

[PAPER/POSTER TITLE]

A Speculative Trading Model of Electricity Market

Jun Maekawa, Ritsumeikan- University, jmaekawa@fc.ritsumei.ac.jp
Koji Shimada, Ritsumeikan- University, shimada@ec.ritsumei.ac.jp,

Overview

After the nuclear accident in 2011, the spread of renewables has become a Japanese national consensus. Japanese government began the liberalization of electric power, and seek the way how to disseminate renewable energy in that market.

Renewable energies are desirable energies for the viewpoint of economic efficiency.

The variability of renewable energies is a major disadvantage because there is a characteristic that power supply must always be consistent with demand. In order to disseminate renewable energy in the power market, a mechanism to cope with this instability is indispensable. The unstable supply of renewable energy indicates that the cost for adjusting supply and demand will increase. It is necessary to be able to trade electricity until just before generated.

One of the way to control this risk is to leave the supply to some monopolistic suppliers.

In Japan, electric power supplies were commonly monopolized by government and government enterprises in former time. However, as monopoly restrained price competition and the incentive for technological development to be born became problematic, liberalization tried in almost all developed countries.

Furthermore, it is important to increase the liquidity of electricity. Some researcher investigated the wind power generation in Germany pointed out the importance of increasing the liquidity of electricity (Holtinen(2005), Ummels et. al (2006)). As weather forecasting requires data that changes from moment to moment, the existence of the various ahead market is essential for ensuring liquidity.

However, increasing trading opportunities has the aspect of allowing market participants to dynamically make speculative actions. Electric powers are difficult to save, but if the liquidity of the market increases and the transaction becomes easier, it is natural that a company that obtains profits by using the price difference. That is, optimistic supplier can buy the future electricity and sell it on that day in these dynamic market.

So, we analyzed the speculative bubble in the electricity market by using a simple model based on heterogeneous-belief bubble model like Miller(1977) or Harrison and Kreps(1978). The bubble of electricity market is not considered to occur. Because saving the electricity is technically difficult, the speculative action is said to be impossible. However, accompanying with the rise of renewable energies, we can trade the electricity one-month before market or one day before market. So, the speculative trade is not so difficult to use the dynamic market structure.

We show two main conclusion. The elasticity of price increase and consumer surplus increase by this speculative market. This findings support the liberalization policy in electricity market.

Method

Micro model, General equilibrium, Game-theoretical methods

Miller(1977) and Harrison and Kreps(1978) make a speculative model by using heterogeneous belief agent. If all investor have a common belief, there is no incentive for trading assets. However, as some heterogeneity exist in investors' belief, each investor have a different value to the asset and trade can occur.

In energy market, as discussed by Gabriel et al. (2009), investors can behave strategically by heterogeneous expectation. Joets(2015) found significant evidence that energy markets are composed of heterogeneous traders depending on the intensity of the price fluctuations and the uncertainty context.

For the purpose of framing speculative tradings, we introduce a dynamic and heterogeneous-belief investors to the electricity market model. Investors have different expectations about future renewable supply and future electricity price. This heterogeneity will give investors an incentive to speculative trade. By analysing the equilibrium, we can compare this model to a standard electricity market.

Results

We found two theoretical results in this paper. One is the elasticity of the demand. Based on the results of the model speculative behavior, even if consumer demand for electricity is inelastic to price, the price elasticity of demand is newly born, whereby price change becomes gentle. In standard electricity market theory, the demand curve is assumed to be inelastic, but in this model, the paper shows these assumptions are not suitable in a dynamic market. The other is consumers' surplus. In a heterogeneous belief model, the asset is sold by pessimistic investors and it is bought by optimistic investors. As a result, the price is raised by these optimistic beliefs. In this model, the suppliers of electricity who have pessimistic beliefs about the demand on the next day will sell the electricity now, the optimistic suppliers buy them, and it implies the supply of the next day increases. This model shows that some regulation for optimistic prospects can increase consumers' surplus. This result is a strong incentive to progress the liberalization of the power market.

Conclusions

Increasing market liquidity is an indispensable factor in introducing renewable energy. However, raising liquidity in economics generally can lead to speculative behavior. Policymakers, especially the Japanese government, have a strong tendency to vigor speculative actions on the electricity market and strengthen regulations. In this paper, we outlined the problem with a simple model. Our paper indicates the possibility that these speculative markets can support the weak point of the electricity market and increase the consumers' welfare.

In addition, it is a dynamic electricity market model. It is often pointed out that the linkage of the electricity market is essential for future analysis of this field. This model is very simple settings, the suppliers are price taker players and only two period model, but it shows that there are cases in which consumer surplus is eventually reduced. It will be necessary to comprehensively analyze the linkage of dynamic markets rather than individual markets and this model is one of the basic frameworks of the dynamic market model.

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