Is regulatory quality related to industry performance? Evidence on telecommunications, gas and electricity in EU15

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Abstract

This paper provides empirical evidence on *ex ante* and *ex post* indicators of regulatory quality and the relationship between those indicators and market performance in liberalised EU-15 network industries. We report a low level of regulatory independence and competence, a high level of cross-country variations in regulatory quality, and a prevalent absence of correlation between *ex ante* regulatory quality and *ex post* performance indicators. On the basis of these findings, we suggest that the design of national regulatory agencies (NRAs) in Europe is not optimal and may be conducive to regulatory ineffectiveness or outright regulatory failure. Nevertheless, the existence and strengthening of EU-level regulators could enable EU member states to reduce the risk of regulatory failure by encouraging coordination and adoption of best practice.

KEY WORDS: Economics of Regulation, European Public Policy, Regulatory Quality, European Network Industries.

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Introduction

Over the last decade or so, EU network industries have been subject to liberalisation reforms and regulation. The timing and extent of liberalisation have differed between sectors and across member states; and so has the strength and competence of national regulatory agencies (NRAs). In spite of these variations, some students of European regulation point to the emergence of a 'European order' of network industry regulation, the main characteristics of which are: (i) progressive market opening that allows for free entry of suppliers and consumer switching between suppliers; (ii) increasing transparency through unbundling of production, transmission and retail supply activities; and (iii) establishment of independent NRAs complemented by EU-level regulatory bodies (Napolitano, 2005).

The aim of this paper is to assess the quality of the emerging European regulatory regime, which consists of the heads or representatives of NRAs and representatives of the EU Commission, in EU-15 telecommunications, gas, and electricity markets. We begin with a review of the existing literature on the political economy of regulation and factors that may reduce the risk of regulatory failure. Then, in section 2, we examine the *ex ante* indicators of regulatory quality in EU network industries. The aim here is to provide some evidence on *ex ante* indicators of regulatory quality and whether there is consistency between these indicators. In section 3, we look at some *ex post* performance indicators such as market structure, prices, and consumer switching. The aim here is to ascertain the extent to which the NRAs have been effective in influencing supplier behaviour and market structures. Finally, the conclusion will bring together the main findings and elaborate on the scope for improving the quality of the European regulatory framework.

1. The political economy of network industry regulation

Network industry regulation is a public policy problem, the resolution of which is complicated by information asymmetries, transaction costs, agency problems, and strategic interaction between multiple actors such as consumers, suppliers, regulators, and governments. Information asymmetries and transaction costs combine to generate incomplete contracts between these actors. Incomplete contracts, in turn, may lead to sub-optimal regulatory outcomes that emerge either as inadequate or as excessive regulation.

The *objective theory* of regulation addresses the question as to how transaction costs, information asymmetries and principal-agent problems (i.e., *the constraints*) may lead to regulatory failures. (See, Berry, 1982; Estache and Martimort, 1999; Dal Bo, 2006.) Earlier work in this tradition tended to focus on regulator's endowment or membership size of the regulated group as determinants of regulatory quality. In the commission inadequacy approach, which dates back to 1930s, inadequate resources and/or expertise tend to prevent the regulator from reducing the excessive rents that the regulated firm derives (Frankfurter, 1930; Trachsel, 1950). Students of the group approach, on the other hand, argue that the regulator would tend to protect the interest of the regulated industry because the large/diffused group of consumers would fail to organise whereas the small group of regulated firms would organise effectively and influence regulatory outcomes (Bernstein, 1955; Olson, 1965; Wilson, 1974; Berry, 1982).

These pessimistic findings drew further support from studies in which the regulator (equated with the government or the legislator) is modelled as a strategic player trying to maximise its own objective function (mainly the chance of re-election). For example, Stigler (1971) demonstrates that regulation will be excessive and will increase the ability of regulated firms to extract excessive rents through restricted competition. Peltzman (1976) refines Stigler's model, but arrives at a similar conclusion: regulation will typically entail less than optimal protection for consumers, but its protection of producer interests will be less pervasive than what the Stigler-type models predict.

This type of modelling acknowledges that regulators have their own objective functions, but it says very little about how they realise their objectives. To address this shortcoming, Tirole (1986) and Laffont and Tirole (1993) analyse the regulatory process as a two-stage game between the government, the regulator, and the regulated firm. In stage one; the firm has private information about its cost, which is not yet known to the regulator or government. The government appoints a regulator, whose powers are specified via a second-best contract that enables it to increase its knowledge of the firm's true cost structure. The second-best contract reduces but does not eliminate the rents for the firms. In stage two, the firm offers the regulator a side-contract (i.e., some kind of bribe) before the latter decides how much of the cost information it should pass on to the government. If the regulator takes the firm's offer, the latter continues to extract rents that it now shares with the regulator. If the regulator declines, then no rents remain. The problem for the government (i.e., the principal) is then to offer the regulator a contract that will induce him not to lie about the firm's cost structure and

to offer the firm a regulatory regime that will provide the latter with rents that are just enough to prevent it from colluding with the regulator (Dal Bo, 2006: 207).

The difficulty in resolving this regulatory problem is confirmed in a large number of empirical studies on network industries. For example, Upadhyaya and Raymond (1994), who use cross-sectional US data for 1922, 1927 and 1932, report that the US regulatory regime was unsuccessful in lowering state-level electricity prices below monopoly levels. 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 report that regulation was not a statistically significant determinant of prices in that period. 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, where market power remains a significant issue. Instead, one can make a case to treat regulation as a necessary but not sufficient condition for reducing the distortions that arise from market power. Identifying the sufficient conditions and providing institutional design solutions are issues within the realm of the *normative theory* of regulation, which examines the institutional arrangements that may enable the policy maker to reduce the risk of regulatory failure. For this purpose, Estache and Martimort (1999) provide an extensive list of contractual design characteristics that could minimise the risk of sub-optimal regulation. These are summarized in Table 1 and include the following: (i) independence and autonomy of the regulator *vis-à-vis* the regulated industry and the political principal; (ii) multiple regulators with complementary competences; (iii) accountability of the regulator; (iv) quality and availability of information about regulatory outcomes; (v) availability of industry-specific information to be shared between regulators; and (vi) anti-collusion measures applicable to current and future relations between the regulator and the regulated industry.

(Table 1 here).

One contractual/institutional design characteristic that may reduce the risk of regulatory failure is independence. Independent regulators are more likely to deliver efficient *ex post* outcomes because they can help resolving the conflict between credible commitments and *ex post* efficiency. Given that any regulatory contract is essentially incomplete due to information asymmetries and agency problems, it would be more efficient to allow for re-

negotiations of the regulatory contract. If periodic changes in the regulatory contract are undertaken by the government who also control the regulator, it will be less feasible to distinguish between changes introduced for political convenience and those introduced with a view to improve the regulatory contract on the basis of new and relevant information. Once this confusion arises, the regulated industry will question the credibility of the regulatory standards and will increase its lobbying activities aimed at inducing the government to change the regulatory requirements.

However, if the regulator is independent the regulated industry will have less incentive to lobby the government for change. This is because the rates of return on lobbying will fall either because the independent regulator is likely to resist government pressure or the government will be able to deflect the lobby pressure on the ground that the independent regulator has different information that contradicts the private information of the firm. The end result will be that the regulatory contract will remain credible between reviews and the latter will incrementally improve the quality of the contract over time. This combination will increase the probability of securing optimal *ex post* outcomes in terms of efficiency and welfare.

Another contractual design characteristic that increases the probability of optimal *ex post* outcomes is the existence of multiple regulators with complementary competences. This characteristic may minimise the risk of regulatory failure for two reasons. First, complementarity - i.e., absence of overlapping competences – minimises the scope for regulated firms to 'shop' between regulatory jurisdictions with a view to choose the most lenient regulator. Secondly, regulators with complementary powers set the level of regulation in their area of competence without having to take into account the standards set by other regulators. In other words, the regulators are not motivated to dilute their regulatory toughness with a view to secure the loyalty of the regulated firms. (See Laffont and Martimort, 1999).

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

The institutional/contractual design characteristics discussed above should be considered as relevant only for assessment of *ex ante* regulatory quality – and not as determinants of *ex post* regulatory outcomes with respect to prices or investment or service quality. However, it is

possible to establish a theoretical link between the *ex ante* indicators of regulatory quality and ex post outcomes, and to empirically test if the existing evidence supports or refutes the theorised link. Therefore, in what follows, we first assess the *ex ante* indicators of regulatory quality in EU-15 network industries and then we examine the extent to which these quality indicators have had the expected effects on *ex post* performance in regulated markets. This is necessary not only to avoid hasty generalisations about the quality of regulatory outcomes but also to increase the tractability of the findings.

2.1 Co-existence of EU and national regulatory bodies

One *ex ante* characteristic of the emerging European regulatory regime is the co-existence of both national regulatory authorities (NRAs) and EU-level regulatory bodies such as ERG (The European Regulators Group for Electronic Communications) and ERGEG (The European Regulators Group for Electricity and Gas). This co-existence tends to satisfy the condition of complementary in two ways. First, it could legitimise the incorporation of any EU-level rules or agreements into national regulatory policies. As a result of the potential convergence that would follow, firms would find it more difficult to engage in regulatory arbitrage by moving between jurisdictions. Secondly, the newly established EU regulatory bodies such as ERG or ERGEG derive their legitimacy from the high level of professional expertise concentrated in critical areas of the national regulatory domains and in cross-border issues that arise from the nature of the emerging single European market for network industries. Finally, EU-level regulatory bodies are formally incorporated into the supranational rule development and enforcement of the Commission. Indeed, the Commission refers frequently to the reports and recommendations of ERG and ERGEG in its proposals for new directives or regulations aimed at increasing competition and strengthening the regulatory framework in network industries (Eberlein and Newman, 2008).

Writing on EU-level regulatory bodies that precede the network industry regulators such as ERG and ERGEG, Majone (2000, 2002) reports that EU-level regulatory bodies tended to act as central nodes that encourage efficient cooperation, coordination and adoption of best practice among national and sub-national regulatory agencies. Majone (2002) indicates that the effectiveness of these 'first-generation' European regulators depended on three conditions: (i) high levels of mutual trust and cooperation between agencies; (ii) high levels of professionalism; and (iii) a common regulatory philosophy. Yet, there is no agreement on

whether the first-generation European regulators have been designed in a way that satisfies these conditions. For example, Coen and Doyle (2000) indicate that EU-level legislation provides only for a regulatory framework, leaving detailed legislation to be adopted at the national level. 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). In other words, the positive effect of EU-level regulatory bodies on the quality of national regulation cannot be taken for granted. Although the they may reduce the risk a 'drive to the bottom' in terms of regulatory toughness, they may not necessarily lead to diffusion of best practice due to factors related to the process of EU policy making - e.g., bargaining, multiplicity of political actors, issue linkage, etc.

Recent work on the second generation of EU-level regulatory bodies including ERGEG provides similar findings. For example, Eberlein and Newman (2008: 36) identify factors similar to those identified by Majone (2002) and argue that 'professional homogeneity', the degree of 'delegated authority' and 'administrative capacity' are the determinants of the differences in the ability of national and EU-level regulators to perform effective regulation. Their findings on ERGEG suggest that the latter has made key contributions to the development of the internal energy market. One such contribution was the codification of its policy proposals into the European Commission's third legislative package of 2006 for further liberalisation and regulation of the electricity and gas markets. Secondly, ERGEG's opinions and recommendations have been referred to as blueprints for best practice by the Council and the Parliament. Yet, 'lack of full independence from government and insufficient powers' limit the effectiveness of national enforcement by NRAs, leading to 'regulatory asymmetry between national jurisdictions' (Eberlein and Newman, 2008: 44).

On the basis of these findings and my reading of ERG and ERGEG achievements after 2004, it is possible to argue that the emerging EU-level regulators of network industries are a step in the right direction. This is mainly because they have been effective in limiting the scope for downward convergence in EU regulatory standards. Stated differently, ERG and ERGEG have been instrumental in preventing a drive to the bottom in terms of regulatory norms and have strengthened the hand of the European Commission in its bargaining with national governments. However, both ERG and ERGEG are still far from being able to ensure upward convergence in EU network industry regulation. In fact, they are due to be superseded by new EU-level regulatory agencies – as envisaged in the third reform package of the European

Commission for electricity and gas, and in the fifth reform package for electronic communications. The third package for electricity and gas was approved by the European Parliament in September 2007 and is expected to be endorsed by the Council by December 2009. The fifth package concerning electronic communications is yet to be debated by the European Parliament and the Council. Unlike ERG and ERGEG, the future EU-level regulatory agencies will be funded through the EU budget and will be empowered to take binding decisions. However, their competence is likely to remain limited to cross-border issues, excluding other areas of regulation concerning prices, investment, and intra-country concentration.

2.2 Regulatory competence and independence

Two other *ex ante* regulatory quality indicators are independence and competence. Regulatory independence is necessary to resolve the government's commitment problem and address problem of resource/expertise adequacy. Regulatory competence, on the other hand, is necessary to ensure that relevant market outcomes such as prices, environmental standards, investment or universal service are within the regulator's competence. Table 2 below provides evidence on indicators of regulatory independence and regulatory competence in 15 EU member states. The data, obtained from Copenhagen Economics, is derived from a detailed examination of the national regulatory legislation on national regulators and the resources made available to them. It had been used in the reports commissioned by the Internal Market Directorate-General of the European Commission (Copenhagen Economics, 2005).

The *regulatory independence* indicator is constructed by taking the simple average of the scores for a number of sub-indicators, which consist of: 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 between 0 and 1, depending on the level of independence, relative budget/personnel size, and the extent of power sharing. Similarly, the *regulatory competence* indicator is also the average of the 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. For both indicators, a value close to 0 indicates highly limited independence or competence whereas a value close to 1 indicates high levels.

The evidence in Table 2 paints a mixed picture about regulatory competence and independence in the three industries. First, existing NRAs in general do not enjoy a high degree of independence, the cross-section average of which is 0.55 for telecommunications, followed by 0.54 for gas and 0.49 for electricity. This implies that NRAs, on average, enjoy only about half of the level of independence that a fully-fledged regulator is expected to enjoy. Therefore, NRAs face a risk of regulatory capture, as predicted by 'commission inadequacy' theory of regulation.

(Table 2 here).

Secondly, the evidence suggests that there is a high degree of variation between NRA independence across member states. The coefficient of variation is highest for the gas industry regulators (at 43.61%) followed by electricity regulators (at 41.72%). In the telecommunications industry, there is a higher degree of convergence as reflected by the low value for the coefficient of variation at 16.64%. The implication here is that further coordination is needed to encourage the adoption of best practice with respect to regulatory independence in gas and electricity industries.

The third observation relates to the scope of regulatory competence. 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 variation 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 levels of regulatory independence and competence across EU-15 countries. A high level of correlation between the two *ex ante* indicators would suggest that NRAs, across EU-15, are equipped with the resources that are commensurate 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. We have calculated the Pearson's rank correlation coefficient for the two indicators in 2003 – the latest year for

which data is available. The results indicate that the estimated coefficients are very low (0.118 and 0.139 for electricity and gas regulators, respectively) and not statistically significant at 5%. In telecommunications, the correlation coefficient is 0.587 and it is statistically significant. Even though this correlation is not strong, it distinguishes the telecommunications regulators from gas and electricity regulators where there is evident mismatch between independence and regulatory competence across EU-15. There are two types of anomalies that cause mismatch between regulatory competence and independence or *vice versa*.

The first type of anomaly concerns high levels of independence combined with low levels of competence. This is evident in the case of electricity regulators in Austria and the UK, with significant levels of independence (0.64 and 0.74, respectively) but relatively limited 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 tend to have high levels of independence, but this independence is 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 ineffective regulation with respect to other outcomes.

The second type of anomaly is the mirror image of the first: low independence 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 are either not independent of the government or they spread their powers too thinly over a large number of regulatory targets. In any case, their regulatory decisions are likely to be open to the risk of capture either by the industry or by the government.

2.3 Transparency

The third *ex ante* indicator relates to transparency requirements that regulated firms must comply with in their pricing strategies and access provision. Transparency is necessary for enabling end-users or other users to choose between different retail suppliers or network operators. It is also necessary to monitor the performance of the regulator in terms of its effect

on firm behaviour. 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 3 is derived from NRA responses to a questionnaire sent by ERGEG. It is constructed as follows: for each transparency criterion specified by ERGEG, 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 no transparency. The transparency index in the last column is the *national average* across the transparency criteria; whereas the index in the last row of the table is the *EU average* across member states for each transparency criteria. The transparency criteria (C1-C7) are described in the note under the table.

(Table 3 here).

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 large range of overall variation from 0.11 to 0.89 between countries. The range of overall variation is smaller (from 0.42 to 0.77) between transparency criteria, but this should be considered in the light of two additional observations. First, the lowest level of transparency (0.42) is observed in C7, which measures the comparability of published prices. This implies that EU-15 gas and electricity companies, as of 2005, introduced and maintained a high level of noise into their price information, and the national regulators were least effective in this area. Secondly, the highest transparency score is observed in C1 – publication of price lists. This suggests that regulators have been successful in forcing the regulated gas and electricity companies to publish price information, but this information does not lend itself to effective price comparison.

According to ERGEG (2005: 5), lack of transparency benefits incumbents, undermines the position of new entrants, and aggravates consumer mistrust in the price formation mechanism. That is why 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 3 and enable us to conclude that NRAs regulating the electricity and gas industries do not yet satisfy the transparency condition for effective regulation.

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-15 satisfies the *ex ante* conditions for minimising the risk of regulatory failure. On the one hand, the emerging regulatory regime is in line with the normative implications of the economic theory of regulation as it combines national and EU-level regulatory frameworks. This design reduces the risk of excessively lenient regulation, but it is compromised by extensive bargaining and compromises that characterise 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 independence. 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 independence as well as to mismatch between the two.

3. *Ex post* indicators of regulatory quality and outcomes

In this section, we examine evidence on *market outcomes* that can be associated with the effectiveness of regulation in EU network industries. We begin with the market opening index (MOI), which measures the extent of liberalisation in the relevant industry as of 2003. The MOI is calculated as an index between 0 (not open) and 1 (fully open) on the basis of legal and actual arrangements in place with respect to: (i) unbundling of transmission and distribution system operators; (ii) third-party access to distribution, transmission and storage infrastructure; and (iii) the degree of free choice of supplier. The data for MOI is obtained from Copenhagen Economics Market Opening Milestones database. Descriptive statistics for the MOI over the 1990-2003 period are as follows: in the gas sector, the EU-15 average of the MOI was 0.14 and the coefficient of variation was 134%; in the electricity and telecommunications sectors, respectively, the corresponding figures were 0.25 and 0.25 for the MOI average, and 84% and 97% for the coefficient of variation. As of 2003, the EU-15 average of MOI was 0.54 for gas, 0.67 for electricity, and 0.72 for telecommunications; with

corresponding coefficients of variation at 187% for gas, 68% for electricity, and 49% for telecommunications.

3.1 Regulatory independence/competence and market opening

In the initial stage of liberalisation, we would expect regulatory competence and independence to increase in line with the level of market opening (i.e., liberalisation). 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. Therefore, theoretically, we expect a high degree of cross-section correlation between the level of market opening on the one hand and the levels of regulatory independence/competence on the other. To verify whether this is the case, we use the regulatory independence/competence indicators presented in Table 2 and the market opening index (MOI) summarised above. To reflect the significance of the length of time over which market opening has reached a certain threshold (0.3), we multiplied the national MOI in 2003 with the number of years over which market opening was 0.3 or greater in that member states.

The findings (not tabulated here due to space limitations), suggests that the coefficients of correlation between the weighted MOI and regulatory independence/competence are rather low (between - 0.08 and 0.33 for the MOI/Independence correlation and between 0.11 and 0.60 for the MOI/Competence correlation) 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 findings 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. 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 the exception that proves the rule: we observe a relatively high (0.60) and statistically significant degree of correlation in this industry because both the weighted MOI and the level of regulatory competence in this industry are low!

3.2 Regulatory indicators, competition and prices

Over time, effective network industry regulation can be expected to induce a higher level of competition, leading to lower prices as a result of reduced concentration and collusive behaviour. Formally, the impact of regulation-induced competition on prices can be stated as follows (MacAvoy, 2007: 9-10):

$$(PQ - \Sigma C_i Q_i) / PQ = \text{HHI}\ (1 + v) / e. \qquad \text{(Eq. 1)}$$

Where:
P = industry price Q = industry output C_i = firm i's variable cost per unit
Q_i = firm i's outptut e = demand elasticity
HHI= Herfindahl-Hirschman index (sum of squares of market shares of firms in the industry, takes values between 0 and 1)
v = conjectural variation index (a measure of collusive/coordinated behaviour, which can be smaller, equal or greater than zero).

The left hand side of the equation is the price-cost margin at equilibrium, measured as proportion of industry revenue. Assuming that demand elasticity is constant, the right hand side of the equation suggests that the price-cost margin will fall if the concentration level (HHI) and extent of collusive behaviour (v) falls. Table 4 below provides some evidence on network industry price indices over time - with 1997 as the base period.

(Table 4 here).

Table 4 suggests that prices in the telecommunications industry has fallen significantly over time and in comparison with the level of inflation (the harmonised index of consumer prices – HICP) in EU15. This is in line with the expected effect of regulation. The average price index for electricity reflects a less clear-cut trend. It tended to fall until 2002, but started to increase from 2003 onwards. Nevertheless, both price indices (households and industrial customers) for electricity have remained below the HICP index throughout the period. This is also in line with the expected effect of regulation, but the evidence is less clear-cut than the telecommunications sector for 3 reasons. First, the fall in the price index has occurred before the introduction of the regulatory reform package at the EU level; (ii) the increase in the price index, however, occurred from 2003 onwards when regulatory effectiveness was expected to increase as a result of EU-level coordination; and (iii) Equation 1 above indicates that the fall

in price levels should be substantive and continuous until the concentration ratio and the level of strategic collusion have been reduced to levels compatible with effective competition.

In contrast to electricity and telecommunications, price indices for gas have increased over time and relative to the HICP index despite the fact that the market opening reforms in this industry began at the same time as electricity. Explanations of the increase in gas prices include the following: (i) indexation of gas prices to oil prices; (ii) supply bottlenecks caused by network capacity; (iii) significant market power enjoyed by incumbents; and (iv) long durations of sale/purchase contracts. (ERGEG, 2006; EU Commission, 2007). Therefore, excluding the impact of other factors that may affect price levels, we can conclude that regulation has been associated with significant decline in telephony prices, had an uncertain effect on electricity prices, and failed to dampen the price increases in the gas sector.

Another way in which we can try to establish if association exists between regulation and price levels is to look at coefficients of correlation between prices and regulatory quality indicators across member states. Table 5 below provides the correlation coefficients for regulatory indicators and retail price indices for electricity, gas and telecommunications. The regulatory indicators are the independence and competence indicators presented in Table 2 above. The retail price indices (RPIs) are adjusted by taking: (i) the difference between industry price index and the harmonised index of consumer prices (HICP); and (ii) the ratio of the industry price index to HICP. For RPI as well as HICP, the base year is 1997.

(Table 5 here).

The results reported in Table 5 indicate that only two coefficients of correlation are statistically significant at 10% level: the coefficients of correlation between regulatory competence in the telecommunications industry and the adjusted RPI for national calls. In addition, these coefficients have the 'correct' (i.e., negative) sign, indicating that an increase in regulatory competence is associated with price falls across member states. The remaining 22 coefficients are statistically insignificant and 8 of them have *incorrect* (i.e. positive) signs. Given these results, it is possible to conclude that, with the possible exception of national call prices, the levels of regulatory activity in 2003 were not associated with lower gas, electricity or telephone call prices in 2005.

One reason for these results is that independence and competence of NRAs are distributed unequally across EU-15 and they tend to be around only 50-60% of fully effective levels – as indicated in Table 2 above. In addition, some member states such as the UK, Sweden, and Austria have had independent NRAs for gas and electricity since mid-1990s. These regulators have either advisory or concurrent powers shared with national competition authorities (EU Commission, 2005b: 22). Some others such as Austria, Belgium, Denmark, Germany and the UK have also had well-established NRAs in the telecommunications industry. However, in the rest of the EU-15, NRAs are either not independent of the government or do not have advisory or concurrent powers with the national competition authorities. In addition, the European Commission has so far had to maintain a lenient approach to competition issues in network industries. For example, it has taken only 16 actions against infringement of competition rules from 2003-2007. Also, it has prohibited only 2 out of 439 network industry mergers and acquisitions that have taken place between 1995-2005 (EU Commission, 2007a: 54). Given the absence of conjunction between competition and regulation authorities and the relative weakness of the latter, it is not surprising to observe that the association between *ex ante* regulatory indicators and *ex post* outcomes such as price levels is very weak and statistically insignificant.

Another reason relates to persistent market concentration and the ability of the incumbents to manipulate prices. According EU Commission (2005a and 2006), the gas and electricity markets 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). Finally, the lack of transparency aggravates mistrust in the price formation mechanisms in the retail and wholesale markets. These indicators of distortions to competition are confirmed by ERGEG (2006), which highlight the tendency to 'nurture European champions' through cross-border mergers. According to ERGEG these mergers may 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 with a view to benefit the subsidiaries.

ERGEG (2006: 7) also indicates that NRA reports for 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 regulators but also to induce the latter to be lenient towards the regulated.

The exception is telecommunications, but even in this industry competition has been constrained due to dominant position of the incumbents in fixed telephony and oligopolistic competition in mobile telephony. While the number of major players increased in the majority of EU15, it was reduced in France and Sweden. Nevertheless, market developments in the telecommunications sector have been in the direction of moving away from vertical integration and the average market share of the incumbent in fixed telecommunications has fallen from 100% at the start of liberalisation to approximately 65% in 2005 (EU Commission, 2007a).

3.3 Regulation and consumer switching

The extent of switching between suppliers is a significant indicator of the scope for competition. Tables 6 below provide information on this indicator in the electricity and gas markets (gas market figures are in parenthesis). Switching data is not available for telecommunications.

(Table 6 here).

In the electricity market, there are 5 member states where about 50% of the large industrial users have switched from one supplier to the other since market opening. These are Denmark, Finland, Ireland, Sweden and the UK. In the remaining member states that have reported switching data, the rate for large industrial users ranged between about 10 - 35 per cent. Despite the variation, the evidence indicates a significant level of switching activity by large users of electricity. However, the rate of switching is very low among small commercial and household 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 introduced only recently. A similar trend is observable in the

gas industry too: in only two member states (Italy and the UK) was the rate of switching significant (35% to 50%) among large as well as small users.

4. Conclusions and policy implications

The theoretical and empirical literature on the quality of regulation 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. Although there are variations in the findings about the extent of regulatory failure, these variations are about the degree of regulatory failure - and not about whether failure 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 failure highlighted in work on other cases. On the positive side, we have established that the co-existence of EU- and national-level legislation and regulatory bodies is a necessary but not a sufficient condition for reducing the risk of regulatory failure. In addition, we have established that there is scope for the diffusion of best regulatory practice through the coordination and cooperation activities of the EU-level regulatory bodies such as ERG and ERGEG.

On the negative side, however, we have identified a large number of *ex ante* and *ex post* indicators that suggest that the emerging European regulatory regime is less than optimal. The *ex ante* indicators of regulatory independence and competence suggest that NRAs are highly unequal across countries and that there is significant discrepancy between regulatory independence and competence 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, even though we do not have data for the telecommunications market. The *ex post* indicators demonstrate that, with the exception of national calls in the telecommunications sector, there is no statistically significant correlation between indictors of regulatory independence/competence on the one hand and the level of market opening or prices on the other. This lack of correlation suggests that the independence/competence of NRAs is not commensurate with the level of market opening at the national level. Therefore, and not surprisingly, the independence/competence of NRAs is not a good predictor of the price level or degree of competition in member states. 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.

One policy implication that can be derived from the analysis above is that it is necessary to invoke competition rules against anti-competitive behaviour by firms and against member states that fail to transpose EU regulations and directives into national legislation – especially in the gas and electricity markets. There are signs indicating movement in that direction. In its network industries evaluation report for 2006, the Commission reports that it has taken 16 actions against member states/firms in the gas and electricity sectors (EU Commission, 2007a). This is a small number but it signals to the possibility of increased future activism, which may help address the deficiencies of the national regulatory regimes. Yet it must be viewed against the background of two adverse tendencies. First, the level of national mergers and take-overs (70% of aggregate value and 75% of total numbers) that may *reduce* the contestability of the national markets has been much higher than that of cross-border mergers and take-overs (30% and 25%, respectively) that may *increase* the contestability of national markets. Secondly, the rate of prohibiting mergers on competition grounds has been quite low – only 0.5% between 1995-2005 (EU Commission, 2007a: 51-54).

The other policy implication is related to the first and points to the need to increase the powers of EU-level regulators such as ERG and ERGEG. Indeed, the Commission has made a move in that direction by adopting on 19 September 2007 a third package of legislative proposals, which provides, inter alia, for the establishment of a new Agency for the Cooperation of National Energy Regulators (ACER). The package was approved by the European Parliament on 19 September 2007 and the Council adopted a common position on 9 January 2009, with a view to endorse the package by December 2009. Under the new package, ACER will be funded from the EU budget and will have the power to take binding decisions – unlike ERGEG which acts mainly as a platform for voluntary coordination based on the principle of 'comply or explain'. The European Commission also put forward similar proposals for telecommunications regulation in November 2007, but these proposals have not yet been discussed or approved by the European Parliament or the Council. Given these developments, it can be conjectured that the increase in the competence and independence of the EU-level regulator may reduce the risks of regulatory failures examined above. However, in the electricity and gas sectors, it will take a long time for the European Commission and the member states to strike a bargain about the specific powers of ACER and how much of the NRAs' powers should be transferred to it. It will take an even longer time to observe any change in the telecommunications sector.

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Tables

Table 1: Minimising transaction costs through regulatory design

Sources of transaction costs	Adverse effects	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 induces the firm to under-invest in specific assets in period 1 and chooses inefficient technology to manipulate the regulator's beliefs about its performance in period 2.	• Create independent regulatory bodies to improve commitment; • 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 complementary; 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.
Politicians tend to maximise welfare of median voter 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.
Regulators strike side contracts with regulated firms with a view to share 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 Martimort (1999: 22).

Table 2: Indicators of regulatory independence (IND) and competence (COMP) - 2003

	NRAs in Electricity		NRAs in Gas		NRAs in Telecomms.	
	IND	**COMP**	**IND**	**COMP**	**IND**	**COMP**
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.

Regulatory independence (IND): simple average of scores (between 0 and 1) for budgetary allowance, number of personnel weighted by population, and extent of power sharing with governmental bodies
Regulatory competence (COMP): simple average of scores (between 0 and 1) for regulation of prices for different types of consumers and network users, conditions of access to the network, and quality of service

Table 3: Price transparency indices derived from NRA responses for gas and electricity - 2005

	C1	C2	C3	C4	C5	C6	C7	Transparency Index Average
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 Average	**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 to 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?

Table 4: Network industry price indices: EU-15 average prices; 1997 = 100

	1997	1998	1999	2000	2001	2002	2003	2004	2005
Telecommunications Price Indices 1997=100 (Euro per 10 min call)									
Local calls price index: EU-15	100.0	107.0	105.4	104.3	105.9	102.0	102.5	100.5	97.1
National calls price index EU 15	100.0	82.8	69.0	53.8	40.7	36.9	35.7	31.1	29.2
Electricity prices indices 1997=100 (Euro per kWh)									
Electricity household price index	100.0	99.0	97.1	95.9	96.9	98.0	101.3	102.9	105.1
Electricity industrial price index	100.0	98.0	95.2	94.2	94.5	94.9	102.1	98.5	105.5
Gas prices indices 1997=100 (Euro per Gigajoule)									
Gas household price index	100.0	101.4	95.0	102.9	127.9	121.7	123.4	121.1	133.8
Gas industrial price index	100.0	96.3	82.1	103.3	152.2	134.6	137.8	133.7	152.3
HICP, EU 15, 1997=100	**100.0**	**101.3**	**102.5**	**104.4**	**106.7**	**109.0**	**111.1**	**113.3**	**115.7**

Source: Eurostat (2).

Table 5: Correlation matrix for regulatory indicators in 2003 and relative price index (RPI) in 2005

RPI **Reg. Indicator**	Electricity: industrial users RPI	Electricity: households RPI	Gas: industrial users RPI	Gas: households RPI	Telecoms: local calls RPI	Telecoms: national calls RPI
Independence of Electricity Regulators	0.021 (0.019) N = 15	0.166 (0.146) N = 15				
Competence of Electricity Regulators	-0.04 (-0.009) N = 15	-0.147 (-0.163) N = 15				
Independence of Gas Regulators			0.075 (0.080) N = 12	-0.181 (-0.183) N = 13		
Competence of Gas Regulators			-0.154 (-0.164) N = 12	-0.117 (-0.139) N = 13		
Independence of Telecoms Regulators					0.095 (0.104) N = 15	-0.204 (-0.196) N = 14
Competence of Telecoms Regulators					-0.003 (-0.006) N = 15	-0.497* (-0.529)* N = 14

* = statistically significant at 10% level.
RPI = Retail price index, 1997 = 100.
N = Number of countries for which full data is available

Top entry: coefficients of correlation when price adjustment is the *difference* between RPI and HICP in 2005.
Bottom entry (in brackets): coefficients of correlation when price adjustment is the *ratio* of RPI to HICP in 2005.

Source: Eurostat(1) and Copenhagen Economics.

Table 6: Switching estimates - Electricity and (Gas)

	Large industrial users		Small commercial/domestic users	
	Since market opening	**During 2003**	**Since market opening**	**During 2003**
Austria	22% (9%)	7% (9%)	3% (0.5%)	1% (0.5%)
Belgium	35% (60%)	8% (n.a)	19% (4%)	19% (4%)
Denmark	50% (30%)	22% (3%)	5% (n.a)	5% (n.a)
Finland	50% (n.k)	16% (n.k)	n.k (n.k)	4% (n.k)
France	22% (25%)	n.k (5%)	n.a (n.a)	n.a (n.a)
Germany	35% (7%)	n.k (n.k.)	6% (<2%))	n.k (0%)
Greece	0% (n.k)	0% (n.k)	n.a (n.k)	n.a (n.k)
Ireland	50% (>50%)	6% (1%)	1% (n.a)	1% (n.a)
Italy	c.15% (30%)	n.k (n.k)	n.a (35%)	n.a (35%)
Luxembourg	10% (<5%)	n.k (n.k)	n.a (n.a)	n.a (n.a)
Netherlands	30% (30%)	n.k (n.k)	35% (2%)	n.k (n.k)
Portugal	9% (n.k)	7% (n.k)	1% (n.k)	1% (n.k)
Spain	18% (>50%)	5% (22%)	0% (5%)	0% (5%)
Sweden	50% (n.k)	5% (n.k)	n.k (n.a)	10% (n.a)
UK	50% (>50%)	n.k (19%)	50% (47%)	22% (13%)

Source: EU Commission (2005b: 5, 6)
n.a.: Not applicable
n.k. = No information