UNIVERSITÀ COMMERCIALE LUIGI BOCCONI

MILAN

Ph. D.
in
INTERNATIONAL LAW AND ECONOMICS

XXI Cycle
(2005-2008)

TRANSMISSION NETWORK UNBUNDLING AS AN INSTANCE OF THE "EUROPEANIZATION" PROCESS IN ENERGY INDUSTRIES. AN EMPIRICAL ANALYSIS

TUTOR:
Prof. Alberto BRUGNOLI

Ph.D. CANDIDATE:
Paolo NARDI
Matr. n. 1125640

To my family

Contents

List of Figures

PART I

PART II

PART III

List of Tables

PART I

PART II

PART III

Acknowledgments

At the end of this hard but fascinating journey, I would like to express my gratitude first of all to Prof. Alberto Brugnoli, who gave me this important opportunity.

Thanks to Prof. Garrone and Prof. Clifton, members of the Thesis Committee, for their final comments; to Prof. Senn for his guidance and Prof. Warleigh-Lack, who introduced me to public policy analysis and who taught me the passion for European studies; to Prof Iossa for her friendship during my visiting at Brunel University; to Prof. Pollitt, Prof. Thomas, dr. Fumagalli for their suggestions; many thanks also to the faculty and the staff of the University.

Very important persons: my friends, all of them, Giuliano, Carmine, Paola, Giorgio, Rob, Maurizio, Gabriele, Guido, Cristian, Daniele, Sergio, Andrea, Mirko, Lollo, Marco, Lorenzo, Stefano, Giovanni, Paolo, Ale and his family, Vale, Ila the greatest friend in so many hard circumstances we shared; obviously, Santo and all the other thousands and thousands of friends I have not mentioned here...

Thanks to my family who has been always supporting me in this adventure since I began four years ago. Thanks for your sacrifices and your help.

Preface

'Energy policy was a core area at the start of the European project.
We must now return it to centre stage.'
(Commission President José Manuel Barroso, January 2007)

The international political debate on energy and different supply solutions has been increasing for the last three decades. Two different reasons might be argued to explain it. On one hand the increasing consumption of energy all over the world; on the other hand, the emerging political and economic competitive advantage of those countries that export fuels or electricity. Basically,

> '[t]he most fundamental attribute of modern society is simply this: ours is a high energy civilization based largely on combustion of fossil fuels. […] [H]uman advances during the twentieth century were closely bound with an unprecedented rise of total energy consumption' (Smil, 2003:1-2)

This attention on the energy sector is reflected by the debate on different aspects of the electricity industry: electricity is not a primary source, but a convenient way to transport and to use energy. As a consequence, the world economic development is strictly related to electricity consumption.

The European Union (EU) polity started to give a renewed importance to energy, both electricity and gas, policy in its legislation since the '90s. It could be argued that the fundamental aim is a stronger integration of the many national markets into one single European electricity sector. Hence more internal competition and higher investments in infrastructure are supposed to emerge inside the EU, whilst a stronger bargaining power would characterize international relations with main extra-EU energy exporters (Kroes, 2006; 2007; Piebalgs, 2007). Not only competition, in fact, but also new issues including environmental sustainability in energy consumption and energy security have been politically debated for the very last years, as finally recalled in the COM(2007)1.

Thus, the proposal of the third package of reforms for the energy sector aims to achieve a stronger integration between markets, completing the process of Europeanization of the electricity sector. Three essential measures were suggested: the implementation of transmission network ownership unbundling, the creation of an Agency for regulation and the consolidation of cooperation between transmission system operators. Up to date, the third package has not yet come into force, as a second reading by the European Parliament is required.

The thesis, organized into three parts, has been inspired by this recent development of the European energy policy. It aims to offer an assessment of the process of Europeanization of the electricity sector; moreover, whether and to what extent it can be said to converge towards a single market, ruled by a common legal framework and led by common institutions.

To this extent, the first part of this thesis offers a review of scholars' debate on the concept of Europeanization, as a process of adaptation of national policies to the EU provisions. Albeit

Europeanization of electricity sector has been often analyzed by scholars, mainstream economics usually focuses on the harmonization of liberalization and competition of the markets (Pineau *et al.*, 2004; Levi-Faur, 2004; Glachant and Lévêque, 2006); scholars do not agree whether an impact of the EU polity on national policies might be recognized and rather suggest the emergence of a clustered convergence among MS (Börzel, 2002; Börzel and Risse, 2003). The original contribution of this first part consists of providing an assessment of the level of Europeanization including more than competition policies, namely environmental sustainability and energy security. Henceforth the research questions concern the effective similarities and differences emerging among MS in the electricity sector *latu sensu*: competition, environmental sustainability and supply security. As a consequence, the method of cluster analysis better fits with the aims of the research in order to study data and identifying groups of similar MS.

Clarified the concept of Europeanization and emerged differences among MS, transmission network unbundling has been proposed as an example of the process of harmonization of national policies by the European Commission. After functional and legal unbundling, in the previous directives, transmission network ownership unbundling is one of the main points of the third package of reforms in order to strengthen the process of integration of markets. The second part firstly introduces the economic rationale behind the suggestion of ownership unbundling in the network industry. In a nutshell, models argue any investment in the grid shows a pro-competitive effect, stimulating new entrants in the market (Léautier, 2001, Alesina *et al.*, 2005; Arellano and Serra 2008); consequently, there is no incentive for vertically integrated incumbent to invest in new capacity and quality of the grid, because of a clear conflict of interest; hence, network ownership unbundling is suggested as the only structural solution to this conflict of interest of incumbents (Léautier, 2001; Alesina *et al.*, 2005;). Albeit some evidence in support of the positive relationship between unbundling and competition has been brought, the net effect on the welfare is ambiguous (Baarsma *et al.*, 2007; Brunekreeft, 2008; Pollitt, 2008). In particular the effect on the transmission network has been generally neglected by scholars (Pollitt, 2008), notwithstanding the important role of the network in the electricity supply. Thus the second part of the thesis aims to assess whether and to what extent it is possible to identify any relationship between the implementation of unbundling measures, functional, legal or ownership, and investments in the grid, quantified as improvements of physical and quality characteristics of the network.

Besides, ownership unbundling proposed in the third package and the negative reactions opposed by some MS have shown that there are not only economic reasons, but also geopolitical issues which foster political and scientific debates. These dynamics clearly emerged in the documents, reports, interviews and comments during the decision-making process of the third package, namely for the

opposition of some MS led by France and Germany. The third part of the thesis completes the evaluation of the transmission network unbundling as an instance of the process of Europeanization. It proposes a policy analysis trying to put in evidence rationales behind positions of main actors (European Commission, MS and Utilities); models are proposed as interpretative keys, and afterwards they are assessed on the base of official documents, comments, speeches.

Conclusions summarize the main results on the process of Europeanization and the transmission network unbundling as an instance of this process; some policy implications are pointed out.

References

Alesina, A., Ardagna, S., Nicoletti, G. and Schiantarelli, F. (2005) Regulation And Investment. Journal of the European Economic Association 3 (4) 791-825.

Arellano, M.S. and Serra, P. (2008) The competitive role of the transmission system on price-regulated power industries. Energy Economics 30 (4) 1568-1576

Baarsma, B., de Nooij, M., Koster, W. and van der Weijden, C. (2007) Divide and rule. The economic and legal implications of the proposed ownership unbundling of distribution and supply companies in the Dutch electricity sector. Energy Policy 35 (3) 1785-1794

Börzel, Tanja (2002) States and Regions in the European Union. Institutional Adaptation in Germany and Spain. Cambridge: Cambridge University Press

Börzel, Tanja and Risse, Thomas (2003) Conceptualizing the Domestic impact of Europe. Chapter 3 in Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Brunekreeft, Gert (2008) Ownership Unbundling in Electricity Markets. A Social Cost Benefit Analysis of the German TSO's. EPRG Discussion Paper 08-15, University of Cambridge

Glachant, Jean-Michel and Lévêque, François (2006) Electricity Internal Market in the European Union: What to do Next? CWPE 0623 and EPRG 0605

Kroes, Neelie (2006) Speech 648, available at http://europa.eu/rapid/pressReleasesAction.do ?reference=SPEECH/06/648&format=HTML&aged=0&language= EN&guiLanguage=en

Kroes, Neelie (2007) Speech 63, available at http://europa.eu/rapid/pressReleasesAction.do ?reference=SPEECH/07/63&format=HTML&aged=0&language=EN&guiLanguage=en

Léautier, Thomas-Olivier (2001) Transmission Constraints and Imperfect Markets for Power. Journal of Regulatory Economics 19 (1) 27-54

Levi-Faur, David (2004) On the "Net Impact" of Europeanization. The EU's Telecoms and Electricity Regimes Between the Global and the National. Comparative Political Studies 37 (1) 3-29

Pineau, P.O., Hira, A., and Froschauer, K. (2004) Measuring international electricity integration: a comparative study of the power systems under the Nordic Council, MERCOSUR, and NAFTA. Energy Policy 32 (13) 1457-1475

Piebalgs, Andris (2007) Speech 586, available at http://europa.eu/rapid/pressReleasesAction.do ?reference=SPEECH/07/586&format=HTML&aged=0&language=EN&guiLanguage=en

Pollitt, Michael G. (2008) The arguments for and against ownership unbundling of energy transmission networks. Energy Policy 36 (2) 704-713

Smil, Vaclav (2003) Energy at the Crossroads: global perspectives and uncertainties. London and Cambridge (MA): The MIT Press

PART I

How "Europeanized" are the European Electricity Industries?
A Cross-country Analysis of Markets and Policies

1. Introduction

The recently increased attention paid to energy in European legislation, in terms of higher competitiveness and integration of markets, stronger supply security, environmental sustainability, gives an incentive to assess whether and to what extent it is possible to identify an impact of the EU polity on the Members States' (MS) electricity policies and markets, in terms of convergence and integration among them. Many scholars already studied these dynamics in both the electricity sector and in many other sectors, including social policies, telecommunications, or trade in goods: this stream of literature recognizes a sort of 'quixotic' situation, where there is no clear evidence on the degree of Europeanization (o Communitarization), unless a single sector or country is observed. Based on these findings, this work aims to provide a complete overview of the level of Europeanization of the electricity sector, in order to evaluate to what extent it is a process of convergence or not. The research is based on a set of variables supposed to be impacted by EU policies, including not only competition of national markets, as usual, but also other aspects of the EU directives. Hence, the method of cluster analysis allows better identifying similarities and differences among MS. Furthermore, this method shows clearly which and how many groups MS can be divided into, according with their adherence to the EU pace of reform.

Firstly, the paper will focus on the different concepts of Europeanization as defined in the literature so far, in order to apply it to the current work about the electricity sector (section 2). Section 3 will analyse what EU polity has done and does concerning electricity policy. The scholars' point of view is introduced in section 4. Research questions and selected indicators for the analysis have been explained in section 5. The cluster analysis and the steps of this statistical technique follow; afterwards, findings will be assessed and commented in section 7. Finally, a conclusion on the policy implications for the EU and the MS will follow, aiming to identify those obstacles to the process of Europeanization of the electricity sector (section 8).

2. Europeanization v. Convergence: definitions

There is a very wide literature on Europeanization, both in general political studies and in sector-specific terms, showing different approaches to this topic (Schmidt, 2002; Feartherstone and Radaelli, 2003; Bache, 2006). Hence, it is clearly understandable why Olsen argues about the existence of 'many faces of Europeanization' which contribute to clarify its general meaning (Olsen, 2002). He underlines that all the different definitions are only partial aspects of a single

wider phenomenon: they are complementary elements and do not exclude one another. It is possible to distinguish different concepts of Europeanization (Olsen, 2002: 923-924). Among them, he lists:

- the system of '[c]hanges in external boundaries', referring to Europeanization as the political process of involvement of new countries in the process of political integration;
- the capacity to have an impact on countries out of the EU, '[e]xporting forms of political organization';
- according to the past European studies, the description of Europeanization as a bottom-up process in which MS are involved in the creation of effective institutions at the EU level. This approach, known also as '"Europeification" […] or "Vergemeinschaftung" (communitarization)' (Börzel, 2002: 15; also Radaelli, 2003) represents one of the typical way in which relationship between MS and EU has been studied, above all in the first years of the European studies. In the electricity case, the power in regulation matters given to the Commission and the European level of Regulatory Bodies represents clearly this dynamic.
- Finally, Europeanization as the phenomenon of '[c]entral penetration of national systems of governance'

2.1. Europeanization of public policies

The definition of Europeanization this analysis will rely on concerns the Olsen's last mentioned approach which concerns the process of Europeanization of public policies. Olsen points out that the existence of the EU influences, of course, the national systems of governance, introducing EU institutions and norms in the national systems of decision-making and policy-making processes. Europeanization, in this last meaning, represents one of the elements of the new structures of governance (Multi-Level Governance) which is changing the national political systems based on government power: this tendency involves also the electricity sector, both policy and markets.

However, this definition still appears too wide. As Radaelli underlines, quoting Sartori (1970), 'conceptual analysis is a fundamental step in comparative political science' (Radaelli, 2003: 28); so Europeanization of public policy in a special way needs to be clear and specific in order to avoid confusion. In particular, he would like to preserve his work from three hypothetical errors due to an ambiguous definition: the first one recalls the literature on the general variety of meanings of the word 'Europeanization', underlining the problem of a possible 'concept misformation' (2003: 28). After that, Radaelli suggests two further risks to be avoided. Boundaries of a concept have to be clear, trying to fix the limits in term of its both intension and extension, avoiding the 'conceptual stretching' (2003: 31): this work will focus clearly only on the electricity market; consequently it will be possible to analyze more properties, including i.e. the involved actors and the aspects of regulation. Finally, to complete his arguments, Radaelli warns against the risk of 'degreeism',

consisting in evaluating the analyzed aspects as Europeanized at 'a certain degree' (2003: 31), leaving rather uncertain and confused when it can be considered not Europeanized. The result of his approach is the following definition of Europeanization, intended as:

> '[All those] 'processes of (a) construction, (b) diffusion, (c) institutionalization of formal and informal rules, procedures, policy paradigms, styles, 'way of doing things', and shared beliefs and norms which are first defined and consolidated in the making of EU public policy and politics and then incorporated in the logic of domestic discourse, identities, political structures, and public policies' (Radaelli, 2003: 30).

This definition, deepening Olsen's last analyzed one, proposes some more steps in shaping the concept of Europeanization for electricity policy:

- Europeanization as a top-down process, influencing MS;
- Complexity of this process, presenting different elements, even informal or implicit ('way of doing things');
- A clear taxonomy of areas of impacts, including public policies.

Summarizing, Europeanization is a multiple concept, widely deepened by European and Comparative studies; among the five categories Olsen suggests (2002), two of them have been studied more in literature: (a) Europeanization as a bottom-up process, consisting in the creation of EU institutions and in the shift of power from national Governments to them, and (b) Europeanization as a top-down process, with scholars underlining and studying whether and to what extent EU influences MS governance, including public policy-making processes.

2.2. Downloading and uploading dynamics

Börzel underlines that this last approach has been increasing during the last years in the studies of many scholars and she provides a wide review of the most relevant scholars' studies on the various areas of national policy which present this impact (2002: 16). The process bringing EU and MS in influencing national policies can be considered a two-way process as well. The following step after the definition of Europeanization as a top-down dynamic is the emergence in this relationship of two opposite streams of influence, both downloading EU policies and uploading national ones at the EU level (Börzel, 2002; 2005).

The result, as again Börzel points out, (2005) is a set of three possible strategies:

- Pace-setting: this is the position of those countries which try to upload their policies. They have to face all the other competitors trying to uploading their own policy, or, at least, in most part. The UK, for instance, is an interesting example of pace-setter in up-loading its policy of liberalization of electricity sector, facing the strong opposition of countries, including France or Germany, with a completely different regulation.

- Foot-draggers are the ‘mirror image’ of the previous: these countries try to stop or, at least, contain the attempts by other MS to upload their policies at the EU level, in favour of the status quo or their own policies.
- Fence-sitting is the intermediate position of those countries which do not have a clear position, usually because either they do not give any value to or miscalculate the topic; in this same category there are those countries with no action capacity to lobby EU bureaucracy and forcing it to adopt their own policies.

As Börzel states, these positions belong at the same time to many countries, because sector-specific: thus, if Italy has been considered as a foot-dragger with Portugal, Greece, Spain, Ireland in the environmental policy (2005: 170), in the electricity policy its position, as explained below, is rather as fence-sitter. Anyway, when a country succeeds in uploading its policy at the EU level, at the end of the process all the others have to download it, assuming the position either of foot-draggers or fence-sitting.

In the policy uploading process, MS influences EU to adopt its own particular legislation, in order to maximize benefits and minimize costs of adaptation to the European policy (Börzel, 2005). The reason is evident: the more a EU policy fits domestic policy, the more is cheap to implement it, because it is not necessary to change the internal legislation; at the same time, particularly in high-regulated countries, this process represents a way of safeguard of internal industry, because other countries are compelled to apply the same standards of regulation to their industries. A clear internal policy represents a necessary condition in order to a successfully lobbying at the EU level; but it is not enough if the MS has not the right capacity to put in action its preferences and force the EU polity to accept and ‘Europeanize’ them in front of the other MS (Börzel, 2005: 165). A risk of asymmetry then arises. These requested conditions make evident why highly industrialized countries prefer to upload and usually succeed in their strategy; on the contrary, latecomers in industrialization need to download EU policies, because they have neither a regulation nor the sufficient bargaining power to oppose it.

The process of policy downloading, depending on the single MS, explains why Europeanization is not possible to be considered as an automatic convergence process, but it helps to justify the existing divergence between countries. There are conditions encouraging or preventing policy downloading (Börzel and Risse, 2003): it is necessary, even if not sufficient, what scholars call ‘adaptional pressure’ (Radaelli, 2003; Börzel and Risse, 2003) or ‘goodness of fit’ (Risse et al., 2001 in Börzel and Risse, 2003) or ‘mismatch’ (Héritier et al., 1996 in Börzel and Risse, 2003), or, eventually, ‘misfit’ (Duina, 1999 in Börzel and Risse, 2003) between European and national legislation. The most part of them argues that this two variables are in a direct proportion, so that

the higher are the differences between them, the higher is this pressure to adaptation; to some extent, as Radaelli asserts, it could be more precisely considered as a curvilinear proportion. Too low levels of compatibility between them could make easier for the MS not to adapt and to oppose (inertia state), as well as a high level of compatibility makes pointless any effort towards a stronger integration; any intermediate level between the minimum and maximum of compatibility are in positive relationship with a level of adaptional pressure (2003: 45). Scholars, on this very point, suggest even a scale of possible strategies which MS can afford; even if with different concepts, they generally converge in five of them, including: retrenchment; inertia; absorption; accommodation; transformation (Radaelli, 2003; Börzel and Risse, 2003).

2.3. Factors influencing the process of Europeanization

There are different theories trying to explain how Europeanization has an impact on domestic policies; each of them underlines those conditions, whose presence is sufficient to encourage the downloading. It is possible to distinguish among two historical general theories: one explaining Europeanization as a process of redistribution of resources, the other as a process of socialization and learning at the level of institutions (Börzel, 2002; Börzel and Risse, 2003).

The former theory underlines that one of the reasons stimulating MS to accept Europeanization is that this process takes to a redistribution of power among national actors, weakening some of them and strengthening many others, 'reshuffling power' domestically (Kohler-Koch and Eising, 1999). If there is not a strong power of veto in the hands of one of the actors, this dynamic is generally verified: above all among scholars following the Multi-Level Governance approach, this theory is widely considered positively. The latter approach underlines that institutions are not only moved by economic or profit-oriented reasons, but also by ideological and symbolic ones. Consequently, Europeanization is determined by the internalization of the meanings and culture at the domestic level, so that the concrete aspects of policies follow. Europeanization becomes a value shared by MS, so that they are 'morally' compelled to adapt their policies to the EU decisions.

The 'third way' suggested by Börzel (2002) in her 'Institution Dependency Model' seems to provide one more element helping in understanding Europeanization: she asserts that even if the two previous approaches are not wrong, they do not explain properly why Europeanization produce different impacts on MS. She asserts that 'the extent to which Europeanization changes the institutions of the member states depends on those very institutions' (2002: 2). Of course, Europeanization does not happen in a vacuum, but there are both external (to the EU and MS) and internal (to the MS) factors: institutions, including state-owned enterprises or trade unions played a strong role in the Europeanization process.

What emerges from this last model is that 'Europeanization does not necessarily equate with convergence' (Anderson, 2002: 797): many scholars underline this point, with a general symmetry of arguments. Mény *et al.* (1996) recognize convergence in terms of:

- Emergence of a single European political agenda shared by MS;
- Similar forms of interest representation;
- Similar operational models implemented by the involved actors.

In this sense, Mény *et al.* admit a sort of convergence, but at the same time they exclude that Europeanization equate with harmonization: in conclusion, they seem to confirm that convergence is not the same concept of Europeanization, but it could be considered as its own consequence (Feartherstone and Radaelli, 2003), even if not automatic.

2.4. Synthesis: defining Europeanization

Summarizing, Europeanization is a process of interaction between institutions which aims to an integration between policies, regulation and models of industrial organization. As such it can determine a policy convergence, in terms of goals and outcomes, processes and institutions, but this is not an automatic phenomenon; furthermore, this political process is not a one-way process, on the contrary, it includes both uploading and downloading phases. Consequently, it could be argued that Europeanization's impacts have been very different (Schmidt, 2002; Van den Hoven and Froschauer, 2004), according to the involved sector and the country[1].

The differences in the same sector among MS will be one of the main points emerging in this work: MS data show how Europeanization can noticeably vary both as process and as consequences. In this sense, the 'Institution Dependency Model' offers an interesting interpretation of what happens in the electricity sector: the 'consensual model' on one side against the 'Westminster model' of State and governance on the other side (Zeff and Pirro, 2001; Giuliani in Feartherstone and Radaelli, 2003). The interesting aspect of this dichotomy is that Europeanization does not generate one convergence, but a 'clustered convergence' (Börzel, 2002), that is convergence at different paces by different clusters of countries. Those MS which face similar pressures for adaptation will belong to the same cluster. This work, assuming this concept of Europeanization, will try to show how, in the case of the electricity sector, this complexity appears.

[1] Scholars have been underlining various levels of convergence in, for example: telecom (Gerardin and Luff, 2004; Harcourt in Feartherstone and Radaelli, 2003); social policy (Sykes and Alcock, 1998); economy and monetarian (Barrell, 1992); development and cohesion (Leonardi, 1995)

3. European electricity sector: a policy review

Energy has been perceived since the beginning of the experience of the Common Market in Europe as an important aspect; in the same decade of the birth of the European Coal and Steel Community (ECSC) and the European Atomic Energy Community (EURATOM), the six founders declared that:

> '[p]utting more abundant energy at a cheaper price at the disposal of the European economies constitutes a fundamental element of economic progress. That is why all arrangements should be made to develop sufficient exchanges of gas and electric power capable of increasing the profitability of investments and reducing the supply costs. Studies will be undertaken of methods to coordinate development prospects for the production and consumption of energy, and to draw up general guidelines for an overall policy' (The Messina Declaration, 1955).

After more than 50 years, the Treaty, as in the consolidated version[2] as of 9-5-2008, mentions among EU (shared) competences: energy (art. 4.2.i) and trans-European networks (art. 4.2.h). Provisions on services of general interest also concern electricity, as articles 14 and 106 state. The former stipulates that « […] the Union and the Member States, each within their respective powers and within the scope of application of the Treaties, shall take care that such services operate on the basis of principles and conditions, particularly economic and financial conditions, which enable them to fulfil their missions». The latter recalls «the rules on competition» and the role of the Commission which «shall ensure the application of the provisions of this Article and shall, where necessary, address appropriate directives or decisions to Member States».

Moreover, EU legislation on energy developed through a wide number of Green and White Papers, Communications from the European Commission, but, above all through the adoption of directives whose analysis needs two *caveats*: electricity is part of energy policy, so not always it is possible to distinguish its legislation from gas; this work will focus only on those pieces of legislation which have a direct relevance on the electricity sector.

3.1. First and second packages of reforms of the energy sector

EU energy policy apparently starts with ECSC (1952) and EURATOM (1957), but their impact did not determine any proper integration of electricity policy; on the contrary, if ECSC helped the integration of market of coal, EURATOM was prevalently related to defensive and military aspects. Thus, only after oil crisis in 1973-1974, which brought to the creation of the International Energy Agency (IEA) at the international level, the need of a stronger energy policy became evident (Matlàry, 1997).

[2] Relevant articles 4, 14, 93, 106 and 107 are in appendix 1

The first step towards an 'Energy Policy for Europe[3]' was, in fact, the Single European Act in 1985: it became clear that a stronger integration of markets needed first of all the integration of energy market, being energy one of the most important factors of production. Consequently, if the integration of the internal energy market was the aim, liberalization of energy was the method: EU legislation began to concentrate on liberalization with the directive 96/92/EC («to speed up liberalization», Preamble, [3]). Its contents were consolidated and reviewed with the directive 2003/54/EC: there are two fundamental previsions, regarding, respectively, demand and supply:

- The partial liberalization of market, in order to make customers free to choose their provider: article 21.1 concerns both the market opening and the corresponding eligible customers. From the first directive in 1996 to July 1st 2004, step by step the thresholds in electricity consumption identifying eligible customers became lower and lower (according to the national legislation); in any case from that date, at the latest, all non-household customers were to be able to choose their provider; from July 1st 2007, liberalization should have had to involve household customers too.
- In the Preamble [8] a new measure was introduced, that is the unbundling of distribution and transmission network operation from generation or retail of electricity in vertically integrated firms; EU requested at least a legal and managerial independence of those entities, not necessarily the separation of the ownership of assets (from art.10 to 15). The aim of these directives was the introduction of the principle of the Third Party Access to transmission and distribution networks, when they are owned by one of the competitors, leading to its *de facto* autonomy (art.20).

A third general prevision in the EU directive was the creation of Regulatory Authorities as «competent, [...] wholly independent [entities] [...] responsible for ensuring non-discrimination, effective competition and the efficient functioning of the market» (art.23). The connected Regulation 1228/03 aimed to clarify the necessity of «fair rules for cross-border exchanges in electricity» (art.1), trying to give some incentives to increase the trade in electricity among MS.

3.2. Environmental issues

During the same years, a new issue emerged at the international level: the protection of environment against pollution and the phenomenon of the Climate Change. Important steps were the Montreal Protocol (1987), the Rio Declaration (1992) and the well known Kyoto Protocol (1997) warning against the possible collapse of the planet ecosystem. EU environmental policy, inevitably, influenced electricity sector, because of the strong relations between the two: a new directive,

[3] As COM(2007)1 calls it

2001/77/EC, was approved, promoting the shift towards renewable sources in the generation of electricity, according with « national indicative targets […] consistent with the global indicative target of 12% of gross national energy consumption by 2010 and in particular with the 22,1% indicative share of electricity produced from renewable energy sources in total Community electricity consumption by 2010», as art. 3.4 states. Two years later the EU greenhouse gas emission trade scheme was approved and put into force as of 2005, aiming to adopt and transfer Kyoto Protocol goals into a European system of environmental policy (directive 2003/87/EC, amended with the 2004/101/EC). Since then, many other interventions, usually in the form of Communication of the Commission, have been strengthening these provisions, including COM(2004)366, COM(2006)848 and, more recently, SEC(2007)12. They inevitably involved the electricity sector in terms of both its technology and its consumption all over the EU. This last point seems to be important, because one of the parallel strategies followed by the EU in its environmental policy has been the promotion of the energy efficiency: improving the technology in the electricity generation and saving energy reducing its consumption are seen as fundamental and successful strategies in order to have less pollution, as the COM(2000)247, COM(2006)545 and SEC(2006)1173 assert.

3.3. Energy security

If, at first, the integration of energy sectors was part of the method followed for the integration of markets, during the last years, a new issue emerged: integration is vain unless EU insures energy supply and safeguards it. In this sense, after the COM(2005)265, usually known as 'Doing more with less' about energy saving, a new directive was approved, the 2005/89/EC: nonetheless, the problems involved with the security of supply, including the political relations with Russia, the bargaining power of the OPEC countries, the environment safeguard, have affected EU electricity policy, determining a new approach. As the 2005/89/EC, the following and more recent works of the EU polity related to the electricity sector seem to be more interested in suggesting goals than to focus on single sector policies. The COM(2006)105, SEC(2006)317, SEC(2007)12 provide an example of this approach of the EU polity.

3.4. Towards the third package of reforms

The COM(2007)1, 'An Energy Policy for Europe', sums up all those previous interventions and offered an essential content for the EU Council in April 2007 and in the related Council declaration 7224-07. The former can be considered as a document which tries to summarize the principal current key issues on energy, including obviously electricity, and the new challenges for the EU. Three pillars have been identified, strictly connected with the content of the previous directives.

First one is sustainability: the demand of energy, energy consumption, is incontrovertibly destined to increase and it will affect the growth of electricity generation. Sustainability matters with the capacity to provide energy so as to satisfy its demand and with doing so with an environment-friendly technology. In this sense, the EU established as its goal to decrease MS levels of greenhouse gas emissions by 20% by 2020 compared to the 1990 baseline. Secondly, but deeply related to the previous, security of energy supply issue concerns the important problem that MS growth of consumption requires increasing amount of primary sources which the EU has not in sufficient quantities: thus, more efficiency in supply and consumption and the development of alternative and, possibly, renewable sources have to be encouraged. Finally, competitiveness, in terms of affordable prices of electricity, as well as the quality and the universality of service, is suggested as third pillar of the Energy policy for the EU. This EU piece of legislation presents also an 'Action Plan' (paragraph 3) which, among the topic already seen previously, suggests four new areas of intervention, as instruments in order to face the challenges.

- Infrastructure: the EU underlines the importance of new investments in order to improve the cross border relations among MS and between MS and energy exporter countries;
- Research: MS are requested to sustain research in new technologies, new fuels, more efficient production systems; at the same time, some programs are promoted at the EU level, in order to help MS activity;
- A common foreign policy in energy, in order to have more bargaining power in trade with other countries;
- Tax level, which can lever and influence both the supply and the demand of electricity, stimulating efficiency and sustainability.

3.5. Europeanization of institutions

EU electricity policy can be intended also as the development of institutions (EU-ification) with a competence on electricity sector. So far, the leading role in the EU polity, concerning electricity, belongs to the Commission: in particular, not only the DG on Energy, but, as said above, Competition, Taxation and Customs Union, Research and Technology, and, finally, Environment are involved (Matlàry, 1997: 107). The increasing role of DG Competition in the frequent process of mergers and acquisitions among utilities implies a stronger role for the European Court of Justice (ECJ), often involved in order to strengthen or reject the decisions taken by the Commissioner for Competition (Matlàry, 1997). This role of 'Antitrust' played by the Commission and of Supreme Court by the ECJ represents another important aspect to be evaluated in the analysis of Europeanization, in particular regarding the infringement procedures against MS in electricity sector. Finally, another important institution is the European Regulators' Group for electricity and

gas, created by the directive 2003/796/EC: the ERGEG represents the first step in the integration of the MS regulators through a slow process of harmonization of standards and rules (Matlàry, 1997); it is not a supranational body, but international, a mere association of the national bodies, which, as stated in the COM(2007)1, will strengthen their cooperation in the forthcoming European Agency (ACER).

4. European electricity policy: a literature review

Trying to summarize in an essential review the wide literature analyzing EU policies and their impact on MS electricity markets, some general trends among scholars can be easily pointed out. As said previously, EU political project to integrate electricity markets has a reason: electricity, being an essential input in production, is strictly related to growth. If EU electricity policy making is a step towards electricity market integration, this latter is a step towards the full market integration:

> 'El-Agraa's (1989) conceptualizes regional trade and integration of markets as steps taken on a continuum towards full regional integration. We extend his insight to assess the steps that regions have taken to integrate key aspects (dimensions) of common electricity markets' (Pineau *et al.*, 2004: 1457).

Pineau *et al.*, trying to evaluate the impact of EU policies, assess the degree of Europeanization in three main areas:

- Infrastructural integration, considering the level of interconnection among countries;
- Regulatory integration, about the harmonization of regulatory bodies and standards;
- Commercial integration, including, above all, the Europeanization of suppliers (2004: 1458 and ff.).

All of them are important and worth to be singularly analyzed; this work will focus prevalently on the second one, according to the definition of Europeanization as an attempt to integrate policies. The first, quite important, cannot be summarized and analyzed in few lines. The increase of interconnection circuits and capacity anyway represents an important aspect, but this work will not focus on it. At the same time, the last one, commercial integration, has been deepened in several studies. It could be argued that there is a clear group of energy utilities characterized by a European dimension, including mainly EDF, RWE, E.ON, Vattenfall and ENEL; they operate in more than one national wholesale and retail markets, even if with a high different degree of market share, often not only in the EU area, but also at a global level (Glachant and Lévêque, 2006).

Notwithstanding this concept of Europeanization in terms of same players in different markets, scholars underline how the EU energy policy rather aims to the integration of the MS markets into one single 'Internal Energy Market', led and regulated by the EU polity (Eising and Jabko, 2001: 745). In this sense, scholars often criticize how Europeanization has been mainly characterized by a 'policy-led' dynamic, opposed to a 'market-led' approach (Pineau *et al.*, 2004: 1462): thus, while

the latter so far brought to a clear, autonomous, Europeanization of players, the former, as it will be explained, did not lead to an integration of markets by a convergence in policies. Finally, focusing on what Pineau *et al.* define 'regulatory integration', two main research questions emerge in literature:

- how to measure if EU policy affected MS electricity sectors?; and
- did EU policy affected MS electricity sectors and, if it did, to what extent?

4.1. How to evaluate Europeanization of electricity policies

Talking about the variables to evaluate Europeanization of the electricity sector in terms of regulation policies, literature is essentially focused on the process of liberalization of the MS electricity markets. Levi-Faur points out the link between the process of Europeanization and the spread of liberalization of markets, considering the former as control variable and the latter as the dependent one. Consequently, he underlines that 'if EU matters' (2004: 7), it should be evident from some emerging signals, among which the effects of liberalization come firstly: the ownership of utilities, promoting their privatization, and the regulation, which should be harmonized towards liberal policies. At the same time, in order to stress this relation and the complexity of the two variables, Levi-Faur underlines that Europeanization's impact should affect also other sectors which are necessarily linked to liberalization. Third signal is the opposition of at least some countries. Finally he argues that a general convergence among countries should emerge (Levi-Faur, 2004).

Not all the scholars identify a one-to-one relation between EU electricity policy and liberalization: as Héritier argues, Europeanization of electricity sector is the result of a sort of dichotomy between the integration of markets through the economic liberalization process and the safeguard of those elements of public service, as '[European legislation] has triggered concerns over the maintenance of general-interest goals in service provision' (Héritier, 2001: 826). The EU propensity towards competition policy and market liberalization has been faced by the traditional European welfare approach, less liberal than in the United States: in this sense, it could be rightly argued that Europeanization cannot be identified strictly with liberalization, on the contrary, EU legislation has been not highly specific, so that there has been not a proper coercion on MS (Schmidt, 2002).

More precisely, Vrolijik (2002) points out four variables in order to evaluate MS level of Europeanization, based on each MS market's level of:

- Unbundling of transmission;
- Ownership of utilities operating in the generation;
- Market opening;
- Generation mix and the level of renewable.

This approach, also considering the recent moves from the European Commission, appears more complete than a simple analysis of the liberalization degree of markets; this is the reason why this work will try to broaden the analysis to more variables generally not included in the previous assessments.

4.2. The level of Europeanization of electricity policies

Concerning the aspect of evaluating whether, and to what extent, there has been an impact of EU policies on MS industries, scholars recognize a quixotic situation. Some of them argue that the integration of electricity sector in the EU is working, even if it proceeds at different rates: Genoud and Finger suggest that probably with a less political path and more technical one, and a system of governance rather than government, convergence would have been more easily achieved (2002). Similarly, the concept of 'different rates' in the Europeanization of the electricity sector is quite spread in the literature: even when the general judgment on Europeanization is positive, this process is defined 'à la carte' by Eising and Jabko (2001: 745), because of both the wide-ranging legislation EU has been approving and the different ways MS used in implementing (or not) them properly. Negotiations have been cautious rather than 'in a pure give-and-take spirit' (Eising and Jabko, 2001: 762): the impact has been a 'patchwork', as defined by Börzel and Risse (in Feartherstone and Radaelli, 2003).

Some other scholars, deepening these last arguments, point out a completely negative perception of this process of Europeanization in the electricity sector. Arguing that, in general, energy does not automatically determine the integration among States, Hira and Amaya underline that

> 'In Europe, electricity integration is a result of a common dependency on sharing imported natural gas and other fuels and, more importantly, an important component of the overall process of integration. Thus, we see that *the nature of energy market integration depends on the interplay of resource endowments, the development of natural markets which create private entrepreneurs, and the motivations and design of national and regional institutions* [italic in the original]' (Hira and Amaya, 2003: 198).

Levi-Faur (2004) argues eventually that the current implemented reforms in the single electricity markets would have been the same and would have gained the same results even if EU polity did not exist: he justifies his conclusions comparing MS with other countries and regional polities where similar dynamics are occurring.

4.2.1. The role of globalization

There are several studies underlining that the process of Europeanization of electricity sector does not happen in a vacuum, and that, on the contrary, there have been several influences from the global context which challenged both EU as a whole and MS, in terms of historical events or international polities or treaties (i.e. Kyoto Protocol, as in Didden and D'haeseleer, 2003).

Unfortunately, this work cannot deepen properly this aspect, but it ought not to be ignored in order to understand eventually whether 'Europeanization [does] matter, and if so, to what extent and in what respects' (Levi-Faur, 2004: 3). Many scholars studied the international dynamics around the energy sector influencing national or regional electricity policies (Surrey, 1996). Comparative studies are developing this approach, focusing on regional polities, including SIEPAC, MERCOSUR, EU and NORDPOL (Hira and Amaya, 2003); Nordic Council, MERCOSUR and NAFTA (Pineau *et al.*, 2004); EU and NAFTA (Van den Hoven and Froschauer, 2004). These cases and the rationales behind the reforms of the national electricity sectors and the aim to integrate them have been deepened and it can be easily detected that there is no homogeneity among models. For instance, liberalization and integration did not start at first in the EU, but among Northern Europe countries. (Green, 2006).

4.3. Concluding remarks and research hypothesis

In conclusion, literature about the Europeanization of the electricity sector, often strictly focused on the process of liberalization and integration of the MS electricity markets, suggests this impact is negative: nevertheless a problem emerges, to which this work try to answer.

Liberalization policy is only one of the aspects of the EU policies related to the electricity sector: other areas must be considered, according to the wider range of areas last EU documents have included. Henceforth this work will put attention also to supply security issues and environmental sustainability of single MS markets. The research question is to assess, on the base of a wider spectrum of policies, whether MS electricity industries have converged towards a single EU model or a clustered convergence, as some scholars argue.

5. Methodology

In order to analyze the effective presence of a clustered convergence among the 25 MS electricity sectors, it has been decided to focus on the data available for 2005. It would probably be more complete to analyze the process of convergence during a decade, e.g. between 2000 and 2007, but it would have included only the EU15; at the same time a dynamic analysis including only 2005 and 2006 would have been incomplete and partial as well. The following analysis will try to identify the clusters existing in the EU in 2005, trying to provide a sort of picture of the MS in a precise moment.

5.1. Variables of the dataset

Following the steps of EU legislation on electricity sector, it has been decided to choose those variables which better could explain the behaviour of the MS in order to adapt to the three 'pillars' for the process of Europeanization, as emerged in the COM(2007)1:

1. Competitiveness: first of all, the concentration of the wholesale market has been considered; due to the incompleteness of data concerning the market share of the largest operator in each country, the level of concentration has been identified by the sum of the shares of the three largest generators and by the number of operators with a market share higher than 5%. Secondly, the prices for both the households and the large industrial consumers have been considered. The level of unbundling for the transmission and distribution system can contribute to show the level of adaptation to the EU provisions. Finally, beside the 'official' aspects of competition, the level perceived by customers has been considered, evaluating the phenomenon of switching for households, industrial customers and small and medium enterprises. Obviously the opening of electricity market, according to the national legislations, has been considered as well.

2. Improvement of the efficiency in order to achieve a stronger security of supply: good proxies have been considered, first of all, the level of energy dependency from foreign sources; at the same time the low concentration of the energy mix for the generation, measured with the Herfindahl-Hirschman Index (HHI), shows the attitude to rely on more than one or two sources. The degree of international openness of the electricity network, measured as the ratio of the sum of import and export flows of electricity to the internal consumption, expresses how the internal network is interconnected with other countries. Finally, the higher is the level of energy intensity of the industry, the higher is the electricity demand, and, consequently, the security of supply will be more important.

3. Environment friendly policies in order to guarantee a sustainable growth of consumptions: the ratio of electricity from renewable sources to the sum of both generated and consumed electricity. Also the level of Greenhouse gas emissions from energy industries has been considered.

A dataset has been elaborated, including 25 observations for each one of the 17 variables which summarize country-specific data on electricity as of 2005. The variables have been indicated in table 1, in alphabetical order, with their labels. Descriptive statistics are in Appendix 2.

Table 1: Elements of the dataset for the cluster analysis

Indicator	Definition	Source
C3	Market Share of the three largest operators	EUROSTAT
Dx_Unbund	Synthetic index measuring the level of unbundling of distribution network (1-6)	SEC(2005)1448
Ghg_percap	Greenhouse gas emissions from energy industry measured in tons per capita	EUROSTAT
HHI_Nrg_Mix	Herfindahl-Hirschman Index on concentration of primary sources in generation	EUROSTAT
Intl_Openness	Ratio of the sum of import and export to the total national consumption	EUROSTAT
Mkt_Opening	Degree of openness of the market, eligibility	SEC(2005)1448
Nrg_Intensity	Gross inland consumption of energy divided per GDP; kWh/€	EUROSTAT
Nrg_Dependency	Net flow of electricity to total inland consumption	EUROSTAT
Price_HH	Price for households, € per KWh, without taxes	EUROSTAT
Price_Ind	Price for industries cat. Ig, € per KWh, without taxes	EUROSTAT
Res_Consum	Renewable sources to the total national consumption (%)	EUROSTAT
Res_Gen	Renewable sources to the total national generation (%)	EUROSTAT
Share>5%	Number of companies with more than 5% of wholesale market	SEC(2005)1448
Switch_HH	Cumulative percentage of switching among households	SEC(2005)1448
Switch_L_Ind	Cumulative percentage of switching among large industrial customers	SEC(2005)1448
Switch_SME	Cumulative percentage of switching among small and medium enterprises	SEC(2005)1448
Tx_Unbund	Synthetic index measuring the level of unbundling of transmission network (1-6)	SEC(2005)1448

6. Cluster analysis

In this section the process of partition of the countries through the cluster analysis will be analyzed. The object of this technique is to partition a set of objects into groups or clusters so that the profiles of objects in the same cluster are very similar, whereas the profiles of objects in different cluster are quite distinct. Cluster analysis can be viewed as a data reduction technique: it reduces the number of several and different objects by creating groups of objects called clusters.

6.1. Identifications of factors

After examining the dataset and checking (multivariate) outliers are not included, the number of the original variables has been reduced into factors using a data reduction method (factor analysis). 5 factors have been chosen, in order to describe the clusters. The factors represent the 5 main tendencies of the observations according to the considered variables. These factors explain together the most part (80%) of the explained variance: in particular the factors explain respectively the 34%, 16%, 13%, 9% and 6% of the variance. To better understand the factors a varimax factor rotation has been introduced. The method minimizes the number of variables which have high correlations with a factor and the majority of loadings are forced to 0 or 1. Hence the factors are

very different among each other. Focusing on the factor loadings that exceed the 0.5, it is possible to identify 5 different factors, measured as follows:

Table 2: Rotated Factor Pattern for cluster analysis; values over |0.50| are shown.

Indicator	Factor1	Factor2	Factor3	Factor4	Factor5
Share>5%	0.89568	.	.	.	.
Switch_L_Ind	0.78982	.	.	.	.
Switch_HH	0.73517	.	.	.	.
Switch_SME	0.7039	.	.	.	.
Mkt_Opening	0.63035	.	.	.	.
HHI_Nrg_mix	-0.68582	.	.	.	.
C3	-0.91378	.	.	.	.
Price_HH	.	0.89204	.	.	.
Price_Ind	.	0.83702	.	.	.
Energy_Dependency	.	0.621	.	.	.
Nrg_Intensity	.	0.67527	.	.	.
Res_Gen	.	.	0.95415	.	.
Res_Consum	.	.	0.8933	.	.
Ghg_percap	.	.	-0.54185	.	-0.51528
Dx_Unbund	.	.	.	0.89934	.
Tx_Unbund	.	.	.	0.7817	.
Intl_Openness	.	.	.	.	0.82966

Afterwards, each factor has been given a name, trying to explain the level of information each provides. In particular, they are:

Factor 1 – Competition: it is mainly related to the number of companies with more than 5% of market share and to the market share of the largest 3 companies. Beside the effective competition, it is possible to distinguish the influence of the perceived competition, represented by the level of switching among operators by the different typologies of consumers (households, large industry and small and medium enterprises). Obviously switching depends on the market opening as of 2005, in each country. Competition in electricity market is also an indirect effect of the concentration of the energy mix used to generate electricity: the higher the HHI index is, the higher is the market power in the upstream industry.

Factor 2 – Sensitivity to (factors affecting) unsuitability of electricity: it includes those variables which to some extent affect the (in)convenience of consumption of electricity domestically and in the industry. When their values increase, a positive sensitivity emerges: the consumption of electricity in the country is supposed to be unsuitable and it would imply a special political attention to electricity policies (namely liberalization ad privatization).. Firstly, prices have obviously a

decisive role as they influence domestic and industrial demands. The degree of dependency from electricity imports matters too, because the higher is the dependency the more there is an incentive to decrease electricity consumption. Eventually, high energy intensity of the economy represents an element of inefficiency related to the sector: it means that energy as factor of production affect negatively the final costs, introducing an element of inefficiency.

Factor 3 - Environmental sustainability: it sums up the ratios of renewables to the production and consumption of electricity in each country; the level of greenhouse gas emissions per capita generated by the energy industry introduces the attitude to preserve environment and, consequently, to respect the international agreements at both EU and international level.

Factor 4 - Network unbundling: the levels of unbundling of both the transmission and distribution network have been jointed, giving a single index of the degree of unbundling of the electricity network in general, according to the evaluation of the EU Commission (Energy and Antitrust) in its annual Benchmarking Report on the process of integration.

Factor 5 - Optimality of electricity interconnections: the level of international interconnections among national grids firstly is influenced by geographical aspects. Nevertheless it has been difficult to explain and define this factor, even if it is mainly related to the degree of openness of the electricity system. In fact, it could be said that the energy intensity determines whether or not the current level of interconnections is adequate to the internal demand of electricity (determined by the energy intensity). Similarly, a high level of emissions can be argued to show that either import should be increased or export decreased, substituting internal generation.

Before deepening the values each cluster is characterized by, it should be underlined how, in general, all the groups show a negative value for the median, from the lowest one in the case of the environment sustainability (-0.29) to the unbundling factor, very close to zero (-0.01): a negative median imply a value lower than the mean, which suggests a rather negative level of adequacy of national characteristics to the European mean. Also the width of the range of values for each factor change, from the lowest (3.50), in the case of competition, to the environment sustainability (4.03) and optimality of interconnectivity (4.39): it would seem suggest that the difference between the lowest and the highest value of MS in the case of competition is lower than the other two cases.

6.2. Identification of clusters

Cluster analysis techniques follow two different approaches: the hierarchical and the partitioning. In the former the process proceeds sequentially yielding a nested arrangement of objects in groups; in hierarchical clustering the data are not partitioned into a particular cluster in a single step. In the latter, a series of partitions takes place, which may run from a single cluster containing all objects to *n* clusters, each one containing a single object. Two agglomerative hierarchical clusterings (Ward

and complete) which proceed by series of fusions of the *n* objects into groups will be used, so once an object is allocated to a group, it cannot be reallocated to another group.

Ward (1963) proposed a clustering procedure seeking to form the partitions P_n; P_{n-1}... P_1 in a way that minimizes the loss of associability within each group and quantifies that loss in a form that is interpretable. At each step in the analysis, the union of every possible cluster pair is considered and the two clusters whose fusion results in minimum increase in 'information loss' are combined. Information loss is defined by Ward in terms of an error sum-of-squares criterion. Thus Ward's method is a hierarchical method designed to optimize the minimum variance within clusters. Looking at the statistics[4] it is possible to identify 5 clusters.

It is preferable to compare it with the complete method in order to identify any difference. As in the previous methods, the statistical distance between the observations will be used, so that it is necessary to standardize the variables. In the complete linkage, also called farthest neighbour, the distance between groups is now defined as the distance between the most distant pair of objects, one from each group. Here the distance between every possible object pair (*i*, *j*) is computed, where object *i* is in cluster *r* and object *j* is in cluster *s* and the maximum value of these distances is said to be the distance between clusters *r* and *s*. In other terms, the distance between two clusters is given by the value of the longest link between the clusters. At each stage of hierarchical clustering, the clusters *r* and *s*, for which the distance *D(r, s)* is minimal, are merged. Looking at the statistics, 6 clusters have been selected.

After merging the results of the Ward's and the complete method, the clusters of the two different methods are described and represented and then compared, looking at the plot on the first and the second factors. Now the system plots the observations and colours, according them to the cluster the observations belong to.

In the Ward's method (fig. 1) the 5 clusters are overlap. The blue cluster has positive mean for each factor except for the second and the fifth. The countries are represented at the fourth quadrant of the plot, so these countries seem to be the best performers. The third quadrant shows the magenta cluster, which has strong negative mean value for each factor except for the fourth and fifth ones. The red cluster, at the top of the considered plot, is positive for the second and the fourth factors and negative for the third. The light blue cluster, in the middle of the plot, has low mean values for each factor. The green cluster seems to be the worst performer: the whole factors have great negative mean values. In the considered plot the countries are represented in the second and third quadrants.

[4] The statistics are Pseudo-F, Pseudo-t^2, Semipartial- R^2 and R^2. They are used to choose the number of the clusters, value the distance between clusters and monitor the obtained partitions.

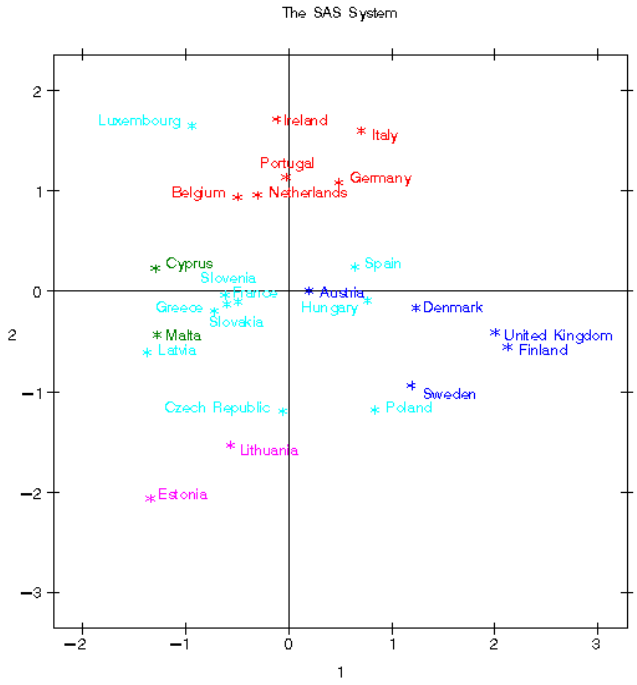

Figure 1: Ward's method; on the left axis values of the factor 2 are shown; at the bottom axis, factor 1

In the complete method (fig. 2) there are 6 overlapped clusters. The clusters blue, magenta and green are the same of the previous method. The red cluster is the same of the previous method, but includes also Luxemburg. Finally, the orange cluster is composed by a single observation: Latvia, which is in the third quadrant. This country is very different from the other clusters: it has a highly positive mean value for the third factor and negative mean value for the first and second.

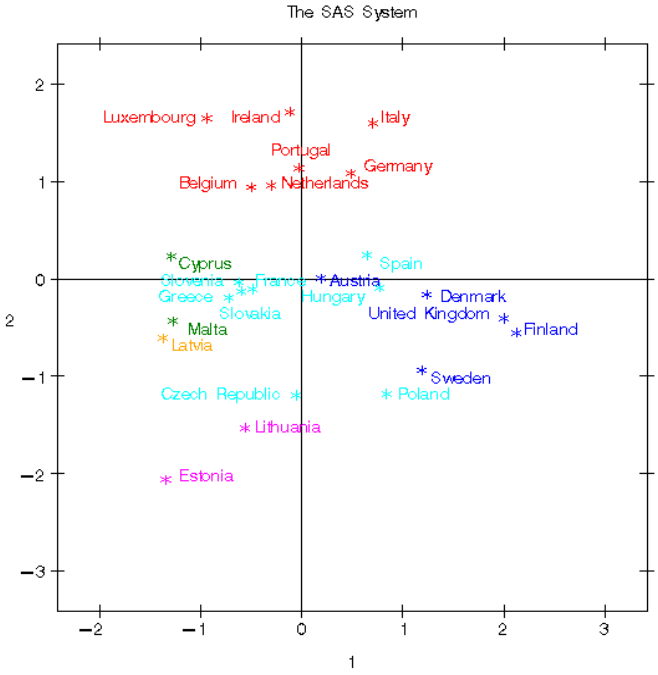

Figure 2: complete method; on the left axis values of the factor 2 are shown; at the bottom axis, factor 1

The graphical comparison (fig. 3) between the different hierarchical methods confirms the stability of the clusters, except for two observations. Luxembourg and Latvia are weakly bounded to the clusters (border problems).

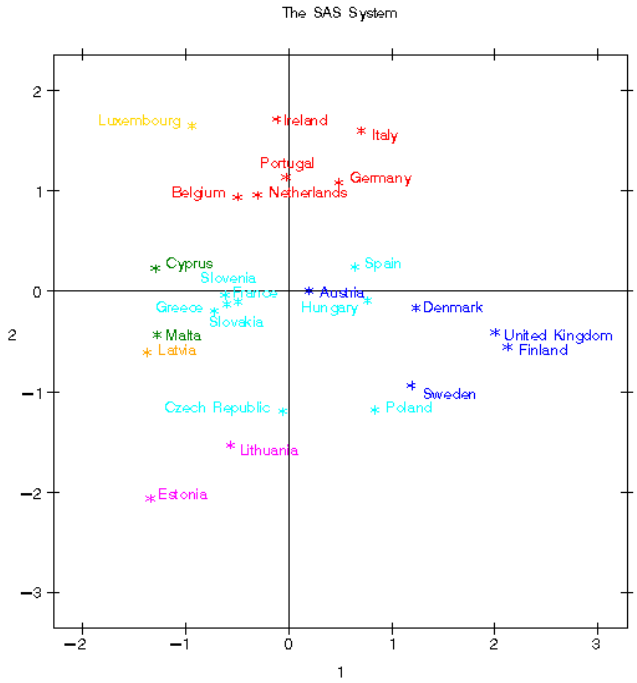

Figure 3: the comparison between Ward's and complete method; on the left axis values of the factor 2 are shown; at the bottom axis, factor 1

The partitional clustering techniques produce a single partition of the data, not a structure like a dendrogram. These techniques move from a user-defined clustering, then optimize the clustering according to some validity measurement by iterations. Partitional algorithms are good because they are easily implementable and very efficient. A disadvantage is that the user must choose *ex ante* how many clusters exactly are desired. Furthermore, the final results can vary depending upon the initial clustering. Thus, it may be desirable to run the algorithm several times with a different initial setup and choose the best resulting partition. The best partition is composed by 7 clusters. As the previous methods the variables are standardized because they may be expressed with different units of measurement and so they may influence the results: the statistical distance is considered. The procedure returns, after 3 iterations, the initial seed of the centroids which are chosen randomly and the minimum distance between the initial seed is 5.88. This procedure returns overlapped clusters and the maximum distance from the seed to the observations is greater than the distance between the centroids. The different clusters are showed below, with a graphical plot on the first and second factors as example (fig. 4).

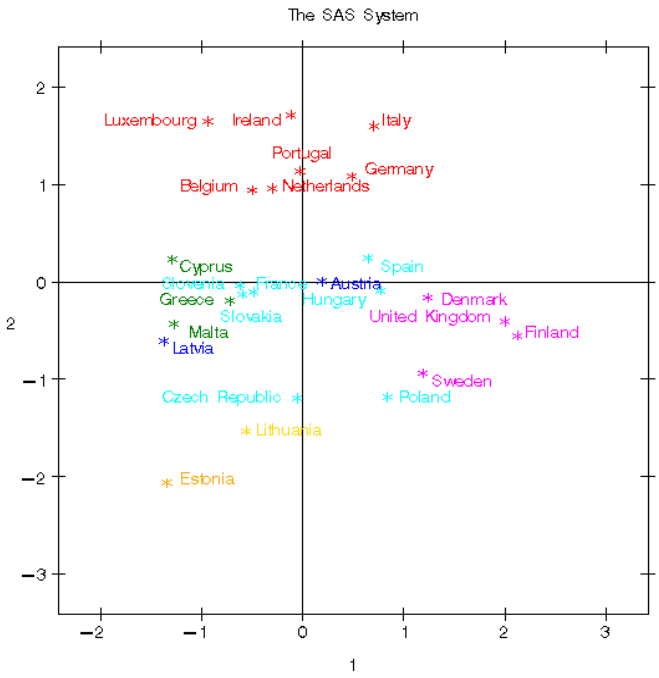

Figure 4: Partitional Clustering; on the left axis values of the factor 2 are shown; at the bottom axis, factor 1

The red countries have the same characteristic of the red cluster of the complete method so they have positive mean values for the second and fourth factors and negative one for the third. The green cluster, composed by the Mediterranean isles, has negative mean values for each factor. The magenta cluster has positive mean values for each factor except for the second and fifth ones, the best performer. The light blue countries have positive mean values only for the fifth factor while the others are negative. The blue cluster is composed by only two observations, Latvia and Austria, and it has a great positive mean value for the third factor and negative for the first and second. The orange cluster is composed by a single observation, Estonia, which has negative mean value for each factor except positive mean value for the fourth one. The last golden cluster, Lithuania, has positive mean value only for the last two factors, while the others have positive mean values.

A final comparison of the different methods is useful to find the stable clusters (fig. 5). The different methods create 10 clusters but only 4 clusters can be considered stable. From the intersection of the identified clusters, in fact, in 4 cases the groups are similar: that means that cluster do not depend on the selected method, but exclusively on the values of the variables of the dataset. This is the reason why comments will concern only the four stable clusters.

The other observations are considered as border problem: they change cluster according to the considered method. The changes are due to the different peculiarities of each observation.

Table 3: Stable clusters and their mean for each factor

Mean	Competition	Sensitivity	Environmental sustainability	Network unbundling	Optimality of interconnection
Magenta Cluster: **DK, FI, SE, UK**	1.6389275	-0.5122575	0.50144	0.436175	-0.5093225
Green Cluster: **CY, MT**	-1.284835	-0.09924	-0.54575	-1.162205	-1.775385
Red Cluster: **BE, DE, IE, IT, NL, PT**	0.042846667	1.240953333	-0.395376667	0.66711	-0.0853
Light blue Cluster: **CZ, ES, FR, HU, PL, SI, SK**	0.070942857	-0.352998571	-0.309167143	-0.79428	0.605811429

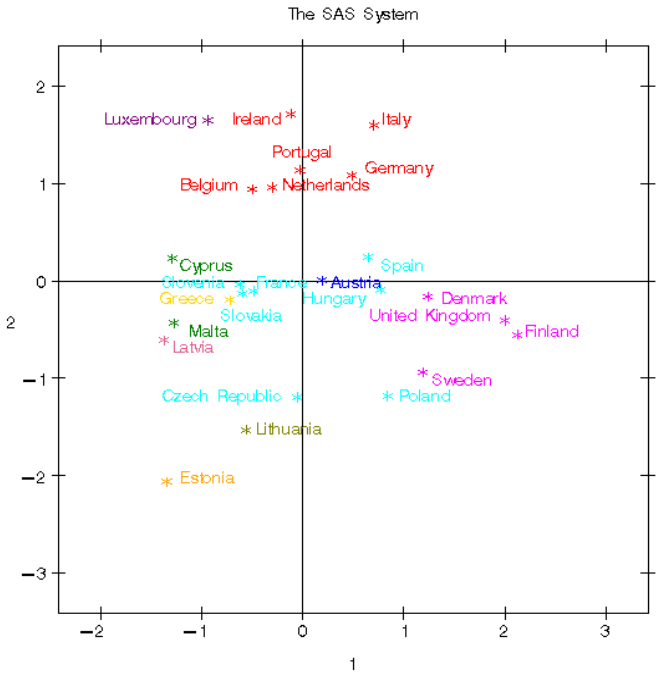

Figure 5: the final comparison; on the left axis values of the factor 2 are shown; at the bottom axis, factor 1

7. Results from cluster analysis

The impact of Europeanization seems to have not brought, so far, to a general convergence, but to a clustered convergence among MS. This analysis aimed to explain whether and to what extent these clusters do or do not reflect the traditional taxonomy, as defined by Börzel, of 'pace-setting', 'foot-draggers' and 'fence-sitting' (2005). The final stable clusters, in fact, seem to confirm the existence of these three main groups, as in other sectors affected by Europeanization. The fourth group

including only Cyprus and Malta depends on their small dimensions and geographical aspects, determining their similar results. The following comments would suggest an interpretative key to justify differences among emerged clusters, in order to identify those critical aspects each cluster is characterized by.

7.1. The pace-setting (or the 'Final Four')

This cluster includes the United Kingdom, Sweden, Denmark and Finland, that is a sort of 'Nordic' EU, excluding Ireland. It is a group quite uniform not only for the values of the different factors, but also for their geographical position. The main characteristic is the high score gained in the competition policies: markets show a low concentration, with more than 8 operators with a market share higher than 5% and a C3 lower than 40%. Customers are free to choose their suppliers and to switch them, as many already did (excluding Swedish SMEs), showing a national mean of switching higher than the mean of EU25. Obviously the decision to integrate the Scandinavian electricity markets in a common one, Nordel, as well as the process of liberalization in the UK have not been an effect due to the process of adaptation to the EU policy, but, on the contrary, influenced the EU polity in such a direction. Also the concentration of the energy mix is under the mean, due mainly to the development of many technologies, from coal to a high variety of renewables; nuclear energy is an important primary source, as well. Related to competitiveness, the level of unbundling (factor 4) is less uniform inside the cluster, due to the differences MS show in the unbundling of the distribution network: anyway, all of them got the maximum score for the transmission network unbundling and values higher than the EU25 mean for the distribution. Given the already high competitiveness, a good level of unbundling can strengthen it, but it seems to be less influential. Coal as an energy source give the UK a less performing value in the environment sustainability, compared to the Scandinavian markets, based to a greater extent on nuclear and renewables. Synthetically, as factor 2, measuring sensitivity to unsuitability, shows, for this cluster electricity is extremely convenient to be used as a source of energy: all markets are open to competition, prices lower than the EU25 mean, low energy intensity. Whilst all the previous factors show the best performances for this cluster, the factor 5 puts in evidence that their interconnectivity is not optimal, but for Denmark. The geographical position, obviously, influences this performance; the levels of greenhouse gas emissions in the UK, Denmark and Finland (higher than the EU25 mean), as well as the energy intensity in the UK, Sweden and Finland, seem to suggest the need of a stronger interconnectivity with the rest of the EU.

7.2. The fence-sitting (or the 'wannabe countries')

This cluster includes Belgium, Germany, the Netherlands, Ireland, Italy and Portugal, a heterogeneous group of countries, both for their geographical positions and for their dimensions and GDP. The common and most evident element is the high value of unsuitableness of electricity as a factor of production: prices are among the highest in the EU25, also because all these countries are mainly energy dependent (excluding Germany). Another interesting element characterizing these countries is the peculiar relation between the values of unbundling and competitiveness: Italy and Germany, with a 'negative' unbundling value, show the highest level of competition, due mainly to the existence of several regional companies rather than a low concentration of the markets. On the contrary, in the other countries inside the cluster, notwithstanding a positive level of unbundling, competition is low and concentration of markets high: it could be determined by economies of scale, being these countries less wide than Italy and Germany; at the same, it should be deepened what are, besides theoretical models, concretely, the relations between unbundling and competition and between price and competition, which sometimes are quite different from what expected. Excluding Portugal, all the other countries show a negative performance in environment sustainability, in particular Germany. Also factor 5 does not show any impressive result, but the general tendency to negative performance: Belgium, the Netherlands, Italy and Ireland need more interconnectivity. Anyway, all the countries have an international openness under the EU25 mean. This is a great difference with the previous cluster. At the same time, this seems not to give incentives to the adaptation to EU policies concerning competition: a market-led approach would be probably more successful, but it would need a higher interconnectivity and, before, a political decision to invest in interconnections.

7.3. The foot-draggers and the new comers

This cluster includes countries similar for characteristics but, in fact, quite different for the reasons determining such a situation. Czech Republic, Hungary, Poland, Slovakia and Slovenia have recently joined the EU, so that differences from the EU policies can be explained as a problem of time of adaptation. It is completely different for France and Spain, whose characteristics still remain different from the rest of the EU, and have determined their inclusion in the cluster of the EU new comers. The main element of this cluster is the performance concerning unbundling, negative for all the countries, but Slovenia: as in the previous cluster, a peculiar relation emerges. In fact, even if competition has high values, it should be noted also the performance in factor 2, negative for all countries but Spain: this cluster shows low prices, no energy dependency (but Hungary); the high level of energy intensity reveals the difference in industrial structure between the new comers and France and Spain. Similarly, France and Spain mark a difference because of the negative values of

the optimality of interconnectivity: both the countries are quite distant from the EU25 mean, so as to show a *de facto* isolationism towards the rest of the EU. Differently, the other countries of the cluster perform a positive level of interconnectivity: of course, it may also be because they are transit countries between West-EU and Russia. It could be argued that the current situation of this cluster shows still a distance from the principal EU policies: nevertheless, the situation of Czech Republic, Hungary, Poland, Slovakia and Slovenia seem to be dynamically converging; Spain and France better represent the foot-draggers in the Europeanization of electricity sector.

7.4. The 'energy islands'

Few words are needed to explain and comment the results of this cluster including Cyprus and Malta, whose scores are similar, but for the factor 2. Prices in Malta are lower, so that electricity is obviously more convenient to be used as factor of production. The geographical position and the dimension of these two countries make them quite specific and, consequently, some of the EU policies are not applicable.

8. Conclusions

At the end of this work, evaluating the emerging clusters related to data as of 2005, the next step should be the analysis diachronically of, e.g., the EU15 across the last decade. This work would have complemented the cluster analysis, by verifying, dynamically, whether Europeanization is leading towards a convergence among MS, and to understand what kind of convergence, and among whom.

Secondly, it has been possible to recall with the main three analyzed clusters the taxonomy by Börzel: pace-setting of the EU energy policy are represented by the UK and Nordel countries; the role of foot-dragger in electricity sector is mainly of France and Spain, trying to preserve their positions, while new comers in the EU are supposed to need more time to be evaluated on their convergence; finally, the fence-sitting are those countries whose process of Europeanization seems to be suspended between the effective adaptation and the preservation of *status quo*. These data seem to confirm that process of Europeanization is not an automatic convergence process: there are conditions encouraging or preventing it (Börzel and Risse, 2003). The lower are the differences between European and national legislations, the higher is the pressure to adaptation, while too low levels of compatibility between them could make easier for the MS not to adapt and to oppose (inertia or retrenchment states, as for France), as well as a high level of compatibility makes pointless any effort towards a stronger integration (as in the case of the pace-setting); any intermediate level between the minimum and maximum of compatibility are in positive relationship with a level of adaptional pressure (2003: 45).

It should be concluded that the Europeanization of electricity sector is a process of ‘clustered convergence’ (Börzel, 2002), where countries’ adaptation process depends on the similarities and differences with the EU policy; at the same time the more stable the Government is, the more effective will be its lobbying in order to promote national policies at EU level or to stop them, as the UK, Scandinavian countries, but also France, Poland and Spain show. The weaker the Government is, the more difficult and slow will be the process of adaptation that is convergence among those MS which face similar pressures for adaptation, as Italy, Germany and their cluster demonstrate.

How does this status affect the future Europeanization of the electricity sector? The model of market-led integration so far resulted more successful. The model of integration of markets in the Nordel case, in the Scandinavian countries, which gave an incentive to competition, as well as the UK model of internal competition, are evident examples. It could be concluded that the EU polity has not (yet) enough strength to influence MS: the process of integration among markets will probably follow easily an already integrated industry. In this sense, the third package promoting a stronger form of unbundling in order to develop national networks and interconnections seems to suggest the adoption of this strategy, rather than the ‘government approach’. This analysis brought the EC to the proposal of network unbundling, a regulation led by an Agency of the Cooperation of the Energy Regulators (ACER), and no more by national Authorities. The question is whether the EU polity will succeed in this aim: this is indeed the real Nordian Knot for the future of the EU.

References

Anderson, Jeffrey J. (2002) Europeanization and the Transformation of the Democratic Polity, 1945-2000. Journal of Common Market Studies 40 (5) 793-822

Bache, I. (2006) The Europeanization of Higher Education: Markets, Politics or Learning? Journal of Common Market Studies 44 (2) 231-248

Barton, B., Redgwell, C., Rønne, A. and Zillman, D.N., eds. (2004) Energy Security. Managing Risk in a Dynamic Legal and Regulatory Environment. Oxford: Oxford University Press

Barrell, Ray ed. (1992) Economic Convergence and Monetary Union in Europe. London: SAGE Publications

Basu, D.R. (1981) Future Energy Policies for the UK. An Optimal Control Approach. London and Basingstoke: The Macmillan Press

Bennett, Colin J. (1991) What Is Policy Convergence and What Causes It? [www] British Journal of Political Science 21 (2) 215-233

Börzel, Tanja (2002) States and Regions in the European Union. Institutional Adaptation in Germany and Spain. Cambridge: Cambridge University Press

Börzel, Tanja and Risse, Thomas (2003) Conceptualizing the Domestic impact of Europe. Chapter 3 in Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Börzel, Tanja (2005) Pace-setting, Foot-dragging and Fence-sitting: Member State Responses to Europeanization. Chapter 10 in Jordan, Andrew ed. (2005) Environmental Policy in the European Union. Actors, Institutions and Processes. 2nd ed. London: Earthscan Publications

Busch, Per-Olof and Jörgens, Helge (2005) The international sources of policy convergence: explaining the spread of environmental policy innovations. Journal of European Public Policy 12 (5) 860-884

Cody, R.P. and Smith, J.K. (1985) Applied Statistics and the SAS Programming Language. New York: north Holland

Didden, Marcel H. and D'haeseleer, William D. (2003) Demand Side Management in a competitive European market: Who should be responsible for its implementation? Energy Policy 31 (13) 1307-1314

Eising, Rainer and Jabko, Nicolas (2001) Moving Targets. National interests and Electricity Liberalization in the European Union. Comparative Political Studies 34 (7) 742-767

European Commission (1997) The Single Market Review. Single Energy Market. Subseries II, Volume 10. London: Kogan Page and Luxembourg: Office for Official Publications of the European Communities

European Commission (2003) Observatory of European SMEs. SMEs and the Liberalisation of Network Industries: Telecommunications and Electricity Markets, n.3, Luxembourg: Enterprise Publication

European Commission (2005) Report 2005 on Progress in Creating the Internal Gas and Electricity Market

Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Gaynor, K.B. and Karakitsos, E. (1997) Economic Convergence in a Multispeed Europe. Basingstoke: Macmillan Press

Gerardin, D. and Luff, D. (eds.) (2004) The WTO and Global Convergence in Telecommunications and Audio-Visual Services. Cambridge: Cambridge University Press

Gilardi, Fabrizio (2005) The Institutional Foundations of Regulatory Capitalism: the Diffusion of Independent Regulatory Agencies in Western Europe. ANNALS, AAPSS, 598, 84-101

Giuliani, Marco and Piattoni, Simona (2001) Italy: Both Leader and Laggard. Chapter 6 in Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers

Glachant, Jean-Michel and Lévêque, François (2006) Electricity Internal Market in the European Union: What to do Next? CWPE 0623 and EPRG 0605

Green, Richard (2006) Electricity liberalisation in Europe – how competitive will it be? Energy Policy 34 (16) 2532-2541

Helm, Dieter (2003) Energy, the State, and the Market. British Energy Policy since 1979, revised edition. Oxford: Oxford University Press

Helm, D., Kay, J. and Thompson, D. (1989) The Market for Energy. Oxford: Clarendon Press

Héritier, Adrienne (2001) Market integration and social cohesion: the politics of public services in European regulation. Journal of European Public Policy 8 (5) 825-852

Hira, Anil and Amaya, Libardo (2003) Does energy integrate? Energy Policy 31 (2) 185-199

Hunt, Sally (2002) Making competition work in electricity. New York: John Wiley and Sons

Jacobsen, H.K., Fristrup, P. and Munksgaard, J. (2006) Integrated energy markets and varying degrees of liberalisation: Price links, bundled sales and CHP production exemplified by Northern European experiences. Energy Policy 34 (18) 3527-3537

Jordan, Andrew ed. (2005) Environmental Policy in the European Union. Actors, Institutions and Processes. 2nd ed. London: Earthscan Publications

Kohler-Koch, B. and Eising, R. eds. (1999) The Trasformation of Governance in the European Union. London and New York: Routledge

Leonardi, Robert (1995) Convergence, cohesion and Integration in the European Union. Basingstoke: Macmillan Press

Levi-Faur, David (2004) On the "Net Impact" of Europeanization. The EU's Telecoms and Electricity Regimes Between the Global and the National. Comparative Political Studies 37 (1) 3-29

Littlechild, S.C. and Vaidya, K.G. (1982) Energy Strategies for the UK. London: George Allen & Unwin

Mardia, K.V., Kent, J.T., and Bibby, J.M. (1979) Multivariate Analysis. London: London Academic Press

Matláry, J.H. (1997) Energy Policy in the European Union. London and Basingstoke: MacMillan Press

Mény, Y., Muller, P. and Quermonne, J. eds. (1996) Adjusting to Europe. The impact of the European Union on national institutions and policies. London and New York: Routledge

OFGEM, Domestic Competitive Market Review. Versions 2004, 2005, 2006, 2007

Olsen, Johan P. (2002) The Many Faces of Europeanization. Journal of Common Market Studies 40 (5) 921-952

Padgett, Stephen (2003) Between synthesis and emulation: EU policy transfer in the power sector. Journal of European Public Policy 10 (2) 227-245

Pedersen, Lene H. (2006) Transfer and Transformation in processes of Europeanization. European Journal of Political Research 45 (6) 985-1021

Pineau, P.O., Hira, A., and Froschauer, K. (2004) Measuring international electricity integration: a comparative study of the power systems under the Nordic Council, MERCOSUR, and NAFTA. Energy Policy 32 (13) 1457-1475

Rasmussen, Jorgen (2001) Britain: Aloof and Skeptical. Chapter 7 in Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers

Radaelli, Claudio M. (2003) Europeanization of Public Policy. Chapter 2 in Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Roberts, J., Elliott, D. and Houghton, T. (1991) Privatizing Electricity. The Politics of Power. London and New York: Belhaven Press

Robinson, Colin (1993) Energy Policy. Errors, Illusions and Market Realities. The Institute for Economic Affairs. Occasional Paper 90

Robinson, Terry (2007) Have European gas prices converged? Energy Policy 35 (4) 2347-2351

Sartori, Giovanni (1970) Concept Misformation in Comparative Politics. American Political Science Review 64 (4) 1033-1053. Quoted in Radaelli, C.M. (2003)

Schmidt, Vivien A. (2002) Europeanization and the mechanics of economic policy adjustment. Journal of European Public Policy 9 (6) 894-912

Schneider, V., Fink, S. and Tenbücken, M. (2005) Buying Out the State. A comparative Perspective on the Privatization of Infrastructures. Comparative Political Studies 38 (6) 704-727

Smil, Vaclav (2003) Energy at the Crossroads: global perspectives and uncertainties. London and Cambridge (MA): The MIT Press

Surrey, John ed. (1996) The British Electricity experiment. Privatization: the record, the issues, the lessons. London: Earthscan Publications

Sykes, R. and Alcock, P. Eds. (1998) Developments in European Social Policy. Convergence and diversity. Bristol: The Policy Press

Timm, Neil (2002) Applied Multivariate Analysis. New York: Springer

Van den Hoven, A. and Froschauer, K. (2004) Limiting Regional Electricity Sector Integration and Market Reform: The Cases of France in the EU and Canada in the NAFTA Region. Comparative Political Studies 37 (9) 1079-1103

Vrolijik, C. (ed.) (2002) Climate Change and Power. Economics Instruments for European Electricity. London: Earthscan Publications

World Energy Council (1993) Energy for Tomorrow's World. London: Kogan Page

Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers

Appendix 1: Relevant articles of the Consolidated Version of the Treaty on the Functioning of the European Union

Article 4

1. The Union shall share competence with the Member States where the Treaties confer on it a competence which does not relate to the areas referred to in Articles 3 and 6.

2. Shared competence between the Union and the Member States applies in the following principal areas:

(a) internal market;

(b) social policy, for the aspects defined in this Treaty;

(c) economic, social and territorial cohesion;

(d) agriculture and fisheries, excluding the conservation of marine biological resources;

(e) environment;

(f) consumer protection;

(g) transport;

(h) trans-European networks;

(i) energy;

(j) area of freedom, security and justice;

(k) common safety concerns in public health matters, for the aspects defined in this Treaty

Article 14

Without prejudice to Article 4 of the Treaty on European Union or to Articles 93, 106 and 107 of this Treaty, and given the place occupied by services of general economic interest in the shared values of the Union as well as their role in promoting social and territorial cohesion, the Union and the Member States, each within their respective powers and within the scope of application of the Treaties, shall take care that such services operate on the basis of principles and conditions, particularly economic and financial conditions, which enable them to fulfil their missions. The European Parliament and the Council, acting by means of regulations in accordance with the ordinary legislative procedure, shall establish these principles and set these conditions without prejudice to the competence of Member States, in compliance with the Treaties, to provide, to commission and to fund such services.

Article 93

Aids shall be compatible with the Treaties if they meet the needs of coordination of transport or if they represent reimbursement for the discharge of certain obligations inherent in the concept of a public service.

Article 106

1. In the case of public undertakings and undertakings to which Member States grant special or exclusive rights, Member States shall neither enact nor maintain in force any measure contrary to the rules contained in the Treaties, in particular to those rules provided for in Article 18 and Articles 101 to 109.

2. Undertakings entrusted with the operation of services of general economic interest or having the character of a revenue-producing monopoly shall be subject to the rules contained in the Treaties, in particular to the rules on competition, in so far as the application of such rules does not obstruct the performance, in law or in fact, of the particular tasks assigned to them. The development of trade must not be affected to such an extent as would be contrary to the interests of the Union.

3. The Commission shall ensure the application of the provisions of this Article and shall, where necessary, address appropriate directives or decisions to Member States.

Article 107

1. Save as otherwise provided in the Treaties, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market.

2. The following shall be compatible with the internal market:

(a) aid having a social character, granted to individual consumers, provided that such aid is granted without discrimination related to the origin of the products concerned;

(b) aid to make good the damage caused by natural disasters or exceptional occurrences;

(c) aid granted to the economy of certain areas of the Federal Republic of Germany affected by the division of Germany, in so far as such aid is required in order to compensate for the economic disadvantages caused by that division. Five years after the entry into force of the Treaty of Lisbon, the Council, acting on a proposal from the Commission, may adopt a decision repealing this point.

3. The following may be considered to be compatible with the internal market:

(a) aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment, and of the regions referred to in Article 349, in view of their structural, economic and social situation;

(b) aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State;

(c) aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest;

(d) aid to promote culture and heritage conservation where such aid does not affect trading conditions and competition in the Union to an extent that is contrary to the common interest;

(e) such other categories of aid as may be specified by decision of the Council on a proposal from the Commission.

Appendix 2: Descriptive statistics tables of selected indicators (Alphabetical order)

Table 4.i

	C3 (range 0-1)
Mean	0.752000
Median	0.760000
Maximum	1.000000
Minimum	0.390000
Std. Deviation	0.213717

Table 4.ii

	Dx_Unbund (index 1-6)
Mean	2.640000
Median	3.000000
Maximum	6.000000
Minimum	0.000000
Std. Deviation	1.729162

Table 4.iii

	Ghg_percap (tons per capita)
Mean	3499.678000
Median	3198.855000
Maximum	10641.850000
Minimum	791.208800
Std. Deviation	2142.483000

Table 4.iv

	HHI_nrg_mix (max 10000)
Mean	4403.085000
Median	3961.033000
Maximum	10000.000000
Minimum	1832.498000
Std. Deviation	2263.087000

Table 4.v

	Intl_Openness
Mean	0.468193
Median	0.276068
Maximum	1.796721
Minimum	0.000000
Std. Deviation	0.471897

Table 4.vi

	Mkt_Opening (range 0-1)
Mean	0.783600
Median	0.800000
Maximum	1.000000
Minimum	0.000000
Std. Deviation	0.272257

Table 4.vii

	Nrg_Dependency
Mean	0.031248
Median	0.024128
Maximum	0.529555
Minimum	-0.374023
Std. Deviation	0.193894

Table 4.viii

	Nrg_Intensity (kWh/€)
Mean	149.320000
Median	205.700000
Maximum	246.920000
Minimum	823.380000
Std. Deviation	114.120000

Table 4.ix

	Price_HH (€/kWh)
Mean	0.094052
Median	0.090000
Maximum	0.144000
Minimum	0.057600
Std. Deviation	0.023946

Table 4.x

	Price_Ind (€/kWh)
Mean	0.064676
Median	0.064600
Maximum	0.089600
Minimum	0.040900
Std. Deviation	0.012792

Table 4.xi

	Res_Consum (%)
Mean	14.99600
Median	10.000000
Maximum	57.900000
Minimum	0.000000
Std. Deviation	16.609800

Table 4.xii

	Res_Gen (%)
Mean	17.874990
Median	11.368050
Maximum	69.602450
Minimum	0.000000
Std. Deviation	19.033680

Table 4.xiii

	Share>5%
Mean	3.840000
Median	3.000000
Maximum	10.000000
Minimum	1.000000
Std. Deviation	3.144837

Table 4.xiv

	Switch_HH (range 0-1)
Mean	0.078400
Median	0.000000
Maximum	0.480000
Minimum	0.000000
Std. Deviation	0.124052

Table 4.xv

	Switch_L_Ind (range 0-1)
Mean	0.228800
Median	0.190000
Maximum	0.600000
Minimum	0.000000
Std. Deviation	0.208253

Table 4.xvi

	Switch_SME (range 0-1)
Mean	0.144000
Median	0.030000
Maximum	0.820000
Minimum	0.000000
Std. Deviation	0.215870

Table 4.xvii

	Tx_Unbund (index 1-6)
Mean	4.440000
Median	5.000000
Maximum	6.000000
Minimum	0.000000
Std. Deviation	1.916594

Appendix 3: Results of Cluster Analysis

Table 5: Normalized values for each country-factor pair; EU median and width of the range

ID	Factor1	ID	Factor2	ID	Factor3	ID	Factor4	ID	Factor5
LV	-1.3756300	EE	-2.05705	EE	-1.10848	MT	-1.49099	MT	-1.90904
EE	-1.3437300	LT	-1.52741	CZ	-1.08541	HU	-1.45208	CY	-1.64173
CY	-1.2920200	CZ	-1.19204	LT	-0.79992	CZ	-1.42416	EE	-1.26103
MT	-1.2776500	PL	-1.17883	DE	-0.7836	PL	-1.2166	UK	-0.92605
LU	-0.9359100	SE	-0.93437	UK	-0.69424	ES	-0.92734	FI	-0.83309
EL	-0.7183800	LV	-0.60611	IE	-0.68889	CY	-0.83342	EL	-0.78607
FR	-0.6190000	FI	-0.5513	HU	-0.65893	LU	-0.79528	SE	-0.38645
SI	-0.5974000	MT	-0.4297	PL	-0.63101	SK	-0.78388	FR	-0.38227
LT	-0.5611000	UK	-0.40418	CY	-0.55774	EL	-0.72753	IE	-0.32669
BE	-0.4955300	EL	-0.19481	MT	-0.53376	FR	-0.41189	NL	-0.25741
SK	-0.4882500	DK	-0.15918	SK	-0.48614	DE	-0.12758	IT	-0.23413
NL	-0.3014500	SI	-0.12342	BE	-0.47671	IT	-0.01607	ES	-0.09976
IE	-0.1124100	SK	-0.1029	IT	-0.29428	FI	-0.01428	BE	-0.07322
CZ	-0.0545700	HU	-0.08574	NL	-0.2883	LV	-0.01213	AT	0.1027
PT	-0.0249500	FR	-0.03362	ES	-0.15886	AT	0.11888	LV	0.10825
AT	0.1950300	AT	0.00753	EL	-0.02657	SE	0.26287	DK	0.1083
DE	0.4873600	CY	0.23122	PT	0.15952	DK	0.5764	PT	0.10939
ES	0.6479600	ES	0.24556	DK	0.32025	SI	0.65599	PL	0.19747
IT	0.7040600	BE	0.9427	FR	0.40093	PT	0.6763	DE	0.27026
HU	0.7677900	NL	0.96124	SI	0.45525	UK	0.91971	CZ	0.90287
PL	0.8400700	DE	1.08354	FI	0.53627	NL	0.9792	SI	0.90403
SE	1.1920900	PT	1.14162	LU	0.57224	BE	1.23047	HU	1.00023
DK	1.2350700	IT	1.60102	SE	1.84348	IE	1.26034	LU	1.21858
UK	2.0044900	LU	1.65064	AT	2.06751	LT	1.53143	SK	1.71811
FI	2.1240600	IE	1.7156	LV	2.91738	EE	2.02165	LT	2.47674
Median	*-0.11241*	*Median*	*-0.1029*	*Median*	*-0.29428*	*Median*	*-0.01428*	*Median*	*-0.07322*
Width	*3.49969*	*Width*	*3.77265*	*Width*	*4.02586*	*Width*	*3.51264*	*Width*	*4.38578*

PART II

Transmission Network Unbundling and Grid Investments: Evidence from the UCTE Countries

1. Introduction

EU third package identifies three pillars as fundamental for the development of a European energy sector in order to enhance welfare: competition, environmental sustainability and supply security. Concerning electricity sector, each of these pillars can be argued to be strictly connected with the development of a European electricity network, including both the national transmission networks (TX) and the interconnections (ICX) among EU (and non-EU) countries. Based on an analysis of mainstream economics, this paper moves from the hypothesis that investments in the grid aiming to increase its capacity (and quality) affect positively the level of competition in both the wholesale and the retail markets. Thus, generation companies currently owning the grid have no interest in investing and increasing grid capacity: unbundling of TX network can be seen as a structural solution to this vicious circle. The EU decision to unbundle electricity transmission network and to create a European regulator of the TSOs relies on this simple framework. However, other scholars show how unbundling has not always a clearly positive impact; on the contrary, there are arguments of economies of coordination a vertically integrated system would better bear.

This dichotomy among scholars requires an empirical assessment of the relationship between unbundling reforms and investments in TX and ICX emerged during last years: the transmission grid and unbundling have not had yet enough attention in literature. So far, scholars have yielded empirical evidences on the relation between regulatory reforms in general (liberalization, privatization) and the electricity system, mainly wholesale and retail markets, developing several interesting analyses, but only recently there have been studies on TX system *per se*: on this very point, Pollitt argues that '[t]he lack of definitive econometric evidence on reform effects […] clearly illustrates the need for further work on this now that we have more experience of reform. However the problems of co-incidence with other reform steps and difficulties in modelling underlying resource costs will continue to be an issue.' (2008: 709). Henceforth, this work desires to be a contribution to fill this gap, focusing on the specific role of unbundling on transmission and interconnection investment and operation among the electricity subsectors.

Consequently, this paper at first, will introduce some fundamental elements concerning the economics of TX systems (section 2), then the main policies EU is pursuing and why (section 3). After a literature review about the assessment of transmission network unbundling's impacts, showing direct and indirect benefits and costs, and the emerging ambiguity in results (section 4), an empirical analysis is proposed, focused on UCTE (Union for the co-ordination of transmission of

electricity) countries between 2000 and 2006 (sections 5 and 6). On the base of this evidence, a general assessment of the unbundling reforms is provided and some policy implications for the EU energy policy are suggested (section 7).

2. Economics and policy analysis of the TX systems

Transmission network can be considered as a particular phase of electricity system, where the general tendency to deregulation, competition and privatization applied in wholesale and retail markets, cannot be implemented. TX system can be considered a natural monopoly so that both the ownership of the grid and its operation require a clear and specific form of regulation. It could be argued that TX systems do not sustain competition, but they need a form of 'coordination for [enhancing] competition' (Hogan, 2005: 358) among generators and traders in the up- and downstream markets (also Fagan, 2006). The following taxonomy briefly introduces those elements determining the natural monopoly condition of TX system:

- Duplicating the existing grid imply a social cost which could not be sustained in term of welfare equilibrium. Besides this economic reason, recently a new aspect emerged. There are local environmental externalities which affect electricity facilities siting, including high voltage grid, able to generate cases of Nimby syndrome.
- Investments in increasing TX network capacity are essentially lumpy, with an effect of high economies of scale; thus, in case of increased demand of capacity, grid operators will presumably be compelled to sustain investments beyond the current need.
- Investments in the grid represent a sunk cost for the operators: lump sum competition and contendibility are thus unlikely to emerge.

These last years have been characterized by a great attention paid to the competition in the both wholesale and retail markets, as well as to the concentration of the energy mix in the generation, the energy efficiency and other measures in order to achieve sustainability in both energy supply and consumption. The European Commission's program "Energizing Europe" synthesizes in 3 pillars the key issues for energy markets and their implications for the electricity sector: a) the goal of integration of MS electricity markets, which requires a stronger liberalization and competition; b) supply security, which concerns sustainability of the equilibrium between demand and supply. It does not mean only to achieve an adequate installed generation capacity, but also to reduce limit constraints in the national transmission network, as well as to safeguard both physical interconnections with foreign electricity systems and geopolitical relations with energy exporter countries. Finally, c) environmental sustainability is included as main topic; it concerns R&D investments, stimulates the shift towards renewable sources, and promotes the diffusion of energy efficient systems and appliances. As it will be better explained in section 3, all these policies need

to be sustained by an adequate development of the TX and ICX networks. Some examples: to link new entrants' plants to the high voltage grid; to increase physical capacity of the grid so as to support new generation capacity; to strengthen ICX capacity and to build new circuits in order to concretely integrate national markets and to stimulate competition among operators on the base of costs and sustainability of generation.

2.1. Gap in TX network investments

Despite their small incidence on the final costs, between 5% and 10% in OECD countries (IEA, 2002: 49-50), networks are essential elements in the electricity supply: any policy concerning electricity sector development cannot ignore them. Joskow and Schmalensee argued that 'the practice of ignoring the critical functions played by the transmission system in many discussions of deregulation almost certainly leads to incorrect conclusions about the optimal structure of an electric power system' (1983: 63). A lack of investments could make TX systems 'a bottleneck for the electricity supply industry … [as happened] in many OECD countries'(IEA, 2002: 45): recent studies have properly underlined how insufficient is the level of infrastructures and the amount of investments in the TX systems, in comparison with the growth of the electricity demand. IEA underlines that in many OECD countries '[t]ransmission lines are increasingly congested […]. Networks are not well adapted to the emerging patterns of electricity transmission […]. Additional investment in transmission is necessary to reduce the congestion of transmission lines.' (2002: 46). The US Federal Energy Regulatory Commission (FERC) criticized 'a decade of under-investment in needed transmission' (2002: 3), whilst the US Department of Energy (DOE) remarked the 'growing evidence that the US transmission system is in urgent need of modernization. The system has become congested because growth in electricity demand and investment in new generation facilities have not been matched by investments in new transmission facilities' (2002: xi). In the EU the same problem arises. The Guidelines for Trans-European energy networks in 2003 (TEN-E Guidelines) have recognized 314 infrastructure projects of 'common interest', among which 32 are high priority electricity projects. The following Priority Interconnection Plan, COM(2006)846, identifies several cases where difficulties are delaying the conclusion of the project; furthermore, the development of networks is considered 'insufficient', whilst investments in cross-border infrastructures are defined 'dramatically low'. Assessing more precisely the level of implementation of the TEN-E projects, the MVV Consulting Report (2007) underlines that, for the years 2004-2006, out of the previous 32 electricity projects, only 5 have been finalized, 3 are under construction, 11 are waiting for the final authorization, 13 are in the preliminary study phase. Recently, the report COM(2008)770 considers more widely the projects of common interest, as identified in the Guidelines, and shows that only 80 (57 for electricity sector and 23 for gas) have

been finalized during 2002 and 2006: 68 are high priority projects (54 in the electricity sector). The UCTE Development Plan 2008 estimates the necessary investments for both grids and interconnections in 17 billions € of overhead lines for the following 5 years. On 13 November 2008, a new plan for energy infrastructures has been proposed in the EU, the Second Strategic Energy Review (SEER2), 'An EU Energy Security and Solidarity Action Plan', where immediately it is underlined that 'promoting infrastructure [is] essential to the EU's energy needs'. Finally, a 'vision towards 2050' is proposed, based on the project to transform the current system into a smart interconnected electricity network, able to connect both big conventional generators and small suppliers of renewable energy, across MS without cross-border congestions. The Green Paper presented contextually, COM(2008)782, underlines that 'network development is an important element of energy policy. The emphasis of EU network policy has been to "plug gaps" in networks or deal with "bottlenecks", for internal security of supply reasons'.

Thus, if the development of the TX and ICX is still needed, the EU is suggesting measures of unbundling as the right policy to this emerging problem. The next section will try to identify the essential step the EU followed in promoting unbundling policy and sustaining higher investments in the grid.

3. The 2007 review of EU energy policy

After the two main directives in 1996 and 2003, concerning mainly liberalization, an important step for the development of the EU energy policy and for strengthening the process of integration among MS markets has been taken forward in October 2005 when a call for a single European Energy Policy was made by the Hampton Court European Council: afterwards, a 'Green Paper on a European Strategy for Sustainable, Competitive and Secure Energy' was published on March, COM(2006)105, aiming to collect comments before proposing a comprehensive reform. At the same time, a Sector Inquiry had been launched on 17 June 2005 in order to assess the degree of harmonization among MS energy markets. On 10 January 2007 the Commission published the results of the Sector Inquiry accompanied by a final report complaining how 'while progress has been made, the objectives of market opening have not yet been achieved. Despite the liberalisation of the internal energy market, barriers to free competition remain […] and limited possibilities to exercise customer choice'. More precisely, the Sector Inquiry identified some problematic issues needing to be solved in order to achieve a stronger harmonization and competition in the EU markets, including, above all: (1) market concentration leading to an uncompetitive market power by the incumbents; (2) vertical foreclosure in the supply; (3) lack of market integration including both physical and regulatory aspects of cross borders interconnections; (4) lack of transparency affecting regulation of utilities and price formation as well. Against these four major findings, the

Final Report suggested four structural remedies the EU has to pursue with 'urgent action and priority': '(1) achieving effective unbundling of network and supply activities, (2) removing the regulatory gaps (in particular for cross border issues), (3) addressing market concentration and barriers to entry, and (4) increasing transparency in market operations'. The first one, ownership unbundling, was introduced as 'essential to resolve the systemic conflict of interest inherent in the vertical integration of supply and network activities, which has resulted in a lack of investment in infrastructure and in discrimination'.

In parallel with the Final Report of the Sector Inquiry, the COM(2007)1 'An Energy Policy for Europe' brought to a conclusive proposal the debate on the Green Paper COM(2006)105. The document synthesized into three pillars the challenges an EU Energy Policy has to face: environmental sustainability, security of supply and competitiveness. The EU, at the same time, underlines how the achievement of these goals requires both a stronger level of interconnections and higher investments in the national grids, aiming to increase their capacity: new energy infrastructures could stimulate competition among new environmental-friendly and traditional (fossil fuels) generators (sustainability); higher capacity can encourage new entrants in the wholesale and retail markets, decreasing prices, as well as improving the performance of the grid (competitiveness); finally, more interconnections would affect the problem of energy dependency of most of the MS, decreasing the risk of black-outs and encouraging 'solidarity' among them (security of supply). The COM(2007)1 recognizes 'the danger of discrimination and abuse when companies control energy networks as well as production or sales, protecting national markets and preventing competition'; consequently, the Commission concludes that '[s]uch a situation also creates a disincentive on vertically integrated companies from investing adequately in their networks, since the more they increase network capacity, the greater the competition that exists on their "home market" and the lower the market price'. As in the analysis emerged in the Sector Inquiry, among the several suggested remedies, network unbundling is proposed as the right solution to encourage new investments. More precisely, the preferred way is the ownership unbundling of the grid from generators and other suppliers; otherwise, only as second best, a model of Independent System Operator (ISO) where an independent company operates the grid, while the incumbent maintains the ownership and receives a regulated return. The proposal was discussed by the Spring European Council 2007, which approved the unbundling measures and the ISO model, though trying, at the same time, to find a compromise due to the opposition of some MS. In the Presidency conclusions, a sort of 'regulatory unbundling' was admitted, consisting in strengthening the current regulation without any further intervention to unbundle network and generation. The resolution European Parliament approved on 10 July 2007 considers ownership unbundling 'to be

the most effective tool to promote investments in infrastructures in a non-discriminatory way, fair access to the grid for new entrants and transparency in the market'; at the same time the resolution declares 'that this model might not address all of the issues at stake such as interconnections or congestion points', showing a keen scepticism on the Commission package, due to the opposition of important MS. Notwithstanding this remarks, the Commission presented on 19 September 2007 a proposal for a package of directives amending the previous ones on energy sectors. As Commissioner Kroes argued presenting the package, EU energy markets are affected by

'- First, continuing high levels of concentration so incumbents maintain market power;

- Second, vertical foreclosure, as the old monopolists continue to own the energy infrastructure;

- Third, low levels of cross-border trade, due to insufficient interconnector capacity and to contractual congestion since spare physical capacity is not always released;

- Fourth, lack of transparency about operations in the wholesale energy sector, which makes it difficult for new entrants to understand how the markets work in practice and the risks that they take on; and

- Finally, lack of confidence that wholesale energy prices are the result of meaningful competition';

Consequently,

'[a]n urgent, decisive and effective response to these issues is needed. Today's package provides just that'.

In particular, the reform consists of: (1) an effective ownership unbundling, though ISO model is still accepted; (2) the creation of an Agency of the Cooperation of the Energy Regulators (ACER); (3) a stronger coordination among the European Networks Transmission System Operators (ENTSO).

Confirmed by the European Council on June 2008, the package has to be approved by the European Parliament after the second reading: anyway, the debate on implementing a stronger unbundling involved MS and major utilities trying to put in evidence its benefits or costs.

Ownership unbundling has been firmly proposed by the EU Commission as a pro-competitive solution, preferred to legal and functional unbundling which have been considered to give a positive, but not sufficient contribution to achieve EU energy policy goals. It could be argued, as previously mentioned, that the EU position relies on a wide literature confirming this approach; hence, looking also at the debate around the possible, but not sure, positive effect of this measure, the aim of this work is to provide an assessment of the impact unbundling, in its different degree, had on grid investments.

4. Studies on network unbundling

It is well acknowledged that investments in TX and ICX capacity can have a positive effect on the reliability of the entire system, mainly because their impact can contribute to increase the quality of the grid so as to decrease disturbances and the volume of energy not supplied. Nevertheless, this analysis will focus on the relation between TX and ICX constraints and competition in wholesale

markets, which the recent EU energy policy, as previously shown, relies on. Since 2000, scholars have been arguing the role of expanding TX and ICX capacity in reducing congestion on the grid and eventually have a pro-competitive impact allowing new generation companies (gencos) to access the grid, to enter the market and to reduce incumbents' market power. As major implications, at first, according to this approach, incumbents owning or operating the TX grid have little interest in increasing grid capacity; hence vertical integration could have determined the lack of investments in TX and ICX many institutions have been complaining about since 2000. Consequently, unbundling has been widely suggested as the *ad hoc* solution to avoid the abuse of market power, including elevated electricity prices or inefficient generation. Pro-competitive impact of increase in grid capacity has been deeply analyzed with different models and empirical evidences, and the following review will try to identify its main aspects; at the same time, unbundling as adequate instrument to incentive grid investments has not been sufficiently evaluated and the present research will try to assess some evidences exactly on this topic.

4.1. Pro-competitive effect of investments in TX capacity

Borenstein *et al.* (2000) move from the research question to show theoretically how TX constraints badly affect consumers' surplus, and increase the firm's one; thus, the pro-competitive effect investment is introduced: in a model of two markets geographically distinct, each dominated by a single generator in a monopolistic equilibrium, a new TX line connecting the markets determines a shift towards an unconstrained Cournot duopoly equilibrium. The conclusions focus on the need to reduce congestions as a pro-competitive measure able to reduce market power and elevated prices through investments in the grid, whereas no profit-maximizing firm would agree in such a policy.

Research published by Léautier (2001) offers an important framework to this topic. He deepens the previous model, identifying a wider taxonomy of the impact of a TX capacity increase. A three-node network is introduced with two generators and a consumer linked by a loop: in the model, a benevolent TX system operator plans and allocates generation between the two gencos at time 0, considering the physical constraint in the grid. In absence of regulation on prices, a TX capacity increase affecting the constraint determines a double impact: first of all a 'substitution effect' consisting in the replacement of units of electricity from the more expensive generator to the cheaper one, re-allocating both the volumes of supply previously fixed by the planner and, consequently, their surplus. Together with this impact, a 'strategic effect' emerges: a price-shedding effect affects the distribution of surplus not only among generators (as in substitution effect), but also between consumers and suppliers, generating more consumers' surplus: lower market power determines lower prices, due to a pro-competitive impact on the wholesale markets. Quick and Carey (2002) rely upon these previous works and simulate the Colorado electricity market: they

compare incumbent's market prices with and without an increase of 1000 MW in TX capacity, under assumption of deregulated market, showing an average effect of reduced incumbent's market power, even if it depends on the level of demand. They conclude that an increase of TX capacity introduces a threat of entry which has a positive impact on prices and mark-up; in the 'normal' scenario, price could be 11.6% higher than the competition price: furthermore, in case of congestion, maximum price, if applied, would be 54.9% of the time. If Léautier's model and following works assume a price-deregulated market, as in the mainstream of literature till Californian crisis (Griffin and Puller, 2005), similar conclusions have been found in case of price regulation: Arellano and Serra (2008) confirm the impact of TX expansion on competition in the wholesale market. In fact, they move from a price-regulated market, an inelastic demand and a planner (an ISO) which allocates generation so as to minimize costs and which sets prices: they argue that even if wholesale prices are set by regulator and, apparently, there should be no distortion, in such a regulated market TX expansion has a pro-competitive impact. Incumbent, who cannot lower prices, organizes its energy mix so as to increase efficiency: summarizing, TX capacity expansion stimulates competition among generators through strategic and substitution effects either affecting prices (in deregulated markets) or generation portfolios (in price-regulated markets).

4.2. The structural conflict of interest between generation and transmission companies

COM(2006) 851 "confirms the finding that it is essential to resolve the systemic conflict of interest inherent in the vertical integration of supply and network activities, which has resulted in a lack of investment in infrastructure and in discrimination. It is crucial to ensure that network owners and/or operators do not have incentives that are distorted by supply interests of affiliates. This is particularly important at a time when Europe needs very large investments to ensure security of supply and to create integrated and competitive markets." (n.53). This concept of structural (or systemic) conflict of interest (COM(2006) 851 n.52) was already present in Léautier (2001): he concludes his work stressing, as a consequence of his model, the lack of incentives for generators to invest in TX capacity increase; in fact, vertically integrated utilities are aware that the substitution and strategic effects due to TX capacity increase would limit their market power in the local or national wholesale electricity markets, and might thus strategically under-invest. In this sense, a research by Boyce and Hollis (2005), recalling the importance of TX network capacity increase in lowering incumbent's market power, analyzes a wide set of typology of TX companies (transcos) and evidences those assets of governance which make transcos not able to be captured by incumbent or gencos. In conclusion, transcos should neither be shared by gencos nor be not-for-profit: an independent for profit operator is likely to have greater incentives to invest in the grid,

because of its independence from gencos. Facing this strategic behaviour of oligopolistic gencos, Minoia *et al.* (2006) simulated the work of a regulatory authority in assessing the 'optimal network upgrade': starting from an existing grid, they analyze the impacts of network increase applied at a three bus network, trying to identify a solution able to be accepted. Sauma and Oren (2006), recognizing different interests involved in this game model, describe the impacts of TX network expansion for the surplus of each one of the players, including the incumbent (in case of monopoly) or the gencos (in case of oligopoly), the regulatory authority for competition and consumers.

Based on these studies, many scholars focused on the eventual solution to this structural conflict of interest, suggesting different policies, including unbundling.

4.3. Unbundling as a structural solution to the conflict of interest

Two main approaches have been focused on in order to solve the negative consequences of the conflict between gencos' and transcos' interests on grid investments: it is possible to distinguish between short run behavioural measures and long run structural measures. Among the formers, there is a stream focusing on transmission property rights (Joskow and Tirole, 2000; Gilbert, Neuhoff and Newbery, 2004). Still in a short run approach, Sappington (2006) states that, in case of vertically integrated companies, the impact on lower consumers prices would depend on the incumbents' industrial costs structure and their power to practice 'sabotage' of competitors. Thus, he concludes that enforcing control by regulators could be enough to solve the conflict of interest, without any further structural intervention; the need for controls, anyway, is shared by most scholars as a necessary complementary measure. Kwoka (2002), supporter of vertical integration, as explained later, argues that if structural de-integration should be adopted in order to encourage competition in the wholesale market, benefits of vertical integration would need to be preserved either by policies *ad hoc* or by regulatory interventions by specific authorities. It is not possible to deny the positive effects of these solutions and more attention should be paid to them: nevertheless, they do not solve for good the consequences of the incumbents' conflict of interest.

A structural remedy, on the contrary, would affect the natural opposition of gencos in investing in the grid. Léautier, as previously mentioned, introduces the pro-competitive effects of TX capacity increase and argues the risk of conflict of interest for the incumbent; hence, he suggests unbundling as the right, structural solution to solve this problem (2001). Different levels of unbundling can be introduced in the market: 1) the accounting unbundling, requiring only separated accounts for the genco and the transco; 2) the functional unbundling, where separation concerns the activities and the management; 3) the legal unbundling, where the transco and the genco are separated companies; 4) the ownership unbundling, requiring the transco not to be owned by the genco. Many scholars agree on the positive impact of unbundling in grid investments (Boyce and Hollis, 2005; Cremer *et*

al., 2006): among them, a wide and complete review is in Pollitt (2008). In his work, focused on the assessment of ownership unbundling, he concludes that 'ownership unbundling of electricity and gas transmission networks is a key feature of jurisdictions with the most successful energy markets. [...] It seems to be consistent.' (2008: 712).

4.4. Costs of unbundling transmission network

Beside the previous literature promoting unbundling as an investment-enhancing policy, a new strand of scholars have been defending vertical integration in the electricity industry, identifying some evidences of economies of vertical integration among generation and transmission. Pioneers in this field, Kaserman and Mayo (1991) adapted a multiproduct cost function to the vertical structure of the electricity industry, trying to show the existence of 'multistage cost' economies to be preserved from de-integration; they tested this model on a sample of 74 US private owned electricity mono-utilities, concluding that 'the results provide empirical evidence of the existence of significant vertical economies between the generation and distribution stages of electricity supply [so that] … the evidence presented does place a heavy burden on proponents of deregulation schemes that are premised upon forced vertical divestiture in this industry' (1991: 500). Confirmations arrive from D'Aveni and Ravenscraft's comparison between multiproduct cost economies and bureaucracy costs in vertical integrated firms (1994); Delmas and Tokat (2005), testing on 177 US electricity firms between 1998 and 2001; Greer (2008) analyzing cost functions of the rural electricity firms, mainly cooperatives. Outside of the US, Nemoto and Goto (2004) found cost savings from economies of coordination between 0.13 and 2.97% in Japan; in Spain, Jara-Diaz *et al.* (2004) valued 6.5% of savings, while Arocena (2008) shows an impact between 1.1 and 4.9%; Fraquelli *et al.* (2005) found 3% out of the costs in Italy.

At the same time, as Kwoka suggested, 'vertical deintegration is a two-edged sword: While it may be necessary in order to foster competition among generators, it dissolves the structure traditionally relied upon to capture economies of coordination among vertical stages of electricity production' (2002: 653-654). Economies of coordination do not include exclusively multiproduct cost economies, as Kwoka (2002; also Kwoka, 2008) clearly pointed out. He recognizes the existence of multiproduct cost economies, but also takes account of transaction costs economies between generation and transmission: testing on a set of 147 electricity utilities data as of 1989, he concludes that owing to their vertical integration economies most of the current utilities have been able to get their positive results. He proposed a wider catalogue of these economies of coordination:

'– Least-cost dispatch, or deployment, of generating units in order to achieve system minimum cost.

– Coordination of scheduled shutdowns for maintenance.

– Better information about downstream load for purposes of determining future capacity requirements.

– Conservation of reserves by supplying consumption points with diverse load patterns.

– Joint decisions regarding plant size / siting and transmission systems — for example, between a large but distant generator versus smaller generators closer to consumption points.

But unlike other industries, vertical integration in electric power must also address two unique and subtle aspects of network operation that can give rise to market failures. First, since the network must observe energy balance at all times, unexpected supply or demand shocks require adjustments to prevent system failure. Integration accomplishes this by real-time management of power flows from numerous generating units, as well as power flows to large users whose supply may be curtailed to maintain system balance. Second, electricity flows across all available transmission lines in accordance with the laws of physics rather than along some 'contract path' between parties to a financial transaction. The resulting 'loop flow' onto lines of non-parties imposes external costs, costs that are better internalized, for example, by large regional utilities.' (Kwoka, 2002: 655)

Economies of transactions clearly emerge in case of investments in TX network capacity, in fact sunk costs. The generation firm to be connected has to guarantee the supply of electricity in order to make this investment profitable and not useless. Different owners, of course, make these expectations more uncertain: an expensive contract, with high asymmetric information, is to be signed between generation and transmission companies, whilst integration could avoid these transaction costs. Other examples on the role played by the economies of coordination can be found in Arocena (2008), who identifies positive impacts in vertical integration not only in cost savings but also in increased quality of the service. Connected to this last element, Jamasb and Pollitt (2008) hypothesize that the lack of investments in R&D emerged in the last decade is also due to reforms including unbundling.

Also a problem of allocative efficiency arises: in absence of a clear regulation, there is a risk of 'double marginalization' by the two or more different unbundled firms (gencos and transco) instead of the previous single incumbent (Baarsma *et al.* 2007). As also the institutional framework does matter, Baarsma *et al.* (2007) include as well the risk that de-integrated (and less capitalized) firms might be taken over by foreign utilities, with a noxious effect on energy independence and supply security (also in Thomas, 2007b), showing the emergence of geopolitics issues which are strictly related, in the case of the EU energy policy debate, to the economic issues. Künneke and Fens (2007) recognize a problem of supply security in case of de-integration, although they do not consider as an option to preserve vertically integrated companies: they suggest that in a context of privatization in the wholesale and retail electricity markets, (ownership) unbundling, even showing costs for welfare, could be a way to preserve TX network under public ownership, whereas generation is going towards a process of concentration at European level. It is indirect evidence that unbundling, if not associated with public ownership, could determine a problem of energy dependency from foreign or private for profit owners.

There are also interesting findings in Glachant and Lévêque (2006), which underline the role of finance and investment in the electricity sector and, thus, suggest that for financial actors 'vertical integration is the best protection against volatility and the cyclical nature of markets' (2006: 10).

In general terms, the property rights literature shows that vertical integration (Grossman and Hart, 1986) may (or may not) be a second best solution because of the inherent incompleteness of contracts. As in Michaels (2006), the interconnection between de-integration and other factors including the system operator, the condition of competition in the wholesale market and the access to the market of the consumers, should be assessed, because it is the entire system which guarantees reliability.

4.5. An unclear net impact: the role of empirical evidence

In conclusion, scholars assert that both TX network unbundling and vertical integration have an ambiguous net effect on welfare. A deeper assessment on the effect of ownership unbundling is requested, according to Baarsma *et al.* (2007): in their evaluation of unbundling in the Dutch electricity market, they identify potential advantages and disadvantages to be seriously analyzed before proceeding to unbundle. Pollitt presented a similar taxonomy of both benefits and costs of unbundling, which mainly recalls the arguments previously explained (2008): afterwards, he proposes a set of both econometric evidences and case-studies, where the different models of unbundling have been implemented, suggesting a qualitative assessment of the main cases. Brunekreeft (2008) asserts that 'the idea of unbundling is twofold. On the one hand, unbundling should improve competition by restoring the level playing field among competitors. On the other hand, unbundling should improve the incentives for more investment in interconnector capacity' (2008: 5). He argues that unbundling's pro competitive impact would affect not only national markets, but also interconnections with foreign electricity systems, so as to stimulate competition EU-wide. Notwithstanding the emergence of these two important and positive aspects, the 'competition effect' and the 'interconnection effect', recalling the Léautier model, he admits the emergence of a 'cost effect', mainly representing the loss of economies of coordination. He includes the three aspects in his 'Social Cost Benefit Analysis' of the German TSOs, trying to point out some conclusions concerning ownership unbundling's impact: findings from simulation show a positive effect, but small, confirming the difficulty to recognize a clear net impact.

This approach, considering both the positive and the negative impacts appears to be one of the most complete and frequent in the today debate: still there is a need of empirical evidences for a final assessment. The mixed findings, emerging from theories and models, require an analysis of the evidences emerging in different countries implementing reforms, including unbundling, during last years. Thus, besides mono-country analyses, already mentioned above, a cross-country approach can be argued to be more adequate to identify similarities in different contexts, and, as a result, to justify wider conclusions. So far, albeit many scholars recognize a specific role of transmission network unbundling in impacting electricity system, their analyses point out the effects on the

electricity market as a whole, or mainly generation but not transmission *per se*. Steiner (2000) and Hattori and Tsutsui (2004), based on a sample of OECD countries, focus on the impact of unbundling on the retail prices of electricity, but no evidence concerning impacts on the TX capacity or quality is brought. Also Alesina *et al.* (2005) shows clear evidences of positive impact of reforms on investments: their database, concerning 21 OECD countries between 1975 and 1998, include data on regulatory aspects (access to the grid, vertical integration and public ownership) organized in 4 different indicators and on investments in utility sector. Again this is an empirical work assessing investments, but there is no distinction between water and energy, thus nothing specific about impacts of reform on TX system.

4.6. Research hypotheses

As emerged in the literature review, ambiguous evidences do not help to assess whether the net effect of unbundling is positive or negative. The uncertainty of the conclusions of scholars can be easily explained, at first, because of the different assumptions in their theoretical models rely on, influencing the final findings. Secondly, most of the empirical works, as previously presented, try to apply models to the cost functions of firms operating in a specific country: thus these works estimate the possible impact of unbundling on these firms, studying their costs, but no general and *ex post* evidences of impacts have been yet provided and analyzed, nor effects other than cost efficiency are explored.

This work moves from the consideration that, after a decade of proposed and implemented unbundling policies, it is eventually possible, albeit preliminarily, to assess their impact on the electricity sectors involved. Studies on consequences of unbundling on the wholesale and retail markets, as already said, are numerous and rather exhausting on this topic: what the debate needs is an assessment of capacity and quality of the national grid and interconnections. On the base of these previous arguments, it is clear that the research hypotheses relate to the assessment of evidences of higher investments in TX and ICX capacity and quality, identifying possible connections with the ongoing process of unbundling that characterizes most of the analyzed countries in the period 2000-2006. Obviously, as mentioned above, unbundling measures can be introduced into different ways and with different effects on the level of vertical integration of the incumbents. Three different levels of unbundling have been identified: ownership unbundling; legal unbundling; account and functional unbundling. Thus, synthetically, this work aims to verify whether:

- 1a) the TX and ICX networks that have been ownership unbundled show a greater growth of capacity and a higher quality (less disturbances) in opposition to all the other electricity markets;

- 1b) the TX and ICX networks that have been ownership -or legally- unbundled show a greater growth of capacity and a higher quality in opposition to all the other electricity markets;
- 1c) the TX and ICX networks that have been ownership -or legally or functional- unbundled show a greater growth of capacity and a higher quality in opposition to not unbundled electricity markets.

In the approach *à la* Léautier, unbundling is implemented in presence of a vertically integrated incumbent who has not sufficient incentives to invest in the network. Hence, there is a second strong hypothesis to be verified: it could be supposed that a positive relation between unbundling and grid investments might be more evident where the level of market power of the wholesale market is higher and the incumbent's market power stronger. On the contrary, where competition in the market is established, there could be minor evidence: incentives to discriminate rivals could be smaller as network capacity could have already adapted. Consequently, concentration of the wholesale markets has to be considered, namely if markets are concentrated or not (in case of TX networks); or if both the interconnected countries are concentrated or not (for ICX networks). Henceforth, hypotheses to be verified will include the following statements:

- 2a) If the wholesale markets are concentrated, the TX and ICX networks that have been ownership unbundled are more likely to show a greater capacity and higher quality;
- 2b) If the wholesale markets are concentrated, the TX and ICX networks that have been ownership –or legally- unbundled are more likely to show a greater capacity and higher quality;
- 2c) If the wholesale markets are concentrated, the TX and ICX networks that have been ownership –or legally or functional- unbundled are more likely to show a greater capacity and higher quality.

At the same time, it could be also expected that:

- 3a) If the wholesale markets are not concentrated, the TX and ICX networks that have been ownership unbundled may or may not show a greater capacity and higher quality;
- 3b) If the wholesale markets are not concentrated, the TX and ICX networks that have been ownership –or legally- unbundled may or may not show a greater capacity and higher quality;
- 3c) If the wholesale markets are not concentrated, the TX and ICX networks that have been ownership –or legally or functional- unbundled may or may not show a greater capacity and higher quality.

5. Empirical strategy

The statistical analysis aims to be a first step into this research field: it could be defined as an exploration inside the general trend characterizing the physical and qualitative development of the TX and ICX systems before and after the introduction of the unbundling measures into the national electricity sectors.

5.1. Indicators

Most of scholars, in the previously cited works, use monetary values. Alesina *et al.* (2005) chooses monetary proxies (investments, gross capital stock, and value added at the country-sector-year), taken from the OECD STAN database, but, as already said, values in that case include both water and energy, without any possibility to distinguish electricity. As well as OECD, most of the other international institutions, including the International Energy Agency (IEA) do not provide any database concerning monetary expenditures in TX grids and ICX. On the other hand, balances of the main national companies could have been collected and analyzed: this approach would have reduced the breadth of this research, as monetary values cannot be easily collected for a sufficient group of firms through their annual reports: balances are available on line only for few cases and for the latest years; they are not always available online in other languages but the national one, and even if they were, often these documents do not clarify the destination of the investments; in case of vertically integrated firm this makes quite difficult to analyze data. Finally, it could be argued that physical rather than monetary values get real of the problem of potentially inefficient investments, by coupling the grid improvements.

Consequently, it has been decided to focus upon techno-engineering indicators which provide information on the extension and quality of the grid.

- For TX capacity:
    - length of the national TX network, both 220kV and 380kV lines, and their sum;
    - number and capacity of transformers in the TX network, including transformers from 220kV to less than 220kV; from 380kV to 220kV; and from 380kV to less than 220kV.
- For TX quality:
    - number of annual unplanned disturbances in the TX due to failure of the grid and not to external factors;
    - minutes of annual outages in the TX;
    - energy not supplied (ENS) during the annual outages.
- For ICX capacity:
    - conventional thermal capacity of ICX between two countries of the sample;

- number of circuits between two substations of an ICX, organized into 3 groups of different range of voltage (lower than 220kV; equal to or higher than 220kV but lower than 380kV; higher than 380kV).

- For ICX quality:
  - minutes of annual planned disturbances in the ICX due to maintenance;
  - minutes of annual unplanned disturbances in the ICX due to failure of the grid and not to external factors.

Both for TX and ICX it is noteworthy that quality indicators on disturbances provide also a measure of capacity: disturbances due to failures of the system often depend on bottleneck of the grid, which are a sign of not adequate capacity.

Regulatory indicators for each country have been chosen in order to estimate:

- level of unbundling in the electricity sector
- concentration of the wholesale market

5.2. Data sources

Whilst monetary data on grid investments are not available, data concerning physical aspects and qualitative performance of TX network and ICX are available, but they are raw, not collected and organized in any database at international level. OECD, IEA, EUROSTAT or World Bank's online databases concentrate on electricity market values (prices, concentration of the market, level of generation and energy mix, import and export flows), not on the physical characteristics of the grid. Although international institutions related to TX exist, they often collect and provide widely data on daily (even hourly) electricity flows among countries, but there is no systemic collection of data on the grid *per se*, or, whereas present, they are raw and, for some countries not updated. Some of these institutions are the Union for the co-ordination of transmission of electricity (UCTE), the association of the transmission operators of 24 countries of the continental Europe, including both western and eastern countries[1]; Nordel, which operates in the Scandinavian countries[2]; European Transmission System Operators (ETSO, since December 2008 ENTSO) where the previous associations cooperate with operators of other countries[3].

Data concerning the grid have been collected mainly from UCTE archive, and subsequently re-organized in an appropriate dataset. The availability of these data and the political relevance of the represented countries justify the decision to concentrate this research only on most of the EU

[1] Austria, Bosnia Herzegovina, Belgium, Bulgaria, Switzerland, Czech Republic, Germany, Denmark West, Spain, France, Greece, Croatia, Hungary, Italy, Luxembourg, Montenegro, FYROM, the Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, Slovak Republic.

[2] Denmark, Finland, Iceland, Norway and Sweden.

[3] UCTE and Nordel Members plus Cyprus, Estonia, Latvia, Lithuania, Ireland, the United Kingdom.

countries and their neighbours, ignoring the USA, Japan or other OECD members. At the same time, one of the aspects of originality of this work consists of the collection of data on the physical status of TX and ICX and their availability to analyze and to assess what has happened in the UCTE countries between 2000 and 2006. The selected range of years, from 2000 to 2006, has been chosen in order to guarantee that for many countries the time window embraces the period before and after unbundling implementation and it takes into account also the different steps of unbundling legislation. The annual European Commission's Communications on the Prospects for the internal gas and electricity market (or Benchmarking Reports on the implementation of the internal gas and electricity market), since 2001, have been providing periodic reviews of the levels of implemented unbundling in the EU countries; for the extra-EU information have been collected by the national laws or previous analyses. The same source has been used to identify other aspects of the market, including concentration and public ownership.

Table 1: TX capacity and quality indicators

Name	Definition	Time	Source
Length 220kV grid	Length of the 220kV grid measured in KM	2000-2006	UCTE Statistical Yearbook
Length 380kV grid	Length of the 380kV grid in KM	2000-2006	UCTE Statistical Yearbook
Total length grid	Sum of the length of the 220kV and the 380kV grid in KM	2000-2006	UCTE Statistical Yearbook
Capacity Transformers 380/400 – 220	Capacity of transformers in the network from 380/400kV to 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Capacity Transformers 220 - < 220	Capacity of transformers in the network from 220kV to less than 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Capacity Transformers 380/400 - < 220	Capacity of transformers in the network from 380/400kV to less than 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Number Transformers 380/400 - 220	Number of transformers in the network from 380/400kV to 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Number Transformers 220 - < 220	Number of transformers in the network from 220kV to less than 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Number Transformers 380/400 - < 220	Number of transformers in the network from 380/400kV to less than 220kV in GVA	2000-2006	UCTE Statistical Yearbook
Unplanned Disturbances	Number of disturbances due to a) overload or failure in the transmission network (UCTE code 2002-2003: R3-R6); b) overload or false operation or failure in protection device or other elements (UCTE code 2004-2006: R4-R6)	2002-2006	UCTE Statistical Yearbook
Outages	Restoration time for unplanned disturbances in minutes	2002-2006	UCTE Statistical Yearbook
Energy Not Supplied (ENS)	Estimated amount of energy which would have been supplied if the unplanned disturbance (defined as above) did not occur; measured in MWh	2002-2006	UCTE Statistical Yearbook

Table 2: ICX capacity and quality indicators

Name	Definition	Time	Source
Conventional Thermal Capacity	Sum of the thermal load capability of cross-frontier tie-lines of each interconnection, calculated on parameters standardised by the UCTE based on specific ambient temperature, wind velocity and voltage; measured in MVA	2000-2006	UCTE Statistical Yearbook
Number of Circuits	Number of cross-frontier tie-lines for each interconnection	2000-2006	UCTE Statistical Yearbook
Planned Disturbance	Time of unavailability of cross-frontier tie-lines due to maintenance, repair or new construction (UCTE code 2002-2003: R1-R2; UCTE code 2004-2006: R1-R3)	2002-2006	UCTE Statistical Yearbook
Unplanned Disturbances	Time of unavailability of cross-frontier tie-lines due to a) overload or failure in the transmission network (UCTE code 2002-2003: R3-R6); b) overload or false operation or failure in protection device or other elements (UCTE code 2004-2006: R4-R6)	2002-2006	UCTE Statistical Yearbook

Table 3: Regulatory indicators

Name	Definition	Time	Source
TX Unbundling	Level of Unbundling of Transmission Network distinguished among: - Ownership unbundling (OU) - Legal unbundling (LU) - Functional or Accounting unbundling (FU) - No unbundling	2000-2006	European Commission's Benchmarking Reports on the implementation of the internal electricity and gas market; Swiss Department for Energy; National Authorities
Concentration of the market	Concentration of the wholesale market. According to usual parameters, markets are supposed to be concentrated (CONC=1) whether: - The largest company's market share (C1) is higher than 33%; or - The sum of the three largest companies' market shares (C3) is higher than 50%; or - The Herfindahl-Hirschman index (HHI), defined as the sum of the squares of the market shares, in percent, of all firms in the market, is higher than 1800	2000-2006	EUROSTAT; European Commission's Benchmarking Reports on the implementation of the internal electricity and gas market; National Authorities

5.3. General overview of the sample

A database has been designed to include the mentioned 14 countries[4] from UCTE for the TX network and 28 ICX[5] among UCTE members and between UCTE and non-UCTE countries, during the period 2000-2006. For each country-year pair, physical indicators have been evaluated not in

[4] Austria, Belgium, Switzerland, Czech Republic, Germany, Spain, France, Hungary, Italy, the Netherlands, Poland, Portugal, Slovenia and Slovakia

[5] Austria – Switzerland, 1; Austria - Czech Republic, 2; Austria – Germany, 3; Austria – Italy, 4; Austria – Hungary, 5; Austria – Slovenia, 6; Belgium – France, 7; Belgium – the Netherlands, 8; Switzerland – Germany, 9; Switzerland – France, 10; Switzerland –Italy, 11; Czech Republic – Germany, 12; Czech Republic –Poland, 13; Czech Republic – Slovakia, 14; Germany – Denmark East, 15; Germany – Denmark West, 16; Germany –France, 17; Germany - the Netherlands, 18; Germany – Poland, 19; Germany – Sweden, 20; Spain – France, 21; Spain – Portugal, 22; France – United Kingdom, 23; France – Italy, 24; Italy – Slovenia, 25; Hungary – Slovakia, 26; Poland – Sweden, 27; Poland – Slovakia, 28.

their absolute value, but in their annual growth rate; quality indicators, on the contrary, have been evaluated in their absolute value.

5.3.1. Transmission system data

A general overview of the database concerning TX can be useful before introducing the statistical analysis. First of all, looking at the length of the grid (fig.1), it appears clearly the relevant dimension of TX network in France, Germany, Spain, but also in Italy and Poland.

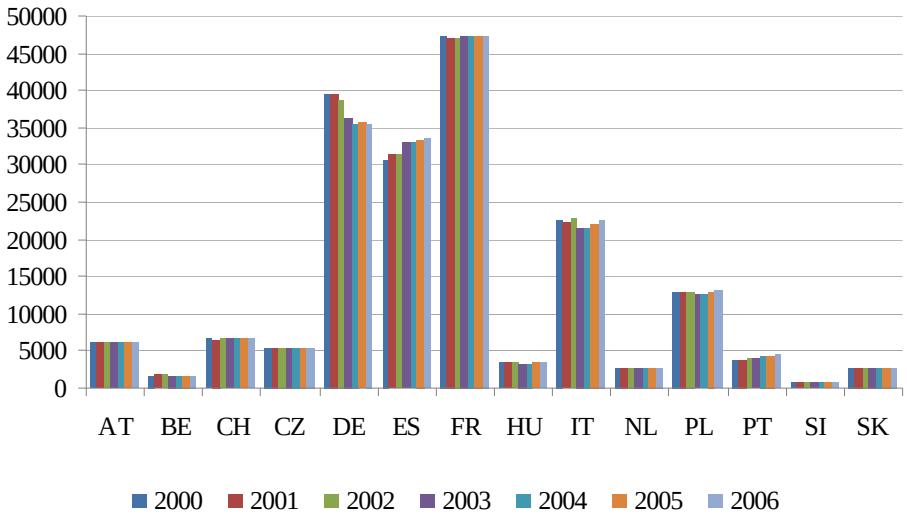

Figure 1: Grid length of the network between 2000 and 2006. UCTE Statistical Yearbooks

Between 2000 and 2006, everywhere the dimension of the grid has not considerably changed: as figure 1 shows, annual increases and decreases are almost negligible with the exceptions of Germany and Spain. Both of them have been characterized by an increase of the 380kV network but in Germany the decrease of the 220kV network has negatively affected the net effect. Looking at the aggregated data (fig. 2) the range of values between the minimum in 2004 and the maximum in 2006 is not impressive and show no substantial variations.

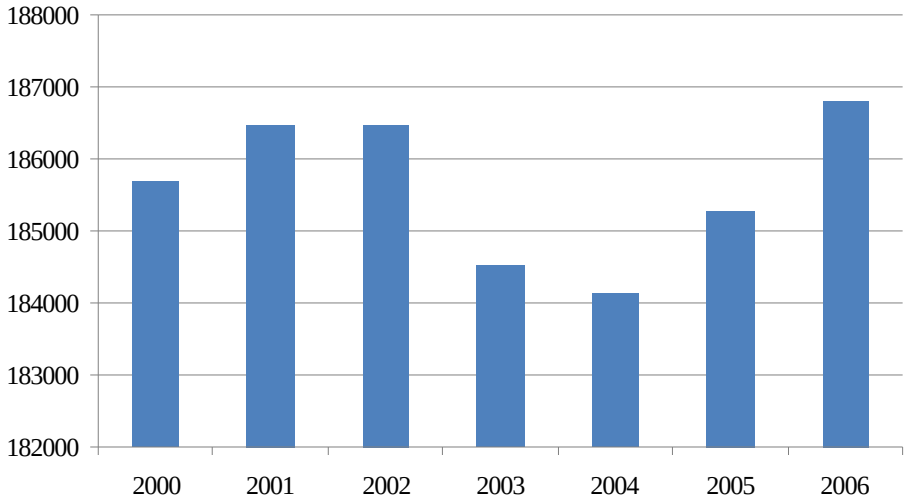

Figure 2: Length of the grid of the entire sample (km). Source: UCTE Statistical Yearbooks

Some essential statistics on the TX grid capacity variation have been reported in the tables 4 and 5: these data confirm that variations have been quite few and of low impact, as mean and medians clearly show, in particular way for the length grid. Transformers show a wider range between maximum and minimum, due probably to the shift towards a stronger 380kV network. Distributions of the variables showed in the following tables have been represented in the appendix.

Table 4:Annual variation of total grid length in TX-dataset

	Total length grid (Annual growth rate)
Time	*2001-2006*
Obs.	84
Mean	0.005414
Median	0
Maximum	0.131755
Minimum	-0.081009
Std. Deviation	0.026126
Skewness	1.011371
Kurtosis	10.46348

Table 5:Annual variation of total number of transformers in TX-dataset

	Number of Transformers (Annual growth rate)
Time	*2001-2006*
Obs.	84
Mean	-0.007212
Median	0
Maximum	0.352941
Minimum	-0.783871
Std. Deviation	0.114034
Skewness	-3.827977
Kurtosis	28.41616

In relation to qualitative performance of the grid (summarized in tables 6-8), more comments can be suggested. First of all, it should be said that these three variables, although interconnected, are not correlated, because each case of disturbance can have different duration and imply different levels

of ENS. Secondly, as emerged in the tables, while capacity seems not to have changed substantially, unplanned disturbances in the TX grid occurred with high frequency and involved the most part of the sample, but Austria, Belgium and Slovenia. At the same time, it should be said that standard deviations confirm a high variability among countries, not only for the number of unplanned disturbances, but also, and mainly, for the duration they take and the ENS they imply. In Poland and France a large number of unplanned disturbances happened, albeit only in Poland it determined a long restoration time. Moreover, among the cases which more seriously affected the quality of the service, Poland has been characterized by a long duration of interruptions, mainly in 2003; while Italy, where duration of –frequent- disturbances is low, in 2003 has been signed by a very high level of ENS.

Table 6: Number of unplanned disturbances in TX-dataset

	Unplanned Disturbances
Time	*2002-2006*
Obs.	65
Mean	2.476923
Median	1
Maximum	22
Minimum	0
Std. Deviation	3.996513
Skewness	2.528374
Kurtosis	10.73603

Table 7: Minutes of outages in unplanned disturbances in TX-dataset

	Outages
Time	*2002-2006*
Obs.	65
Mean	1240.954
Median	15
Maximum	39485
Minimum	0
Std. Deviation	5262.922
Skewness	6.278734
Kurtosis	44.74125

Table 8: ENS (MWh) in unplanned disturbances in TX-dataset

	ENS
Time	*2002-2006*
Obs.	65
Mean	3791.108
Median	20
Maximum	180099
Minimum	0
Std. Deviation	22515.53
Skewness	7.573142
Kurtosis	59.68025

After analyzing physical and qualitative variables, regulation in the sample has to be considered between 2000 and 2006: figure 3 puts in evidence that since 2000 countries which implemented unbundling increased so as to involve the entire sample: as of 2006, all countries have at least a minimum level of unbundling, 13 legal unbundling, although only five countries out of 14 adopted

ownership unbundling policy. Unexpectedly, it is very surprising that concentrated wholesale markets in 2000 (11 out of 14) equate to those in 2006: it could be immediately argued that unbundling policy seem not to have produced any significant impact on the concentration index of wholesale markets.

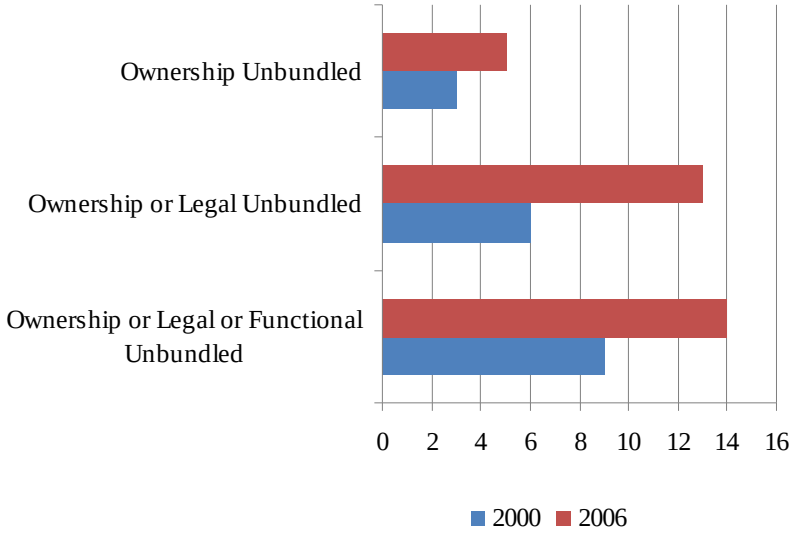

Figure 3: Number of countries implementing unbundling measures in the electricity sector. Source: Elaboration on European Commission data

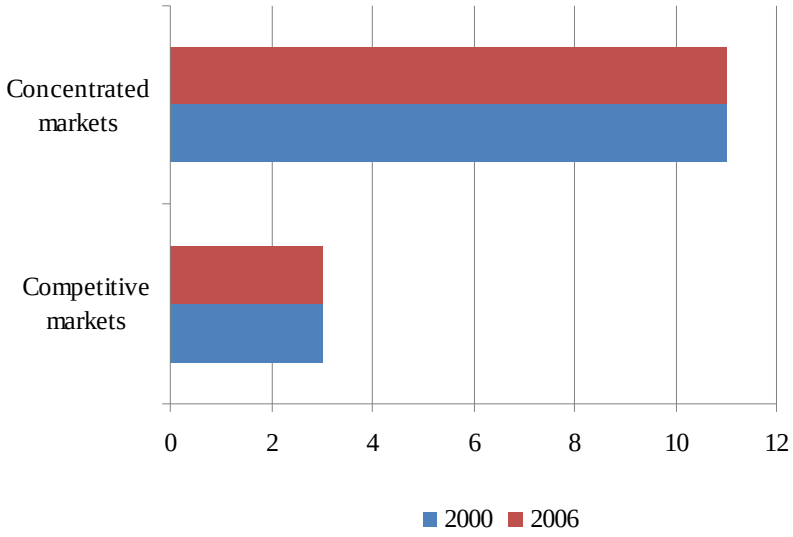

Figure 4: Number of concentrated and competitive national electricity wholesale markets in 2000 and 2006. Source: Elaboration on European Commission data

5.3.2. ICX systems data

The analysis of the ICX-dataset allows identifying immediately the principal axis along which European interconnections rely on. It could be argued that there are sort of 'heart', in the middle of Europe, where there are the most part of the ICX networks in terms of number of circuits and their capacity: it is the area including Germany and its partners Austria, Switzerland and the Netherlands (fig. 5); Spain - Portugal and Italy - Switzerland are recently strengthening their relationships as well, essentially because of the increasing demand of energy in Italy and Portugal.

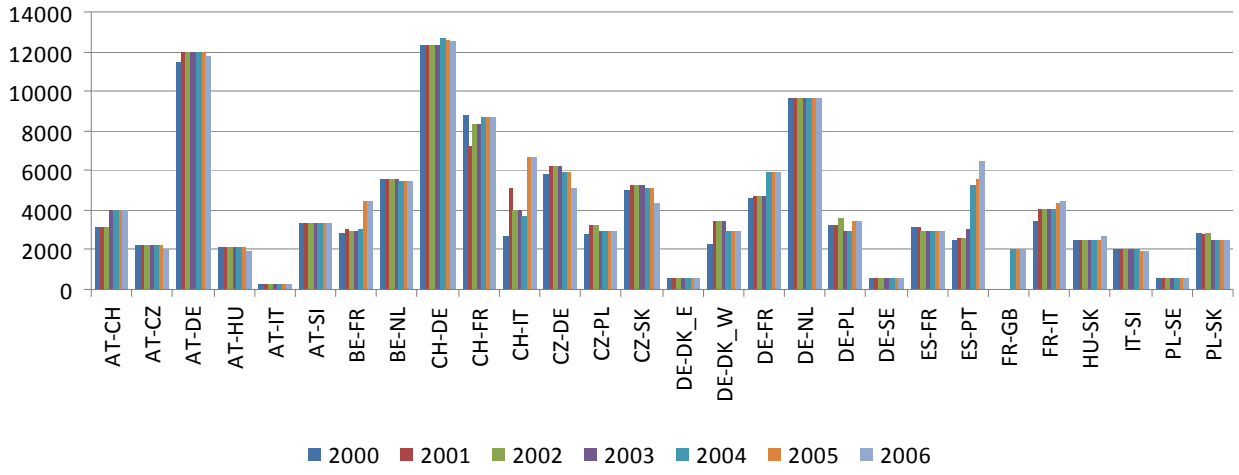

Figure 5: Conventional thermal capacity of ICX networks in ICX-dataset

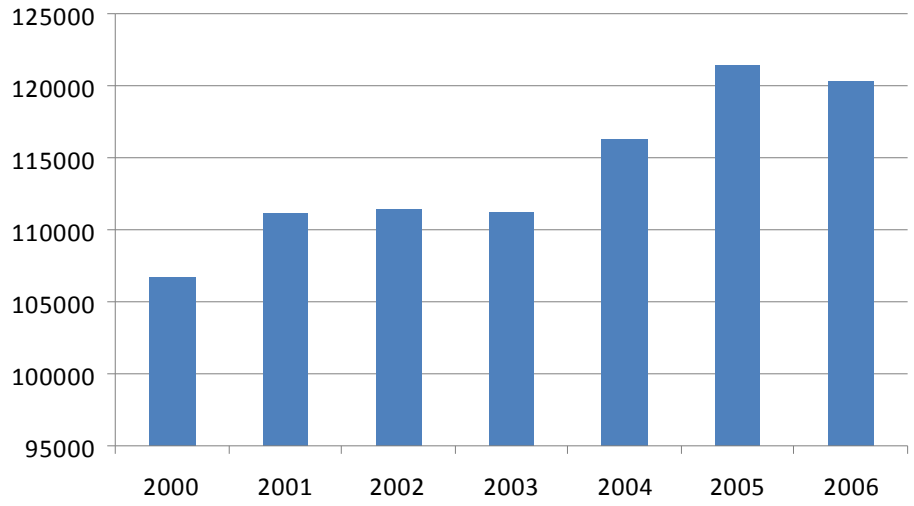

Figure 6: Aggregated conventional thermal capacity of ICX (2000-2006). Source: Elaboration on UCTE data

Differently from the TX-dataset, in general aggregated ICX capacity shows a positive trend of growth (fig. 6), even if, as shown in the tables 9 and 10, due, presumably, to the increased demand of energy which national markets are no longer able to face without relying on higher quantity of imported electricity.

Table 9: Conventional thermal capacity (MVA) of ICX

	Conventional Thermal Capacity (Annual growth rate)
Time	*2001-2006*
Obs.	164
Mean	0.023529
Median	0
Maximum	0.892449
Minimum	-0.227131
Std. Deviation	0.133886
Skewness	4.276916
Kurtosis	25.10064

Table 10: Number of circuits for each ICX

	Number of Circuits (Annual growth rate)
Time	*2001-2006*
Obs.	166
Mean	0.007531
Median	0
Maximum	0.333333
Minimum	-0.2
Std. Deviation	0.057018
Skewness	3.42723
Kurtosis	21.12719

Qualitative performance of the system of ICX show a substantial difference between planned and unplanned disturbances: the former show a high mean and median and the range of values is quite wide, albeit their positive skew; finally higher duration of these disturbances seems to be more likely linked with higher capacity. Unplanned disturbances are not frequent and their maximum is however lower than the mean of planned disturbances. Median is 0 and the low variance reveals a positive performance of the ICX networks.

Table 11: Duration of planned disturbances in ICX (minutes)

	Planned Disturbances
Time	*2002-2006*
Obs.	140
Mean	53625.88
Median	37880
Maximum	245673
Minimum	0
Std. Deviation	52031.31
Skewness	1.399926
Kurtosis	4.629078

Table 12: Duration of unplanned disturbances in ICX (minutes)

	Unplanned Disturbances
Time	*2002-2006*
Obs.	140
Mean	440.7429
Median	0
Maximum	10288
Minimum	0
Std. Deviation	1465.747
Skewness	4.569018
Kurtosis	25.211

In order to analyze the impact of unbundling on investments in the ICX, particular attention will be paid to the cases of interconnections between countries which have, both of them, implemented a) ownership unbundling (BOU); b) legal unbundling (BLU); c) functional unbundling (BFU). The regulatory context in 2000 and 2006 is shown in the figure 7: as in the case of the TX network analysis, all the couples of countries can be defined BFU in the 2006, while they were 9 in 2000, and 22, out of 28, BLU, 20 more than in 2000. Notwithstanding this high increase of unbundling implementation, only 2 couples are BOU. As in the TX-dataset, concentrated markets not only do

not decrease, but, in the ICX dataset affect a higher number of ICX (3 units more), with a reduction of the number of ICX characterized by competitive countries (fig. 8).

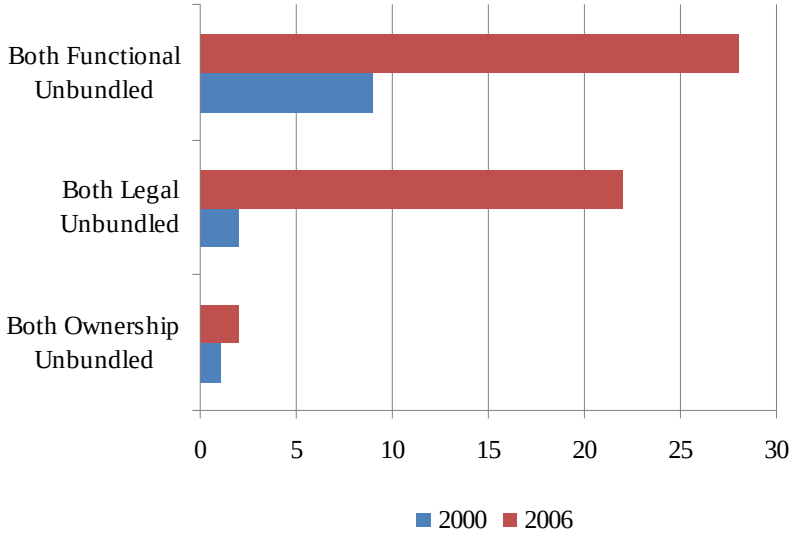

Figure 7: Number of couples of countries implementing unbundling measures in the electricity sector. Source: Elaboration on European Commission data

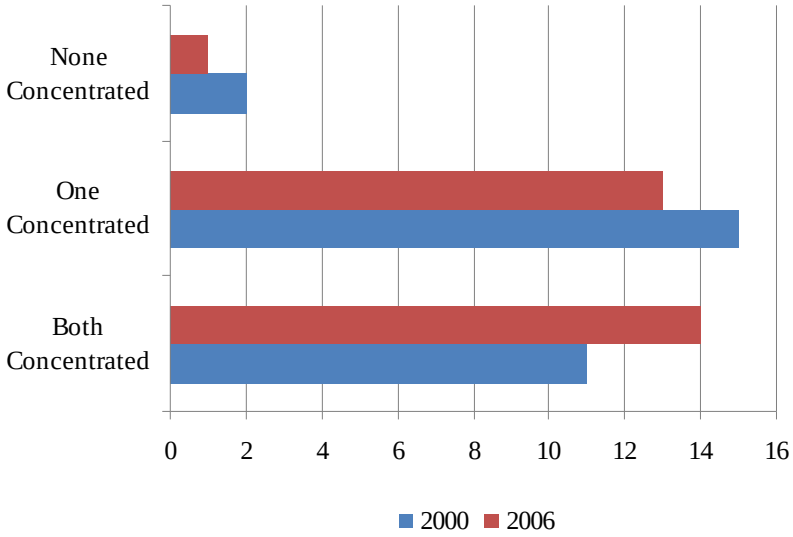

Figure 8: Taxonomy of ICX-year pair based on the concentration of the respective markets: both concentrated wholesale markets; only one out of 2; or none concentrated (both competitive). Source: Elaboration on European Commission data

In conclusion, this general overview seems to confirm the problems of under-investments the European Commission have been complaining about for the last years. In a context of increasing demand and supply of energy, infrastructures become more and more important for the sustainability of the energy system. Debating on the effective role of unbundling, as promoted and suggested by the EU, cannot forget that, as just said, unbundling, although functional and legal, has been widely introduced so far; nevertheless, while concentration of the market do net decrease, essential physical and qualitative aspects of the grid do not show important growth rates.

5.4. Statistical methodology

In general terms, the empirical analysis compares a group of observations characterized by a specific level of unbundling with the counterfactual case (all the other observations) for each subsample. Afterwards differences emerging from the comparison of the groups' performances will be analyzed to produce some general findings and, eventually, to explain them. Moreover, median has been selected as the statistic that better allows comparing the two groups for each subsample. Two remarks on this statistical methodology are fundamental. Median tests are not parametric tests, so differences between the two groups' medians are a good indicator to discover an impact of unbundling on quality; it is less clear if it is so powerful for capacity values as well. This is the reason why it has been decided not to focus on one single variable, but a set of them has been chosen. Actually, even if a multivariate analysis could better answer to this topic, this is a first attempt to give a sort of robustness to this topic: many different variables as proxies are an attempt to find an answer to the research question about an effective relationship between unbundling and grid investments. Secondly, time is an important limit of this analysis: only seven years, and often even less for some forms of unbundling and for some variables, are quite few, and this could have affected the general results. Nevertheless, because of the lack of empirical evidences in the current debate, this contribution can represent a first step on this topic, to be updated and corrected year after year, the wider the ownership unbundling is adopted and the more the time of implementation increases.

Among variables of TX-dataset, concentration of the wholesale market distinguishes two subsamples; it is equal to 1 for concentrated wholesale electricity markets, and equal to 0 for competitive markets. The EU methodology has been chosen in order to assess whether a market can be defined as 'concentrated': if the largest generator's share (C1) is higher than 33% of the market, then concentration is equal to 1. Whereas C1 is not available, the alternative criteria are: if the sum of the three largest generators' shares (C3) is higher than 50% or if the HHI is above 1800. In the case of the ICX database, the two subsamples are organized distinguishing ICX between couples of both concentrated countries (BCON=1) and ICX between countries where at least one is not concentrated (BCON=0).

Unbundling for each country-year pair has been distinguished into the three general levels of functional, legal and ownership unbundling, according to the EU Benchmarking Reports. In the first test of TX-dataset, median of the observations concerning countries where ownership unbundling (OU) has been implemented have been compared to the median of the group of countries where it has not. In the second test, the two groups have been identified on the base of the adoption of either ownership or legal unbundling, that is, synthetically, legal unbundling (OLU); finally, third test,

median of countries implementing at least functional unbundling (OLFU) has been compared to the characteristics of those countries not implementing any form of unbundling. In the ICX database, as previously said, each couple of countries has been associated to a combination of cases: 1) both countries with ownership unbundled network (BOU); 2) only one ownership unbundled and the other legally unbundled; 3) both countries with legally unbundled network (BLU); 4) only one legally unbundled and the other functionally unbundled; 5) both countries with functionally unbundled network (BFU); 6) only one functionally unbundled and the other not unbundled, but it does not include any observation. In fact, only cases 1, 3 and 5 have been considered for tests on ICX-dataset: in particular the three tests analyze and compare medians between case 1) and all the other observations; between case 3) OR 2) OR 1) versus others; between case 5(=6) OR 4) OR 3) OR 2) OR 1) versus others.

In conclusion, on the base of the research hypotheses on relation between different levels of unbundling and grid investments; on the base of the distinction between concentrated and not concentrated markets in the sample, both the TX-dataset and the ICX-dataset have been split into two subsamples, respectively A-B and C-D, based on the concentration of markets; according to different levels of unbundling, 3 tests for each subsample have been applied on the observations.

- TX-dataset:
    - Subsample A, concentrated wholesale markets (CONC=1)
        - test A1: ownership unbundled (OU) markets versus other observations;
        - test A2: ownership or legally unbundled (OLU) markets versus other observations;
        - test A3: ownership or legal or functional unbundling (OLFU) versus other observations.
    - Subsample B, competitive wholesale markets (CONC=0)
        - test B1: OU markets versus other observations[6];
        - test B2: OLU markets versus other observations;
        - test B3: OLFU versus other observations.
- ICX-dataset:
    - Subsample C, both countries with concentrated wholesale markets (BCON=1)
        - test C1: both ownership unbundled (BOU) markets, described previously as case 1), versus other observations;

[6] only one observation in the OU group; test results, not significant, have not been included in final tables.

- test C2: at least both legally unbundled (BLU) markets, including the above mentioned cases 1, 2 and 3, versus other observations;
- test C3: at least both functional unbundling (BFU), including from case 1 to 5, versus other observations.

o Subsample D, including ICX where at least one country's wholesale market is not concentrated (BCON=0)

- test D1: BOU versus other observations[7];
- test D2: at least BLU versus other observations;
- test D3: at least BFU versus other observations.

6. Empirical results

Main findings from the median tests have been here collected in tables and analyzed. Few words on the rationale the tables have been set with. At first, results of tests on TX-dataset will be assessed, followed by the analysis of the ICX-dataset. Quality indicators have been distinguished from the capacity indicators and separately analyzed. For both quality and capacity indicators tables distinguish among tests on the whole sample, on observations concerning concentrated markets (CONC=1 for TX; for ICX between both concentrated markets BCON=1) and competitive markets (CONC=0 for TX; for ICX where at least one of the two markets is not concentrated BCON=0). Finally, for the whole sample and each subsample, three tests, as previously mentioned, have been applied and their results have been aggregated in one single table. Every table shows both the medians and the number of observations of the groups compared in the tests, followed by the general median and the total number of observations, not grouped according to the level of unbundling.

6.1. TX system: quality

In tables 13-15 findings concerning quality in TX systems are shown.

Table 13: quality in TX network 2002-2006; whole sample (concentrated and competitive markets)

Median	*obs.*	ENS [MWh]	*obs.*	Outages [min]	*obs.*	Number of unplanned disturbances
OU markets	*24*	28.5	*24*	31	*22*	1
Counterfactual	*39*	0	*37*	0	*41*	0
OLU markets	*48*	6.5	*47*	0	*47*	2
Counterfactual	15	192	14	35	16	0
OLFU markets	*55*	13	*53*	0	*54*	0.5
No unbundling	*8*	160	*8*	90	*9*	3
All sample	*63*	16	*61*	10	*63*	1

[7] only one observation for the BOU group, hence test results have not been included in the final tables.

Table 14: quality in TX network 2002-2006; concentrated markets (CONC=1)

Median	*obs.*	ENS [MWh]	*obs.*	Outages [min]	*obs.*	Number of unplanned disturbances
OU markets	*23*	25	*23*	15	*21*	1
Counterfactual	*26*	0	*26*	0	*24*	0
OLU markets	*44*	6.5	*44*	3.5	*41*	0
Counterfactual	*5*	128	*5*	99	*4*	2.5
OLFU markets	*44*	6.5	*44*	3.5	*41*	0
No unbundling	*5*	128	*5*	99	*4*	2.5
All sample	*49*	16	*49*	10	*45*	0

Table 15: quality in TX network 2002-2006; competitive markets (CONC=0)

Median	*obs.*	ENS [MWh]	*obs.*	Outages [min]	*obs.*	Number of unplanned disturbances
OLU markets	*4*	212.5	*3*	0	*3*	0
Counterfactual	*10*	286	*11*	33	*11*	2
OLFU markets	*11*	315	*11*	16.5	*10*	1
No unbundling	*3*	257	*3*	138.5	*4*	2
All sample	*14*	286	*14*	29	*14*	1.5

Analyzing, firstly, quality performances in the whole sample (table 13), it can be argued that medians of indicators for OLFU markets are lower than medians in not unbundled countries, which implies that unbundling, if compared to vertical integration, can be associated to less frequent unplanned disturbances, minor outages and less ENS. It is noteworthy that this evidence can be argued to be independent from the level of concentration of the wholesale markets, as tables 14 and 15 produce the same results, with only one exception for ENS in OLFU competitive markets. Positive values for quality indicators emerge also in the OLU markets, both in concentrated and in competitive markets: unbundling guarantees more incentives to safeguard quality performance of the grid. On the contrary, different findings emerge from the analysis of the OU markets. First of all, as already pointed out, there is only one ownership-unbundled system among the 21 competitive markets of the sample: the analysis of OU relates mainly to concentrated markets. In this case, surprisingly, the result is even twisted if related to our hypotheses. OU is associated to worse TX network quality, if compared to the counterfactual case: all the three quality indicators show a median value higher in case of OU. OU, supposed to offer more incentives to improve performances, in fact seems to determine a distortion: not only medians but also means (in appendix) confirm these results.

6.2. **TX system: capacity**

Tables 16A: capacity in TX network 2001-2006; whole sample (concentrated and competitive markets)

median	*obs.*	Δ Length 220kV grid	*obs.*	Δ Length 380kV grid	*obs.*	Δ Total length grid
OU markets	*27*	0	*27*	0	*27*	0.0000603
Counterfactual	*57*	0	*57*	0	*57*	0
OLU markets	*57*	0	*57*	0.000414	*57*	0.000786
Counterfactual	*27*	0	*27*	0	*27*	0
OLFU markets	*70*	0	*70*	0	*70*	0
No unbundling	*14*	-0.00089	*14*	0.002024	*14*	-0.0000947
All sample	*84*	0	*84*	0	*84*	0

Table 16B: capacity in TX network 2001-2006; whole sample (concentrated and competitive markets)

median	*obs.*	Δ Capacity transformers 380/400 - 220	*obs.*	Δ Capacity transformers 220 - < 220	*obs.*	Δ Capacity transformers 380/400 - < 220
OU markets	*24*	0	*27*	0	*27*	0
Counterfactual	*57*	0	*56*	0	*57*	0
OLU markets	*54*	0	*56*	0	*57*	0
Counterfactual	*27*	0	*27*	0	*27*	0
OLFU markets	*67*	0	*69*	0	*70*	0
No unbundling	*14*	0	*14*	0	*14*	0
All sample	*81*	0	*83*	0	*84*	0

Table 16C: capacity in TX network 2001-2006; whole sample (concentrated and competitive markets)

median	*obs.*	Δ Number transformers 380/400 – 220	*obs.*	Δ Number transformers 220 - < 220	*obs.*	Δ Number transformers 380/400 - < 220
OU markets	*24*	0	*27*	0	*27*	0
Counterfactual	*57*	0	*56*	0	*57*	0
OLU markets	*54*	0	*56*	0	*57*	0
Counterfactual	*27*	0	*27*	0	*27*	0
OLFU markets	*67*	0	*69*	0	*70*	0
No unbundling	*14*	0	*14*	0	*14*	0
All sample	*81*	0	*83*	0	*84*	0

Table 17A: capacity in TX network 2001-2006; concentrated markets

median	*obs.*	Δ Length 220kV grid	*obs.*	Δ Length 380kV grid	*obs.*	Δ Total length grid
OU markets	*26*	0	*26*	0	*26*	0.0000301
Counterfactual	*40*	0	*40*	0	*40*	0
OLU markets	*53*	0	*53*	0.000143	*53*	0.0000603
Counterfactual	*13*	0	*13*	0	*13*	0
OLFU markets	*57*	0	*57*	0	*57*	0
No unbundling	*9*	0	*9*	0	*9*	0
All sample	*66*	0	*66*	0	*66*	0

Table17B: capacity in TX network 2001-2006; concentrated markets

median	*obs.*	Δ Capacity transformers 380/400 – 220	*obs.*	Δ Capacity transformers 220 - < 220	*obs.*	Δ Capacity transformers 380/400 - < 220
OU markets	*24*	0	*26*	0	*26*	0.009009
Counterfactual	*40*	0	*39*	0	*40*	0
OLU markets	*51*	0	*52*	0	*53*	0
Counterfactual	*13*	0	*13*	0	*13*	0
OLFU markets	*55*	0	*56*	0	*57*	0
No unbundling	*9*	0	*9*	0	*9*	0
All sample	*64*	0	*65*	0	*66*	0

Table17C: capacity in TX network 2001-2006; concentrated markets

median	*obs.*	Δ Number transformers 380/400 – 220	*obs.*	Δ Number transformers 220 - < 220	*obs.*	Δ Number transformers 380/400 - < 220
OU markets	*24*	0	*26*	0	*26*	0
Counterfactual	*40*	0	*39*	0	*40*	0
OLU markets	*51*	0	*52*	0	*53*	0
Counterfactual	*13*	0	*13*	0	*13*	0
OLFU markets	*55*	0	*56*	0	*57*	0
No unbundling	*9*	0	*9*	0	*9*	0
All sample	*64*	0	*65*	0	*66*	0

Table 18A: capacity in TX network 2001-2006; competitive markets

median	*obs.*	Δ Length 220kV grid	*obs.*	Δ Length 380kV grid	*obs.*	Δ Total length grid
OLU markets	*4*	0.000507	*4*	0.026745	*4*	0.010279
Counterfactual	*14*	-0.003582	*14*	0.002024	*14*	-0.000157
OLFU markets	*13*	0	*13*	0.000414	*13*	0.000786
No unbundling	*5*	-0.091429	*5*	0.005376	*5*	-0.02365
All sample	*18*	-0.001832	*18*	0.004712	*18*	0

Table 18B: capacity in TX network 2001-2006; competitive markets

Median	*obs.*	Δ Capacity transformers 380/400 - 220	*obs.*	Δ Capacity transformers 220 - < 220	*obs.*	Δ Capacity transformers 380/400 - < 220
OLU markets	*3*	0.040462	*4*	0.019796	*4*	-0.010417
Counterfactual	*14*	0	*14*	0	*14*	0
OLFU markets	*12*	0	*13*	0	*13*	0
No unbundling	*5*	0	*5*	0	*5*	0
All sample	*17*	0	*18*	0	*18*	0

Table 18C: capacity in TX network 2001-2006; competitive markets

Median	*obs.*	Δ Number transformers 380/400 – 220	*obs.*	Δ Number transformers 220 - < 220	*obs.*	Δ Number transformers 380/400 - < 220
OLU markets	*3*	0.036697	*4*	0.04386	*4*	-0.013889
Counterfactual	*14*	0	*14*	0	*14*	0
OLFU markets	*12*	0	*13*	0	*13*	0
No unbundling	*5*	0	*5*	0	*5*	0
All sample	*17*	0	*18*	0	*18*	0

Comparison of medians of capacity indicators, for the whole sample (tables 16A-B-C), is characterized by few differences. Furthermore, most of the medians are equal to 0; it confirms the low growth of the grid, as described in the previous sections. Differences emerge in the annual growth rate of the total grid length (table 16A): in general, not unbundled markets show an even negative median, lower than the OLFU markets. On the contrary, other levels of unbundling, OLU and OU, show a positive median, higher than their counterfactuals' medians, equal to 0. It is a first sign which allows identifying a positive relationship between unbundling and grid capacity growth. This relationship is confirmed both in the concentrated markets: but for OLFU markets, unbundling is associated to a higher median of annual growth rate of grid length. However, no other relevant values emerge.

In competitive markets, although test on OU observations is not included, OLU and OLFU markets show better values than their counterfactuals, but a deeper analysis is required. Medians concerning length of the network offer different results. Indicator of the total length of the grid confirms the same findings of the whole sample: in particular medians for the groups of both not unbundled markets and not OLU markets are negative. It implies that in competitive markets unbundling, despite the research hypotheses, is firmly related to higher values, as for quality indicators. Looking at the other indicators, the median of increments of length of the 380kV network, the more structural aspect of the system, is higher in case of not unbundled countries; for the 220kV network the highest value belongs to the OLFU countries. The growth of the 220kV network probably refers to the connection to new operators in the periphery of the network, but not on the core system; unfortunately, no evidence emerges from other indicators. OLU markets always show the highest median, but for the number and the capacity of the transformers 380/400 - <220, whose medians are even negative. To some extent it could be argued that this tendency strengthen the hypothesis that in competitive markets introducing at least a measure of legal unbundling has an impact in term of length of the grid, although in peripherical area, possibly, because of the connection to new generators.

6.3. **TX system: final assessment**

On the base of the research hypotheses, results have been summarized so as to offer some answers to these questions and a conclusive assessment concerning the TX system.

From the analysis, ownership unbundling is not substantially related to grid investments in capacity, on the contrary the system of network and transformers does not show relevant growth. The problem of bottlenecks has not been solved: it could be argued that results for ownership unbundled markets' quality indicators are even more problematic in the long run: they are strictly worse than not ownership unbundled markets. On the contrary, OLU and OLFU markets have positively performed: their medians are constantly higher than their counterfactual cases. Unbundling *tout court* seems to provide the sufficient incentives to investments in quality and capacity.

Focusing on concentrated markets, findings mentioned for the whole sample are confirmed, even included the twisted effect of ownership unbundling. Although the length does increase, due to the new connections to other traders or generators, quality is worse than in the not ownership unbundled markets. It could mean that, albeit vertical foreclosure to new entrants is largely legally not permitted, investments only for new connections in the peripherical areas and not in the 380kV network, allows keeping uncompetitive effects. In other words, in the case of concentration in wholesale markets, even in the case of ownership unbundling, markets keep on being locally based, so that concentration is not hit, at least in the short run. This process could require deeper studies of

the long run effects: at the same time it is to be said that in the analyzed seven years no clear evidence of the relationship between unbundling and network quality and capacity, in particular as a pro-competitive instrument, has been brought so far.

On the contrary, in the already competitive markets unbundling seem to have stronger effects: the medians of the most of the analyzed indicators are higher for OLU and OLFU markets. Despite of research hypotheses, according to which prominence of unbundling was not necessarily expected, unbundling gets the best results both for quality and capacity. It suggests that probably unbundling is not effective in general, but at some conditions, e.g. an already competitive market; and not in the short run, but presumably in longer periods.

6.4. ICX system: quality

Results on ICX systems are shown in the following tables 19-24:

Table 19: quality in ICX network 2002-2006; whole sample (BCON=1 and BCON=0)

median	*obs.*	Planned disturbances [min]	*obs.*	Unplanned disturbances [min]
BOU markets	*9*	89654	*9*	0
Counterfactual	*124*	29975.5	*126*	0
At least BLU markets	*66*	28591	*64*	0
Counterfactual	*67*	37527	*71*	0
At least BFU markets	*98*	32980	*100*	0
No unbundling	*35*	33942	*35*	0
All	*133*	33134	*135*	0

Table 20: quality in ICX network 2002-2006; BCON=1

median	*obs.*	Planned disturbances [min]	*obs.*	Unplanned disturbances [min]
BOU markets	*8*	99130	*8*	1.5
Counterfactual	*56*	31810	*56*	0
At least BLU markets	*44*	39244	*44*	0
Counterfactual	*20*	31810	*20*	0
At least BFU markets	*57*	33134	*57*	0
No unbundling	*7*	76980	*7*	0
All	*64*	36461	*64*	0

Table 21: quality in ICX network 2002-2006; BCON=0

median	*obs.*	Planned disturbances [min]	*obs.*	Unplanned disturbances [min]
At least BLU markets	*22*	10715	*20*	0
Counterfactual	*47*	41627	*51*	0
At least BFU markets	*41*	23115	*43*	0
No unbundling	*28*	22285.5	*28*	0
All	*69*	22727	*71*	0

In general, it should be said that tests on ICX-dataset provide quite few information, because medians are mainly equal to 0 and the duration of planned disturbances is the only indicator where most of the differences emerge.

Hence, starting from quality, tests on planned disturbances of the whole sample (table 19) confirm findings on quality in the TX network. In particular, the group of countries implementing at least

BLU and, with less difference, the group of at least BFU show a low median respect to their counterfactual. This is not confirmed if the tests are applied to the sample separated on the base of concentration. In the BCON=1, at least BFU markets are associated to a better performance: their counterfactual, although only seven observations are included, show a median which is more than twice higher. Again it would seem to confirm that in concentrated markets unbundling in general is more related to better quality. On the contrary, the medians of both at least BLU markets and BOU markets' planned disturbances are higher than their counterfactuals. In the BCON=0 subsample, on the contrary, not unbundled markets perform better, but, the difference is lower than 1000 minutes, less than 5%. Unbundling in general does not provide enough incentives as it happened for TX-dataset: at least BLU markets guarantee those incentives to strengthen ICX and, probably, to incentive competition with foreign players.

6.5. **ICX system: capacity**

Table 22: capacity in ICX network 2001-2006; whole sample (BCON=1 and BCON=0)

median	*obs.*	Δ Conventional Thermal Capacity	*obs.*	Δ Number of circuits
BOU markets	*10*	0.020947	*10*	0
Counterfactual	*154*	0	*156*	0
At least BLU markets	*67*	0	*68*	0
Counterfactual	*97*	0	*98*	0
At least BFU markets	*113*	0	*114*	0
No unbundling	*51*	0	*52*	0
All	*164*	0	*166*	0

Table 23: capacity in ICX network 2001-2006; BCON=1

median	*obs.*	Δ Conventional Thermal Capacity	*obs.*	Δ Number of circuits
BOU markets	*9*	0.014621	*9*	0
Counterfactual	*67*	0	*67*	0
At least BLU markets	*46*	0	*46*	0
Counterfactual	*30*	0	*30*	0
At least BFU markets	*63*	0	*63*	0
No unbundling	*13*	0	*13*	0
All	*76*	0	*76*	0

Table 24: capacity in ICX network 2001-2006; BCON=0

median	*obs.*	Δ Conventional Thermal Capacity	*obs.*	Δ Number of circuits
At least BLU markets	*21*	0	*22*	0
Counterfactual	*67*	0	*68*	0
At least BFU markets	*50*	0	*51*	0
No unbundling	*38*	0	*39*	0
All	*88*	0	*90*	0

Focusing on capacity, it could be argued that unbundling has no impact on ICX capacity (tables 22-24). In case of BOU, in the whole sample (table 22), medians confirm a twisted result, with a better performance in the annual growth of capacity but, as said before, a worse quality due to longer planned disturbances. It can be explained as the same phenomenon occurring in the TX systems,

where increasing physical capacity does not imply any improvement of the sustainability of the system. Interventions on the number of circuits, increasing capacity as well, have not been accompanied by an adequate level of quality of the grid. This is, in fact, the case of BCON=1 (table 23), where incumbents are interested in preserving their market power. ICX capacity growth would have an impact on the possibility to enter the market in favour of foreign suppliers.

6.6. **ICX system: final assessment**

It could be argued that when markets are already competitive, stronger unbundling measures have an increasing positive impact on quality and, in case of BOU, also on capacity: according to such conclusions, unbundling is not *always* related to a grid investments (hence to a pro-competitive impact), but it depends on the circumstances; on the contrary, where competition works, unbundling can strengthen it.

Two *caveats* are important to be fixed: 'planned disturbances' could be an ambiguous indicator of quality, because it could show both the interventions due to network obsolescence, and the interventions to upload network. In the former case, the higher is its value the worse is the performance of the network. This is the interpretation that, based on engineering empirical evidence, has been assumed: thus, it confirms previous comments, but, anyway, more country-specific analysis is required. Secondly, the sample has been divided on the base of the concentration of both the countries of each ICX; however, unbundling impacts on ICX between a concentrated market and a competitive one can be different from the impacts between two competitive markets: the low number of observations in this latter case, only 11 observations, has not let any further statistically significant analysis.

7. Conclusion and policy implications

This work aims to offer some preliminary findings on the impact unbundling policies had in the UCTE countries between 2000 and 2006. From the debate among scholars on the relation between unbundling and grid investments and development, empirical results have been obtained; they emerge from statistical analysis.

First of all, answering to the research question on whether unbundling does matter and to what extent, it should be said that ownership unbundling, the core of the third package of reforms by the EC, does not show any evidence of better quality and capacity expansion as assumed in the hypotheses for both concentrated and competitive markets. The developments in quality and capacity emerging in this analysis show, above all, an enlargement of the grid at the peripheries, but not a substantial enforcement of the grid, in order to guarantee the sustainability of the flows of electricity. On the contrary, ownership unbundling not only does show no improvement of investments in the network, but also a lack of quality emerges, so that these twisted results move

severe doubts on the recent EU policies. Another hypothesis has not been confirmed: albeit a stronger positive relationship was expected at least in concentrated markets between unbundling and grid investments, on the contrary, it is in this very case that twisted results emerge. On the other hand, a more positive relationship concerns already competitive markets. These findings could be justified by scholars' arguments underlining the prevalence of costs of unbundling; this reason, anyway, is not sufficient to explain unbundling's positive performance in competitive markets. It seems useful to consider the possibility of other reasons which, even in case of unbundling, have not let the growth and the sustainability of the grid, and the increase of competition. One of the reasons could be the role of Governments: the presence of a wide public ownership, both in the incumbents and in the transcos (as in French EDF and RTE), do not encourage new competitors, do strengthen the interest in few ICX and low capacity, which could let foreign suppliers to enter the market, but, at the same time, could guarantee a good service. Thus, geopolitics, as well as lobbying from the incumbents, could have their important role in influencing policies and their impacts as well in the markets.

Secondly, strictly related to the previous comment, there is an urgent need of more studies on this topic: in particular a multivariate analysis could put in evidence the relation between aspects of both the economics of TX policies and the politics of energy markets.

Thirdly: in order to widen studies on TX systems, more data should be made available by international institutions and operators as well. The current gap, this work had to face, makes very hard to collect harmonized data: at the same time, there are many institutions which are related to TX and ICX systems, both international and national, both regulatory authorities and associations of operators. One of the reasons could be the low importance given to the TX system, if related to generation and retail: nevertheless, as said at the beginning of this work, TX network and ICX have a more and more decisive role in the sustainability of the entire system and in possibility to pursue the goals of competitiveness, environmental sustainability and supply security.

A final remark on the policy implications for the EU: first of all, it should be noted how unbundling is an invasive measure, requiring time to be implemented and to evaluate its effective impact. As emerged, OU cannot be considered as a *panacea*, because positive results can be pointed out also in not unbundled systems. On the contrary OU could be related to problematic consequences in the medium/short run, at least on quality; unbundling in general better safeguards the grid. A first implication concerns the way policies are suggested and implemented: if OU is adopted, results should be assumed to emerge in the long run, not before, and, possibly, introduces some corrections to avoid distortions above all on quality. Furthermore, the right policy to be suggested is not a single and general policy for all the MS: it could be probably more impacting an approach where a

single and general goal (or set of goals) is identified by the EU and checked by the Commission or by an Agency, and, according to the fulfilment of the goal(s), each model of electric system can be assessed. An approach encouraging regional coordinated programs, as the EU is beginning to practice, could be a right step in this work.

References

Alesina, A., Ardagna, S., Nicoletti, G. and Schiantarelli, F. (2005) Regulation And Investment. Journal of the European Economic Association 3 (4) 791-825

Arellano, M.S. and Serra, P. (2008) The competitive role of the transmission system on price-regulated power industries. Energy Economics 30 (4) 1568-1576

Arocena, Pablo (2008) Cost and quality gains from diversification and vertical integration in the electricity industry: a DEA approach. Energy Economics 30 (1) 39-58

Baarsma, B., de Nooij, M., Koster, W. and van der Weijden, C. (2007) Divide and rule. The economic and legal implications of the proposed ownership unbundling of distribution and supply companies in the Dutch electricity sector. Energy Policy 35 (3) 1785-1794

Bayliss, K., Hall, D. and Perez Corral, V. (2001) FDI Linkages and infrastructure: some problem cases in water and energy [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

Borenstein, S., Bushnell, J. and Stoft, S. (2000) The competitive effects of transmission capacity in a deregulated electricity industry. The RAND Journal of Economics 31 (2) 294-325

Boucher, Jacqueline and Smeers, Yves (2001) Alternative Models of Restructured Electricity Systems, Part 1: No Market Power. Operations Research. 49 (6) 821-838

Boyce, John. R. and Hollis, Aidan (2005) Governance of electricity transmission systems. Energy Economics 27 (2) 237-255

Brend, B., Paarsch, H.J. and Solow, J.L. (2006) Estimating market power in the presence of capacity constraints: An application to high-fructose corn sweetener. International Journal of Industrial Organization 24 (2) 251-267

Brunekreeft, Gert and Newbery, David (2006) Should merchant transmission investment be subject to a must-offer provision? Journal of Regulatory Economics 30 (3) 233-260

Brunekreeft, Gert (2008) Ownership Unbundling in Electricity Markets. A Social Cost Benefit Analysis of the German TSO's. EPRG Discussion Paper 08-15, University of Cambridge

Claes, Dag Harald (2002) The process of Europeanization: Norway and the Internal Energy Market

Cremer, H., Cremer, J., De Donder, P. (2006) Legal vs. Ownership unbundling in network industries. CEPR Working Papers, n. 5767

D'Aveni, Richard and Ravenscraft, David (1994) Economies of Integration versus Bureaucracy Costs: Does Vertical Integration Improve Performance? The Academy of Management Journal 37 (5) 1167-1206

Delmas, Magali and Tokat, Yesim (2005) Deregulation, Governance Structures, and Efficiency: The U.S. Electric Utility Sector. Strategic Management Journal 26 (5) 441-460

Department of Energy (2002) National Transmission Grid Study. Available at http://www.ferc.gov/industries/electric/gen-info/transmission-grid.pdf

Fagan, Mark L. (2006) Understanding the Patchwork Quilt of Electricity Restructuring in the United States. Regulatory Policy Program Working Paper RPP-2006-04. Cambridge, MA:

Mossavar-Rahmani Center for Business and Government, John F. Kennedy School of Government, Harvard University

Federal Energy Regulatory Commission (2002) News Release – July, 31st. Available at http://www.ferc.gov/news/news-releases/2002/2002-3/july31-02smdx.pdf

Fraquelli, G., Piacenza, M., and Vannoni, D. (2005) Cost Savings from Generation and Distribution with an Application to Italian Electric Utilities. Journal of Regulatory Economics 28 (3) 289-308

Fumagalli, E., Garrone, P. and Internulli, M. (2005) Effetti Economici Degli Investimenti Nella Rete Elettrica Di Trasmissione. Mimeo

Garcia, S., Moreaux, M. and Reynaud A. (2007) Measuring economies of vertical integration in network industries: An application to the water sector. International Journal of Industrial Organization 25 (4) 791-820

Gilbert, R., Neuhoff, K. and Newbury, D. (2004) Allocating Transmission to Mitigate Market Power in Electricity Networks. The RAND Journal of Economics 35 (4) 691-709

Glachant, Jean-Michel and Lévêque, François (2006) Electricity Internal Market in the European Union: What to do Next? CWPE 0623 and EPRG 0605

Glachant, J.M. and Finon, D. (2003) Competition in European Electricity Markets. A Cross-country Comparison. Cheltenham and Northampton (MA): Edward Elgar

Green, Richard (2001) Markets for Electricity in Europe. Oxford Review of Economic Policy 17 (3) 329-345

Green, Richard (2005) Electricity and Markets. Oxford Review of Economic Policy 21 (1) 67-87

Greer, Monica (2008) A test of vertical economies for non-vertically integrated firms: The case of rural electric cooperatives. Energy Economics 30 (3) 679-687

Griffin, James M. and Puller, Steven L. eds. (2005) Electricity deregulation: choices and challenges. Chicago: the University of Chicago Press

Grossman, Sanford and Hart, Oliver (1986) The Cost and Benefits of Ownership: A Theory of Vertical and Lateral Integration. The Journal of Political Economy 94 (4) 691-719

Hall, David (2007) Self-assessment or public debate? Evaluating the liberalisation of network services in the EU and USA [www]. PSIRU Reports, available at http://www. psiru.org/publicationsindex.asp

Hart, Oliver and Moore, John (1990) Property Rights and the Nature of the Firm. The Journal of Political Economy 98 (6) 1119-1158

Hattori, Toru and Tsutsui, Miki (2004) Economic impact of regulatory reforms in the electricity supply industry: a panel data analysis for OECD countries. Energy Policy 32 (6) 823-832

Henry, C., Matheu, M. and Jeunemaître, A. (2001) Regulation of Network Utilities. The European Experience. Oxford: Oxford University Press

Hirst, Eric and Kirby, Brendan (2001) Key Transmission Planning Issues. The Electricity Journal 14 (8) 59-70

Hogan, William W. (1999) Market-based Transmission Investments and Competitive Electricity Markets. Center for Business and Government, John F. Kennedy School of Government, Harvard University

Hogan, William W. (2005) Transmission Market Design. Chapter 9 in Griffin, J. and Puller, S. (2005) Electricity Deregulation. Choices and Challenges. Chicago and London: The University of Chicago Press

IEA (2002) Security of Supply in Electricity Markets. Evidence and Policy Issues. Paris

Jara-Diaz, S., Ramos-Real, F. J., and Martinez-Budria, E. (2004) Economies of integration in the Spanish electricity industry using a multistage cost function. Energy Economics 26(6) 995-1013

Joskow, P. L. and Schmalensee, R. (1983) Markets for Power: An Analysis of Electric Utility Deregulation. Cambridge (MA): MIT Press

Joskow, Paul and Tirole, Jean (2000) Transmission Rights and Market Power on Electric power Networks. The RAND Journal of Economics 31 (3) 450-487

Kaserman, David and Mayo, John (1991) The Measurement of Vertical Economies and the Efficient Structure of the Electric Utility Industry. The Journal of Industrial Economics 39 (5) 483-502

Kirschen, Daniel and Strbac, Goran (2004) Fundamentals of Power System Economics. Chichester: John Wiley and Sons, Ltd

Künneke, Rolf and Fens, Theo (2007) Ownership unbundling in electricity distribution: The case of The Netherlands. Energy Policy 35 (3) 1920-1930

Kwoka, John (2002) Vertical economies in electric power: evidence on integration and its alternatives. International Journal of Industrial Organization 20 (5) 653-671

Kwoka, John (2008) Restructuring the U.S. Electric Power Sector: A Review of Recent Studies. Review of Industrial Organization 32 (3) 165-196

Léautier, Thomas-Olivier (2001) Transmission Constraints and Imperfect Markets for Power. Journal of Regulatory Economics 19 (1) 27-54

Michaels, Robert J. (2006) Vertical Integration and the Restructuring of the U.S. Electricity Industry. Policy Analysis n.572

Minoia, A., Ernst, D., Dicorato, M., Trovato, M. and Ilic, M. (2006) Reference Transmission Network: a game theory approach. IEEE Transactions on Power Systems 21 249-259

Müller, Holger and Wärneryd, Karl (2001) Inside versus outside ownership: a political theory of the firm. The RAND Journal of Economics 32 (3) 527-541

MVV Consulting (2007) Implementation of TEN-E projects (2004-2006). Evaluation and Analysis. Available at http://ec.europa.eu/ten/energy/studies/doc/2007_11_ten_e_evaluation_report_en.pdf

Nemoto, Jiro and Goto, Mika (2004) Technological externalities and economies of vertical integration in the electric utility industry. International Journal of Industrial Organization 22 (1) 67-81

Parks, Bill (2002) Transforming the Grid to Revolutionize Electric Power in North America, meeting at Edison Electric Institute, October 13rd 2002

Pollitt, Michael G. (2006) Electricity Reform in Chile: Lessons for Developing Countries [www] Cambridge-MIT Institute Working Paper 51. Available at web.mit.edu/ceepr/www/ 2004-016.pdf

Pollitt, Michael G. (2008) The arguments for and against ownership unbundling of energy transmission networks. Energy Policy 36 (2) 704-713

Quick, David M. and Carey, Janis M. (2002) Transmission capacity and market power: the effect on a dominant generation firm. Energy Policy 30 (8) 699-708

Sappington, David (2006) On the Merits of Vertical Divestiture. Review of Industrial Organization 29 (3) 171-191

Sauma, Enzo and Oren, Shmuel (2006) Proactive planning and valuation of transmission investments in restructured electricity markets. Journal of Regulatory Economics 30 (3) 358-387

Serrallés, Roberto J. (2006) Electric energy restructuring in the European Union: Integration, subsidiarity and the challenge of harmonization. Energy Policy 34 (16) 2542-2551

Steiner, Faye (2000) Regulation, industry structure and performance in the electricity supply industry. OECD Economics Department Working Paper, ECO/WKP 11

Thomas, Steve (2007a) Unbundling of electricity transmission networks: Analysis of the European Commission's position [www]. PSIRU Reports, available at http://www.psiru.org/ publicationsindex.asp

Thomas, Steve (2007b) A critique of the European Commission's Impact assessment on the legislative package for electricity and gas [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

Van den Hoven, A. and Froschauer, K. (2004) Limiting Regional Electricity Sector Integration and Market Reform: The Cases of France in the EU and Canada in the NAFTA Region. Comparative Political Studies 37 (9) 1079-1103

Vogelsang, Ingo (2001) Price Regulation for Independent Transmission Companies. Journal of Regulatory Economics 20 (2) 141-165

Yocom, Dennis and Helms, Marilyn (2001) Discharge in the electric industry. European Business Review 13 (3) 137-151

Appendix 1: Terminology

List of main acronyms

- **ETSO:** Association of transmission system operators founded in 2001 by four regional organizations: TSOI, the association of TSOs in Ireland; UKTSOA, the United Kingdom TSO association; NORDEL, the Nordic TSOs, and UCTE, the Union for the Co ordination of Transmission of Electricity, association of CENTREL, TSOs of the Continental countries of Western and Central Europe. It includes 32 countries and 40 operators (members and associate members). (Source: ETSO website available at http://www.etso-net.org/association/membership /companies/e_default.asp)
- **Nordel:** Nordel is an association for co-operation between the transmission system operators in Denmark, Finland, Iceland, Norway and Sweden, whose objective is to create preconditions for a further development of an effective and harmonised Nordic electricity market. (Source: Nordel website, available at http://www.nordel.org/content/Default.asp?PageID=204)
- **UCTE:** The Union for the Co-ordination of Transmission of Electricity is the association of transmission system operators in continental Europe in 24 countries, provides a reliable market platform to all participants of the European Internal Electricity Market; it coordinates the operation and development of 29 operators of the electricity transmission grid. (Source: UCTE website, available at http://www.ucte.org/aboutus/members/)

List of technical definition:

- **Conventional Thermal Transmission Capacity:** The conventional transmission capacity of cross-frontier tie-lines is based upon parameters standardised within UCTE for the calculation of the thermal load capability of each line. For areal lines these are : ambient temperature of + 35°C, wind velocity of 0,56 m/s at a right angle to the line as well as the voltage of the line. The conditions relevant to system operation in various countries at various time of the year can strongly differ from those above. Because the real allowable load capability of the line depends on many other factors, such as load flow distribution, upholding of voltage, real ambient conditions, limits of stability, n-1 security, etc., the conventional transmission capacity has no relevance from the point of view of system operation or economics but allows just a comparison of order of magnitude of the various lines. Adding together the conventional transmission capacity of several tie-lines does not allow to infer on the real total transmission capability and leads to irrelevant results from the point of view of system operation. (Source UCTE website, available at http://www.ucte.org/_library/statsyearbook/Statistical_Yearbook_2006_6.pdf)

- **ENS:** Estimation of the Energy not supplied during an interruption of the electricity flow; measured in MWh

List of units:

- **GVA: g**igavoltampere
- **GW:** gigawatt (1.000.000.000W)
- **GWh:** gigawatt-hour
- **kV:** kilovolt (1000V)
- **MVA:** megavoltampere
- **MW:** megawatt (1.000.000W)
- **MWh:** megawatt-hour

Appendix 2: Graphs on statistical distribution of indicators

TX-dataset: capacity

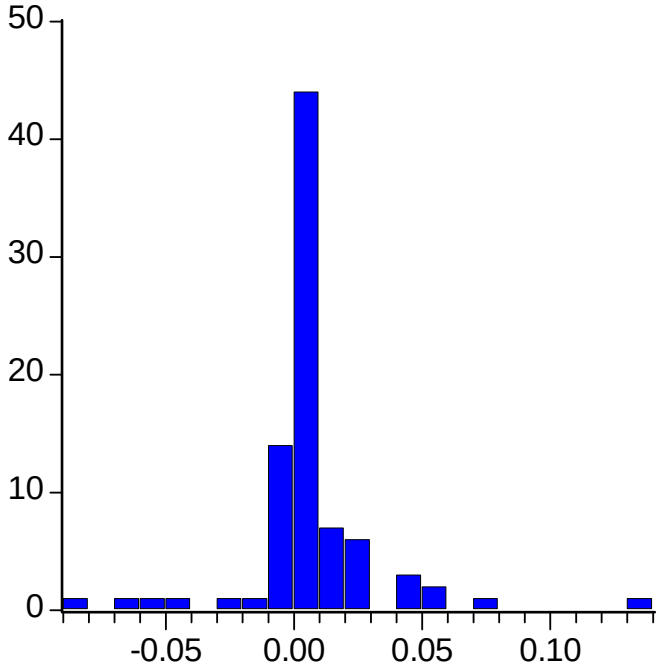

Figure 9: Annual Growth Rates of the grid length (2001-2006). Source: UCTE Statistical Yearbooks

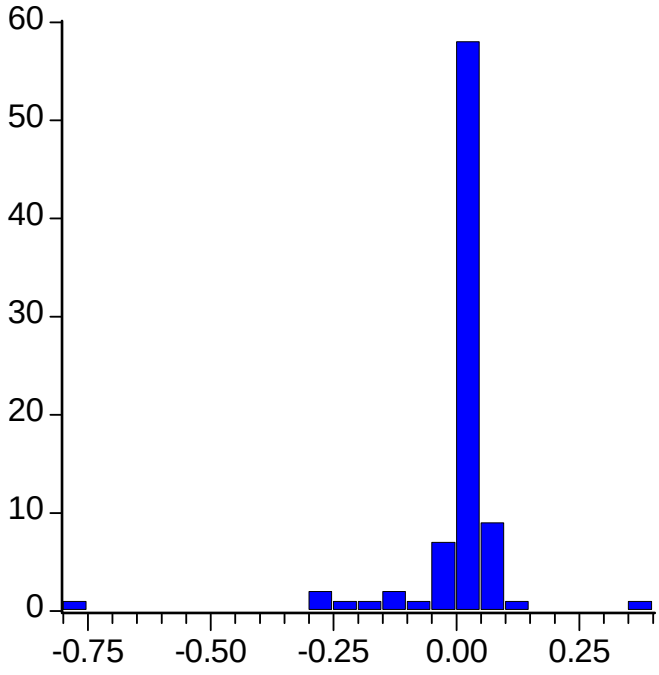

Figure 10: Annual Growth Rates of the total number of Transformers (2001-2006). Source: UCTE S.Y.

TX-dataset: quality

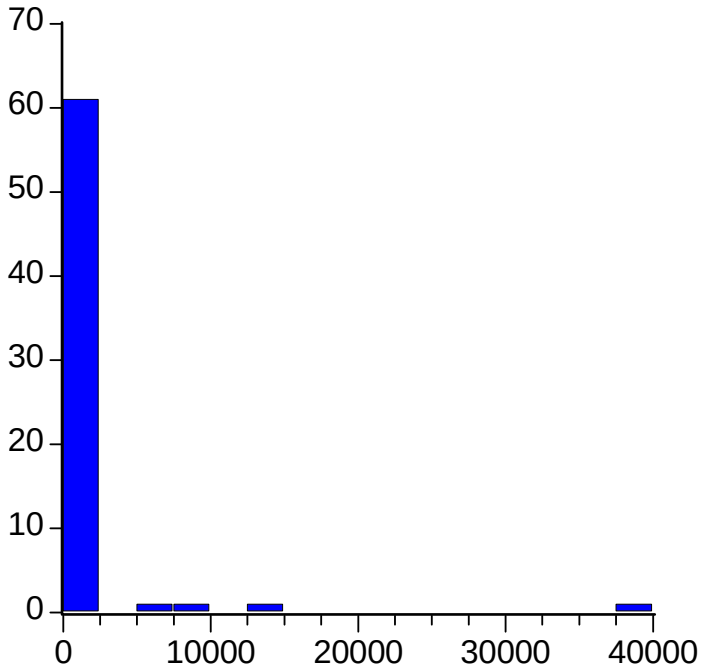

Figure 11: Distribution of duration of outages in minutes (2002-2006). Source: Elaboration on UCTE data

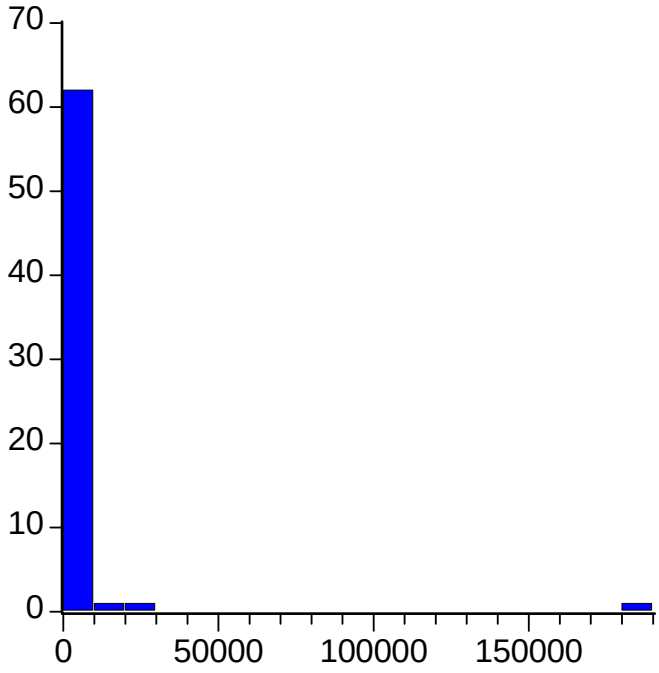

Figure 12: Distribution of ENS (MWh) during disturbances (2002-2006). Source: Elaboration on UCTE data

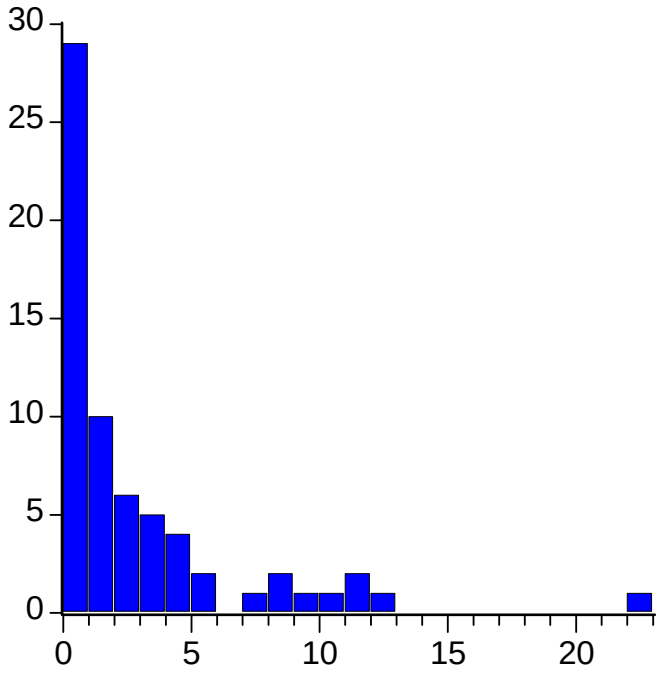

Figure 13: Distribution of number of unplanned disturbances (2002-2006). Source: Elaboration on UCTE data

ICX-dataset: capacity

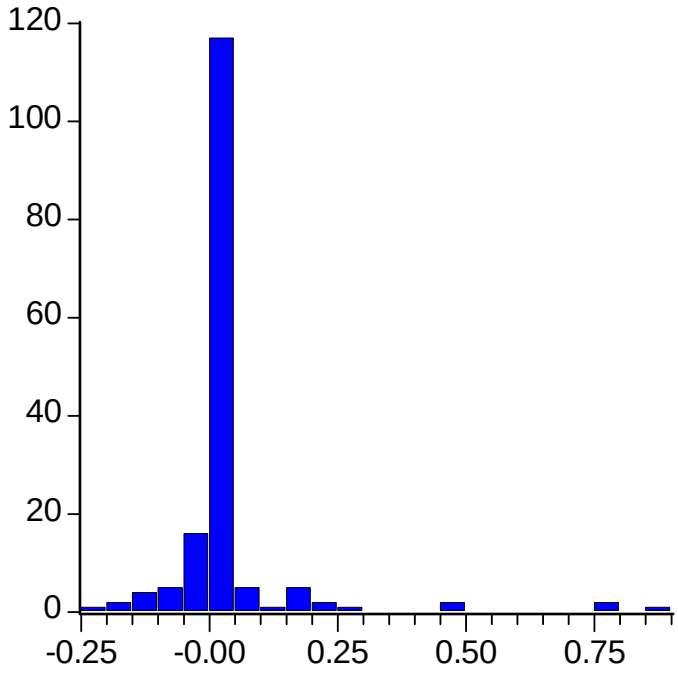

Figure 14: Annual growth rate of capacity of ICX (2001-2006). Source: Elaboration on UCTE data

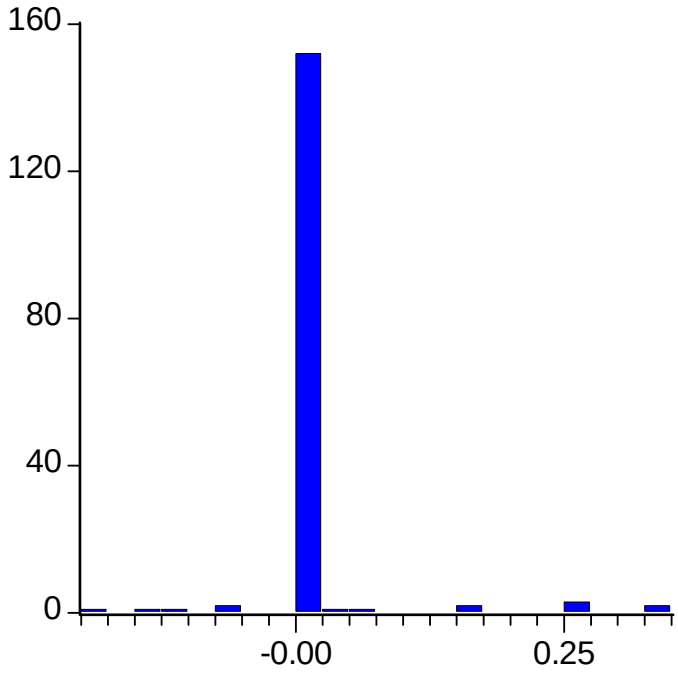

Figure 15: Annual growth rate of number of tie-lines (2001-2006). Source: Elaboration on UCTE data

ICX-dataset: quality

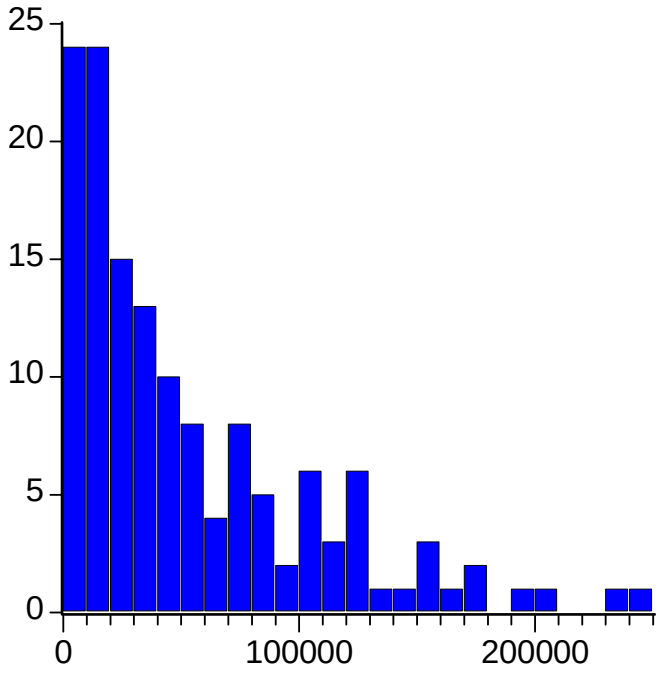

Figure 16: Duration of planned disturbances in minutes (2002-2006). Source: Elaboration on UCTE data

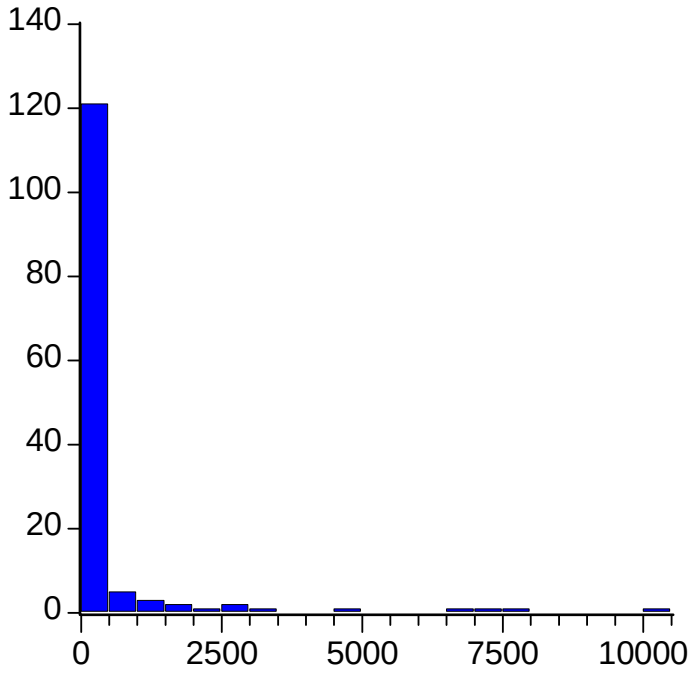

Figure 17: Duration of unplanned disturbances in minutes (2002-2006). Source: Elaboration on UCTE data

Appendix 3: Number of observations implied in the tests

Table 25: number of observations of TX-dataset distinguished for unbundling and level of concentration of markets

TX network	CONC=1	CONC=0	Whole sample
OU	**29**	1	30
OLU	**58**	5	63
OLFU	**63**	16	79
NU	**14**	5	19
All	**77**	21	98

Table 26: number of observations of ICX-dataset distinguished for unbundling and level of concentration of markets

ICX network	BCON=1	BCON=0	Whole sample
BOU	**10**	1	11
at least BLU	**47**	23	70
at least BFU	**65**	58	123
NU	**22**	51	73
All	**87**	109	196

These data do not take into account outliers and missing values emerged for some indicators for some country-year or interconnection-year pairs.

PART III

The Interplay between the European Commission and Member States in Energy Policy: An Analysis of the Debate on Transmission Network Unbundling

1. Introduction

The third package proposed by the European Commission (EC) on September 2007 has been provoking a great debate between the same EC, mainly involving Commissioners Kroes and Piebalgs, and those Member States (MS) which have strongly opposed the new legislation. The provision to force all MS to introduce transmission network ownership unbundling (OU) into their legislation, or, in alternative, an independent system operator model (ISO) has not been accepted by many MS; at the same time, it has been criticized by some vertically integrated utilities (VIUs) operating within MS.

On one hand, the debate seems to be simply determined by classic economic theory, namely on the evidence concerning the positive impact of OU on the electricity markets in terms of competition and grid investments. On the other hand, arguments proposed by the involved players and their strategies show the emergence of other issues besides the economic theory, in particular geopolitical dynamics, which seem to increase their impact on energy policy.

Consequently, debate on OU lies in the midst of a general shift of main paradigms which have characterized economy and politics during the '80s and '90s, synthetically expressed by the trilogy liberalization-privatization-deregulation. Four main processes characterize this general change:

- The decline of the Regulatory State as a model for a new governance; the process of integration of the EU, considered by scholars an example of emerging regulatory state, has been unequivocally affected.
- Energy security, as well as environment sustainability, has received renewed attention; the neo-liberalism paradigm in energy sector promoting competition in energy sector seems to have no longer a primary importance.
- Geopolitics dynamics affect strongly national and international energy policies since the strategic role of energy security for the economic development has become evident; consistently, energy primary sources exporter countries use them for increase political power in the international relations.
- Utilities, once state-owned inefficient companies, play a new role in the global economy; in many cases they are among the largest international companies and utility industry is one of the most profitable.

The shift happened requires new approaches and new interpretative keys to explain the rationales and the possible solutions to the interplay on OU between EC and MS. This work aims to offer, after a complete overview of the principal facts happened around the third package proposal (section 2), a literature review on those aspects to be considered for a correct assessment of the debate (section 3). Research questions are pointed out (section 4) and three different scenarios or models are suggested, according to the scholars' suggestions (section 5). Afterwards these models are checked on the base of the main positions and comments of the EC members, the MS and the Utilities, as emerged from an analysis of documents, press releases, interviews and articles across 2007 and 2008 (section 6). The conclusions will evaluate which one of the three hypotheses best explains what is (still) happening and will identify some policy implications for the future of the reforms (section 7).

2. The third package: a brief introduction

Ownership unbundling has been firmly proposed by the EC as a pro-competitive solution, preferred to legal and functional unbundling which have been considered to give a positive, but not sufficient contribution to achieve EU energy policy goals. Description of the dynamics occurred in 2007 and 2008 help to focus not only the facts characterizing the legislative route, but also, and mainly, to put in evidence positions and strategies, positive and negative critics, in the debate on unbundling, in particular aiming to underline the role played by the EC, MS and utilities.

2.1. The steps before the third package

The EC stepped towards the EU energy "third package" on January 2007 with a set of documents, including 1) an assessment of the implementation of previous EU reforms in the MS and their impact to date (Final Report of the Sector Inquiry), 2) an analysis of the three pillars the EU energy policy should be based on (COM(2007)1), and 3) the proposal to introduce OU as the right solution to the problems of lacking competition. In a nutshell, higher competition would have implied decreasing prices, promotion of investments, a higher integration of the electricity grids among MS and, consequently, a major role for the EU polity in leading energy sector.

The EC's decision to proceed firmly on this policy was confirmed and strengthened by the following Spring European Council, where OU was essentially encouraged. On that occasion, President Barroso could affirm that 'the status quo is not an option [...] that is very clear' (Financial Times, FT, 12 March 2007); notwithstanding the substantial invitation to the EC to confirm its proposal in a new directive within the next months, the Presidency conclusions did not exclude that a strong regulation, without any further intervention to unbundle network and generation, could have been enough (regulatory unbundling). On June, during the European Council of Energy Ministers, two coalitions clearly emerged, so that Commissioner Piebalgs admitted it was a 'very,

very uneasy situation' (FT, 6 June 2007). Sceptic positions, led by Germany and France, included also Austria, Bulgaria, Slovak Republic, Greece, Luxemburg, Latvia and Cyprus. As it will be better explained later, opposition converged on two hypothetical consequences of OU, that are: 1) the absence of evidence of better performances in unbundled electricity markets; 2) the increasing risk that an unbundled transmission company (transco) (as well as an unbundled player operating in the wholesale or retail markets) might be taken over by foreign (extra-EU) companies. This latter point, encouraged by a clear strategy pursued by Russian Gazprom, was even more concrete in the gas sector: Russian players, as well as sovereign funds could enter the national markets, acquiring its (politically and economically) strategic assets. On the other hand, it was probably the emerging opposition to unbundling measures which encouraged eight countries, including Denmark, the Netherlands, Belgium, Finland, Sweden, Spain, the United Kingdom and Romania, to send an official letter to Commissioner Piebalgs to sustain EC's position. The resolution European Parliament approved on 10 July 2007 considers ownership unbundling 'to be the most effective tool to promote investments in infrastructures in a non-discriminatory way, fair access to the grid for new entrants and transparency in the market'; at the same time the resolution declares 'that this model might not address all of the issues at stake such as interconnections or congestion points', showing a compromise resolution due to the keen scepticism emerging among MS on the Commission position.

2.2. The proposal of the third package by the EC

On September 19th the EC proposed the so called "third package" promoting (1) an effective OU, although ISO model is still accepted; (2) the creation of an Agency of the Cooperation of the Energy Regulators (ACER); (3) a more effective coordination among the European Networks Transmission System Operators (ENTSO). It has been considered as a compromise due to the recognition of a sort of two speed route. Beside the confirmation of OU as preferred solution, the ISO model, quite spread in the USA was suggested as a second-best, admitting the vertically integrated incumbent to keep the ownership of the assets, but introducing an independent player to operate the network. At the same time a safeguard clause (so called Gazprom clause) was introduced in order to guarantee the EU control on 'both its direct and indirect independence from supply and generation activities' (Explanatory Memorandum, 1.3) of any purchaser of a EU grid: in particular, it requires 'the effective unbundling of transmission system operators and supply and production activities not only at national level but throughout the EU. It means in particular that no supply or production company active anywhere in the EU can own or operate a transmission system in any Member State of the EU. The requirement applies equally to EU and non-EU companies. [... and] in the event that companies from third countries wish to acquire a significant interest or even

control over an EU network, they will have to demonstrably and unequivocally comply with the same unbundling requirements as EU companies' (*ibidem*).

France and Germany, still not satisfied by the solution EC had proposed, tried to organize and suggest an alternative proposal to the EC: after being accused to implement a delaying tactic, waiting for the conclusion of both EP and Commission terms (first semester 2009), on January, 29th 2008 the group of eight sceptics (above mentioned, excluding Cyprus) sent a missive to Mrs Niebler, ITRE (Industry, Research and Energy Committee) Chairwoman. The alternative proposal, analyzed in the section 6.2, introduced the option of the Effective and Efficient Unbundling (EEU), which essentially would guarantee the *status quo* of VIUs, although in presence of a quite stronger regulation. At the end of February 2008, the EC rejected this proposal and confirmed the third package previsions.

2.3. Recent events

After German and French proposal had been rejected by the Commission, at the end of February the Council of the Energy Ministers substantially confirmed the EC's position, as the European Council did on June 2008. At the same time, probably in connection with this decision, the CEO of the German E.ON, one of the most relevant VIUs in the European energy markets, announced the decision to unbundle its grid in Germany, determining negative comments from other integrated utilities and, even, the German Government. Notwithstanding this important step, up to date E.ON still owns its grid

After a first approval by the EP, the second reading is still forecast before spring 2009, when the EP term will end: however, the risk the package might not to be approved in time is still very high.

In fact, EU energy policy, during 2008, has been strictly connected to climate change issues, which determined new alliances around 'pace-setting' countries, including many countries, but also (this time) France and Germany, opposed to 'foot-draggers', including mainly Italy and Poland. This focus on environmental issues, and difficulties in achieving a unanimous agreement before the end of the French Presidency of Mr. Sarkozy in the second semester 2008, seems to have debased the third package provisions on unbundling.

Far from being a proof of less interest on this topic, the following sections will try to explain whether and why, on the contrary, this could be a clear signal of a political decision to review the terms of the third package on unbundling measures. This section, based on a brief overview of main events, began to show the connection between economic rationales and political dynamics emerged in the EU policy making process.

3. Economic theory and political economy: a literature review

Role of economic theory is obviously important in this debate; nevertheless, an approach of institutional analysis cannot ignore the existence of reasons and arguments beside the economical evidence (Genoud and Varone, 2006). The need of equilibrium between economic theory and political economy has to be recognized.

In particular, not many contributions have been wrote down on the debate emerged in the EU on unbundling, because of the closeness of events and the incompleteness of the process of decision-making. However, this last contraposition on unbundling reflects a tendency emerged during these last years: a general rethinking of many of the main issues which characterized economic theory in the '90s. The neo-liberalism paradigm 'privatization-liberalization-deregulation', which seemed to have buried Keynesianism, has been step by step put on trial; this could provide a background to the possible scenarios explaining the different positions on EC third package and, in particular, on unbundling. The following literature review aims to put in evidence 4 areas, connected to the main topic of this work, where it could be argued that a U-turn in the neoliberal economic theories happened.

3.1. Unbundling, a discussed net impact

Scholars' general approach lies on the economics debate between the advantages of unbundling, in favour of more competition, and its disadvantages depending on the diseconomies of integration, preferring a model of vertically integrated company. The former recognize a structural problem of conflict of interest affecting vertically integrated operators. Léautier (2001) justifies this conflict arguing that grid investments increasing its capacity have a pro-competitive double impact: (1) a 'substitution effect' consisting in the replacement of units of electricity from the more expensive generator to the cheaper one, re-allocating both the volumes of supply previously fixed by the planner and, consequently, their surplus; and (2) a 'strategic effect' in terms of distribution of surplus not only among generators (as in substitution effect), but also between consumers and suppliers, generating more economic value. Henceforth, a vertically integrated player will not be interested in increasing grid capacity: thus, many scholars argued the importance to unbundle network and generation, either legally or in terms of ownership, to solve this conflict (Léautier, 2001; Boyce and Hollis, 2005; Cremer *et al*., 2006; Arellano and Serra, 2008).

On the other hand, Kaserman and Mayo (1991) focus on the existing economies of vertical integration which would better guarantee good performances of the energy players, in terms of higher investments and quality of service; empirical evidence has been brought by D'Aveni and Ravenscraft (1994); Nemoto and Goto (2004); Jara-Diaz *et al.* (2004); Delmas and Tokat (2005);

Fraquelli *et al.* (2005); Arocena (2008); Greer (2008). Kwoka (2002; 2008) introduces a wider catalogue of economies of coordination (2002: 655).

In conclusion, transmission network unbundling implies both benefits and costs, whose net effect still remains ambiguous. Recently, Pollitt (2008) summarizes main of the impacts, both positive and negative, grouping them into a general catalogue; then he proposes some econometric evidence and case-studies, where the different models of unbundling have been implemented, suggesting a qualitative assessment of the main cases. Brunekreeft (2008) defines unbundling as twofold, because besides the 'competition effect' and the 'interconnection effect', *à la* Léautier, there is a 'cost effect', mainly representing the loss of economies of coordination: findings concerning the German electricity market show a positive effect, but small, confirming the difficulty to recognize a clear net impact. In other terms, it should be said that there is no universal solution, on the contrary good results can be achieved by different models; the EU energy markets show there is 'no single European way', as argued by Glachant and Finon (2003). At the same time, unbundled markets, so far, brought no incontrovertible evidence of welfare-enhancing impact.

3.2. The decline of the EU as emerging Regulatory State

The concept of Regulatory State emerged in the '90s concerned the end of the 'Government' as known in the Keynesianism, in favour of a lighter State based on a Multilevel Governance approach. The step from the Keynesian state to the regulatory state, according to one of its major theorists, Majone, is a 'a redrawing of the borders of the public sphere in a way that excludes certain fields better left to private activity, while at the same time strengthening and even expanding the state's regulatory capacity in other fields like competition or environmental and consumer protection' (1994: 80). More precisely, it is a redrawing concerning three important aspects (Majone, 1990; Moran, 2001; Levi-Faur, 2004):

- a new responsibility: the State has to guarantee the respect of competition, correcting those cases of market failure. At the same time, State identifies consumers' rights and, as a consequence, it has to control the respect of the minimal standards for the safeguard of citizens, intervening indirectly in the process of equilibrium between demand and supply;
- the rise of new actors with specialized competences and the decline of the bureaucracy: the proliferation of a large number of new agencies which have very specific competences and peculiar powers. The majority of the aspects of a citizen's life are controlled by *ad hoc* agencies or authorities (e.g. energy, water, telecommunication, antitrust, food);
- a new concept of statehood as result: the State is only one actor among a wide network of others. Each one has not enough power and information to decide and to implement a policy alone: they need to cooperate, as a consequence of both national and international dynamics.

One of the most important shifts of power should have happened in favour of the regional and global institutions leading the economic and political processes of liberalization of the international trade and integration of the markets. As Bevir, suggests

> '[t]he main ideas of system governance include: a shift from hierarchies and markets to networks and partnerships at least within the public sector, the interpenetration of state and civil society and of national and international domains, a change in the role of the state from intervention and control to steering and coordination, a related change in state activity from laws and commands to negotiation and diplomacy, the incorporation of non-state actors into the policy process, an emphasis on local self governance, greater levels of public involvement in decision-making, and a reliance on more reflexive and responsive modes of public policy. System governance seems to be committed to ideals of dialogue, participation, consensus, empowerment, and social inclusion.' [2004: 2].

The development of the European Union has been considered as a proper example of this political and economic process, where MS' Governments lose their role and power in favour of a light centralized government, the EC, and a set of specific agencies. Bartle argues that '[i]n many areas decision making moved from the national to the EU level' (1999: 363); more precisely, Bahgat specifies that 'energy security is an international issue that necessarily entails growing interdependence between major producers and consumers. No country or region can alone achieve a state of energy security (2006: 966). In this sense, it could be even argued that OU, combined with the independence of the transcos and a single European regulation by ACER, could be inspired by the aim to lead electricity sectors towards an integration of markets and, afterwards, an integration of policy making process in the hands of the EC. 'Divide and rule', as in Baarsma *et al.* (2007).

As previously mentioned, notwithstanding many studies on the rise of Regulatory State, some scholars have begun to criticize Majone's view, recognizing, on the contrary, an opposite tendency in the EU (Genoud and Varone, 2002) and in MS' positions (Clifton and Dìaz-Fuentes, 2008b). Furthermore, Finger and Varone, focusing on the network industries, underlines that liberalization has been essentially imperfect, so that a re-regulation is needed: in particular they point out the links among economic, political and technical aspects of these services, which require a special analysis (2006: 4). In conclusion, mainly in the case of public service, the role of the State seems to be far from the theorized *laissez faire*, on the contrary, many governments are still players in the market and, as the opposition to the OU provisions shows, no direct devolution to the EU polity has still occurred or, even, desired.

3.2.1. Subsidiarity: the right relationship between the EU and MS

It should also be mentioned, besides the dichotomy between Westphalian and Regulatory State the concept of subsidiarity, recognized by the Treaty as a fundamental principle. As Pelkmans asserts, subsidiarity implies, from an economic point of view, the 'optimal assignment' of powers among

the EU polity and MS so as to safeguard the best level of satisfaction of local preferences (2005; Pelkmans *et al.*, 2008). Hence, this does not automatically mean a prominence of MS level over the EU in shared competence, including energy: on the contrary, subsidiarity would imply either centralization or decentralization, on the base of the more appropriate level of governance for each specific policy. This is even more important in the case of energy, a public service where industrial models and role of State have been differed sensibly along the decades. Pelkmans, in the subsidiarity test, as criterion to decide between centralization and decentralization, propose to assign powers to the EU level whether a credible cooperation is not feasible among MS and EU (2005: 17). The debate on subsidiarity would imply necessarily a deeper analysis; this topic has been introduced because the increasing role of the MS, namely in the energy policies, does not represent exclusively a re-thinking of the Regulatory State and the EU integration; according to an economic and legal perspective, subsidiarity could justify and legitimate the opposition of some MS to the EC policies of OU.

3.3. Paradigm shift on energy issues

As Helm argues, although 'paradigm of energy policy has been during the '80s based on liberalization, privatization and competition' (2005: 2), international dynamics related to energy consumption in developing countries, geopolitics around ownership of energy sources and need of more investments made it no longer sustainable; on the contrary, new issues emerged in the political and economic debate on energy: climate change and security of supply, as, in fact, happened during 2008. Energy sector can be considered multitasking (Belyi, 2003) as '[e]nergy, in turn, plays a vital role for production (especially the industrial, residential and transport sectors), finance (in terms of benefits provided especially by oil trade), knowledge (related to technological development, including energy and environmental sectors), as well as security (setting up international institutions dealing with energy supply or direct intervention in oil-producing regions)' (2003: 353). Belyi, basically, underlining the complexity of the energy policy (he recalls Strange, 1980) and focusing on energy security, not only confirms the interconnection between geopolitical and economic dimensions, but he also points out that geopolitics can deeply influence the economic aspects of energy policy, arguing, for instance, that liberalization can bring instability. On this very point, unbundling can increase the risk that a de-integrated (and less capitalized) firm might be taken over by foreign utilities (even owned by a foreign Government), with clear consequences in terms of less energy independence and supply security (Baarsma *et al.*, 2007; Thomas, 2007b). Applying to MS strategies towards the EU, what Raza (2007) assumes to be the EU strategy in the WTO negotiations, a neo-mercantilism approach emerges, so as to maximize profits from external relations, without any concessions on the internal legislative and economic context.

Although energy security has always been an issue which has strongly affected national and European energy policies through recent decades, (Chick, 2007), it could be argued this paradigm shift has determined a U-turn in the relations among MS which could contribute to explain their positions around the OU provisions.

3.4. A rethink of the role of public services

Clifton *et al.* argue that '[g]lobal public goods provision needs to be rethought [...], we need to renew our justifications for public goods in the age of globalisation' (2004: 9). Furthermore, although recognizing the relevant role of economic theory, 'a 'bottom-up', normative and citizen-centred theory of entitlements is necessary in conjunction with a goods-centred top-down theory in order to redefine the role of public services at the supranational level' (2004: 11). The so called commodification of public services, encouraged by neo-liberalism (Raza, 2007), gives the way to a new paradigm of public service, based no longer on competition policy *tout court*, but also on the recognition of citizens' rights (Clifton and Diaz-Fuentes, 2008a). In the case of the EU energy policy, it would mean a higher attention paid to a positive integration based on 'social and territorial inclusion, rather than concentrating on 'negative' integration, linked to removal of trade barriers' (Clifton *et al.*, 2006b). In this sense, a 'public utility model', most related to safeguard public objectives seems to prevail on the previous market-driven commodity model, where there is no role for political issues (Künneke and Fens, 2007).

3.5. Hybridisation of utilities

The process of neo-liberal reform which affected Public Utilities, promoting their privatization, liberalization and de-regulation of markets, and, in the EU, integration among them, transformed old style state-owned, bureaucratic and inefficient companies providing services into authentic Trans-National Corporations (TNCs). At the same time, whilst many of the players with low market share (quite spread in Italy and Germany, owing to their regionalism) collapsed because of the liberalization of markets and the increase of competition, the consequences have been a process of concentration which has brought, at least in the EU electricity sector, to a group of only six TNCs: in a nutshell, ugly ducklings have become (big) swans, as Clifton *et al.* (2007) underline. Hybridisation of utilities concerns the change these companies showed in the very last years, becoming in many case those 'national champions' to be preserved by eventual competitors in domestic markets or by foreign take over. It is interesting also to put in evidence how in many cases these TNCs flourished owing to a strong public ownership, which guarantees financial stability and political consensus; and also owing to a strategy of asymmetric liberalization: on one hand strengthening own market share in the domestic market through a slow process of liberalization, on

the other hand, entering all those markets where liberalization was already implemented (Clifton and Dìaz-Fuentes, 2008b). French EDF is one of the most important electricity operators in the UK, where national companies have almost disappeared, together with German E.ON and RWE which have there relevant market shares; also the Italian ENEL recently acquired Spanish Endesa. EDF, RWE, ENEL, (Endesa too in Spain) and E.ON could have relied on a strong position of incumbent in domestic markets. It could help to have a look at the Global Fortune 500, the annual ranking of the world's largest companies[1]: in 2008, among the 500, Utilities were 19 occupying from the 24th to the 444th position; furthermore, behind the Chinese State Grid, the most important utilities have been EDF (68th out of 500), Enel (109th), Veolia (153rd), Gaz de France (193rd), Centrica (231st, before the take over by EDF), Scottish & Southern Energy (253rd), Endesa (258th), Iberdrola (339th), Vattenfall (396th). It is also interesting that among the 19 utilities all the European players show a positive increase of the rates of both their revenues and profits; figure 1 shows their trend since 2005:

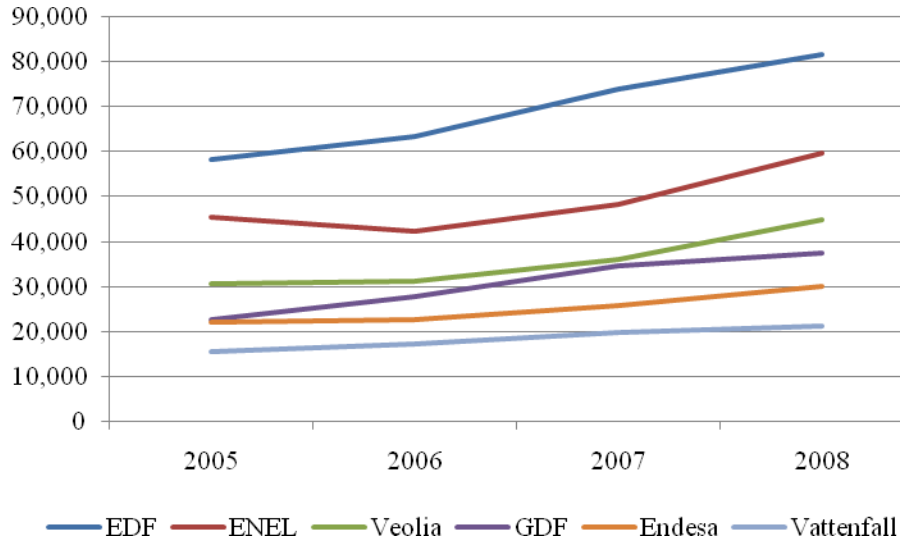

Figure 1: Revenues from 2005 to 2008 (Million $). Source: Elaboration on data Fortune Global 500

Also a hybridized TSO, the British National Grid, has been included (351st) among the 500 largest companies: National Grid, with its investments in the Northeastern USA, can be considered an example of TNCs emerged from the '90s reforms.

Similarly, UNCTAD published on September 2008 its World Investment Report which offers a wide overview of the 25 top non-financial TNCs by foreign assets as of 2006: among the electricity, gas and water utilities, the list includes EDF (9th), E.ON (12th), Suez (19th) and RWE (22nd). Among the largest companies in network industries, besides the already mentioned companies, Endesa, Vattenfall and National Grid are included in top positions. The analysis by UNCTAD underlines

[1] Available at http://money.cnn.com/magazines/fortune/global500/2008/industries/38/index.html

how, not surprisingly, French and German utilities are among the largest TNCs by foreign assets: at the same time, they oppose to a regulation which, in fact, gave them the opportunity to invest abroad. Besides political reasons, Glanchant and Lévêque (2006) would suggest that this shift in industrial paradigm implies, from a financial point of view, that 'vertical integration is the best protection against volatility and the cyclical nature of markets' (2006: 10): at least in their home markets, this could justify their asymmetric preferences.

4. Research questions

The four paradigm shifts analyzed in the literature review bring to the conclusion that there is a clear link between economic and geopolitical issues emerging behind the debate on unbundling. It could be argued that beside the discussion on aspects of economic theory, MS face a double negotiation: with domestic groups of pressure, utilities, on one side and the EU polity and other MS on the other one. The problems emerge when the legitimacy of rationales which determine final decisions could not to be the same among the two groups (Putnam, 1988; Coleman and Tangermann, 1999). This interdependence make more complex the decision making process, which goes further an economic assessment of models.

In conclusion, it should be verified whether, beside the classic economic model of interpretation, there could (also) be recognized other dynamics.

- On one hand, there could be a phenomenon of capture of MS by lobbying of hybridized TNCs. Glanchant, and Lévêque introduce the problem that 'whilst at the national level an important problem was the collusion between grid operator and incumbent, now, in the European view it could be the collusion between grid operator and national interests' (2006: 14). More precisely, Van Koten and Ortmann provide econometric evidence of a connection between the degree of corruption of EU-15 Governments and the implementation of unbundling, suggesting that behind the unbundling debate in Europe there is a clear phenomenon of capture by hybridized Utilities In fact, albeit their results do not fit for the other MS not in the EU-15, they find a correlation between the index of corruption and transparency of Governments and their position on the unbundling policy, arguing the existence of a causality nexus. Even of no causality could be deducted, the capture by utilities could be an alternative explanation of the debate.
- On the other hand, a geopolitical negotiation can be supposed to be hidden behind an economic debate, in order to get supremacy between EU polity and single MS. Findings by Florio (2007) on some European Markets suggest that no empirical evidence of OU emerge from those countries where it has been introduced. The analysis on prices show that their level is not related to level of unbundling, on the contrary, France, where market is concentrated and legal unbundling is implemented, prices are among the lowest in the EU. Notwithstanding these

results, the EC is firm on this way. Thus, doubts emerge on the presence of a secondary, geopolitical, aim followed by the EC. To some extent, for instance, smaller EU countries may feel “invaded” by incoming foreign FDI. At the same time, bigger countries may prefer to preserve their national champions, because of protectionism or to stimulate the recognition of reciprocity which would let internal incumbent to internationalise.

5. Taxonomy of interpretative models

Starting from the conclusions emerged in the previous section, it could be argued that political preferences of the involved players, the EU, Member States (MS) and the Utilities should be considered in order to explain the different positions emerged in the debate. The EU aims to integrate markets and to gain concretely a stronger relevance in leading MS energy policy (Europeanization of Policies). On the other side, MS, often owners of the electricity national incumbent, are interested in preserving the integration of the company and the ownership of network because it is considered as an element of supply security. Energy security is enhancing its role in the international politics theories: energy independence and quality of national energy infrastructures affect the international power of a country. The consequence is that, as well as economical rationality, political preferences matter in the EU reform proposals, and the recent debate on the third package, mainly on OU, confirmed (Van den Hoven and Froschauer, 2004; Clifton and Guillén, 2005; Glanchant and Lévêque, 2006; Baarsma, de Nooij, Koster and Van der Weijden, 2007).

Taxonomy of the three general interpretative models, as emerged from the literature review, will follows; afterwards, they will be tested, analyzing more deeply events and behaviour of the relevant players, in order to evaluate which is the best explanation.

5.1. Pure pro-market model (Conventional Wisdom)

Both the EU and the MS look at competition as their goal: the debate relies on the effectiveness of unbundling as a correct instrument to increase competition in wholesale and retail market. It could be also defined as the conventional wisdom because, as previously said, the debate has been based generally on economic theory and prevalent paradigm of neo-liberalism. The EU suggests OU as a pro-competitive measure: to solve the conflict of interest affecting the VIU on grid investments, OU is the only structural solution. MS, or, more precisely, some of them, consider OU unnecessary, underlining that so far there are no clear evidence in favour of OU or against vertical integration; on the contrary, it could be considered even noxious for competition, if good performances of some VIU in terms of prices and investments are considered. In this first case the role and the preferences of utilities, mainly incumbents, are not taken into account.

5.2. Capture by lobbies of hybridised utilities

This approach argues MS' positions are not determined only by economical considerations, but by pressure of lobbying incumbents, worried to lose the network with its value and to lose market power in favour of new comers. Thus, incumbents assume a role of important players in the European governance system: the so called process of hybridisation of most of these companies brought them to be no longer inefficient state-owned companies but successfully Trans-National Corporations. Vertical integration, in this case, can be argued to consolidate market shares in the domestic market and to guarantee enough financial stability to be able to invest abroad; whereas company is state-owned, as in the EDF case, stability is even stronger.

5.3. Struggle for geopolitical supremacy

There is not an economical reason inspiring both the EU policy and the MS positions. The current debate is rather a struggle of power. The EU, unbundling the TX network and strengthening its power of Regulation with the ACER, aims to weaken MS and their decision-making powers on energy policy. National incumbents are obliged to face competition at the European level; a European electricity industry, based on five or six international major companies, can emerge from this case. It should be said that the EU policy pursues the political aim to consolidate the process of regional integration in a globalized environment in order to bargain power in the international relations. On the other side, MS defend their powers on energy policy, as an instrument of geopolitical power and independence from foreign countries, above where, as in many MS, foreign countries already control the upstream. In this sense, national incumbents can be seen as 'national champions' to be preserved and strengthened in order to guarantee supply security and stability of the internal markets (Glanchant and Lévêque, 2006) or, even more, a way to pursue neo-mercantilistic goals.

The table 1 summarizes the 3 scenarios.

Table 1: Hypotheses on possible scenarios and players' strategies

Scenario	EU	MS	Utilities
Pure pro-market model Conventional Wisdom	OU is the structural solution of the conflict of interest affecting VIUs; pro-competitive and grid investment-enhancing policy	There are no evidence of pro-competitive impact of OU. Scholars argue net effect on welfare is even ambiguous	No influence at all
Capture by lobbies	Same as in the pure pro-market model	MS' opposition to OU reflects the Utilities' point of view. Governments are lobbied by them	Utilities, become TNCs, have great interest in preserving: - the ownership of the grid, in order to safeguard domestic market power; - state-ownership (if applicable), in order to strengthen its financial stability
Struggle for power	The EU aims to strengthen its role in the global polity, considering one regional single voice more efficacious than many national ones. OU is a way to encourage a deeper integration of energy markets, essential step before the integration of energy policies.	Energy security and climate change bring MS to defend their sovereignty, also against the EU; after neo-liberalism and its *laissez faire*, the emergence of a new paradigm requires a new string role for the national State.	VIUs are 'national champions' to be preserved and strengthened in order to guarantee supply security and stability of the internal markets

6. Analysis of players' position

The three models can be evaluated on the base of EU polity, MS and Utilities behaviours and decisions. The method this work will adopt focuses on the analysis of EU and MS official documents, effective decisions, newspapers comments day-by-day. All these documents will be assessed in order to identify which one among the identified models better explains what has been happening since, in the last months, the EC proposed its third package.

6.1. European Commission

Commissioner for Competition, Mrs Kroes, in several speeches explained the economic rationale behind the proposal of a new package of reforms including a strong form of unbundling as OU. Before the official proposal in the COM(2007)1, she affirmed (speech 06/648) that in order to achieve the aim of 'secure, sustainable and affordable energy supplies depends on market-based competitive electricity and gas prices. Security of supply is enhanced through correct market signals which will lead to both the investments we need to see within the EU and a diversification of supply. And sustainability is boosted by correct price signals, which give incentives for greater energy efficiency'. She also complained that 'at present there is no such thing as a competitive Single Market for energy in Europe', due essentially to market concentration which supports

incumbents' strategy; lack of liquidity and infrastructures; and, finally, a low level of cross-border integration among MS markets. The latter determines an increase in congestion revenues: the problem, as Mrs Kroes pointed out, is that these sums are not invested in new interconnection capacity, because of a clear conflict of interest of incumbents (speech 07/63). Thus, vertical integration of 'energy giants' was considered the cause of the conflict of interest affecting the EU electricity sectors and determining the previous catalogue of problems: henceforth 'absolute priority' as solution was given to OU, considered the only structural reform, beside to more transparency, able to achieve the goal of higher competition and integration. Philip Lowe, director general of DG Competition, accused '[t]he lack of infrastructure investment or delaying tactics by vertically integrated supply [… so that] incumbents remain dominant at all stages of the supply chain, and the markets remain closed to competition [… and] still largely national'. Consequently, he recognized the existence of 'currently systemic conflicts of interest resulting from the vertical integration of the energy giants [… and that] the current level of unbundling is clearly insufficient. Respondents [to the Sector Inquiry] tell us that network companies still favour their own supply or generation businesses. And there is evidence that investments are based on what is good for the integrated company, rather than on efficiency gains for the network company. We need to ensure a structural unbundling that removes the opportunities for discriminating against competing suppliers, and which provides the proper incentives to invest in the network' (speech 06/17).

Commissioner Kroes argued that no other solutions can guarantee a positive impact as OU would do: '[l]egally unbundled companies are supposed to put in place information barriers between their transmission activities and their commercial distribution activities. Despite this, information leakage through these 'Chinese walls' is all too common, giving the company's supply business an advantage over its competitors'; at the same time, also the ISO model, suggested instead of OU as a compromise by the EC, 'would be an improvement on the status quo but it does not address investment incentives as effectively as ownership unbundling. It would also be at a price of complex regulation and heavy administrative burdens, and so would be directly contrary to the 'Better Regulation' agenda which the Barroso Commission is pursuing so energetically' (speech 07/63).

These positions found a clear support in the European Regulators Group for Electricity and Gas (ERGEG): its President Sir John Mogg several times, before the EC proposal, underlined the need of a new legislative package in order to enhance regulatory powers, to develop an integrated single EU grid and to introduce a full ownership unbundling of the network (ERGEG, PR-06-09; PR-07-04). Thus, the essential content of the third package, in particular ownership unbundling and the

creation of an EU Agency for Regulation, the so called ACER, have been 'warmly welcomed' (ERGEG, PR-07-09).

6.1.1. Empirical evidence of EC arguments

A recent study commissioned by DG Competition and prepared by London Economics, analyzed electricity markets of six MS markets, namely Belgium, the Netherlands, Spain, France, Germany and Great Britain, trying to point out relations between markets structures and impact on prices (LE, 2007): although findings seem to confirm EC's positions, it should be said that this study do not provide any strong evidence of positive correlation between prices and concentration of wholesale markets. On the contrary, it could be easily pointed out how trend in prices even shows conflicting results:

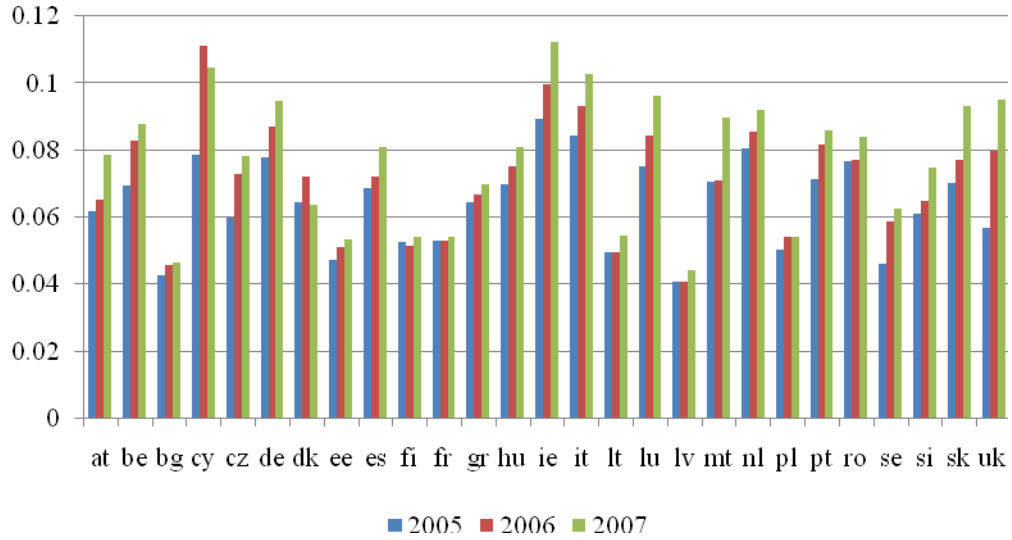

Figure 2: National/EU average ratio on prices without taxes for industrial consumers, cathegory Ie. Source: elaboration on EUROSTAT data

The positive trend for France, Austria, Bulgaria, if compared to prices in the UK, Italy or Spain (figure 2) and the emergence of a not strict relation between low concentration of market and low prices (figure 3) seem to suggest how other important element affect MS performances on prices, not always synthesizable as a problem of low competition.

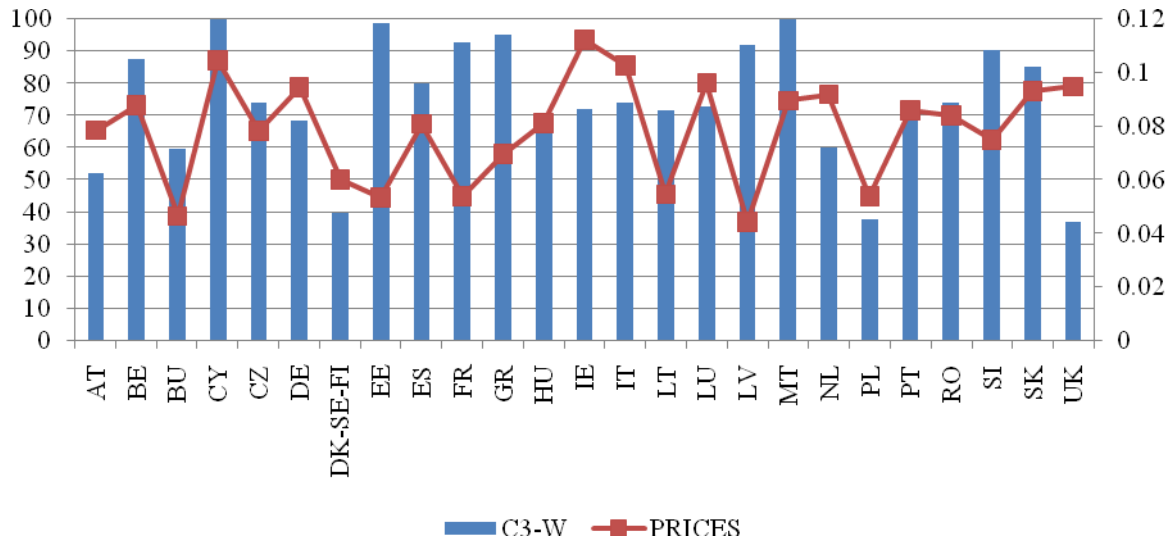

Figure 3: Prices (€/KWh) for Ie consumers in 2007; Concentration index (C3) for 3 largest companies' wholesale market shares in 2007. Source: Elaboration on EUROSTAT data

6.1.2. The emergence of geopolitical issues

Energy dependency for primary sources, geographical position, or environment legislation often represents an obstacle even stronger than competition which requires an energy policy wider than a competition policy, as Italy or Germany show. These data well introduce the emergence of geopolitical issues in the debate among EC and MS. Awareness of a geopolitical issue in the EC is evident in several interventions of Commissioners, showing on this very point a clear disappointment of the EC for the positions of those MS opposing to OU measures. Mrs Kroes clearly pointed out that EC considered unacceptable 'that there is a "balance to be struck" between competition and energy security. That is just too easy an argument to make. Instead, the facts are that these two elements are – and must continue to be - mutually reinforcing' (speech, 07/212), concluding it was the core content of the EC disappointment. Furthermore, Mr Piebalgs, talking about oil and gas geopolitics, recognized that '[g]overnments in various parts of the world are viewing their energy resources as a strategic instrument, to be used for political ends […] Moreover, some nations are using political and economic power to buy into external energy reserves. In others, governments are using energy subsidies to buoy up their popularity, leading to spiralling demand and wastage. This may have a detrimental effect on sustainable economic development in some of the world´s most vulnerable regions. Each of these developments undermines the creation of a stable, predictable and transparent global energy market. How can the EU develop an energy policy which can reduce the risks of insecurity, imbalance and uncertainty?' (speech 07/586). The answer to this question identify the possible aspect of geopolitics behind the third package: Mr Piebalgs continued underlining two essential goals to be achieved: a) the need of an EU common energy agenda; b) a not superficial cooperation, as it is argued to be now, but more

effective domestically and at international level. In other terms, it should be given up 'the traditional perception that energy is a *national* security issue – it is a *European security issue*' (speech 07/586, italic in original): the COM(2006)841 and SEC(2007)1179 already underlined that policy making on energy security is beyond power of single MS.

In conclusion, when Mrs Kroes ironically wondered which was the most attractive market and most powerful condition in negotiations between '27 mini energy markets with an average of around 18 million consumers each, or a market of over 490 million consumers' (speech 06/648), the answer for the EC was clear: only a strong EU could bargain power in the global context of energy geopolitics; only this EU vision of cooperation would ensure 'greater stability for investors; greater predictability in supply and demand; recognition of mutual interests among suppliers and consumers; and the reduction of risk to energy supplies [… furthermore, EC considers] energy cooperation as a pre-requisite for dealing with some of the most complex political issues of our time – climate change, geopolitical threats and terrorism' (Mr Piebalgs, speech 07/586).

6.2. States opposing ownership unbundling

In an interview, some weeks after the COM(2007)1 and the debate on OU, Mrs Merkel had already synthesized the positions of those MS which would have not supported the third package, sustaining that competition 'is a precondition for an efficient European energy policy' encouraging the creation of new 'infrastructure for this competition to take place, for instance by setting up interconnectors'; but she also underlined: 'unbundling is a different issue. We have many traditions in Europe. Fourteen member states already have unbundling, others like Germany have a different tradition. I do not think the issue of competition can be reduced to the unbundling question' (FT, 6 March 2007).

6.2.1. The position of the "Club of 8"

In order to defend their "traditions", some MS, expressed their doubts on the route EC pursues to achieve its "EU vision" and clarified their point of view in the missive they sent to the Chairwoman of the ITRE Commission, Mrs Angelika Niebler, on 29th January 2008. First of all they pointed out the 'several crucial doubts' on the OU, in particular on the consequences in terms of 'the *legality, opportunity, proportionality and efficiency* of such a measure' (italic in original): in particular, in the missive, they asserted that OU:

- is not compatible with constitutional law and with the free movement of capital;
- has no clear positive consequences on prices and investment but reasonable risks of negative impact on welfare.

Thus, they finally underlined their doubts OU might be a 'per se sufficient and appropriate tool' to achieve EC objectives. Whilst, about the first point, EC measures 'fulfil all the conditions set by

Art.95 EC' (Pielow and Ehlers, 2008: 15), 'considerable concerns as regards the enforceability of a European-wide introduction of ownership unbundling resp. the imposition of an obligation to implement ISOs' (Pielow and Ehlers, 2008: 25) arise. The reliefs on the impacts on prices have been partially deepened in the previous section; however it could be interesting to have a look at the trends of prices and concentration of the wholesale markets in countries with (1) and without (0) OU:

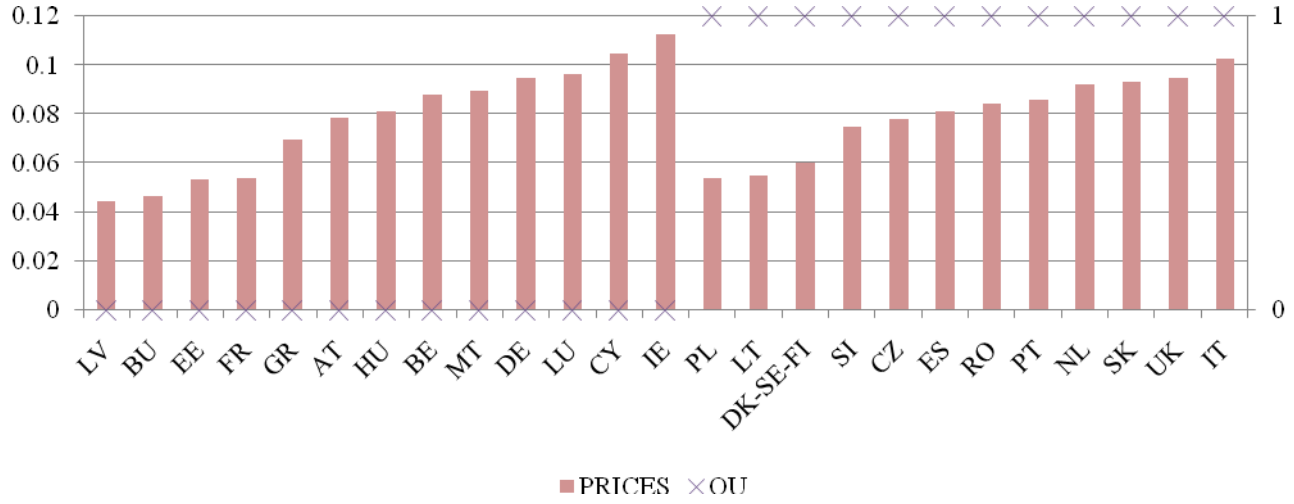

Figure 4: Comparison of prices for Ie customers (€/KWh) between countries with (1) and without (0) OU in 2007. Sources: elaboration on EUROSTAT and SEC(2008) 460

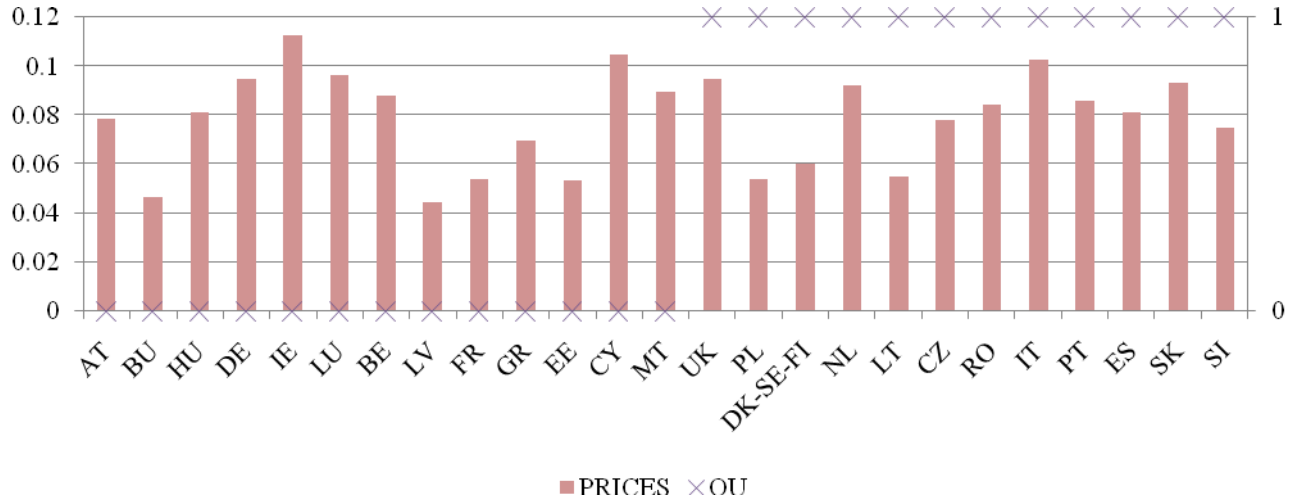

Figure 5: As in fig. 4, but observations have been ordained basing on their C3 values. Sources: elaboration on EUROSTAT and SEC(2008) 460

- (fig. 4-5) ordering the observations, divided into OU and not OU markets, according to their prices (fig.4) and their degree of concentration (fig.5), no clear tendencies emerge on the relation between prices and OU, as well as among prices, concentration and OU, confirming the doubts of the eight MS.

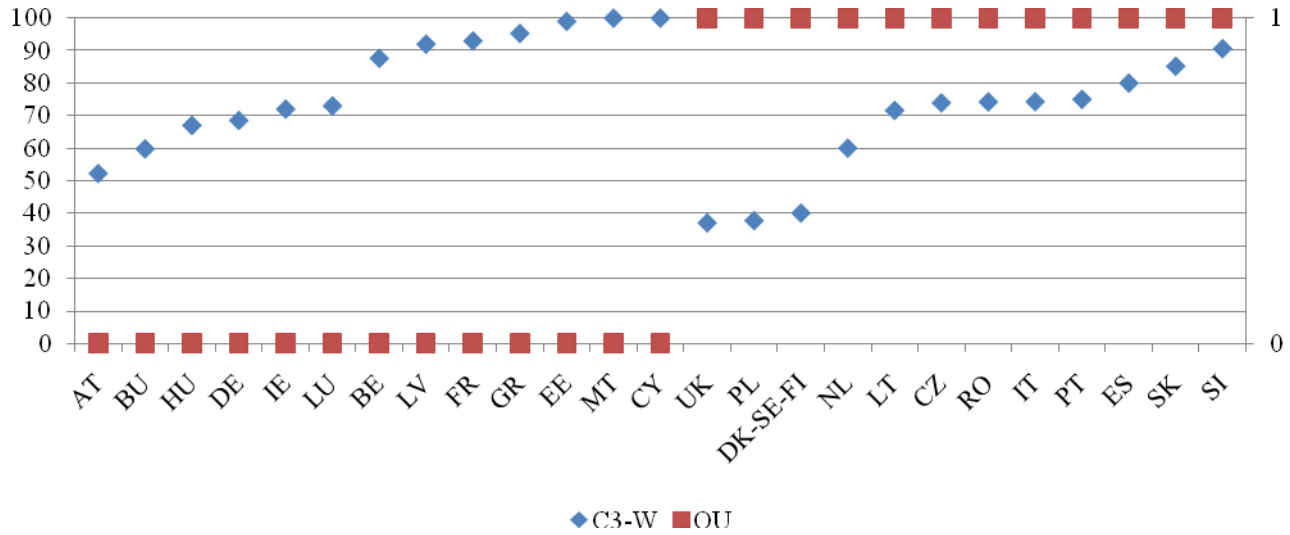

Figure 6: Comparison of level of C3 between OU and not OU countries. Sources: elaboration on EUROSTAT and SEC(2008) 460

- (fig. 4-6) although prices and concentration (measured as the 3 largest companies' market share) in the case of OU countries have minimum and maximum values lower than in the not OU countries, both the range of values and their variance are quite similar; and although average C3 in the OU countries is much lower than in the other subsample, average prices are quite similar, showing no clear impact, as the following tables summarize:

Tables 2 and 3: Descriptive statistics of C3 and prices (€/KWh) in the two subsamples including ownership unbundled (OU=1) MS and not ownership unbundled (OU=0) MS in 2007. Sources: elaboration on EUROSTAT and SEC(2008) 460

OU=1	mean	variance	min	max	diff.
C3	66.62833	348.227	37	90.6	53.6
Prices	0.079708	0.000258	0.0541	0.1027	0.0486
OU=0	**mean**	**variance**	**min**	**max**	**diff.**
C3	81.49462	277.7752	52.2	100	47.8
Prices	0.077985	0.000511	0.0443	0.1125	0.0682

Their alternative proposal focused on an 'Effective and Efficient Unbundling' (EEU), where "effective" stands for the fulfilment of all the requirements set by the progress report and "efficient" expresses the idea this option might better achieve the goals of fair competition, adequate investments, access to new entrants and market integration. Two pillars would have characterized this measure: a) a structure of governance of the TSO and the undertakings which guarantee an impact deeper than the legal unbundling, achieved by strict obligations and rules checked by national public authorities; b) definition of competences and rules on grid investments, by an indicative 10-year national network development plan, based on an 'extensive and transparent consultation by public authority or trustee', with powers to public authority to oblige the TSO to realise those required investments.

The positive results in terms of cooperation among national markets even if not OU markets were pointed out, underlining the development of the Pentalateral Energy Forum including France, Germany, the Netherlands, Luxembourg and Belgium.

As previously said, the EEU proposal was rejected by the EC on February 2008, which preferred to go straight towards the approval of OU and ISO models as the only acceptable solutions, determining the reaction of Ministers of the 8 MS stating that 'convincing evidence were never produced' in favour of OU (FT, 28 February 2008).

According to this point of view, it sounds worryingly the declaration of Jean-Pierre Jouyet, France's Europe Minister, who, debating on OU, affirmed that the EC proposal relies on an 'ideological view. We [the French Government] have a strategic view. It is a better balance between European interests and competition rules, it is not an ownership problem. A national regulator that guarantees fair access to the market is a good method': in other terms, while MS follow economic reasons, the EC proposes an ideological legislation in order to damage vertically integrated companies.

6.3. Utilities' point(s) of view

A synthesis of the European utilities assessment on the OU debate can be identified in the position paper that Eurelectric released. In fact, the association of the EU electricity utilities do not agree with the EC preference for the OU: on the contrary, it suggests a compromise based on the creation of regional areas with central TSO governance in the hand of the Regional Independent Operator (RIO). The RIO model would better safeguard vertically integrated companies and the ownership of the asset, even if operated by another regional player. The Council of European Energy Regulators (CEER) commented the Eurolectric's paper and, even recognizing some merits including the positive impact of the model on the regional integration, thus preventing national discrimination, at the same time underlined that the main problem of the conflict of interest between incumbent and grid operator would not be solved unless clear rules on the relation between network owners and RIOs were specified. Consequently, an effective unbundling, according to the CEER, remains the *ad hoc* complementary measure with RIOs.

6.3.1. The debate in utilities' annual reports

Notwithstanding this common position paper, utilities operating in electricity generation and transmission in Europe are quite different each other for market dimensions, level of vertical integration, degree of internationalization: these differences prevent this work to catalogue these companies as a homogeneous group of interest, in particular on the debate on OU. Several CEOs' communications introducing companies' annual reports (2007) have been analyzed in order to identify whether there had been any comment on the OU debate. Among the companies across all the EU national electricity markets, more attention has been paid to the main VIUs, namely EDF,

E.ON, RWE, Vattenfall, Verbund (AT) and, for the OU systems, the principal TSOs, namely National Grid (UK), Terna (IT), TenneT (NL), Elia (BE), EirGrid (IE), Energynet.dk (DK), Svenska Kraftnet (SE), Fingrid (FI).

It is surprising that few words have been spent to the OU debate in the reports of the main VIUs, but for few cases. RWE observed that the relation between unbundling and grid investment 'has not been proven empirically and is questionable from a scientific point of view. [...] In our opinion, drastic changes in ownership rights will not lead to increased competition or be an incentive for investment' (RWE, 2007: 52). E.ON synthetically complains about the increasing negative opinion (without evidence) on the direct role of state in the market (E.ON, 2007). More specifically, Verbund CEO 'is not convinced that the goals referred to above [EU goals on competitiveness, sustainability and security of supply] can be achieved through ownership unbundling [...]. The existing statutory framework for legal unbundling is sufficient provided that the concept is implemented consequently throughout Europe and adherence to the concept is effectively controlled. According to the legal opinion of Verbund, ownership unbundling is not consistent with the Austrian legal system nor is it in line with the relevant provisions – pertaining to ownership – of the EC Treaty' (Verbund, 2007:9). On the contrary, for many transcos 'the debate conducted in a number of major Member States with the European Commission about unbundling transmission systems from generation and sales is irrelevant' (Elia, 2007: 2); it is also understandable that, as Belgian Elia, these independent transmission system operators are seen 'as something of a role model' (Elia, 2007: 2). At the same time, the TenneT CEO is convinced that the real question is 'not if, but when the European grid operators will be legally and economically separeted from their original holding companies' (Tennet, 2007: 12). Their independence is judged as totally positive and, in the case of National Grid and Terna, even an opportunity to grow own business in other markets. While NG invests and operates in grids in the northeastern area of USA, Terna owns relevant shares in the Brazil transco. In other terms, on one hand there is a group of VIUs investing and growing up in other EU and non-EU markets, on the other hand an alternative model of international business is represented by transcos which, specializing on transmission system operation domestically, enter new markets and invest abroad.

In conclusion, there is not one single position among Utilities, as well as among MS: on the contrary it could be argued that two main groups emerge. The first one includes vertically integrated companies operating both in domestic markets (relying on low degree of competition) and, many of them, in international markets, confirming the emergence of a hybridized utility, a swan from the old ugly duckling. The second group includes TSOs economically stable and independent from generation companies: a hybridized utility model seems to emerge also among TSO, as NG and

Terna. As a consequence, MS' positions reflect the business strategies of their national champions: the question is whether it is a case of capture by utilities or utilities are an instrument for the Government to safeguard their energy security and, eventually, to implement a neo-mercantilistic policy.

7. Conclusions

This research, focusing on the debate on the OU measures introduced by the EC in the third package of reforms of the electricity sector, relies on the evidence that economic theory and political economy have to be jointly analyzed in order to provide an interpretative key to the dynamics affecting decision making process, mainly in the EU polity. The energy sector, in particular, is more and more characterized by a strict connection between economic models, to date based on neo-liberalism, and geopolitical issues, namely energy security and energy independence, which seem to have radically introduced a new perspective on the energy agenda of both the EU polity and MS. The specific case of TX network ownership unbundling well illustrate the tension between these two factors, economic theory and geopolitical economy, which requires a sort of third, intermediate, level of analysis. This intermediate level of institutions and policy analysis implies, in this specific case of OU debate, the assessment of the different players involved: each one, the EC, MS and the utilities, shows a complex set of preferences, economically and politically based. This work introduced and gave an overview of this interplay; after the analysis of the main players' arguments, two main comments could be proposed.

The decline of neo-liberalism, suggested by many scholars, do not prevent from admitting important positive impacts liberalization and privatization brought to some electricity markets. At the same time, transmission, as a natural monopoly, cannot be liberalized and its operation requires a clear regulation on new investments, ordinary maintenance, and third party access: on this point unbundled companies have been showing good performances, but good results have been achieved also by VIUs. Furthermore, no determinant evidence can be proved on a positive impact of OU on market concentration and prices, strengthening opposition by not OU countries and VIUs. Thus, why is the EC so firm on this package of proposals? Geopolitical dynamics are probably much more important than what has suggested so far.

Thus, debate on unbundling can be interpreted as a struggle for supremacy, between the EU polity which aims to a stronger role inside and outside its borders on energy policy. Integration of energy markets can be considered as a first step for the centralization of energy policy: afterwards, the essential role of energy for the development of the contemporary society will increase the EU polity's importance respect to national states. It should be said that the process of globalization, although increasing the risks for states, requires players with enough power to positively negotiate

at international level: on this very point Mrs. Kroes' comment on the higher bargaining power of a single market than 27 mini markets sounds reasonable. Opposition led by some MS, paradoxically, seems to be more based on economic arguments, at least in the French case, where a concentrated and not OU market guarantees good performances and low prices; obviously, as already said, the geopolitical relevance of energy security and the strategic use of sources make energy policy a dangerous field to be attributed to EU competencies, as it happens for sensible fields including defence or foreign policy. Therefore, the role of utilities has been important and has influenced MS Governments' positions. It seems to be not consistent the hypothesis that utilities capture MS, as the E.ON case has shown: notwithstanding the decision to proceed to unbundle according to the EC proposal (it has to be repeated that nothing has happened to date), Germany position has not changed at all; at the same time, the public ownership of EDF makes more credible the hypothesis that it is the Government which influence its utility's strategy, not the contrary.

Consistently, one of the possible ways to solve positively the conflict, apparently irreconcilable, would depend on a shared responsibility by all the players. The EU polity should determine the strategic aims of the energy policy, namely sustainability, competitiveness, security, leaving to MS the opportunity to identify those measures which better guarantee the achievement of the EU goals, according to their specific conditions. As Pielow and Ehlers stated 'instead of pursuing an inflexible and irreversible restructuring of the ownership in and the operation of electricity and gas transmission grids, we consider it more appropriate to think intensively about more flexible adaptations of the existing legal framework supporting a "competition of systems" amongst the Member States [... encouraging] 'the introduction of binding "competition benchmarks"' (2008: 26-27); regular monitoring would be assigned to national regulators or the ACER. Synthetically, it is no longer time for "competition *per se"*, but competition of systems or competition benchmarks can better achieve a sustainable growth and enhance welfare.

References

Baarsma, B., de Nooij, M., Koster, W. and van der Weijden, C. (2007) Divide and rule. The economic and legal implications of the proposed ownership unbundling of distribution and supply companies in the Dutch electricity sector. Energy Policy 35 (3) 1785-1794

Bahgat, Gawdat (2006) Europe's energy security: challenges and opportunities. International Affairs 82 (5) 961-975

Bartle, Ian (1999) Transnational Interests in the European Union: Globalization and Changing Organization in the Telecommunications and Electricity. Journal of Common Market Studies 37 (3) 363-383

Belyi, Andrei V. (2003) New dimensions of energy security of the enlarging EU and their impact on relations with Russia. Journal of European Integration 25 (4) 351-369

Bevir, Mark (2004) 'Democratic Governance' [www], Institute of Governmental Studies University of California, Berkeley, available at http://repositories.cdlib.org/igs/WP2004-5

CEER (2007) CEER's Response to a Regional Independent Operator (RIO) proposal by EURELECTRIC. Ref: C07-GA-34-08. Available at http://www.ceer.eu/portal/page/portal/CEER_HOME/CEER_PUBLICATIONS/CEER_DOCUMENTS/2007

Chick, Martin (2007) Electricity And Energy Policy In Britain, France And The United States Since 1945. Cheltenham and Northampton: Elgar

Ciaralli, Ermelinda (2008) I mercati europei dell'elettricità e del gas. Il terzo pacchetto legislative presentato dalla Commissione. Mercato concorrenza regole X (1) 179-217

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2004) Reconceptualizing Public Services after Integration: State, Markets and Entitlements in the European Union. UNU-CRI e-Working Papers. W-2004-8

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2006a) Privatizing public enterprises in the European Union 1960-2002: ideological, pragmatic, inevitable? Journal of European Public Policy 13 (5) 736-756

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2006b) Empowering Europe's Citizens? Towards a charter for services of general interest. Public Management Review 7 (3) 417-443

Clifton, J., Comìn, F. and Diàz Fuentes, D. (2007a) Transforming Public Enterprise in Europe and North America. Networks, Integration and Transnationalization. Basingstoke: Palgrave Macmillan

Clifton, J., Comìn, F. and Diàz Fuentes, D. (2007b) Privatisation in the European Union. Public Enterprises and Integration. Dordrecht, Boston, London: Kluwer Academic Publishers

Clifton J. And Dìaz-Fuentes, Daniel (2008a) Evaluating EU policies on public services: a citizens' perspective. MPRA paper n.9420. Available at: http://mpra.ub.uni-muenchen.de/9420/

Clifton J. And Dìaz-Fuentes, Daniel (2008b) Public Services in the Single Market: Privatization, Asymmetric Liberalization and Multinational Corporations. Mimeo

Clifton, J. and Guillén, A. (2005) Electrifying or Europeanising social policy? Some Research Challenges. Chapter 10 in European Research Centre, Cross-National Research Papers 7 (6) 56-61

Coleman, W. and Tangermann, S. (1999) The 1992 CAP Reform, the Uruguay Round and the Commission: Conceptualizing Linked Policy Games. Journal of Common Market Studies 37 (3) 385-405

EURELECTRIC (2007) Position Paper on the European Commission's approach to market developments. Available at http://www2.eurelectric.org/content/default.asp?PageID=627

Finger, Matthias and Varone, Frédéric (2006) Governance of network industries: towards European regulators, differentiated regulations, or self-regulation? ECPR Conference at the University of Bath, September 7-8 2006

Florio, Massimo (2007) Electricity Prices as Signals for the Evaluation of Reforms: An Empirical Analysis of Four European Countries. International Review Of Applied Economics 21 (1) 1-27

Genoud, C. and Varone, F. (2002) Does Privatization Matter? Liberalization and regulation: The case of European electricity. Public Management Review 4(2) 231-256

Glachant, J.M. and Finon, D. (2003) Competition in European Electricity Markets. A Cross-country Comparison. Cheltenham and Northampton (MA): Edward Elgar

Glanchant, Jean-Michel and Lévêque, François (2006) Electricity Internal Market in the European Union: What to do Next? CWPE 0623 and EPRG 0605

Helm, Dieter (2005) The Assessment: The New Energy Paradigm. Oxford Review of Economic Policy 21 (1) 1-18

Johnson, Debra (2005) EU-Russian Energy Links: a Marriage of Convenience? Government and Opposition 40 (2) 256-277

Künneke, Rolf and Fens, Theo (2007) Ownership unbundling in electricity distribution: The case of The Netherlands. Energy Policy 35 (3) 1920-1930

London Economics (2007) Structure and Performance of Six European Wholesale Electricity Markets in 2003, 2004 and 2005. Available at http://www.londecon.co.uk/le/publications/recent_reports.shtml

Majone, Giandomenico (1990) Deregulation or Re-regulation?, London, Pinter Publishers

Majone, Giandomenico (1994) 'The Rise of the Regulatory State in Europe', Western European Politics 17 (3) 77-101

Majone, Giandomenico (1996) Regulating Europe, London and New York, Routledge

Moran, Michael (2001) The Rise of the Regulatory State in Britain. Parliamentary Affairs 54 (1) 19-34

Pelkmans, Jacques (2005) Subsidiarity between Law and Economics. College of Europe, Research Papers in Law n.1/2005. Available at www.coleurop.be/file/content/studyprogrammes/law/studyprog/pdf/ResearchPaper_1_2005_Pelkmans.pdf

Pelkmans, J., Hanf, D., Chang, M., eds.(2008) The EU Internal Market in Comparative Perspective. Economic, Political and Legal Analyses. Brussels: Peter Lang

Pielow, Johann-Christian and Ehlers, Eckart (2008) The Constitutional Challenge of Ownership Unbundling – a European and German Perspective. Available at: http://www.unecom.de/HTML/results.html

Putnam, Robert D. (1988) Diplomacy and domestic politics: the logic of two-level games. International Organization 42 (3) 427-460

Raza, Werner (2007) Service Liberalization in the WTO: Implications for Public Services in Europe. Paper presented at the conference "An alternative to the market: The social, political and economic role of public services in Europe" ETUI-REHS, EPSU, SALTSA, Brussels, November 19-20, 2007

Strange, S. (1980). States and Markets. London: Pinter Publishers. Cited in Belyi, Andrei (2003)

Thomas, Steve (2007a) Unbundling of electricity transmission networks: Analysis of the European Commission's position [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

Thomas, Steve (2007b) A critique of the European Commission's Impact assessment on the legislative package for electricity and gas [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

UNCTAD (2008) World Investment Report 2008. Transnational Corporations and the Infrastructure Challenge. New York and Geneva: United Nations

Van den Hoven, A. and Froschauer, K. (2004) Limiting Regional Electricity Sector Integration and Market Reform: The Cases of France in the EU and Canada in the NAFTA Region. Comparative Political Studies 37 (9) 1079-1103

Van Koten, S. and Ortmann, A. (2008) The unbundling regime for electricity utilities in the EU: A case of legislative and regulatory capture? Energy Economics 30 (6) 3128-3140

Concluding remarks

At the end of this work, it is noteworthy to recall some essential impressions which have emerged from the analysis.

1. First of all, energy policy confirmed its unique role for economic development; at the same, energy has become a strategic factor for international relations, namely in the EU, affected by an increasing demand and a strong dependency from gas and oil producers. Besides pro-competitive measures against high concentration of wholesale and retail energy markets, energy security and environmental sustainability of energy consumption rose as complementary aspects of a consistent energy policy. Henceforth, the new energy paradigm implies an effective debate on emerged pros and cons of competition, whilst, in the '80s, it was more ideologically supposed to show mainly positive impacts.
2. The EU legislation has recently given more impulse to the process of integration of energy sector: a physical integration of the network; a regulatory and legislative harmonization, which might strengthen the EU polity in its role of political guidance and market watchdog; a consolidated European-based industry, through an internationalization of existing players and the intensification of processes of mergers and acquisitions among them. This latter point, in fact, has been already achieved by the internationalization which characterized utilities including EDF, ENEL-ENDESA, E.ON, RWE, Suez-GDF, Vattenfall: these companies do not operate only in their previous domestic markets, where they still preserve a large share, but also abroad. For what concerns physical integration and legislative harmonization, part I and part II have shown that Europeanization in fact has not yet been achieved. On the former, the proposed datasets for the first time organize information on physical and quality characteristics of the grid; a rather low annual growth rate affects almost all the countries of the UCTE, and, hence, of the EU. On the other hand, regulation, development of renewable sources, and improvement of energy efficiency have been implemented with considerable differences and with consequent different impacts.
3. An overall consideration emerging from the thesis suggests that economic rationales and political economy are deeply interconnected: the analysis of the transmission network unbundling policy required a double approach in order to achieve a complete knowledge of all the factors behind the decision-making process and to understand policy-makers' positions. In few words, welfare-enhancing measures do concern competition issues, but they also affect international relations and the need of bargaining power respect to suppliers, namely Russia and OPEC countries; the principle of subsidiarity, safeguarding the autonomy of MS; the risk that an

unbalanced equilibrium between asymmetric liberalization of domestic electricity sectors and protectionism (or even neo-mercantilism) towards national champions.

On this very point, transmission network unbundling and the debate around the third package have concretely been instances of the problems related to the process of Europeanization of the electricity sector. Network unbundling, from a geopolitical point of view, guarantees the independence of transmission operators, hits the conflict of interest of incumbents and encourages a stronger interconnection among grids; finally, a more important role of the European Commission would be determined. Focusing on the economic aspects, evidence shows that there is no clear relation between unbundling and grid investments, mainly in the concentrated markets, which was supposed to be the most affected by the introduction of transmission unbundling. Several reasons can justify these results: unbundling is probably not sufficient to promote competition if not introduced with other measures. Furthermore, investments in transmission grid have often to face problems related to siting (e.g. Nimby sindrome) and to bureaucratic procedures. However, in the past years, transmission grid did not receive the necessary attention if compared to generation. These political and economic issues, differently relevant for each MS, influenced their position.

Some policy implications can also be pointed out.

First of all, the gap in information concerning the European grid, in terms of monetary investments, physical characteristics and qualitative performance, requires the intervention of specific institutions which might introduce a periodical survey and organize public datasets for policy-makers above all.

The UK and Nordic countries, included in the same cluster achieve similar results, although the way towards has been different; their example allows introducing a final remark concerning the approach followed by the EC. If electricity sectors are determined also by energy mix, geographical conditions, traditions of capitalism, it could be probably more efficient for the EU to identify general goals, whereas single MS, according to the principle of subsidiarity, could adopt the model they consider best fitting. The difficult journey of the third package, again, has been a good instance: the proposed approach suggested in the part III aims to reduce political problems among Commission and MS, encouraging a new form of competition between models, and evaluating MS performances on the base of the achievement of the goals, not on the implementation of generic rules.

General References

Alesina, A., Ardagna, S., Nicoletti, G. and Schiantarelli, F. (2005) Regulation And Investment. Journal of the European Economic Association 3 (4) 791-825.

Anderson, Jeffrey J. (2002) Europeanization and the Transformation of the Democratic Polity, 1945-2000. Journal of Common Market Studies 40 (5) 793-822

Arellano, M.S. and Serra, P. (2008) The competitive role of the transmission system on price-regulated power industries. Energy Economics 30 (4) 1568-1576

Arocena, Pablo (2008) Cost and quality gains from diversification and vertical integration in the electricity industry: a DEA approach. Energy Economics 30 (1) 39-58

Baarsma, B., de Nooij, M., Koster, W. and van der Weijden, C. (2007) Divide and rule. The economic and legal implications of the proposed ownership unbundling of distribution and supply companies in the Dutch electricity sector. Energy Policy 35 (3) 1785-1794

Bache, I. (2006) The Europeanization of Higher Education: Markets, Politics or Learning? Journal of Common Market Studies 44 (2) 231-248

Bahgat, Gawdat (2006) Europe's energy security: challenges and opportunities. International Affairs 82 (5) 961-975

Barrell, Ray ed. (1992) Economic Convergence and Monetary Union in Europe. London: SAGE Publications

Bartle, Ian (1999) Transnational Interests in the European Union: Globalization and Changing Organization in the Telecommunications and Electricity. Journal of Common Market Studies 37 (3) 363-383

Barton, B., Redgwell, C., Rønne, A. and Zillman, D.N., eds. (2004) Energy Security. Managing Risk in a Dynamic Legal and Regulatory Environment. Oxford: Oxford University Press

Basu, D.R. (1981) Future Energy Policies for the UK. An Optimal Control Approach. London and Basingstoke: The Macmillan Press

Bayliss, K., Hall, D. and Perez Corral, V. (2001) FDI Linkages and infrastructure: some problem cases in water and energy [www]. PSIRU Reports, available at http://www.psiru.org/ publicationsindex.asp

Belyi, Andrei V. (2003) New dimensions of energy security of the enlarging EU and their impact on relations with Russia. Journal of European Integration 25 (4) 351-369

Bennett, Colin J. (1991) What Is Policy Convergence and What Causes It? [www] British Journal of Political Science 21 (2) 215-233

Bevir, Mark (2004) 'Democratic Governance' [www], Institute of Governmental Studies University of California, Berkeley, available at http://repositories.cdlib.org/igs/WP2004-5

Borenstein, S., Bushnell, J. and Stoft, S. (2000) The competitive effects of transmission capacity in a deregulated electricity industry. The RAND Journal of Economics 31 (2) 294-325

Börzel, Tanja (2002) States and Regions in the European Union. Institutional Adaptation in Germany and Spain. Cambridge: Cambridge University Press

Börzel, Tanja (2005) Pace-setting, Foot-dragging and Fence-sitting: Member State Responses to Europeanization. Chapter 10 in Jordan, Andrew ed. (2005) Environmental Policy in the European Union. Actors, Institutions and Processes. 2nd ed. London: Earthscan Publications

Börzel, Tanja and Risse, Thomas (2003) Conceptualizing the Domestic impact of Europe. Chapter 3 in Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Boucher, Jacqueline and Smeers, Yves (2001) Alternative Models of Restructured Electricity Systems, Part 1: No Market Power. Operations Research 49 (6) 821-838

Boyce, John. R. and Hollis, Aidan (2005) Governance of electricity transmission systems. Energy Economics 27 (2) 237-255

Brend, B., Paarsch, H.J. and Solow, J.L. (2006) Estimating market power in the presence of capacity constraints: An application to high-fructose corn sweetener. International Journal of Industrial Organization 24 (2) 251-267

Brunekreeft, Gert (2008) Ownership Unbundling in Electricity Markets. A Social Cost Benefit Analysis of the German TSO's. EPRG Discussion Paper 08-15, University of Cambridge

Brunekreeft, Gert and Newbery, David (2006) Should merchant transmission investment be subject to a must-offer provision? Journal of Regulatory Economics 30 (3) 233-260

Busch, Per-Olof and Jörgens, Helge (2005) The international sources of policy convergence: explaining the spread of environmental policy innovations. Journal of European Public Policy 12 (5) 860-884

CEER (2007) CEER's Response to a Regional Independent Operator (RIO) proposal by EURELECTRIC. Ref: C07-GA-34-08. Available at http://www.ceer.eu/portal/page/portal/CEER_HOME/CEER_PUBLICATIONS/CEER_DOCUMENTS/2007

Chick, Martin (2007) Electricity And Energy Policy In Britain, France And The United States Since 1945. Cheltenham and Northampton: Elgar

Ciaralli, Ermelinda (2008) I mercati europei dell'elettricità e del gas. Il terzo pacchetto legislative presentato dalla Commissione. Mercato concorrenza regole X (1) 179-217

Claes, Dag Harald (2002) The process of Europeanization: Norway and the Internal Energy Market

Clifton J. and Dìaz-Fuentes, Daniel (2008a) Evaluating EU policies on public services: a citizens' perspective. MPRA paper n.9420. Available at: http://mpra.ub.uni-muenchen.de/9420/

Clifton J. and Dìaz-Fuentes, Daniel (2008b) Public Services in the Single Market: Privatization, Asymmetric Liberalization and Multinational Corporations. Mimeo

Clifton, J. and Guillén, A. (2005) Electrifying or Europeanising social policy? Some Research Challenges. Chapter 10 in European Research Centre, Cross-National Research Papers 7 (6) 56-61

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2004) Reconceptualizing Public Services after Integration: State, Markets and Entitlements in the European Union. UNU-CRI e-Working Papers. W-2004-8

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2006a) Privatizing public enterprises in the European Union 1960-2002: ideological, pragmatic, inevitable? Journal of European Public Policy 13 (5) 736-756

Clifton, J., Comìn, F. and Diàz Fuentes Daniel (2006b) Empowering Europe's Citizens? Towards a charter for services of general interest. Public Management Review 7 (3) 417-443

Clifton, J., Comìn, F. and Diàz Fuentes, D. (2007a) Transforming Public Enterprise in Europe and North America. Networks, Integration and Transnationalization. Basingstoke: Palgrave Macmillan

Clifton, J., Comìn, F. and Diàz Fuentes, D. (2007b) Privatisation in the European Union. Public Enterprises and Integration. Dordrecht, Boston, London: Kluwer Academic Publishers

Cody, R:P: and Smith, J.K. (1985) Applied Statistics and the SAS Programming Language. New York: north Holland

Coleman, W. and Tangermann, S. (1999) The 1992 CAP Reform, the Uruguay Round and the Commission: Conceptualizing Linked Policy Games. Journal of Common Market Studies 37 (3) 385-405

Cremer, H., Cremer, J., De Donder, P. (2006) Legal vs. Ownership unbundling in network industries. CEPR Working Papers, n. 5767

D'Aveni, Richard and Ravenscraft, David (1994) Economies of Integration versus Bureaucracy Costs: Does Vertical Integration Improve Performance? The Academy of Management Journal 37 (5) 1167-1206

Delmas, Magali and Tokat, Yesim (2005) Deregulation, Governance Structures, and Efficiency: The U.S. Electric Utility Sector. Strategic Management Journal 26 (5) 441-460

Department of Energy (2002) National Transmission Grid Study. Available at http://www.ferc.gov/ industries/electric/gen-info/transmission-grid.pdf

Didden, Marcel H. and D'haeseleer, William D. (2003) Demand Side Management in a competitive European market: Who should be responsible for its implementation? Energy Policy 31 (13) 1307-1314

Eising, Rainer and Jabko, Nicolas (2001) Moving Targets. National interests and Electricity Liberalization in the European Union. Comparative Political Studies 34 (7) 742-767

EURELECTRIC (2007) Position Paper on the European Commission's approach to market developments. Available at http://www2.eurelectric.org/content/default.asp?PageID=627

European Commission (1997) The Single Market Review. Single Energy Market. Subseries II, Volume 10. London: Kogan Page and Luxembourg: Office for Official Publications of the European Communities

European Commission (2003) Observatory of European SMEs. SMEs and the Liberalisation of Network Industries: Telecommunications and Electricity Markets, n.3, Luxembourg: Enterprise Publication

European Commission (2001-2007) Reports on Progress in Creating the Internal Gas and Electricity Market

Fagan, Mark L. (2006) Understanding the Patchwork Quilt of Electricity Restructuring in the United States. Regulatory Policy Program Working Paper RPP-2006-04. Cambridge, MA: Mossavar-Rahmani Center for Business and Government, John F. Kennedy School of Government, Harvard University

Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Federal Energy Regulatory Commission (2002) News Release – July, 31st. Available at http://www.ferc.gov/news/news-releases/2002/2002-3/july31-02smdx.pdf

Finger, Matthias and Varone, Frédéric (2006) Governance of network industries: towards European regulators, differentiated regulations, or self-regulation? ECPR Conference at the University of Bath, September 7-8 2006

Florio, Massimo (2007) Electricity Prices as Signals for the Evaluation of Reforms: An Empirical Analysis of Four European Countries. International Review Of Applied Economics 21 (1) 1-27

Fraquelli, G., Piacenza, M., and Vannoni, D. (2005) Cost Savings from Generation and Distribution with an Application to Italian Electric Utilities. Journal of Regulatory Economics 28 (3) 289-308

Fumagalli, E., Garrone, P. and Internulli, M. (2005) Effetti Economici Degli Investimenti Nella Rete Elettrica Di Trasmissione. Mimeo

Garcia, S., Moreaux, M. and Reynaud A. (2007) Measuring economies of vertical integration in network industries: An application to the water sector. International Journal of Industrial Organization 25 (4) 791-820

Gaynor, K.B. and Karakitsos, E. (1997) Economic Convergence in a Multispeed Europe. Basingstoke: Macmillan Press

Genoud, C. and Varone, F. (2002) Does Privatization Matter? Liberalization and regulation: The case of European electricity. Public Management Review 4 (2) 231-256

Gerardin, D. and Luff, D. (eds.) (2004) The WTO and Global Convergence in Telecommunications and Audio-Visual Services. Cambridge: Cambridge University Press

Gilardi, Fabrizio (2005) The Institutional Foundations of Regulatory Capitalism: the Diffusion of Independent Regulatory Agencies in Western Europe. ANNALS, AAPSS, 598, 84-101

Gilbert, R., Neuhoff, K. and Newbury, D. (2004) Allocating Transmission to Mitigate Market Power in Electricity Networks. The RAND Journal of Economics 35 (4) 691-709

Giuliani, Marco and Piattoni, Simona (2001) Italy: Both Leader and Laggard. Chapter 6 in Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers

Glachant, J.M. and Finon, D. (2003) Competition in European Electricity Markets. A Cross-country Comparison. Cheltenham and Northampton (MA): Edward Elgar

Glanchant, Jean-Michel and Lévêque, François (2006) Electricity Internal Market in the European Union: What to do Next? CWPE 0623 and EPRG 0605

Green, Richard (2001) Markets for Electricity in Europe. Oxford Review of Economic Policy 17 (3) 329-345

Green, Richard (2005) Electricity and Markets. Oxford Review of Economic Policy 21 (1) 67-87

Green, Richard (2006) Electricity liberalisation in Europe – how competitive will it be? Energy Policy 34 (16) 2532-2541

Greer, Monica (2008) A test of vertical economies for non-vertically integrated firms: The case of rural electric cooperatives. Energy Economics 30 (3) 679-687

Griffin, James M. and Puller, Steven L. eds. (2005) Electricity deregulation: choices and challenges. Chicago: the University of Chicago Press

Grossman, Sanford and Hart, Oliver (1986) The Cost and Benefits of Ownership: A Theory of Vertical and Lateral Integration. The Journal of Political Economy 94 (4) 691-719

Hall, David (2007) Self-assessment or public debate? Evaluating the liberalisation of network services in the EU and USA [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

Hart, Oliver and Moore, John (1990) Property Rights and the Nature of the Firm. The Journal of Political Economy 98 (6) 1119-1158

Hattori, Toru and Tsutsui, Miki (2004) Economic impact of regulatory reforms in the electricity supply industry: a panel data analysis for OECD countries. Energy Policy 32 (6) 823-832

Helm, D., Kay, J. and Thompson, D. (1989) The Market for Energy. Oxford: Clarendon Press

Helm, Dieter (2003) Energy, the State, and the Market. British Energy Policy since 1979, revised edition. Oxford: Oxford University Press

Helm, Dieter (2005) The Assessment: The New Energy Paradigm. Oxford Review of Economic Policy 21 (1) 1-18

Henry, C., Matheu, M. and Jeunemaître, A. (2001) Regulation of Network Utilities. The European Experience. Oxford: Oxford University Press

Héritier, Adrienne (2001) Market integration and social cohesion: the politics of public services in European regulation. Journal of European Public Policy 8 (5) 825-852

Hira, Anil and Amaya, Libardo (2003) Does energy integrate? Energy Policy 31 (2) 185-199

Hirst, Eric and Kirby, Brendan (2001) Key Transmission Planning Issues. The Electricity Journal 14 (8) 59-70

Hogan, William W. (1999) Market-based Transmission Investments and Competitive Electricity Markets. Center for Business and Government, John F. Kennedy School of Government, Harvard University

Hogan, William W. (2005) Transmission Market Design. Chapter 9 in Griffin, J. and Puller, S. (2005) Electricity Deregulation. Choices and Challenges. Chicago and London: The University of Chicago Press

Hunt, Sally (2002) Making competition work in electricity. New York: John Wiley and Sons

IEA (2002) Security of Supply in Electricity Markets. Evidence and Policy Issues. Paris

Jacobsen, H.K., Fristrup, P. and Munksgaard, J. (2006) Integrated energy markets and varying degrees of liberalisation: Price links, bundled sales and CHP production exemplified by Northern European experiences. Energy Policy 34 (18) 3527-3537

Jara-Diaz, S., Ramos-Real, F. J., and Martinez-Budria, E. (2004) Economies of integration in the Spanish electricity industry using a multistage cost function. Energy Economics 26(6) 995-1013

Johnson, Debra (2005) EU-Russian Energy Links: a Marriage of Convenience? Government and Opposition 40 (2) 256-277

Jordan, Andrew ed. (2005) Environmental Policy in the European Union. Actors, Institutions and Processes. 2nd ed. London: Earthscan Publications

Joskow, P. L. and Schmalensee, R. (1983) Markets for Power: An Analysis of Electric Utility Deregulation. Cambridge (MA): MIT Press

Joskow, Paul and Tirole, Jean (2000) Transmission Rights and Market Power on Electric power Networks. The RAND Journal of Economics 31 (3) 450-487

Kaserman, David and Mayo, John (1991) The Measurement of Vertical Economies and the Efficient Structure of the Electric Utility Industry. The Journal of Industrial Economics 39 (5) 483-502

Kirschen, Daniel and Strbac, Goran (2004) Fundamentals of Power System Economics. Chichester: John Wiley and Sons, Ltd

Kohler-Koch, B. and Eising, R. eds. (1999) The Trasformation of Governance in the European Union. London and New York: Routledge

Künneke, Rolf and Fens, Theo (2007) Ownership unbundling in electricity distribution: The case of The Netherlands. Energy Policy 35 (3) 1920-1930

Kwoka, John (2002) Vertical economies in electric power: evidence on integration and its alternatives. International Journal of Industrial Organization 20 (5) 653-671

Kwoka, John (2008) Restructuring the U.S. Electric Power Sector: A Review of Recent Studies. Review of Industrial Organization 32 (3) 165-196

Léautier, Thomas-Olivier (2001) Transmission Constraints and Imperfect Markets for Power. Journal of Regulatory Economics 19 (1) 27-54

Leonardi, Robert (1995) Convergence, cohesion and Integration in the European Union. Basingstoke: Macmillan Press

Levi-Faur, David (2004) On the “Net Impact” of Europeanization. The EU’s Telecoms and Electricity Regimes Between the Global and the National. Comparative Political Studies. 37 (1) 3-29

Littlechild, S.C. and Vaidya, K.G. (1982) Energy Strategies for the UK. London: George Allen & Unwin

London Economics (2007) Structure and Performance of Six European Wholesale Electricity Markets in 2003, 2004 and 2005. Available at http://www.londecon.co.uk/le/publications/recent_reports.shtml

Majone, Giandomenico (1990) Deregulation or Re-regulation?, London, Pinter Publishers

Majone, Giandomenico (1994) The Rise of the Regulatory State in Europe. Western European Politics 17 (3) 77-101

Majone, Giandomenico (1996) Regulating Europe, London and New York, Routledge

Mardia, K.V., Kent, J.T., and Bibby, J.M. (1979) Multivariate Analysis. London: London Academic Press

Matláry, J.H. (1997) Energy Policy in the European Union. London and Basingstoke: MacMillan Press

Mény, Y., Muller, P. and Quermonne, J. eds. (1996) Adjusting to Europe. The impact of the European Union on national institutions and policies. London and New York: Routledge

Michaels, Robert J. (2006) Vertical Integration and the Restructuring of the U.S. Electricity Industry. Policy Analysis n.572

Minoia, A., Ernst, D., Dicorato, M., Trovato, M. and Ilic, M. (2006) Reference Transmission Network: a game theory approach. IEEE Transactions on Power Systems 21 249-259

Moran, Michael (2001) The Rise of the Regulatory State in Britain. Parliamentary Affairs 54 (1) 19-34

Müller, Holger and Wärneryd, Karl (2001) Inside versus outside ownership: a political theory of the firm. The RAND Journal of Economics 32 (3) 527-541

MVV Consulting (2007) Implementation of TEN-E projects (2004-2006). Evaluation and Analysis. Available at http://ec.europa.eu/ten/energy/studies/doc/2007_11_ten_e_evaluation_report_en.pdf

Nemoto, Jiro and Goto, Mika (2004) Technological externalities and economies of vertical integration in the electric utility industry. International Journal of Industrial Organization 22 (1) 67-81

OFGEM, Domestic Competitive Market Review. Versions 2004, 2005, 2006, 2007

Olsen, Johan P. (2002) The Many Faces of Europeanization. Journal of Common Market Studies 40 (5) 921-952

Padgett, Stephen (2003) Between synthesis and emulation: EU policy transfer in the power sector. Journal of European Public Policy 10 (2) 227-245

Parks, Bill (2002) Transforming the Grid to Revolutionize Electric Power in North America, meeting at Edison Electric Institute, October 13rd 2002

Pedersen, Lene H. (2006) Transfer and Transformation in processes of Europeanization. European Journal of Political Research 45 (6) 985-1021

Pelkmans, J., Hanf, D., Chang, M., eds.(2008) The EU Internal Market in Comparative Perspective. Economic, Political and Legal Analyses. Brussels: Peter Lang

Pelkmans, Jacques (2005) Subsidiarity between Law and Economics. College of Europe, Research Papers in Law n.1/2005. Available at www.coleurop.be/file/content/studyprogrammes/law/studyprog/pdf/ResearchPaper_1_2005_Pelkmans.pdf

Pielow, Johann-Christian and Ehlers, Eckart (2008) The Constitutional Challenge of Ownership Unbundling – a European and German Perspective. Available at: http://www.unecom.de/HTML/results.html

Pineau, P.O., Hira, A., and Froschauer, K. (2004) Measuring international electricity integration: a comparative study of the power systems under the Nordic Council, MERCOSUR, and NAFTA. Energy Policy 32 (13) 1457-1475

Pollitt, Michael G. (2006) Electricity Reform in Chile: Lessons for Developing Countries [www] Cambridge-MIT Institute Working Paper 51. Available at web.mit.edu/ceepr/www/ 2004-016.pdf

Pollitt, Michael G. (2008) The arguments for and against ownership unbundling of energy transmission networks. Energy Policy 36 (2) 704-713

Putnam, Robert D. (1988) Diplomacy and domestic politics: the logic of two-level games. International Organization 42 (3) 427-460

Quick, David M. and Carey, Janis M. (2002) Transmission capacity and market power: the effect on a dominant generation firm. Energy Policy 30 (8) 699-708

Radaelli, Claudio M. (2003) Europeanization of Public Policy. Chapter 2 in Feartherstone, K. and Radaelli, C.M. eds. (2003) The Politics of Europeanization. Oxford: Oxford University Press

Rasmussen, Jorgen (2001) Britain: Aloof and Skeptical. Chapter 7 in Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers

Raza, Werner (2007) Service Liberalization in the WTO: Implications for Public Services in Europe. Paper presented at the conference “An alternative to the market: The social, political and economic role of public services in Europe” ETUI-REHS, EPSU, SALTSA, Brussels, November 19-20, 2007

Roberts, J., Elliott, D. and Houghton, T. (1991) Privatizing Electricity. The Politics of Power. London and New York: Belhaven Press

Robinson, Colin (1993) Energy Policy. Errors, Illusions and Market Realities. The Institute for Economic Affairs. Occasional Paper 90

Robinson, Terry (2007) Have European gas prices converged? Energy Policy 35 (4) 2347-2351

Sappington, David (2006) On the Merits of Vertical Divestiture. Review of Industrial Organization 29 (3) 171-191

Sartori, Giovanni (1970) Concept Misformation in Comparative Politics. American Political Science Review 64 (4) 1033-1053. Quoted in Radaelli, C.M. (2003)

Sauma, Enzo and Oren, Shmuel (2006) Proactive planning and valuation of transmission investments in restructured electricity markets. Journal of Regulatory Economics 30 (3) 358-387

Schmidt, Vivien A. (2002) Europeanization and the mechanics of economic policy adjustment. Journal of European Public Policy 9 (6) 894-912

Schneider, V., Fink, S. and Tenbücken, M. (2005) Buying Out the State. A comparative Perspective on the Privatization of Infrastructures. Comparative Political Studies 38 (6) 704-727

Serrallés, Roberto J. (2006) Electric energy restructuring in the European Union: Integration, subsidiarity and the challenge of harmonization. Energy Policy 34 (16) 2542-2551

Smil, Vaclav (2003) Energy at the Crossroads: global perspectives and uncertainties. London and Cambridge (MA): The MIT Press

Steiner, Faye (2000) Regulation, industry structure and performance in the electricity supply industry. OECD Economics Department Working Paper, ECO/WKP 11

Strange, S. (1980). States and Markets. London: Pinter Publishers. Cited in Belyi, Andrei (2003)

Surrey, John ed. (1996) The British Electricity experiment. Privatization: the record, the issues, the lessons. London: Earthscan Publications

Sykes, R. and Alcock, P. Eds. (1998) Developments in European Social Policy. Convergence and diversity. Bristol: The Policy Press

Thomas, Steve (2007a) Unbundling of electricity transmission networks: Analysis of the European Commission's position [www]. PSIRU Reports, available at http://www.psiru.org/ publicationsindex.asp

Thomas, Steve (2007b) A critique of the European Commission's Impact assessment on the legislative package for electricity and gas [www]. PSIRU Reports, available at http://www.psiru.org/publicationsindex.asp

Timm, Neil (2002) Applied Multivariate Analysis. New York: Springer

UNCTAD (2008) World Investment Report 2008. Transnational Corporations and the Infrastructure Challenge. New York and Geneva: United Nations

Van den Hoven, A. and Froschauer, K. (2004) Limiting Regional Electricity Sector Integration and Market Reform: The Cases of France in the EU and Canada in the NAFTA Region. Comparative Political Studies 37 (9) 1079-1103

Van Koten, S. and Ortmann, A. (2008) The unbundling regime for electricity utilities in the EU: A case of legislative and regulatory capture? Energy Economics 30 (6) 3128-3140

Vogelsang, Ingo (2001) Price Regulation for Independent Transmission Companies. Journal of Regulatory Economics 20 (2) 141-165

Vrolijik, C. (ed.) (2002) Climate Change and Power. Economics Instruments for European Electricity. London: Earthscan Publications

World Energy Council (1993) Energy for Tomorrow's World. London: Kogan Page

Yocom, Dennis and Helms, Marilyn (2001) Discharge in the electric industry. European Business Review 13 (3) 137-151

Zeff, E.E. and Pirro, E.B. eds (2001) The European Union and the member states: cooperation, coordination, and compromise. London: Lynne Rienner Publishers