Method and Initial Results

Xinyu Cao

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1   Data and Empirical Method

The method we use is that we use a perfect Cournot competition model and then put into a repeated game setting with punishment. The data I collect is the Iberian electricity bidding data. The data is open source regulator data from Iberia market, we have the hourly price and also producer and consumer's bid at each hour interval, therefore we indeed have both supply and demand of the market. In the mean time, we have the data of each firm's power plant's engineering data, such as technology type, fuel usage, and energy generation rate combined with fuel price, we could estimate a reasonable marginal cost data at firm level. Using both marginal cost and bidding price at firm level, we are able to identify the behavior of market power or collusion. The difficulty I currently encountered is that I need to build a structural econometric model to identify the structural model of price change relative to the marginal cost change, because since there are reserve for the firm, the marginal cost of the firm's production might not exactly the same as the current energy price, and

1.1   Sequential Markets in Iberian Electricity Market

In Iberian electricity market, there are the a day-ahead forward market and a real-time spot market. Most energy production is first allocated in the day-ahead market, the real-time market is used to

balance the demand and supply. The market is scheduled as follows, first the auction started in the day-ahead market(t-1), supply side and demand side bidding for their desired price and quantity. Thus day-ahead market set up the baseline production according to the production forecast by demand side and also a regulator reserve for expected uncertainty.

2   Summary Statistics

2.1   Hourly Market Price for Iberia Electricity Market

First, we plot some summary statistics of the hourly price of electricity in Iberian energy market from 2002 to 2015. We could see that the market is dominated by few strong outlier. This reflects three basic feature of the energy market. First of all, the demand of electricity market is highly uncertain and inelastic. Civilian energy price usage does not reflect the price change of the wholesale market, people usually receive a flat price over time. Because energy production investment is a long term effects, for producer. Utilizing the current capacity, it's either expensive to increase production after certain capacity or impossible to increase production. In the mean time, electricity is very expensive to store, therefore it's impossible for firm to arbitrage through peak and off-peak periods. Therefore we saw the hourly price fluctuated between 20 and 80 Euro per MWH, and in extreme cases to 0 and 100. However one of the feature of this data(figure 1) surprised me is that the price more frequently hit zero after 2010, it seems that the electricity market started to oversupply and this oversupply is consistent, and as a benchmark this is quite different the data from Nordic market(figure 2).
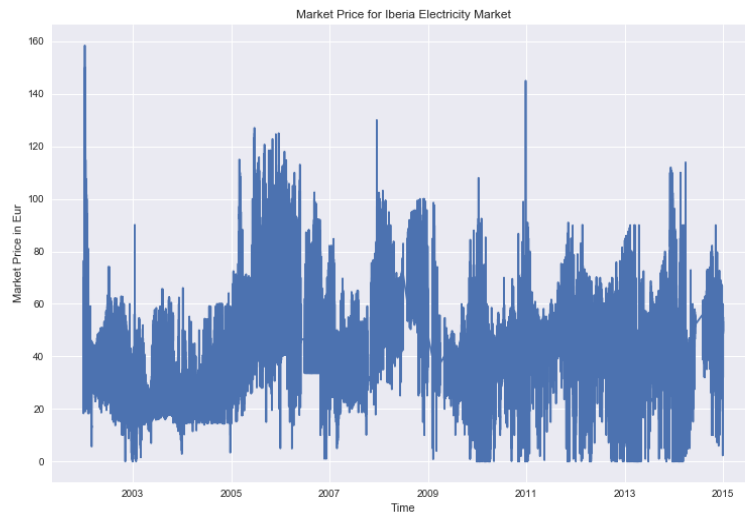
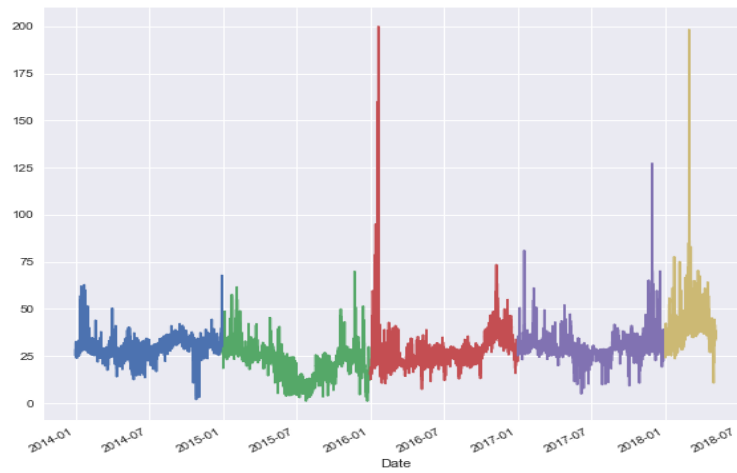Figure 1: Hourly Market Price for Iberia Electricity Market

Figure 2: Hourly Market Price for Iberia Electricity Market

2.2 Market Share and Total Quantity

After we examined the price part of the data, we need to examine the quantity side of the data. In total, there are 2.77×10^8 mega watt hour(MWH) (10^6 watt) are traded in our data, while the actual energy production in this area is 2.74×10^2 tera watt hour(TWH) (10^{12} watt) and 49.1 TWH at Portugal. Our data actually captured the almost all electricity production and bidding in the market. There are 8 largest firms that have more than 1% of the total production, and 7 firms that have more than 1% of the total demand. While in the same time, 38 firms has more than 0.1% of the production and 26 of firms has more than 0.1% of the demand. In total there are 255 firms bid in the market, of which 69 are supplier and 186 are consumer.

References