



# Restructuring European electricity markets – A panel data analysis



Marie Hyland

*Economic and Social Research Institute, Ireland*

## ARTICLE INFO

### Article history:

Received 1 April 2015

Received in revised form

16 November 2015

Accepted 16 November 2015

Available online 24 December 2015

### Keywords:

Econometric modelling

European Union

Electricity market design

## ABSTRACT

This paper looks at the restructuring of European electricity markets that has been underway since the 1990s. The restructuring process, driven largely by EU legislation aiming to create a single market for electricity, has led to significant changes in how electricity markets in member states operate. This research estimates the impact of the restructuring process on electricity prices for industrial consumers. Much of the literature to date estimating the impacts of electricity market restructuring fails to take into account the possible endogeneity of the reform process. The possibility of endogenous reform is important to consider in this context; just as restructuring may affect prices, the decision to restructure may be influenced by prices. By using dynamic panel-data techniques, I aim to overcome this shortcoming. I find that once the endogeneity of reforms is accounted for, restructuring has, as of yet, had no statistically significant impact on electricity prices. This research highlights the importance of accounting for dynamics and possible endogeneity before drawing inferences about the results of EU electricity market reform.

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## 1. Introduction

The restructuring of electricity markets has been underway around the world since the 1980s.<sup>1</sup> Restructuring (or “liberalisation”) has generally involved separation (or unbundling) of vertically-integrated monopolies, privatisation of certain segments of the electricity market and incentive-based regulation for those parts of the industry not generally amenable to competition. As highlighted by Jamasb and Pollitt (2005), the restructuring of the electricity market in the European Union is the most significant cross-jurisdiction reform of the electricity-supply industry to date. While a number of member states were early adopters of electricity market reform, for many countries EU legislation was an important driver of the restructuring process. Legislative packages on electricity market restructuring were adopted in the EU in 1996, 2003, and 2009, and the impact of these packages are analysed here.

The liberalisation of electricity markets was undertaken for various reasons: political ideology, to improve government finances, and in many cases in the context of overall liberalisation of the services sector. Within the EU, expanding the internal market to

network services was also a motivating factor, as noted by Florio (2013). In an overview of international restructuring processes, Joskow (2008) finds that the motivation for reform was generally driven by factors such as construction-cost over-runs for new power plants, escalating operating costs, and high retail prices. He also notes that falling natural gas prices and new technologies (such as CCGT power plants) in some instances resulted in falling production costs. Policy makers sought to achieve overall cost reductions in the sector that would be passed on to consumers in the form of lower retail prices. Joskow (2008) presents a “standard liberalization prescription” for successfully reforming the electricity-supply industry. Some of the main steps he includes are the privatisation of formerly state-owned and vertically integrated monopolies to create incentives for performance improvements; and the vertical separation (or unbundling) of the sector to prevent cross-subsidisation among various industry segments and to ensure equal access to the networks for all competitors. He also recommends the horizontal restructuring of the generation segment to allow competition in power production, and the integration of transmission facilities with network operations to create an independent system operator.

While the overarching aim of electricity market reform was to improve efficiencies, which should (all else equal) result in lower prices, the EU energy market restructuring process may not have been accompanied by falling energy prices for numerous reasons. As stated previously, it was believed that unbundling of the

*E-mail address:* [marie.hyland@esri.ie](mailto:marie.hyland@esri.ie).

<sup>1</sup> In 1982, Chile was the first country to begin the restructuring process, while other early reformers include Great Britain (with the introduction of The Electricity Act in 1989), and Norway (where the New Energy Act was introduced in 1990; see Bye and Hope, 2005).

vertically-integrated monopolies was necessary to foster competition in the industry.<sup>2</sup> Increased competition should increase operational efficiency and lower costs. However, it has been argued that unbundling is associated with increased operational costs and loss of scope or coordination economies. Thus, the potential impact of unbundling on the final price of electricity is ambiguous. Arguments for and against ownership unbundling of the transmission network are provided by Pollitt (2008).

Likewise, the expected effect of sector privatisation on electricity prices is unclear. A conceptual framework for assessing the impacts of reform is provided by Florio and Florio (2013). They note that, while private ownership may decrease inefficiencies and costs, this will not result in lower prices in the absence of effective regulation due to the inelastic nature of electricity demand. The importance of regulatory oversight in the context of restructuring energy markets is also highlighted by Florio (2014), who notes the continued importance of economic regulation to protect consumers. As the electricity sector becomes increasingly subject to both privatisation and market forces, there is a clear need for regulation to ensure that the benefits from restructuring are passed on to consumers and to protect more vulnerable consumer groups. This additional need for effective regulatory oversight may itself lead to higher costs, potentially offsetting other cost savings. The issue of ownership, and the various costs and benefits related to private versus public ownership, is discussed by Florio and Florio (2013), Haney and Pollitt (2013) and Del Bo (2013).

A significant change taking place in European energy markets concurrently with market restructuring is the increased focus on decarbonisation as a policy objective. As part of its 2020 Climate and Energy Package, the EU has adopted strict greenhouse gas abatement targets and minimum requirements on the proportion of electricity generation coming from renewable sources. This has led to large-scale deployment of renewable generation technologies, particularly from wind and solar resources, across the EU. As noted by Moreno et al. (2012), the ultimate effect of increasingly “green” generation portfolios on electricity prices is ambiguous. While the increased use of zero-marginal-cost power sources may help lower electricity prices, the deployment of many of these intermittent technologies has been dependent on additional infrastructure investments as well as embedded subsidies that have raised electricity prices to retail customers. Increased levels of renewable generation on the system may lead to additional network-related costs (as many sources of renewable generation are in locations far from demand centres and thus require investment in transmission and distribution networks to bring them on stream), and costs resulting from the need for back-up generation for intermittent generation sources.

Thus, while the main motivation behind electricity market reform is to increase efficiency and lower electricity prices, different reform steps may have opposing effects on prices. Furthermore, the fact that reform has taken place in the context of changes in the generation mix, with increasing levels of renewable and distributed generation, might also impact price. Indeed research by Apt (2005) (who analyses reform in the US) and Erdogdu (2011) (who considers a large number of developed and developing countries), among others, has not found a clear effect of reform on prices. Jamasb et al. (2005) have highlighted the need for more empirical studies on the effect of electricity market restructuring.

This paper seeks to contribute to the empirical evidence on the effects of restructuring in the EU. The main drivers of electricity

price are likely to be electricity demand, and supply and generation costs.<sup>3</sup> This research hypothesises that the restructuring reforms might also influence price, but whether these effects will be positive or negative is ambiguous. In addition, factors such as the generation mix, electricity trade, and other policies affecting the electricity supply industry will also influence the final price of electricity. Thus, any analysis of the effects of market restructuring on the prices consumers pay for electricity should control for these factors. While a number of different data sets on electricity market liberalisation exist, there are none that contain sufficient detail to estimate the effects of detailed reform steps while controlling for potential confounding factors. Furthermore, the most comprehensive data set available, the OECD’s ETCR database,<sup>4</sup> is missing data for a number of EU countries. Therefore, the data used in this analysis were compiled from a number of different sources (further details are provided in Section 3).

The restructuring that has taken place in Europe is the most internationally comprehensive to date; therefore, understanding the experience of the EU is relevant to electricity market reform in other countries. In particular, research analysing the effects of reform on electricity prices will be of interest to policymakers both in Europe and elsewhere. This study contributes to the research on the effects of electricity market restructuring in several ways. Firstly, the analysis considers a wider range of EU countries than previous analyses of EU electricity market reform. Secondly, the analysis includes detailed data on reform steps, including whether, and to what extent, system operators have been unbundled. Finally, in accordance with more recent and rigorous studies of restructuring, this analysis accounts for the dynamic nature of electricity prices, and for the potential endogeneity of the restructuring process. The paper proceeds as follows: section 2 contains a review of the relevant literature on this topic; section 3 presents the data used in my analysis; section 4 outlines the methodology; and section 5 discusses the results. Finally, section 6 presents some concluding remarks.

## 2. Related literature

Numerous papers provide conceptual discussions of electricity market restructuring and prescribe the appropriate steps to be taken in implementing reform. For example, Jamasb and Pollitt (2005) discuss the progress of electricity market reform in the EU. The authors note that individual member states have made significant progress towards liberalisation, but that the existence of a single market for electricity is far from being realised. An update by Pollitt (2009), highlights persistent concerns relating to levels of competition in the market. Pollitt (2012) provides an overview of the lessons learnt from the liberalisation era based on an extensive literature review. More recently, Glachant and Ruester (2014) note that progress made towards an internal EU energy market may face setbacks in the coming years due to fragmented national policies regarding, for example, financial support schemes for renewable energies. On the other hand market coupling across the EU is decreasing market fragmentation<sup>5</sup>; evidence of increased market integration, at least for some European countries, is provided by Böcker and Heimeshoff (2014).

There is a growing literature of empirical analyses of the effects of electricity market reform considering a range of outcome variables. In one of the earliest papers to empirically test the impact of electricity market reform, Steiner (2000) found that restructuring is

<sup>2</sup> Indeed research by Davies and Waddams Price (2007) does find evidence that the market share of the incumbent electricity suppliers in various UK regions is lower when these companies have been unbundled.

<sup>3</sup> As noted by Florio (2007).

<sup>4</sup> <http://stats.oecd.org/Index.aspx?DataSetCode=ETCR>.

<sup>5</sup> I am grateful to an anonymous referee for highlighting this.

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