

論文の内容の要旨

論文題目 Empirical Analyses of R&D Subsidy and Demand Response Programs
(研究開発補助金およびデマンドリスポンスに関する実証分析)

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In view of population aging and tight state finances in many developed countries, we are strongly required to develop a new strategy for sustainable economic growth. In particular in Japan, we have been exposed to a distinctly different environment since the Great earthquake and tsunami in 2011.

For creating new demand continuously under difficult circumstances, more attentions have been placed upon private-sector product innovation. It has been argued that a private firm cannot obtain full benefit from its new products due to R&D spillovers, which leads to under-provision of private-sector R&D investment (Nelson, 1959, Arrow, 1962). Theoretically, governments can deal with this concern by subsidizing private R&D expenditures (e.g. Spence, 1984). It is, however, an empirical issue how to achieve an efficient allocation of subsidies. Moreover, product innovation can be classified by novelty (or height). New-to-market product innovation probably has a distinct effect on society from new-to-firm one. We have not yet fully understood as to what type of innovation encourages firm growth and what factors determine innovation height.

In addition, for long-term growth, it is obvious that securing stable energy supplies is crucially important. Since the Great earthquake, we are more required to build a diversified flexible energy supply-demand structure for reducing the escalating energy cost. In particular, the development of demand response (DR) is positioned as a significant goal for the nation (Council on Economic and Fiscal Policy, 2015). For considering desirable DR programs, we need to accumulate knowledge about the effects of them as soon as possible. Recently, it is gradually becoming easy to use data on electricity customers with various DR programs. For example, the Japanese Ministry of Economy, Trade, and Industry (METI) initiated the Smart Community Pilot Projects in four cities in Japan (Yokohama, Toyota, Keihanna, and Kitakyushu).

With these backgrounds, this paper focuses on private-sector product innovation and DR programs. Chapter 2 evaluates the effect of public R&D subsidies by taking into consideration R&D spillovers. The estimation and simulation results obtained by use of Japanese firm-level data from an innovation survey indicate that existing subsidies encourage firm's R&D activities, which does not increase its profits due to a negative business stealing effect. Chapter 3 complements the previous chapter by considering innovation height. The same survey data reveals that new-to-market product innovation is likely to increase firm's sales without cannibalizing those of existing products and generate more technological spillover to other firms. Moreover, such innovation is more likely to emerge from firms collaborating with academic institutions.

The following chapters address issues on DR programs. Chapter 4 estimates the effect of load adjustment contracts offered by electric utilities in Japan. They are kinds of incentive-based DR programs targeting commercial and industrial electricity customers. Using unique data on electricity usage of individual plants, it is found that the contracts lower their electricity bills on average. In particular, plants with higher capital equipment ratio are more likely to save their bills and reduce their peak demand by the contracts. Chapter 5, on the other hand, investigates how residential customers respond to price-

based DR programs. A simulation analysis is conducted to examine whether customer's response changes with predictive accuracy in future electricity prices. The results show that the higher predictive accuracy increases consumer surplus.

One general implication of this paper is that understanding the behavior of individual agents is considerably important in predicting treatment responses. R&D spillovers and oligopolistic interactions among firms are non-negligible in evaluating the effect of R&D subsidies (Chapter 2) and a firm with new-to-market product innovation has typically different characteristics from that with new-to-firm one (Chapter 3). The impact of price-based DR programs or incentive-based ones is not uniform among electricity customers (Chapter 4 and 5). It is hoped that more and more micro data becomes available for empirical analyses.

References

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