Regulatory Quality in EU Network Industries:
Evidence on Telecommunications, Gas, Electricity and Rail Transport

Abstract

Over the last decade, market opening in EU network industries has been accompanied by the emergence of an EU-level regulatory framework. The theoretical literature on regulation predicts regulatory capture, which is due to information asymmetries, agency problems and high levels of transaction costs. Regulatory capture, in turn, is conducive to sub-optimal levels of prices, investment, environmental protection, and affordability/accessibility. Given this background, this article aims to examine the quality of regulation in EU network industries, with a view to assess the optimality of the European regulatory framework that combines both national- and EU-level regulation. The data is obtained from EU Commission sources, reports of European regulators, and the Market Opening Milestones database of Copenhagen Economics. The paper examines both *ex ante* and *ex post* indicators of regulatory quality in EU network industries. The *ex ante* assessment is based on indicators of regulatory competence and institutional strength derived from existing legislation. The *ex post* assessment is based on indicators such as market structure, prices, and customer switching, etc. that are affected by the quality of the regulatory framework. The paper also elaborates on the interaction between national- and EU-level regulation, and the implications of the two-tier system for the overall regulatory quality in network industries.

KEY WORDS: Regulation, regulatory quality, public policy, network industries.

Mehmet Ugur
Jean Monnet Chair in European Public Policy
University of Greenwich, Business School, London
E-Mail. M.Ugur@gre.ac.uk

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1. Introduction

Over the last decade or so, network industries in the European Union (EU) have been subject to liberalisation reforms and regulation.[1] The wave of liberalisation and regulation began in the telecommunications sector, with the Commission Directive 90/388/EEC of 28 June 1990. This directive provided for competition in the telecommunications market with the exception of voice telephony. Two further directives followed, extending liberalisation to mobile telephones (Commission Directive 96/2/EC of 16.1.1996) and all voice telephony services (Commission Directive 96/19/EC of 13.3.1996). As a result, the telecommunications industry was largely liberalised by 1998. The regulatory framework followed with some time lag. In March 2002, the European Parliament (EP) and Council Directive 2002/21/EC provided for a common regulatory framework that would be implemented by national regulatory authorities (NRAs). Soon after that, in July 2002, Commission Decision 2002/627/EC provided for the establishment of a European Regulators Group for Electronic Communications (ERG) to encourage coordination and diffusion of best practice between independent NRAs.

Tentative attempts at liberalising the rail transport market began in 1991, with the adoption of Council Directive 91/440/EEC. Although this directive required some changes in the management of railway infrastructure and rail transport services, its main aim was to inject some degree of transparency into state subsidies by un-bundling the accounts and management of incumbent operators. The major step towards liberalisation and regulation was taken with the adoption of the First Railway Package on 26 February 2001. The package consisted of 3 directives (Directives 2001/12, 2001/13, and 2001/14), which provided for: (i) management independence of railway undertakings; (ii) separation between infrastructure management and transport operations; (iii) rules concerning allocation of infrastructure capacity between users; and (iv) levying of charges for the use of infrastructure. This was then followed by the second railway package on 29 April 2004, which provided for full cross-border market opening for freight and passenger services by the end of 2007 and 2010, respectively. As part of the second railway package, the EP and Council Regulation No 881/2004 provided for the establishment of a European Railway Agency. The agency falls

[1] For extensive reviews of liberalisation and regulation in EU network industries, see Geradin (2006) and Napolitano (2005). On market opening and regulation of railways industry in particular, see Vinois (2002) and Scherp (2005).

short of an EU-level regulatory body as its powers are limited to interoperability and common approach to safety.

The liberalisation of electricity began with Council Directive 96/92/EC of 19.12.1996, which provided for common rules for the generation, transmission and distribution of electricity in the EU. The directive also provided for unbundling of accounts and required the transmission system operators (TSOs) and distribution system operators (DSOs) to dispatch and distribute electricity without discriminating between users. Detailed market opening provisions, however, had to wait until the EP and Council Directive 2003/54/EC of 26.6.2003, which repealed Directive 96/92/EC. The latest directive aims to: (i) ensure a level playing field in the generation market; (ii) reduce the risks of market dominance and predatory behaviour; and (iii) ensure organizational and decision-making unbundling. A similar directive (EP and Council Directive 2003/55/EC) was adopted on the same date (26 June 2003) for the gas market. The electricity and gas directives would be implemented by 1 July 2004 - with the exception of some provisions on un-bundling, which can be postponed until 1 July 2007. A European regulators Group for Electricity and Gas (ERGEG) was established in November 2003, pursuant to Commission Decision 2003/796/EC.

As can be seen from the brief summary above, the timing and extent of liberalisation and regulation differ between sectors and across member states. Some member states have been granted exemptions for specific periods. Some others have been slow in transposing and/or implementing the relevant directives. In addition, the strength and competence of the emerging EU-level regulatory bodies differ from one sector to the other. In telecommunications and energy markets, liberalisation has been accompanied by the emergence of EU-level regulatory bodies. These EU-level regulatory groups consist of the heads or representatives of NRAs and Commission representatives. They have been given explicit powers to encourage coordination and adoption of best practice among NRAs across the range of market opening and regulatory legislation. In the rail transport, however, the European Railway Agency’s power has been limited only to issues of interoperability and safety, excluding other dimensions of liberalisation and regulation.

In spite of these variations, it is possible to speak of the emergence of a ‘European order’ of network industry regulation (Napolitano, 2005; Geradin, 2006). The main characteristics of the emerging European order can be summarised as follows: (i) progressive market opening

that allows for free entry of potential providers and enables consumers to switch between retail suppliers; (ii) unbundling of production, transmission and retail supply activities with a view to increase price/cost transparency and facilitate monitoring of compliance with competition rules; and (iii) establishment of independent national regulatory authorities (NRAs) complemented by EU-level regulatory bodies that have mainly a coordinating role.

The aim of this paper is to assess the quality of the regulatory framework that accompanies the liberalisation of telecommunications, gas, electricity and rail transport markets. This is a timely exercise for two reasons. On the one hand, the quality of the regulatory framework is a significant determinant of the efficiency and welfare implications of liberalisation. On the other hand, the quality of network industry regulation depends on the extent to which the regulatory regime can ameliorate the transaction costs that arise from the strategic interaction between a multiplicity of actors – namely, the consumers, the government, the regulator and the regulated actors. To achieve this aim, the paper is organised in four sections.

In section 2, we provide a review of the existing literature on the political economy of regulation with a view to highlight the difficulties involved in ensuring high-quality regulation in terms of efficiency and equity. In section 3, we examine the *ex ante* indicators of regulatory quality in EU network industries. These indicators are derived from existing legislation and provide some information about the extent to which the European regulatory framework is designed in such a way as to minimise the risks of regulatory failure or capture. In section 4, we look at some *ex post* indicators such as market structure, prices, extent of consumer switching, changes in customer perceptions of accessibility/affordability, etc. The *ex post* indicators will provide some information about the extent to which the European regulatory framework has been effective in addressing the inefficiency implications of the monopolistic/oligopolistic market structures that characterise network industries. Finally, the conclusion will bring together the main findings and elaborate on the scope for improving the quality of the European regulatory framework through interaction between EU- and national-level regulatory authorities.

2. The political economy of network industry regulation

Network industry regulation is an institutional design issue that has to deal with information asymmetries and agency problems that affect the strategic interaction between four sets of actors: (i) the consumers of network industries; (ii) the suppliers of network industry products/services; (iii) the regulator as the agent of the government; and (iv) the government as the principal who appoint the regulator. Information asymmetries and transaction costs combine to prevent the design of complete contracts between these actors. In the absence of complete (i.e., fully contingent) contracts, the interaction between any pair of these actors may lead to sub-optimal outcomes that emerge either as inadequate or as excessive regulation.

The debate on regulation has tended to focus on pair-wise or triangular relationship between the actors involved in the process of regulation. For example, the 'commission inadequacy' approach that dates back to 1930s focuses on the weakness of the regulator and the implications of this weakness for the relationship between the regulator and the regulated. The pioneering work of Frankfurter (1930) and Trachsel (1950) demonstrate that personnel weaknesses or resource inadequacy limit the ability of the regulator to acquire the necessary information that would minimise the ability of the regulated firm to extract rents.

This analysis is supported by economics and political science approaches based on group theory (Berry, 1982). One of the earliest works on the politics of regulation (Bersntein, 1955) demonstrates that the regulator will tend to protect the interest of the regulated industry. This is because the diffused majority (customers of the regulated industries) will gradually lose interest in regulation as the organised minority (the incumbents of the regulated industries) become more united given the large stakes involved. This line of argument has drawn further support from Olson's (1965) analysis of collective action problems faced by large groups and from the work of Wilson (1974) who demonstrates that the regulatory outcomes will benefit the regulated group as the latter will be more likely to organise and influence the regulatory decisions. The explanatory variable for this outcome is group size: as group size decreases (increase) each member of the group will avoid high (low) levels of costs or reap high (low) levels of benefit when they organise to influence the regulatory decisions in their own favour. Given that the group size of the regulated companies is always smaller than the group size of the consumers, the former will be always more likely to organise and influence regulatory decisions.

Early group theories in economics also focus on pair-wise relationship between the regulator and the regulated. The difference here, however, stems from the fact that the regulator is modelled as an agent who maximises its own objective function – and not as a passive arbitrator between consumer and producer interests. The regulator here is equated with the government or the legislative, whose interest in re-election interact with regulated group interests to determine the regulatory outcomes (Berry, 1982). For example Stigler (1971) demonstrates that regulation will be excessive and will fail to uphold the interest of the consumers. This is because the regulator (i.e., the government or the legislative organ) will trade off the loss of consumer support with the regulated group's 'campaign donations' that can be used to increase the chance of re-election. As a result of this trade-off, consumer interests are not upheld and the regulated industry's demand for regulation tends to increase. The demand for regulation increases because regulation-demanding industries know that they can capture the regulator through campaign donations or side-payments or a combination of both.

Peltzman (1976) refines Stigler's model and arrives at a similar conclusion: regulation will typically entail less than prefect producer protection but also less than perfect protection for consumers. Incentive for 'regulator entry' is highest when the industry is monopolistic or perfectly competitive. In the case of monopolistic markets, the politician (the principal appointing the regulator) can trade off moderate political losses with producers for a large political gain among consumers. Regulation may increase social welfare in this case, but this is not the main reason why regulatory bodies are established. In the case of perfectly competitive market, regulation will also be excessive because the loss of consumer support due to regulation of a perfectly competitive industry can be traded off against donations from the regulated industry itself. Drawing on US data, Jarrell (1978) provides evidence that state regulation was in greatest demand, and was thus established earliest, in states with the more competitive markets for electricity.

The problem with this type of modelling is that it says very little about how the benefits of the politician or regulator materialise. In addition, neither producers nor consumers are active, strategic players. They are only characterised by certain group characteristics that render them either latent (in the case of consumers) or active lobbyists (in the case of producers). The outcome of the interaction between these groups is almost immediate: lobbies influence the

regulatory policy in their own favour and the regulator (equated with the political actor) maximises a welfare function that favours producers. (Dal Bo, 2006; Estache and Martimort, 1999)

Tirole (1986) and Laffon and Tirole (1993) try to address this shortcoming by analysing regulatory capture in a three-tier setting involving the government, the regulator, and the regulated. The interaction between these actors is analysed in two stages. In stage one, the firm has private information about its cost, which is not yet known to the regulator or government. The latter agrees on offering the firm a second-best contract, with some rents for the firms. During the regulation process, the regulator increases its information about the firm's cost structure. This learning process instigates the second stage of the game, where the firm negotiates with the regulator before the latter decides how much information it should pass on to the government. The firm has incentives to bribe the regulator, who may decide to take or decline the bribe. If the regulator takes the bribe, the firm continues to extract rents that it shares with the regulator. If the regulator declines, then no rents remain. The problem for the government (i.e., the principal) is then to design a regulatory regime that would offer the regulator a contract that will induce him not to lie about the firm's cost structure and to offer the firm a contract that will provide the latter with rents that are just enough to prevent it from colluding with the regulator (Dal Bo, 2006: 207).

The regulatory quality implied by this analysis is better than that predicted by earlier work. However, the regulatory regime is still not optimal as it is essentially a second-best compromise resulting from the government's inability to draw a complete contract with the regulator or the regulated company or both. Therefore, the impact of regulation on prices and social welfare is indeterminate at best and may be negative. In fact, existing empirical work tend to report pessimistic findings.

For example, Moore (1975) examines the impact of regulation on state-level electricity prices in the US and reports that regulation was unsuccessful in lowering prices below monopoly levels. Using commission man-hours of regulation per individual in each state in 1947, 1953, 1960 and 1966, he also reports that the situation was not improving over time – i.e., regulator's learning process is not necessarily leading to better regulatory outcomes. Similarly, Upadhyaya and Raymond (1994) use cross-sectional US data for 1922, 1927 and 1932 and report that regulation remains ineffective in lowering that price of electricity. There are

similar findings from time-series US data too. For example, Upadhyaya and Mixon (1995) use national US time-series data for 1918-53 and regress the electricity prices on 4 variables: population growth, hydro-power generation, technology and regulation. They report that all vairables except regulation are significant determinants of prices in that period. The parameter for egulation has the correct sign (i.e., it is negative), but it is statistically insignificant. Finally, Mitra et al (2005) also report that the Energy Policy Act of 1992 and the Federal Energy Regulatory Commission Orders of 1996 did not lead to production or cost efficiency in the US electricity market between 1983-1999.

Despite these pessimistic findings, it is difficult to make a case against regulation of network industries mainly because market opening in these industries does not put an end to monopolistic or oligopolistic market structures that are essentially due to natural monopoly characteristics of these industries. In the absence of regulation, the level of prices and monopoly rents may be even higher. Therefore, regulation is necessary to reduce distortions that arise from market power but it is not necessarily sufficient to achieve optimal outcomes. The task, then, is to determine the factors that may improve the efficiency of the regulator. This is nothing but identifying contractual mechanisms that will address information asymmetries and principal-agent problems inherent in the design of network industry regulation.

Estache and Martimort (1999) provide an extensive review of the existing literature on the design of regulatory institutions and relate the findings of this literature to concerns raised by practitioners of regulatory policy. Their review can be used as a basis for identifying some contractual design characteristics that would minimise the informational asymmetries and principal-agent problems that increase the transaction costs of network industry regulation. Table 1 below summarises the causes and implications of transaction costs and the mechanisms through which regulatory framework design may minimise these transaction costs.

Table 1: Minimising transaction costs through regulatory framework design

Sources of transaction costs	**Adverse effects on regulatory outcomes**	**How to minimise the adverse effects**
Conflict between commitment and *ex post* efficiency: incompleteness of the regulatory contract makes periodic renegotiations necessary and/or efficient.	Prospect of renegotiations generates perverse incentives for the regulated firm in period 1. The firm under-invests in specific assets and chooses inefficient technology to manipulate the regulator's beliefs about its performance in period 2.	• Create independent regulatory bodies to improve commitment; • Create multiple regulatory bodies with complementary competences; • Combine commitment rules with rules for fine-tuning.
Multiple agency problems in government: competition between departments and bureaucracies for distribution of regulatory rights and rents.	Sub-optimal regulation due to multiplicity of regulators: excessive regulation when regulated activities are complement; inadequate regulation when activities are substitutes.	• Optimise the number of regulatory bodies with complementary competences; • Improve information through benchmarking; • Enable regulators to share information; • Make regulators accountable to a single elected authority.
Discretion of the political principal: politicians tend to maximise welfare or median voter (constituency) rather than social welfare.	Politicians design sub-optimal regulatory contracts that maximise favours from the regulated industry.	• Establish regulatory bodies with board structure – to resolve representation problems; • Increase accountability of the political principal.
Discretion of the regulator: regulators strike side contracts with regulated firms with a view extract rents.	With too much discretion and autonomy, regulators try to maximise regulatory rents; with too little discretion and autonomy, regulators tend to prefer the status quo.	• Increase accountability of the regulator; • Increase information on the regulator's performance; • Introduce collusion-proof constraints – e.g. performance incentives coupled with banning future employment of regulator in regulated industries.

Source: Estache and Mitra (1999).

The summary in Table 1 enables us to identify a number of necessary conditions for minimising the transaction costs associated with regulation in general and network industry regulation in particular. These conditions are: (i) independence and autonomy of the regulator *vis-à-vis* the regulated industry and the political principal; (ii) an optimum degree of competition between regulators with complementary competences; (iii) accountability of the regulator; (iv) availability of information about regulatory outcomes that can be used for monitoring purposes and that of industry-specific information to be shared between regulators; and (v) anti-collusion measures that would prevent collusion between the regulator and the

regulated industry. These are necessary to reduce the risk of regulatory capture but they by no means ensure the achievement of optimal regulatory outcomes with respect to prices, environmental protection standards or investment.

One reason is that these conditions may work at cross-purposes. For example, the co-existence of multiple regulators with complementary competences is a necessary condition to minimise the risk of regulatory capture. However, minimising the risk of regulatory capture through this measure does not ensure that the level of regulatory toughness is optimal (Estache and Martimort, 1999: 6). This is because a regulator with a specific area of competence (e.g., price regulation) decides on the level of regulation in that area without having to compete with another regulator in the same area. On the contrary, it competes with another regulator in a complementary area of competence (e.g., a regulator regulating the level of investment or environmental protection). This type of regulatory externality reduces the risk of 'a drive to the bottom' with respect to regulatory toughness – i.e., it reduces the risk of regulatory capture. However, it may also increase the risk of over-regulation, which leaves less incentive for companies to operate efficiently after regulation. This anti-efficiency bias may result because tough regulatory standards will reduce the 'efficiency rents' that the company can hold on to - the efficiency gains will have to be passed on to consumers via lower prices, higher environmental protection standards or higher levels of investment in network infrastructure.

The second reason is that there can be no ready-made answers to questions concerning the optimal number of regulators with complementary competences in a particular industry. Nor are there clear-cut indicators about the optimum levels of information required. The optimal number of competing regulators or the optimal level of information will differ across countries, legal traditions, and other intervening institutional variables. Put it differently, the optimal level of regulatory competition or information can be established only after a period of 'trial and error' in the process of optimisation.

For these reasons the necessary conditions above should be considered as relevant for an *ex ante* assessment regulatory quality – and not as sufficient conditions that would deliver optimal regulatory quality *ex post*. Once viewed from this perspective, the necessary conditions listed above can be seen as useful yardsticks for assessing the risk of regulatory capture that, together with other factors, determines the optimality of regulatory outcomes.

3. *Ex ante* indicators of regulatory quality in EU network industries

Given the caveat above, we examine the *ex ante* and *ex post* indicators of regulatory quality in EU network industries separately. This is necessary not only to avoid hasty generalisations about the optimality of the regulatory outcomes but also to increase the tractability of the findings.

3.1. Co-existence of EU and national regulatory bodies

One aspect of the emerging regulatory regime in EU network industries is the co-existence of both national and EU-level legislation as well as regulatory bodies. From a political economy perspective, this co-existence may satisfy one of the necessary conditions – namely, the existence of multiple regulators. The European regulatory regime is likely to satisfy this necessary condition if it can be demonstrated that the regulatory activity at the EU and national levels occurs in complementary rather than substitute areas of competence. If the areas of competence are complementary – for example, if national regulators regulate prices while EU-level regulators regulate market access or environmental impact – the risk of regulatory capture decreases. This is because each regulator will set and/or implement standards in its own area of competence without having to worry about the ability of the regulated companies to opt for the jurisdiction of the other regulator who offers a less strict regulation in the same area.

The emerging European regulatory regime in network industries addresses this condition in two ways. First, national-level and EU-level regulatory legislation is complementary rather than substitutes. Complementarity is ensured by the requirement to transpose and implement EU rules where the latter differ from national rules and by the applicability of national rules when EU-level rules do not exist. Therefore, in principle, a company in a particular member state cannot play the EU-level of regulatory standards against the national-level standards with a view to secure a lower level of regulatory toughness. Secondly, national regulatory authorities (NRAs) and the newly established EU regulatory bodies such as ERG or ERGEG are not competing regulators. In fact, ERG and ERGEG consist of the heads or representatives of the NRAs. In addition, EU-level regulatory bodies have mainly a coordinating role aimed

at increasing the level of convergence between national regulatory regimes and encouraging the adoption of best practice. Of course, during the process of convergence, some countries with high regulatory standards may well have to accept some dilution in their standards or the rate of improvement in their regulatory standards may slow down. However, this will be due to bargaining between national governments rather than regulatory capture.

Majone (2000, 2002) has written extensively on the issue of regulation in the wider context of European integration. His main argument, supported by qualitative evidence, is that an extended network of national, sub-national, and EU-level regulatory bodies are operating in various areas of regulatory activity in the EU. In this triangular set up, European regulatory agencies act as central nodes that encourage 'efficient cooperation, coordination and adoption of best practice'. The emerging regulatory regime in EU network industries possesses some of these characteristics and therefore it alleviates the risk of regulatory capture at national levels.

However, there are a number of factors that militate against a significant reduction in the risk of regulatory capture in EU network industries. First of all, even the necessary conditions for effectiveness, as identified by Majone in a wider context, are not satisfied. Majone (2002) identifies three conditions for effectiveness: (i) high levels of mutual trust and cooperation between agencies; (ii) high levels of professionalism; and (iii) a common regulatory philosophy. Even if one assumes that condition (ii) is satisfied, there are a number of factors that militate against the satisfaction of conditions (i) and (iii).

One reason is that the stance of NRA representatives in the meetings of EU-level regulatory groups may be determined not only by concerns about convergence, but also by concerns about maintaining the idiosyncrasies of the national regimes. Secondly, there is a high degree of divergence between national regulatory standards and the scope of EU-level regulatory legislation is not comprehensive enough to ensure significant convergence. In other words, the EU-level regulatory legislation provides only for a regulatory framework, leaving detailed legislation to be adopted at the national level. (See, Coen and Doyle, 2000). Finally, the European regulatory regime does not allow for jurisdiction shopping. However, it has little or no remedies against the pressure that regulated companies can exert on national governments with high regulatory standards so that the latter lower the national standards towards EU average.

In addition, European liberalisation and regulatory reforms tend to result from sub-optimal compromises determined by bargaining between member states, between the latter and the commission, and between the member states and regulated industries. (See, Heritier, 2001). Therefore, factors related to the process of EU policy making (e.g., bargaining, multiplicity of political actors, compromises, etc.) and the essentially national character of the regulatory legislation are likely to limit the gains from reduced risk of regulatory capture that is due to the co-existence of EU- and national-level regulatory frameworks.

Coen and Doyle (2000: 24-25) argue that the solution to this problem is to establish a European regulatory agency, that is independent of both national governments and European institutions. This agency could incorporate existing national regulatory bodies and allow for some national variance. However, the agency's regulatory decisions should be binding and it should not be dependent on NRAs to enforce common directives. Clearly, the emerging European regulatory regime for network industries is still far from satisfying this condition. As Napolitano (2005: 567) has observed, the emerging regualtory regime defines 'scopes and techniques for safeguarding universal service and shapes the nature, powers and procedures of the national regulatory authorities.' Nevertheless, this regime is still incomplete as member atates are still preserving autonomy.

3.2 Regulatory strength, independence and competence

Another *ex ante* indicator of regulatory quality is the independence and autonomy of the regulator. As indicated above, regulator's independence and autonomy is necessary to resolve the government's commitment problem and to reduce the risk of regulatory capture by the regulated industry. Table 2 below provides some indicators of regulatory independence and autonomy – depicted as *regulatory competence* and *institutional strength/resources*. While regulatory competence refers to the range of market outcomes that a national regulator is empowered to regulate, institutional strength/resources refer to the extent to which that regulator is equipped to regulate the specified market outcomes. The data in the table is derived from a thorough examination of the national regulatory legislation and the resources available to national regulators.

The institutional strength/resources indicator is constructed by aggregating a number of sub-indicators that capture the national regulator's independence of the government, budgetary allowance, number of personnel weighted by population, and whether the regulator share power with other governmental bodies. Each sub-indicator is assigned a value that ranges between 0 and 1, depending on the level of independence, relative budget/personnel size, and the extent of power sharing. The overall institutional strength/resources indicator is a simple average of the sub-indicators. Similarly, the regulatory competence indicator also consists of a number of sub-indicators measuring the regulator's competence with respect to regulation of prices for different types of consumers and network users, conditions of access to the network, and quality of service. The overall competence indicator is a simple average of the sub-indicators. A value close to 0 indicates highly limited competence whereas a value close to 1 indicates high level of competence.

Table 2: Indicators of regulatory competence and institutional strength/resources

	Electricity Regulator		**Gas Regulator**		**Telecom Regulator**	
	Institutional strength / resources	**Scope of regulatory competence**	**Institutional strength / resources**	**Scope of regulatory competence**	**Institutional strength / resources**	**Scope of regulatory competence**
Austria	0.64	0.26	0.73	0.39	0.54	0.56
Belgium	0.66	0.61	0.86	0.48	0.61	0.72
Denmark	0.43	0.38	0.48	0.33	0.72	0.70
Finland	0.49	0.40	0.67	0.00	0.55	0.35
France	0.28	0.51	0.46	0.27	0.39	0.43
Germany	0.04	0.43	0.00	0.22	0.65	0.80
Greece	0.37	0.38	0.42	0.00	0.57	0.58
Ireland	0.76	0.62	0.94	0.47	0.57	0.60
Italy	0.42	0.48	0.40	0.61	0.53	0.63
Luxemburg	0.48	0.36	0.51	0.29	0.67	0.53
The N/lands	0.43	0.46	0.40	0.51	0.40	0.53
Portugal	0.69	0.36	0.54	0.00	0.55	0.45
Spain	0.25	0.60	0.29	0.45	0.59	0.70
Sweden	0.61	0.50	0.67	0.14	0.46	0.40
UK	0.74	0.57	0.69	0.58	0.49	0.56
EU-15 Average	**0.49**	**0.46**	**0.54**	**0.32**	**0.55**	**0.57**
Coefficient of variation (%)	**41.72**	**23.24**	**43.61**	**65.99**	**16.64**	**22.43**

Source: Copenhagen Economics, Market Opening Milestones Database

The evidence in Table 2 paints a mixed picture about regulatory competence and institutional strength/resources in the three markets for which data is available: electricity, gas and telecommunications. One observation that can be made is that existing NRAs, on average, do not enjoy a high degree of institutional strength/resources. The highest level of institutional strength/resources is enjoyed by the regulators of the telecommunications industry at 0.55, followed by 0.54 for the gas regulators and 0.49 for the electricity regulators. These findings suggest that existing NRAs, on average, enjoy only about half of the level of strength/resources that a fully-fledged regulator is expected to enjoy. These relatively low levels of strength/resources are likely to imply a significant risk of regulatory capture – as predicted by 'commission inadequacy' or 'informational asymmetry' theories of regulation.

The second observation is that there is a significant degree of variation in the regulators' strength/resources across member states. The coefficient of variation is highest for the regulators of the gas industry (at 43.61%) followed by the regulators of the electricity industry (at 41.72%) and telecommunications industry (at 16.64%). Therefore, with the exception of the telecommunications industry, the divergence between the strengths/resources of the NRAs is significant. This divergence is underpinned by the fact that about half of the national regulators are equipped with strength/resources that are less than EU-15 average. The implication here is that further coordination within EU-level regulatory bodies is needed to encourage the adoption of best practice with respect to regulatory strength/resources.

The third observation relates to the scope of regulatory competence. Weaknesses concerning institutional strength/resources are also observable in the regulatory competence indicator too. On average, NRAs tend to have competence in only about one-third to 50% of the full range of competence areas. The level of regulatory competence is highest in the telecommunications industry (at 0.57) and lowest in the gas industry (at 0.32.). In addition, the extent of divergence between regulatory competences of the NRAs is highest in the gas industry (at 65.99%) and lowest in the electricity and telecommunications industries (at 23.24% and 22.43%, respectively). The implication here is that member states with low regulatory competence are likely to have a dampening effect on the development of regulatory competence in the rest of the EU due to the artificial competitive edge that low regulatory competence provides.

What is also significant is the extent of correlation between the scope of regulatory competence and institutional strength/resources of the regulators. A high level of correlation between the two indicators would suggest that NRAs are equipped with the level of resources that is in line with the range of regulatory competences they have. A low level of correlation, on the other hand, would indicate that the level of resources is either too high or too low compared to the range of regulatory competences. Table 3 below provides the Pearson rank correlation between the two indicators in 2003.

Table 3: Correlation between regulatory competence and institutional strength/resources: 2003

Variables	Pearson's Rank Correlation Coefficient	Significance
Regulatory competence vs institutional strength/resources: electricity	0.118	n.s
Regulatory competence vs institutional strength/resources: gas	0.139	n.s.
Regulatory competence vs institutional strength/resources: telecommunications	0.587	**

n.s. = not statistically significant; ** = significant at 5%

The results indicate that the correlation coefficient is very low and it is not statistically significant in the electricity and gas industries. In the telecommunications industry, the correlation coefficient is 0.587 and it is statistically significant. Therefore, it is possible to argue that there is a degree of correlation between regulatory competence and institutional strength/resources in the telecommunications industry – even though the correlation is not strong. However, such an argument cannot be made about the regulators of electricity and gas industries. In these industries, there are two types of national anomalies whereby the regulatory competence is not matched with institutional strength/resources of vice versa. Such anomalies can be traced in Table 2.

The first type of anomaly concerns high levels of institutional strength/resources combined with low levels of regulatory competence. This is evident in the case of electricity regulators in Austria and the UK, which have significant levels of institutional strength/resources (0.64 and 0.74, respectively) but relatively limited scope of regulatory competence (0.26 and 0.57, respectively). In the gas industry, Austria, Belgium, France, Greece, Ireland, Portugal and Sweden display similar anomalies. In the case of telecommunications, Finland falls into the

same category. These discrepancies suggest that NRAs in these countries/industries are equipped with relatively high levels of institutional strength/resources, but these resources are not deployed across a wide range of regulatory competences. The implication here is that regulators in these countries/industries may be effective in regulating a limited number of market outcomes, but this effectiveness is obtained at a cost of weak or no regulation with respect to other outcomes. A less optimistic interpretation is that regulators in these countries are essentially bureaucratic institutions that have managed to increase their budgets beyond what their regulatory competence would justify.

The second type of anomaly is the mirror image of the first: low institutional strength/resources coupled with high levels of regulatory competence. The French and Spanish regulators in the electricity industry, the Spanish regulator in the gas industry, and the French and the Dutch regulators in the telecommunications industry fall into this category. The implication for regulatory quality here is that these regulators spread their powers too thinly over a large number of regulatory targets. Therefore, their regulatory decisions are more likely to be open to the risk of regulatory capture.

3.3 Transparency

The final *ex ante* indicator we examine relates to the level of transparency. Transparency is necessary not only to enable end-users or users of the network to choose between different suppliers or network operators. It is also necessary to monitor the performance of the regulator in terms of its effect on prices, market structure, and other criteria. In this section, we examine only the first type of transparency as the second type can be measured only *ex post*. Data availability limits the exercise to the electricity and gas industries, the transparency indicators of which are provided in Table 4 below.

The index in Table 4 is derived from NRA responses to a questionnaire sent by ERGEG – the EU-level regulatory group for gas and electricity markets. It is constructed as follows: for each transparency criterion, we assign a value of 1 if the response from the NRA confirms transparency; a value between 0.25 - 0.75 if the answer is qualified; and a value of 0 if the answer confirms that the criterion is not met. The index in the last column and last row is the sum of indices in each cell divided by the number of countries (the last row of the table) or by

the number of criteria (the last column of the table). Criteria (C1-C7) are described in the note under the table.

The table shows that no member state satisfies the condition of full transparency with respect to all criteria. Similarly, no single criterion is satisfied by all member states. In addition, ERGEG (2005) explicitly states that NRAs did not provide detailed information about how transparency is ensured when they report that this is the case. In other words, the index is actually too generous a measure of transparency. Despite this, the overall level of transparency is 0.56 - with significant inter-country variation from 0.11 to 0.89 and inter-criteria variation from 0.42 to 0.77.

Table 4: NRA responses concerning price transparency for gas and electricity: 2005

								Transparency
	C1	C2	C3	C4	C5	C6	C7	Index
Spain	0.00	0.00	0.00	0.00	0.00	0.75	0.00	**0.11**
Sweden	0.00	0.00	0.00	0.00	0.00	1.00	1.00	**0.29**
France	1.00	0.25	0.25	0.25	0.25	0.25	0.00	**0.32**
Portugal	0.75	0.00	1.00	0.00	0.00	0.50	0.00	**0.32**
Ireland	0.50	0.50	0.25	0.50	0.50	0.75	0.00	**0.43**
Italy	1.00	0.00	0.50	0.50	0.50	0.50	0.50	**0.50**
Finland	1.00	0.50	0.50	1.00	0.25	1.00	0.50	**0.68**
Austria	1.00	0.00	0.00	1.00	1.00	1.00	1.00	**0.71**
Greece	1.00	1.00	1.00	1.00	1.00	0.00	0.00	**0.71**
Netherlands	1.00	1.00	1.00	1.00	1.00	0.75	0.00	**0.82**
Belgium	1.00	1.00	1.00	0.50	1.00	0.75	1.00	**0.89**
Great Britain	1.00	1.00	1.00	1.00	0.50	0.75	1.00	**0.89**
EU-12 Av.	**0.77**	**0.44**	**0.54**	**0.56**	**0.50**	**0.67**	**0.42**	**0.56**

Source: Derived from NRA answers in ERGEG (2005: 14, 15, 18).

Transparency index:
1.00 = full transparency; 0.25 – 0.75 = incomplete transparency; 0 = no transparency
Transparency criteria:
C1: Publication of list price is required (by default supplier)
C2: Publication of offer price is required (by new supplier or when moving to a different tariff)
C3: Does every supplier publish prices or just the incumbent?
C4: Does supplier provide price information to the regulator or another body?
C5: When are prices published: before or after the price change?
C6: How can a customer compare prices: platform for information and who provides it?
C7: Is comparability of prices ensured?

According to ERGEG (2005: 5), the lack of transparency benefits incumbents, undermines the position of new entrants, and aggravates consumer mistrust in the price formation mechanism. That is why the EU Commission (2007: 8) reports that all network users demand more transparency and that there is little harmonisation between member-state transparency requirements. These official evaluations confirm the low levels of the transparency index we present in Table 4 and enable us to conclude that NRAs regulating the electricity and gas industries do not yet satisfy the transparency condition for effective regulation. The EU and EU-level regulatory bodies recognise the risk associated with this lack of transparency, but they are still unable to ensure convergent compliance by NRAs despite existing EU legislation. The very low levels of transparency requirements allowed by NRAs in Spain, Sweden, France, Italy, Portugal and Italy are bound to have negative effects on regulatory effectiveness in these countries. They are also likely to dampen the rate of increase in transparency requirements in other member states.

This conclusion is supported by ERGEG (2006: 7-8), who reports that national regulators are unable to fulfil their tasks of monitoring and date collection. Enforcement powers in these areas are in most cases inadequate. What is also alarming is the fact that the consequences of non-compliance are often not proportional to the potential gains that companies reap when they do not provide the data. They are either too small or too drastic to be credible. The consequence is that the regulators are unable to cover the whole range of *ex ante* regulation and *ex-post* monitoring foreseen by the EU directives for gas and electricity.

The evidence presented so far is by no means exhaustive, however it provides some useful insights into the extent to which the emerging regulatory regime in EU network industries satisfies the *ex ante* conditions for minimising the risk of regulatory capture. On the one hand, the design of the European regulatory regime is in line with the normative implications of the economic theory of regulation. Specifically, the emerging regime consists of a two-level regulatory framework consisting of EU- and national-level regulation. This design reduces the risk of excessively lenient regulation, but it is compromised by the need for extensive bargaining and compromises required in the EU decision-making process. On the other hand, the emerging regime combines both strong and weak national regulators in terms of regulatory competence and institutional strength/resources. This mixture may be interpreted as a reflection of transition towards more convergence across member states. However, and

until such convergence occurs by moving towards higher standards, the existing arrangements are essentially sub-optimal. This is due to relatively low levels of regulatory competence and strength/resources as well as to mismatch between the two dimensions of the regulatory independence/autonomy. Finally, although we do not have transparency data for telecommunications and rail transport, the existing data for gas and electricity suggest that the European regulatory regime does not satisfy the *ex ante* transparency criteria.

These deviations from the necessary conditions are highly likely to reduce the effectiveness of the emerging regulatory regime in EU network industries. The next section examines some *ex post* indicators of regulatory quality with a view to develop a more complete picture about the outcomes of the European regulatory regime.

4. Ex post indicators of regulatory quality and regulatory outcomes

In this section, we examine evidence on market outcomes that can be associated with the degree of regulation in EU network industries. We begin with the correlation between the extent of market liberalisation and the indicators of regulatory competence as well as institutional strength/competence. The coefficients of correlation for these two variables are given in Table 5 below. The market opening index (MOI) and regulatory indicators are from Copenhagen Economics Market Opening Milestones database. The MOI and the regulatory indicators are calculated for EU-15 countries in 2003. The MOI is weighted by the number of years during which the level of market opening in a particular EU member has been equal to or greater than 0.3 by the cut-off date in 2003.

4.1 Regulatory indicators and market opening

Theoretically, we would expect the regulatory competence and the institutional strength/resources of the regulators to increase in line with the level of market opening. This is because liberalisation of network industries constitutes a move from a state-owned monopoly towards an oligopolistic or monopolistically competitive market that requires effective regulation. Without effective regulation, the monopolistic or oligopolistic market can lead to distorted prices, output levels or investment levels.

Table 5: Correlation between weighted MOI and regulatory quality: 2003

Variables	Pearson's Rank Correlation Coefficient	Significance
Weighted MOI in 2003 vs Electricity regulator's institutional strength/resources in 2003	0.326	n.s
Weighted MOI in 2003 vs Electricity regulator's regulatory competence in 2003	0.278	n.s.
Weighted MOI in 2003 vs Gas regulator's institutional strength/resources in 2003	0.162	n.s.
Weighted MOI in 2003 vs Gas regulator's regulatory competence in 2003	0.600	**
Weighted MOI in 2003 vs Telecomms regulator's institutional strength/resources in 2003	-0.084	n.s.
Weighted MOI in 2003 vs Telecomms regulator's regulatory competence in 2003	0.110	n.s.

n.s. = not statistically significant; * = significant at 10%

Source: Copenhagen Economics, Market Opening Milestones Databse.

When Table 5 is examined from this perspective, we can see that the coefficients of correlation between the MOI and the regulatory indicators are rather low and statistically not significant – with the exception of the gas industry. In the latter, the coefficient is 0.6 and it is statistically significant at 10% level. These results enable us to argue that the cross-country data for 2003 does not indicate a statistically significant correlation between the level of liberalisation and regulatory institution building in EU network industries. This could be either because regulatory institution building has been lagging behind the level of liberalisation or vice versa. Irrespective of which is the case, it is safe to conclude that there is a high degree of arbitrariness in the way in which the European regulatory framework has been taking shape over the last decade. The gas industry is an exception that proves the rule: we observe a high and statistically significant degree of correlation in this industry because both the weighted market opening index and the level of regulatory competence in this industry has been low. The low level of regulatory competence is confirmed in Table 2 above. The low levels of weighted MOI for the gas industry are confirmed in Ugur (2007a: 25).

4.2 Regulatory indicators and prices

The second ex post indicator of regulatory quality we examine is the correlation between regulatory competence and institutional strength/resources on the one hand and the level of prices in 2005. Theoretically, market liberalisation and regulation are expected to lead to lower prices over time and across countries. The results reported in Table 6 below reflect the degree of correlation between the variables across 15 EU member states. While the indicators of regulatory competence and institutional strength/resources are for 2003, the price levels are for 2005 – to allow time for the regulatory indicators to have an effect on prices. The price levels in 2005 are given as price indices for which the base year is 2007. This specification is more appropriate than absolute prices because prices differ between countries irrespective of the degree of regulation. By normalising all prices to 100 in 1997, the price index in 2005 provides a clear indication about whether prices have been falling or increasing as the process of market opening and regulation sets in.

Table 6: Correlation matrix for regulatory indicators in 2003 and the price index (PI) in 2005 (1997=100).

	Electricity Industrial PI	Electricity Household PI	Gas Industrial PI	Gas H/hold PI	Telecomm Local calls PI	Telecomm National calls PI
Electricity regulator's Institutional strength	0.049 n.s.	0.190 n.s.				
Electricity regulator's Competence	0.033 n.s.	-0.109 n.s.				
Gas Regulator's institutional strength			0.027 n.s.	-0.166 n.s.		
Gas Regulator's Competence			-0.083 n.s.	-0.112 n.s.		
Telecom Regulator's institutional strength					0.109 n.s.	-0.307 n.s.
Telecom Regulator's Competence					0.011 n.s.	-0.449 n.s.

n.s. = statistically not significant.

The results reported in Table 6 indicate that none of the coefficients of correlation is statistically significant. In addition, half of the coefficients have the wrong sign - i.e., they are positive. Ignoring statistical significance, this indicates that member states with higher levels of regulatory competence and/or institutional strength tend to have higher prices. This is in conflict with the expected effect of regulation on prices. The remaining half of the coefficients have the correct sign – i.e., they are negative – but these coefficients are statistically insignificant. Finally, all except one coefficient (-0.449 in the bottom right corner) are very close to zero. Again ignoring statistical significance and wrong signs, small values of the coefficients indicate that the association between measures of regulatory quality and national prices is quite weak across member states. Given these results, it is possible to conclude that member states with higher levels of regulatory activity in 2003 did not necessarily enjoy lower gas, electricity or telephone call prices in 2005.

One reason for these disappointing results could be that the European regulatory regimes are still in the making. Some member states such as the UK, Sweden, Austria and Belgium have had independent regulators for gas and electricity since mid-1990s. These regulators have either advisory or concurrent powers that they share with the competition authorities. (EU Commission, 2005b: 22). Some others such as Austria, Belgium, Denmark, Germany and the UK have also had well-established regulators in the telecommunications industry. However, the EU-level legislation that provides for independent regulators was adopted quite recently in early 2000s. In addition, regulators in the majority of EU countries are either new or not independent of the government. Therefore, the absence of association between regulatory quality indicators and prices may be related to 'teething problems' of the emerging regulatory regime in EU network industries.

However, there is no guarantee that the European regulators will become more effective as they become better established and move up on their learning curves. Evidence on US regulators does not support the argument that regulatory performance improves over time. As Moore (1975) has indiacted, the increase in the regulator's resources over four observation years (1947, 1953, 1960 and 1966) did not lead to lower prices. This finding is supported by Upadhyaya and Raymond (1994), who use cross-sectional US data for 1922, 1927 and 1932 and report that regulation remains ineffective in lowering the price of electricity over time. Finally, Upadhyaya and Mixon (1995) use national US time-series data for 1918-53 and report that regulatory indicators do not have a significant effect on prices.

Given these findings, the extent of market concentration and the ability of the incumbents to manipulate prices acquire added significance in explaining regulatory outcomes. EU Commission (2005a: 5) reports the results of an inquiry into distortions to competition in European network industries. The findings indicate that the gas and electricity amrkets in many member states remain concentrated and create scope for incumbents to influence prices. In addition, many wholesale markets are illiquid either due to long term contracts (gas) or because companies are active both in production and in the retail markets (electricity). Thirdly, there is insufficient unbundling of network and supply activities. Finally, the lack of transparency benefits incumbents and undermines the position of new entrants. This lack of transparency aggravates mistrust in the price formation mechanisms in the retail and wholesale markets.

Similarly, the number of major operators in the telecommunications industry has remained very small despite the increase in the number of authorised public fixed voice telephony operators from 635 in 1998 to 1237 in 2004. In railways, problems with access to the international network, inadequacy of the regulatory framework or simply the low attractiveness of the market limit the emergence of competition. (EU Commission, 2005a: 6)

The extent of distortions to competition is also confirmed by ERGEG (2006), who pint out to the cultivation of ‘European champions’ through cross-border mergers. According to ERGEG these ‘European champions’ might well lead to future market dominance - despite or perhaps because of recent developments towards market integration. National regulators ‘are unable to effectively monitor cross-border unbundling.’ Therefore, a single company operating in one country may own subsidiaries in another country, and operate its network in a way to benefit the affiliate in the neighbouring country.

ERGEG (2006: 7) also indicates that reports of NRAs in the gas and electricity markets contain ‘alarming cases where regulators have increasingly had to coordinate decisions with political decision- makers’. In other cases, governments have been able to overrule decisions taken by the regulators – ‘setting returns on capital or giving direct instructions to the board of directors of the regulator.’ ERGEG had already drawn attention to these problems in its 2005 report, however the situation has deteriorated over the year. The main reason is that rising energy prices and tighter capacities have been used to justify intervention into a market that is perceived not to deliver secure supply at low prices. However, this intervention is carried out

not through regulators but through political discretion. This is a recipe not only to undermine the authority/credibility of the regualtors but also to induce the latter to lean towards the regulated.

Given this evidence, it is difficult to uphold the argument that the lack of association between regulatory indicators and price outcomes is a temprary aberration. On the contrary, it is related to limited regulatory independence/competence, high levels of market concentration, and low levels of transparency requirements in existing legislation.

4.3 Regulation and consumer switching

The extent of switching between suppliers of network services is a significant indicator of the scope for competition. Tables 7 amd 8 below provide information on this indicators in the gas and electricity markets. Switching data is not available available for telecommunications and it is irreelvant for rail transport.

Table 7: Switching estimates - electricity

	Large industrial users		**Small commercial/domestic users**	
	Since market opening	**During 2003**	**Since market opening**	**During 2003**
Austria	22%	7%	3%	1%
Belgium	35%	8%	19%	19%
Denmark	50%	22%	5%	5%
Finland	50%	16%	n.k	4%
France	22%	n.k	n.a	n.a
Germany	35%	n.k	6%	n.k
Greece	0%	0%	n.a	n.a
Ireland	50%	6%	1%	1%
Italy	c.15%	n.k	n.a	n.a
Luxembourg	10%	n.k	n.a	n.a
Netherlands	30%	n.k	35%	n.k
Portugal	9%	7%	1%	1%
Spain	18%	5%	0%	0%
Sweden	50%	5%	n.k	10%
UK	50%	n.k	50%	22%

Source: EU Commission (2005b: 5)
n.a.: Not applicable
n.k. = No information

In the elctricty market, there are 5 of member states where about 50% of the large industrial users have switched from one supplier to the toher since market opening. These are Denmark, Finland, Ireland, Sweden and the UK. In the remining 10 member states, the rate of

switching by large industrial users ranged between about 10 - 35 per cent. Despite the variation, the evidence indicate a significant level of switching activity by large users of electricity. However, the rate of switching is very low among small commercial and houshold users – with the exception of the UK (50% since market opening), The Netherlands (35%) and Belgium (19%). In fact, in some member states switching between suppliers is either not allowed or has been intorduced only recently. A similar trend is observable in the gas industry too. As can be seen from Table 8 below, in only two member states (Italy and the UK) the rate of switching was significant among small users.

Table 8: Switching estimates: GAS (note pp: 6)

	Large industrial users		**Small commercial/domestic users**	
	Since market opening	**During 2003**	**Since market opening**	**During 2003**
Austria	9.0%	9.0%	0.5%	0.5%
Belgium	60.0%	n.a	4.0%	4.0%
Denmark	30.0%	3.0%	n.a	n.a
France	25.0%	5.0%	n.a	n.a
Germany	7.0%	n.k	<2%	0.0%
Ireland	>50%	1.0%	n.a	n.a
Italy	30.0%	n.k	35.0%	35.0%
Luxembourg	<5%	n.k	n.a	n.a
Netherlands	30.0%	n.k	2.0%	n.k
Spain	>50%	22.0%	5.0%	5.0%
Sweden	n.k	n.k	n.a	n.a
UK	>50%	19.0%	47.0%	13.0%

Source: EU Commission (2005b: 6)
n.a.: Not applicable
n.k. = No information

When taken in conjunction with inadequate transparency indiators in Table 4 above, the very low levels of switching by small users may suggest that this user category have not been able to benefit from lower prices as much as the large users have. However, the low rate of switiching in this category may also be due to regulated end-user prices, which may be kept artificially low. Neverthless, the evidence on price gas and electricity prices does not support this argument. The electricity price index increased form 100 in 1997 to 105 in 2005 for both large and small users. In the gas market, the price index increased from by 33% from 1997-2005 for small users, whereas the rate of increase was slightly higher at 55% for large usrs. (See, Ugur 2007a: Table 2).

5. Conclusions

The theoretical and empirical literature on the quality of regulation in general tends to report pessimistic findings. Regulators, in contrast to declared intentions, tend to remain ineffective in reducing the price-cost margins of companies in oligopolistic or monopolistically competitive markets. In fact, there is also theoretical and empirical work demonstrating that the demand fro regulation originates from such companies rather than the consumers that the regulator is expected to protect. True, there are variations in the findings about the extent of regulatory capture that would result from strategic interaction between different players (consumers, suppliers, the government and the regulators). However, these variations are about the extent of regulatory capture - and not about whether capture does occur.

The evidence analysed above enables us to verify the extent to which the emerging regulatory regime in EU network industries has been designed in a manner that would minimise the risk of regulatory capture. We have conducted our investigation by examining the *ex ante* and *ex post* indicators of regulatory quality in the EU network industries. On the positive side, we have established that the co-existence of EU- and national-level legislation and regulatory bodies is likely to reduce the risk of regulatory capture. In addition, we have established that there is scope for the diffusion of bets regulatory practice through the coordination and cooperation activities of the EU-level regulatory bodies, which incorporate the representatives of national regulators.

On the negative side, however, we have identified a large number of *ex ante* and *ex post* indicator that suggests that the emerging European regulatory regime is less than optimal. As far as ex ante indicators are concerned, we have established that the regulatory competence and institutional strength of NRAs are highly unequal across countries and there is significant discrepancy between the two indicators in each member state. In addition, the level of transparency with respect to price and network access is inadequate in the gas and electricity markets. As far as *ex post* indicators are concerned, the available evidence clearly demonstrates that there is no statistically significant correlation between indictors of regulatory strength/competence on the one hand and the level of market opening or prices on the other. This lack of correlation suggests that the strength/competence of national regulators is not a predictor of the price level in member states. It also suggests that the strength/competence of national regulators is not commensurate with the level of market

opening at the national level. Finally, we have also established that a decade of market opening and regulation has not led to high levels of switching among small users of electricity and gas – even though non-availability of data has prevented us from assessing the switching rate in the telecommunications industry.

The findings summarised above can be interpreted in two ways. On the one hand, it can be argued that the regulatory regime in EU network industries is still in its early stages of development and that experiencing-sharing and learning may increase its effectiveness in the future. On the other hand, it can also be argued that time is not necessarily a remedy for the transaction cost and informational asymmetries that generally lead to regulatory capture. Evidence on the US experience, which provides the most relevant comparator for the European regulatory effort, lends support to the second interpretation. Although it would be too hasty a generalisation to argue that the European regulatory regime is bound to be plagued with regulatory capture problems experienced in the US, the result would depend crucially on the interaction between EU- and national-level regulatory arrangements. It remains to be seen whether both EU and national regulatory arrangements would interact in such a way as to minimise the risk of regulatory failures in the EU.

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