertical chain of government. This literature focuses on the role of jurisdictional externalities in terms of the effect of a merger on the surplus that is captured by foreign consumers and the impact on foreign competitors, in a framework where a merger authority maximizes some combination of the surplus of national consumers and producers. Work along these lines includes Haufler and Nielsen (2007), Head and Ries (1997) and Neven and Röller (2000). There is no formal work to my knowledge on the role of regulatory authorities or on how to judge a merger from the point of view of it making more or less difficult the role of regulators when there are jurisdictional externalities.

In the model below, the pre-merger industry structure is one in which there are two firms in each of two local jurisdictions (eg states in the US or member states in the EU). A cross-border merger is examined where two firms which have territorial (ie in specific regions of their countries) regulated natural monopoly assets and competitive assets in their respective countries merge with cost savings. An antitrust central agency decides in terms of the effect of the merger on competitive assets (using eg a Cournot model) and the two decentralized agencies decide in terms of the effects of the merger on regulated assets. The two agencies decide simultaneously how much of the merged firm's savings must be used in a "public interest" project.

The local agencies decide **before** the central agency (perhaps there is a hierarchical decision making process by which the central agency only comes to decide if the two local agencies do not veto the merger; there is no point in approving the merger if the conditions imposed by the local agencies cause the merging entities to cancel the merger -the decision of the state agencies is continuous and the decision of the central agency is discrete; the central agency then not only evaluates the firms' decision, but also the local agencies' decision). The central agency will approve the merger depending on the relationship between the cost savings and α . Assuming α high enough, anticipating the approval, the local agencies will simultaneously decide how much of the merged firm's savings must be spent in a "public interest" project in each local jurisdiction, balancing the second objective (with weight θ) with total surplus in the electricity market (which has a regulated component and a competitive component). Call $x_i \in [0, 1]$ the proportion of the firm's savings that the local agencies decide that must be allocated to a "public interest" project in jurisdiction i . Then the regulatory agency in this jurisdiction solves the following problem:

$$Max_{x_i} \{ \pi_i(x_i, x_j) + v_i(x_i, x_j) + \theta \Omega_i(x_i E) \}$$

with $\frac{\partial \pi_i(x_i, x_j)}{\partial x_k} < 0$ for $k = i, j$, $\frac{\partial v_i(x_i, x_j)}{\partial x_k} < 0$ for $k = i, j$ and $\frac{\partial \Omega_i(x_i E)}{\partial x_i} > 0$.

For example, assume in a Cournot model that inverse demand in country 1 is $P_1 = 1 - \frac{3}{4}Q_1$ with $Q_1 = q_1^1 + q_2^1$ before the merger and $Q_1 = q_1^1 + q_M^1$ after the merger, and in country 2 is $P_2 = 1 - Q_2$ with $Q_2 = q_1^2 + q_2^2$ before the merger and $Q_2 = q_M^2 + q_2^2$ after the merger. The total quantity produced by the merged firm is $Q^M = q_M^1 + q_M^2$. The original marginal costs in the competitive segment are $c_1 = \frac{1}{2}$ (for both firms in country 1) and $c_2 = \frac{2}{3}$ (for both firms in country 2). After the merger, the marginal cost is the one of the more efficient merging firm. It is assumed that the fixed costs are concentrated in the regulated segment and are fully reimbursed. As a result of the cross border merger the price in country 1 does not change (although we assume that shareholders of country 1 share $\frac{1}{2}$ of the total profit of the merged firm, which includes a now higher profit from the subsidiary in country 2).

The pre-merger equilibrium in country 2 results from

$$Max_{q_1^2} \{ (1 - q_1^2 - q_2^2)q_1^2 - \frac{2}{3}q_1^2 \}$$

The first order condition is $1 - 2q_1^2 - q_2^2 - \frac{2}{3} = 0$. The reaction function is

$[\frac{1}{3} - q^2]/2 = q^2 \rightarrow 2q^2 = \frac{1}{3} - q^2 \rightarrow q_1^2 = q_2^2 = \frac{1}{9}$. The price is: $P_2 = 1 - \frac{2}{9} = \frac{7}{9}$. And the profit for each firm is $\pi^2 = [\frac{7}{9} - \frac{2}{3}] \frac{1}{9} = \frac{2}{81}$. Total profits are $\frac{4}{81}$.

Consumer surplus is $CS = \frac{(\frac{1-\frac{7}{9}}{2})^2}{2} = \frac{2}{81}$.

The post-merger equilibrium in country 2 results from

$$\underset{q_M^2}{Max} \left\{ (1 - q_M^2 - q_2^2)q_M^2 - \frac{1}{2}q_M^2 \right\}$$

The first order condition is $1 - 2q_M^2 - q_2^2 - \frac{1}{2} = 0$. The reaction function is

$$[\frac{1}{2} - q_2^2]/2 = q_M^2.$$

$$\underset{q_2^2}{Max} \left\{ (1 - q_M^2 - q_2^2)q_2^2 - \frac{2}{3}q_2^2 \right\}$$

The first order condition is $1 - q_M^2 - 2q_2^2 - \frac{2}{3} = 0$. The reaction function is $[\frac{1}{3} - q_M^2]/2 = q_2^2$. Solving for the firms' quantities: $q_2^2 = \frac{1}{18} \rightarrow q_M^2 = (\frac{1}{2} - \frac{1}{18})/2 = \frac{2}{9}$. Therefore the new price is $P_2 = 1 - \frac{5}{18} = \frac{13}{18}$. And the profits of each firm (the subsidiary of the merged firm and the outsider to the merger) are

$$\pi_M^2 = (\frac{13}{18} - \frac{1}{2}) \frac{2}{9} = \frac{4}{81}$$

$$\pi_2^2 = (\frac{13}{18} - \frac{2}{3}) \frac{1}{18} = \frac{1}{324}$$

$$\text{Total profits are } \frac{4}{81} + \frac{1}{324} = \frac{17}{324} > \frac{4}{81}.$$

$$\text{Consumer surplus is } CS = \frac{(1 - \frac{13}{18})^2}{2} = \frac{25}{648} > \frac{2}{81}.$$

Consequently, this is a welfare improving merger. The increase in total surplus relative to the pre-merger situation is $\frac{59}{648} - \frac{6}{81} = \frac{11}{648}$.

The merged firm achieves an increase in profits (derived from the operations of its subsidiary in country 2) of $\frac{2}{81}$ relative to the pre-merger profits of the merging firms, while the outsider in country 2 sees a reduction in profits (hence the merger has a negative externality on the second firm of country 2, which is more than compensated with a positive externality on the consumers of the same country). An antitrust authority that has a total surplus standard should approve this merger.

Now, each regulator wants to use at least a fraction of the merged firm's gains to fund a "public interest" project. The two merging firms gained $\frac{2}{81}$ each before the merger and now the merged firm gains the same in country 1 and $\frac{4}{81}$ in country 2. So there is a profit gain of $\frac{2}{81}$ to potentially share between the shareholders of both countries.

Both agencies are interested in the cost savings being as large as possible both to benefit market participants and to have resources to fund the "public interest" local project. If both agencies decide non-cooperatively,⁶² however, they play a prisoner's dilemma and the size of the common pool may be reduced relative to the joint profit maximizing level. Each jurisdiction does not internalize the effect of the local decision on the other jurisdiction which takes place via the effect on incentives of the firm to undertake the merger. Assume each country can choose from a set of two public interest projects: a large costly one and a low cost one: if both countries choose the high cost project, they satisfy the "public interest" objective to a large extent, but they exhaust the profit gain and hence

⁶²They may decide non-cooperatively for example because they have "public interest" objectives that are contradictory. For example, a regional government in a European country may want to favour local industrial development with foreign capital and the national government of the EU member state may want to protect national ownership.

their shareholders win nothing (they only have weak incentives to undertake the merger, and they do not have incentives at all if there is sunk cost to the merger, for example in administrative costs, lawyer and consultant fees, etc.). If both choose the low cost project, they partially satisfy the public interest objective and the merger parties still have strong incentives to undertake the merger (which implies gains for consumers of country 2 and for shareholders of both countries). However, if the other regulator chooses the low cost project, one regulator has an incentive to choose the high cost one, as the merger will still be profitable (and hence the public interest project will enjoy more resources).

	High Cost	Low Cost
High Cost	2,3	6,2
Low Cost	1,7	4,5

There is a profit gain of $\frac{1}{81}$ per country to be spent in both projects; moreover, in country 2 consumers gain $\frac{25}{648} - \frac{2}{81} = \frac{1}{72}$ from the merger. The policy choice of each local regulator comes from the following strategy set: $x_i \in \{x_i^L, x_i^H\}$. By appropriate choices of parameter θ and functions Ω_i , and by appropriate choice of units, the specific payoffs in the example can be obtained as follows:

Country 1 (high cost):

$$E(TS_1(x_1^H, x_2) + \theta\Omega_1(x_1^H, x_2)) = \begin{cases} p(\frac{1}{81} + \theta\Omega_1(x_1^H, x_2)) = 2 & \text{if } x_2 = x_2^H \\ \frac{1}{81} + \theta\Omega_1(x_1^H, x_2) = 6 & \text{if } x_2 = x_2^L \end{cases}$$

Country 1 (low cost):

$$TS_1(x_1^L, x_2) + \theta\Omega_1(x_1^L, x_2) = \begin{cases} \frac{1}{81} + \theta\Omega_1(x_1^L, x_2) = 1 & \text{if } x_2 = x_2^H \\ \frac{1}{81} + \theta\Omega_1(x_1^L, x_2) = 4 & \text{if } x_2 = x_2^L \end{cases}$$

Country 2 (high cost):

$$E(TS_1(x_1, x_2^H) + \theta\Omega_2(x_1, x_2^H)) = \begin{cases} p(\frac{1}{81} + \frac{1}{72} + \theta\Omega_2(x_1, x_2^H)) = 3 & \text{if } x_1 = x_1^H \\ \frac{1}{81} + \frac{1}{72} + \theta\Omega_2(x_1, x_2^H) = 7 & \text{if } x_1 = x_1^L \end{cases}$$

Country 2 (low cost):

$$TS_1(x_1, x_2^L) + \theta\Omega_2(x_1, x_2^L) = \begin{cases} \frac{1}{81} + \frac{1}{72} + \theta\Omega_2(x_1, x_2^L) = 2 & \text{if } x_1 = x_1^H \\ \frac{1}{81} + \frac{1}{72} + \theta\Omega_2(x_1, x_2^L) = 5 & \text{if } x_1 = x_1^L \end{cases}$$

where TS_i is the incremental total surplus that can be achieved with the merger in the market. It is assumed that in case both local regulators choose the high cost project, the merger takes place with some probability p lower than 1. If the merger does not take place the payoff is zero. The merger is assumed to take place with probability 1 if at least one of the two countries chooses a low cost project.

The Nash equilibrium finds both local regulators choosing the high cost project and risking the merger not happening at all. A cooperative solution between both regulators would achieve the joint payoff maximizing combination of strategies where both regulators choose the low cost project. The same solution would be obtained with a single local regulator.

The higher payoff of the regulator of country 2 accounts for the fact that in country 2 both consumers and shareholders gain from the merger and in country

1 only shareholders; moreover, what consumers gain in country 2 is not affected by the size of the cost of the public project.

It has been assumed so far that the markets are segmented, so there are two prices and two demand functions. If the merger takes place, in at least one of the countries the cost will go down, and this will affect the price and margin, but there will still be two competitors in each country. If the *markets are integrated* before the merger there will be three firms instead of four and there are externalities on non merging firms. One benefit of market integration is that if one of the countries is a monopoly and the other a duopoly, a "defensive" *local merger* of the duopoly to become a local monopoly will be less harmful -there will be a more symmetric duopoly than the one that would result from a takeover of one of the two local firms by the foreign monopoly.

Additional aspects that deserve closer scrutiny are the role of multi-market contact and, in telecommunications, complementarity of demand (mergers internalizing network externalities).

4.2.2 Allocation of Jurisdiction in US electricity

As explained above in Section 2, the regulation of gas and electricity transitioned from the local to the state level at the beginning of the XXth century. As the scope of the industry grew, the federal government also began to regulate (See Teske, 2004). The prevailing structure for most of the XX Century was based on vertically integrated and state regulated investor owned utilities, with some cases of local municipal or cooperative ownership, but there was some direct federal involvement in production, exemplified most clearly with the Tennessee Valley Authority in the 1930s. Still today, municipal utilities are not regulated by state commissions but by the city councils.⁶³ Regulation was mainly at the state level, with some intervention of the Federal Power Commission (FPC), created in 1920⁶⁴ and having its powers defined by the Federal Power Act (FPA) in 1935; it was later in 1977 renamed Federal Energy Regulatory Commission (FERC). The FPC and the FERC had a role on interstate matters, mainly wholesale transactions and transmission that crossed states borders. The division of regulatory responsibilities was largely not problematic for many decades.⁶⁵ However, by 1950, 25% of Americans received power directly from federally controlled resources. In the 1920s and 1930s the mechanisms of state regulation were often frustrated by the ownership of electricity firms by large interstate holding companies, which operated outside of state authority. The 1935 Public Utilities Holdings Act eliminated holding companies, but some tensions remained.

Stalon and Lock (1990)⁶⁶ argue that the pressures imposed on the energy

⁶³The Los Angeles Department of Water and Power, for example, is governed by the Los Angeles City Council and not by the California Public Utilities Commission (CPUC). See Moore (2002).

⁶⁴See Bernstein (1955).

⁶⁵See Brennan (2003).

⁶⁶One of the authors of this paper, Charles G. Stalon, is particularly well equipped to write on these issues. An Economist, he served as Commissioner of a state regulatory agency, the

industries by the economic crisis of the 1970s and early 1980s encouraged regulators to seek alternatives to the traditional operation of gas and electricity, resulting among other developments into the gradual introduction of competitive pressures at the wholesale level. However, tensions between states and the FERC were previous to the introduction of competition, as FERC tried to encourage coordination and efficiencies through power pools (agreements to share power sources between neighboring utilities) and again holding companies made possible by technological progress in transmission and dispatch control. However, before the major macroeconomic tensions of the 1970s and 1980s, stable input prices and productivity growth, complemented by vertical integrated jurisdictional monopolies, accommodated these tensions and made compatible the inefficient setting of regulated rates with the financial viability of utilities.

After major blackouts in the mid 1960s, the FPC accepted industry proposals to create nine industry-run regional reliability councils and in 1968 a National Electricity Reliability Council (NERC). It was an example of industry self-regulation in lieu of a potential role for federal regulation. The reliability councils aimed at establishing the technological rules of the road for the interconnected utility systems. In theory, it was about technical and not economic regulation, but technical decisions had economic implications, for example the establishment of standards for reserve margins influenced the determination of the base rate for state regulation.

As a result of the increasing tension between the need to achieve interstate efficiencies and the regulatory role of the states, the FERC and the judiciary introduced a new distinction between the role of the federal level and the role of the states in the 1980s, called the *Pike County Doctrine*. According to this doctrine, the FERC would have responsibility for the cost allocation of interstate wholesale services, but the states (which were under pressure because of failed planning decisions) would undertake the prudence review of wholesale purchases by utilities. This doctrine constrained the ability of the states to influence supply planning, but created a new "bright line" that failed to provide a cooperative environment that tackled what were mainly two interrelated decisions.

The "bright line" or dual regulation model, according to Stalon and Lock (1990), "has not produced a climate in which regulation is capable of adapting to fundamental changes in the industry. This concern may be symptomatic of a problem inherent in any effort to statutorily divide jurisdiction with a bright line. As conditions change, the bright line needs to be drawn in different places. Vested economic and political interests, however, consolidate around an existing bright line."

Section 210 of PURPA⁶⁷ (one of the parts of the National Energy Act of 1978), which promotes transactions with non-integrated qualifying facilities (by which the states found a framework to encourage competitive bidding of supply procurement) is deemed by Stalon and Lock (1990) a more successful attempt than any "bright lines" model at achieving a regulatory partnership. The statute

Illinois Commerce Commission, between 1984 and 1989; he also served as Commissioner of the Federal Energy Regulatory Commission, between 1984 and 1989.

⁶⁷Public Utility Regulatory Policies Act.

requires FERC to define Qualifying Facility (QF) status and to establish the standards under which QFs may buy from and sell to utilities. It also requires the state Public Utility Commissions (PUCs) to implement FERC rules, giving PUCs the frontline day-to-day function of regulating both QF sales to and purchases from utilities, and a variety of related issues, such as interconnection requirements and compensation. "Hence, the partnership grants FERC authority over a discrete part of retail ratemaking and delegates a significant portion of federal wholesale authority to state PUCs." It encouraged a dialogue between agencies outside a quasi-judicial context to resolve daily state/federal tensions (between equity and other objectives and efficiency) and made the states more aware of efficiency needs, although some tensions remained. States showed in this framework, according to these authors, an ability to learn from mistakes, adapt and learn from each other.

The redrawing of the frontiers between regulation and markets also implied the redrawing of the frontier between the regulatory jurisdiction of the federal level and the states, because the weight of interstate issues increased with transactions between different firms and competitive exchanges, and also because pressures on retail prices (of which competition was a consequence) due to macroeconomic forces, and the need to pay for mistakes in generation planning, made it more difficult for the states to keep paying for social objectives through regulation. However, the states mostly resisted efficiency enhancing restructuring proposals (for example, vertical separation) for fear of losing jurisdiction.⁶⁸

In 1992 Congress passed the Energy Policy Act, which opened access to transmission networks and made it easier for nonutility power generators to enter the wholesale market. In 1996 the FERC further issued orders 888 to open transmission access to nonutilities and order 889 to build electronic systems for sharing information about transmission capacity. In parallel, some states such as California were experimenting with wholesale markets and restructuring.⁶⁹ Figure 1 shows a map of the services areas of California electricity as an example of the jurisdictional complexity in which restructuring usually takes place. Appendix 3 includes a list of retail sellers of electricity in California in 1999.

This process accelerated in the turn of the century with the proposal of the FERC to create Regional Transmission Organizations (RTO) with the mission of controlling the transmission assets owned by the vertically owned utilities and operating transmission systems and region wide wholesale markets.⁷⁰

Wholesale market rules must be filed with FERC. There is a regulatory structure in place after restructuring not only to regulate natural monopoly segments, but also to monitor wholesale markets, because the fundamental characteristics

⁶⁸Stalon and Lock (1990) claim that an excessively defensive position by the states may cause inefficient bypass of the electricity network by large firms: "the best long-term prospect for reducing end-use customer incentives to bypass is to create an efficient inter-utility trading system that will reduce the large differentials in average costs between supply systems."

⁶⁹For a review of the evolution of electricity in California, including an analysis of the 2000 crisis and its aftermath, see Sweeney (2006).

⁷⁰See Klevorick (2005).

Figure 1: California electric utilities



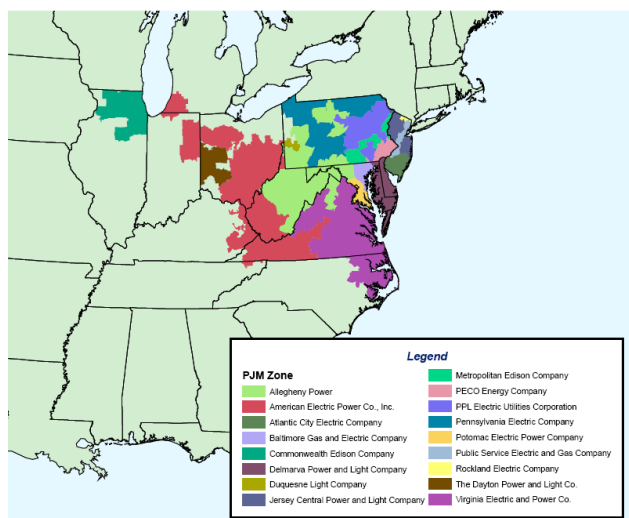


Figure 2: PJM territory

of electricity (very low demand elasticity, unresponsiveness of demand,⁷¹ physical laws of electricity) create a high potential for market power in some instances. Most states have resisted this process, with the momentum for reform being negatively affected by the collapse of the California deregulated market in 2000 and the increase of electricity prices in 2008 (Wall Street Journal, July 17 2008). The PJM system operator (which started in Pennsylvania, New Jersey and Maryland and has expanded to other neighboring states⁷²) is seen as the most successful example of the type of organization promoted by FERC, although there are other similar RTO in New England, New York and Texas (Joskow, 2005). The territory of PJM is shown in Figure 2. PJM or any Regional Transmission Organization can be interpreted as the outcome of a Coasian process, in which interjurisdictional externalities are addressed through negotiation and coordinated decision making (Oates, 1999, warns about the "complexities and perverse incentives that can bedevil such joint enterprises" at creating useful compacts or associations of jurisdictions to deal with particular issues).

Beyond the promotion of a standard market design in wholesale, the FERC has accumulated less regulatory powers than the FCC in the liberalization process. Between 1996 and 2000 half of the states had deregulated their wholesale markets, and today state PUCs are more likely to lose effective control over electricity prices to markets than to FERC regulation.

There is high variation in the extent to which states have embraced retail

⁷¹ As Klevorick (1996) nicely argues, "the restructuring of the electricity industry entails an effort to introduce markets in which one blade of Marshall's scissors hardly cuts at all."

⁷² Mansur and White (2008) report price and efficiency gains as PJM expanded.

competition. Kwoka (2006) relatedly argues that studies about the benefits of RTO rarely admit the high costs associated to creating and maintaining such organizations. The partial deregulation process was accompanied by a merger wave (Kwoka and Pollitt, 2007) that seems to have come to a halt recently (Wolak, 2007). A total of 14.3% of US residential customers were served by public power utilities in 2006, and there were 2014 such public power utilities (see <http://www.appanet.org>). Klevorick (2005) argues that one important function the responsibilities of which need to be allocated in some vertical fashion is the market power mitigation of the new wholesale electricity markets. He suggests that the optimal structure for this would be the FERC delegating a supervisory role to RTOs but retaining final major investigations or sharing these with the Antitrust Division of the Department of Justice. The RTO should have a non profit nature and its boards should not have as objective maximizing the sum of stakeholders payoffs but the efficiency of markets (he adds that he is optimistic that existing institutional arrangements are consistent with this).

4.2.3 Allocation of Jurisdiction in EU electricity

For most of the XX Century and with some exceptions (some private ownership in Spain, municipal ownership in Norway, regional firms in Germany) the industry was dominated by national vertically integrated monopolies. Under the leadership of the EC the industry started to liberalize in the 1990s with two European directives that mainly promoted retail competition and specialized national regulators, although this resulted into little actual competition in most member states due to lack of vertical and horizontal restructuring. A third package is currently under discussion.⁷³ Over time, the EU institutions have focused more on transmission arrangements, especially cross-border interconnection. The interconnections have in turn forced some member states to adapt internal transmission arrangements.

In spite of the electricity directives efforts, today Europe is a collection of separate integrated markets. The most developed of this is the NordPool of the Scaninavian countries, which includes a common electricity market organization owned by the different national system operators. Figure 3 shows the map of the NordPool territory. The European Commission has been promoting retail liberalization whereas the US federal level has been promoting wholesale liberalization.

Joskow (2006) calls this evolution strange but politically astute. The EU institutions are currently discussing a third package with the proposal by the Commission of introducing a pan-european regulator and vertically unbundling transmission assets from other assets, which is strongly contested by some member states, most notably France and Germany. Also in Joskow (2006): "Mecha-

⁷³The agreement of the European Council on an internal energy market can be found at http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/trans/101008.pdf.

The relevant materials of the third package are at http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/trans/101008.pdf

For a critical assesment, see The Economist, June 14 2008.

Figure 3: NordPool Map



nisms being developed through cooperative activities of European transmission and power exchange operators and regulators for integrating energy markets with the allocation of scarce inter-country transmission capacity are moving forward in Central Europe. And recent EU rules governing investment in interconnector capacity that expands transmission capacity between countries are very constructive."

Business organizations sometimes but not always try to adapt to political organization. In Spain and UK there is a history of regional distribution companies; and advising regional branches of national companies such as Endesa have developed.

4.2.4 Case evidence on the impact of overlapping jurisdiction in electricity and gas mergers

The involvement of different levels of government in the same industry can essentially be solved in three different ways: non-cooperation, cooperation or overlapping (or concurrent) jurisdiction. The cases of non cooperation and cooperation were presented in the telecommunications theoretical insights, and the main ideas could be applied to electricity where relevant. In addition, there is one particular aspect of electricity on both sides of the Atlantic that strikes as a clear example of overlapping jurisdiction, and this is merger policy, where different agencies have *de facto* veto power.⁷⁴ In the US, this is *de facto* and

⁷⁴There is also overlapping jurisdiction in telecommunications merger policy, but there has been less merger activity in telecommunications in Europe than in electricity, and therefore

de jure, since legally both the state public utility commissions and FERC have authority to stop a merger. In Europe, this is *de facto*: although the competition conditions of the mergers are allocated according to a very clear rule based on the turnover of the merging companies in several European companies, national regulators and governments can and do intervene if they can argue that the merger jeopardized the financial capacity of regulated segments or other national objectives. Some theoretical insights in electricity merger policy were presented above. Four merger cases (two European, two North American) involving different institutional characteristics in the vertical or horizontal dimension of government illustrate the likely consequences of overlapping merger authority.

-PacifiCorp and Utah Power & Light Company (Stalon and Lock, 1990, p. 470). In 1988, seven state regulatory commissions and FERC were involved in the approval of the merger between these two companies. The state commissions granted approval before FERC acted on the proposal. A FERC's Administrative Law Judge concluded initially that the proposed merger posed too great a threat to competition to receive federal approval. The commission nevertheless approved the merger subject to the stringent condition that the merged company would permit access to its transmission grid at cost-based prices. The Utah Public Utility Commission expressed concerns that the FERC-imposed conditions would damage the interests of Utah's ratepayers, but according to Stalon and Lock (1990), "the company was able to persuade all the PUCs that the benefits of the merger would outweigh any detriments caused by the conditions." These authors argue that "this case vividly illustrates the potential for conflict between FERC's regulatory objective of enhancing the efficiency of the wholesale bulk power markets and the more parochial objectives of state PUCs in protecting the interests of retail ratepayers." In this particular case, without the conditions, there was the risk that one of the merging companies used its monopoly power over bottleneck transmission paths to gain for itself and its ratepayers a portion of the rents associated with interstate power transactions. In future transactions, other states also could exercise monopoly over transmission paths which would damage their neighboring states and reduce the overall efficiency of the wholesale power markets that benefits all states in the long term.

-PSEG and Exelon merger. This case is presented in Wolak (2007). Three sets of agencies assessed the competitive impacts of the proposed merger: the federal wholesale electricity regulator (FERC), the New Jersey and Pennsylvania state public utility commissions, and the United States Department of Justice (DOJ). Note that although the merger took place in the territory of the PJM Transmission Organization, the institutions of this organization did not intervene in the merger review. Both the federal and state regulatory commissions are legally required to apply a "public interest" standard, which is different from the standard applied in the Horizontal Merger Guidelines, based on whether the merger will create or enhance market power. The public interest

it is more difficult to put together examples from both Europe and America.

standard of FERC is based on the impact of the merger on competition, rates and regulation. The public interest of the states is broader and includes the impact on employment and the achievement of tangible or substantial benefits for consumers. Although the explicit focus in the analysis of this merger was on the competition conditions in the wholesale markets, Wolak (2007) argues that the public interest standard affords high discretion to the regulatory agencies. On July 1, 2005, FERC approved the merger with a divestiture package. The next to act was the Pennsylvania Public Utility Commission, which approved the merger in late January 2006 after the subsidiary in the state agreed not to increase retail prices until 2010. It also agreed to spend \$1.2 million on additional consumer outreach to acquaint low-income consumers with discount programs and to maintain its corporate headquarters in Philadelphia through at least 2010. In June 2006, the DOJ approved the merger subject to additional divestitures. Negotiations between the parties and the New Jersey public utility regulatory body NJBPU proceeded for almost three months after the agreement with the DOJ was announced. The state commission was trying to achieve rate reductions and further benefits for their jurisdiction's consumers. In mid-September 2006 the parties withdrew their application for approval of the merger at the NJBPU, which had been pending for more than 19 months. Wolak (2007) argues that "the amount of the public benefits settlement desired by the NJBPU may have been sufficiently large relative to the other concessions to cause the net benefits from the transaction to be non positive.

-Hidroantábrico takeover battle.⁷⁵ In 2000, EnBW, a German subsidiary of the state owned French EDF, announced a takeover of Hidroantábrico, the fourth largest electricity firm in Spain, which has most of its assets in the northern region of Asturias. The Spanish government reacted passing a law forbidding any foreign state-owned firm from controlling an electricity company. This law would be subsequently rejected by the European institutions. The Asturias regional government was more open to bargaining, and since the beginning showed a predisposition to lobby for the takeover in exchange for industrial and employment concessions. The takeover battle triggered by the initial EDF offer ended four years later, in 2004, when the state-owned Electricidade de Portugal, in partnership with a regional savings bank, Cajastur, made a final winning offer that was accepted by the shareholders of Hidroantábrico, committing the firm to keep its headquarters in Asturias and develop a number of industrial development and employment programs.

-Endesa takeover battle. In September 2005 the Spanish Gas Natural made an offer for Endesa that triggered a bitter economic and political debate because a company based in Barcelona was trying to take over a company based in the capital Madrid. The management team of Endesa defended its position using political and economic strategies. In 2006, an offer by E.ON improved upon the one by Gas Natural, although it was also initially rejected by the management team, and triggered a reaction by the Spanish government trying to stop a surprise acquisition of control by foreign interests. This reaction

⁷⁵This and the next case are presented in Trillas (2008).

included a discretionary change in the rules of the electricity regulatory agency that allowed this agency to stop a merger appealing to reasons of security of supply or national interest. In 2007, the battle finished with an Italian company, ENEL, which had the Italian state as the main shareholder, gaining control of the company in partnership with a Spanish construction firm, apparently with the agreement of the Spanish government.

In these cases, in most of the cases (the two American cases and the Endesa case) the federal merger authority was more strictly concerned about economic efficiency and the lower level authorities (states, European member states or regions), more concerned about other objectives, such as employment, national ownership or industrial policy. It is clear that in all these cases the public authorities not only act as regulators but also as agents involved in the ownership of firms and in industrial policy. An interesting feature of the takeovers of Hidrocarburo and Endesa is that the regulatory game conditioned the nature and identity of the firms that eventually resulted from the takeover battles. In Hidrocarburo, eventually the winning bidder was Electricidade de Portugal in coalition with a regional savings bank (Cajastur) partially controlled by the Asturias regional government. In the Endesa takeovers some years later, Enel of Italy, with the Italian state as the largest bidder, won the contest against E.ON after forming a coalition with the Spanish construction company Acciona.

Following the taxonomy of Sah and Stiglitz (1986), when several agencies have parallel decision making powers and have veto power, the architecture is called a veto poliarchy. In this case, it can be shown, as the examples suggest, that there is a risk that a disproportionate amount of Type I errors will occur: some good mergers will not be authorized. There is then a trade off between the different expertise of several regulators (and possibly other attributes such as better political participation, in the sense of Inman and Rubinfeld, 1997) and delay or probability of mistakes. Mergers in regulated sectors have been shown to take place in takeovers that take longer to be completed and that are more costly than takeovers in other industries.⁷⁶ Wolak (2007) argues that "few mergers involving generation unit owners in wholesale electricity markets will be able to survive this multi-stage, federal and state antitrust and regulatory approval process and still provide value to the shareholders of the merged companies. The public benefit standard applied by most public utility commissions provides state governments with a substantial ability to extract financial concessions from the merging parties that may cause the merging parties to terminate potentially beneficial mergers." This raises the risk not only of efficient mergers not happening, but also of inefficient firms winning in some takeover battles: if winning takeover battles is costly and protracted, it will not be the firms that are best at producing electricity that win, but rather the best at playing the political game, or the ones able and willing to foot the bill of these protracted processes, such as firms with bad governance or public ownership.

⁷⁶See Trillas (2001).

5 Concluding comments

In the long history of vertically integrated monopolies in telecommunications and energy, there was a historical trend to move regulation up in the vertical structure of government, at least from the local level to the state or nation-state level. This move alleviated the pressure on regulators to renege on the commitment not to expropriate sunk investments, although it did not eliminate the practice of taxation by regulation that was the result of multiple interest group action. Although central or federal policy making is more focused and specialized⁷⁷ and makes it difficult for more interest groups to organize, it is not clear that under all conditions central powers will not be associated with underinvestment. When technology makes the introduction of competition in some segments possible, the possibilities for organizing the institutional architecture of regulation expand. Different segments in the value chain of network industries may require regulatory intervention with different geographic scopes. It is very likely in this case that industry outcomes will depend on the interaction between several regulators. This article has explored the consequences of non cooperation, cooperation and overlapping responsibilities.

One of the benefits of decentralization is the possibility that under uncertainty mistakes in a single jurisdiction do not contaminate a whole reform package and the other jurisdictions can learn from these mistakes. A clear example is the fiasco in the deregulation of electricity in California in 2000. If the fiasco had taken place in the whole US, the future of electricity liberalization in the US and probably in other countries would have been much bleaker for a long time.

Taking into account that liberalization of network industries has been defined as a long and winding road and that there is little international consensus on many dimensions (eg broadband diffusion strategies), there is merit in leaving different jurisdictions follow their own way. Given that for this or other reasons (for instance legitimacy, political participation or subsidiarity, or because they face strong pressure to do so) local jurisdictions will try to intervene in regulatory policies, the relevant policy question is not so much which government level should regulate industries, but which should be the optimal form of participation of each level of government in regulatory policies, taking into account industry structure, technology, history and the constraints faced by each level of government. The problem of lack of coordination is not unique of decentralized agencies; "independent" national or federal agencies may suffer from the same problem. Bernstein (1955) mentions as one of the weaknesses of independent agencies the lack of coordination with the general government. Aubert and Lafont (2002, p. 45) argue that "even if reallocation of powers is within sight, the first priority may be to improve the regulations themselves -to favor horizontal or vertical cooperation of existing authorities- so that the ground is prepared for politically acceptable institutional reforms."

The difficulties of drawing bright lines to separate jurisdictional boundaries

⁷⁷Centralization of investigations and R&D are regarded in general as pure public goods.

are illustrated by the following quote in the California Public Utilities Commission web page (visited on August 22, 2008):

Congress has preserved state commission jurisdiction over electric retail service and distribution facilities while granting FERC jurisdiction over transmission service and wholesale electric markets. Because the transmission and wholesale market issues have significant impacts upon the electric retail service and rates regulated by the CPUC, it is critical that the CPUC be closely involved in federal electric transmission rate and policy matters, as well as in design and operation of the wholesale markets.

For the same reason, it is important for the CPUC to participate in the North American Western regions transmission planning and coordination processes. Consequently, the CPUC engages with regulatory agencies, organizations and processes beyond California's borders and jurisdiction.

Non central governments intervene in regulated industries not only as regulators, but often as owners or as decision-makers in industrial policy. Participating in targeting universal service schemes and reducing costs of using rights of way are promising tasks for local/regional governments even in a world of increasing liberalization. They can be delegated tasks for which higher level administrations do not want to be overwhelmed, and exercise these tasks with limited and accountable discretion in a disciplined framework.

The analysis here fits uncomfortably with a tendency to build lists of industries to be allocated to each level of government. For example, Aubert and Laffont (2002), Brennan (2003) and Smith (2000) provide examples of such lists. Typically, telecommunications networks are associated to the central level, together with electricity transmission and wholesale electricity markets, with distribution and retail electricity associated to the local or state level. As Woroch (1990) argues "the relative magnitude of spillovers can be reduced by expanding the size of jurisdictions. This reasoning argues for FCC control of all activities that transcend state boundaries, such as equipment standards, spectrum allocation, and satellite transmissions." At most, these lists should be general guidelines as to the relative weight of each level of government in each industry segment. However, central levels may provide an input to policies even where there are few spillovers if there is a need for expertise, for information gathering to be used in yardstick competition, or for common standards. Conversely, even when externalities are significant, local levels may practice "laboratory federalism" or provide an input in the form of tailoring to local conditions and solving collective action problems.

The relevant comparison in practice is often between independent centralized regulation (or two-tier, with the regulator in an informing capacity) or non-independent one-tier decentralized regulation (Bardhan and Mookerjee, 2006, can be interpreted along these lines), because decentralized powers do not need a regulator to improve information since they have enough information or because they don't have access to experts so that they face labour market constraints to set up an independent regulator, or because they have enough commitment powers and do not need to strategically delegate. However, the relative importance of independence varies depending on the location of the hierarchical

relationship; for example, one can argue that regulation is more independent at the national than at the European level, but in some European countries more independent at the national than at the regional level.

The federal level can ease the conflict of policies at the state level. For example, coordinating security of supply in energy policy at the continental level. A broader analysis along these lines should also take into account the role for global institutions: ITU, IEA, Internet governance organizations. The federal level has also a role in market creation or market integration, as a prior action before deciding whether to regulate the market or not. Creating a market and deregulating it are different things. In telecoms, efficiency would call for the creation of large geographic competitive markets; in electricity, large geographic markets which need a regulated transmission segment, and some form of intervention (such as regional transmission organizations in the US) that guarantees the coordination between wholesale markets and system operators. In the US electricity, the attempts to create a role for federal regulation (for efficiency reasons) preceded deregulation, although they largely failed. Then from a normative point of view, the question arises of what is the optimal industry structure and geographic scope for markets, in the Coasian sense of what are the boundaries that minimize the transaction costs of operating with markets. It would indeed promote European integration to be able to have pan-European mobile phone networks (so that there would be only one common "national prefix," as the "1" shared by the US and Canada; and no roaming would be required when crossing a border), or to be able to buy in any country the same satellite TV platform with the possibility of subscribing to any channel in Europe.⁷⁸ Or to have a single pan-European telephone number system, not only for mobile, but also for fixed telephony. However, the Internet is probably reducing the relative gains that could be obtained with such initiatives, as one can for example watch any video from You Tube today and will be able to watch any movie or program probably soon just connecting to the Internet.

The introduction of competition at the federal level requires the development of new instruments or other policy reforms (for example, on universal service or security of supply) to satisfy the "other" policy objectives that local regulators

⁷⁸Since the beginning of Satellite TV, it has been possible in Europe to buy a satellite TV contract in one country, take the decoder to any other country, install a satellite dish and watch the preferred national platform in this other country. Many nationals leaving in other European countries just do that: when the author was a graduate and postgraduate student in Italy and the UK he watched the same Spanish platform with the same decoder (and now also has a British platform in Spain, which has to be paid in a bank account in the UK, not being valid a bank account in a Spanish branch of a British bank); retired families that reside one half of the year in Germany and another half in Spain do the same with their German decoders; English and Irish pubs in the center of Barcelona offer the possibility of watching sports events from their countries through British satellite platforms. The possibility of watching foreign country platforms is not openly publicized (except for example in some magazines for the English speaking community in Barcelona), which suggests that their legal status is at least unclear. But the fact that these experiences exist, and that any distributor knows about them and some indeed specialize in them, does suggest that it would be as easy to have pan-European platforms with the possibility of watching (for a variety of fees) virtually any channel, and that the only thing that stops it is the protection of jurisdictional turf.

used to satisfy with regulation or vertically integrated public ownership, when these policy objectives are legitimate, or the clarification that some of these other policy objectives are not legitimate (eg national champions). Otherwise, the federal introduction of competition will hardly be feasible. In some cases, the "second objective" will be legitimate in some aspects but not in others, eg industrial policy or fight against inflation or environmental objectives, which makes the issue a complex one. For example, Joskow (2006, p. 29) argues that "if policymakers are serious about competitive markets for power they will have to rethink the long tradition of relying on taxation by regulation of the electric power industry to implement policies in ways that hide the associated costs from taxpayers."

6 Appendix 1

Data Set for Table 1:

Country	GDPcap	Urbanicity	Centralization	BBPerformance
Australia	31794	1120.216	0.556	10.53
Austria	33700	1857.749	0.579895739	9.37
Belgium	32119	1763.877	0.572796776	10.17
Canada	33375	1082.22	0.396627149	10.61
Czech Republic	20538	3167.285	0.730748194	7.03
Denmark	33973	2004.834	0.626465482	11.44
Finland	32153	1371.425	0.515214578	12.2
France	30386	1049.33	0.442635422	11.59
Germany	29461	2496.877	0.295654683	10.17
Greece	23381	3128.786	0.748200692	8.26
Hungary	17887	1541.127	0.649370233	8.22
Iceland	36510	2142.871	0.734093076	11.2
Ireland	38505	1601.817	0.807174538	9.01
Italy	28529	1676.603	0.565048938	9.54
Japan	31267	2892.295	0.458684848	15.05
Korea	22029	8905.785	0.689748769	15.92
Netherlands	32684	2408.095	0.582338077	11.77
New Zealand	24996	1638.184	0.89453147	9.68
Norway	41420	1821.501	0.788802829	11.05
Poland	13847	2381.409	0.573285703	7.83
Portugal	20410	1771.782	0.674991406	10.15
Spain	27169	3864.379	0.431537481	9.68
Sweden	32525	2647.032	0.555096123	11.53
Switzerland	35633	2480.904	0.341003551	10.78
United Kingdom	33238	3732.875	0.917159989	10.3
United States	41890	839.2261	0.575944033	10.25

7 Appendix 2

Definitions and sources for variables used in Table 2.

-Penbb: Total number of broadband (DSL, Cable modem, Fibre to the home, Satellite and others) subscribers per capita. Source: Point Topic Ltd. Global Broadband Statistics (2000-2006).

-Intra: Herfindhal index measuring the concentration of DSL firms (intra-platform). Source: Point Topic Ltd. Global Broadband Statistics (2000-2006).

-Inter: Herfindhal index measuring the competition across platforms (inter-platform). Source: Point Topic Ltd. Global Broadband Statistics (2000-2006).

-Row1: Dichotomous variable taking the value 1 when rights of way and digging permits over public land are granted by a single central authority and 0 when rights of way are granted by local authorities. Source: European Union Reports on the Implementation of the Telecommunications Regulatory Package (2000-2006).

-Row2: Dichotomous variable taking value 1 when operators experience delays in getting rights of way or digging permits and 0 when no delays are reported. Source: European Union Reports on the Implementation of the Telecommunications Regulatory Package (2000-2006).

-Llu: A variable that measures the price of an unbundled copper local loop. As in Distaso (2006), it is obtained by adding one third of the one-off charge to the monthly fee. Source: European Union Reports on the Implementation of the Telecommunications Regulatory Package (2000-2006)

-Llp: A variable that measures the prices of a leased line. It is obtained by adding the one-off fee to the annual charge of 2km of 2 Mbps leased line. Source: European Union Reports on the Implementation of the Telecommunications Regulatory Package (2000-2006)

-Full unbundling: Dichotomous variable taking value 1 when full LLU is mandated (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-Bitstream: Dichotomous variable taking value 1 when bitstream access is mandated (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-Subloop: Dichotomous variable taking value 1 when subloop unbundling is mandated (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-Co-mingling: Dichotomous variable taking value 1 when co-mingling collocation is implemented (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-Remote: Dichotomous variable taking value 1 when remote collocation is implemented (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-Virtual: Dichotomous variable taking value 1 when virtual collocation is implemented (0 otherwise). Source: OECD (2003). Developments in Local Loop Unbundling.

-GDP per capita: Gross domestic product at current market prices divided by population. Source: World Bank Development Indicators (2000-2006)

8 Appendix 3: Retail Sellers of Electricity in California in 1999

Electric Utility	Number of Customers	Revenue (\$ Thousands)	Sales (MWh)	Avg.Revenue (\$/MWh)
Investor-owned utilities				
Pacific Gas & Electric Co.	4,535,909	\$6,785,994	70,186,749	\$97
PacifiCorp	41,473	\$53,324	778,531	\$69
San Diego Gas & Electric Co.	1,184,844	\$1,415,141	14,718,306	\$96
Sierra Pacific Power Co.	43,877	\$38,826	506,280	\$77
Southern California Edison Co.	4,213,562	\$6,692,164	67,206,530	\$100
Southern California Water Co.	20,988	\$13,275	127,135	\$104
Total	10,040,653	\$14,998,724	153,523,531	\$98
Municipal Utilities				
Alameda City of	32,569	\$38,979	371,326	\$105
Anaheim City of	105,755	\$220,932	2,416,302	\$91
Azusa City of	14,549	\$21,072	233,213	\$90
Banning City of	9,523	\$13,501	118,821	\$114
Biggs City of	656	\$787	7,340	\$107
Burbank City of	51,488	\$106,360	1,029,003	\$103
Colton City of	16,893	\$26,176	266,108	\$98
Glendale City of	83,100	\$112,701	1,071,277	\$105
Gridley City of	2,191	\$2,315	26,824	\$86
Healdsburg City of	4,903	\$7,397	69,904	\$106
Imperial Irrigation District	93,486	\$193,531	2,384,949	\$81
Lassen Municipal Utility Dist	10,162	\$12,227	136,909	\$89
Lodi City of	23,776	\$38,329	391,276	\$98
Lompoc City of	14,455	\$12,336	125,717	\$98
Los Angeles City of	1,385,396	\$2,080,736	20,056,691	\$104
Merced Irrigation District	148	\$5,362	113,305	\$47
Modesto Irrigation District	92,229	\$136,566	2,164,620	\$63
Needles City of	2,907	\$4,907	60,967	\$81
Palo Alto City of	27,723	\$66,503	1,124,025	\$59
Pasadena City of	58,378	\$129,657	1,129,383	\$115
Redding City of	38,295	\$68,937	683,493	\$101
Riverside City of	92,644	\$160,773	1,647,509	\$98
Roseville City of	36,243	\$60,003	819,570	\$73
Sacramento Municipal Utility Dist	503,615	\$722,046	9,284,751	\$78
San Francisco City & County of	9	\$40,588	728,342	\$56
Santa Clara City of	47,524	\$194,782	2,491,714	\$78
Shasta Lake City of	3,916	\$5,004	65,305	\$77
Trinity Public Utilities Dist	6,464	\$5,606	77,498	\$72
Truckee Donner Pub Utility Dist	10,324	\$8,615	122,029	\$71
Tuolumne County Pub Power Agny	30	\$1,194	23,162	\$52
Turlock Irrigation District	66,456	\$105,366	1,415,162	\$75
Ukiah City of	7,298	\$13,606	106,303	\$128
Vernon City of	2,026	\$55,056	1,161,173	\$47
Total	2,845,131	\$4,671,950	51,923,971	\$90
Electric Co-ops				
Anza Electric Coop Inc.	3,468	\$5,138	34,693	\$148
Plumas-Sierra Rural Elec Coop.	6,067	\$9,607	118,818	\$81
Surprise Valley Electric Corp	3,923	\$4,594	88,802	\$52
Valley Electric Assn Inc.	29	\$337	7,081	\$48
Total	13,487	\$19,676	249,394	\$79
Federal Agencies				
Bonneville Power Admin	10	\$6,365	264,515	\$24
Western Area Power Admin	98	\$94,914	6,019,473	\$16
Total	108	\$101,279	6,283,988	\$16
State Total	12,899,380	\$19,791,632	211,981,140	\$93

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