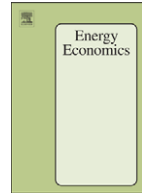




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The unbundling regime for electricity utilities in the EU: A case of legislative and regulatory capture?[☆]

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ABSTRACT

Theory and empirics suggest that by curbing competition, incumbent electricity companies which used to be, and here are referred to as, Vertically Integrated Utilities (VIUs), can increase their profitability through combined ownership of generation and transmission and/or distribution networks. Because curbing competition is generally believed to be welfare-reducing, EU law requires unbundling (separation) of the VIU networks. However, the EU allows its member states the choice between incomplete (legal) and complete (ownership) unbundling. There is tantalizing anecdotal evidence that VIUs have tried to influence this choice through questionable means of persuasion. Such means of persuasion should be more readily available in countries with a more corrupted political culture. This paper shows that among the old EU member states, countries which are perceived as more corrupt are indeed more likely to apply weaker forms of unbundling. Somewhat surprisingly, we do not obtain a similar finding for the EU member states that acceded in 2004. We provide a conjecture for this observation.

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1. Introduction

The European electricity market is undergoing major changes. Prompted by EU legislation (most notably DIRECTIVE 2003/54/EC² and REGULATION 1228/2003³), the EU member states are restructuring their electricity industry to allow for more competition which is widely believed to be welfare-enhancing. A major complication is that, at the outset, the electricity markets were almost completely controlled by large, Vertically Integrated Utilities (VIUs) that used to be regulated state monopolies. These VIUs typically still own almost all generators, as well as transmission and/or the distribution networks.⁴ **Such an ownership pattern is believed to be an obstacle for free competition** (e.g., European Commission Competition DG, 2007, p.169).

To prevent VIUs from using their influence to reduce competition, the EU has required its member states to unbundle (separate) their generation and network activities. Many members, however, have been slow in implementing these directives and many have chosen the weaker (but permitted) form of unbundling. These developments, and the fact that weaker forms of unbundling are allowed at all, are widely believed to be welfare-reducing (e.g. European Commission Competition DG, 2007, pp. 151–169). These observations suggest that the pertinent political, legislative, and regulatory processes might have unduly been influenced.

Motivated by tantalizing anecdotal evidence and a well-established literature on legislative and regulatory capture, we conjecture that a significant part of the timing of the implementation of unbundling regimes and the choice of weaker forms of unbundling regimes, as well as the fact that this choice is possible in the first place, can be explained by questionable (and possibly illegal) influence activities by VIUs. We conjecture specifically that such influence activities are more effective in countries where the policy and regulatory process is more susceptible to manipulations. Our data analysis supports our hypothesis for the old EU member states (the EU-15 countries⁵), but not for the EU member states that acceded in 2004 (from here on, the new member states, or the NMS-10⁶).

The remainder of this paper is organized as follows. In the next section, we give examples of the welfare-reducing effects of having a fully integrated VIU and then discuss types of unbundling. We also formulate our key conjecture that countries with higher CPI score (less corruption) have more complete unbundling regimes and present a summary of the data that we use. In Section 3, we explain the sources of our data, describe our strategy for analyzing the data, and state our hypothesis. In Section 4, we report our results. We conclude with a discussion in Section 5.

2. Motivation

Arguably, the major obstacle in both creating a single market in energy and allowing more competition is the dominance of large, formerly regulated VIUs that were typically state monopolies. The fact that VIUs own both generators and (transmission/distribution) networks is especially problematic as it allows VIUs to use their network ownership to increase their profits and hinder competition.

For example, VIUs can cross-subsidize their generation activities and recover their generation losses with high transmission fees. Apart from blunt refusal, VIUs have several additional tactics available to hinder access of competing generators to the network such as imposing discriminating requirements⁷ or

² "Directive 2003/54/EC of 26 June 2003 of the European Parliament and of the Council concerning common rules for the internal market in electricity and repealing Directive 96/92/EC" (OJ 2003 L 176/37).

³ "Regulation (EEC) No 1228/2003 of the European Parliament and of the Council on Conditions for Access to the Network for Cross-Border Exchanges in Electricity (OJ 2003 L 176/1)".

⁴ Generators produce electricity. The transmission network is operated by a Transmission System Operator (TSO) and is used for the transport of electricity over long distances. The distribution network is operated by a Distribution System Operator (DSO) and is used for the transport of electricity over short distances, mostly to the final consumer.

⁵ EU-15: Austria (A), Belgium (B), England (UK), Germany (D), Denmark (DK), Spain (E), France (F), Finland (FIN), Greece (GR), Italy (I), Ireland (IRL), Luxembourg (L), the Netherlands (NL), Portugal (P), Sweden (S).

⁶ NMS-10: Cyprus (CY), the Czech Republic (CZ), Estonia (EST), Hungary (H), Lithuania (LT), Latvia (LV), Malta (M), Poland (PL), Slovakia (SK), and Slovenia (SLO).

⁷ An inquiry by the European Commission finds that many market participants are "highly critical of the efficiency of existing unbundling obligations, believing that discrimination in favor of affiliates continues, and calling for stricter measures." European Commission Competition DG (2006, executive summary, p.4).

charging unreasonably high access and service fees.⁸ Furthermore, VIUs have little incentive to invest in new transmission capacity⁹ as more transmission capacity makes it more likely that generators from neighboring countries or distant areas can compete with the VIU-owned generators (European Commission Competition DG, 2007; Leautier, 2001; Brunekreeft et al., 2004). In addition, the European Commission Competition DG (2007, p.165) reported cases of VIUs having given commercially valuable inside information to their affiliated generators. This puts independent generators at a disadvantage and thereby decreases competition.

To prevent VIUs from using control over their networks to reduce competition, the EU requires member states to unbundle (separate) their transmission and distribution networks from generation. The EU distinguishes five types of such unbundling:

- 1) Unified ownership requires no unbundling; both network and generation activities continue to be owned and managed by the same company.
- 2) Accounting unbundling is the least drastic form of unbundling; separate accounts must be kept for the network activities and generation activities to prevent cross subsidization.
- 3) Functional unbundling (also called management unbundling) requires, in addition to keeping separate accounts, that the operational activities and management are separated for transmission and generation activities.
- 4) Legal unbundling requires that transmission and generation be put in separate legal entities.
- 5) Ownership unbundling is the most drastic form of unbundling. Generation and transmission have to be owned by independent entities. These entities are not allowed to hold shares in both activities.

Interestingly, the EU allows its member states the choice of an unbundling regime (legal or ownership) and the time path of implementation (quick or slow¹⁰) although there seems to be wide agreement that the quick implementation of ownership unbundling would be welfare-enhancing (e.g., OECD, 2001; Pittman, 2003; European Commission Competition DG, 2007, p.168). Legal unbundling leaves intact the incentives for curbing competition.¹¹ Not surprisingly, in many countries VIUs opposed ownership unbundling in favor of legal unbundling.¹² It is therefore an interesting question (to which our results below provide a suggestive answer) whether VIUs were able to manipulate the legislative and regulatory process in favor of the weaker form of unbundling, and whether these manipulations were a function of the integrity of legislative and regulatory processes.

Table 1 documents the considerable variation in the unbundling regimes implemented in EU member states, and the distribution of regimes over time,¹³ both for the old (EU-15 countries) and the new member states that acceded the EU in 2004 (NMS-10).

Remarkably, but perhaps not surprisingly given the available choices, many countries did not choose to implement ownership unbundling.

⁸ For example, the Commission of the European Communities (2005a,b, technical annex, p.14) claims that in 2005 in 16 out of 25 EU members, the fees for balancing services were set so as to hinder competition. Balancing is the real-time equalization of electricity supply and demand by the TSO; failure of balancing leads to electricity outages. Imbalances are caused by generators who cannot supply the exact amount they contracted for. The TSO has to make up for the shortage or excess in electricity supply and charges out-of-balance generators fees for balancing services. A TSO that is owned by a VIU can curb competition by charging excessive fees for its balancing services. This effect is aggravated by the fact that new and small entrant generators are more likely to cause imbalances than large incumbent generators (Commission of the European Communities, 2005a,b, technical annex, p.13). See Newbery et al. (2003), p.16, for an example of how the balancing system in Belgium (where in 2003 the VIU owned all networks and practically all generation) impedes electricity imports from the Netherlands.

⁹ There is a pressing shortage of transmission capacity between countries (European Commission Competition DG, 16.02.2006, p.152). This is a serious issue since it obstructs the creation of one single market in electricity (Directive 96/92/EC).

¹⁰ For transmission, legal or ownership unbundling had to be implemented by July 2004; for distribution, legal or ownership unbundling had to be implemented by July 2007. However, some countries have adopted such a slow pace of implementation that it borders on noncompliance. In 2005, while 18 EU member countries reported to have implemented legal unbundling, in 8 of these it has not been done effectively in that the network activities of the VIU are not overseen by a separate board of directors (Commission of the European Communities, 2005a,b, p.80).

¹¹ There are several concrete examples of legally unbundled VIUs that curb competition through their combined ownership of generation and transmission or distribution networks, see European Commission Competition DG (16.02.2006, p.144–148).

¹² For example, see Mulder et al. (2005) for the debate in the Netherlands.

¹³ The sources of the data are described in Section 3.

Table 1Unbundling regimes in EU member states^a

Unbundling regime	2001	2002 ^b	2003 ^b	2004	2005	2006
<i>EU-15 countries</i>						
0) None	0	0	0	0	0	0
1) Account	0	0	1 (L)	0	0	0
2) Functional	3 (D, F, GR)	2 (F, L ^c)	1 (F)	1 (L)	0	0
3) Legal	8 (A, B, DK, E, I, IRL ^c , NL, P)	5 (A, B, D, DK, P)	4 (A, B, D, DK)	7 (A, B, D, DK, F, GR, IRL)	7 (A, B, D, F, GR, IRL, L)	7 (A, B, D, F, GR, IRL, L)
4) Ownership	3 (FIN, S, UK)	5 (E, FIN, NL, S, UK)	6 (E, FIN, NL, P, S, UK)	7 (E, FIN, I, NL, P, S, UK)	8 (DK, E, FIN, I, NL, P, S, UK)	8 (DK, E, FIN, I, NL, P, S, UK)
<i>NMS-10</i>						
0) None		0	0	0	0	0
1) Account		1 (H)	2 (EST, H)	1 (LV)	0	0
2) Functional		2 (CY, EST ^c)	2 (CY, PL)	1 (CY)	1 (CY)	0
3) Legal		6 (CZ, LT, LV ^c , PL ^c , SK, SLO)	5 (CZ, LT, LV ^c , SK, SLO)	7 (CZ, EST, H, LT, PL, SK, SLO)	4 (EST, LV, PL, SK)	5 (CY, EST, LV, PL, H)
4) Ownership		0	0	0	4 (CZ, H ^c , LT, SLO)	4 (CZ, LT, SLO, SK)

^a Malta has no transmission network and is therefore not listed in Table 1.^b Greece and Ireland in 2002 and 2003 have been categorized as having implemented a combination of functional (2) and legal (3) unbundling. Italy in 2002 and 2003 has been categorized as having implemented a combination of legal (3) and ownership (4) unbundling. We leave these observations out in the main analysis but we ran several robustness tests including these observations. It turns out that inclusion does not change the results in any significant manner. For our treatment of these observations see Section A.1 in the Appendix.^c In the one of the following years the unbundling regime becomes less rigorous. While leaving these observations in the main analysis for consistency, we ran robustness tests excluding these observations. Again, this inclusion had no significant impact.

The fact that legal unbundling is the modal choice for the NMS-10 and the EU-15 countries set in 2001–2 (and a close contender even in 2003–5) is one indication that VIUs may be able to exert influence over the transmission company.¹⁴ We therefore conjecture that part of the variation in the unbundling regime choice and the speed of implementation can be explained by influence activities of VIUs. These activities may be legal (e.g., transparent lobbying activities) or may include questionable (and possibly illegal) strategies such as under-the-table payments to allegedly independent lobbyists to effect public opinion and the legislative and regulatory process. Of course, it may also be possible that outright bribes were paid.

A recent scandal in the Netherlands illustrates one questionable strategy. In January 2006, it became known that energy companies Nuon, Eneco, Essent, and Delta had secretly promised, contingent on the Netherlands' government deciding against ownership unbundling of the distribution network, a "success fee" of EURO 1.7 million to IMSA, an environmentally oriented consultancy company that presents itself as independent and idealistic.¹⁵ IMSA had forcefully argued against ownership unbundling of energy networks in the Dutch media and in an IMSA consultancy report (Van Dieren et al., 2006). This example is suggestive of the value of weaker unbundling for energy companies, but it begs the question whether the Dutch scandal was an isolated incident or unique only in that it had been exposed.

The effect of such questionable influence activities depends on the integrity of legislative and regulatory processes. Data that directly measure the integrity of such processes do not exist. We therefore use the Corruption Perception Index (CPI) of Transparency International as a proxy. The CPI is a widely used and well-established corruption assessment instrument (e.g., Mauro, 1995; Treisman, 2000) that reflects the (perception of) corruption of a country, it assigns countries a score between 1 (very corrupt) and 10 (hardly corrupt at all). The score is based on a number (up to 18) of sources, not all of them just about perception. In

¹⁴ The Dutch branch of the energy company Essent provides an example of the incumbents' rhetoric against ownership unbundling. Suggesting that unified ownership of the network provides protection against possible foreign take-over, Essent says: "We are now being chopped up, ready for swallowing by large foreign groups with headquarters in Munich or Paris" (<http://www.essent-finance.nl/pressroom/release36.jsp>).

¹⁵ See <http://www.imsa.nl/> for the idealistically flavored mission statements of IMSA. The director of IMSA and benefactor of the success fee, Mr. van Dieren, keeps a public appearance as an independent environmental activist. He is a member of the Club of Rome and the founder of a Dutch militant environmental organization called Friends of the Earth Netherlands.

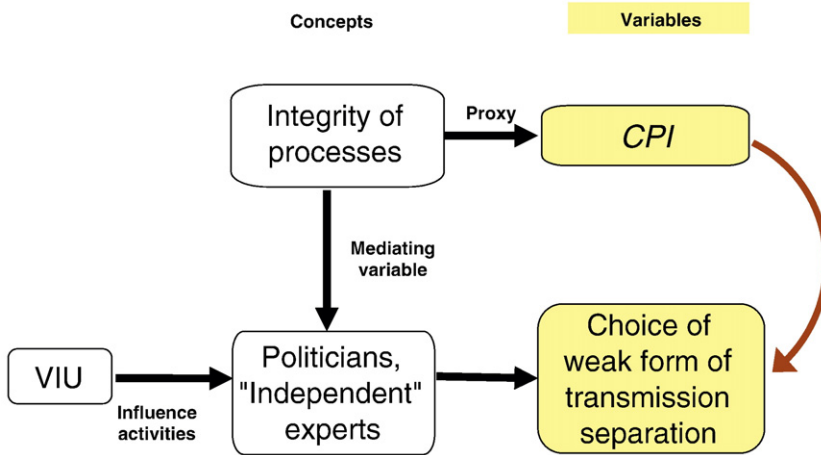


Fig. 1. Relations between concepts and variables.

some sense the name of the CPI has become an anachronism. The CPI of 2006 was based on 12 sources from 9 independent institutions (Lambsdorff, 2006).

We can now formulate our conjecture as follows:

Countries with higher CPI score (less corruption) have more complete unbundling regimes (Fig. 1).

Our study relates to an established literature on rent-seeking and corruption (Mauro, 1995, 1997; Tanzi and Davoodi, 2000; Treisman, 2000). Mauro (1997) reviews studies that show how government policies (e.g. trade, price, and industrial policies) create rents which invite influence activities and corruption. In our view, the unbundling policy is such a source of government-induced rents since the implementation of unbundling regimes less stringent than ownership unbundling are likely to bring about higher profits for VIUs. In line with the literature on rent-seeking and corruption, we expect VIUs to attempt to appropriate these rents by persuading politicians to allow the less stringent unbundling regime. We expect that VIUs will be more successful in these attempts at persuasion in more corrupt countries.

3. Data description and analysis

We collected the data on unbundling regimes and market share of the (three) largest electricity generator(s) from EU Commission (2002, 2003, 2004, 05.01.2005a, 15.11.2005b, 2006, 2008) reports on the implementation of DIRECTIVE 2003/54/EC and REGULATION 1228/2003. For consistency we use these official data for our main analysis.¹⁶

Malta and Cyprus both have a small and isolated electricity system.¹⁷ Moreover, Malta has no transmission network. We therefore have no observations on Malta and excluded those on Cyprus. We ran a robustness check by including the data for Cyprus together with a dummy variable, Small_Isolated.¹⁸ As

¹⁶ The sources used to determine the transmission unbundling regime are summarized in Section A.4 in the Appendix.

¹⁷ Countries that operate a small isolated system (Cyprus and Malta) have little to gain from unbundling as the low demand for electricity and the absence of interconnectors leave no room for effective competition (The Ministry for Resources and Infrastructure of Malta, 2006, p.42). In Malta the total installed capacity is 550 MW and in Cyprus the total installed capacity is 988 MW (Cyprus Energy Regulatory Authority, 2005, p. 17). The European Commission has indeed granted Cyprus derogation on the unbundling requirements; Cyprus is exempted from the obligation to implement transmission unbundling before July 2004. These facts seem substantial enough to affect the choice of unbundling regime.

¹⁸ Malta is such a small country that it makes do without a transmission network; electricity is transported through the distribution network. One typically does not find an assessment of the transmission and distribution unbundling regimes in Malta or Cyprus in the DG Tren reports. Therefore, we draw on information from the Malta Resources Authority (2005); the Ministry for Resources and Infrastructure of Malta (2006); and the Cyprus Energy Regulatory Authority (2005).

expected, *Small_Isolated* had a negative sign, indicating that a small and isolated system has less rigorous unbundling. Also, the categorization of the transmission unbundling regime in Latvia in the report of the Latvian regulator (The [Latvian] Public Utilities Regulation Commission, 2005) is in conflict with the categorization in the DG Tren reports. While we stick to the official EU data (the DG Tren reports) for consistency, we did a robustness test using the categorization of the Latvian regulator; this did not affect the significance of the coefficient of *CPI* in the regression for the NMS-10.

Bulgaria and Romania acceded the EU in January 2007. These countries joined 3 years later than the NMS-10 and therefore had a different time schedule for implementing EU directives. We conjectured that including Bulgaria and Romania together with the NMS-10 would not be appropriate; robustness tests including Bulgaria and Romania confirmed our conjecture (see footnote 29).

The DG Tren reports do not indicate when exactly a particular unbundling regime was in place. We therefore used the following decision rule: If the report said that the data were, say, collected in 2001, then we report them in the column “2001” even if the report itself was published in 2002. Likewise, it does not matter whether a legislative or regulatory change was enacted in January or December. We can not think of any reason why our (strong) results reported below should be significantly affected by these caveats.

The CPI data were obtained from Transparency International.¹⁹ The data on per capita GDP in thousands of Euros (fixed series at 1995 prices and exchange rates), GDP in billions of Euros (fixed series at 1995 prices and exchange rates), electricity prices (per kWh in Euro without taxes) and net electricity import relative to total available production were obtained from Eurostat.²⁰

To test our hypothesis, we ran ordered logit regressions with transmission unbundling regime and quality of implementation, respectively, as the dependent variable and *CPI* and various controlling variables as regressors.

As controlling variables, we use a time trend, *TimeTrend*, the per capita gross domestic product at 1995 prices and exchange rates, *GDP_pc*, the gross domestic product at 1995 prices and exchange rates, *GDP*, the net import of electricity relative to the total net generation of electricity,²¹ *NetElecIMP*, and an approximation of the Herfindahl–Hirschman Index²² concentration of generation, *HHI_med*.

We expect the time trend to have a positive effect (more unbundling) because over time, the European Commission has required more stringent unbundling. We included the per capita gross domestic product and the gross domestic product because we suspect that wealth and economic size of a country influence the choice of the transmission unbundling regime. We expect the new member countries (NMS-10) to have less unbundling, as they joined the reform process at a later stage. On the other hand, the NMS-10 experienced much stronger pressure for implementation of the EU directives on unbundling than the EU-15 countries; implementation of the EU directives was one of the conditions for accession in 2004.²³ These differences seem substantial enough to run separate regressions for the NMS-10 and the EU-15 countries.

We have no prior about the effect of *NetElecIMP*, the net import of electricity.²⁴ On the one hand, we expect a VIU that is a net exporter to gain more from owning the network. On the other hand, a VIU that is a net importer can hamper competing imports from abroad and thereby increase its profit.

¹⁹ Available on <http://www.transparency.org/>.

²⁰ Eurostat website for energy.

²¹ Net imports (Eurostat code: 100600) divided by total net electricity generation (Eurostat code:107100), from the Eurostat website for energy.

²² We are grateful to an anonymous referee for the suggestion to include this indicator which turned out to have a significant impact. The Herfindahl–Hirschman Index (HHI) sums the squares of the market shares in percentages of all relevant firms. The value of the HHI is thus between 0 and 10,000. Surprisingly, the HHI is not readily available. We constructed therefore a proxy that we call *HHI_med* and in which we use data on the market share of the largest (*MSLG*) and the largest three generators (*MSL3G*). The proxy is equal to a generalized average of *HHI_high* and *HHI_low*; respectively the upper and the lower bound of the true HHI. We obtained qualitatively the same results running our regressions with *HHI_high* or *HHI_low* instead of with *HHI_med*. See our website <http://home.cerge-ei.cz/svk/Unbundling&Corruption> for details on the construction of this proxy.

²³ For the obligation of transmission network unbundling no country was granted derogation. Slovenia, Cyprus, and Estonia were granted derogations for implementing parts of the energy directive 2003/54/EC, but not with regard to chapter 4, the unbundling regime.

²⁴ We included this variable in response to a referee's suggestion.

Table 2
Regression models

	EU-15 countries (old member states)		NMS-10 (new member states)	
	Model 1	Model 2 (Only significant variables)	Model 3	Model 4 (Only significant variables)
CPI	2.83*** (1.03)	2.55*** (0.74)	–1.14** (0.45)	–1.63*** (0.43)
TimeTrend	1.35** (0.52)	1.04*** (0.26)	1.18** (.46)	1.55*** (.50)
GDP_pc (in thousands)	–0.56*** (.20)	–0.53*** (0.11)	0.43*** (.12)	0.53*** (.13)
GDP (in millions)	–0.56 (0.79)		–28.2** (13.0)	–24.4*** (6.22)
HHL_med	–0.00048*** (0.00017)		–0.00019 (0.00024)	
NetImport_Gen	19.3*** (5.2)	8.38*** (2.76)	–4.42*** (1.47)	–3.79*** (1.15)
N	58 (14 clusters)	83 (15 clusters)	29 (8 clusters)	40 (8 clusters)

*** Significant at the 1% confidence level.

** Significant at the 5% confidence level.

* Significant at the 10% confidence level.

() Robust standard errors within parentheses.

We estimate the following equation:

$$\Pr(T_unbund = i) = \Pr(\kappa_{i-1} < \alpha + \beta_1 \cdot CPI + \beta_2 \cdot TimeTrend + \beta_3 \cdot GDP_pc + \beta_4 \cdot GDP + \beta_5 \cdot NetElecIMP + \beta_6 \cdot HHL_med + u_i < \kappa_i)$$

where the variables are defined as follows:

- *T_unbund* stands for the transmission unbundling regime implemented and can take the categorical values $i \in \{\text{Unified ownership, Accounting unbundling, Functional unbundling, Legal unbundling, and Ownership unbundling}\}$.
- CPI stands for the Corruption Perception Index.
- *TimeTrend* stands for time trend.
- GDP_pc stands for the per capita Gross Domestic Product in thousands of Euros (fixed series at 1995 prices and exchange rates).
- GDP stands for Gross Domestic Product in billions of Euros (fixed series at 1995 prices and exchange rates).
- NetElecIMP stands for the net import of electricity relative to the total electricity consumption in a country.
- HHL_med is an approximation of the Herfindahl–Hirschman Index of electricity generation in a country.

Our main hypothesis is:

H₀. β_1 and β_2 , the coefficient on *CPI* is equal to zero.

H_A. β_1 and β_2 , the coefficient on *CPI* is greater than zero.

We assume that the variables that we control for are clustered by country, and we therefore use the robust Huber/White/sandwich estimator clustered by country for the variance (Froot, 1989).

4. Results

Table 2 shows the results for the EU-15 countries and the NMS-10.²⁵

For the EU-15 countries, Model 1 shows the regression with significant and insignificant control variables while Model 2 shows the regression with only the significant control variables (HHL_med becomes insignificant after excluding GDP). Both models show that for the EU-15 countries, the effect of the CPI is

²⁵ At the suggestion of an anonymous referee we also ran regressions using as control variables gross electricity generation — as an indicator of the size of the market, and working days lost in strikes per thousand workers — as an indicator of unionization. The variable gross electricity generation correlates highly with GDP ($p=0.97$), using it instead of GDP therefore makes no significant difference for the results. The control variable working days lost in strikes was not significant for either the EU-15 countries or the NMS-10 and did not significantly change the results for the EU-15 countries. For the NMS-10 the inclusion of this control variable made the effect of the CPI insignificant, largely because the missing observations in this control variable diminished the number of available observations from 40 to 22.

highly significant and positive. This supports our hypothesis: The less corrupt of the EU-15 countries (a high CPI score) tend to implement more rigorous transmission unbundling. The significant effect of the CPI is robust to the method of data analysis, the particular specification of controls, in- or exclusion of most of the control variables and varying our treatment of problematic observations.²⁶

To further illustrate the importance of the variable CPI we use our regressions to predict the binary choice between ownership unbundling and less binding unbundling regimes (legal, functional, account and none) for the EU-15 countries.²⁷ Inclusion of the variable CPI, in addition to the significant control variables, adds 30% to the percentage of correct predictions for the EU-15 countries.

Not surprisingly, given that the EU directives require legal unbundling by 2004, the time trend variable *TimeTrend* shows that in later years it is more likely for any country to have more unbundling. Furthermore, the regression results show that the wealthier of the EU-15 countries (as measured by per capita GDP) are less likely to implement rigorous transmission unbundling. This is not straightforward result. We conjecture that for a given level of corruption, a wealthier country has more resources and might thus invite more rent-seeking activities.²⁸ As wealth of a country has a strong negative correlation with corruption in our dataset as well as in general (Tanzi and Davoodi, 2000; Treisman, 2000), this effect can only be found when controlling for corruption. The effect of *NetImportElec* is positive and significant ($p < 0.05$) but not very large.²⁹

Interestingly, the effect of the CPI on the NMS-10 (model 3 and 4) is opposite to the effect in EU-15 countries (model 1 and 2); more corrupt countries in the NMS-10 sample tend to implement more rigorous transmission unbundling.³⁰ Also the effect of wealth is reversed; richer NMS-10 (as measured by *GDP_pc*, the per capita

²⁶ We obtained essentially the same results using survival analysis, an alternative methods of data analysis. We used the Cox proportional-hazards regression model (Cox, 1972) and used ownership unbundling as the survival criteria. We categorized a country as being “alive” as long as it has not implemented ownership unbundling, a country “fails” at the moment it implements ownership unbundling. In the analysis of EU-15 countries, variables *CPI* and *GDP_pc* showed up in the same direction and highly significant ($p < 0.01$). The survival analysis of the NMS-10 was inconclusive as the model could not be reliably fitted due to the low number of degrees of freedom (eight observations and four independent variables). We obtained basically the same result running, as a further robustness test, linear regressions. Using ordered probit regression, a method of data analysis that uses the same technique but assumes a different distribution than ordered logistic regression, resulted in almost identical quantitative results. It takes time to decide on and implement an unbundling regime. It could therefore be argued that the unbundling regime should be regressed on the lagged CPI. However, the CPI indexes are moving averages; the CPI of any year during the period 2001–2005 is based on numerous indexes and reports over a time period including the two previous years (Lambsdorff, 2005a,b) and in 2006 including the previous year (Lambsdorff, 2006). For example, the CPI of 2005 is based on information over the period 2003–2005 and the CPI of 2006 is based on information over the period 2005–2006. Performing a regression on the CPI lagged by one year gave coefficients and significance levels that were virtually identical to the ones in model 1 and 2. As a robustness test we used data on the per capita Gross Domestic Product and on the Gross Domestic Product not as fixed series at 1995 prices and exchange rates, but corrected for purchasing power parity. As a result in the regression for the EU-15 countries in model 1 the significance of CPI slightly increased and, in model 2, the significance of *CPI* ($p < 0.012$) and *netimp_gen* ($p < 0.234$) slightly decreased, while the significance of all other variables remained unaffected. The significance of the variables in the regression for the NMS-10 was virtually unaffected. The data on per capita Gross Domestic Product and on the Gross Domestic Product corrected for purchasing power parity we obtained from Eurostat, section “Economy and finance”. Inclusion or exclusion of control variables did not greatly affect the significance of the CPI; the only critical control variable is *GDP_pc*, the per capita GDP. Without this variable the significance of the *CPI* fell to $p < 0.200$. Exclusion of the other control variables left the CPI always significant at the 5% confidence level and mostly at the 1% confidence level. In addition we ran a pooled, seemingly unrelated regression (Greene, 2003, p. 340) with the observations on the EU-15 countries and the NMS-10 together. We allowed a variable to have different effects for the EU-15 countries and the NMS-10 by using interaction variables. We thus created two sets of interaction variables: one set of variables multiplied with *EU15*, a dummy for the EU-15 countries, and one set multiplying with *NMS10*, a dummy for the NMS-10. For example the effect of the CPI was measured for the EU-15 countries by the variable *CPI*EU15* (which was created by multiplying *CPI* with *EU15*) and for the NMS-10 by the variable *CPI*NMS10* (which was created by multiplying *CPI* with *NMS10*). As a result the effect of CPI strengthened for the EU-15 countries ($p < 0.001$), and weakened for the NMS-10 ($p < 0.088$). All control variables had the same signs and their significance was largely the same as those reported in Table 2. For our treatment of problematic observations see Section A.1 in the Appendix.

²⁷ We thank Jan Hanousek for suggesting this analysis.

²⁸ See for example Svensson (2000) for a model where an increase in rents increases rent dissipating activities.

²⁹ While the effect is significant, the variable does probably not exert a large influence. When we used our regressions to predict the binary choice between ownership and less binding unbundling regimes (legal, functional, account and unified ownership) for EU-15 countries, the exclusion of *NetImportElec* from the regression lowered the percentage of correct predictions by 6% (from 76% to 70%).

³⁰ Including Cyprus together with a dummy variable *Small_Isolated* in model 3 did not change coefficients and significance levels. The coefficient on the dummy *Small_Isolated* was negative (less unbundling for small and isolated systems) and significant ($p < 0.01$), as expected. Including the newest EU member states Bulgaria and Romania did not affect the significance of the CPI, but lowered the significance of *GDP* and *NetImport_Gen*. Artificially shifting the time trend of Bulgaria and Romania 3 years back, in order to align their accession date with the NMS-10, resulted in high significance of all variables in model 3 ($p < 0.01$). This confirms our conjecture that the later accession date of Bulgaria and Romania sets these countries apart from the NMS-10.

GDP) is more likely to implement rigorous transmission unbundling. The effect of being a net importer, captured by NetImportElec, is also reversed; countries that are a net importer are less likely to choose a stricter unbundling regime. The effect of NetImportElec is however not very large.³¹ The economic size of a country (as measured by GDP) has a strongly significant effect; economically larger countries are less likely to implement rigorous transmission unbundling. This latter result is in step with the results for the EU-15 countries.

A possible explanation is that the reverse CPI effect is spurious; the effect is significant but not as robust as the CPI effect we found for EU-15 countries and effectively it is very small.³² Moreover, we have reasons to suspect that the transmission unbundling regime has not always been reported accurately for the NMS-10. For example, in four out of the eight countries in our NMS-10 sample the unbundling regime becomes less rigorous in time over certain periods. The occurrence of such “backwards progression” could be an indication of misreporting.³³

It seems likely that the occurrence of misreporting is related to the level of corruption in the NMS-10. After all, in the pre-accession stage the European Commission has exerted strong pressure on the NMS-10 to show clear signs of reform to be eligible for EU membership in 2004. Compliance with the unbundling requirements is a step towards creating a liberal market-economy and a way for an accession country to signal its commitment for reform to the EU.³⁴ Especially for very corrupt countries such formal compliance is a cheap signal relative to actually curbing anticompetitive practices and governmental corruption. This might explain why more corrupt countries choose (at least formally) more rigorous unbundling. As the rationale for misreporting was eliminated once the NMS-10 had acceded the EU in 2004, we expect to observe variance in the effect of CPI over time. Indeed, additional analysis showed that the effect of CPI differs significantly over time ($p < 0.0003$); the negative effect of the CPI on the unbundling regime was most pronounced in the period 2002–2004, but less so in 2005 and 2006.³⁵ Furthermore, the pressure to show clear signs of reform was most likely more intense for economically smaller countries, as they had less bargaining power vis-à-vis the EU. This would explain that economically large countries in the NMS-10 sample (as measured by the GDP) are less likely to implement rigorous transmission unbundling.

The case of Latvia illustrates our conjecture. The unbundling regime in Latvia was reported in the evaluating DG Tren reports of the EC on 2002 and 2003 (published timely *before* accession) as Legal. This report allowed Latvia to fulfill the accession criteria in this respect. However the unbundling regime in Latvia was reported in the DG Tren reports on 2004 (published *after* accession) as Accounting, having Latvia practically fail the accession criteria in this respect. In addition, the unbundling regime in Latvia in 2002 and 2003 are now being reported by the Latvian regulator as Accounting, which indicates that the reported Legal unbundling in 2002 and 2003 were misreports. Interestingly, Latvia was indicated by the CPI as the most corrupt country in 2001 and 2002 in our sample of EU-25 countries, and one of the smallest

³¹ When we used our regressions to predict the binary choice between ownership and less binding unbundling regimes (legal, functional, account and unified ownership) for the NMS-10, the exclusion of NetImportElec from the regression lowered the percentage of correct predictions by only 2% (from 62% to 60%).

³² The effect of the CPI became insignificant if one of the control variables in model 4 was left out of the regression. This could indicate overfitting; the regression in model 4 in Table 2 includes five independent variables for a sample that consists of only 8 truly independent groups of observations (NMS-10). Furthermore, using our regressions to predict the binary choice between ownership unbundling and less binding unbundling regimes (legal, functional, account and none) for the NMS-10, inclusion of the variable CPI, in addition to the significant control variables, added only a mere 2% to the percentage of correct predictions for the NMS-10.

³³ The countries that reported a “backwards progression” in unbundling regime are Estonia (2002 to 2003; Functional to Account unbundling), Hungary (2005 to 2006; Ownership to Legal unbundling), Ireland (2001 to 2002 and 2003; Legal to a mixed regime of Functional and Legal), Latvia (2002 and 2003 to 2004; Legal to Account unbundling), Luxembourg (2002 to 2003; Functional to Account unbundling), Poland (2002 to 2003; Legal to Account unbundling). Running a regression with these observations excluded did not change the results significantly.

³⁴ Prior to the accession of a selected group of candidate countries in 2004, these candidate countries were evaluated by the European Commission, see for example the European Economy Enlargement Papers. As can be seen in the European Economy Enlargement Papers, one of the criteria on which the candidate countries were evaluated was the state of liberalization and regulation of the energy sector. The European Economy Enlargement Papers are available at http://ec.europa.eu/economy_finance/publications/enlargementpapers_en.htm.

³⁵ At the suggestion of an anonymous referee, we tested for an interaction effect between CPI and time by inspecting the effect of CPI for individual years. We found that for the NMS-10 the effect of the interaction variables $CPI * t_i$ ($2 \leq i \leq 5$) are negative in all years, and strongly significant ($p < 0.01$) in for the years 2002–2004, weakly significant ($p < 0.10$) in 2005 and not significant ($p < 0.21$) in 2006. In contrast, for the EU-15 countries the effect of CPI is positive and highly significant for all years. An LR test ((Long and Freese, 2001, p.146), showed that in the NMS-10 the effect of CPI differs significantly over time ($p < 0.0003$). In contrast, in the EU-15 countries the effect of CPI is not significantly different over time ($p < 0.5795$). A more extensive analysis of the interaction effect between CPI and time can be found in Section A.3 in the Appendix.

Table 3

Marginal effects (in percentages) for EU-15 countries

	Account	Functional	Legal	Ownership
CPI	–0.1% (0.00)	–1.0% (0.01)	–56.0%*** (0.14)	57.0%*** (0.14)
TimeTrend	–0.0% (0.00)	–0.4% (0.00)	–22.8%*** (0.07)	23.2%*** (0.07)
GDP_pc	0.0% (0.00)	0.2% (0.00)	11.6%*** (0.03)	–11.8%*** (0.03)
NetImportElec	–0.2% (0.00)	–3.1% (0.03)	–184.2%*** (0.71)	187.5%*** (0.72)

*** Significant at the 1% confidence level.

** Significant at the 5% confidence level.

* Significant at the 10% confidence level.

() Robust standard errors within parentheses.

economies in our sample of the NMS-10 (its GDP is about 20% of the average).³⁶ As such, Latvia is a prototypical example for the relationships we found between the variables in our regression.

4.1. Sensitivity analysis

We ran tests to determine the sensitivity of our results to the exclusion of specific countries and influential observations. First we applied a jackknife technique: we repeatedly ran ordered logistic regressions of the transmission unbundling regime on the CPI and significant control variables, while excluding one specific country.³⁷ For EU-15 countries, the significance of CPI ($p < 0.001$) was virtually unaffected, the largest weakening was caused by the exclusion of France ($p < 0.003$). France is a country that lacks rigorous unbundling and scores relatively poorly on the CPI (relatively corrupt).

To identify potentially influential observations, we approximated our model by simple linear regression and then drew plots of leverage against normalized squared residuals. Influential observations can be identified as outliers in such plots. Eight potentially influential observations were found, one on Denmark (42:2006), one on Greece (72: 2001), three on Italy (96: 2004, 97: 2005, 98: 2006), and three on Luxemburg (116:2003, 118:2005, 119:2006). Running our equation excluding these observations did not affect the significance of the CPI ($p < 0.004$).

For countries in the NMS-10 sample the effect of the CPI on unbundling regime was less robust to the exclusion of countries. The significance of the CPI ($p < 0.009$) was weakened most by the exclusion of Estonia ($p < 0.468$). Interestingly, the inclusion of the observations on Bulgaria and Romania – artificially shifted three years back to align their accession date with that of the NMS-10 – into our sample strengthened the statistical relationship considerably. As a result the exclusion of Estonia from this regression lowered the significance of the CPI less drastically ($p < 0.031$).

Approximating our model by simple linear regression we identified three potentially influential observations in the sample of NMS-10, all of which are instances of the backwards progression explained in footnote 32; two on Latvia (101, 102: the misreports in 2002 and 2003), and one on Poland (136: 2002). Running the regression excluding these three observations did not change the results qualitatively.

4.2. Marginal effects for EU-15 countries and the NMS-10

To explore the size of the effect of the CPI on the transmission unbundling regime,³⁸ we calculate the marginal effect of the CPI on the probability of choosing an unbundling regime.

Table 3 shows that an increase in the CPI with one point (the country is less corrupt) increases the likelihood of the average EU-15 country to choose ownership unbundling for transmission by 57%.

³⁶ However, running the ordered logit regression for the NMS-10 excluding Latvia does not affect the significance of the coefficients much. See the sensitivity analysis below.

³⁷ We thank Jan Hanousek for suggesting this analysis.

³⁸ We expected that the same effect could be found for the unbundling regime for distribution. Running an ordered logit regression of the distribution unbundling regime of EU-15 countries on the CPI and controlling variables resulted in a positive (0.67) but insignificant ($P < 0.207$) coefficient. In a regression of the distribution unbundling regime of the NMS-10 the coefficient on the CPI was negative (–1.42) and not significant ($p < 0.136$). A possible explanation is that distribution unbundling was scheduled to be implemented later (July 2007) than transmission unbundling (July 2004), and that the effect of the CPI will show up significantly once data over 2007–2008 are available.

Table 4

Marginal effects for the NMS-10

	Account	Functional	Legal	Ownership
CPI	3.1% (0.03)	2.5% (0.02)	5.8% (0.04)	–11.3%** (0.04)
TimeTrend	–2.9% (0.02)	–2.4% (0.02)	–5.4% (0.04)	10.8%*** (0.03)
GDP_cp	–1.0% (0.00)	–0.8% (0.01)	–1.9% (0.01)	3.6%*** (0.01)
GDP	45.9%** (0.34)	37.6%* (0.26)	86.4% (0.68)	–169.9%*** (0.65)
NetImportElec	7.1%** (0.05)	5.8% (.04)	13.4% (.11)	–26.3%*** (0.10)

*** Significant at the 1% confidence level.

** Significant at the 5% confidence level.

* Significant at the 10% confidence level.

() Robust standard errors within parentheses.

Likewise, a decrease in the CPI (the country is more corrupt) increases the probability to have legal, functional or accounting unbundling.

Table 4 shows that an increase in the CPI by one point (the country is less corrupt) lowers the likelihood for the average country in the NMS-10 sample to chose ownership unbundling for transmission with 11.3%, while increasing the probability to have legal, functional or accounting unbundling.

4.3. Legal origin and unbundling regimes

In a series of papers (Djankov et al., 2002, 2003; La Porta et al., 1997, 1998, 1999, 2004) the authors suggest that legal origin has an important, unambiguous, significant and unidirectional influence on a collection of institutional performance indicators such as quality of government, judiciary and regulation; corruption; and availability of external finance. La Porta et al. (1997, 1998, 1999, 2004) found that common law countries have governments of higher quality, have less corruption, are less regulated and have more external finance available for firms than countries with other law origins. Countries of French legal origin have the worst score, while countries of German and Scandinavian legal origin are in the middle group. In line with these findings, we expect that common law countries have the most progressive unbundling regimes, that French law countries have the least progressive unbundling regimes, and that Scandinavian and German law countries are in between.

By and far, our data seem to contradict the findings of La Porta et al. (1998). While countries of French and German legal origin – in line with the findings of La Porta et al. (1998) – show less unbundling than countries of common law origin in a regressions, the differences are not statistically significant. Moreover, countries of Scandinavian legal origin show – in contrast with the findings by La Porta et al. (1998) – significantly ($p < 0.10$) more unbundling than countries of common law origin. We conclude that legal origin does not play an important role in explaining the variation in unbundling regimes.

5. Discussion

For the EU-15 countries, we found a significant and robust effect of a well-established corruption measure on the realized unbundling regime: countries that are more corrupt are more likely to have chosen weaker unbundling regimes than seems desirable. The fact that politicians that are likely to be more corrupt allow less unbundling is an indication that less unbundling is indeed a way to grant VIUs higher rents.³⁹ It also suggests that the choice EU law provides – a choice not suggested by economic theory – might be the result of a legislative process that has been compromised through questionable means of persuasion.

Our result adds empirical evidence to a literature that casts doubt on the wisdom of allowing a weak unbundling regime which facilitates the continuing existence of large utilities that are effectively still integrated. Our result suggests specifically that the questionable practices of persuasion that were

³⁹ Indeed, as we document in Section A.2 in the Appendix, less unbundling seems to lead to more rents available to VIUs, both for EU-15 countries and the NMS-10.

uncovered in the Netherlands (and that we discussed in Section 2) may be systemic; our result also suggests that VIUs in countries that are more corrupt might use – apart from legal lobbying channels and questionable (but not illegal) practices – illegal means to further their interests.

The analysis which focused only on the NMS-10 shows a weaker but statistically significant effect in the opposite direction. We conjecture that countries in the NMS-10 sample reported early adoption of formal EU requirements as a cheap means to increase their chances to be judged eligible for accession into the EU. This strategy should be especially attractive for corrupt countries, for which it is costly to implement other EU requirements such as curbing anticompetitive practices and governmental corruption. The case of Latvia seems to provide a good illustration.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.eneco.2008.07.002](https://doi.org/10.1016/j.eneco.2008.07.002).

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⁴⁰ At the time of writing the authors, most likely because of the turmoil caused by their compromised independence, did not allow the final version of the report to be downloaded anymore. The paper is available at our website <http://home.cerge-ei.cz/svk/Unbundling&Corruption>.