

Measuring Marginality: the Evolution of Competitiveness in the Italian Electricity Market

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Overview

Despite the drastic changes in the production technologies, the generous public funding and incentives, and the penetration of renewables, electricity prices in Italy remain higher if compared to EU markets counterparts. We address the question of going to the roots of this phenomenon that can be attributed to Electricity Market design, to strategic bidding of producers, or to the structure of the generation industry. Different explanations emerging from the analysis justify different policy prescriptions for the regulatory authority.

The current market structure allows a few firms to exert considerable market power that hinders the transmission of cost efficiency of innovative technologies to market price. According to the current market design, the equilibrium price is determined by the highest accepted bid, after arranging all received bid price-quantity pairs in increasing order according to their offer. This feature might significantly dampen the positive effect on prices due to the low marginal cost of production of renewable plants. Indeed, the most relevant interactions for price determination are those that take place around the equilibrium point where supply and demand meet. To study this issue, we introduce and measure the notion of *marginality* of a plant, i.e. how close a plant is to being the marginal producer. The idea of marginality is to assess the importance of a production unit in price determination or closeness to marginality, measured by the frequency of the event. The second step is to analyse the unit ownership and technology: the first point helps us to detect possible portfolio bidding by firms while the second point allows us to calculate the degree of dependence of the system from gas as productive input.

Methods

To investigate the evolution of competitiveness and marginality of firms and technologies, we use disaggregated plant-level data of daily bids in the Italian day-ahead market from 2015 to 2023. Our large dataset contains information regarding bids submitted every hour of the day by each plant in the day ahead market and bilateral contract, matched with their status (accepted, partially accepted or rejected), and the price awarded to each one. Since the market is hourly, we mainly focus on four hours (03,09,13,20) which are meant to capture the most representative peak and off-peak phases of the market and ease the computation. The determination of the marginal unit requires an ad hoc procedure. Given that we only know plants IDs, bids and outcome, we can restrict our attention to those accepted and look at the Merit Order (MO) established by the System Operator (SO). In the analysis we consider the plant with the highest MO number, and also the zonal configuration, since the market splits according to macro-regions of the Italian territory, whenever transmission constraints are present. Indeed, market splits quite often, though there are clear indications of a decreasing trend. When such separation happens, we pick the marginal plant of the market to which the northern zone belongs to.

Results

For every hourly market considered, we identify the marginal plant, which allows us to retrieve the specific producer and technology, as can be seen in the figures, for the H20 market of 2023 and for the top 30 most marginal plants of the period 2015-2023. Despite the significant change in market structure and the substantial increase of renewable plants, natural gas remains by far the most likely marginal technology and the role of the dominant firm (ENEL) is still unchallenged. We proceed to identify the plants that are most likely to be marginal for each year and find that throughout the period such tail plants (that we set to 20 for simplicity) make the price around 45-50% of the time, showing no significant evolution over the 9 years. To measure the marginality of the top plants, we also compute some indexes, for instance the ADM (average distance from the marginal), which represents the average difference in MO number between the considered plant and the marginal one. Applying such index year by year, we register an increase in volatility of the ADM index of the top marginal plants, which we interpret as a growth in the uncertainty at the margin.

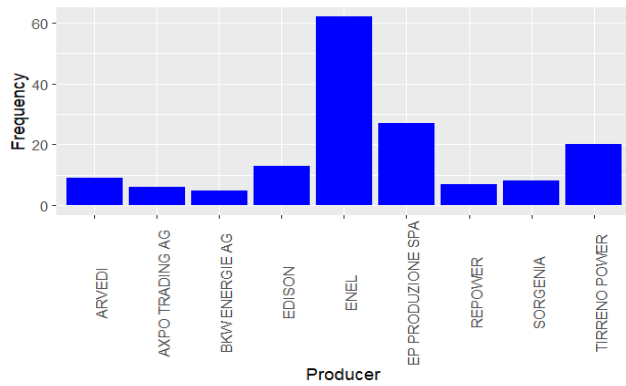


Fig.1: Top 30 marginal producer for 2023

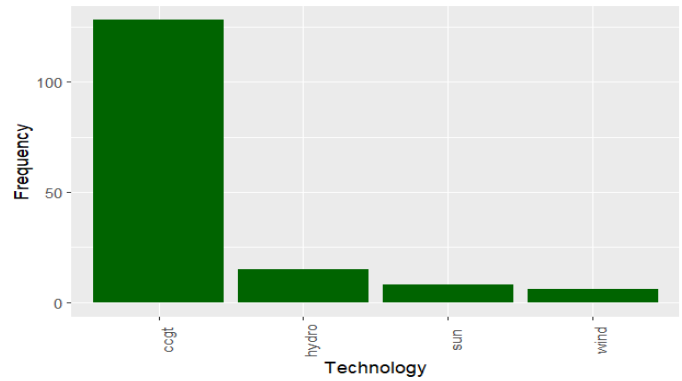


Fig.2: Top 30 marginal technology 2023

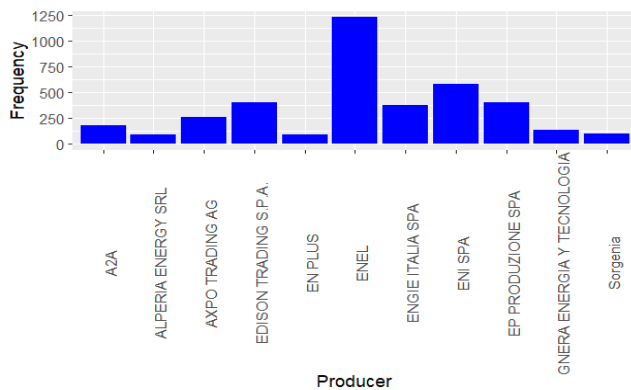


Fig.3: Top 30 marginal producer 2015-2023

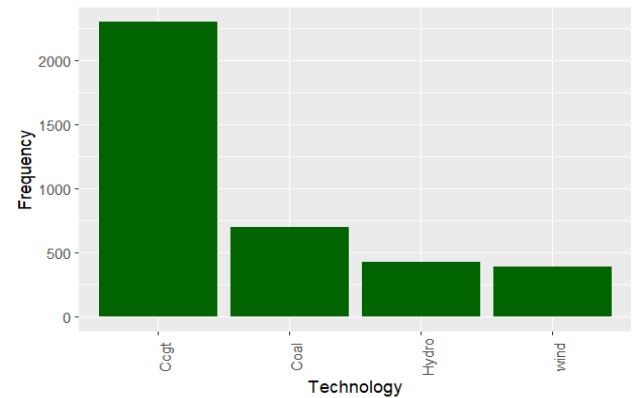


Fig.4: Top 30 marginal technology 2015-2023

Conclusions

Using a large dataset containing disaggregated plant-level information, we investigate the changes occurred over the last 9 years in the final segment of the supply curve of the Italian (day-ahead) electricity market. Although a sharp increase in renewable production and in the composition of the production technology profile, renewables have still a hard time challenging the predominant role of natural gas as marginal technology and represent no threat to traditional plants. As confirmed by our analysis, though some minor changes occurred, a few dominant producers dominate the price-making activity and the introduction of more renewable sources, especially when the investment is realized by the same dominant operators, is unlikely to change the situation since the bidding strategy is determined at corporate group level.

References

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