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NON-COMPETITIVE POTENTIAL IN THE IRANIAN ELECTRICITY MARKET

Abstract:

The electricity markets worldwide have distinctive particularities due to some political and historical reasons. However, principal guidelines of market design remain very similar. The Iranian electricity market has been inaugurated as a pay-as-bid market in 2004. Although the Iranian electricity market has had positive consequences, the economic discussion about proper market design and architecture is in its infancy. The main goal of this paper is analyzing market power and efficiency in the Iranian electricity market.
Generally, in spite of the fact that Iranian electricity market is not a high concentrated market, it has potential for non-competitive results. Analyzing results and other facts of the market shows that the most important reason for this is the urgent shortage of supply threshold in this market, rather than the extent of concentration in the industry.

Keywords:

market power, efficiency, Iranian Electricity Market

JEL Classification: D49

1. Overview

The electricity markets worldwide have distinctive particularities due to some political and historical reasons. However, principal guidelines of market design remain very similar. The Iranian electricity market has been inaugurated as a pay-as-bid market in 2004. Although the Iranian electricity market has had positive consequences, the economic discussion about proper market design and architecture is in its infancy. The main goal of this paper is analyzing market power and efficiency in the Iranian electricity market.

There is a diverse spectrum of studies of the performance of electricity markets. One group of the studies makes use of structural indexes to examine market power (Hogan, 1997). The most well-known of these indexes include:

- Market Share
- Hirschman-Herfindahl Index (HHI)
- Residual Supply Index (RSI)
- Pivotal Supplier Indicator
- Supply Margin Assessment

Another group of the studies has assessed market power based upon Behavioral Indices and Analysis (Joskow et al, 2002; Baker et al, 1999; Wolfram, 1999; von der Fehr et al, 1993). In this case, a comparison of price and marginal cost is used to estimate efficiency and power of the market. Other methods included in the Behavioral Indices and Analysis group are based on profit analysis, economic withholding, and physical withholding. These methods deals with the behavior of the players in power markets and are based on the idea that “if a generator would profit (in expectation) from the sale of an additional unit of electricity, assuming the market price would not change, and the generator chooses not to sell, it has exercised market power” (Stoft, 2002) .

A third group of studies related to efficiency is based on Simulation Models. These models deal with the comparison of actual and hypothetical outcomes. Competitive Benchmark Analysis belongs in the group of these models. In this case, the actual behavior of the players will be compared with the optimum simulated behavior (S. Borenstein et al, 1999; Mansur et al, 2001; Mansur, 2008).

Oligopoly Simulation Models is the most common method in the group of studies related to the assessment of the market power. To this end, Cournot’s model has been used a lot. Supply Function Equilibrium, first used by Klemperer and Meyer, is also one of the common methods in assessing and simulation of power markets (Green et al, 1992; Holmberg, 2009).

2. Methods

The paper makes use of the structural indexes to examine the efficiency of the Iranian power market. First, the market share index and the HHI are calculated for the Iranian market in 2012. The values of these indexes are also calculated for the daily load peak hours in order to obtain the actual market fluctuation. Then, the Iranian supply threshold was calculated using the RSI.

The first indicator of the competitiveness in the aforementioned market is market share, the percentage of sales that a firm controls in a relevant market. It is better to obtain market share based on the capacity not energy production in order to have good assessment about potential market power. Moreover, for better results, we have calculated market share in two scenarios. In the first case we have calculated market share including renewable capacity and in the second scenario without renewable energy capacity[1].

The Hirschmann-Herfindahl Index is given by the formula:

$$HHI = s_1^2 + s_2^2 + \cdots + s_N^2$$

Where S_i is the market share of the i^{th} firm.

The Residual Supply Index (RSI) is defined as the ratio of residual supply (the total available supply minus the capacity of a large supplier) over demand.

RSI = (Total Supply - Largest Seller's Supply) / (Total Demand)

$$RSI = \frac{AS - C}{AD}$$

The RSI is better estimation for analyzing market power. The most important characteristic of this index is its economic logic which takes into account both supply and demand sides. The RSI captures the proportion of market that residual suppliers must meet. The lower the RSI, the lower the residual supply elasticity. When residual suppliers reach their capacity limits, the elasticity of residual supply is zero, and the Price-cost mark-up may approach infinity. When residual supply is greater than 100 percent (suppliers other than the largest firm have enough capacity to meet the demand of the market), the largest firm has less influence on market clearing price. On the other hand, if residual supply is less than 100 percent of demand, the largest firm becomes the only source to fill the shortage and, thus, is the pivotal player in the market.(Vassilopoulos, 2003)

3. Results

[1] In the Iranian electricity market the share of renewable capacity is about 16 percent. But from energy production point of view, this is less than 4 percent.

The Iranian electricity market and its Grid Management Corporation (IGMC) were inaugurated in 2003 and 2004, respectively. Table 1 shows the main characteristics of this electricity market in 2012.

All data provided by Iranian Grid Management Company (IGMCO) and TAVANIR. Total hourly demand and generation output data is taken from IGMCO, Dispatching Report, 2005-2012. The output of all power plants for each hour is also taken from these data.

As I mentioned before, market share was calculated in two different scenarios. Based on the results Tehran Regional Electricity Company is the biggest player in the Iranian market with 19% and 21% market share in first and second scenario, respectively.

For Market share in the peak hours of different days of the year for the biggest supplier is as follows:

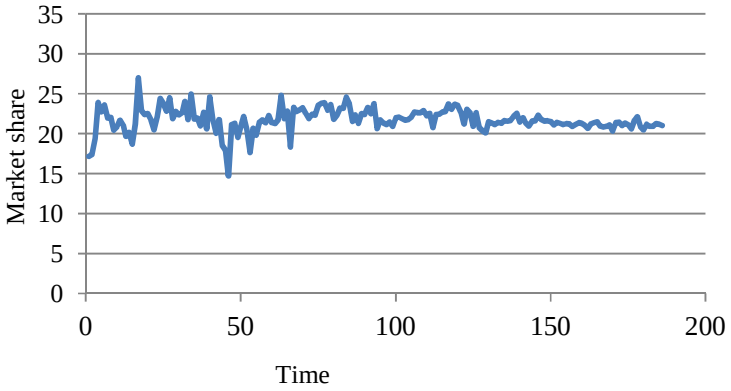

Figure 1: Fluctuations of market share of the biggest producer in the Iranian power market

HHI in the period studied is as follows:

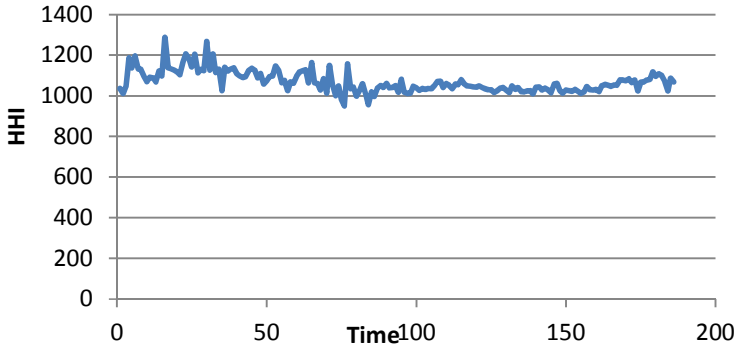

Figure 2: HHI fluctuations in the Iranian power market

In the period studied, the Residual Supply Index looks like this:

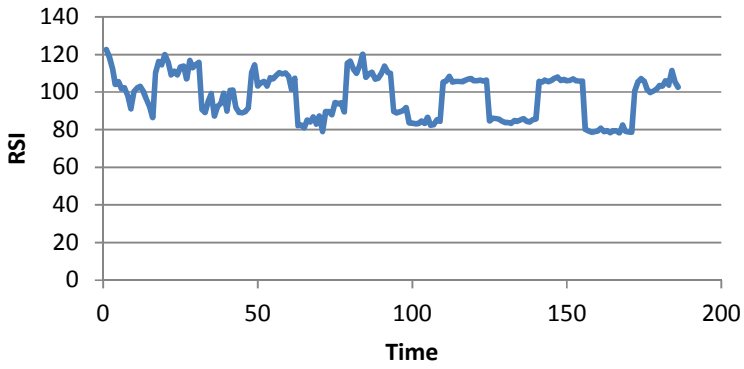

Figure 3: RSI in in the period studied in the Iranian power market

4. Conclusion

1. Trend of the market share changes of Tehran Regional Power Company in the duration of the study exhibits a lack of significant changes in the market share of this producer. Specifically, in the summer when demand is at a maximum, variation is very low, and in the spring the variation is between 27 and 15 percent.

2. Within the duration of the study, The Herfindahl Concentration Index varies between 1280 and 980.

3. Based on the RSI calculations, Iranian market has a high potential for non-competitive behavior.

Generally, in spite of the fact that Iranian electricity market is not a high concentrated market, it has potential for non-competitive results. Analyzing results and other facts of the market shows that the most important reason for this is the urgent shortage of supply threshold in this market, rather than the extent of concentration in the industry.

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Table 1. Iranian Electricity Market Profile

Total Nominal Capacity	**65212 MW**	
Total Actual Capacity	57522 MW	
Maximum Demand	42367 MW	
Generation	Steam Turbine	25%
	Gas Turbine	37.10 %

	Combined Cycle	22.30 %
	Hydroelectric	13.70 %

Source: (TAVANIR, 2012) and Calculations