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Do regulatory mechanisms promote competition and mitigate market power? Evidence from Spanish electricity market

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HIGHLIGHTS

- Competition and regulation in the Spanish electricity market.
- Net supplier and net demander behavior in the spot market.
- Panel cointegration methods used: FMOLS, PMG, MG, DFE and DOLS.
- The price cap regulation is effective in mitigating market power.
- Market power and marginal cost have positive effects on bidding strategies.

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ABSTRACT

This paper estimates the relationships between bidding quantities, marginal cost and market power measures in the Spanish wholesale electricity market for two different regulatory periods: 2002–2005 and 2006–2007. Using panel econometric techniques we find differences in the impacts on bidding strategies for both periods. Hence, the marginal cost and the market power measures affect bid and net quantities. The market power measures also suggest that the coefficient is consistently positive and highly significant for both periods.

Moreover, the market power and marginal costs have mixed effects according to the models proposed for both periods. In addition, our results point to the effectiveness of the different effects of mitigating the market power in the Spanish electricity market. For the 2006–2007 period, the proposed causal relationships are partially validated by the cointegration results, which assumes there is a significant causality between the Lerner Index and the marginal cost.

1. Introduction

In electrical systems, the supply function includes many different technologies, with different investments, fixed costs, variable costs and marginal costs. This is why the market offers different rewards for different technologies. The producer also offers positive net-supply with positive mark-ups and pushes down prices using its market power, while mark-ups are zero at the contracting point where net-supply is also zero (Holmberg and Newbery, 2010).

As the mismatches persist, specific price-quantity pairs for each of the 24 h of the following day may be different. Aggregating the bids of all power plants owned by a single generator allows obtaining its hourly supply schedule. Therefore, the expected profit maximizing supply schedule should pass through all ex-post profit maximizing price and quantity pairs (Ciarreta and Espinosa, 2010a, 2012).

A high concentration index and an inelastic demand suggest that producers use market power to set prices well above marginal costs. The Spanish electricity sector suffered from several threats with regard to its sustainability, the main ones being the difficulty in controlling market power and an increasing reliance on bidding strategies in the spot market.

The market power of the two main Spanish producers in the electricity sector is a result of their capacity with regard to pricing in the wholesale market. Endesa's and Iberdrola's ability to establish the marginal prices in the wholesale market cannot be explained only by the large power production installed capacity: the pool pricing offered throughout the different hourly periods is conditioned mainly by the differences between production technologies used by the power plants of the installed system.

Kühn and Machado (2004) showed that the way market power is exercised depends on whether firms are net demanders or net

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suppliers. They suggest that Endesa is a net supplier and Iberdrola a net demander. Although the net demander and the net supplier behavior in market power situations have been referred to by the literature, the effect of net demand and net supply bids have never been analyzed on electricity markets, which is addressed in this study.

Another factor that could have affected the competition in the Spanish spot electricity market of generators is vertical integration. However, its effect on bidding was neutralized by the fact that distribution was a regulated activity and therefore, the distributor profits were not in the objective function (distribution surplus was used for the Costs of Transition to Competition, namely CTC payments) (Ciarreta and Espinosa, 2010a, 2010b, 2012; Crampes and Fabra, 2005). In addition, the incentives provided by the regulation may interfere with the day-ahead market and results in lower prices than the ones predicted by the profit maximization behavior. On the other hand, the CTC payment and administrative price on "internal trends" in the Spanish electricity market were conditional on an average pool price not higher than the price cap revenue for the 2002–2007 period. And so, the revenues obtained for the higher price were subtracted from future CTC payments if the power producer average price exceeded that amount (Ciarreta and Espinosa, 2012). Thus, that price cap revenue criteria should protect consumers while proper regulation should contribute to a fairer market and may provide guidance as to what constitutes anti-competitive practices among market-leading energy providers (Banovac et al., 2009).

The reforms on regulation introduced by the Spanish government (among others, the administration prices on spot trades in electricity in February 2006, the abolition of CTC in June 2006, the virtual power plant for Endesa and Iberdrola, which seek to improve market liquidity and provide a more reliable price of forward contracts, and the legal framework for procurements auctions in February 2007 and April 2007) jointly induced a descending trend in price auctions in spot market in most part of 2007.

Although the application of the new regulatory measures were set up to control the level of concentration and market power, a slow progress in effective liberalization in that period still remained, which has not been analyzed in electricity markets. Accordingly, our aim is to address this gap.

As a result, the main objective of this study is to empirically investigate the impact of important factors that affect bidding strategies in the Spanish wholesale electricity market for the 2002–2007 period. In doing so, this study specifically seeks to achieve the following purposes: (i) to examine the relative impacts of marginal costs on bidding strategy; (ii) to ascertain the direction of causality between bidding strategies and marginal costs under market power mitigation. In order to achieve them, we use the Lerner indexes proxis involving two different time frames: the 2002–2005 and the 2006–2007 periods, which are characterized by different types of regulation.

Using cointegration analysis we will give an overview of what has been the reality for the variables under analysis in the 2002–2007 regulatory period, how they are related to each other and how they have been evolving. Therefore, the present study is relevant to the design of appropriate competition on wholesale market and regulatory policies, including meeting the objectives for the post integrated Iberian electricity market.

Moreover, the rest of the paper is structured as follows. Section 2 succinctly describes the Spanish electricity market. Section 3 provides the literature review. Section 4 describes the data and methodology used in the empirical analysis. Section 5 describes the econometric strategy and presents the empirical results. Section 6 concludes with some policy implications.

2. The Spanish electricity market

The Spanish Royal Decree 2019/1997, of December 26th set new rules which aims to regulate and organize the electricity production market. It was a response to the major restructuration need of the Spanish electricity sector. This Decree, however applied from January 1998 onwards, established a new structure in the electricity market, which is based on a wholesale and a retail market. This structure remains until today.

The wholesale market, called "Omel", encompasses a set of transactions arising from the participation of market players in the sessions of both the daily and intraday markets. The daily market is the platform in which most transactions take place. All production units as well as external agents registered as sellers can take place as long as they are not linked to a contract.

The demand side involves distributors, retailers, eligible consumers and external agents registered as buyers. There is a single price per hour in the daily market, which corresponds to the marginal price of that market. In each hourly timetable this price is set equal to the price of the last sale bid of the last production unit whose acceptance must have been necessary to meet all purchase bids, in order to ensure the condition that the energy sold is equal to the energy demanded.

Several technologies coexist involving many different cost structures in this new management model of the Spanish electricity market. At any time new investments in power capacity can be made in a single technology. As a consequence, sunk costs and the long service life of the facilities make it possible that the best technologies can coexist at any time.

As a result, technologies with high fixed costs and low variable costs operate almost continuously side by side with the technologies with high variable costs, whose activity is discontinuous and heavily dependent on exogenous variables such as water river flows and wind intensity. Therefore, the market for technologies has different yield for different technologies as a consequence of unpredictable phenomena at the time of investment.

The readjustment of production capacity is not possible in the electricity production sector as most of the investments are not replicable. Moreover, sinking cost discourages the abandonment of technologies whose remuneration do not cover average costs, but only the variable costs.

In this new market structure in which a mandatory market exists to carry out the sale and purchase of electric energy, there must be a neutral agent to regulate all interests at stake. This market operator receives both discriminated energy sell bids from producers for the 24 h of the following day and discriminated purchase bids from distributors, traders and other agents. For each hour of the following day, the market operator aggregates both sale bids (and deploys a price function that grows with power) and purchase bids (and creates a demand function in which price decreases with power).

For a given hour h, sale and purchase bids functions intersect determining a pair of values for price (ph) and power (Ph). All power stations that offered their production power at a price lower than ph are selected to supply during that hour, with the sum of their power being equal to Ph. All selected production centers are paid the price ph, the system marginal price of hour h. For example, if a sale bid of a power station is zero, it will be paid at the system marginal price during hour h. The revenue thus obtained will cover fixed costs of the facility. Also, the power station with the highest price has fixed costs which will be recovered by allocating the other available stations with an additional fund, called "capacity payments".

At equilibrium, the price of electricity, which is the same for all hourly production, neither take into account the differences in costs nor discriminate the origin of each KWh produced for the