

Impact of Company's Capital Investment and R&D on Japanese Corporate Performance

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Abstract: *This study examined the correlation between capital investment, and R&D costs with corporate performance such as sales, gross profit of sales, operating profit, ordinary income, or net profit after tax. This research performed regression analysis with corporate performance as dependent variable and capital investment and R & D cost as independent variable. As a sample, this study used data of companies that could be obtained in Nikkei 225 companies. The period of data was between 1990 and 2015. Most of results of this study indicated that capital investment and R & D costs were negatively correlated with corporate performance, although some results indicated that capital investment and R & D costs were positively correlated with company performance. The result of this study was in accordance with many previous researches.*

Keywords: capital investment, research and development costs, corporate performance, regression analysis

1. Introduction

This study examined strategies of Japanese companies from the perspective of capital investment and research and development costs. Capital investment in Japanese companies has continued to decline since 1990s although internal reserves continued to rise. In general, companies generated more income by investing capital. However, in reality, many companies did not invest in capital despite having sufficient funds in the company. Meanwhile, the cost of research and development (R&D) of Japanese companies continued to increase. However, compared to intern number of corporate reserve, the increase of R&D was not high. Although the number of intern reserves increased 2.98 times between 1991 and 2016, the total cost only increased 1.24 times between 1991 and 2016. This was because Japanese companies were unwilling to invest (including in R&D).

It was interesting to examine whether the above phenomenon was true or not. This study analyzed phenomenon from statistical point of view by means of regression analysis. This study examined whether the relationship between investment (including in R&D) and company performance was negatively or positively correlated. If the outcome was negatively significant, it indicated amount of investment (including in R&D) of the company was not increasing because investment (including in R&D) was not effective for developing the company. Meanwhile, if the result showed significant positive correlation, the result was very interesting because although investment (including in R&D) was effective for developing the company, Japanese companies did not invest (including in R&D).

2. Definition of Problem

What matter in this research was the relationship between investment (including in R&D) and company performance. The question posed to the problem was, why the amount of capital investment decreased and the cost of R&D did not rise in line with the increase in the number of intern Japanese

company reserves since the 1980s. What was the correlation between capital investment, including R&D costs, and company performance in short, medium and long term. Short term was (t) and (t + 1). The medium term was (t + 5) and (t + 10). The long term was (t + 1 ~ t + 5) and (t + 6 ~ t + 10). Companies needed to invest (including in R&D) in order to develop the company and improved company performance.

3. Literature Review

There have been several studies on correlation between capital investment and R&D costs with company performance.

Tanaka, (2010), conducted research in chemical, medical, and electronic companies. His research focused on correlation between R&D costs and company performance. According to him, the cost of R & D and (value added) of chemistry, medical, and electronics company were positively correlated. While R&D cost and company performance such as: sales, ordinary income, income before taxes, and income after taxes, in electronic fields significantly negative correlated. Therefore, although the result of the analysis was significant positive correlation when viewed from the perspective of R&D costs and some performance index of the firm's value added, the correlation of R&D costs other than sales index, ordinary income, income before taxes and income after taxes were negatively significant. Tanaka argued that Japanese companies were prioritizing value added when doing R&D. However, although firms may favor value added as company's performance index, other indices such as sales or operating profit were also important index in management of the company. Tanaka's research samples were listed companies so they unlikely ignored the index because they kept the value of shareholders in mind. Therefore, a significant negative correlation in Tanaka's research results was also an important outcome.

Genba, Takeoka, Imahashi, and Kaminishi, (2016), examined correlation of investment, including R&D and corporate profits. They used sample of Japanese firms in

production within period between 2000 and 2014. As a dependent variable, their research used operation profit on sales (t). Meanwhile, as independent variable, their research used ratio of R&D expenses to sales, ratio of equipment investment to sales, and \log_{10} sales. According to their research, the ratio of research and development cost to sales continued to be significantly negative correlated to operating profit between 2000 and 2014. Genba, Takeoka, Imahashi, and Kaminishi research was almost similar to this study. However, there are differences also. In this study, the index as a dependent variable was shifted, whereas in their study, the index was fixed bound variable (t). Therefore, they did not examine the possibility of investment, including research and development, relating to the future performance of the company such as ($t + 1$). R & D was also carried out for future engineering or product development so it may take a long time to generate profit or sales.

Murakami (1999) also had similar argument through qualitative research. In his research, Murakami explained R&D cost was more difficult to generate profits running than the past using several well-known companies in Japan, such as Sony or Canon. However, his research only used data of 9 companies so that when viewed from the number of samples, his research had limitations. However, the company was quite well known and had big influence on Japanese economy. Although the number of sample was limited, the result was quite useful.

Con (2005) examined correlation of R&D with company performance from stock exchange point of view (stock price). The information in Con's research was total cost of R & D on sales. Registered company information had to be made public so stock information was also easy to obtain. Con study sample was a company that enrolls at The First Section of the Tokyo Stock and The Second Section of the Tokyo Stock and used R&D costs of more than 1% on sales throughout 2004. Con concluded that R&D was significantly and positively correlated with firm performance.

4. Research Method

The method used in this research was quantitative method. The sample companies in this study were 225 companies selected when calculating Nikkei Stock Average. Nikkei Stock Average was average stock price of 225 companies in the first stock, Tokyo Stock Exchange 1st Section. A total of 225 companies consisted of companies representing various fields such as automobiles, banks, development and others. In Japan, the Nikkei Stock Average was considered a very important index because Nikkei Stock Average showed the state of Japan's economy. In addition, this study used company data that continues to register on the first exchange, Tokyo Stock Exchange 1st Section, between 2001 and 2015. Based on data, shifts variables can be monitored. As another requirement when selecting a sample of companies, the selected company was company that could provide complete financial data within the company that keep registering in the first exchange between 2001 and 2015. Finally, the sample size of this research was 134 companies. The analysis used in this research was regression analysis (multiple regression analysis). This study used following formula: Company Performance = $\beta_0 + \beta_1(\text{fixed intangible}$

assets) $_t + \beta_2(\text{fixed intangible assets})_t + \beta_3(\text{research and development costs})_t + \beta_4(\text{capital investment})_t + \beta_5(\text{net assets})_t + \beta_6(\text{total assets})_t + \beta_7(\text{firm field / dummy variable})_t + \beta_8(\text{year / dummy variable})_t + e_t$ company performance: sales, gross profit, operating profit, ordinary income or income after taxes, Tangible fixed assets and intangible fixed assets are also used as independent variables. The reason was they were the capital investments made before that year. It was possible that tangible fixed assets and intangible fixed assets affected company's performance. Net assets and total assets were also used as independent variables. Net assets and total assets were used to control large sample companies. In general, there was tendency of the more profit the greater the company. In general, this tendency was called economies of scale. Therefore, net assets and total assets were used as independent variables. The above free variables were selected by reference of previous studies such as from Tanaka (2010) and Genba, Takeoka, Imahashi, and Kaminishi (2016).

Company performance as dependent variable changed from (t) to ($t + 10$) ($t =$ this year, $t + 1 =$ next year, $t + 10 =$ 10 years to come). The reason was that in general investment, including research and development, had effect on subsequent years. In addition, the average number ($t + 1 \sim t + 5$) or ($t + 6 \sim t + 10$) was also used in this study as dependent variable because there was possibility that investment, including research and development, continued to influence for several years.

This study used the number as capital investment because the price of capital investment was not written in (B/S) and (P/L) of companies in Japan as the sample of this study was described as follows.

Shifting balance of accounts receivable (B / S) or profit and loss (P / L). Investment capital = (book value end of year period) - (book value end of last year period) + (depreciation cost) besides some B / S or P / L variable as independent variable, this research would use two dummy variables (field of company). It was intended to solve the sample bias problem, so both dummy variables were required. In general, Japanese economic movement influenced every company. In other words, if Japan's economy was good then the company's performance was also good automatically. Meanwhile, if Japan's economy was not good, the company's performance was not good too. As a result, comparisons in different year samples were not easy. There was a possibility that a sample bias problem arose and an appropriate result had been obtained. Therefore, in this study, dummy was used to solve the problem. Similarly, the industrial structure also differed depends on the industrial field. As a result, it was likely that the problem of sample bias appeared and the right result had been obtained. Therefore, in this study, industrial dummy variable was used to overcome the problem. This study did not discuss companies without public listed stock because the data was difficult to obtain. Therefore, this study discussed only large companies, namely companies registered on the first exchange. Although the purpose of this study was limited, the samples of this study were companies representing Japan's image so that the result of this study could explain strategies of most Japanese companies. The company's financial data used in this research was obtained

from a database named SPEEDA. SPEEDA is a Japanese company's financial database provided by Uzabase Inc. Although SPEEDA has financial data of Japan's companies listed on all exchanges in Japan, in this study, the selected companies were companies registered in Nikkei Stock Average.

5. Result Finding

The sign of most of significant results in the following table was negative. Meanwhile, the result of sales analysis (t + 10), operational profit (t + 1), current profit (t + 1) and net profit after tax (t + t + 1) were significantly positive.

Table 1: List of Coefficient Sign of Correlation of Capital Investment

	t	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Sales	—***	@	—***	+***	—**	@
Gross Sales Profit	—***	—**	—***	—*	—***	—***
Operation Profit	@	+*	—***	@	—***	—***
Current Earnings	@	+***	—***	@	—***	@
Net Profit After Tax	+***	+***	—***	—*	—***	—**

- : Negative Significant + : Positive Significant @ : Not Significant *** : Significant in 1% ** : Significant in 5% * : Significant in 10%

All signs of significant sales results and gross profit of sales were positive. Meanwhile, all significant yield signs, which were operating profit, profitability and net profit after tax were negative. The difference in outcome appeared clearly between sales and gross profit of sales and operating profit, current profit and net profit after tax.

Table 2: List of Coefficient Signs Correlation of Research and Development Cost

	t	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Sales	+***	+***	+***	@	+***	@
Gross Sales Profit	+***	+***	+***	+***	+***	+***
Operation Profit	@	@	—***	—**	@	—**
Current Earnings	—*	@	—***	—**	@	—***
Net Profit After Tax	—*	@	—***	@	@	—***

- : Negative Significant + : Positive Significant @ : Not Significant *** : Significant in 1% ** : Significant in 5% * : Significant in 10%

In this part, shift in each interval is shown.

Table 3: Lost of Coefficient Sign of Correlation Capital Investment (2001—2007 and 2008—2015)

2001—2007	t	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Sales	—***	@	—***	+**	—***	@
Gross Sales Profit	—***	—**	—***	—*	—***	—***
Operation Profit	+***	+***	—***	@	@	—***
Current Earnings	+***	+***	—***	@	@	@
Net Profit After Tax	+***	+***	—**	—*	+**	—**

This divided the 2001-2015 periods into two periods, namely 2001-2007 and 2008-2015. This study examined the shift in the correlation of capital investment, including research and development on Japan's firms and firm performance. If the results of the 2001-2007 span analysis were compared with

the results of the 2008-2015 range analysis, there was an interesting difference although almost all results are the same. In the 2001-2007 range, the results of operational profit (t, t + 1) and net income after tax (t + 1 ~ t + 5) were positive. Meanwhile, in the range of 2008-2015, the result of operational profit analysis (t, t + 1) and net profit after tax (t + 1 ~ t + 5) were negatively significant.

2008—2015	t	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Gross Sales Profit	—***	—**	—***		—**	
Operation Profit	—**	—*	—***		—***	
Current Earnings	@	@	—***		—***	
Net Profit After Tax	@	@	—***		—***	

- : Negative Significant + : Positive Significant @ : Not Significant *** : Significant in 1% ** : Significant in 5% * : Significant in 10%

 : Significantly different part compare with analysis result (2001—2007)

If the results of the 2001-2007 span analysis were compared with the results of the 2008-2015 range analysis, there was an interesting difference although almost all results were the same. In the 2001-2007 range, the after-tax net profit (t + 1 ~ t + 5) was negatively negative. Meanwhile, in the range of 2008-2015, the sign of the result of net profit analysis after tax (t + 1 ~ t + 5) was positive

Table 4: Lists of Coefficient Signs Correlated to Cost of Research and Development (2008—2015 and 2008—2015)

2001—2007	T	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Sales	+***	+***	+**	@	+***	@
Gross Sales Profit	+***	+***	+***	+***	+***	+***
Operation Profit	@	+***	—**	—**	@	—**
Current Earnings	@	+***	—***	—**	@	—***
Net Profit After Tax	—**	+***	—***	@	—**	—***

2008—2015	T	t+1	t+5	t+10	t+1~t+5	t+6~t+10
Sales	+***	+***	+***		+***	
Gross Sales Profit	+***	+***	+***		+***	
Operation Profit	—**	@	@		+**	
Current Earnings	—***	@	@		@	
Net Profit After Tax	—***	@	@		+**	

- : Negative Significant
 + : Positive Significant
 @ : Not Significant
 *** : Significant in 1%
 ** : Significant in 5%
 * : Significant in 10%

 : Significantly different part compare with analysis result (2001—2007)

6. Discussion

The summary of main analysis results from table 1 and 2 was described as follows:

- (1) Capital investment and average sales (t + 1 ~ t + 5) were negatively correlated.
- (2) Capital investment had significant positive correlation with operating profit (t + 1), current profit (t + 1), and net profit after tax (t, t + 1).
- (3) Capital investment was significantly negatively correlated with all

types of earnings if viewed from the point of view of the average ($t + 1 \sim t + 5$). (4) Capital investment was significantly negative correlated with operating profit, net profit after tax, and average gross sales profit ($t + 6 \sim t + 10$). This study showed that Japanese company's capital investment and earnings in most of results of the research analysis were significantly negative correlated.

In general, many people thought that capital investment required a lot of time to gain profit but the analysis showed the opposite result, i.e. at the time (t) or ($t + 1$) some of the results showed a significant correlation positive between capital investment and corporate performance. As an explanation of this phenomenon, there were natures of company samples where they were registered on the stock exchange. There was possibility that they need to issue good results to receive support from shareholders. As a result, there was a possibility that the company chose capital investment which can earn revenue during the period such as (t) and ($t + 1$). As another explanation of this phenomenon, there was possibility that relation between profit and capital investment was in reverse. There was the possibility that a company do capital investment at the time when company has good performance. In other words, there was a possibility that capital investment was not immediately linked to performance, but capital investment was made because performance was good. Therefore, when interpreting the result, the analysis need to be thorough, especially the result of t or $t + 1$ because the possible cause-and-effect turns upside down.

Summary of the main analysis results of Research and Development Costs: (1) The cost of research and development was significantly positive correlated with the average sales ($t + 1 \sim t + 5$). (2) Cost of research and development was significantly negatively correlated with operating profit ($t + 5, t + 10, t + 6 \sim t + 10$), current earnings ($t, t + 5, t + 10, t + 6 \sim t + 10$), and net profit after tax ($t, t + 5, t + 6 \sim t + 10$). The orientation of this result was similar to the one conducted by Murakami (1999) and Genba, Takeoka, Imahashi and Kaminishi (2016). (3) The cost of research and development was significantly correlated positively with sales and gross profit of sales. The results of this analysis strengthen the research of Con (2005). However, as already explained, the results need to be interpreted thoroughly.

Based on perspective of sales, all significant marks were positive. From these results, this study could show that the cost of research and development as well as sales within 5 years after research and development carried out significant positive correlation. However, in the longer term ($t + 6 \sim t + 10$) the results were not clear because they were not significant. When interpreting this result also, as already mentioned, it is necessary to interpret the result while paying attention that the sample companies are listed companies or causal relationship may be reversed.

Based on perspective of profit, this study found different results between gross profit of sales and other profits. In the gross profit of sales, all the marks of the analysis were positive. Although the cost of research and development was positively correlated with the gross profit of the sale, it was

possible that the accounting problem affected the result of this analysis. The reason was the cost of research and development was divided into two parts, cost of sale or selling and administration expenses, in the accounting system based on the cost nature.

When calculating the gross profit of a sale, the company deducted cost of sale from sales. However, the cost of research and development as a dependent variable in this study contained two cost variables (including cost of sale and selling and administration expenses). As a result, it was possible that the result of the analysis was deflected. Similarly, in the capital investment section, there was possibility that the result of the analysis used by the gross income of the sales was deflected. Therefore, analysis of sales gross profit should be thorough. In addition, the correlation of research and development cost with operating profit, current earnings and net income after taxes was somewhat similar to the outcome when using the capital investment as a dependent variable. The results of analysis ($t + 5, t + 10, t + 6 \sim t + 10$) was significantly negative. Meanwhile, there was also different section with capital investment analysis when viewed from the point of view in ($t + 1$). The result showed that although capital investment and research and development were profitable investment in the future, two factors have different factor.

Next was an overview of the main analysis results from tables 3 and 4 on Capital Investment as follow: (1) Almost all results were the same. (2) In 2001 – 2007 range, Japanese company capital investment was significantly positive over operating profit ($t, t + 1$) and net after-tax net income ($t + 1 \sim t + 5$). However, in the range of 2008-2015, Japanese company's capital investment was negatively negative on operating profit ($t, t + 1$) and net profit after tax ($t + 1 \sim t + 5$).

Research and Development Costs showed as follow: (1) Almost all the results are the same. (2) From these results, this study can show in the 2001-2007 range, the Japanese company's research and development is significantly negative over the net after-tax net income ($t + 1 \sim t + 5$). However, in the range of 2008-2015, Japan's corporate research and development is significantly positive for net income after tax ($t + 1 \sim t + 5$).

The result of shifting analysis between 2008-2015 and 2008-2015 was different. In the analysis of capital investment shifts, the result of a shift from negative to positive was found. Meanwhile, in a shift in research and development, the result of a shift from positive to negative was found. From these results, this study showed that Japanese companies had different strategies when investing in capital as well as in research and development although both investments were profitable in the future.

7. Conclusions

Most of results of this study showed significant negative correlation between investment, including in research and development, and profit (operating profit, profitability, and net profit after tax). This result was in accordance with results of previous studies that have been presented in the

Literature Review Section. This phenomenon was very interesting because investment, including in research and development, was considered as source to generate profit. It was difficult to have sales earnings in Japan, so that Japanese government needed to change the economic construction in order to push investment, including in research and development. It would be easier then for Japan's company to generate profit and sales. The hope was that the results of this study would be useful to advance and expand the scientific reach of Japanese studies.

8. Future Scope

There is still gap on the result of this research, it was the research sample. Companies used as sample was the one that was registered on the first stock exchange, Tokyo Stock Exchange 1st Section, from 2001 to 2015. As a result, this study excluded companies that were not registered on the exchange even though there was possibility that the company would show different result with this sample companies. Beside it, complete financial data of companies that were not registered on the exchange was hard to come by. This research divided samples into two types, service and manufacturing industry. However, in both industries there were various fields. Therefore, for further research, samples should be divided according to the company's field, such as motorcycle, food, energy, and others. Simultaneously, to overcome the gap, the number of sample companies also needed to be added.

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References

- [1] Huang Weiwei; Atsumi Kenito; Murakami Yutaro (2011) "Impact of depreciation on corporate capital investment behavior: Was the tax system reform in 2007 promoting corporate capital investment? No 7
- [2] Kimono official, Takeoka Ziyang, Imahashi Yutaka, Kamisai Keisuke (2016) "Empirical analysis of R & D investment, capital investment and profitability of Japanese manufacturing enterprises" Annual Scientific Meeting Abstracts Introduction 31
- [3] Ministry of Finance. (2016) "Corporate enterprise statistics for FY2008" Kiyori Sakakibara; Masaharu Tsujimoto (2004) "Why did the efficiency of research and development of Japanese firms decline?" Cabinet Office Economic and Social Research Institute "Economic Analysis" 172
- [4] Ministry of Internal Affairs and Communications. (2016, 2019). "Research on science and technology"
- [5] Keiichi Tao (2008) "Empirical analysis on R & D investment and capital investment trends in R & D type manufacturing industry - Relationship with group management Ritsumeikan Business School No. 47
- [6] Shin Tanaka (2010) "Research and development cost and consideration about performance." Annual report Financial management research No 21
- [7] Chung Yoshiaki (2005) "Stock Performance of R & D Companies: Anomalous Returns and R & D Factors" Securities Analyst Journal No. 43-10
- [8] Cabinet Office (2009, 2014). "National Accounts Calculation"
- [9] Cabinet Office. (2013 - 2016) "Heisei 26 - 29 Annual Economic and Financial Report"
- [10] Nikkei 225 official website "Historical data" dari <https://indexes.nikkei.co.jp/nkave/archives/data?list=annually>, accessed at 31 o'clock March 31, 2018 "
- [11] Shinichi Fukuda, Nobuhisa Kasugaya, Masayuki Keita (2007) "Entrepreneurial spirit and capital investment: Another explanation of sluggish capital investment under deflation" Bank of Japan Working Paper Series No 07-J-7
- [12] Mizuho Research Institute. (2010). "Exploring the Factors of Declining Competitiveness of Japanese Companies: Problems and Challenges from the Viewpoint of Research and Development"
- [13] Murakami Ryouichi (1999). "Innovation management (born out of crisis consciousness (" employment creation "then the company ...) Works No 37
- [14] Kim, H.S. (2010). "Ownership Structure and Firm Investment : An Examination of Hotel Firms". Master Tesis Faculty of Purdue Agustus.
- [15] Li, Z. (2004). "Essays Corporate Investment Decisions". Dissertasion Michigan State University
- [16] Marian, C.A. (1998). "The Process of Investing in Capabilities". Tesis pada Faculty of Purdue University untuk memperoleh gelar Master of Philosophy, Mei.