Market Power in Iberian Energy Market

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Introduction

This research aim to identify the market power firm exercise in the Iberian energy market in 2003 -2015.

The Data

We have the data of the hourly price and quantity of Iberia energy market bidding. 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. 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 large firm. This reflects three basic features of the energy market.

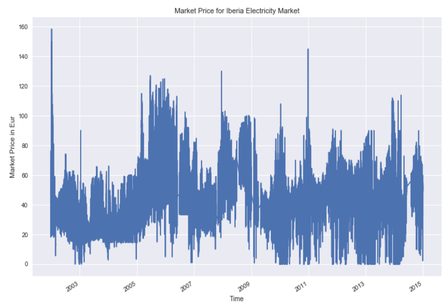

Figure 1: Hourly Market Price for Iberia Electricity Market

The Market Concentration

The market is mainly consist of 3(in supply side) or 4(in demand side) major company, and a share of 70 - 80% of the production and the demand are from the

Table 1: Summary of Market Share of 2013

Type of Firm	Significant (> 10%)	Large (1%, 10%)	Medium (0.1%, 1%)	Small (< 0.1%)
Supply Side	3	10	28	31
Demand Side	4	7	19	160

Empirical Method Estimation

The hypothesis is that the price is negatively correlated with the supply side market power and negatively correlated with demand side market power.

$$y_i = \beta \mathbf{X}_i + \gamma D_i + \varepsilon_i$$

where X is a vector of dependent variable, in model 1, we add the model of the measures of concentration: HHI index, the market share of four largest production firms. D is the log weekly demand of the electricity.

Declined Supply Side Concentration

Indeed after the wholesale market deregulation, we could see a sharp decline of the market concentration, here we measure market concentration by Herfindahl-Hirschman Index(HHI Index). Note a number of 1 is perfectly concentrated in 1 market and 0 means there are infinite amount of firm share a very small fraction of the company.

$$H = \sum_{i=1}^{N} s_i^2$$

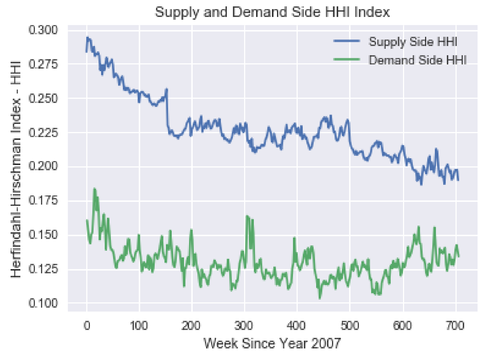

Figure 2: Supply's Concentration

Estimation Results

Now I run three sets of OLS estimation, in those estimation I run as follow. In model 1, I add supply side measures of concentration, and in model 2 I add demand side measures of concentration, in model 3 I add both side measures.

Table 2: The Regression Results

	Model 1	Model 2	Model 3
Demand_HHI		-43.69***	-44.48***
		(5.63)	(7.06)
Demand_perc_1_largest		15.69***	15.87***
		(2.60)	(3.29)
Demand_perc_2_largest		14.94***	15.30***
		(1.73)	(2.35)
Demand_perc_3_largest		9.69***	11.48***
		(1.48)	(1.88)
Demand_perc_4_largest		6.62***	5.88***
		(1.07)	(1.81)
HHI	6.92		15.03***
	(5.34)		(5.18)
lnQuant	0.19***	0.07**	0.18***
	(0.06)	(0.03)	(0.06)
perc_1_largest	-1.42		-8.67***
	(3.32)		(3.20)
perc_2_largest	-3.10		-5.77**
	(2.69)		(2.55)
perc_3_largest	0.22		-6.62***
	(2.12)		(2.43)
perc_4_largest	3.78***		1.52
	(1.21)		(1.48)

Random Forest

I run a random forest model, and showed that the indeed those features are both account for similar portion of the variance, therefore, it's important to keep track of all of them, and the results is robust.

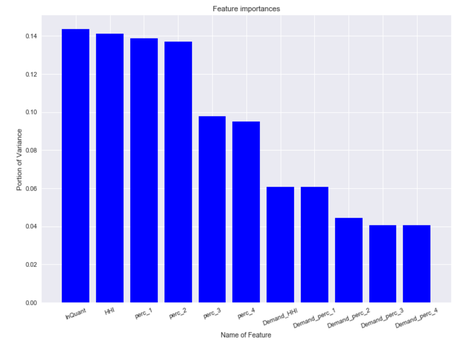

Figure 3: Feature Importance of Random Forest

Conclusion

In conclusion, we saw that the market price is explained by demand, supply side market power and demand side market power. As we predicted, the price is positively correlated with weekly demand and supply side market power and is negatively correlated with demand side market power.

Extension

This model is a correlation model, therefore still needs to add more component of the causal inference. What's more the data of the cost of individual firm could be take into consideration. Another potential extension is the second order method (Abrantes-Metz et.al. 2006). Due to Cater agreement, firms in Carter are harder to adjust the price, therefore if we could identify that firm with higher price have a lower volatility, then we are more confident to say there might be collusion.

Reference

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Brown, Donald M.; Warren-Boulton, Frederick R. (May 11, 1988). "Testing the Structure-Competition Relationship on Cross-Sectional Firm Data". Discussion paper 88-6. Economic Analysis Group, U.S. Department of Justice.
Abrantes-Metz R M, Froeb L M, Geweke J, et al. A variance screen for collusion[J]. International Journal of Industrial Organization, 2006, 24(3): 467-486.