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Analysing the impact of renewable energy regulation on retail electricity prices☆

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ABSTRACT

Retail electricity prices have substantially increased in the last decade in the European Union (EU) as a result of different regulations, raising the concern of policy makers. The growth in the support costs for electricity from renewable energy sources (RES-E) has often been singled out as a main driver of the increase in these prices. The aim of this paper is to analyse the degree of influence of RES-E promotion costs on the evolution of the retail price of electricity in the EU Member States. The analysis is carried out for households as well as for industry, with the help of a panel data econometric model. Our results show that the impact of renewable energy promotion costs on retail electricity prices is positive and statistically significant, although relatively small. Differences across consumer types can be observed. An increase of 1% in those costs induces an average increase of only 0.023% in industrial retail prices and 0.008% in the residential retail prices. This impact on retail prices is mediated by the type of support scheme which is adopted, with price-based support instruments showing a greater effect than quantity-based ones.

1. Introduction

A combination of targets and policies in the climate and energy policy areas has been adopted in the European Union (EU) for both 2020 and 2030. The 2020 package sets three key targets: a 20% cut in greenhouse gas emissions (GHG)(from 1990 levels), 20% of EU energy from renewable energy sources (RES) and a 20% improvement in energy efficiency (European Council, 2009). For 2030, these targets include a 40% cut in greenhouse gas emissions compared to 1990 levels, a 27% share of renewable energy consumption and 27% energy savings compared to a business-as-usual scenario (European Council, 2014). In its recent Winter Package, the European Commission (2016) recently presented a package of measures with the aim to contribute to a sustainable energy system in its three dimensions. These include environmental sustainability (CO2 mitigation and other pollutants), security of energy supply (diversification and reliability of energy sources) and economic sustainability (a competitive energy system, i.e., affordable energy). The package pursues three main goals: putting energy efficiency first, achieving global leadership in renewable energies and providing a fair deal for consumers (European Commission, 2016). In the area of RES, the package includes a revision of the renewable energy Directive, with cost effective deployment and investor certainty being one of its main objectives (Schmidt, 2016).

In this context, the EU and its Member States (MS) have been and are committed to the deployment of electricity from renewable energy sources (RES-E). In recent years, the share of electricity generation from renewables in the EU has quickly grown from around 14.8% in 2005 to 25.4% in 2013 (Eurostat, 2015). Arguably, the targets in the RES-E Directive for 2010 and the RES Directive for 2020 as well as MS promotion schemes for RES-E deployment have leveraged significant growth in renewables. RES-E installed capacity and generation have increased, respectively, from 202 GW and 549 TWh in 2007 to 358 GW and 888 TWh in 2013 (IRENA, 2017; Eurostat, 2015). This has been the result of substantial increases in wind and solar PV deployment, whereas the other renewable energy sources for electricity have slightly increased (in relative terms) over the same period. According to Eurostat (2015), generation from wind and solar PV has increased from 104 TWh and 4 TWh in 2007, respectively, to 235 TWh and 81 TWh in 2013. Despite low growth rates, the increase in hydro generation has been relevant in absolute terms (from 348 TWh in 2007 to 403 TWh in 2013). Biomass generation has increased from 52 TWh to 85 TWh over the same period.

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On the other hand, the large and recent increase of RES-E penetration in the EU has raised the concern of EU and MS policy makers about the costs of RES-E promotion. Policies to promote the diffusion of renewables in electricity generation were introduced in many EU Member States in the 1990s. This was mostly motivated by the need to green the electricity supply in order to mitigate GHG emissions and to help those technologies advance along their learning curves and reduce their costs accordingly. As a result, RES-E support schemes were adopted. These instruments usually provided a production subsidy (€/kWh) above the wholesale electricity price to cover the RES-E generation costs, which were above the (private) costs of conventional electricity. These costs have usually been passed to electricity consumers in their bills and have increased considerably in the last years, particularly for wind energy and solar PV. Total wind energy support costs increased almost three-fold between 2009 and 2013 (from 4,883 M€ to 12,447 M€) and solar PV increased almost four-fold (from 5,855 M€ to 23,128 M€)(Ortega and del Río, 2016, based on data from the Council of European Energy Regulators, CEER). The costs of RES-E support are passed to electricity consumers in their bills and they are often regarded as a main driver of the increase of retail electricity prices, triggering an EU-wide discussion on the need to limit those costs. First, governments in EU MS have implemented cost-containment measures, i.e., instruments and design elements which have reduced the overall costs of support in existing RES-E support schemes (Mir-Artigues and del Río, 2014; Del Río and Linares, 2014). Second, the European Commission has stressed the need to have cost-effective and market-based instruments, suggesting that the predominant RES-E support instrument (feed-in tariffs (FITs)) have been too expensive and not suitable to integrate an increasing volume of RES-E in electricity markets (European Commission, 2013, 2014a, 2014b).

The concern about higher retail electricity prices which have been triggered by RES-E support costs is related to the relevance of electricity as an input factor in the production and consumption decisions of households and firms in all production sectors. The impact of energy regulations on retail electricity prices may result in less money being available in the pockets of households' breadwinners for other consumption alternatives. This consumer surplus loss is obviously negative for the welfare of households. On the other hand, the negative impact of higher retail electricity prices on the competitiveness of firms is currently a major source of concern in the EU Member States, where the importance of a strong economy and industry is often stressed (European Commission, 2015).

Several European Commission Communications stress the need to consider the effects of the different policy initiatives, and particularly energy policy, on the retail electricity price and the competitiveness of industries. For example, EC (2012) points out that European industry is on average facing higher retail electricity prices than industries in other developed economies such as the US, Canada, Mexico and Korea, and this price gap has increased over the last decade. EC (2014c) argues that a strong industrial base will be of key importance for Europe's competitiveness and that a main weakness hampering growth is EU firms facing higher energy prices than most of their leading competitors. EC (2010) emphasises the need to consider the competitiveness effects of all policy initiatives including energy and environmental policies. Those communications also suggest the need to have an ex post evaluation of the effects of legislation/regulation on competitiveness, arguing that systematic evaluations of legislation must become an integral part of smart regulation.

Despite the relevance of the issue, research on the relative impact of the different components of the retail electricity prices (whether regulatory or non-regulatory ones) and, particularly, on the comparative effect of RES-E support with respect to other components, has been rather scarce (see next section for a literature review). To the best of our knowledge, the few contributions have generally focused on a single country and some of them are rather descriptive. Furthermore, the use of econometric models as a methodological tool to identify the relation between the relevant variables has been virtually absent. Finally, to the best of our knowledge, the impact of different types of RES-E support schemes on those prices has not been analysed before. The aim of this paper is to cover this gap in the literature. An empirical analysis of the degree of influence of RES-E support costs and different types of RES-E support instruments on the retail price of electricity (for households as well as for industry) is provided, with a relatively wide time and geographical coverage (22 out of 28 EU Member States over the 2007–2013 period). Our empirical application is based on the estimation of an econometric model with panel data, in contrast to the descriptive approaches and the approach based on electricity market models used in part of the literature.

Accordingly, this paper is structured as follows. The next section provides the background and the links to the existing literature. Sections 3 and 4 describe the methodology and the data, respectively. Section 5 includes and discusses the results of the empirical analysis. Section 6 presents the main conclusions and provides a discussion of the policy implications of the study.

2. Background and literature review

The analysis of the impact of RES-E support on retail electricity prices can be placed in the context of the regulatory analysis of the electricity sector. Among the various economic activities, electricity is characterised for being one of the most highly regulated sectors. Indeed, the regulatory changes affecting the electricity sector have been especially intense in the EU in the last two decades and have had an enormous impact on the structure of the sector and its business agents, as well as on the functioning of the electricity market itself.

Evaluating the economic impact of the regulations of the electricity sector and the changes in these regulations is a complex task. The assessment and measurement of the impact of the reform processes and regulatory changes have been analysed in the relevant literature with different approaches, including a macroeconomic approach focusing on the analysis of regulatory policies and their impact within the framework of general equilibrium theory (Chisari et al., 1999) and a quantitative evaluation of a country's regulatory framework. We follow the so-called performance-metrics approach in this paper, which has been widely used in academic studies for evaluating the impact of regulatory changes based on the results obtained in terms of pricing, investment, accessibility, service quality or the evolution in greenhouse gases emissions, among others (Cubbin and Stern, 2006; Pollitt, 2009).

Several regulatory variables can be considered as key drivers of retail electricity prices, including the promotion costs related to RES-E support, network costs, taxes and levies. Therefore, although the focus of this paper is on the first one, the others are taken into account in the econometric analysis as control variables.

There is an abundant literature on the analysis of the impact of higher levels of RES-E generation (usually triggered by RES-E support schemes) on wholesale electricity prices. The literature on the so-called merit-order effect has focused on the impact of such generation on wholesale electricity prices, leading to the general conclusion that it results in a reduction of those prices (see Sáenz de Miera et al., 2008; Gelabert et al., 2011; Würburg et al., 2013; Sensfuß et al., 2008; Fischer, 2009, among many others). Since RES-E generation is generally supported with an add-on on the wholesale price paid by electricity consumers in their bills, the issue is whether the lower wholesale price is partially or totally offset by the RES-E support, leading to an increase or reduction in the retail prices. The literature has been inconclusive in this regard, with some contributions showing an increase in retail prices (EIA, 2003; Traber and Kemfert, 2009; Costa-Campi and Trujillo-Baute, 2015) and others a reduction (Tellus Institute, 2002; UCS, 2004; Sáenz de Miera et al., 2008; Rathmann, 2007). Assumptions about the slopes of the supply of renewable and non-renewable energy play a crucial role in explaining the different results across studies (Fischer, 2009).

However, this paper adopts a different approach. The analysis