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Collateral effects of liberalisation: Metering, losses, load profiles and cost settlement in Spain's electricity system

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HIGHLIGHTS

- We evaluate the unexpected consequences of the liberalisation process in a power system.
- We uses as a natural experiment the disappearance of the DSO role as electricity supplier.
- The liberalization has had negative effects in terms of the balancing system requirements.
- The negative effects directly impact the final electricity prices and consumers welfare.

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ABSTRACT

European energy markets have undergone a major transformation as they have advanced towards market liberalisation and it is vital that the details of these developments be carefully examined. The success of liberalisation is based on smart regulation, which has been capable of providing solutions to unforeseen events in the process. Our paper seeks to contribute to existing understanding of the unexpected and collateral effects of the liberalisation process in the power system by examining a natural experiment that occurred in Spain in 2009. In that year, the electricity supply by distribution system operators disappeared. This change in retail market competition, as we demonstrate in this paper, has had an unexpected effect in terms of the system's balancing requirements. We undertake a rigorous assessment of the economic consequences of this policy change for the whole system, in terms of its impact on final electricity prices.

1. Introduction

In the 1990s, when most national electricity and natural gas markets were still monopolies, the European Union and its Member States opted for the gradual opening up of these markets to competition. Significant progress has since been made in this direction in the case of the electricity market thanks to the gradual introduction of competition via a number of legislative packages. Underlying these proposals is the strong conviction that liberalisation increases the efficiency of the energy sector and the competitiveness of the European economy as a whole.

Spain has been no exception in this liberalisation process. In line with the broader trend, the Spanish government established as a priority the opening up of the electricity sector to competition. The Electric Power Act 54/1997 represented the first step in this liberalisation process, with the establishment of a general framework for the electricity sector aimed at guaranteeing competition and competitiveness. Under this new framework, the government defined a transition period towards full liberalisation and while the introduction of tariffs of last resort in the residential electricity market did not increase liberalisation per se Federico (2010), it did represent a starting point in the drive to the deregulation of the retail market.

An evaluation of the liberalisation process conducted to date across Europe shows that not all the expected changes, especially those concerning lower electricity prices and effective retail market competition, have yet to be achieved. However, it is not the aim of this paper to analyse the results of the liberalisation process; rather, our objective is to examine some collateral or unexpected effects of the liberalisation process in the energy sector

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by examining a natural experiment conducted in Spain in 2009. The Second Electricity Directive[1] and its transposition to national regulation included a number of measures directly concerning distribution system operators (DSOs). Thus, the regulatory framework required the separation of distribution activities from other segments of the electricity value chain (i.e., generation, transmission and supply activities). In the case of Spain, prior to June 2009, distribution companies had also been responsible for supplying consumers under a regulated tariff. However, in July 2009, this regulated supply disappeared and was substituted by a last resort supply system, managed by suppliers of last resort. This change in retail market competition, as we shall demonstrate in this paper, has had consequences in terms of the system's balancing requirements.

An increase in the adjustment service costs of tertiary regulation and deviation management have been observed since 1 July 2009, together with an increase in the corresponding adjustment service costs incorporated in the final electricity price paid by consumers. The aim of this study is to provide a better understanding of the impact of liberalisation on the costs of volume adjustment. We exploit this policy event to compare the costs of adjustment in the periods before and after the policy change. Although demand forecast methods have received special attention from the academia (Cancelo et al., 2008; Ramanathan et al., 1997; Soares and Medeiros, 2008; Taylor et al., 2006), when explaining the cost of balancing services, demand deviations effects have not been as deeply studied as the effects that stem from intermittent renewable generation (Ela et al., 2014; Frunt, 2011; Glachant and Finon, 2010; Haas et al., 2013; Hirth and Ziegenhagen, 2015; Hirth et al., 2015; Vandezande et al., 2010).

Within the overall liberalisation process, during which European energy markets have undergone a major transformation, the issue analysed in this paper-energy market balance-could be considered a minor question. However, the success of any transformation process lies in applying smart regulations that can provide solutions to unexpected aspects of the process so as to exploit its potential benefits for society. In this new liberalised paradigm, the System Operator (SO) has to be more concerned with real-time system operations and the ability to manage supply and demand constantly given that additional demand deviations induced by the energy market balance can potentially result in new operational reliability issues that need to be analysed.

In this context, drawing on data for the Spanish power market for the period just before and after the regulatory change became effective, this study aims to address the question of the collateral consequences of the liberalisation process in terms of system reliability. The paper seeks to determine whether this policy change means that additional system flexibility is required thus affecting final electricity prices insofar as increasing energy market balance is addressed through ancillary services. Although the liberalisation process undertaken in Spain goes beyond the disappearance of the regulated supply and its impact on power system balancing costs, it is crucial to assess its economic consequences, especially if the last intention of the regulatory change is to benefit all electricity consumers.

The remainder of this paper is structured as follows. Section 2 provides an overview of the policy change under revision and its economic implications. The data used, empirical strategy and model specification are presented in Section 3. Estimation results are presented and discussed in Section 4. The paper ends with a final section summarising research conclusions and presenting the policy and regulatory recommendations.

2. The policy

2.1. Policy design

2009 was a key year for Spain's electricity sector and, in particular, for its retail markets. On 1 July 2009, end-user regulated electricity prices disappeared along with the DSOs' role as suppliers. Prior to that date, consumers had been able to choose between being supplied by distribution companies – through end-user regulated prices – or by retailers under free market conditions. Distribution companies would no longer be able to supply electricity to their customers.

However, these reforms, which were designed to foster competition in the retail market and to promote progress towards the creation of an efficient Internal Energy Market in the European Union, had collateral and negative consequences for balancing markets in relation to electricity system losses and the estimation process of the electricity consumption for those customers without hourly metering. As the energy metered at distribution network entry points (transmission nodes and embedded generation) is not the same as that metered at distribution network exit points owing to the existence of losses, energy demand at the power station busbars[2] is estimated using a regulated standard coefficient of losses. It should be stressed that the energy estimated according to this procedure does not have to coincide with the amount of energy eventually dispatched, arising hourly energy imbalances (see Fig. 1). As a result, the energy dispatched to meet the customers' energy requirements is not necessarily the same as that initially expected by the suppliers, appearing a positive or negative energy difference, for which a balancing process is required.

The main difference since July 2009 is the way in which this new energy imbalance is addressed[3]. In the pre-liberalisation system, the energy imbalance was resolved by the DSOs permanently matching electricity demand forecasts with the energy actually dispatched. Under liberalisation, this system is no longer valid. From a regulatory perspective, the electricity imbalances resulting from the difference between the average transport and distribution losses and the standard losses used in balancing the system as a whole are considered additional system deviations. This difference, defined as the energy market balance (EMB), requires additional adjustment services to ensure that energy generation and demand are in permanent equilibrium. Addressing the energy market balance is achieved through ancillary and energy balancing services based, in most instances, on market procedures such as the secondary and tertiary reserves and the imbalance management process, so there is a direct relationship between the size of the deviation and the cost to the system when solving it.

The analysis of the relationship between the energy market balance and the final electricity price is the main objective of this paper. When a difference arises between the energy measured at the power station busbars and the energy scheduled in the market, the system has to manage that difference by increasing production through the adjustment markets in real time. As explained next, the energy market balance implies economic consequences for both suppliers and consumers, who have to face increasing balancing costs related to the energy adjustment mechanism

[1] Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC.

[2] The power plant busbar is that point beyond the generator but prior to the voltage transformation in the plant switchyard; it is the starting point of the electric transmission system.

[3] See Appendix for a detailed explanation of the technical aspects underpinning the energy market balance (EMB).

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