Empirical Study on the Determinants of Industrial Research and Development Expenditures

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ABSTRACT

This study focuses on the wide range of manufacturing industries in Japan and hypothesized the numerous factors external to a corporation particularly for abstracting the determinants of research and development (R&D) expenditures. Previous studies primarily dealt with internal corporate factors such as sales, operating profits, or diversification. This study selected, integrated, and performed multiple regression analyses for nine industries based on the panel data concerning R&D expenditures. This resulted in the abstraction of statistically significant factors. R&D expenditures in the preceding term are an internal factor. This could be considered a comprehensive and continuous indicator of the scale of a corporation, its performance, its fixed R&D expenditures and corporate strategies. External factors cited are growth of the market, competitiveness, export dependency, labor intensity, and whether products are directed toward end-customers. This study would especially aid in deciding the R&D strategy as an aspect of the company expenses.

KEYWORDS

Determinants, Empirical Study, External Corporate Factors, Japanese Industries, Research and Development Expenditure

INTRODUCTION

In numerous corporations, the allocation of research and development (R&D) expenditure is defined through period cost-based budget management. Two methods are considered when controlling R&D expenditures via annual budgets:

1. Determining and allotting the cap;
2. Accumulating individual projects.

As shown by Blake (1967) and Naslund et al. (1973), because of restrictions on resources, in practice, these decisions could often be taken by a compromise method. For example, a process such as uniformly reducing a budget proposal and revising it by negotiating additional budget allocations or rendering corrections based on past performances is adopted.

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Suggested methods of determining the cap on R&D expenditures are as follows:

1. Setting it at a constant ratio according to the planned or predicted value of corporate performance or the measured performance value;
2. To uniformly maintain the R&D expenditures of the corporation, the cap is determined as a fixed value;
3. Based on R&D expenditures of similar companies, competitive R&D expenditures are estimated;
4. R&D expenditures are viewed as an investment to estimate the profits that could be earned through R&D, and this is determined as a standard.

As shown in the results of the questionnaires designed by Clive de Paula (1964), the Science and Technology Agency (1966) and Brockhoff (1994), two or more methods of deciding these caps are combined appropriately and finally revised while observing the fund balance.

The question is what type of internal or external factors are considered to define the R&D expenditure of the corporations.

The theoretical research conducted by Cohen & Mowery (1984) is considered to be a pioneering one. They categorized the determinants of R&D expenditures as factors internal to and external to a corporation, with the former referring to management resources and cash flow within the internal structure of a corporation, its research facilities, and corporate strategy. The internal structure of a corporation signifies its scope of authority, incentive system, information flow, and performance measurement. Corporate strategy signifies the selection of a product market and allocation of capital resources. The latter—factors external to a corporation—refers to market demand, growth rate, market concentration rate, technology opportunities of the market, and effectiveness of patents. “Technology opportunities of the market” refers to the varying opportunities for the success of a new product. Industries such as drugs and medicines and computers, for example, are high-opportunity industries, while a low-opportunity industry is iron and steel (Link & Long, 1981, p. 107).

Empirical studies include those based on single fiscal year data of manufacturing industries in the United States, including those by Grabowski (1968), Link & Long (1981), Mansfield (1981), and Link (1982).

Instead of using the absolute amount of R&D expenditure as a dependent variable, Grabowski (1968) considered R&D intensity that is measured by the R&D expenditure divided by total sales. Thus, he adjusted the gap between corporations of different sizes. He used the number of registered patent rights, the degree of diversification, and internal reserves as explanatory variables to analyze the data of 41 chemical corporations in the United States in 1962. All the explanatory variables were significant. Link & Long (1981) modeled the determinants of basic research expenditure. The estimation was based on the data of 250 manufacturing corporations of 1977. The result indicated a significant relationship between the degree of diversification, cash flow, and industries with high opportunities for successful new products. Mansfield (1981) estimated the relationship between the proportion accounted for by basic research expenditure, applied research expenditure, and development research expenditure within R&D expenditure, total sales, and market concentration rate. The total sales influence basic research expenditure positively; an increase of 1 percent in corporation sales leads to an increase of 1.65 percent of the basic research expenditure. Market concentration rate was not statistically significant. Link (1982) further developed his research with Long (1981) by modeling the explanatory factors of R&D intensity and the factors that influence the proportion accounted for by basic research expenditure, applied research expenditure, and development research expenditure within R&D expenditure. The estimation was based on the data obtained from 275 manufacturing-related American corporations of 1977. As explanatory factors of R&D intensity, three variables were significant: profitability (profit of previous term after deduction of taxes and dividends divided by sales), degree of diversification, and subsidy from the federal government. Market concentration rate was not significant. In basic research expenditure, variables such as profitability, degree of
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