

A Study on a Non-cooperative Game Theoretic Pricing Framework in a Oligopolistic Electricity Market

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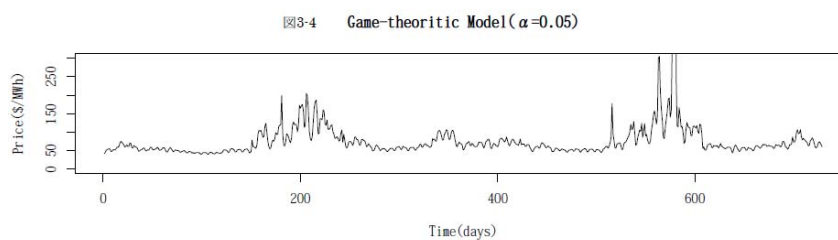
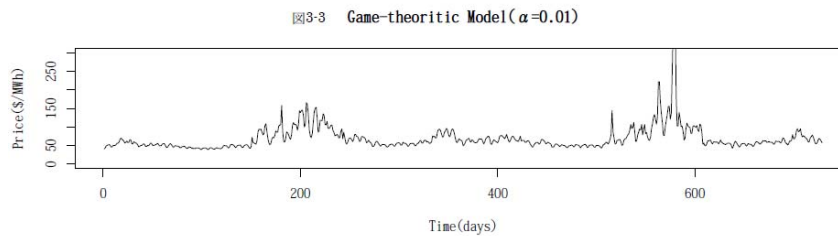
(1)Overview

We examine the manner how equilibrium spot prices process would determine in a wholesale oligopolistic electricity market. To investigate this issue, we use a model to express following situations: 1) non-storable electricity trade satisfies balancing rule, 2) each power generating firm can strategically offer his/her supply curve which is greater than the marginal cost curve, 3) each objective function is the alpha-quantile of the future profit distribution. Our former study, Tezuka and Ishii(2007) constructs a model and show the unique Nash equilibrium in the limited cases. In this study we extend our former studies and show the Nash equilibrium. Then we evaluate the futures of the equilibrium and state polity implications.

(2)Methods

We investigate a non-cooperative game in which each power producer bids strategically his/her supply function to the market with the demand distribution, and the unique Nash equilibrium is derived. And we show the probability distributions of the equilibrium spot price process and obtain some policy implications for market. While our former study each supplier has the same cost function, we show the case that different types of firms in the market in this study. In other word, we show the unique Nash equilibrium

where one firm with highly efficient cost function and two firms with low ones. Additionally, we show numerical examples of estimated spot price process of PJM market in U.S. by using our model. (See the figures as examples.)



(3) Results and (4) Conclusions

In this work, we show that a unique Nash equilibrium exists in the game, where each firm has the different cost function and same strategy set in the oligopoly electricity market. From the results, we deduce that there is a difference between marginal cost and spot price in the equilibrium. Therefore, we can observe that each power generating firm enforces its mark-ups. We also find the implication that less capacity of power supply or the greater alpha (riskier attitude), the more mark-up would occur.

Articles

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“Equilibrium Spot and Forward Prices in Wholesale Electricity Markets: A Generalized Bessembinder and Lemmon Model and its Application,” Masahiro Ishii, Koichiro Tezuka, Proceedings, 28th Annual IAEE international conference, Taipei. [2005]

“Investment decisions and trading emissions permits under uncertainty,” Masahiro Ishii, Motokazu Ishizaka, Koichiro Tezuka, Yukihiro Yasuda, *Chuo University Institute of Economics, Discussion Paper*, No.66, [2004].