

MEASURING THE TRADE-OFF BETWEEN DYNAMIC AND STATIC EFFICIENCY IN THE RESPECT OF R&D INVESTMENT: THE CASE OF THE ELECTRICITY-GENERATING FIRMS FOLLOWING ELECTRICITY INDUSTRY LIBERALIZATION

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Overview

After the worldwide liberalization of the electricity market, a warning on R&D disincentives has been raised. We propose a new empirical framework to analyze the impact of the market restructuring on firms' static and dynamic efficiency of the industry. In this paper, we construct a model which can observe dynamic efficiency change occurred by reduced R&D investment of the electricity generation firms' following the liberalization. The model has a 'quasi two-stage' setup. In the first stage, the firms make R&D investment decision. We endogenize firms' R&D decisions, which impacts on the marginal costs in the long run with accumulation and spillover effects. In the second stage, firms follow price decision under market structure and the marginal cost condition which is endogenized by accumulated R&D investment. We estimate this model for the 16 electricity generating firms in 3 countries (Korea, Japan and UK). The results suggest that the liberalization policies could be harmful for dynamic efficiency in the respect of R&D investment.

Methods

In this paper, we propose the integrated model to analyze static and dynamic efficiency by market structure change. Our model has a 'quasi two-stage' setup to account for competition in R&D as well as product (electricity) market. In the first stage, firms make R&D investment decision. In the second stage, firms follow price decision. We endogenize firms' R&D decisions, which impact on the marginal costs of the firms by long run accumulation and spillover effects. The R&D investment accumulate the knowledge stock the firm can utilize to reduce production cost. In the second stage, the firms are engaged in the price-setting game based on the market circumstances and their cost-structure which is determined by their knowledge stock.

The empirical framework in this paper is based on oligopolistic competition models and discrete choices of consumers developed. It assumes that demand is characterized with a discrete-choice model and prices are endogenously determined by price-setting oligopolistic power generating firms. And we set up R&D investment equation and integrate the R&D equation and the oligopolistic competition models. In this setting, we can estimate not only the effect of knowledge stock on the cost structure but also the effect of liberalization measures on the market power. R&D investment is not an input factor which can affect cost immediately. So we adopt knowledge stock variable to fill the gap of timing between the R&D investment and the output performance. By integrating the results of R&D equation and the oligopolistic model, we can observe the effect of the liberalization measures on the static- and dynamic efficiency.

We estimate this model for the 16 electricity generating firms in three countries (Korea, Japan and UK), which experienced electricity liberalization process. The reason for choosing them is that since their electricity grids are isolated from neighboring countries grids, so the market performance or the market power of the firms in the countries is not affected from neighboring countries.

Results

Our model analyzed the role of R&D investment in the electricity industry by estimating the effect of three kinds of knowledge stocks on the marginal cost and R&D investment. According to our result, internal knowledge stock stimulates its R&D investment and accelerates the virtuous cycle between R&D investment and dynamic efficiency of the firm. And as for external knowledge stock, the production cost of a firm is affected by other firms' R&D investment significantly. It means that if the overall R&D investments of private firms are decreased by the restructuring, the efficiency of the firms is decreased not only by reduced internal knowledge stock but also reduced

external knowledge stock. And the result of R&D equation confirms that the liberalization measures decreased the firms' R&D investment in the electricity industry. It implies that the competitive policies which were introduced for increasing static efficiency could harm dynamic efficiency in terms of R&D investment. And the result shows the effect of the pro-innovative policies such as government R&D and patent system. The result suggests that the government knowledge stock can decrease firms' production cost and the patent system can encourage the private R&D investment in the electricity industry.

Conclusions

In this paper, we explored the impact of liberalization policies on generating firms' static and dynamic efficiency in the respect of the R&D investment. In our model, we could observe the dynamic efficiency changes which have been occurred following electricity industry liberalization. We designed empirical model to uncover the role and the position of R&D activities in the pricing mechanism of electricity industry and to confirm the effect of the pro-competitive policies and pro-innovative policies on the R&D incentives in the electricity industry.

Our results suggest that the reduced R&D investment following the liberalization of the electricity industry could be harmful for dynamic efficiency and the government R&D and patent system can be complimentary policies with the competitive policies for improving the dynamic efficiency of electricity industry.