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Etude réalisée par Marton Kenessey (MSc in International Finance 2013)
sous la direction de Monsieur David Thesmar Professeur à HEC PARIS

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The Role of EU Deregulation in the European Electric and Gas Utilities Merger Wave: An Empirical Analysis of Cross-Border M&A

Márton Kenessey*

Master's Thesis

Department of Finance & Economics, HEC Paris

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Abstract

The European electric and gas utilities industry, synonymously referred to in this thesis as the European energy or utilities industry, has seen a surge in cross-border mergers and acquisitions (M&A) over the last two decades. This period also coincided with a structural change in the regulatory environment in the European energy sector with the introduction of the electricity and gas directives by the European Commission in 1996 and 1998, respectively. The aim of these directives was to liberalise the industry and create a single European market. This thesis will empirically analyse the role of deregulation in the surge of cross-border M&A within the European energy industry, using annual indicators developed by the OECD. The empirical analysis uses a panel data set for 22 European countries for the period 1990 to 2007. The results suggest that while both deregulation in the acquiring (home) and target (host) country played an important role in the amplified volume of international M&A, the effect of deregulation on outward M&A depends on the initial level of regulation. Indeed, there is evidence for a U-shaped relationship between host country regulation and cross-border M&A activity in the energy industry.

Keywords: Cross-border M&A; Deregulation; Electric and gas utilities industry, Merger wave.

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* Author's e-mail address: marton.kenessey@hec.edu.

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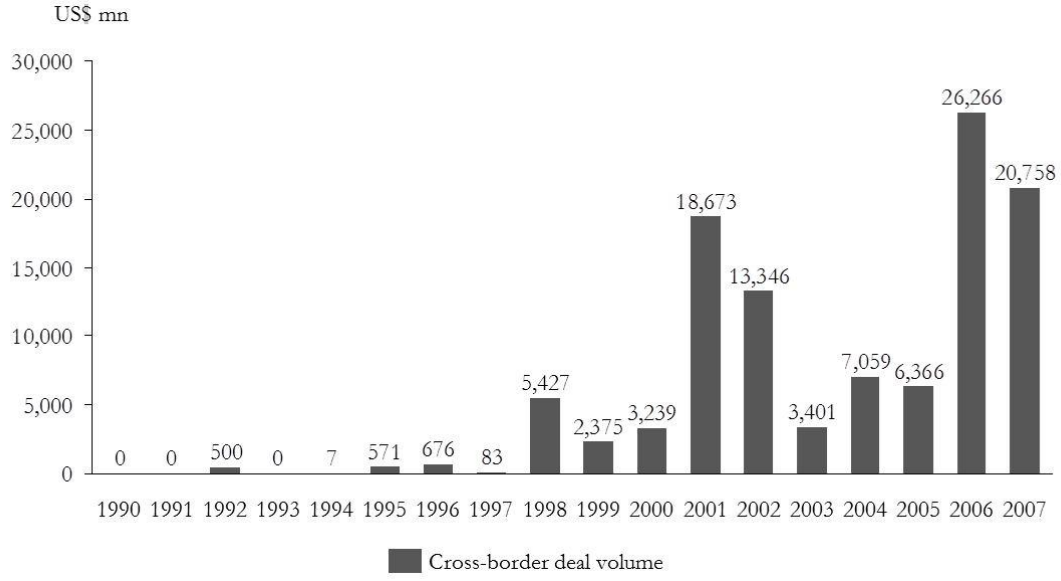
1 Introduction

Mergers and acquisitions[1] occur in waves (Brealey & Myers, 2003). This formerly stylized fact has been empirically tested and confirmed by Golbe and White (1993) using data on U.S. merger activity over the period of 1895 to 1989. Historians usually refer to five distinctive sets of merger waves: One around the turn of the 19th and 20th century, the 1920s, the late 1960s, the mid- to late-1980s and most recently, the mid-1990s until 2000 (Kleinert & Henning, 2002). The latest wave could not only be observed on an aggregate level, but also in terms of cross-border M&A, a type of company takeover that takes place between firms headquartered in different nations, and is the focus of this thesis. Indeed, according to the World Investment Report by the United Nations Conference on Trade and Development (UNCTAD) published in 2000, the worldwide value of completed cross-border M&A rose from US$100 billion in 1987 to US$720 billion in 1999. A similar development can be witnessed within the European[2] electric and gas utilities industry[3]. Non-existent in 1990, the value of cross-border M&A in this industry increased to US$18.7 billion in 2001 (see figure 1)[4].

Figure 1: Evolution of cross-border M&A in the European energy industry, 1990-2007



Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

This period characterized by an enormous growth of M&A volume both in terms of value and deal numbers coincided with a structural change in the regulatory environment in the

[1] The term "mergers and acquisitions" is used synonymously in this thesis with "M&A", "mergers", and "acquisitions".

[2] The definition of "Europe" henceforth concerns the current composition of the European Union (27 member states) plus Norway. More on the logic of this selection can be found in section 4.1 on page 19.

[3] "Electric and gas utilities industry" is synonymously referred to as "energy industry" and "utilities industry". More details on the sector covered can be found in section 4.1 on pages 19 and 20.

[4] Details on the data selection process and the database used to obtain my numbers can be found in section 4.1 starting on page 19.

European energy sector. In the early 1990s, most of the national electricity and natural gas markets were still monopolised and vertically integrated, a fact acknowledged by a European Commission Working Document in 1988 (Commission of the European Communities, 1988). This status quo started to crumble when the European Commission introduced a directive on electricity (Directive 96/92/EC) in 1996, followed by a directive on gas (Directive 98/30/EC) in 1998. These directives were due to be implemented by February 1999 and August 2000, respectively. Both directives were revised and superseded first in 2003 (Directive 2003/54/EC [electricity]; Directive 2003/55/EC [gas]) and again in 2009 (Directive 2009/72/EC [electricity]; Directive 2009/73/EC [gas]).

A basic understanding of the structure of the electricity industry is necessary to understand the implications and objectives of the European Union (EU) directives. The electricity industry can be split into three segments: The upstream market of generation, the downstream market of transmission and distribution, and retailing. First of all, the directives determined that the operation of the networks (transmission) would remain non-competitive, whereas the other parts, such as production and supply to customer would be liberalised. More importantly, the new rules required the legal separation of the upstream and downstream operations, with the objective of gradually shifting from a monopolistic towards a competitive market. Independent regulators were installed to monitor the sector and the consumers were given the freedom to choose their supplier. In a second step, the directive aimed at separating the retail and distribution businesses, and all retailers were granted permission to sell power across the transmission networks, including third party retailers (Leslie et al., 1999).

Similar to the electricity directives, the gas directives aimed at creating a competitive natural gas market. The major instrument to achieving this was third-party network access (TPA), giving natural gas suppliers the right to transport their gas through pipelines not controlled or owned by them. From a customer's perspective, TPA established a right to choose the supplier of gas. Contrary to the electricity market, only the mid- (transportation and storage) and downstream (distribution) segments of the gas market were affected by the EU legislations (see Article 1 of Directive 98/30/EC). Effectively, the EU Commission's aim was to reduce energy prices through the introduction of competition by means of creating a liberalised single European energy market (European Parliament, Council, 2003).

The question that arises is how the above two episodes, increased merger volume and liberalisation of the energy market, are related to each other. Becker-Blease et al. (2004) write that in the United States, following the passage of the Energy Policy Act of 1992, electric utilities adopted a strategy of acquiring other electric or gas utilities. Indeed, liberalisation of a market in the host country, especially in the form of privatization, should increase investment

opportunities and reduce entry costs, thus prompt cross-border M&A activity (Boudier & Lochard, 2012). The effect of deregulation in the acquiring country seems more ambiguous as noted in a paper by Boudier and Lochard (2012) that focuses on the effects of deregulation on cross-border M&A in the services sector. On the one hand, it could motivate firms in the deregulated country to engage in cross-border M&A to reach a critical size and improve their strategic positioning. This in turn would decrease the risk for the acquiring company of becoming a takeover target. On the other hand, companies in a highly regulated market often enjoy strategic advantages that could allow them to pursue a more aggressive acquisition strategy abroad. Consistent with Boudier and Lochard (2012), Mitchell and Mulherin (1996) and Harford (2005), who both study data across different industries, inter alia find that merger waves are partly triggered by deregulation shocks.

The objective of this thesis is to add to the existing literature on the determinants of cross-border M&A, and more specifically on the role of deregulation in these international takeovers. The empirical part of the thesis aspires to isolate the effect of deregulation on the level of cross-border M&A, using macroeconomic, financial and institutional control variables that draw on previous research on cross-border M&A determinants. The causal relationship between changes in the regulatory environment and developments in cross-border M&A have only been researched with a focus on the services sector. The remaining literature on cross-border M&A, which is presented and discussed in section 3, has mainly focused on macroeconomic and institutional determinants.

This thesis provides empirical evidence that deregulation played an important role in the apparent merger wave observed in the European utilities industry. Not only do market liberalisation, increased competition and smaller government involvement in the utilities sector attract investments in the form of M&A by foreign firms, they also incentivise companies to expand internationally. However, the effects of deregulation on M&A volume in the home country depend on the initial level of regulation. This thesis presents statistical evidence for a U-shaped relationship in the acquirer country between M&A volume within the energy industry and the level of regulation. Whereas every regulatory dimension except for market concentration matters in the target country, from vertical integration, entry regulations to public ownership, the level of market concentration is the main dimension in the acquiring country pushing companies to pursue international takeovers. There is weaker evidence for a negative relationship between the level of government ownership and entry regulation in the energy industry and outward M&A.

Secondly, this paper also supports some previous results from the relatively young but growing literature on the determinants of cross-border M&A. To mention a few, typical gravity

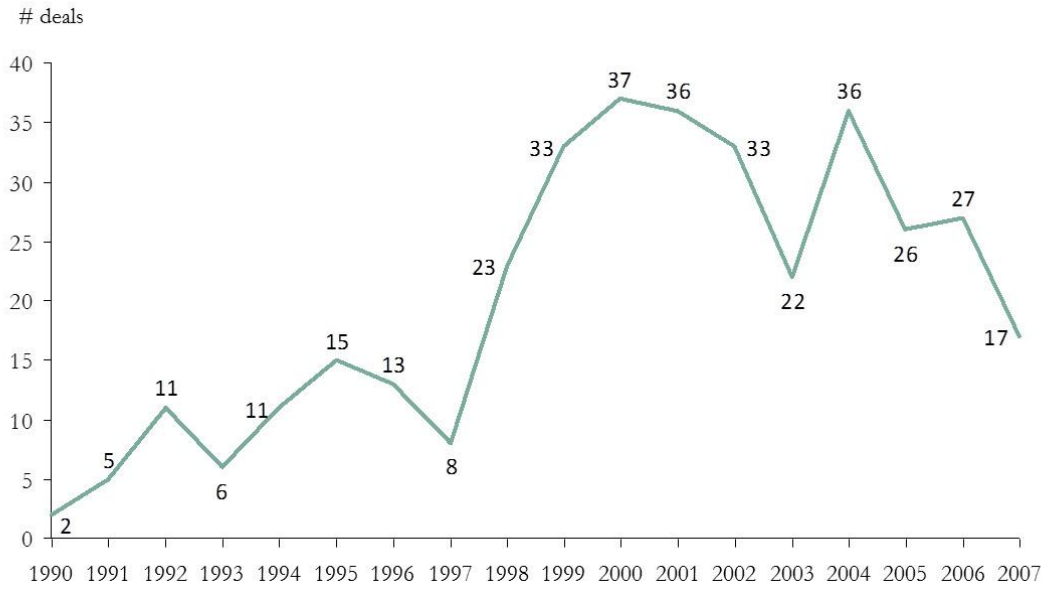
type variables such as market size both in the acquiring and target country as well as geographic proximity are dominant explanatory factors. Lastly, the opening of the European energy market has not only increased the possibility of cross-border activity, but also contributed to a broader integration across European countries. Indeed, using the anti-self-dealing index (ASDI) computed by Djankovic et al. (2008) and measuring the level of legal protection of minority shareholders, my research suggests that economic integration of European countries has spurred a convergence of corporate governance amongst merging firms. This supports previous empirical results by Rossi and Volpin (2004), Alba et al. (2009) and Erel et al. (2012). On the other hand, only weak evidence is found to support a wealth of previous research, initiated by Di Giovanni (2005), which determined the importance of financial market development (also referred to as financial depth) in the acquiring country as a facilitator of international transactions.

The thesis is structured as follows: Part 2 discusses the trends in the European electric and gas utilities market for corporate control since 1990. Part 3 is a presentation and discussion of the existing literature. Part 4 describes and presents the data used throughout this thesis. Part 5 provides an assessment of the methodology used and a presentation of the econometric model. Part 6 discusses the empirical results. Part 7 concludes the paper and suggests topics for future research.

2 European Energy M&A: Developments since 1990

The first merger wave in the European utilities sector emerged parallel to the fifth broader wave of mergers and acquisitions, typically referred to as the global or strategic wave of the 1990s. Deal value during this fifth wave accounted for US$5.6 trillion in Europe across all industries, more than eight times the aggregate of the fourth wave (Martynova & Renneboog, 2006). Martynova & Renneberg (2006) further note that the surge of M&A on the old continent can largely be explained by an increase in intra-European transactions, as opposed to transatlantic deals prevalent in the late 1980s. These intra-European deals were brought about by the development of a unified European market and the introduction of the Euro in the 1990s, which eliminated the currency risk within the Eurozone. The situation in the European electric and gas utilities industry was more pronounced than in others. It had traditionally been regionally fragmented, domestically-oriented and vertically integrated. As the introduction of the electricity and gas directives opened the market to international competition, many European utilities resorted to takeovers as a means to survive and strengthen their market position. Consequently, the number of European deals increased steadily from a handful in 1990 to 37 at the turn of the millennium (see figure 2).

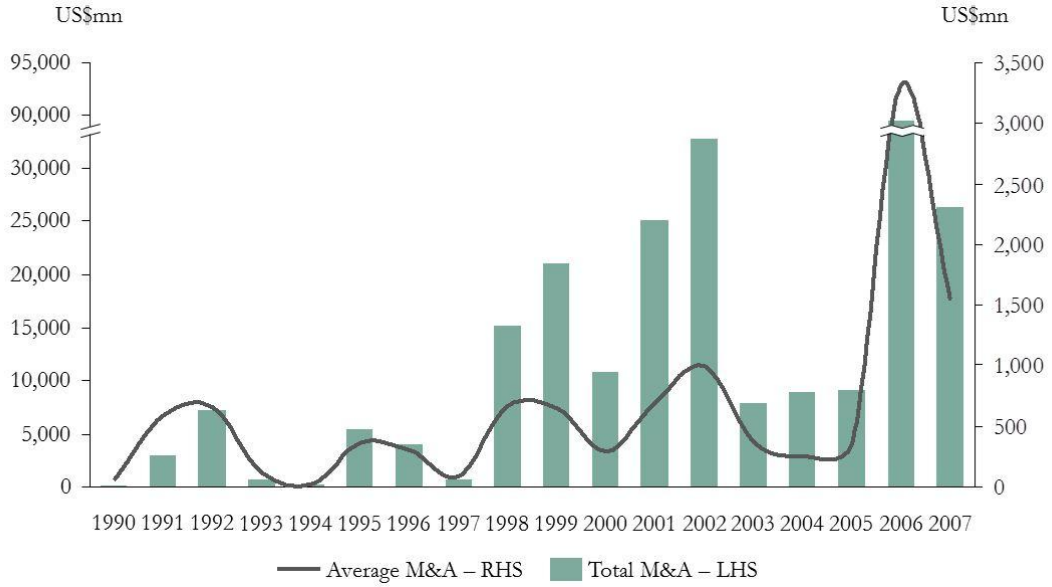
Figure 2: Number of intra-European M&A deals in the utilities sector, 1990-2007



Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

This surge in deal numbers was mirrored by a similar increase in deal volume. The value of M&A fell after its peak in 2002 and skyrocketed in 2006 and 2007 owing to a small number of mega-deals (GDF/Suez, Enel/Acciona/Endesa, Iberdrola/Scottish Power, E.ON/Endesa/Enel assets) (see figure 3).

Figure 3: Value of intra-European M&A deals in the utilities sector, 1990-2007



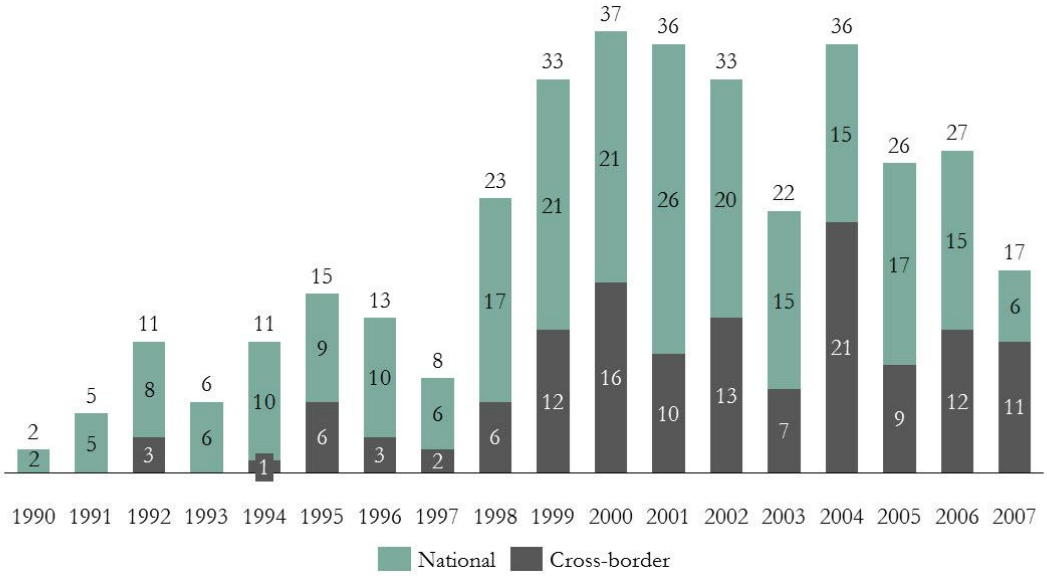
Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

2.1 Cross-border versus national M&A

Figure 4 divides the annual number of deals into national and cross-border, illustrating that cross-border deals were almost inexistent prior to the passage of legislation that aimed at creating a single European market. A couple of factors have been identified as justifications of the takeover wave. One of the premises was the increase in cash liquidity of energy companies, which was used to partly finance deals to the detriment of investments in generation and transmission activities (Verde, 2008). Codognet et al. (2003) point out that the surge in national deals reflects numerous companies' strategy to strengthen their domestic market position. Domanico (2007) goes as far as to suggest that some EU member states have been following a politically motivated objective of creating "national champions", overriding the European Union's strategy of achieving more competition and security of supply. Examples for deals supporting this assertion, some completed, others just intended, can be found in Germany, France and Spain. In 2002, Germany's largest electric power company, E.ON, acquired the German gas giant Ruhrgas. Even though the Federal Cartel Office prohibited the merger in early 2002 on competition and public interest grounds (Bundeskartellamt, 2002), the German Government approved the merger later in the same year. In Spain, the Government overruled a decision by the Spanish competition authority in an attempt to facilitate the acquisition of the largest domestic electricity producer, Endesa, by Gas Natural, despite a higher offer by E.ON. Nonetheless, Gas Natural eventually withdrew its bid and Acciona /Enel succeeded in a joint bid in 2007, part of which involved selling Endesa Italy and Enel's Viesog to E.ON (Endesa, 2007). In France, former gas monopoly Gaz de France (GDF) merged with the Franco-Belgian energy

company Suez in 2006 to form GDF Suez, which was seen as a defence move by the Government to protect Suez from the hostile bid launched by Italian electric utility Enel.

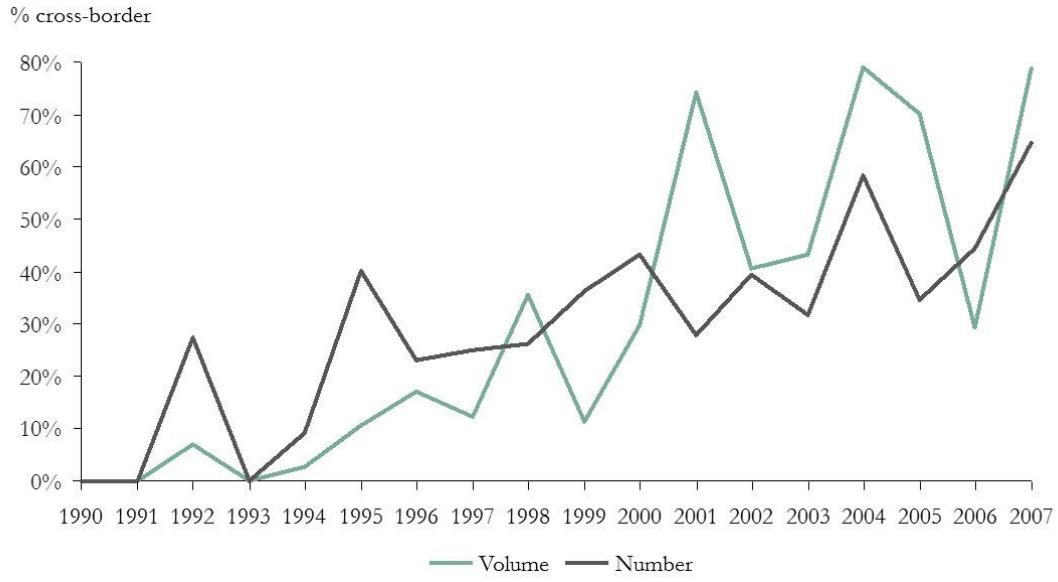
Figure 4: Number of deals: National vs. cross-border



Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

These three examples underline the pursuit of national interests that took place in the 2000s. However, it was the international counterpart of domestic deals that came to the fore after the turn of the century, taking over national deals in terms of deal value for the first time in 2001 (see figure 5). Over the whole period 1990 to 2007, international transactions accounted for 41% of the total volume, up from 17% in the 1990s. Following the implementation of the two directives in 1999 and 2000, utility companies prepared for the heightened competition in Europe by increasing their geographic reach and size, thereby lowering the risk of being taken over in the market for corporate control. A new trend emerged, which now seems to be the prevalent strategy amongst European electric and gas utilities: The creation of pan-European players (Verde, 2008).

Figure 5: Evolution of cross-border vs. national deals

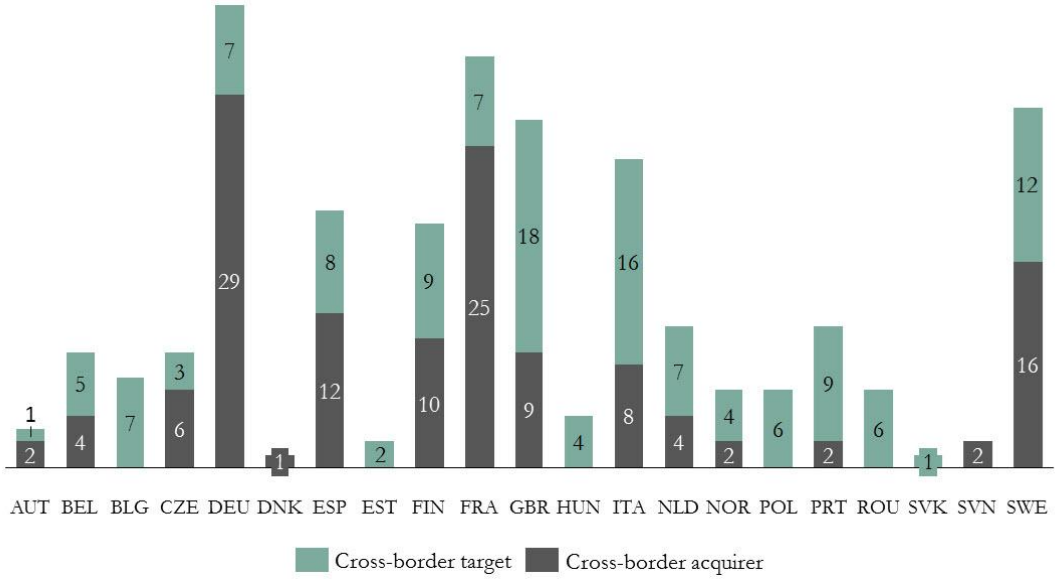


Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

Similar to Codognet et al. (2003), this paragraph investigates cross-border M&A deals on a country-level and particularly analyses on which end of the deal certain country groups could predominantly be found. Figure 6 illustrates the presence of three types of countries. First, there are six countries (Bulgaria, Estonia, Hungary, Romania, Slovak Republic and Poland) that have not acquired any companies in Europe but have attracted foreign capital. In most of these Eastern European countries, European utility heavyweights have expanded their reach on the way to becoming pan-European players. French majority state-owned GDF Suez and Eléctricité de France (EDF) have purchased national companies in both Hungary and Romania, whereas Italian majority state-owned Enel SpA has bought assets from the Romanian and Slovak government. German E.ON expanded most aggressively in Eastern Europe with acquisitions in Bulgaria, Hungary and Romania. Thomas (2007) explains that the scramble for Eastern European companies had "more to do with the expected profitability of these businesses and the fact they were available to buy than with any great strategic advantage". Secondly, Slovenia and Denmark did not attract any foreign owners and together accounted only for three cross-border acquisitions amounting to US$86 million over the period 1990 to 2007. Lastly, the biggest group comprises countries that have both invested abroad and attracted European capital. Belgium, Italy, Netherlands, Norway, Portugal and the United Kingdom have been net targets, whereas Austria, Czech Republic, Finland, France, Germany, Spain, and Sweden have had more outbound than inbound mergers and acquisitions. As Codognet et al. (2003) explain, the latter group reflects the strategies of firms that are either domestically constraint (E.ON and RWE in Germany) or enjoy a near monopolistic position in their domestic market (EDF/GDF Suez in France). The former group reflects the openness of the energy markets in countries that

liberalised early (United Kingdom, Norway) or effectively privatized most of the energy market (Italy, Portugal) (Jamasb & Pollit, 2005; Lévêque & Monturus, 2008).

Figure 6: Country breakdown: Cross-border targets and acquirers[5]



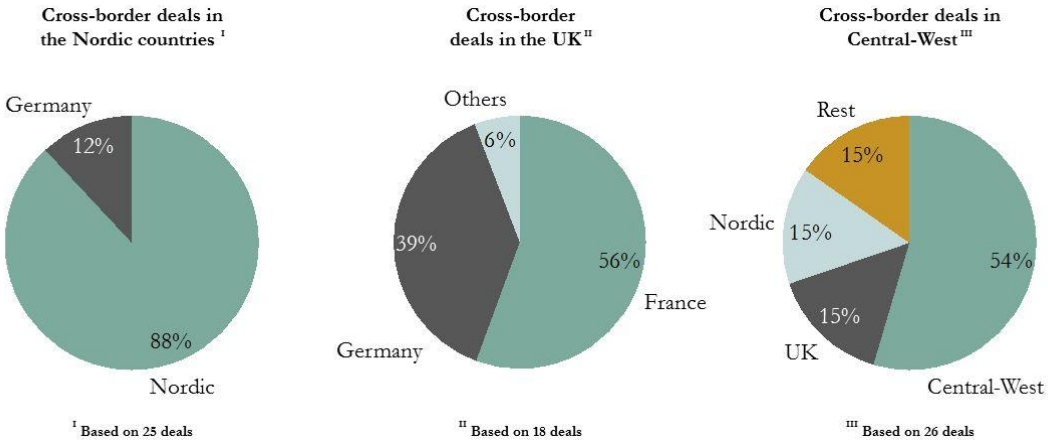
Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.
Note: This figure excludes countries in Europe that have neither acquired nor been targeted over the period 1999 to 2007. Following countries are concerned: Cyprus, Greece, Ireland, Latvia, Lithuania, Luxembourg and Malta.

The last country-level analysis of cross-border deals highlights the tendency to expand electricity and gas businesses in the vicinity of the companies' headquarters. In 37% of the cross-border deals studied, the target was headquartered in a neighbouring country. Similarly, the average distance between countries that successfully completed deals over the 1990 to 2007 period was 878 kilometres, compared to an average distance across all countries in the sample of 1252 kilometres. The proximity phenomenon can also be illustrated by breaking the European electricity market into seven groups, as has been done by the European Regulators' Group for Electricity and Gas (ERGEG). In the spring of 2006, ERGEG, an advisory group to the European Commission, launched seven Electricity Regional Initiatives (ERI) as a stepping stone towards the creation of a single European market. Their goal was to bring together all electricity market stakeholders, from regulators to companies, with a focus on implementing solutions that improve the way in which regional energy markets develop (European Energy Regulators). Note that a few countries belong to more than one region (see appendix table 8). In more than half the cases of my sample, the acquirer and target country belonged to the same ERI. Figure 7 graphically illustrates the points made in this paragraph using as examples the deals that occurred

[5] AUT = Austria, BEL = Belgium, BLG = Bulgaria, CZE = Czech Republic, DEU = Germany, DNK = Denmark, ESP = Spain, EST = Estonia, FIN = Finland, FRA = France, GBR = United Kingdom, HUN = Hungary, ITA = Italy, NLD = Netherlands, NOR = Norway, POL = Poland, PRT = Portugal, ROU = Romania, SVK = Slovak Republic, SVN = Slovenia, SWE = Sweden.

in Scandinavia (Denmark, Finland, Norway, Sweden), commonly referred to as the Nordic countries, the United Kingdom and a region ERGEG dubbed Central-West (Belgium, France, Germany, Luxembourg, Netherlands). 56% of the acquisitions in the UK over the sample period were made by French companies. These two countries belong to a common regional initiative called France-UK-Ireland. My results confirm a similar analysis carried out by Lévêque and Monturus (2008), who used a self-collected sample of deals announced between January 1998 and December 2007 and valued above €100 million between energy companies in the European Union.

Figure 7: Regional cross-border deal dynamics[6]



Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

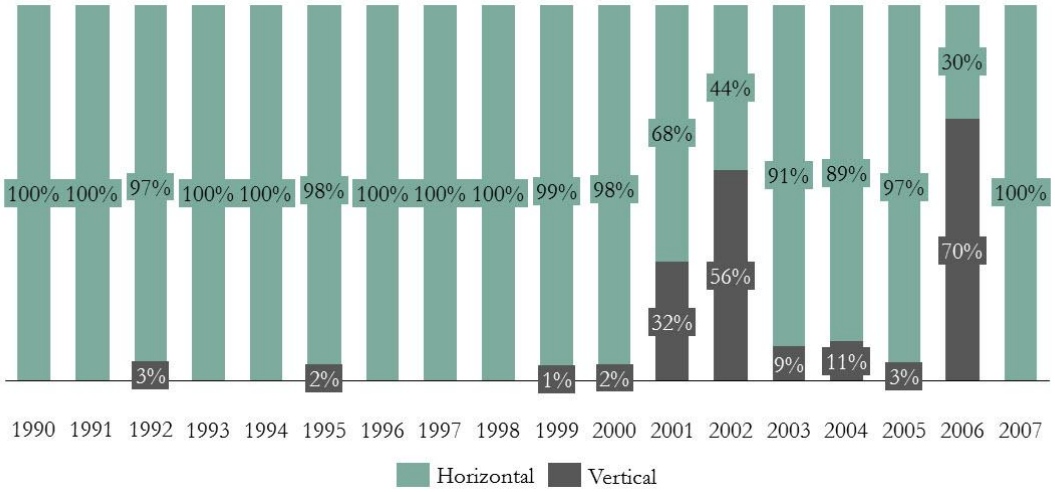
2.2 Vertical vs. horizontal deals

In the previous section, a distinction was made between deals that took place within national borders and those that looked beyond borders. An alternative comparison of deals is vertical versus horizontal. The former, often referred to in the literature as convergent merger (Becker-Blease et al., 2008), occurs when two companies that operate at different levels of the supply chain merge together. For example, the acquisition of a natural gas distributor by an electric utility could be labelled as convergent, since natural gas is one of the primary energy sources used to generate electricity. In a non-convergent, i.e. horizontal merger, the two merging entities are competitors, operating at the same stage in the production cycle in the same industry. Analysing deals based on their four-digit Standard Industrial Classification (SIC) codes, data reveals that convergent deals have been at best scarce in the 1900s. The trend changed since 2001 with the consolidation of several gas and electric utilities (see figure 8). Various examples come to mind, such as the merger between gas-dominated GDF and integrated energy company Suez in 2006. Other deals such as RWE/Innogy Holdings plc (2002) or

[6] Numbers might not add up to 100% due to rounding.

Hidrocantabrico/Naturcorp (2003) accentuate this development. The likely and often-mentioned conclusion (e.g.: Verde, 2008) is that a second phenomenon, the integration between gas suppliers and electricity producers, has arisen in the 2000s alongside the trend of expanding businesses across national borders.

Figure 8: Vertical vs. horizontal deals based on transaction value



Source: Author's elaborations based on data from Thomson Reuters SDC Platinum.

The rationale for this development is manifold. From a power utility's perspective, a convergent merger creates potential business synergies, diversifies core businesses and leads to a higher security of gas supply. The latter is important since technological developments of gas combined cycle turbines in the last decade transformed gas into one of the most important sources of electricity production (Leslie et al., 1999). Furthermore, convergent mergers decrease the risk of gas price fluctuations and can be seen as a form of price volatility hedge. On the other hand, a vertical deal reduces demand uncertainty for the gas company (Domanico, 2007; Verde, 2008).

In conclusion, the liberalisation of electricity and gas markets spurred a reaction by European utilities that could be seen as a creation of newly integrated energy companies that operate both in the electricity and gas market.

2.3 Summary

In summary, a significant increase in overall takeover activity and a parallel growth in the frequency of cross-border mergers occurred over the last two decades in the European gas and electric utilities sector. German, French and Swedish utilities turned out as the most industrious cross-border acquirers, whereas the UK and Italy were the most popular target countries. In terms of deal value, Spain ranks amongst the top three for both inbound and outbound M&A. The regional factor of the electricity and gas markets played an indisputable factor in the strategic

choice of extending a company's market beyond its own borders. As a side note, it should be mentioned that many authors have identified a path towards higher market concentration as a result of the described merger wave. Some have even predicted that this trend will culminate in the survival of only seven to ten significant players in the European electricity market (Codognet et al., 2003). Thomas (2003) went as far as to predict that "seven brothers", all based in mainland Europe, will soon dominate the worldwide markets for network-delivered services such as electricity and gas. He coined the term seven brothers in reference to a similar evolution in the oil market that created the "seven sisters".

The next section reviews the existing literature on cross-border M&A, theoretically linking the described surge in international takeovers with the empirical study that follows in part 6 and 7.

3 Literature Review

The purpose of this chapter is to provide a review of the existing literature on the topics investigated in part 6 and provide the reader with a theoretical framework underpinning my empirical work. Looking ahead, the main objective will be to isolate the effect of the changing regulatory environment on the described merger wave. Since the analysis of international deals will be conducted on a country-level, the exercise is to include a set of adequate macroeconomic, institutional and financial country-level control variables that have been identified in previous research on cross-border M&A to be significant drivers.

Evenett (2002) is one of the first papers in this young but growing field of academic literature to study the drivers of cross-border M&A, using cross-sectional data on outward M&A by U.S. companies in 1999. Motivated by the surge of cross-border M&A in the 1990s and the increased number of countries applying merger review laws, he estimates the effect of three[7] different types of merger review regimes on the total value of cross-border M&A undertaken by firms headquartered in the U.S. He finds that American outward M&A depends on the recipient's national income, GDP per capita and tax rate, the distance from the U.S., and whether or not the host country has a British colonial heritage, thus sharing a common business language and legal framework with the acquiring corporation.

Globerman and Shapiro (2005) compare the determinants for inward and outward M&A with determinants for Foreign Direct Investments (FDI). Their objective is to fill the empirical gap of evaluating the determinants of a specific FDI mode, namely M&A, as opposed to finding the determinants for overall FDI, which consists of greenfield investments and M&A. Using data collected by UNCTAD on cross-border M&A between 1995 and 2001 on a sample of 154 countries, the authors take Evenett's (2002) analysis a step further by including institutional and financial variables. Institutional factors are approximated by an aggregate index for governance based on Kaufmann, Kraay and Mastruzzi (2003) and a measure for investor protection based on the seminal paper written by La Porta et al. (1998). The ratio of stock market capitalization to GDP was determined to be an adequate choice for a financial variable, acting as a measure of liquidity and efficiency of capital markets. Unlike Evenett (2002), they find no significance for the common law variable in the host country, which supports Kaufmann et al.'s (2003) claim that broad measures of governance are more informative institutional variables than narrow measures such as a country's legal heritage or ownership protection. However, they support Evenett (2002) in that national income is a significant pull-factor of M&A, and add that strong governance and high capital market liquidity in the home country drive cross-border M&A. Globerman and

[7] The three different types are voluntary merger notification, mandatory pre-closing merger notification, and mandatory post-closing merger notification regimes (Evenett, 2002).

Shapiro's (2005) inclusion of a governance factor is based on previous work by Rossi and Volpin (2004). Studying the cross-country determinants of worldwide mergers and acquisitions announced between 1990 and 1999, Rossi and Volpin (2004) focus on the differences in laws and regulations across 49 countries, also using data compiled by La Porta et al. (1998). Resembling Globerman and Shapiro's (2005) work, they find that firms in countries with weaker investor protection are more likely to be acquired than those in countries with relatively strong investor protection, concluding that cross-border M&A facilitates the convergence of corporate governance regimes across countries. The evidence of converging corporate governance is supported by Bris et al. (2008), who find that the transfer of strong governance practices increases the value of companies in host countries with weak corporate governance.

Di Giovanni (2005) belongs to a set of papers that have predominantly studied financial variables as determinants for international M&A. Using a gravitational model as is customary in the cross-border M&A literature, he assess the roles of macroeconomic, institutional and financial variables on cross-border M&A, using a panel data set for the sample period of 1990 to 1999. Financial market size in the home country is measured as the ratio of stock market capitalization to GDP and the amount of credit provided by banks relative to GDP. Whilst both variables are found to correlate positively with the amount of international mergers, stock markets play the dominant role. Coeurdacier et al. (2009) analyse bilateral cross-border M&A at the sectorial level (manufacturing and services), and conclude that the importance of stock market depth in the acquiring country holds for both horizontal and vertical mergers. In a paper that focuses on the impact of bilateral trade costs on cross-border M&A, Hijzen et al. (2008) find that financial market depth is not only a catalyst of outbound M&A, but also attracts inbound M&A, a result that is confirmed by Rossi and Volpin (2007). However, both papers base their dependent variable on the number of deals as opposed to the value of cross-border deals.

A paper contradicting the presented empirical evidence of a positive link between financial depth and inbound M&A is Kamaly (2007), which fills a gap in the empirical literature by analysing the macroeconomic determinants of M&A activity directed towards developing countries. Unexpectedly, according to his data on deals completed in the 1990s, stock market activity in the host country deters M&A. This result is only endorsed by Coeurdacier et al. (2009), who find a negative but non-significant effect of market capitalization in the host country. The explanation provided by Kamaly (2007) is that foreign companies take advantage of favourable valuations presented by a deteriorating stock market through M&A, which resembles the fundamental securities market strategy of buying underpriced stocks. On the other hand, both their and Erel et al.'s (2012) paper add validity to Di Giovanni (2005), confirming that a depreciating currency in the host country encourages inward M&A.

Neto et al. (2009) extend the work of Globerman and Shapiro (2005) on two levels: First of all, they use panel data on 53 countries over the period 1996 to 2006 instead of cross-sectional data (Neto et al., 2009). Secondly, by including greenfield investments into their analysis, they study the determinants of not only one, but both modes of FDI. Their results point to evidence that there is a group of variables called mode-encompassing that are relevant to all the entry modes of FDI, namely the size of an economy, openness, governance level and a Human Development Index. On the other hand, they find that investor protection is an M&A mode-specific variable, and the higher this variable, the higher the likelihood of companies to invest abroad through M&A, in detriment of greenfield investments, a result that contradicts the evidence suggested by Globerman and Shapiro's (2005) study.

Alba et al. (2009) investigate the link between corporate governance and cross-border M&A from a different angle than Rossi and Volpin (2004). Instead of analysing the effect of international M&A on corporate governance, they analyse the causes of cross-border M&A. They maintain that a weak corporate governance environment offers profit-taking opportunities for both domestic and foreign investors alike. The implication of their work is that the flourishing of cross-border M&A in the 1990s was a friendly internationalisation of the hostile takeover boom in the 1980s, which sought to increase shareholder value through better management. Studying 147 Japanese firms' takeover activities in the U.S. between 1987 and 1994, Alba et al. (2009) conclude that the two landmark corporate governance regulations put in place by the U.S. Securities and Exchange Commission (SEC) in 1992 contributed significantly to the decline in Japanese M&A into the United States. Erel et al. (2012) use a non-U.S.-specific M&A dataset and a newly assembled anti-self-dealing index by Djankovic et al. (2008) to confirm Rossi and Volpin's (2004) results on shareholder protection and accounting standards. The larger the difference in either of these variables between acquirer and target country, the more likely the two nations are to engage in bilateral M&A. They argue that their results are consistent with the governance argument by Rossi and Volpin (2004), since accounting standards are likely to be correlated with better corporate governance.

Next, I turn my attention to a paper that inspired my model specification more than any other. Hyun and Kim (2010) is the first paper to incorporate host country institutional factors as well as home country financial development indicators into a gravity model to explain international M&A. Using worldwide cross-border M&A data covering 101 countries from 1989 to 2005, they find that both conventional measures of financial market development matter, and confirm Di Giovanni's (2005) conclusion that stock market depth dominates over credit markets in the determination of outward M&A. Contradictory to results presented in previous papers, Hyun and Kim (2010) find no significant connection between exchange rate changes/volatility

and the likelihood of M&A, arguing that exchange rate variables are only relevant when takeovers are conducted in developing countries.

Finally, the only paper I found during my research to consider the effects of deregulation on cross-border M&A is a working paper by Boudier and Lochard (2012). Using data on cross-border M&A in 30 OECD countries, they estimate the impact of deregulation in the services sector on international corporate transactions. While the effect in the target country is always positive and significant, the result for the acquiring country is ambiguous and depends on the initial level of regulation. In fact, their results provide evidence of a U-shaped relationship between public ownership (a low-level indicator for regulation) and outward M&A in the services sector.

Table 1 on the next two pages provides a summary of the main results discussed in this section.

Table 1: Country-level-determinants of cross-border M&A: Empirical results

	Positive	Negative	Insignificant
Market size in home country	Globerman and Shapiro (2005), Di Giovanni (2005) Hijzen et al. (2008) Coeurdacier et al. (2009) Neto (2009), Hyun and Kim (2010), Boudier and Lochard (2012)		
Market size in host country	Evenett (2002) Globerman and Shapiro (2005), Di Giovanni (2005) Hijzen et al. (2008) Coeurdacier et al. (2009) Neto (2009), Hyun and Kim (2010), Boudier and Lochard (2012)		
Income level in host country	Evenett (2002)		
Market growth in home country	Globerman and Shapiro (2005), Neto (2009)		
Market growth in host country			Globerman and Shapiro (2005) Kamaly (2007) Neto (2009), Hyun and Kim (2010)
Δ Income level	Rossi and Volpin (2004) Di Giovanni (2005) Erel et al. (2012)		
RTA	Hyun and Kim (2010)		Di Giovanni (2005)
Bilateral trade	Rossi and Volpin (2004) Di Giovanni (2005) Erel et al. (2012)		
Taxation in host country		Evenett (2002) Di Giovanni (2005) Erel et al. (2012)	Boudier and Lochard (2012)
Exchange rate depreciation, host country	Di Giovanni (2005) Kamaly (2007) Erel et al. (2012)	Hyun and Kim (2010)	

Table continues on next page.

	Positive	Negative	Insignificant
Stock market depth in home country	Globerman and Shapiro (2005), Di Giovanni (2005) Hijzen et al. (2008) Coeurdacier et al. (2009) Neto (2009), Hyun and Kim (2010), Boudier and Lochard (2012)		
Stock market depth in host country	Globerman and Shapiro (2005), Rossi and Volpin (2007), Hijzen et al. (2008) Neto (2009)	Kamaly (2007) Boudier and Lochard (2012)*	Coeurdacier et al. (2009), Boudier and Lochard (2012)*
Credit market depth in home country	Hyun and Kim (2010) Boudier and Lochard (2012)		Di Giovanni (2005)
Distance		Evenett (2002), Rossi and Volpin (2004) Di Giovanni (2005) Hijzen et al. (2008) Hyun and Kim (2010) Erel et al. (2012)	Coeurdacier et al. (2009)
Common language	Evenett (2002) Rossi and Volpin (2004) Di Giovanni (2005) Hijzen et al. (2008) Coeurdacier et al. (2009) Hyun and Kim (2010)	Erel et al. (2012)	
Common border	Coeurdacier et al. (2009)		
Δ Accounting standard	Rossi and Volpin (2004) Erel et al. (2012)		
Δ Shareholder protection	Rossi and Volpin (2004) Bris et al. (2008) Erel et al. (2012)		
Governance level home country**	Rossi and Volpin (2004) Globerman and Shapiro (2005)*, Neto (2009)		Globerman and Shapiro (2005)*
Governance level host country**	Globerman and Shapiro (2005)*, Neto (2009)	Rossi and Volpin (2004) Alba (2009)	Globerman and Shapiro (2005)*
Deregulation	Boudier and Lochard (2012)		

* Significance of variable depends on model specification.

** Governance level as approximated either by a governance index or an investor protection index.

Bold: Variables used in my regression analysis as right-hand-side variables.

4 Data

4.1 Cross-border M&A in the electric and gas utilities industry

The first exercise in data collection is to identify all the cross-border transactions that occurred in the European utilities industry over the sample period, which is 1990 to 2007. More specifically, my analysis covers all completed deals that were announced between 1 January 1990 and 31 December 2007. The Thomson Financial Security Data Corporation's Mergers and Corporate Transactions database (SDC Platinum) provides the most comprehensive account for corporate M&A transactions, covering all deals in the world since 1990 involving an ownership change of at least 5%. The chosen sample period is limited by the availability of data on my variable of interest, an index of regulation, which I will turn to in more detail later in this section.

The initial sample contains all deals where both the acquirer (defined as the ultimate parent, which is not necessarily the acquiring entity) and the target company are headquartered in the European Union[8] or Norway. Norway is included in the sample for various reasons. First of all, Norway successfully liberalised its energy market ahead of the EU in 1991, with the adoption of the Energy Act (NVE, 2011). Norway is a member of the European Economic Area (EEA), which shares a common goal with the EU, the development of an internal market in energy across Europe. Furthermore, Norway has legally adopted the EU directives on electricity and gas as lied out in Annex IV of the EEA Agreement. Lastly, it is one of the founding members of the first international power exchange (Nord Pool Spot AS) and forms a significant part of the Nordic energy market, given its energy surplus and low-cost electricity production (Dorsman et al., 2011).

Companies are defined to be part of the electric and gas utilities sector based on their 4 digit SIC code. Deals that happened within following SIC codes are included into my sample:

- 4911: Electric Services
- 4922: Natural Gas Transmission
- 4923: Natural Gas Transmission and Distribution
- 4924: Natural Gas Distribution
- 4931: Electric and Other Services Combined

[8] The EU as of 1 January 2007 comprises of following countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom.

Deals that involve to a large extent operations upstream of gas distribution and electricity production, such as oil and gas exploration and production, are excluded since this part of the energy industry was not targeted by the EU directives.

I further exclude all obvious duplicates, buybacks and recapitalization programmes. Since the aim is to study mergers and acquisitions, i.e. events where two firms merge or one firm is consolidated into another entity through the acquisition of a majority ownership (change in control), I delete all SDC Platinum recorded events where the acquirer owns less than 50% post or more than 50% prior to the deal. A cross-border deal flag helps to exclude all national deals from the sample. Note that SDC Platinum defines a cross-border deal as an event where the ultimate owner of the acquiring entity is headquartered in a country different to the target. For example, PowerGen PLC's US$2.5 billion acquisition of the generation and supply business of TXU Europe in 2002 is regarded as a cross-border deal because PowerGen PLC is a subsidiary of the German company E.ON.

102 deals, or 44% of the sample, are dropped because of a missing deal value or a deal value below US$1 million. The presence of incompletely recorded data could be a concern if this would be a result of non-random sampling, as that is a potential source for bias. However, according to Di Giovanni (2005), the deal entries with no values appear to be random, since no industry sector, country or year has more missing values than others. With all of above restrictions, 132 merger events remain in the final sample involving 21 countries, with a total transaction value of US$108.7 billion. Note that no deals were recorded over the sample period in my sector of interest in which a company from Cyprus, Greece, Ireland, Latvia, Lithuania, Luxembourg and Malta was on either side of the transaction. A potential explanation in the case of Greece and Ireland is that they were allowed to delay the implementation of the EU directives (Leslie et al., 1999). Cyprus and Malta both have small and isolated markets that remain monopolised and are challenging to be integrated into a single European market (European Commission, 2007; Ioannu, 2011). These conditions, in combination with the relatively high electricity production costs as reported by Eurostat[9] detract from the desirability of foreign investments.

Table 9 and 10 in the appendix summarize the cross-border dataset in terms of cross-country deal numbers and deal value.

4.2 Level of regulation in the electric and gas utilities industry

Following Boudier and Lochard (2012), I use country-level indicators computed by the OECD (Conway & Nicoletti, 2006) to quantify the level of regulation in the European electric

[9] See http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Electricity_and_natural_gas_price_statistics.

and gas utilities industries. The indicator is available for 30 OECD countries on a yearly basis over the period 1975 to 2007, covering 21 EU countries and Norway. The indicators are not available for Bulgaria, Latvia, Lithuania and Romania and are incomplete for Estonia, the Slovak Republic and Slovenia (see table 2). The regulation indicators for the electricity and gas industry range from 0, indicating a liberalised, disintegrated and private market, to 6, representing a highly regulated, vertically integrated and publicly owned market. The European electric utilities industry has not only been less regulated overall than the gas industry (average regulation indicator of 3.3 vs. 3.9), but has also moved at a quicker pace towards more liberalised and competitive markets (average drop in the indicator: 3.8 vs. 2.5).

Table 2: OECD regulation indicators: Data availability and summary statistics

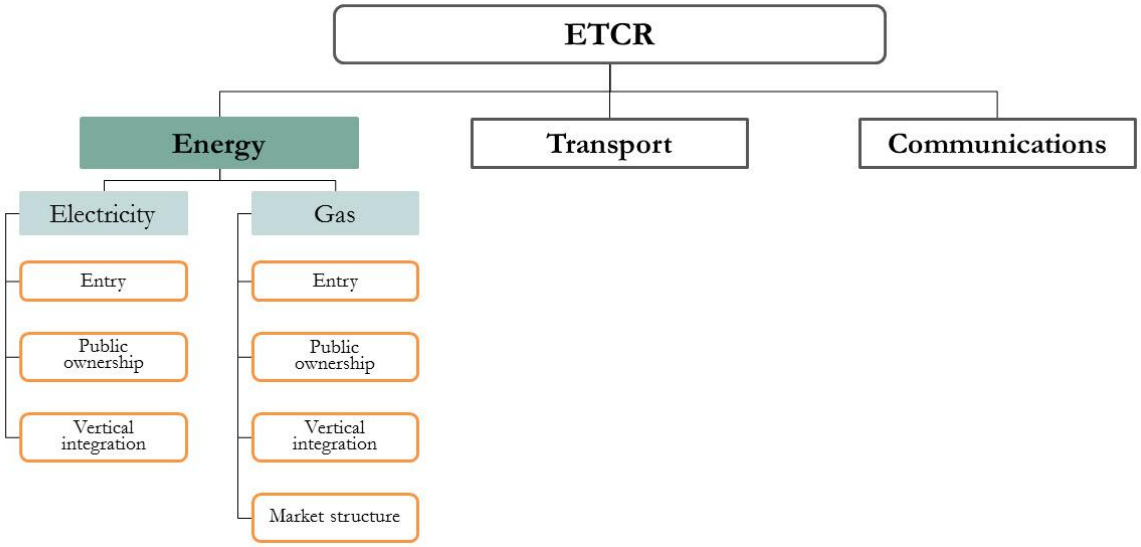
	Electricity	Gas	Electricity average	Δ 1990-2007 Electricity	Gas average	Δ 1990-2007 Gas
Austria	1990-2007	1990-2007	3.9	4.0	3.7	2.4
Belgium	1990-2007	1990-2007	3.2	2.5	3.7	2.4
Bulgaria	no data	no data	n.a.	n.a.	n.a.	n.a.
Cyprus	no data	no data	n.a.	n.a.	n.a.	n.a.
Czech Republic	1990-2007	1990-2007	4.2	4.5	4.6	3.7
Denmark	1990-2007	1990-2007	3.7	4.0	3.7	3.3
Estonia	2007	2007	2.8	n.a.	2.1	n.a.
Finland	1990-2007	1990-2007	2.7	4.0	4.5	0.2
France	1990-2007	1990-2007	4.7	4.0	5.1	3.9
Germany	1990-2007	1990-2007	2.5	3.7	2.5	1.6
Greece	1990-2007	1990-2007	4.7	3.9	5.6	2.3
Hungary	1990-2007	1990-2007	4.1	5.0	4.0	4.2
Ireland	1990-2007	1990-2007	4.6	3.5	5.1	2.7
Italy	1990-2007	1990-2007	4.2	5.0	4.0	3.1
Latvia	no data	no data	n.a.	n.a.	n.a.	n.a.
Lithuania	no data	no data	n.a.	n.a.	n.a.	n.a.
Luxembourg	1990-2007	1990-2007	4.6	4.5	4.1	1.2
Malta	no data	no data	n.a.	n.a.	n.a.	n.a.
Netherlands	1990-2007	1990-2007	3.9	3.5	4.4	1.7
Norway	1990-2007	1990-2007	2.1	4.0	3.8	1.4
Poland	1990-2007	1990-2007	4.7	3.8	5.1	2.2
Portugal	1990-2007	1990-2007	3.3	4.5	5.0	2.5
Romania	no data	no data	n.a.	n.a.	n.a.	n.a.
Slovak Republic	1990, 1999-2007	1990, 2003-2007	2.2	3.8	3.9	3.2
Slovenia	2007	2007	1.5	n.a.	2.4	n.a.
Spain	1990-2007	1990-2007	2.2	4.0	3.0	2.9
Sweden	1990-2007	1990-2007	3.2	3.5	3.4	1.9
UK	1990-2007	1990-2007	0.2	0.8	2.2	2.8
Overall			**3.3**	**3.8**	**3.9**	**2.5**

Source: Author's elaborations based on data from Conway and Nicoletti (2006).

The electricity and gas regulation indicators are sub-indicators of the so-called ETCR indicator, which measures regulatory restrictions in energy, transport and communication. The energy indicator is computed as a simple average of the two sub-indicators used in this study:

Electricity and gas. Figure 9 illustrates the composition of the two sub-indicators and shows that they are made up of three and four low-level indicators, respectively.

Figure 9: Composition of OECD ETCR indicator



Source: Conway and Nicoletti (2006).

The *entry regulation indicator*[10] assesses the terms and conditions of third party access to the transmission grid for both electricity and gas. In the electricity sector, this is complemented by an assessment of the existence of a wholesale market (one of the goals of the EU electricity directive) and the consumption threshold consumers must exceed in order to be able to choose their electricity supplier. In the gas sector, information is provided on competition restrictions in either the production or import market.

The *public ownership indicator* quantifies the level of direct government involvement, ranging from fully private to fully public, in the generation/production, transmission and distribution section of the two industries.

The *vertical integration indicator* focuses on separation between typically competitive activities such as electricity generation/gas production, and natural monopoly activities such as the national grid and/or local distributors. Conway and Nicoletti (2006) assume in their construction of the indicator that the scope of anticompetitive behaviour is largest when an electricity or gas company simultaneously controls the network in its respective market and operates in upstream or downstream competitive markets. The indictor ranges from complete separation, to legal/accounting separation and full integration.

A *market structure indicator* supplements the gas regulation indicator, reflecting the market shares of the largest company in the gas production, gas transmission and gas supply industry.

[10] All words in this section that appear in italic describe variables that are used in the empirical part of this thesis as right-hand-side variables.

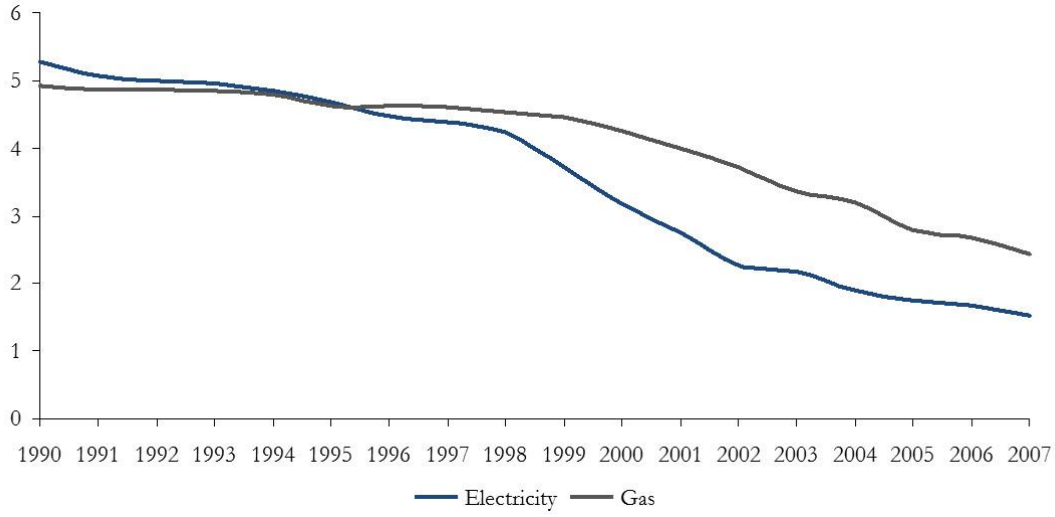
Similar to the electricity and gas indicators, all the low-level indicators range from 0 to 6. The full table specifying the composition of the indicators with the weights of each low-level indicator can be found in the appendix (see table 11).

Overall, the composition of the regulation indicators suggests that they closely measure areas targeted by the EU directives, such as third party access, vertical separation and the creation of wholesale electricity markets, supporting my assumption that the OECD indicators provide a good quantification of the changing regulatory environment.

4.2.1 Evolution of regulatory environment

This section provides an overview of the development of the aforementioned indicators, which should reflect the development of the regulatory environment in the European energy industry. The pace of deregulation according to the OECD indicators accelerated considerably after the implementation of the first two EU directives in 1999 and 2000, reflecting a partial success of their efforts. The indicators also reveal the slight lag of the implementation of the gas directive compared to the electricity directive (see Figure 10).

Figure 10: Evolution of OECD electricity and gas regulation indicators

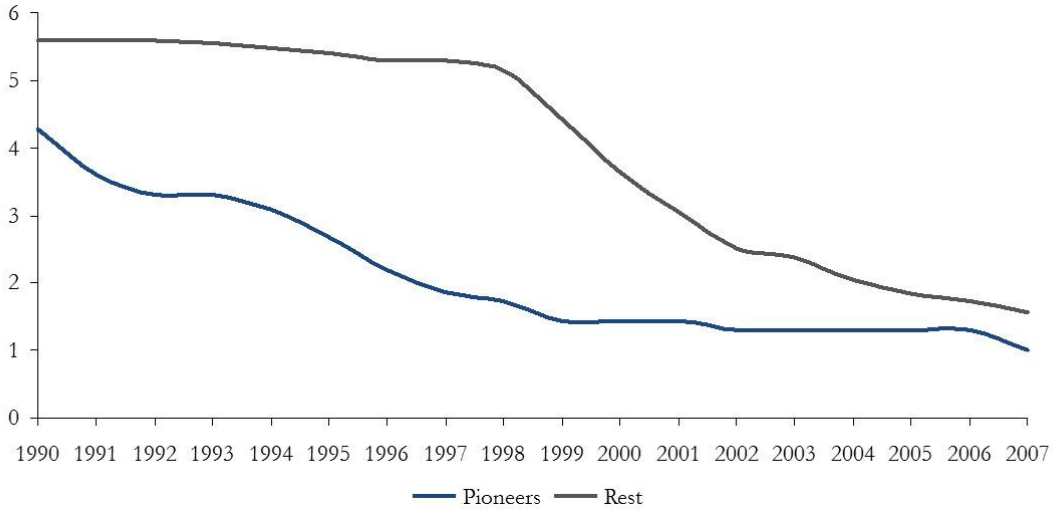


Source: Author's elaborations based on data from Conway and Nicoletti (2006).

Figure 11 reveals the fact that the pace and timing of electricity liberalisation varied across the countries in my sample. Prior to the EU directives, the decreasing European average for the regulation indicators was driven by a small set of countries: The United Kingdom, Spain and the three Nordic countries Finland, Norway and Sweden. The United Kingdom acted as a pioneer of electricity market liberalisation in the 1980s under Prime Minister Margaret Thatcher and almost completed the process before the European one began. The Norwegian indicator dropped from 5.0 to 2.0 upon the introduction of the Energy Act in 1991. Norway's partner in the establishment of the Nordpool, Sweden, and their trading partner Finland, also liberalised

ahead of the broader market. The last one in this group of "pioneers", Spain, passed an electricity law reform in 1997, leading to the creation of an independent regulator (CNSE) and an open wholesale market, as well as the privatization of integrated state owned Endesa (OECD, 2000). The rest of the group almost drew level with the forerunners thanks to a relatively swift implementation of certain aspects of the electricity directive.

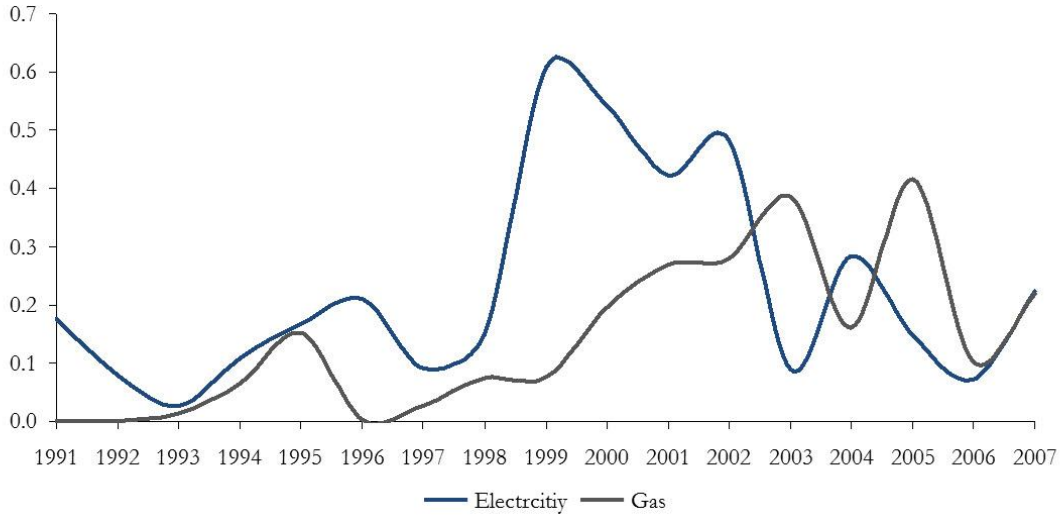
Figure 11: Evolution of electricity regulation: "Pioneers" vs. rest[11]



Source: Author's elaborations based on data from Conway and Nicoletti (2006).

The bulk of the already realized liberalisation across Europe occurred essentially over the years 1999 to 2002 in the electricity industry and from the early- to mid-2000s in the gas industry, as illustrated by the average yearly drop in the indicator (see figure 12).

Figure 12: Average annual drop in electricity and gas regulation indicators

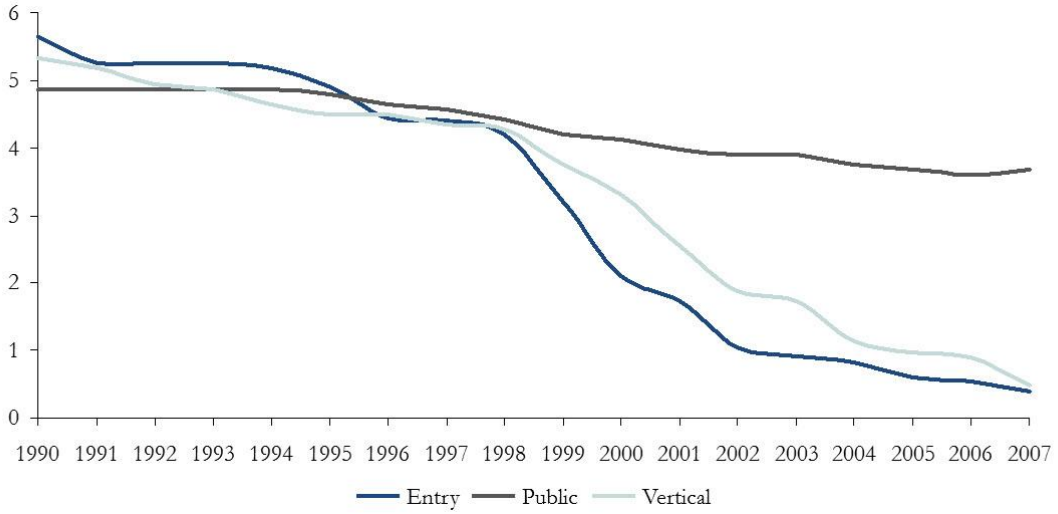


Source: Author's elaborations based on data from Conway and Nicoletti (2006).

[11] "Pioneers" is an average of the electricity regulation indicator in Finland, Norway, Spain and the UK.

Breaking the electricity regulation indicator into its low-level indicators reveals that the deregulatory success was principally driven by granting third party access to the transmission grid and separating vertically integrated entities. Governments, however, maintained a strong foothold in many of Europe's electric power utilities (see figure 13).

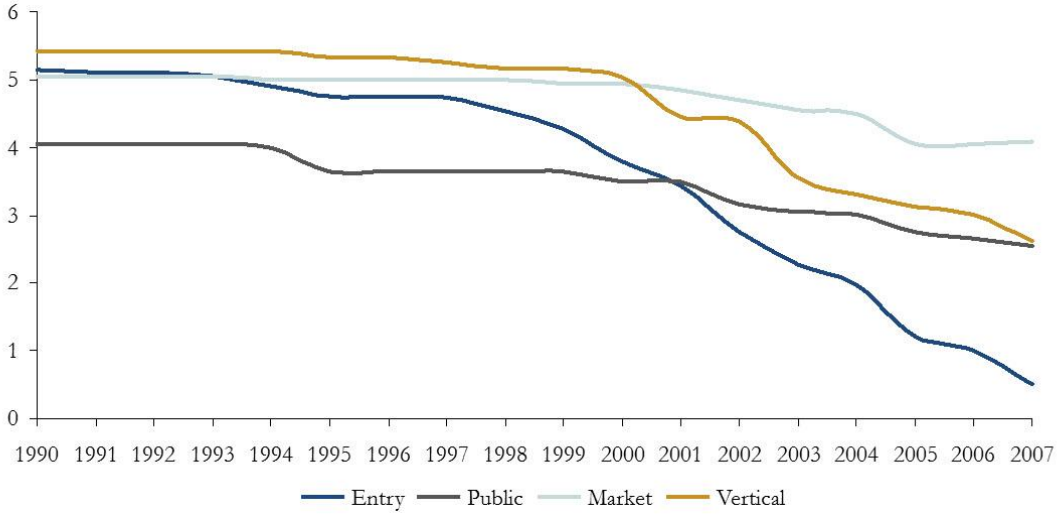
Figure 13: Evolution of electricity low-level indicators



Source: Author's elaborations based on data from Conway and Nicoletti (2006).

The gas industry was liberalised slightly later than the electricity industry and less effectively as shown in figures 10 and 12, respectively. Consequently, the correlation between the average annual drop in the electricity and gas indicators is a relatively low 0.28. With this in mind, it comes as no surprise that a sector inquiry by the European Commission launched in 2005 concluded that despite all the progress, the level of concentration in the European gas market remains relatively high due to insufficient unbundling and a lack of cross-border competition (Commission of the European Communities, 2007). The gas low-level indicator in figure 14 named *Market* accurately reflects the prevalent high level of market concentration. Moreover, the vertical integration of gas companies is much more pronounced in the gas than the electricity industry, according to the latest data points (2.6 vs. 0.5).

Figure 14: Evolution of gas low-level indicators



Source: Author's elaborations based on data from Conway and Nicoletti (2006).

4.3 Independent variables: description and data sources

The principle objective of my econometric work is to estimate the effect of changes in the regulatory environment, using data described in the last section, on the value of cross-border M&A between European countries within the energy industry. However, as identified by the literature, other factors also determine the amount of cross-border M&A, and are as such necessary to be included in the econometric model as control variables.

Market size is measured by the *Gross Domestic Product (GDP)* of both the acquirer and target country. The intuition is that the larger the market in the target country, the more investment opportunities the acquirer can pursue, other things being equal (Globerman & Shapiro, 2005). A relatively rich economy in the home country is likely to indicate the presence of sizeable companies that have the financial power and willingness to invest abroad. The *Distance* variable controls for various factors. It is generally seen as a proxy for bilateral trade or investment costs, an important determinant of cross-border M&A. More intuitively, the further the foreign subsidiary, the more difficult it can be to run and manage these assets, or simply acquire information on them during the acquisition process, which acts as an investment deterrent (Evenett, 2002). Distances between countries are calculated using the Haversine formula[12] using latitude/longitude data provided by the CIA World Factbook[13]. *Regional Trade Agreements (RTA)* is another gravity-type variable included in the regression as a dummy variable. Data to compute this dummy is collected from de Sousa (2012). The literature does not provide a definite answer as to whether M&A flows act as substitutes or complements for trade flows. A positive relationship between *RTA* and M&A would imply a complementary relationship and a negative

[12] Haversine formula = 6371 * arccos [sin(lat1) * sin(lat2) + cos (lat1) * cos (lat2) * cos (lon2 - lon1)].
[13] See https://www.cia.gov/library/publications/the-world-factbook/fields/2011.html#gm.

one the opposite. For example, Hyun and Kim (2010) find a significant positive relationship when the trade volume between a given country pair is excluded from the regression of the full sample set, and an insignificant negative relationship when focusing on deals between OECD countries. Di Giovanni (2005) finds mixed results depending on the type of trade agreement analysed. In the case of the free trade dummy, he finds a negative yet insignificant coefficient. A last geographical variable that is specific to the energy markets is a dummy called *Electricity Regional Initiative (ERI)*, a variable explained in section 2. Given the regional limitations of the energy markets due to costs of storage and transportation, I assume that most utilities pursued a corporate strategy that focused on strengthening their regional foothold in this fragmented market before growing on a larger and more international scale. Thus, I expect this dummy to be a strong and positive explanatory variable of European energy M&A.

The two country-pair dummies *RTA* and *Distance* are accompanied by a *Contiguity* dummy that is set to 1 if the two countries share a common border. This data is extracted from the World Bank Trade, Production and Protection database (Nicita & Olarreaga, 2006). Again, given the regional fragmentation of the energy markets, I expect the relationship to be positive and significant.

Two variables measuring financial depth are considered as control variables. The first is stock market capitalization relative to GDP (*MktCap*). Di Giovanni (2005) writes that financially deep markets, measured either by liquidity or size, provide the necessary access to capital for investments that firms want to undertake, but might otherwise have to forego. This is especially valid for multibillion dollar deals that are usually financed to a large extent by equity. The effect of financial depth in the target country is more ambiguous. On the one hand, a large stock market can increase the number of takeover opportunities, but on the other hand, decreasing asset prices can lead to undervalued targets and more profitable investment opportunities (Boudier & Lochard, 2012). As a substitute to raising equity or tapping into the cash pile on the balance sheet, deals can also be financed by credit, either through bank financing or the bond market. It is well-known that European corporates rely heavily on traditional bank financing as opposed to debt securities (De Fiore & Uhlig, 2011). Therefore, I add the credit provided by banks relative to GDP[14] (*Credit*) as a second measure of financial depth.

As identified in the literature review, besides macroeconomic aspects, institutional factors play an important role in attracting foreign capital. Proxies for institutional strength range from accounting standards (Rossi & Volpin, 2004; Erel et al., 2012), and shareholder protection (Rossi & Volpin, 2004; Globerman & Shapiro, 2005; Neto et al., 2009; Erel et al., 2012), as well as

[14] The data source for GDP, stock market capitalization and credit market depth is the World Bank's latest version of the dataset called World Development Indicator.

quality of institutions in the host country (Hyun & Kim, 2010) to broad governance indicators (Globerman & Shapiro, 2005; Neto et al., 2009; Alba et al., 2009). I include two indices capturing the difference in institutional quality, one on accounting standards (*Disclosure*) and one on shareholder protection. Data for the *Disclosure* index is obtained from Andrei Shleifer[15], who arranged his dataset using the 1990 annual report of the Center for International Financial Analysis and Research, which has also been used by both Rossi and Volpin (2004) and Erel et al. (2012). The first paper that addressed legal factors to understand differences in stock market development and corporate governance around the world was "Law and Finance" by La Porta, Lopez, Shleifer and Vishny (LLSV, 1998). Their major innovation was to define an anti-director rights index (ADRI) based on six items (vote by mail, no requirement to deposit shares prior to the General Shareholders' Meeting, representation of minorities on the board of directors, oppressed minorities mechanisms, minimum percentage of share capital that entitles a shareholder to call an extraordinary shareholder meeting is less than 10% and existence of preemptive rights that can only be waved by a shareholders' vote), and to subsequently compute this index for 49 countries. Their results suggest that common law countries provide better protection than civil law countries and that stronger investor protection is associated with larger capital markets and greater ownership dispersion. Using the difference of the index computed by LLSV between acquirer and target countries, Rossi and Volpin (2004) were the first ones to show that cross-border M&A results in corporate governance convergence. In the meantime, Djankovic, La Porta, Lopez and Shleifer (DLLS, 2008) published a paper with a new measure of legal protection of minority shareholders against expropriation by corporate insiders: The anti-self-dealing index (*ASDI*). They argue that the new index, computed for 72 countries based on legal rules prevailing in 2003, is better grounded in theory and should henceforth be used for future research. Just like Erel et al. (2012), I use the *ASDI* by DLLS (2008) as a proxy for corporate governance to control for differences in investor protection between acquiring and host country.

[15] Andrei Shleifer's datasets can be found on http://www.economics.harvard.edu/faculty/shleifer/dataset.

5 Research methodology

5.1 Panel data

Unlike other studies that are based on cross-sectional data, such as Rossi and Volpin (2004), this thesis uses panel data. One of the main reasons for this is that a panel data analysis allows researchers to obtain more observations (larger sample), resulting in more data variability. Specifically, the variability in the level of regulation can be used to explain variability in the M&A volume over the time period of my sample. In Rossi and Volpin's (2004) case, the underlying assumption is that the proxies for corporate governance (indices for accounting standards and shareholder protection) are relatively constant over their paper's time period (1990-1999), and help explain variability in their dependent variable, the number of aggregate cross-border deals for each country pair. Moreover, Verbeek (2004) explains that one important advantage of panel data compared to time series or cross-sectional data sets is that it allows for identification of certain parameters or questions, without the need to make restrictive assumptions. Because of the larger set of data points in panel data, estimators based on panel data are often more accurate (efficient), and the collinearity between the explanatory variables is reduced. However, as Neto et al. (2009) summarize aptly, "the principal advantage of estimating with panel data is the revelation of individual heterogeneity, which is often neglected in cross or time-section estimates, giving origin to biased results. This heterogeneity is captured by the fixed specific effects of the individuals (country pairs, in this case) or by the components of random effects, depending on the characteristics of the sample". In short, as stated by Verbeek (2004), "the availability of repeated observations on the same units allows economists to specify and estimate more complicated and more realistic models than a single cross-section or a single time series would do".

Following Verbeek (2004), the standard linear regression model for panel data can be written as follows:

$$y_{it} = x'_{it}\beta_{it} + \varepsilon_{it}, \qquad (1)$$

where:

$i = 1, \dots, N$ (cross-sectional units)

$t = 1, \dots, T$ (time-periods)

In an entity fixed-effects model, each unit has a different intercept. This model is used when it is deemed to be necessary to control for omitted variables that differ amongst the panel but are constant over time:

$$y_{it} = \alpha_i + x'_{it}\beta_{it} + \varepsilon_{it}, \qquad \varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2) \tag{2}$$

A time fixed-effects model is similar to equation (2), except that α_i is replaced by α_t. This model assumes that there are unobserved factors that vary across time but are constant across the panel.

Lastly, in a random effects model, it is assumed that all factors affecting the dependent variable that have not been included as regressors can be summarized by a random error term that is independently and identically distributed over i (Verbeek, 2004):

$$y_{it} = \beta_0 + x'_{it}\beta + \alpha_i + \varepsilon_{it}, \qquad \alpha_i \sim IID(0, \sigma_\alpha^2) \text{ and } \varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2), \tag{3}$$

where $\alpha_i + \varepsilon_{it}$ is a composite error term that consists of two components. Firstly, a unit specific component α_i that is constant over time, and a remainder ε_{it} which is assumed to be uncorrelated over time. The two components are assumed to be mutually independent and independent of all x_{it}, which leads to the random effects model.

5.2 Estimation methods

A central question that researchers often have to address is which method to use to estimate the regression coefficients. I use three different methods to estimate the model presented in this section. Due to its relative simplicity, the OLS model is often a good benchmark to start with.

5.2.1 Ordinary Least Squares (OLS)

Taking the standard linear panel model from equation (1) as an example, the OLS method effectively estimates the population regression line that minimizes the sum of the squared residuals (error terms), which is equal to the squared difference between each observed value and its linear approximation:

$$\min \sum_{t=1}^{T} \sum_{i=1}^{N} (y_{it} - x'_{it}\hat{\beta}_{it})^2 = \min \sum_{t=1}^{T} \sum_{i=1}^{N} \varepsilon_{it}^2 \tag{4}$$

The error term is the distance between the fitted line and the observations. Since the observations can lie above and below the fitted line, the square ensures that the positive and negative derivations do not cancel each other out when taking the summation. Mathematically, the minimization is achieved by differentiating the left-hand-side of equation (4) with respect to the vector $\hat{\beta}_{it}$, where the hat denotes the fact that the beta value is the sample estimate of the population parameter. The second order condition is checked to verify that the estimates indeed correspond to the minimum (Verbeek, 2004).

OLS typically assumes that (i) none of the dependent variables are perfectly correlated, (ii) the error term is independently and identically distributed with mean zero and constant variance, and (iii) the dependent and independent variables have finite fourth moments (Stock & Watson, 2007).

5.2.2 Tobit

If OECD data on regulation was available for all EU countries and Norway over the whole sample period, the sample size would be 13,608 (28 home countries * 27 host countries * 18 time periods). Due to missing data on regulation as outlined in table 2 earlier, the sample reduces to 8,316 overall and 6,466 observations when the level of energy regulation in the host and home country are included as regressors. The dependent variable is zero in 98.7% of those 6,466 cases, reflecting the reality that utility companies from a given country pair did not engage in cross-border deals in every year. To account for the extremely large number of cases where a country i does not acquire a company in country j, an alternative method to OLS called censored regression model, is usually estimated in the literature. Censored regression models are also referred to as Tobit model, named after James Tobin (1958), who first proposed the model. As Wooldridge (2002) puts it, "censored regression models generally apply when the variable to be explained is partly continuous but has positive probability mass at one or more points". In the case of panel data on cross-border M&A, this clustering occurs at zero. Wooldridge (2002) explains that censored regressions can be put into two categories, censored regression applications and corner solution models:

1. In the first case, there is true censoring of data. There is a variable with quantitative meaning, y^*, and we are interested in the population regression $E(y^*|x)$. If y^* and x were observed for everyone in the population, we could just use normal OLS estimation as explained above. However, a data problem arises because y^* is censored from above or/and below, meaning that it is not observed for part of the population.

2. In the second case, the term censoring is less appropriate, but occurs more often in econometrics. In this application, y is an observable choice or outcome describing some agent with the following characteristics: y takes on the value zero with positive probability but is a continuous random variable over strictly positive values. In effect, we have an economic agent solving an optimization problem and for some of these agents the optimal choice will be the corner solution, $y = 0$. Wooldridge (2002) refers to these types of models as corner solution models. The issue here is not data observability, but data clustering around zero. We are interested in the features of the distribution of y given x, such as $E(y|x)$ and $P(y = 0|x)$. In the case where corner solutions can be the optimal choice, OLS estimates are downward biased and inconsistent while Tobit estimates are consistent and asymptotically normal (Ameniya, 1973).[16]

My case falls into the second category since the dependent variable y is observed for the whole sample. There is no issue of data observability and the corner solution $y = 0$ occurs in the majority of the cases.

Statistically, the standard Tobit model in terms of an index function can be written as (Greene, 2002; Wooldridge, 2002):

$$y_i^* = x_i'\beta + \varepsilon_{it}, \qquad \varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2), \tag{5}$$

$$\text{where } y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

The response variable in this model, y_i^*, is conventionally referred to as the *latent variable*. The estimation of the coefficients in a Tobit model involves the method of maximum likelihood (ML). Details of ML mechanics, the derivation of first order conditions and marginal effects can be found in Greene (2002) and Wooldridge (2002) amongst others.

5.2.3 Probit

Linders and Groot (2006) studied various ways to deal with zero trade flows surrounding the gravity model framework. They find that the log-linear specification often used in the literature cannot straightforwardly account for the occurrence of zero flows between country pairs. Applying their results to cross-border M&A implies that zero flows result from binary

[16] This assumes that error terms are normally distributed.

decisions whether or not to invest in a specific country through the acquisition of a company (Hyun & Kim, 2010). Probit is the appropriate model to estimate such binary decisions. In this nonlinear regression model, the dependent variable is binomial and the specification estimates the probability of a cross-border deal to take place between any given country pair for each year. A general form of this model can be written as (Stock & Watson, 2007):

$$\Pr(Y = 1|X_1, X_2, \dots, X_k) = \theta(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k), \qquad (6)$$

where Pr denotes probability, the dependent variable Y is binary and θ is the cumulative standard normal distribution function, which defines the boundaries of the outcome as 0 and 1. The coefficients are estimated using the maximum likelihood method.

5.3 Model specification

The econometric specification used in this thesis to analyse my panel data set of cross-border M&A deals is an augmented gravity model. Initially developed for and used in the trade literature, these types of models are now based on strong theoretical foundations (see Anderson & van Wincoop, 2003; and Boudier & Lochard, 2012) and have been used in many of the recent studies relating cross-border M&A to macroeconomic variables (e.g. Di Giovannia, 2005; Hijzen et al., 2008; Hyun & Kim, 2010). Briefly stated, the gravity model of trade predicts bilateral trade flows based on distance an economic size.

My estimation equations will take variations of the following specification, which is a log-linear transformation of the multiplicative form of the original gravity model:

$$\begin{aligned} ln(MA_{ij,t})^{17} = {} & \beta_0 + \beta_1 ln(GDP_{i,t}) + \beta_2 ln(GDP_{j,t}) + \beta_3 ln(Dist_{ij}) + \beta_4 ln(MktCap_{i,t}) \\ & + \beta_5 ln(MktCap_{j,t}) + \beta_6 ln(Credit_{i,t}) + \beta_7 (Contiguity_{ij}) + \beta_8 (RTA_{ij,t}) + \beta_9 (ERI_{ij}) \\ & + \beta_{10} (\Delta Disclosure_{ij}) + \beta_{11} (\Delta ASDI_{ij}) + \beta_{12} (Reg_{i,t}) + \beta_{13} (Reg_{j,t}) + a_t + \varepsilon_{ij,t}, \end{aligned} \qquad (7)$$

where:

i = acquirer country (Austria, Belgium, …, United Kingdom)
j = target country (Austria, Belgium, …, United Kingdom)
t = time period (annual, 1990-2007)
β_0 *= model intercept*
a_t *= time fixed effects (dummy variable for years 1990-2006)*
$\varepsilon_{ij,t}$ *= composite error term*

[17] Similar to Globerman and Shapiro (2005), Hijzen et al. (2008) and Hyun and Kim (2010), I used ln(MA+1) as the dependent variable in the OLS and Tobit estimations to deal with the fact that the log of zero is not defined.

Dependent variable:

MA = nominal value of cross-border M&A (in U.S. dollar millions)[18]

Test variables:

Reg = set of regulation indicators ranging from industry-level (RegEgy) to low-level indicators (Entry, Public, Vertical, Market) (all indicators range from 0-6)

Control variables:

GDP = real gross domestic product (in 2000 US$ millions)
Dist = distance between country i and j (in kilometres)
MktCap = stock market capitalization (% of GDP)
Credit = gross domestic credit provided by the banking sector (% of GDP)
Contiguity = common border (binary variable, equals 1 if country i and j share a border)
RTA = Regional Trade Agreement (binary variable, equals 1 if i and j are part of the same regional trade agreement)
ERI = Electricity Regional Initiative (binary variable, equals 1 if i and j were placed in the same region by the ERGEG)
ΔDisclosure = difference in accounting disclosure index between i and j (index ranges from 0 to 90)
ΔASDI = difference in the anti-self-dealing index between i and j (index ranges from 0 to 1)

Table 12 in the appendix presents a detailed description of the variables included in the estimations and the data sources used. Borrowing from Di Giovanni (2005), table 3 summarizes the expected signs for the coefficients in equation (7) based on discussion from section 4:

Table 3: Expected signs for regression coefficients

GDP_i	+	RTA	+/-
GDP_j	+	ERI	+
Distance	-	Δ Disclosure	+
$MktCap_i$	+	Δ ASDI	+
$MktCap_j$	+/-	Reg_i	+/-
$Credit_i$	+	Reg_j	-
Contiguity	+		

Note: "+/-" indicates that no clear expectation can be formed based on theory, intuition and past results.

[18] Baldwin (2006) calls the inappropriate deflation of nominal trade values in the gravity model by the US' aggregate price index the *bronze-medal mistake*. He argues that deflation would cause spurious correlation due to global trends in inflation rates and refers to Rose (2000), who successfully offset this error by including time dummies. I follow Rose (2000) and similar papers that deal with cross-border M&A in the gravity model framework and include time dummies without deflating the dependent variable.

6 Empirical Results and Analysis

The descriptive statistics for all variables included in one of the regressions can be found in table 13 in the appendix. Note that only the 22 countries OECD computed energy regulation indicators for are included in the dataset, which results in a total number of 8,316 observations (22 home countries * 21 host countries * 18 time periods).

6.1 OLS

6.1.1 Focus on control variables

In a very first step, I use the most basic estimation method of all, namely OLS, to analyse the effects of deregulation on M&A activity. Before delving into the specifics of the effects of deregulation on M&A, I check for the robustness of the overall OECD energy regulation indicator by running various specifications. Results are shown in table 4. The first column includes controls for the basic gravity variables market size and distance. The results are at odds with theory and previous research. Both the market size in the home and host country has a positive effect on bilateral M&A, whereas the distance between two countries has the expected negative effect on cross-border M&A. The latter observation is in line with Evenett (2002) who suggests that it is costlier to manage distant subsidiaries and acquire information on such targets, as well as with Hyun and Kim (2010), who propose that transportation costs may be relevant not only to trade, but also constrain international asset transactions. Even though the sign of the distance variable is unchanged across all the models (1 to 5), the significance of the variable fades in columns 3 and 5. The reason is that part of the distance effect is picked up by the *Contiguity* and *ERI* variables. As observed in part 2.1, over a third of international M&A transactions in my sample took place between neighbouring countries and over half of them occurred between countries that are part of the same "electricity region" within Europe (as defined by the Energy Regulators). Therefore, the implication of the results in columns 3 and 5 is that whenever an acquisition takes place outside an adjacent country or a country that is within the acquirer's region in Europe, the distance factor disappears. The coefficients on the dummy variables *Contiguity* and *ERI* are both positive and significant, as indicated in columns 3 and 5. For example, the full specification in column 5 indicates that the M&A volume between neighbouring countries is 12.2% higher than between disconnected countries. The results for market size in home and host countries are confirmed in regressions 2 to 5.

The most surprising result in table 4 is probably the insignificance of all the financial variables. This is highlighted in column 2, which focuses on the proxies for financial depth, and the overall model presented in column 5. Di Giovanni (2005) presents a possible explanation: The presence of a relatively high correlation between both the credit and stock market variables

with the GDP variables of the acquiring country and the high in-between correlation of the two financial variables. Indeed, if market size in the home country is dropped from specification 5 and the stock market and credit variables are included individually, both estimates are positive and highly significant at the 1% level. The estimates for the stock market to GDP ratio in the host country are positive in all of these regressions, but remain insignificant (see appendix table 14).

Table 4: OLS – Robustness test

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$ln\ GDP_{it}$	0.0588***	0.0616***	0.0546***	0.0876***	0.0527***
	(0.0103)	(0.0110)	(0.0103)	(0.0233)	(0.0108)
$ln\ GDP_{jt}$	0.0290***	0.0307***	0.0240***	0.0565***	0.0286***
	(0.00701)	(0.00751)	(0.00715)	(0.0196)	(0.00819)
$ln\ Dist_{ij}$	-0.0590***	-0.0623***	-0.0138	-0.104***	-0.0115
	(0.0129)	(0.0136)	(0.0148)	(0.0291)	(0.0165)
$ln\ MktCap_{it}$		0.00342			0.0126
		(0.00972)			(0.0106)
$ln\ MktCap_{jt}$		-0.00410			0.00647
		(0.00723)			(0.00824)
$ln\ Credit_{it}$		-0.0130			-0.00937
		(0.0162)			(0.0164)
$Contiguity_{ij}$			0.0995**		0.122**
			(0.0481)		(0.0518)
RTA_{ijt}			-0.0376*		-0.0382
			(0.0206)		(0.0282)
ERI_{ij}			0.0603**		0.0583*
			(0.0294)		(0.0320)
$\Delta\ Disclosure_{ij}$				0.000482	
				(0.000919)	
$\Delta\ ASDI_{ij}$				0.0814**	0.0530***
				(0.0363)	(0.0199)
$RegEgy_{it}$	-0.0141	-0.0182	-0.0210*	-0.0177	-0.0218*
	(0.0110)	(0.0119)	(0.0111)	(0.0208)	(0.0119)
$RegEgy_{jt}$	-0.0341***	-0.0348***	-0.0409***	-0.0582***	-0.0385***
	(0.00970)	(0.00941)	(0.00991)	(0.0177)	(0.00954)
Observations	6,254	5,880	6,254	2,808	5,800

Notes: Robust standard errors in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies.

The non-significant effect of stock market depth in the host country is in line with Coeurdacier (2009), who argues that the smooth development of financial depth across time is

captured by fixed-effect variables. Another explanation is the ambiguous nature of stock markets in the host country. A large stock market to GDP ratio could indicate the presence of a large number of takeover opportunities, while a small stock market to GDP ratio could point towards undervalued targets and more profitable investment opportunities (Boudier & Lochard, 2012). The net effect of these two opposing factors is likely that they offset each other, which results in the observed insignificant variable. Investment decisions are often made months before a public announcement. Since the market environment can considerably change within that period, I ran a set of regressions using lagged financial variables, with unchanged results.

As indicated previously, the literature is discordant whether trade and M&A flows act as substitutes or complements. The negative coefficients in columns 3 and 5 add to the view that they act as substitutes. However, only the coefficient in column 3 is significant.

Lastly, column 4 investigates whether mergers and acquisitions in the European energy market have led to corporate governance convergence. The coefficients on both proxies for differences in corporate governance standards between acquirer and target, namely an accounting index ($\perp Disclosure_{ij}$) and anti-self-dealing index ($\perp ASDI_{ij}$), are positive and, in the case of *ASDI,* significant. The latter result is reinforced by the full specification shown in column 5. My results are consistent with Erel et al. (2012) and reiterate Rossi and Volpin's (2004) conclusions: Firstly, firms in countries with weaker investor protection are more likely to be acquired. Secondly, shareholder protection in the target company increases via cross-border deals. Lastly, cross-border deals enhance market efficiency because the reduced likelihood of minority shareholder expropriation reduces the cost of raising external equity. Overall, cross-border M&A seems to play a governance role by targeting firms in countries with lower investor protection (Rossi & Volpin, 2004).

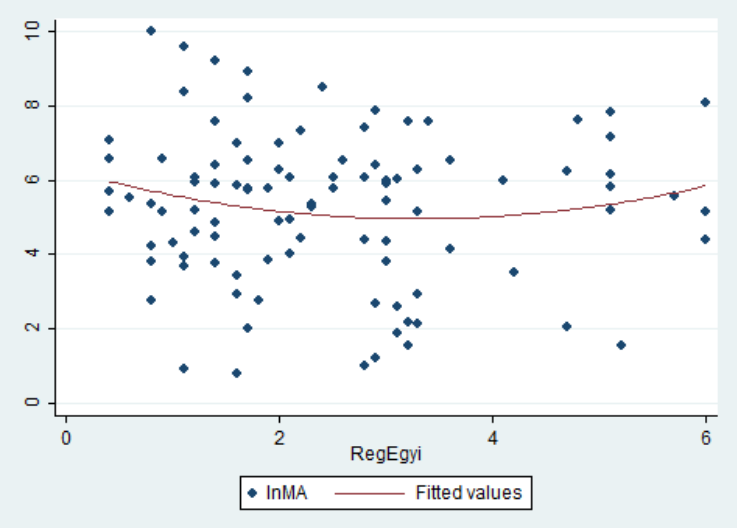
On a broader level, the results reveal that the test coefficients measuring the level of energy regulation, i.e. the last two variables in table 4, are robust to the inclusion of various test variables. This robustness is demonstrated by the fact that the coefficients on energy regulation are fairly stable, regardless of which control variables are included. The only exception is column 4, where the negative coefficient on host country regulation increases quite considerably, most likely because the sample size more than halves due to the limited data availability on accounting standards. As a result, the accounting index was dropped in the full specification (column 5) and will not be included in the subsequent full models. The preliminary conclusion is that the reduced level of regulation observed in many European countries over the past two decades created a friendlier investment environment, leading to an increase in inbound M&A in those deregulated countries. The situation in the acquiring country is less clear-cut. Even though the coefficients are all negative, they are only significant at the 10% level in model 3 and 5. This

could be due to the ambiguous nature of the variable. As mentioned previously, Boudier and Lochard (2012) explain that deregulation could motivate firms to engage in cross-border M&A to reach a critical size. However, a highly regulated market often grants companies strategic advantages that allow them to pursue a more aggressive acquisition strategy abroad. If the former explanation dominates, one could expect a negative relationship between cross-border M&A and regulation while if the latter dominates, the opposite would be true. Thus, the indefinite result could be a consequence of those two contradictory effects. In fact, Boudier and Lochard (2012) argue that the two opposite effects may depend on the initial level of regulation, with the latter effect only dominating in countries with a very high level of regulation. Whether this is true in the case of the electric and gas utilities industry is investigated in the remaining segments of this section.

6.1.2 Focus on test variables

Table 5 summarizes the regression results that use the full model specification from table 4 (column 5) as a basis. Additionally, all four low-level indicators for energy regulation, entry regulation (*Entry*), public ownership (*Public*), vertical integration (*Vertical*) and market structure (*Market*)[19], are introduced alongside a squared term for each regulation indicator in the acquiring country. Note that the first three low-level indicators are generated as an average of the gas and electricity low-level indicators, whereas *Market* is only available for the gas industry. A scatterplot (excluding observations where $MA_{ij,t} = 0$) between the dependent variable and the level of overall regulation in the acquiring country in combination with a quadratic prediction of the observations yields a graphic indication for a U-shaped relationship between the two variables (see figure 15).

Figure 15: U-shaped correlation between M&A and regulation in host country



[19] These variables are described in detail in part 4.2.

Table 5: OLS – Focus on test variables

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$ln\ GDP_{it}$	0.0410***	0.0526***	0.0440***	0.0573***	0.0324***
	(0.00999)	(0.0111)	(0.00927)	(0.0109)	(0.00842)
$ln\ GDP_{jt}$	0.0285***	0.0343***	0.0326***	0.0325***	0.0397***
	(0.00816)	(0.00898)	(0.00790)	(0.00848)	(0.00804)
$ln\ Dist_{ij}$	-0.0100	-0.0107	-0.0120	-0.0155	-0.0284
	(0.0164)	(0.0171)	(0.0160)	(0.0164)	(0.0175)
$ln\ MktCap_{it}$	0.0170*	0.00917	0.0130	0.0150	0.0361***
	(0.0103)	(0.0101)	(0.0105)	(0.0106)	(0.00907)
$ln\ MktCap_{jt}$	0.00607	0.00538	0.00862	0.00964	0.0126
	(0.00825)	(0.00835)	(0.00870)	(0.00781)	(0.00841)
$ln\ Credit_{it}$	-0.00759	-0.00825	-0.00259	0.00391	-0.0130
	(0.0164)	(0.0183)	(0.0157)	(0.0170)	(0.0172)
$Contiguity_{ij}$	0.124**	0.130**	0.119**	0.123**	0.136***
	(0.0518)	(0.0534)	(0.0504)	(0.0503)	(0.0504)
RTA_{ijt}	-0.0318	-0.0374	-0.0244	-0.0405	-0.0282
	(0.0280)	(0.0304)	(0.0275)	(0.0277)	(0.0270)
ERI_{ij}	0.0621*	0.0526	0.0540*	0.0550*	-0.00155
	(0.0317)	(0.0323)	(0.0311)	(0.0313)	(0.0347)
$\Delta\ ASDI_{ij}$	0.0570***	0.0560***	0.0565***	0.0522***	0.0551***
	(0.0199)	(0.0212)	(0.0195)	(0.0200)	(0.0196)
$RegEgy_{it}$	-0.150***				
	(0.0459)				
$RegEgy_{jt}$	-0.0386***				
	(0.00953)				
$RegEgy^2_{it}$	0.0179***				
	(0.00565)				
$Entry_{it}$		-0.0498**			
		(0.0252)			
$Entry_{jt}$		-0.0283***			
		(0.00779)			
$Entry^2_{it}$		0.00494*			
		(0.00292)			
$Public_{it}$			-0.0576**		
			(0.0288)		
$Public_{jt}$			-0.0165**		
			(0.00640)		
$Public^2_{it}$			0.00669*		
			(0.00361)		
$Vertical_{it}$				0.0129	
				(0.0370)	
$Vertical_{jt}$				-0.0344***	
				(0.00772)	
$Vertical^2_{it}$				-0.00125	
				(0.00447)	
$Market_{it}$					-0.318***
					(0.0804)
$Market_{jt}$					-0.00544
					(0.00814)
$Market^2_{it}$					0.0363***
					(0.00892)
Observations	5,800	5,651	5,975	5,975	5,975

Notes: Robust standard errors in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies.

The statistical results underpin the graphic observation, as becomes evident in column 1 of table 5. The coefficient estimate for the level of regulation in the acquiring country is still negative, whereas the coefficient on the squared indicator is positive. More importantly, both coefficients are statistically significant (at the 1% level). Setting the specification in column 1 equal to zero and solving for $RegEgy_{it}$, I find that the turning point of the overall energy regulation indicator is at 4.19 [=0.15/(2*0.0179]. In other words, I would expect that on average, all other things being equal, a marginal amount of deregulation would reduce outbound M&A in a highly regulated country (indicator > 4.19) and vice versa. Except for the United Kingdom, which already started the final decade of the last century at an OECD energy regulation level of 2.2, all countries in my sample have over the course of the last two decades broken through the turnaround barrier. Thus, I would expect further deregulation in the overall European gas and electricity business over the next years to induce an acceleration of the on-going industry consolidation.

Columns 2 to 5 in table 5 offer an insight into which regulatory dimension matters most in the acquiring country. Breaking the overall energy regulation indicator into its low-level indicators, I find that every regulatory dimension bar vertical integration matters. Moreover, the U-shaped relationship is evident in all of the three low-level indicators that indicate statistical significance. Lastly, changes in the market structure seem to matter most in the explanation of the variation of outbound M&A transaction. The intuitive underpinning for this result is fairly straightforward: In a highly concentrated, oligopolistic market, one could expect the handful of existing companies to possess the financial firepower necessary to acquire foreign companies. Meanwhile, in a highly dispersed market, the extremely competitive home market could incentivise companies to pursue investment opportunities abroad and build an international presence and size that decreases the risk of becoming an easy takeover target. It is no surprise that the level of vertical integration does not have an effect on foreign acquisitions, as there are no apparent financial or strategic reasons for either vertically integrated or separated energy companies not to pursue active acquisition strategies abroad, a notion clearly supported by the data.

The effect of deregulation on inbound M&A is slightly different to the one on outbound M&A. Overall, column 1 suggests that a more deregulated environment in the target country increases cross-border M&A in the electric and gas utilities industry. A smaller involvement of the government, easier access to the transmission grid and a larger degree of vertical separation all attract foreign investments into local firms. Varying levels of market concentration on the

other hand, do not matter. Depending on the strategy of the acquiring company, both companies with a large and small market share in their home market can be interesting takeover targets.

6.2 Tobit

This section replicates the OLS regressions using the Tobit estimation method explained in section 5.2.2. The Tobit replication of the OLS estimations from table 4 can be found in the appendix in table 15. The results are virtually unchanged in terms of statistical significance and direction of relationship. If anything, the previous result of an existing relationship between deregulation and outward M&A turns out to be more robust in the case of Tobit.

Table 6 summarizes the regression results that focus on different aspects of regulation and also include a squared term of the regulation indicators in the acquiring country. Before turning to the test variables, one group of control variables warrants a closer look. The Tobit estimates suggest that financial depth in the home country supports acquisitions of energy companies abroad. The coefficients on the *Credit* variable are all positive, albeit not significant at conventional levels (see columns 3 to 5). However, the same columns reveal a positive and significant relationship between the ratio stock market capitalization to GDP in the acquiring country and international M&A. Even though the coefficients on the stock market capitalization to GDP ratio in the host country are negative, the hypothesis that these coefficients are in fact statistically irrelevant cannot be rejected at the 5% significance level. The insignificance probably arises from the previously discussed contradictory effect of stock markets on inbound M&A.

The overall interpretation of the effects of deregulation on international M&A in the energy industry is unchanged for both target and acquirer countries. Deregulation attracts inbound and incentivises outbound M&A (see table 6, column 1). In line with my previous results, all regulatory dimensions except changes in the market concentration matter for inbound M&A. My analysis of this result is unchanged: Both companies with relatively small and large market shares are potential acquisition targets. An example of the former is EDF's acquisition of Demasz, a Hungarian power distribution company with 11% market share (Lévêque & Monturus, 2008), while an example of the latter would be GDF's acquisition of Suez, which enjoyed a near monopolistic position in the Belgian wholesale gas and electricity production market through its subsidiary, Electrabel (OECD, 2009). One regulatory dimension that loses its significance on outbound M&A is public ownership (*Public*). According to this result, both energy companies that are majority owned by the government as well as fully private companies engage in cross-border M&A. Given the theoretical underpinning for using Tobit rather than OLS in the case of data clustering, more weight should be attached to this outcome. Not only

Table 6: Tobit – Focus on test variables

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
ln GDP $_{it}$	2.823***	3.874***	3.922***	4.089***	2.868***
	(0.934)	(0.868)	(0.993)	(0.918)	(0.892)
ln GDP $_{jt}$	2.167**	2.597***	2.346***	2.664***	2.806***
	(0.872)	(0.795)	(0.785)	(0.806)	(0.883)
ln Dist $_{ij}$	-1.237	-1.802	-1.553	-1.428	-2.244
	(1.667)	(1.539)	(1.539)	(1.602)	(1.546)
ln MktCap $_{it}$	2.304	1.665	3.051**	2.547*	4.077***
	(1.452)	(1.433)	(1.492)	(1.526)	(1.581)
ln MktCap $_{jt}$	-1.717	-1.502	-0.953	-1.765	-0.863
	(1.225)	(1.152)	(1.147)	(1.158)	(1.063)
ln Credit $_{it}$	*dropped*	*dropped*	1.686	0.547	0.348
			(2.432)	(2.453)	(2.433)
Contiguity $_{ij}$	5.331**	5.054**	5.540**	5.322**	5.610**
	(2.497)	(2.346)	(2.338)	(2.390)	(2.382)
RTA_{ijt}	-1.645	-1.821	-1.364	*dropped*	*dropped*
	(2.704)	(2.684)	(2.745)		
ERI_{ij}	6.303***	4.189**	4.502**	5.996***	2.390
	(2.303)	(2.024)	(2.078)	(2.193)	(2.029)
$\Delta ASDI_{ij}$	6.431***	5.127**	5.697**	5.555**	5.387**
	(2.483)	(2.199)	(2.270)	(2.224)	(2.198)
RegEgy $_{it}$	-7.066***				
	(2.497)				
RegEgy $_{jt}$	-2.804***				
	(0.863)				
RegEgy^2 $_{it}$	0.691**				
	(0.322)				
Entry $_{it}$		-2.479*			
		(1.432)			
Entry $_{jt}$		-1.518***			
		(0.576)			
Entry^2 $_{it}$		0.163			
		(0.227)			
Public $_{it}$			1.057		
			(1.608)		
Public $_{jt}$			-1.112**		
			(0.477)		
Public^2 $_{it}$			-0.323		
			(0.250)		
Vertical $_{it}$				-2.459	
				(2.178)	
Vertical $_{jt}$				-2.732***	
				(0.761)	
Vertical^2 $_{it}$				0.113	
				(0.297)	
Market $_{it}$					-7.071***
					(2.100)
Market $_{jt}$					-0.230
					(0.598)
Market^2 $_{it}$					0.852***
					(0.280)
Observations	5,938	5,788	5,975	5,975	5,975
Year dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	-532.4	-536.7	-528.5	-524.2	-527.6

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies. The dropped variables support convergence. Standard errors in parentheses.

that, but intuition also suggests that this result is more likely to reflect reality. To illustrate the point with an example, Sweden and France, who had two of the highest averages in the

electricity public ownership indicator over the whole period (5.8 and 6.0, respectively) were both among the most active countries in the market for corporate control (see figure 6 in section 2.1). Dynamic government-owned acquirers in these two countries that come to mind are Vattenfall and GDF Suez. At the same time, Germany, whose averaged public ownership indicator stands at a very low 1.3, indicating small government involvement, topped the list of most active acquirers.

Albeit slightly weakened, the statistical evidence for a U-shaped relationship between outbound M&A and regulation remains. The regulatory dimension that matters most in the acquiring country is the market structure. Both the coefficient estimates for market structure and squared market structure are significant at the 1% level (column 5), and negative and positive, respectively. Introducing competition into a highly concentrated market reduces incentives to engage in cross-border M&A. The opposite is true as soon as the market share of the most powerful company is less than 65%, which is implied by the turn-around value of 4.15 [=7.071/(2*0.852)] and the assumption of a linear construction of the *Market* low-level indicator (see appendix table 11B for details). My last point concerns the level of the coefficients. Borrowing from Ameniya (1973), I mentioned in section 5.2.2 that when corner solutions can be the optimal choice, OLS estimates are downward biased and inconsistent while Tobit estimates are consistent and asymptotically normal. Indeed, the much larger coefficients from the Tobit regressions support this theoretical claim.

6.3 Probit

Lastly, following Hyun and Kim's (2010) application of Linders and Groot's (2006) suggestion that zero M&A flows in a given year for a given country pair may be the outcome of a binary investment decision, the next page reports the estimates using a Probit model. In this model, the dependent variable, cross-border M&A, is a binomial variable that takes the value 1 if any transaction occurred between country *i* and *j* in a given year, and zero otherwise. The results replicating the initial OLS estimates from table 4 can be found in the appendix in table 16.

Table 7 details the results of the in-depth regulation regressions. The result of the Tobit estimations that financial depth in the home country does play a role in explaining the level of cross-border M&A transactions is confirmed by the Probit results in columns 3 to 5. Likewise, all the other results are in line with the Tobit estimates. The market sizes (*GDP*) in the home and host countries as well as geographic proximity (*Contiguity, ERI)* explain international M&A in the European utilities market. Moreover, the evidence for convergence in corporate governance as a result of cross-border M&A persists, as seen by the positive and significant coefficients on the *ASDI* variable. Lastly, deregulation is a push-and-pull factor for international M&A. A push

factor because it drives companies to acquire foreign players and a pull factor because deregulated markets attract investments by foreign corporates.

Table 7: Probit – Focus on test variables

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$ln\ GDP_{it}$	0.292***	0.384***	0.398***	0.419***	0.293***
	(0.0977)	(0.0882)	(0.0971)	(0.0909)	(0.0903)
$ln\ GDP_{jt}$	0.211**	0.261***	0.236***	0.276***	0.291***
	(0.0909)	(0.0816)	(0.0789)	(0.0825)	(0.0901)
$ln\ Dist_{ij}$	-0.134	-0.169	-0.166	-0.160	-0.242
	(0.177)	(0.165)	(0.158)	(0.167)	(0.161)
$ln\ MktCap_{it}$	0.251	0.133	0.328**	0.290*	0.439***
	(0.159)	(0.158)	(0.152)	(0.159)	(0.162)
$ln\ MktCap_{jt}$	-0.174	-0.153	-0.0883	-0.142	-0.0726
	(0.132)	(0.123)	(0.119)	(0.128)	(0.121)
$ln\ Credit_{it}$	0.00335	0.140	0.184	0.0616	0.0520
	(0.265)	(0.251)	(0.255)	(0.260)	(0.260)
$Contiguity_{ij}$	0.632**	0.605**	0.579**	0.567**	0.595**
	(0.260)	(0.246)	(0.236)	(0.245)	(0.245)
RTA_{ijt}	-0.173	-0.180	-0.152	-0.292	-0.0834
	(0.297)	(0.291)	(0.288)	(0.292)	(0.295)
ERI_{ij}	0.639***	0.417*	0.468**	0.652***	0.258
	(0.241)	(0.214)	(0.212)	(0.226)	(0.212)
$\Delta\ ASDI_{ij}$	0.712***	0.571**	0.582**	0.574**	0.558**
	(0.260)	(0.230)	(0.230)	(0.228)	(0.227)
$RegEgy_{it}$	-0.718***				
	(0.273)				
$RegEgy_{jt}$	-0.317***				
	(0.0934)				
$RegEgy^2_{it}$	0.0676*				
	(0.0361)				
$Entry_{it}$		-0.232			
		(0.157)			
$Entry_{jt}$		-0.168***			
		(0.0628)			
$Entry^2_{it}$		0.00692			
		(0.0261)			
$Public_{it}$			0.118		
			(0.168)		
$Public_{jt}$			-0.111**		
			(0.0485)		
$Public^2_{it}$			-0.0343		
			(0.0260)		
$Vertical_{it}$				-0.258	
				(0.231)	
$Vertical_{jt}$				-0.304***	
				(0.0778)	
$Vertical^2_{it}$				0.0108	
				(0.0316)	
$Market_{it}$					-0.732***
					(0.218)
$Market_{jt}$					-0.0209
					(0.0634)
$Market^2_{it}$					0.0884***
					(0.0293)
Observations	5,800	5,651	5,975	5,975	5,975
Year dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	-302.9	-306.5	-310.4	-304.9	-309.5

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies. Standard errors in parentheses.

7 Conclusion

The main purpose of this thesis is to statistically determine whether the liberalisation of the European energy market played a role in the spike of M&A volume around the turn of the millennium. Using data on cross-border M&A in the European electric and gas utilities industry from the comprehensive SDC Platinum database, I estimate an augmented gravity model by three different methods. The results are conclusive: The M&A wave would have been at best less pronounced without the European Union's effort to create an internal market through the introduction of competition and separation of vertically integrated industries. In short, deregulation mattered. This main result is robust to the inclusion of various sets of control variables (i.e. different specifications of the econometric model), different estimation methods, and to the change of the dependent variable from M&A volume to M&A as a binary choice variable.

Moreover, this thesis not only sheds light on the reasons for the merger wave in the energy industry, it also confirms a variety of past results on the general macroeconomic, institutional and financial determinants for cross-border M&A. My results validate the importance of gravity type variables such as market size and distance and also suggest that cross-border M&A promotes an improvement in the overall corporate governance level. Assuming that target companies adopt governance standards of the acquirer country, which is legally required in the case of full acquisitions (Bris et al., 2008), one could go as far as to suggest that cross-border M&A through the spill over effect of good governance results in improved capital markets. Lastly, my results indicate that deep stock markets in the acquirer country support acquisitive cross-border strategies and dominate over credit markets.

Returning to my results on the link between the level of regulatory reform and international corporate transactions, I find that deregulation not only attracts M&A in the deregulated country, it also incentivises companies in the deregulated country to pursue acquisitions in the international market for corporate control. Yet, this is only true if specific elements of the industry are reformed by regulators. Statistically, the results suggest that policies targeted at decreasing the market concentration fuel outbound M&A more than any other government effort. The result makes intuitive sense: If a monopolized or oligopolistic market is broken up into a competitive one, companies react by acquiring competitors to decrease the risk of being taken over. Nevertheless, I interpret this result with caution. It could be a cause for concern that the market structure low-level indicator is only computed by the OECD for the gas industry, but applied in my study to the whole dataset. This whole dataset inter alia includes horizontal deals in the electricity industry, which some would argue should not be affected by changes in the gas

market. Gilbert and Newbery (2010) would probably disagree by explaining that "electricity and gas are actual potential competitors in a broader market for energy services. In the medium run, the best placed potential entrant into the electricity market is a gas supplier, who has access to the fuel needed for combined cycle gas turbines (the natural choice for entrants), and who can (partially) hedge gas price risk by selling gas directly or as electricity". Another counterargument is that a lot of the companies labelled by SDC Platinum through their primary SIC code as electric utilities de facto also own gas businesses. Ultimately, a question remains that demands more explicit empirical evidence. I leave it to future research to (i) compute a market structure indicator for the whole energy industry and/or (ii) to potentially exclude horizontal mergers and acquisitions by pure electric utilities and run comparable regressions to contest my results. Next, even though this result is statistically weaker than that of changing market structures, facilitating market entry for new industry players and allowing third party access to the national transmission grid also incentivises incumbents to increase their size with international corporate transactions. The intuition is that more lax industry entry regulations attract new competitors, especially in industries such as utilities, where companies generate fairly consistent profits. And in the wake of increased competition in the home market, companies tend to turn to the international market for corporate control, as discussed earlier.

Importantly, the aforementioned effects of deregulation on outward M&A depend on the initial level of regulation. Indeed, a U-shaped relationship is suggested between international M&A and industry regulation by the overall indicators and also the market structure low-level indicator. This result confirms Boudier and Lochard's (2012) overall conclusion that "in highly deregulated countries, deregulation fosters outward cross-border M&As, whereas in countries in which the government control is extensive, deregulation reduces the incentives for firms to engage in cross-border M&As". However, my results reveal that there is value in more focused industry-level research, which has important policy implications. Studying the effect of deregulation on cross-border M&A in the services sector, which includes the transportation and communications industries alongside energy, they only find a non-linear relationship between the public ownership low-level indicator and outward M&A. In the energy industry, though, there is very weak evidence for any relationship between public ownership and outward M&A. In conclusion, given the statistical evidence for a U-shaped relationship, the overall turnaround value of 5.11 [=7.066/(2*0.691)] implied by the Tobit estimates (see table 6, column 1) and the current level of overall energy regulation, which is below 5.11 for every European country covered by the OECD, further deregulation in the European gas and electricity business can be expected to lead to an intensified cross-border M&A volume, with the possibility of an

accelerated industry consolidation. Interestingly, the turnaround value in the energy industry is quite a bit higher than the one found by Boudier and Lochard (2012) for the services sector (5.11 vs. 3.00), indicating that deregulation incentivises outbound M&A at a more infant stage of liberalisation in the energy sector compared to the services industry.

The situation is more unequivocal in the case of inward M&A. Expect for the level of market concentration, all the indicators studied, ranging from industry-level to low-level indicators, imply a negative relationship between the level of industry regulation and inbound M&A. In terms of national policy implications, everything else being equal, a government that seeks to attract foreign investors can do so by privatizing the energy industry, separating vertically integrated companies and simplifying industry entry requirements. Yet, given the strategic importance of the energy industry in national politics, market liberalisation as seen in the UK will in most countries be perceived as an obligation to comply with EU directives instead of as a national policy tool per se.

The most significant policy implication of this thesis, however, concerns not the national but the European policy makers, namely the European Commission. My empirical results demonstrate that the gas and electricity market liberalisations achieved through the implementation of the directives suggested by the European Commission played an important role in the cross-border merger wave. Thus, the European Union's policy makers must tackle the question of whether their directives could eventually result in the creation of continental "energy champions", a term borrowed from Schiavone (2010). It is still premature to confirm Thomas' (2003) decade-old prophecy of the emergence of a few European energy giants that will supposedly come to dominate the entire market as a result of the EU's policies aimed at integrating a fragmented market and increasing market competition. However, the issue of intensified market concentration is now a real concern that has been voiced by numerous researchers (for example Durand, 2006; Domanico, 2007; Leite et al., 2006; Lévêque & Monturus, 2008; Gilbert & Newbery, 2010; Chiorean-Sime, 2011) and even the European Commission (Commission of the European Communities, 2007). We have arguably reached a crossroad that asks for coherent and firm actions to be taken by the European Union's Competition Commission (Verde, 2008) surrounding international merger rules, which could help to turn around the current trend. In Thomas' (2003) words, "the laissez faire attitude to company mergers and takeovers" by the EU should be reassessed because it is undermining their broader targets of increased competition and reduced energy prices. While the European Commission does not have the power to overturn the decision of national competition authorities that allowed the proliferation of national champions, it can impede the creation of

continental champions by blocking mergers on antitrust grounds. In terms of national megamergers (e.g. E.ON/Ruhrgas, GDF/Suez), various market observers (Durand, 2006; Leite et al., 2006; Lévêque, 2006) have recognized that the "two-thirds rule", which grants national authorities the responsibility to sanction mergers if more than two thirds of each of the merging entities' EU-wide gross revenue is created in one and the same member state, constitutes a serious obstacle to achieving the goals of the EU directives. Lévêque (2006) suggests that reducing the percentage of this rule would contribute to greater efficiency of European electricity markets. Although politically challenging to implement, granting the European Union's Competition Commission increased competence that would allow it to rule on national mergers in collaboration with national authorities could be part of a broader solution tackling the apparent divergent interests between the EU and some of its member states.

The scope for future related research is abundant. Addressing the question of the effects of deregulation on cross-border M&A in other industries is a good starting point. Studying the effects of deregulation on national M&A activity is another possible direction of research. More conclusive evidence on whether deregulation results in increased market competition - as anticipated by the EU's electricity and gas directives - or in more concentrated markets will be fundamental for future policymakers.

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9 Appendices

Appendix 1: ERI membership

Table 8: Overview of ERI membership

Region	Members
Baltic	Estonia, Latvia, Lithuania
Central-East	Austria, Czech Republic, Germany, Hungary, Poland, Slovak Republic, Slovenia
Central-South	Austria, France, Germany, Greece, Italy, Slovenia
Central-West	Belgium, France, Germany, Luxembourg, Netherlands
Northern	Denmark, Finland, Germany, Norway, Poland, Sweden
South-West	France, Spain, Portugal
France-UK-Ireland	France, Ireland, United Kingdom

Source: European Energy Regulators.

Appendix 2: European energy cross-border M&A, 1990-2007

Table 9: Number of cross-border M&A, 1990-2007

TARGET COUNTRY \ ACQUIRER COUNTRY	AUT	BEL	BLG	CZE	DEN	EST	FIN	FRA	DEU	GRE	HUN	IRE	ITA	LIT	LUX	NLD	NOR	POL	POR	ROU	SLK	SLV	ESP	SWE	GBR	Total
Austria (AUT)	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Belgium (BEL)	0	**0**	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5
Bulgaria (BLG)	2	0	**1**	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	7
Czech Republic (CZE)	0	0	0	**3**	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Denmark (DNK)	0	0	0	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estonia (EST)	0	0	0	0	0	**0**	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Finland (FIN)	0	0	0	0	0	0	**24**	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	9
France (FRA)	0	0	0	0	0	0	0	**4**	1	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	7
Germany (DEU)	0	0	0	0	1	0	1	0	**19**	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	1	7
Greece (GRE)	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary (HUN)	0	0	0	0	0	0	0	3	1	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Ireland (IRE)	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy (ITA)	0	2	0	0	0	0	0	4	2	0	0	0	**31**	0	0	0	0	0	0	0	0	0	7	0	1	16
Lithuania (LIT)	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg (LUX)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
Netherlands (NLD)	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	**8**	0	0	0	0	0	0	0	0	1	7
Norway (NOR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**24**	0	0	0	0	0	0	4	0	4
Poland (POL)	0	0	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	1	0	6
Portugal (PRT)	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	**3**	0	0	0	2	0	3	9
Romania (ROU)	0	0	0	1	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	**0**	0	0	0	0	0	6
Slovak Rep. (SLK)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0**	0	0	0	0	1
Slovenia (SLV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0
Spain (ESP)	0	1	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	2	0	0	0	**18**	0	0	8
Sweden (SWE)	0	0	0	0	0	0	8	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	**35**	0	12
United Kingdom (GBR)	0	0	0	0	0	0	0	10	7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**46**	18
Total	2	4	0	6	1	0	10	25	29	0	0	0	8	0	0	4	2	0	2	0	0	2	12	16	9	**132**

Source: Thomson Reuters SDC Platinum.
Note: The total in this table excludes national deals (in bold) and thus represents a sum of all cross-border deals.

Table 10: Value of cross-border M&A, 1990-2007

TARGET COUNTRY \ ACQUIRER COUNTRY	AUT	BEL	BLG	CZE	DEN	EST	FIN	FRA	DEU	GRE	HUN	IRE	ITA	LIT	LUX	NLD	NOR	POL	POR	ROU	SLK	SLV	ESP	SWE	GBR	Total
Austria (AUT)	**336**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	346
Belgium (BEL)	0	**0**	0	0	0	0	0	1,590	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374	1,964
Bulgaria (BLG)	341	0	**2**	717	0	0	0	0	179	0	0	0	0	0	0	0	0	0	0	0	0	47	0	0	0	1,286
Czech Republic (CZE)	0	0	0	**1,321**	0	0	0	0	3,708	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	5,069
Denmark (DNK)	0	0	0	0	**1,716**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,716
Estonia (EST)	0	0	0	0	0	**0**	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	14
Finland (FIN)	0	0	0	0	0	0	**3,119**	0	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,019	0	4,264
France (FRA)	0	0	0	0	0	0	0	**62,713**	55	0	0	0	372	0	0	22	0	0	0	0	0	0	237	0	0	63,399
Germany (DEU)	0	0	0	0	30	0	415	0	**25,685**	0	0	0	0	0	0	554	0	0	0	0	0	0	0	2,055	721	29,460
Greece (GRE)	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary (HUN)	0	0	0	0	0	0	0	344	86	0	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	430
Ireland (IRE)	0	0	0	0	0	0	0	0	0	0	0	**101**	0	0	0	0	0	0	0	0	0	0	0	0	0	101
Italy (ITA)	0	432	0	0	0	0	0	5,821	14,392	0	0	0	**12,948**	0	0	0	0	0	0	0	0	0	749	0	1,196	35,536
Lithuania (LIT)	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	0	0	0	0	0	0	0	0	0	0	0	2
Luxembourg (LUX)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
Netherlands (NLD)	0	0	0	0	0	0	0	418	1,462	0	0	0	0	0	0	**4,820**	0	0	0	0	0	0	0	0	168	6,867
Norway (NOR)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1,817**	0	0	0	0	0	0	51	0	1,868
Poland (POL)	0	0	0	531	0	0	0	80	369	0	0	0	0	0	0	0	0	**83**	0	0	0	0	0	230	0	1,293
Portugal (PRT)	0	324	0	0	0	0	0	136	322	0	0	0	0	0	0	0	0	0	**1,218**	0	0	0	214	0	255	2,469
Romania (ROU)	0	0	0	194	0	0	0	388	383	0	0	0	1,193	0	0	0	0	0	0	**0**	0	0	0	0	0	2,159
Slovak Rep. (SLK)	0	0	0	0	0	0	0	0	0	0	0	0	1,089	0	0	0	0	0	0	0	**0**	0	0	0	0	1,089
Slovenia (SLV)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0
Spain (ESP)	0	8	0	0	0	0	0	0	4,245	0	0	0	2,157	0	0	0	0	0	3,243	0	0	0	**7,992**	0	0	17,643
Sweden (SWE)	0	0	0	0	0	0	3,130	0	1,292	0	0	0	0	0	0	0	8	0	0	0	0	0	0	**4,202**	0	8,632
United Kingdom (GBR)	0	0	0	0	0	0	0	9,346	19,647	0	0	0	0	0	0	0	0	0	0	0	0	0	22,210	0	**31,217**	82,420
Total	677	763	2	2,763	1,746	0	6,678	80,836	71,951	0	0	101	17,758	2	0	5,396	1,825	83	4,461	0	0	57	31,402	7,557	33,969	**108,735**

Source: Thomson Reuters SDC Platinum.
Notes: The total in this table excludes national deals (in bold) and thus represents a sum of all cross-border deals. Values are in US$ millions.

Appendix 3: Composition of OECD regulation indicators

Table 11: Composition of the low-level indicators for the energy sector

A. Sectoral indicator of regulatory reform: Electricity

	Weights by theme (b_j)	Question weights (c_k)	Coding of data					
Entry regulation:	1/3							
			Regulated TPA		Negotiated TPA		No TPA	
How are the terms and conditions of third party access (TPA) to the electricity transmission grid determined?		1/3	0		3		6	
			yes				no	
Is there a liberalised wholesale market for electricity (a wholesale pool)?		1/3	0				6	
			No threshold	<250 gigawatts	Between 250 and 500 gigawatts	Between 500 and 1000 gigawatts	More than 1000 gigawatts	No consumer choice
What is the minimum consumption threshold that consumers must exceed in order to be able to choose their electricity supplier ?		1/3	0	1	2	3	4	6
Public ownership:	1/3							
			Private	Mostly Private	Mixed	Mostly Public	Public	
What is the ownership structure of the largest companies in the generation, transmission, distribution, and supply segments of the electricity industry?		1	0	1.5	3	4.5	6	
Vertical integration:	1/3							
			Separate Companies		Accounting separation		Integrated	
What is the degree of vertical separation between the transmission and generation segments of the electricity industry?		1/2	0		3		6	
			Unbundled		Mixed		Integrated	
What is the overall degree of vertical integration in the electricity industry?		1/2	0		3		6	
Country scores (0-6)			$S_j b_j \, S_k c_k \, answer_{jk}$					

Source: Conway and Nicoletti (2006).

B. Sectoral indicator of regulatory reform: Gas

	Weights by theme (b_j)	**Question weights (c_k)**	Coding of data		
Entry regulation:	1/4				
			Regulated TPA	Negotiated TPA	No TPA
How are the terms and conditions of third party access (TPA) to the gas transmission grid determined?		1/3	0	3	6
What percentage of the retail market is open to consumer choice?		1/3	(1-% of market open to choice/100)*6		
			No, free entry in all markets	Yes, in some markets	Yes, in all markets
Do national, state or provincial laws or other regulations restrict the number of competitors allowed to operate a business in at least some markets in the sector: gas production/import		1/3	0	3	6
Public ownership:	1/4				
			None	Between 0 and 100 %	100%
What percentage of shares in the largest firm in the gas production/import sector are owned by government?		1/3	0	3	6
What percentage of shares in the largest firm in the gas transmission sector are owned by government?		1/3	0	3	6
What percentage of shares in the largest firm in the gas distribution sector are owned by government?		1/3	0	3	6
Vertical integration:	1/4				
			Ownership separation	Legal/Accounting	Integrated
What is the degree of vertical separation between gas production/import and the other segments of the industry?		1/2	0	3	6
What is the degree of vertical separation between gas supply and the other segments of the industry?		3/10	0	3	6
Is gas distribution vertically separate from gas supply?		1/5	0	3	6
Market structure:	1/4				
			< 50%	between 50 and 90%	> 90%
What is the market share of the largest company in the gas production/import industry?		1/3	0	3	6
What is the market share of the largest company in the gas transmission industry?		1/3	0	3	6
What is the market share of the largest company in the gas supply industry?		1/3	0	3	6
Country scores (0-6)			$S_j b_j S_k c_k$ answer$_{jk}$		

Source: Conway and Nicoletti (2006).

Appendix 4: Variable definitions and data sources

Table 12: Variable definitions and data sources

Name	Definition	Source
$M\&A_{ijt}$	M&A volume in target country *j* by acquirer country *i* in year *t*.	SDC Platinum.
$GDP_{it/jt}$	Real GDP in country *i*/*j* in year *t*.	The World Bank - World Development Indicators.
$Distance_{ij}$	Distance between country *i* and *j* in kilometres computed using the Haversine formula.	CIA World Factbook (longitude/latitude data).
$MktCap_{it/jt}$	Stock market capitalization of listed companies as a % of current GDP in country *i*/*j* at time *t*.	The World Bank - World Development Indicators.
$Credit_{it}$	Domestic credit provided by the banking sector as a % of GDP in country *i* at time *t*.	The World Bank - World Development Indicators.
$Contiguity_{ij}$	Dummy variable equalling 1 if country *i* and *j* share a common border, and 0 otherwise.	Nicita and Olarreaga (2006).
RTA_{ijt}	Dummy variable equalling 1 if a bilateral trade agreement exists in year *t* between country *i* and country *j*, and 0 otherwise.	de Sousa (2012).
ERI_{ij}	Dummy variable equalling 1 if country *i* and *j* are part of the same Electricity Regional Iniatitive, and 0 otherwise.	European Energy Regulators.
Δ $Disclosure_{ij}$	Difference in the accounting standards quality index created by the Center for International Financial Analysis and Research, which rates the 1990 annual reports of at least three firms in every country on their inclusion or omission of 90 items. The index ranges from 0 to 90.	Andrei Shleifer's data sets.
Δ $ASDI_{ij}$	Difference of legal protection of minority shareholders in acquirer and target country using an index developed by DLLS. The index ranges from a minum of 0 to a maximum of 1, where 1 indicates very strong investor protection.	Djankovic et al. (2008).
$RegEgy_{it/jt}$	Index for regulation in the energy market calculated by the OECD on a yearly basis. It ranges from 0-6, where 6 stands for a highly regulated market. The index is calculated as the simple average of the two indicators for regulatory reform in the electricity and gas industry.	Conway & Nicoletti (2006).

Appendix 5: Empirical analysis

Table 13: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
$lnM\&A_{ijt}$	8,316	0.1	0.6	0	10.0
$lnGDP_{it/jt}$	8,001	12.0	1.4	8.3	14.5
$lnDist_{ij}$	8,316	7.0	0.6	5.1	8.0
$lnMktCap_{it/jt}$	7,770	3.6	1.1	-1.8	5.8
$Credit_{it}$	7,896	4.2	0.6	2.8	5.3
$Contiguity_{ij}$	8,316	0.1	0.3	0	1
RTA_{ijt}	8,316	0.7	0.4	0	1
ERI_{ij}	8,316	0.3	0.4	0	1
$\Delta Disclosure_{ij}$	2,808	0	17	-47	47
$\Delta ASDI_{ij}$	6,840	0	0	-0.9	0.9
$RegEgy_{it/jt}$	7,434	3.8	1.5	0.4	6
$Entry_{it/jt}$	7,350	3.3	2.1	0	6
$Public_{it/jt}$	7,602	3.9	1.7	0	6
$Vertical_{it/jt}$	7,602	4.0	1.7	0	6
$Market_{it/jt}$	8,316	4.4	1.8	0	6

Table 14: OLS – Focus on financial variables

	(1)	*(2)*
ln GDP $_{jt}$	0.0262***	0.0255***
	(0.00776)	(0.00770)
ln Dist $_{ij}$	-0.00445	-0.00768
	(0.0155)	(0.0147)
ln MktCap $_{it}$	0.0203**	
	(0.00865)	
ln MktCap $_{jt}$	0.00716	0.00538
	(0.00790)	(0.00764)
ln Credit $_{it}$		0.0307**
		(0.0137)
Contiguity $_{ij}$	0.0964*	0.105**
	(0.0509)	(0.0510)
RTA_{ijt}	-0.0303	-0.0236
	(0.0275)	(0.0252)
ERI_{ij}	0.0951***	0.0813***
	(0.0324)	(0.0303)
$\Delta ASDI_{ij}$	0.0831***	0.0745***
	(0.0221)	(0.0214)
RegEgy $_{it}$	-0.0416***	-0.0412***
	(0.0116)	(0.0110)
RegEgy $_{jt}$	-0.0413***	-0.0380***
	(0.00989)	(0.00926)
Observations	6,029	6,022

Notes: Robust standard errors in parenthesis. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies.

Table 15: Tobit – Robustness test

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$ln\ GDP_{it}$	4.580***	4.556***	4.224***	2.847**	3.413***
	(0.959)	(1.002)	(0.893)	(1.122)	(0.889)
$ln\ GDP_{jt}$	2.038***	2.296***	1.536**	2.043*	1.992**
	(0.791)	(0.857)	(0.744)	(1.158)	(0.824)
$ln\ Dist_{ij}$	-4.655***	-5.012***	-1.109	-6.551***	-1.206
	(1.453)	(1.528)	(1.574)	(1.866)	(1.597)
$ln\ MktCap_{it}$		0.806			2.250
		(1.547)			(1.481)
$ln\ MktCap_{jt}$		-2.112*			-1.654
		(1.201)			(1.191)
$ln\ Credit_{it}$		-0.309			0.617
		(2.389)			(2.415)
$Contiguity_{ij}$			4.908**		5.791**
			(2.392)		(2.404)
RTA_{ijt}			-2.328		-1.534
			(2.493)		(2.724)
ERI_{ij}			5.155**		5.178**
			(2.121)		(2.139)
$\Delta\ Disclosure_{ij}$				0.106	
				(0.0766)	
$\Delta\ ASDI_{ij}$				5.181*	6.145***
				(2.887)	(2.325)
$RegEgy_{it}$	-1.797**	-1.887**	-2.135***	-2.181**	-2.291***
	(0.753)	(0.834)	(0.734)	(0.914)	(0.803)
$RegEgy_{jt}$	-1.844**	-2.363***	-2.417***	-2.643***	-2.872***
	(0.791)	(0.879)	(0.792)	(0.994)	(0.866)
Observations	6,254	5,880	6,254	2,808	5,800
Year dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	-551.5	-538.7	-540.7	-452.2	-523.3

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies. Standard errors in parentheses.

Table 16: Probit – Robustness test

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
$ln\ GDP_{it}$	0.477***	0.472***	0.439***	0.308**	0.349***
	(0.0950)	(0.0996)	(0.0892)	(0.126)	(0.0903)
$ln\ GDP_{jt}$	0.212**	0.235***	0.158**	0.222*	0.203**
	(0.0823)	(0.0890)	(0.0784)	(0.131)	(0.0859)
$ln\ Dist_{ij}$	-0.506***	-0.542***	-0.126	-0.760***	-0.132
	(0.149)	(0.156)	(0.168)	(0.204)	(0.169)
$ln\ MktCap_{it}$		0.0920			0.249
		(0.164)			(0.155)
$ln\ MktCap_{jt}$		-0.219*			-0.167
		(0.128)			(0.127)
$ln\ Credit_{it}$		-0.0336			0.0675
		(0.257)			(0.260)
$Contiguity_{ij}$			0.529**		0.624**
			(0.252)		(0.249)
RTA_{ijt}			-0.248		-0.173
			(0.270)		(0.293)
ERI_{ij}			0.557**		0.558**
			(0.223)		(0.224)
$\Delta\ Disclosure_{ij}$				0.0121	
				(0.00870)	
$\Delta\ ASDI_{ij}$				0.577*	0.647***
				(0.326)	(0.242)
$RegEgy_{it}$	-0.194**	-0.203**	-0.233***	-0.250**	-0.248***
	(0.0803)	(0.0890)	(0.0778)	(0.105)	(0.0845)
$RegEgy_{jt}$	-0.194**	-0.252***	-0.257***	-0.289**	-0.305***
	(0.0841)	(0.0928)	(0.0832)	(0.114)	(0.0898)
Observations	6,254	5,880	6,254	2,808	5,800
Year dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	-328.4	-320.5	-317.5	-259.0	-304.8

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. The regression controls for time-fixed effects. I do not report results of the constant term and time-dummies. Standard errors in parentheses.

HEC PARIS
78351 Jouy-en-Josas Cedex
Tél : 01 39 67 97 86
Fax : 01 39 67 73 44
jullienc@hec.fr
http://www.hec.fr/club-finance

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