



Eco-efficiency outcomes of mergers and acquisitions in the European electricity industry



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ABSTRACT

The European electricity industry was recently liberalized. In response, there was a surge of mergers and acquisitions (M & As). This study addresses the effects of M & As on the eco-efficiency of European electricity producers in 2005–2013. The environmental production technology comprises CO₂ emissions as an undesirable output. I compute eco-efficiency using data envelopment analysis (DEA) and the Malmquist-Luenberger productivity index, which are both based on radial directional distance function. I observe a decreasing trend in average eco-efficiency, which contradicts the previously documented moderate efficiency gains of liberalization. The effects of M & As are isolated using second-step fractional regression. The domestic horizontal M & As, which are systematically regulated by the European Commission, have no impact. Although one cross-border horizontal deal has a same-year effect of roughly –3%, this effect becomes approximately +1.5% over a two-year timespan. Vertical domestic M & As have a short-run negative impact of 3.6% that does not persist over time. Vertical international M & As reduce the eco-efficiency by 2.1% two years after their completion. Limited evidence suggests that the conglomerate deals are at least not harmful. The policy implication is that the merger regulation should be based on DEA eco-efficiency measures. Regulators should devote more attention to cross-border M & As and particularly to vertical deals.

1. Introduction

Europe is the third-most important electricity market after Asia and North America. In 2013, the European Union (EU) represented 19.1% of worldwide energy-generation capacity and produced 16.4% of global electricity. In the early 1990s, the European energy market was highly regulated, as each state aimed to ensure its own energy security. In most of these states, the installed generation capacity largely overlapped with actual needs. Because utilities were forced to use internal resources instead of low-cost alternatives, they did not diversify their fuel sources, had low operational and corporate flexibility and relied on long-term forecasting (Serrallés, 2006). Thus, energy producers had no incentives to become efficient. The liberalization of the European electricity sector started in 1996 with Directive 96/92/EC whose objective was the establishment of a common, competitive EU market. The three declared aims were consumer choice in electricity suppliers, third-party access to the transmission and distribution system, and unbundling distribution networks from generation.

As a consequence of this liberalization, EU electricity producers have faced the challenges of drastically increased competition and turbulent operational environments. These market players initiated an intense wave of mergers and acquisitions (M & As), which allowed them

to swiftly readjust their allocations of distribution and production capacities. Prior to liberalization, energy producers functioned entirely within national borders and, hence, were commonly referred to as “national champions”. These firms pursued cross-border M & As to increase their cost efficiency, incorporate foreign managerial expertise and gain access to distribution networks. Thus, liberalization has induced M & As, a high share of which are cross-border deals. In 2010, the global energy industry completed many deals, second only to the financial sector (Schmid et al., 2012). European electricity producers have greatly contributed to that wave. In 2011, they accounted for approximately 35% of global energy intakes.

This study addresses the period governed by the second and third EU electricity directives. The second directive (2003/54/EC) has produced the most liberalization-related policy changes. The most significant changes were the establishment of independent national regulators and free entry into electricity generation. The directive further strengthened the vertical unbundling of distribution and transmission activities from generation and retail. The third directive (2009/72/EC) introduced ownership unbundling of energy production from transmission. The European Commission further promoted the independence of national regulators and established the Agency for the Cooperation of Energy Regulators (ACER).

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This paper belongs to a narrow branch of the M & A literature that aims to assess post-merger alterations in firm-level efficiency. Several studies on electricity generation and distribution are worth mentioning. The only previous attempt to address international M & As in the energy sector was conducted by Berry (2000), who did not find any impact. Becker-Blease et al. (2008) revealed the financial losses caused by mergers between US electric utilities. They also found that integration with gas activities and diversification into new geographic areas are detrimental to both market and operating performance. Kwoka and Pollitt (2010) applied data envelopment analysis (DEA) and assessed the performance outcomes of M & As in the US electricity market between 1994 and 2003. They did not find any evidence that M & As improve cost performance. Bagdadioglu et al. (2007) and Çelen (2013b) predicted efficiency outcomes of electricity market reforms in Turkey. Çelen (2013a) exploited a two-stage DEA approach and revealed the determinants of the efficiency of Turkish electricity distribution companies.

To the best of my knowledge, only three published studies have assessed firm-level post-merger outcomes in the European electricity industry, and two of these studies are devoted to the initial stage of the liberalization. Bednarczyk et al. (2010) addressed 37 cross-border M & As between bidders from Western industrialized countries and targets from Central and Eastern Europe over the 1995–2005 period. Their event study revealed a small, positive impact on target shareholder wealth in the short run. Datta et al. (2013) studied 156 mergers completed from 1990 to 2006 among electricity, gas, water and telecommunication firms. These authors revealed that combined EU utilities experienced statistically significant losses over both the short and long run. Saastamoinen et al. (2017) studied merger gains in the electricity distribution sector of Norway. These authors argue that merger outcomes significantly vary with respect to the regulatory model.

This paper investigates the outcomes of 129 M & As that were completed by the 15 largest European electricity producers between 2004 and 2013. All of these firms are multinationals that combine fossil, nuclear and renewable sources for electricity generation. I employ DEA to compute firm-level eco-efficiency and isolate the causal impacts of M & As. DEA is a nonparametric mathematical technique that is frequently applied in performance evaluation and operational research in the financial sector. I contribute to a growing strand of energy and environmental (E & E) studies exploiting DEA. Recent applications in the energy sector include Yang and Pollitt (2009), Zhang et al. (2013), Arabi et al. (2014), Atkinson and Tsionas (2016) and Duan et al. (2016).

I compute eco-efficiency scores using an output-oriented DEA model based on a radial directional distance function (DDF). I employ installed capacity and total operational expenditure as inputs and generated electricity and carbon dioxide (CO₂) emissions as good and bad outputs, respectively. I address the panel nature of the dataset with two alternative approaches. The window DEA approach assumes the absence of technological progress. I assess the obtained DEA eco-efficiency scores using a fractional quasi-maximum likelihood estimator with correlated random effects. As an alternative, I compute the Malmquist-Luenberger productivity index (MLPI), which has recently become a common measure in intertemporal efficiency evaluation. In this case, I use OLS with time and firm fixed effects as the second-stage estimator.

The results suggest that in the short run, domestic mergers reduce eco-efficiency by an average of 3.35%. The effects of cross-border deals appear to be weaker (−2.06%). In total, 93 cross-border M & As are analyzed, representing 72.1% of the sample. This study is the second since Bednarczyk et al. (2010) to differentiate between horizontal and non-horizontal energy mergers. I find that carefully regulated domestic horizontal mergers do not have a statistically significant impact. Cross-border horizontal mergers hamper eco-efficiency in the short run but stimulate it two years after completion. An interesting and somewhat

new result is that vertical mergers are detrimental to eco-efficiency. More precisely, domestic vertical mergers have a short-run negative impact of 3.63%, but this impact does not persist over time. Cross-border vertical mergers dampen eco-efficiency by 2.1% over a two-year horizon. Regulatory authorities should adapt efficiency-promoting merger regulation using this study as a reference.

The paper proceeds as follows. In Section 2.1, the pattern of M & As among EU electricity producers is characterized. I describe the DEA model in Section 2.2, and I explain the comprehensive second-stage fractional regression analysis in Section 2.3. Then, I report the computed eco-efficiency scores in Section 3.1. The effects of cross-border and domestic mergers and acquisitions are quantified in Section 3.2. I further distinguish among the eco-efficiency outcomes of horizontal, vertical, and conglomerate M & As in Section 3.3. Finally, Section 4 summarizes the research and discusses the policy implications.

2. Data and methodology

2.1. M & As

In this study, I use panel data for the 15 largest European electricity producers over the 2005–2013 period. In 2005, the firms of interest represented 54.2% of installed EU capacity and produced 55.1% of total electricity. In 2013, they generated 62.3% of all European energy and represented 53.2% of the region's capacity. The complete list of firms is presented in Table A.1.

The data on M & As were extracted from the Thomson Reuters SDC Platinum database. The sample is composed of 129 M & As. Hereinafter, I employ the term “mergers”.¹ Note that all deals in the sample are cases where one large EU electricity producer acquires a smaller entity. Mergers included in the sample satisfy the following conditions: First, the date of completion was between January 2004 and December 2013; second, the acquisition was realized by one of the studied energy firms rather than by an affiliate, associate or subsidiary company; and third, the acquirer's stake was initially below 50%, but after completion of the acquisition, the stake was 50% or higher.

The total sample is composed of 93 cross-border (72.1%) and 36 domestic (27.9%) deals. I classify a merger as a cross-border deal if the headquarters of the target and acquirer are not located in the same country. In some cases, the firms of interest finalized both international and domestic mergers in the same year. The number of deals of each type is reported separately for each firm-year observation. A timeline of M & A activity is shown in Fig. 1. European energy firms merged most intensively in 2006 and 2008, whereas the highest share of international mergers was observed in 2005. In 2004 and 2010, nearly as many domestic as international mergers occurred.

I further differentiate among horizontal, vertical and conglomerate mergers (see Fig. 2). Whereas horizontal mergers occur between electricity utilities, the vast majority of targets in vertical mergers are separate power plants that co-generate heat and electricity or use alternative energy sources. Other vertical targets operate in the extraction of fossil fuel or in the production of turbines and generators. The targets in conglomerate mergers are not related to any stage of energy generation or to energy distribution. I report the number of deals in each category in Table 1. Disaggregation at the sector level is presented in the Appendix (Table A.2).

¹ For instance, the European Merger Regulation (European Commission, 2004, 2008) is dedicated exclusively to mergers. In the M & A literature, the terms “merger” and “acquisition” are often used synonymously. However, they have different definitions. A merger occurs when two entities of similar size are combined into one new entity. An acquisition occurs when a larger firm purchases a smaller firm or entity. In practice, mergers per se are quite rare.

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