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Reserve price: Lessons learned from Brazilian electricity procurement auctions

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HIGHLIGHTS

- Outcomes from Brazilian electricity procurement auctions were analyzed.
- Cases of success and frustration after adopting (in)adequate reserve prices.
- Setting different price caps per source is inefficient.
- Higher-than-normal price cap is more effective than fine-tuning reserve prices.

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ABSTRACT

Auctions have been used in several formats in the electric energy industry. In general, regulators may be uncomfortable initiating a reverse auction at a higher-than-expected final price, fearing that participants may sell their energy at an excess profitability. Nevertheless, evidence from electricity procurement auctions conducted in Brazil supports the findings that these types of auctions have the opposite effect. By attracting a larger number of agents, these auctions can trigger stronger competition and lead to lower settlement pricing. Accordingly, the Brazilian cases examined in this article present significant evidence to support this directional theory. In fact, there are some cases of electricity procurement auctions that show that inadequate auction reserve pricing leads to inefficient outcomes and may also cause the auction to fail. On the other hand, auctions with adequate price caps have led to lower final clearing prices, thus contributing to reasonable final energy pricing.

1. Introduction

Setting an auction starting price is an art, and in a descending auction, it is important that the reserve price be established in a way that stimulates more supply to join the auction without leading to an expensive outcome regardless of whether collusion is observed. Thus, the objective of this paper is to show real cases where the auction reserve price leads to the success or failure of the bidding process.

For this purpose, Brazilian electric energy procurement auctions were used as sources for the empirical insights. These auctions show cases of failure that were due to inadequate reserve prices, a situation perceived as unfavorable to the government, the consumers, and the investors. However, they also show success cases where reserve prices were established that attracted more competitors, thus leading to more efficient results that ultimately benefitted all stakeholders involved in the electricity sector.

This article is divided into three sections not including the introduction and the conclusion. The first section is a brief overview of the Brazilian electricity market. The next section presents a brief review of auction mechanisms, particularly those used in Brazilian electricity procurement auctions. The third section presents cases of success and frustration as a result of adopting adequate or inadequate reserve prices. Finally, this article presents concluding remarks and recommendations based on the lessons learned from the Brazilian energy auction experience.

2. Brazilian electricity market

Brazil is a large country (8.5 million km^2, larger than the USA when excluding Alaska) with regards to continental distances and its sizable power system, both in terms of generating capacity and grid extension. A prominent feature of the Brazilian power system is the weight of its hydropower, with more than 85% of it being generated in an interconnected system such as that of Canada or Norway. However, most hydro-capacity in Brazil is associated with large reservoirs that work as energy regulators (Araújo et al., 2008,

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p. 553; Harris, 2006, pp. 165–167). The transmission system has more than 100,000 km of lines that operate at 230 kV and above.

Dispatch is performed by the national system operator, which is closely associated with the transmission function. The trial schedule, however, does not take emissions into account and is based on 'merit order' (generators must submit the audited marginal cost) by which hydro, wind and nuclear plants must operate.

The Brazilian electricity market has two electricity-trading environments: the regulated contracting environment (RCE) and the free contracting environment. In the former, distributors purchase electricity from independent power producers through publicly regulated procurement auctions. In the later, free consumers and generators directly negotiate their own bilateral contracts.

RCE procurement auctions are one sided, i.e., only sellers can bid (winners are power producers who bid the lowest value for electricity to supply the demand), and there is one 'single buyer'—a government company that is simply a short-term coordinating intermediary between producers and distributors. In other words, distribution companies do not participate in these auctions.

Sellers' bids, on the other hand, are made by power plants, in which each auction winning power plant must be a special purpose company to sign the power purchase agreements. As a generation company bid is not allowed, it is not possible to establish a combinatory bid with more than one power plant from the same company, which may reduce the efficiency of the auction.

Distribution companies, or a single buyer acting on behalf of a distribution company, aim at "outsourcing" the supply of electricity to meet the market requirements. Accordingly, distribution companies are responsible for the demand forecasts, while each utility declares to the auctioneer the electricity demand it wishes to contract. Thus, the distribution companies sign power purchase agreements with independent power producers that are in charge of building a power plant and delivering electricity by a certain date. The fundamental difference from centralized procurement is that the government does not provide payment guarantees, nor does it assume a contractual position in the market (Maurer and Barroso, 2011, p. 34 and p. 40).

It is important to highlight that distribution utilities must contract 100% of their market through auctions. That is, if, after a 12-month period, the utility finds itself short of energy, it will have to buy energy through short-term contracts whereby prices are subject to the vagaries of the spot market. On the other hand, when a utility is over-contracted by up to 3% of the market, this cost is passed on to the consumers, thus acknowledging that a perfect forecast does not exist and allowing for a tolerance of forecast errors. As a result, distribution utilities may not have the incentive to buy at the lowest price, as all contract costs up to 103% of their load will be paid by consumers (Araújo et al., 2008, p. 558). Where the price is considered high, the government-owned single procurement buyer is allowed to buy less electricity than necessary for the load growth to achieve the lowest possible price, a decision that is not expected from distribution companies.

These power purchase agreements are for periods of 15 (thermal), 20 (wind) and 30 (hydro) years with the beginning of the supply year. Each contract is entered into and irrevocable by its term of validity.

The long-term energy contracts (15–30 years) were created to attract investments in generation and in countries with high load growth (Araújo et al., 2008, p. 550), as long-term contracts have the effect of reducing the incentives for the generating companies to manipulate output and prices in spot markets (Pittman and Zhang, 2010, p. 396). Additionally, according to Arellano (2003, p. 8) theoretical and empirical literatures show the more a generator's capacity is contracted forward at fixed prices, the less incentive the firm has to manipulate the spot market and the closer the outcome is to a competitive market.

3. Brazilian electricity procurement auction

3.1. The descending clock Anglo-Dutch auction

The government of Brazil (GoB) decided to adopt the descending clock (Cramton and Stoft, 2007, p. 7) Anglo-Dutch (Klemperer, 2002, p. 181) auction. In this design, there is first an "oral" bid (an electronic bid) stage, i.e., concurrent, and the classification is based on sorting in descending order (reverse English auction). The second stage is a "sealed envelope" bid (an electronic final bid) stage in which the players qualified in the initial stage are allowed to offer one single and final lowest bid. The declared winners of the auction are those who offer the lowest prices for the quantity demanded.

Cramton and Stoft (2007, p. 7) state that descending clock auctions have excellent dynamic properties of efficiency due to their robust disclosure of price. These auctions operate as follows: (i) the auctioneer announces a price cap, (ii) the players indicate the quantity they intend to meet at this price cap, (iii) the auctioneer determines the excess supply and announces a lower price for the next round, and (iv) the players accept or reject the current price.

In the descending clock auction mechanism, the quantity supplied decreases as the current price decreases, and the equilibrium price is reached when the offer is equal to the demand.

According to Klemperer (2002, pp. 169–170) and Maurer and Barroso (2011, pp. 110–111), the concerns in the design of a public auction are the same that any regulator would recognize as key concerns: collusive and predatory behaviors, barriers to the entry of new competitors, and more generally, market power. Failure to address these issues can lead to failure of the competition (Klemperer, 2002, p. 187).

In addition, Bülow and Klemperer (1996) state that a major concern in practical auction is its ability to attract candidates, as few players may result in low profitability for the auctioneer, and the bidding process thus may be potentially ineffective. Cramton and Stoft (2007, p. 89) had the same worry and further argued that a lack of competitiveness occurs when there is no oversupply of at least 4%. Thus, in case of supply failure, new projects are contracted based on the reserve price.

In addition, Maurer and Barroso (2011, p. ix) noted that the foundations of a successful auction include (i) the rule of law and enforcement of contracts, (ii) the regulatory stability and consistency in the auction rules, and (iii) the avoidance of a lack of transparency, i.e., not leaving the auctioneer (often the government) with a great deal of flexibility in establishing parameters and formulas.

Particularly in the case of an electricity auction, the biggest concern of Cramton and Stoft (2007, p. 8) was to avoid market power behavior as, according to them, there is a strong incentive for existing generators to exercise that power. The reason for this is that the major generators have significant market shares and existing plants have substantial sunk costs, while new plants account for only a small fraction of the total. As a result, any of the large generators can unilaterally set the equilibrium price by withholding supply, a factor that could be particularly important in the Brazilian case, where eight[1] major agents of power

[1] Eletrobras (38,336 MW), Petrobras (7900 MW), CESP (7455 MW), Tractebel (6965 MW), Cemig-GT (6783), Copel-GT (4545 MW), AES Tietê (2651 MW) and Duke Energy (2151 MW).