Empirical Research on the Profitability of R&D Expenditure: Estimations Based on Firm-level Accounting Data in the Japanese Textile Industry

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ABSTRACT

Yamada and Nakayama (2018) estimated the profitability of research and development (R&D) expenditures for the Japanese manufacturing industry, using industry-level data. The results of the manufacturing industry are not necessarily reflective of the state of each individual firm. The purpose of this study is to understand the present state of profitability of R&D expenditures in major Japanese textile firms using firm-level financial data. In terms of methodology, a cost-effectiveness model that considers endogeneity between revenue and R&D expenditure, as well as methods from the literature that can be used to analyze even small samples, are used. The methods used in this article will help practitioners better understand the specific circumstances of their own firms. The authors’ work quantifies the investment levels of R&D expenditure, presents strategic management challenges around R&D expenditure to advocate for the consideration of rates of return, and urges the establishment of management accounting criteria at the firm level.

KEYWORDS

Decision-Making, Management Accounting, Profitability, R&D Expenditure, Strategic Cost Management

INTRODUCTION

Yamada (2017) showed that the decision on the level of research and development (R&D) expenditure in the Japanese manufacturing industry is likely to be made incrementally, based on inertia. Similarly, Yamada and Nakayama (2018) estimated the profitability of R&D expenditure in the Japanese manufacturing industry using industry-level data. They showed that R&D expenditures have not contributed to value addition since fiscal year 2001. To minimize the concern for the validity of the results of this archival research, the scope of analysis is expanded from industry-level to firm-level. Estimates are derived from different data sources and methods of analysis. In particular, this study focuses on analyzing whether the profitability and efficiency of R&D expenditures of individual firms in the manufacturing industry are also declining. This is a valid inquiry, because results obtained from data on the entire manufacturing industry is not necessarily reflective of the state of each individual firm. Thus, this paper is roughly divided into two parts, using data at the firm level in the textile industry. The first part discusses the analysis of profitability and efficiency of R&D expenditure for the textile industry based on various analytical methods, and the second part discusses the efficiency of R&D expenditures of individual firms.

DOI: 10.4018/IJSSOE.2019010102

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The performance of the textile industry was in decline since 1986, but started to recover since the latter half of the 2000s. The firms in the textile industry, in particular, were selected because the contribution of R&D since fiscal year 2001 may be easily detected.

As for analytical models and results based on data from the manufacturing industry as a whole, we note that practitioners prefer to estimate their firm’s specific coefficients. Rousseau (2006), referring to the “fact-based management” of Pfeffer and Sutton (2006), stated that the theory and methodology provided by statistical and quantitative management accounting researchers bring usefulness to the research only when they are combined with practitioners’ management knowledge. However, if practitioners try to apply such knowledge to their own small sample of data, they could run into numerous problems in the application of commonly used sophisticated analytical models and methodology, as shown in the literature. To address this issue, we evaluate the profitability of R&D expenditures by presenting analytical methods from literature that can be applied to small sample data for individual firms, as well as panel data analysis of precise cost effectiveness.

As per past studies, the two leading indicators for measuring the efficiency of R&D that can be estimated at the firm-level, even for small samples, are as follows. The first indicator is the ratio of R&D expenditure to capital investment, as described in Kodama (1991). Kodama (1991) compared total R&D expenditure and capital investment amounts for all Japanese listed manufacturing firms during the period from 1980 to 1987, and found that, in 1986, R&D expenditure exceeded the level of capital investment, which showed a reduction in the efficiency of R&D. Although there may be industry-specific characteristics, in general, capital investment is used to generate sales and profits when a firm is still in the “catch-up stage” in terms of technical knowledge (i.e., when they are still learning the technology utilized by more industrialized foreign firms). In this process, the level of capital expenditure often exceeds that of R&D expenses. However, when the technology frontier has been achieved, firms need to engage in unexplored R&D. Therefore, the R&D expenditure of firms in this stage must be maintained or increased, since “trial and error” types of R&D activities increase at this stage. As a result, investment in R&D will exceed the amount of capital investment at some point in the process of industrial development. Even if this reversal phenomenon can be considered to be evidence that the technical level of the Japanese manufacturing industry has entered the post-catch-up frontier stage, it may imply that the cost-effectiveness of R&D expenditure has declined. However, there are cases where capital investment is made for many other reasons, such as saving labor, rationalization, production capacity expansion, and maintenance of facilities, that have nothing to do with R&D.

The second indicator is the method of observation of annual changes in the degree of correspondence between revenue and expenses. Dichev and Tang (2008) conducted an analysis based on the assumption that the degree of correlation between revenue and expenses appears at the level of correspondence between these variables. The paper obtained the degree of correspondence of cost revenues in a single fiscal year over time and used its change as an indicator. It examined a time-series trend of 1,000 major corporations in the US during the period from 1967 to 2003, and observed that the degree of correspondence of operating expenses to US revenues in the 37 years (i.e., the profitability of US firms studied in this paper), declined. Since cost is strongly correlated in the time-series data, the paper adopted a multivariate model that included the cost of the previous fiscal year, as well as the following fiscal year. Going forward, we refer to this indicator as the correlation between contemporaneous revenues and expenses.

Kagaya (2011) presented a follow-up test of Dichev and Tang (2008). Dichev and Tang (2008) collectively analyzed operating expenses such as cost of sales, selling expenses, and general administrative expenses, while Donelson, Jennings, and McInnis (2011), and Srivastava (2014), separated these same items and analyzed the individual correlation between contemporaneous revenues and expenses. Arai (2016) divided operating expenses into R&D expenditure and other expenses and confirmed the correlation between them for 107 firms in the transportation equipment industry, for each fiscal year from FY 2000 to 2013. The trend showed that the degree of correspondence of R&D
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