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Decision-making of product development considering disclosure and use of information

– Timing of decision-making using game theory and real option analysis –

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In corporate management, in order to secure future growth and stable profits, it is necessary not only to maintain and expand existing businesses, but also to create new businesses through R&D activities. In general, R&D activities require investment for technology development, but it is uncertain whether the results will be accepted in the market. However, there are competitors in the duopoly market, and if other companies launch new products in the market ahead of time, they may be built ahead of barriers to entry and so on. On the other hand, if the firm is a second mover, it is possible to obtain technical information by referring to the patent issued by the first mover firm or by reverse-engineering the product, and to invest in R&D by using the technical information of other firms.

The purpose of this study is to make decisions on R&D investment by firms in a duopoly market, and to consider the situation in which profits will occur during the R&D investment period. This paper has proposed a framework for analysis taking into account the resolution of market uncertainty and the effects of freeride. For the analysis, a model combining real option analysis and game theory are used. Real option analysis evaluates investment value taking into account the flexibility of strategic investment, and game theory is a method that can analyze decision-making that takes into account multiple players. By combining these two approaches, this study has addressed the case of new product development in a duopoly market and has seen how the disclosure and use of information between

a first mover firm and a second mover firm affects the decision-making.

Using an exogenous change profit model, the two firms' R&D investment decisions over two periods were examined. Assuming that demand will increase or decrease in the second term, two firms can make an investment decision in both the first and second periods, but one firm makes an investment in the second period, the other firm should be able to make decisions after assessing demand. Furthermore, if one firm invests in R&D in the first term and supplies new products to the market, it is possible to obtain information on product development. If the firm makes an investment in the second term, R&D costs may be reduced.

As a result, it is confirmed that in a situation where information can be used, there is a possibility that oneself will select a second mover firm and reduce the investment cost while avoiding uncertainties in future demand, thereby increasing profits. In addition, the investment behavior of a second mover firm varies depending on the magnitude of the effect of using information. If the use of information can greatly reduce investment costs, regardless of uncertainty in demand, it is appropriate to make an investment after doing so. If the reduction in investment costs due to the use of information is small, it is appropriate to postpone the investment and make an investment if the demand increases after obtaining the information. However, when the investment cost is very low, even if the information can be used, it may be more appropriate to make an investment in first stage, and there is a threshold for using the information.

It is disadvantageous for the first mover firm to disclose information (for example patent application) unnecessarily, and when filing a patent application, it needs to obtain a strong patent right including peripheral patents. Accordingly, the first mover firm can point out infringement of rights when supplying new products to the market, and it is important to take measures to prevent other firms from filing similar patent applications. In addition, a first mover firm anticipates that own information would be used by the other firms, and leads other firms to the second mover, and is confirmed that there could be situations in which the first mover firm could increase profits by investing in advance.