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Mergers and R&D inRecent Japanese Manufacturing: Learningsfrom Empirical Analyses

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Abstract

Using a before-and-after merger comparison in Japan, this paper examines the effects of mergers on R&D activity of joining firms, with a special focus on merger cases after 2000. The findings are derived from the simple evaluations; 1) Merger effects were diverse in R&D intensity; 2) Similarly, the effects on patent application vary among merger cases. The results are likely to be consistent with US and Europe's findings. Such "stylized facts" suggest an importance of economic analysis on "dynamic consideration" in merger regulation, since mergers may impede innovation in some cases, and inversely promote innovation in other cases. The diversity leads to the problem of "dynamic assessment" (and its procedures) of merger effects for its regulation as well.

Key Words: mergers, dynamic competition, R&D intensity, patents, counterfactuals, dynamic consideration

JEL ClassificationNumbers: L11; L13; L25; L40

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I. Introduction: Mergers and Dynamic Efficiency

Now, Japan is still in a lot of economic difficulty. One of the solutions of improving or overcoming those difficulties is considered to be "innovation" in various fields. Firms can innovate themselves through business combinations such as consolidations, acquisitions and equity joint ventures (hereafter called mergers collectively). In fact recently in high-tech fields and also in low- and middle-tech fields, many mergers have been carried out with reference to innovation.[1] Many proposed mergers have emphasized "strengthening research and development (R&D) and technological capability" along with "improving managerial efficiency" (X-efficiency).[2] Also, "cutting back on R&D" is frequently included in the efficiency effect of mergers, implying an association with the efficiency of R&D（Coate & Heimert [2009]）. Have these mergers practically been able to have a promoting effect on innovation?

Recently, we had an interesting case of merger offer. The case is the proposed acquisition by *Pfizer* of *AstraZeneca*, which has failed to take place in 2014. *AstraZeneca* rejected the offer, emphasizing that "there is little evidence that big mergers have improved innovation in the pharmaceuticals industry" (for example see *The Financial Times*, May 13, 2014). The assertion is inconsistent with so-called "the Shumpeter(ian) hypothesis" that emphasizes market power and firm size as major driver of innovation.

Also, the recent studies suggest interesting findings. First, Doi, Honjo and Kudo [2014] report that R&D intensity has a positive effect on market mobility (*i.e.*, fluctuation in firms' market share and position), suggesting that innovation may lead to dynamic competition. The mobility is likely to capture greater rivalry with innovation. And, Doi, Kudo and Kato [2014] show that R&D intensity of a firm leads to the firm's greater international competitiveness, which is picked up by its share of foreign salese (*i.e.*, exports plus foreign subsidiaries' sales) in the whole sales. These findings suggest that innovation may be important for competition and competitiveness in domestic and global markets.

Thus, whether competition and antitrust enforcements promote innovation is one of the most important policy issues today. In particular, the effectiveness of mergers has been one of the most frequently discussed issues in competition economics and policy.[3] Also, in recent years merger

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[1] For low- tech and middle tech- innovation, see Hirsch-Kreinsen and Jacobson [2008].

[2] These two goals may relate to one another, because companies frequently invest in new technologies in order to increase their management efficiency. As a result, the "management efficiency improvement" which is emphasized as a goal of merging also surely implies "R&D strengthening". For example, in the manufacturing industry, because anti-warming, energy-saving, resource-saving types of environmental technologies are now important, cost (X) efficiency improvement, new process development, and new product development are carried out all together. Thus, it can be said that many mergers also emphasize the strengthening of R&D and technology development. It is necessary to also analyze merger effectiveness while explicitly considering the relationship between X-efficiency and R&D.

[3] For example, in the USA, out of 109 cases brought up by the Ministry of Justice and the FTC from 2001 to 2003, 41 cases involved "concerns about innovation" as the reason. From this fact, "The actions of anti-trust policy authorities in the US reflect the judgment that competition promotes innovation"（Gilbert [2006], p.160-1）. In other words, "dynamic efficiency consideration" of mergers is considered important.

effects have been receiving attention from the viewpoint of the *ex post* evaluation of merger remedies (and merger regulations). However, existing studies provide varied evidences regarding the effects of mergers and merger regulations on R&D activity.

Therefore, now that the progress of technological development is remarkable, and that more mergers are being carried out, whether mergers promote innovation is one of the most important problems. In fact today, the effect which mergers have on innovation and competition is again receiving greater attention from theoretical and policy perspectives. In particular, when taking into account the fact that a great majority of innovations come from largely oligopoly industries with diversity in business behavior, the importance of merger analysis is very large in antitrust theory and enforcement.

Thus, this paper aims to empirically explore the effects of mergers consummated since 2000 on R&D activity in Japanese manufacturing industries. Also, some face-to-face interviews were complementarily conducted. And at the same time, the paper suggests issues which should be examined in the future analysis of innovation effects of mergers, and also in the enforcement of merger regulation.

II. Survey of Existing Studies: Diversity in Findings

(1) Theoretical Examination: Interaction and Diverse Relationships between Firms

When considering the R&D effect of mergers, a typical starting point is traditionally the "market power" hypothesis and the "Schumpeter(ian)" hypothesis. Following the former hypothesis, if mergers strengthen market power, a risk-avoiding "quiet life" weakens the incentive of technological development, since firms can ensure larger profits through market power with no taking risk. The hypothesis is likely to be supported by some recent findings from the EU; after a cartel breaks down, the former cartel-joining firms frequently prefer mergers among them (see for example Davies *et al*. [2014]). The finding suggests that those mergers may be collusion-oriented, leading to the quiet life.

On the other hand in Japan, we have found no definite relationship between cartel breakdown and merger among detected or prosecuted cartels. Merger, and in particular big merger did not take place in 34 available industries in which cartel and bid-rigging in the domestic markets were detected by the Japan Fair Trade Commission during 1985 to 2010. But, the findings should be carefully interpreted, since the examination does not include undetected cartels.

On the other hand, the "Schumpeter(ian)" hypothesis emphasizes greater R&D capability (appropriability, financing and risk-taking), greater R&D efficiency (economy of scale inR&D) and more chances to apply the R&D outcomes (diversification) as major promoters of technological development (see Doi [1996] for alternative interpretations of the hypothesis). This claim suggests that mergers which expand firm size and industry concentration are effective in the promotion of innovation.

These hypotheses both focus on the incentive and capabilities of R&D performers. Concerning the validity of these hypotheses, a very great amount of empirical study has been developed, but there is no resolution to the controversy.

The theoretical analyses of oligopoly (the post-Chicago school) clarify the diverse activities of oligopoly firms. The activities include, for example, competitive strategy as well as "unilateral effect", "coordinated effect" (implicit cooperation), and cartels (explicit cooperation). Similarly, the effect of mergers is also predicted to be diverse depending on the assumptions of various activities post-merger.[4] For example, non-merging firms' reactions against a merger may have an effect on the performance of the merging firm, and also on market performance of the industry. These possibilities are predicted from the fact called as the "merger paradox", which shows that after merger a merging firm' sales decline relative to the total sales pre-merger of its joining parties, and also from the facts known as the "folly of mergers" (particularly in Japan) and "merger cynics", which capture the findings that a large number of merging firms have experienced a decline in profit rates (or stock prices) post-merger. These facts may suggest a similar effect on R&D activities as well.

The competition-restricting results due to the "unilateral effect" of mergers are discussed on price behavior. The unilateral effect might be observed in R&D as well. Mergers may restrain innovation activities of a merging firm and also of rivals relative to the pre-merger level. For example, that is the case where one party of joining firms launches an improved existing product, or a newly developed product which would considerably reduce the sales of the other party. This possibility is discussed in the "innovation diversion (ratio)" theory by Farrell & Shapiro [2010]. The theory suggests that through avoiding R&D investment which has the possibility to cause "cannibalization" of sales between products after the unification (with horizontal merger), and also through internalization of the leakage of development performances, a merger can have a negative effect on R&D incentive. This mainly focuses on the configuration of products between the joining parties, and consequently their competitive relationships. In fact, competition policy in recent years has focused on this kind of unilateral effect in R&D (innovation restraint).

However, if a merger were to incite non-mergingfirms (or rival firms) to antagonistic, rivaling reactions and uncooperative, independent activities (which Kwoka [1989] calls "maverick behavior"), the innovation-restricting effect by the merger would likely be reduced. This is because the R&D reduction of the merging firm will be offset by the R&D expansion of non-merging firms. The non-merging firms might try to expand its share through aggressive R&D and innovation, in order to react against the market share expansion of the merging firm. In this case, the industry as a whole might on the contrary experience an increase in net innovation, *i.e.*, a positive "innovation balance" (see Appendix 1). Therefore, in merger regulations, it is necessary to pay attention to the

[4] For the unilateral effect and cordinated effect in mergers, see, for example, Davis & Huse [2010], Gilbert & Rubinfeld [2011] and Andolczak [2010].

R&D effect of non-merging firms post-merge as well as the overall industry effect.

Therefore, the reactions of non-merging firms have an important effect. This relates to the argument that "a significant competitor exists", which is a frequently utilized reason when a merger is approved. Then it must be made clear under what conditions competition effects will take place from the existence of a "significant competitor". For example, suppose that a merger leads to an asymmetrical distribution of market share (*i.e.*, an "asymmetrical oligopoly") as suggested by the dominant firm oligopoly model, and is concurrently accompanied by an asymmetrical access to managerial resources, *i.e.*, relative competitive advantages of a merging firm, and growth barriers or intra-industry mobility barriers against non-merging firms. Then, competition restriction may take place because of the difficulties of the "maverick" actions of non-merging firms. This possibility suggests that a variety of differences or asymmetries between firms, specifically merging and non-merging firms can have an influence on merger incentive, the post-merger behavior of a merging firm, and the reactions of non-merging firms.

Thus, the post-merger behavior and performance of a merging firm are affected by the behavior of non-merging rivals. As a result, the market performances of a merging firm and the industry in question are not definite. The R&D strategy of merging firm is likely to be affected by the behavior of rivals and non-merging firms. Therefore, to evaluate the effects of merger on R&D investment incentive, it is necessary to look at the competitive interaction of firms within an industry.

Next, similarly to price behavior, a "coordinated effect" can be presumed in R&D competition.[5] The coordinated effect is of an implicit cooperation which reduces R&D with mutual understanding between merging and non-merging firms. But, the possibility of the coordinated effect in R&D aspect is not necessarily definite. It is because R&D includes different and diversified contents such as new product development and new process development, and as a result, it might not be easy to capture the contents of rivals' R&D strategies. Also, for the reason, even if there is an agreement to refrain from R&D rivalry, it is not easy to detect if someone breaks away. Then the cooperation is likely to break down easily. In this meaning, the possibility of a R&D's coordinated effect may be smaller than in the case of its unilateral effect.

Finally, there are vertical and diversification mergers (including a "congeneric" type) as well as horizontal type. Those types of merger may have different effects on R&D. For example, assume a vertical merger in which a finished product firm acquires a raw materials firm. Even if the parties have no intention of strategically "locking out" or "foreclosing" rivals, the merger conducted from simply independent profit maximization motive may induce the halting or lessening of direct outward sales of raw materials, leading to the effect of restricting raw materials purchase by rivals. This is equivalent to the "exclusive unilateral effect", and might through less competition weaken the R&D incentive of the merging firm. On the other hand, as the Schumpeter(ian) hypothesis asserts, vertical or diversified type of mergers might promote R&D activities. It is because the types

[5] Cooperative effects sometimes include explicit type such as cartels, but this paper does not include the type.

of merger are likely to include more development opportunities through the production of multiple products. Also, the merging firms can internally and stably obtain more R&D funds in a field from other product fields, leading to larger incentives to promote R&D.

Thus, theoretically mergers can have different effects on R&D activities in merging firms, non-merging firms and the whole industry, depending on various factors such as the type of merger, the relationship of products/technologies between merging parties, and the relationship between merging and non-merging firms (or the behavior of non-merging firms). Therefore, the evaluation of merger effects on R&D is left to empirical examination. This study aims to examine the effects in Japanese industries after 2000.

(2) Survey of Empirical Results: Diverse Effects

After discussing the various theoretical possibilities of merger effects, it is necessary to empirically test the relations. Now, evidences from several existing empirical studies are surveyed. [6] One of the major findings is that the results are diversified among the studies. In particular, it is noted that in most existing studies mergers have an adverse effect on R&D. Here we look at some representative studies which focus on the outcome of R&D.

First, based on detailed questionnaire inquiries and data from interviews for 31 cases, Colombo & Garrone [2006], through a "clinical" type of analysis, examine the effect of mergers on the R&D activities of joining firms. The activities were measured by research facilities, number of R&D staff, and R&D expenditures. Worthy of special notice is the fact that while most of the existing studies examine the R&D activity of a merging firm as a whole, this study analyzes in detail the R&D activities by business segmentation. The results of this study show that mergers and especially horizontal mergers tend to cause a decline in R&D activities, which is likely to harm dynamic efficiency, and point out, from such findings, that merging firms tend to overestimate the synergy effect, and underevaluate the adverse effect on innovation, suggestinga large importance of competition policy.

It also suggests that both the technological and market relationships between joining firms have a significant influence on the results of merger. In particular, when their technologies are complementary between the joining parties, they are proactive in R&D activities. On the other hand, when the technological relation is alternative, R&D activities are reduced. Therefore, the merger effects are affected not only by the above relationships between merging and non-merging firms, but also by the relationships between joining firms. These results suggest that it is also important to examine the effects that various pre-merger factors have on R&D and innovation activities post-merger.

Second, Caldenrini *et al*. [2003] analyze the effects of mergers on the number of patents of an acquired firm (which is called as "inside effect"). The following results are shown. First, the

[6] There is also a great number of surveypapers regarding existing empirical analysis. See for example Cassiman & Colombo[2006], Katz & Shelanski[2007]and Schulz[2007].

innovation activities of an acquired firm (almost horizontal type) tend to decline after acquisition. Second, this decrease is caused by administrative issues of integrating R&D activities. Therefore, R&D management post merger is not as easy as expected pre-merger, and many firms frequently overestimate the improvement in R&D capability caused by mergers.

Third, from the oligopoly model, it is understood that the R&D activities of a merging firm may reflect the reactions of rivals or non-merging firms. But, the previous studies don't explicitly take into account the reactions of rivals or non-merging firms. For example, Fair Trade Commission [2008] suggests, from the interview with the merging firm and the data on the number of patent applications, that in the acquisition by *Fuji Electric* of *Sanyo Electric Vending Machines*, the R&D activity did not decline post-merger (the *JFTC Annual Report 2008*, p. 177). The indication focuses not only on the "inside" effect of mergers on the R&D activities of merging firms but also on the "outside effect" on the R&D activities of non-merging firms or rivals and of the industry as a whole. Unfortunately, the report does not indicate the detailed results of the outside effect.

One of the few studies that analyze the effect of mergers on the R&D activities of non-merging firms is Ornaghi [2006]. Taking up the world pharmaceutical industry, it indicates the fact that mergers have an adverse effect on the R&D of non-merging firms. The result suggests that as suggested above, in the evaluation of a merger, it is necessary to clarify the inside effect of a given merger not only on R&D and innovation of merging firms, but also on the outside effect on innovation and R&D of non-merging firms and then of the whole industry in question. The industry-level of net outcome of R&D activity is usually called "innovation balance", which is equivalent to inside effect plus outside effect.

Finally, the existing empirical studies on profit effects of mergers may suggest different R&D effects of mergers. A great deal of empirical studies, through a variety of methods, suggests that mergers do not lead to increases in profits (the adverse profit effect is as suggested earlier called "the merger paradox" or "the folly of mergers"). These results are a "stylized fact" in merger analysis. These facts, as suggested above, might restrict the R&D incentive of the potential merging firms. Also, acquired firms were frequently sold off after the acquisitions. This fact, along with the adverse profit effect, suggests that the performance-improving and R&D-promoting effects of mergers are likely to be doubtful.

On the other hand, there may be alternative possible situations. For example, in the event study, if stock prices were to rise after a merger plan was announced, this would not only capture increased market power and/or X-efficiency, but could also include a strengthening of R&D capability (dynamic efficiency) as long-term effects. In the latter cases, mergers surely have a positive effect on technology development. It is therefore useful to compare event studies with R&D outcome analyses.

Thus, the R&D effects of mergers are neither definite theoretically nor empirically. This fact, as with the results about price and profit effects, might have an effect on competition policy, which is reflected in the fluctuation in merger regulations; more strict regulation at one time, and more

relaxed regulation at another time. The implication of these surveys is that when enforcing policies, it is necessary to carry out a case-by-case evaluation through theoretical and empirical analyses. Therefore, especially in the case of empirical analysis, a cross-industry analysis at the firm level is not necessarily appropriate. It is rather preferable to conduct multifaceted and detailed analyses of individual merger case. This suggestion, together with the characteristics of available dataset referred to later, led to a descriptive “before-and-after analysis” used here.

Also, the R&D or innovation effects of a merger are not so simple. For example, a reduction in R&D expenditures will not always invite a decline in innovation. This is because in some cases, a merger can, through improvement in R&D plans and systems (for example budget, research subject, and organization), on the contrary, improve R&D efficiency. For example, merging firm can efficiently focus its resources on a particular R&D area, and thereby succeed to develop new technologies. Better performance of R&D and innovation, and its resulted competitiveness expansion lead to active competition. In this meaning, a detailed individual study is preferable.

Furthermore, mergers, as suggested by Caldenrini *et al*. [2003], usually involve internal or organizational problems in corporate governance and management. For the reason, when examining the post-merger R&D activities, it is necessary to pay attention to the internal factors of a merging firm, *i.e.*, R&D management on research staffs, organizational restructuring, post-merger fusion of corporate culture and so on. The issue is among the economics of organization, but is beyond the scope of the present paper.

III. Methodology

This paper adopts a simple approach of comparing R&D-related variables between pre- and post-merger. The methodology is explained as follows.

(1) Measures of R&D Activities: R&D Intensity and Number of Patent Application

The paper makes use of two indices to capture the R&D effects. The first approach examines R&D expenditures-sales ratio (R&D intensity) as the input aspect of R&D activity. Then, the pre-merger ratio is the weighted average of joining parties. And, listed firms were largely used as sample. The target period is pre-merger 3 years, and post-merger 5 years. However, due to the availability of statistical data, in some cases post-merger 3 years were used. R&D expenditures were calculated from the "general selling and administrative costs" and "current-term manufacturing costs" in the "consolidated profit and loss statement" of the *Annual Security Report* of a joining or merging firm.

The relationship of the before-and after- ratios of R&D intensity is indicated as follows;

$$\Sigma i \ \{ \Sigma n \ (RD_{n.0-i}/R_{n.0-i})(S_{n.0-i})\} \ \diagup 3 \text{ or } 5 \ \leqslant \ \Sigma i \ (RD_{0+i}/R_{0+i}) \diagup 3 \text{ or } 5$$

where **RD** is R&D expenditure, **R** sales, **S** the ratio of sales of a joining party to total sales of all

joining parties (**n:** 1,2 with two joining parties), **i** the year of observation (1,..,3 or 5), and suffix **0-i** and **0+i** show respectively the i-th year before merger and after merger.

However, there are several qualifications for this approach for some reasons. First, as the data is corporate-based, the effects from merger may not necessarily be fully captured. Second, alternative R&D indices such as number of researchers, number of filed patents, and sales ratio of new products are not used. Also, in some cases a part of R&D expenditures is not included, because the expenditures are not shown in the item of the "current-term manufacturing costs" of the *Annual Security Report*. Then, inter-firm comparisons of the intensity are lack in accuracy.[7] But, the problem does not involve large bias in the results, because there are only a small number of cases, and the expenditures included in the item are of a small level.

Finally, the approach is based on the "absolute" comparisons between only merging parties, not the "relative" evaluation (*i.e.*, a “difference-in-difference analysis”) which take into account the performance of non-merging firmsas control group (Ikeda and Doi [1983]). It is difficult to choose a suitable control group. It is largely because those firms are frequently diversified firms, and produce varied products, suggesting that it is difficult to construct control samples of non-merging firms who are enough comparable with a merging firm to relatively evaluate the merger effects. Thus, this paper used a simple before-after analysis, not a difference-in-difference analysis.

Another index is the number of "laid open patent application" as a measure of the output aspect of R&D. It is calculated from the *Japan Patent Office*'s published data. But, only available is the count number of application by a merging firm (unconsolidated figures), not corporate-wide consolidated figures. Therefore, the index may not always pick up the effects of mergers.

Also, as a more serious issue, when using patent application, attention must be paid to the fact that time-lag are included. The lags include three differences in period; the pregnancy period from starting of R&D activities to invention, the period from invention to patent application, and the period from patent application to "laying open" by the *Patent Office* (*i.e.*, applications are officially published one year and a half after). In particular, the first two lags may reflect firm behavior; The first one may be affected by R&D efficiency, and the second one may reflect discretionary application strategy, suggesting the possibility that firms strategically don’t apply their new invented technologies to the *Patent Office*. When there exist such time-lag, the number of patent application does not capture precisely the impacts of mergers.

Finally, the namber reflects patent application, not permitted or filed patents, suggesting that the measure does not always capture the quality of invented technologies.

(2) Merger Cases – 39 Cases –

39 merging firms were selected during 2000 to 2008 in manufacturing. They are in the following industries: 1 case for sugar manufacturing, 1 for milling, 2 for cooking oil, 2 for paper

[7] If R&D costs included in the” current-term manufacturing costs” are zero, this issue does not occur. In some firms, there is no xplanation for this.

manufacturing, 5 for pharmaceuticals, 1 for cosmetics, 1 for industrial-use gas, tires, firebricks, sheet glass, petroleum products, iron and steel, aluminum sash, and housing machinery respectively, 2 for bearings, 1 for control units, construction machinery, photocopy machines, storage batteries, tiny motors respectively, and finally 2 for toys. A variety of industries are covered. One of the features of these cases is that an overwhelming majority (*i.e.*, 35 cases) of them were of a horizontal type, while there were 1 case for vertical merger, and 3 cases for diversification merger respectively. Also, those which were classified as horizontal mergers frequently included an aspect of vertical or diversification merger.

Next, the 39 cases were mergers between listed firms, with some exceptions (the *Kao – Kanebo Cosmetics* merger and the *Teikoku Zoki – Gureran Pharmaceuticals* merger). Only 2 cases include unlisted firms: *Kanebo Cosmetics* and *Gureran Pharmaceuticals*. Then, the level of R&D intensity is computed only for the listed firms, both an acquiring firm. Also, 2 cases are of an international merger: *Japan Sheet Glass*which acquired a foreign rival (outward foreign direct investment (FDI)), and *Chugai Pharmaceuticals* which was acquired by foreign firm (inward FDI). In these cases, the R&D intensity and number of patent application both were computed for Japanese firms only.

IV. Results and Discussion

Now, the findings from the two indicators are in turn explained as follows.

(1) R&D intensity

The summary results of the "before-and-after" comparison are shown in Tables 2 and 3.

First, comparing the pre-merger 3 year average and the post-merger 3 year and 5 year averages, out of the 39 merger cases, 17 cases (44%) show rise in the post-merger 3-years average, while the remaining 22 cases show its fall. Also, the post-merger 5 year average rose in 17 cases (50%) out of the 34 cases, and decreased in the other 17 cases.

But for a while after merger, restructuring of operations and organization may have a restrictive influence on R&D activities. The merger effects would come out after the 3rd year post-merger. Then, it is better to compare the average of 3 years pre-merger with the average of 3 year period after the 3rd year post-merger. The result is not greatly different from the former one, with rising in 17 cases (55 percent) out of available 31 cases, and decreasing in the other 14 cases. The configuration of the list of the cases is almost the same as in the former analyses in both rising and declining groups respectively. Thus, an increase effect was only seen in slightly more than half cases.

Also, R&D activities are affected by the characteristics of an industry, and in particular technological characteristics which may lead to different results. There are more cases with increased R&D intensity in "progressive" industries such as pharmaceuticals and machineries. Of 15 cases where 5-years-average R&D intensity post-merger is 3% or greater, 9 cases show an

increase. Also, with 4% or greater of R&D intensity, 7 cases out of 10 available cases experienced an increase. These facts suggest that in progressive industries R&D activities are likely to expand in a greater number of merging firms. More detailed analyses are necessary for a greater number of merger cases in the progressive industries.

Third, of the cases which this study took, 6 cases (*JFE Steels, Daiichi Sankyo, Nihon Unipack, Astellas Pharma, Mitsubishi Tanabe Pharma,* and the acquisition of *Amatsuji Bearing* by *Nippon Seiko*) were investigated for possible antitrust regulation by the *Fair Trade Commission*. The R&D intensity increased post-merger in five cases except for *Amatsuji Bearing* which was delisted after acquisition and did not publish detailed financial statements. Therefore, in these five cases mergers did not impede R&D activities.

Finally, as one of features of mergers since around 2000, many mergers were implemented through the establishment of a "holding company", which was lifted a ban on by the Antimonopoly Act in 1997 (The firms are showed by notation HD in Table 1). Of the merger cases taken in this study, 11 cases have adopted the form of a holding company. Of those 11 mergers, increase in R&D intensity was observed in 8 firms, and the other 2 cases showed oppositely fall in R&D intensity. One company was excluded from examination due to short post-merger period. Therefore, the holding company system is consistent with R&D, at least providing no reactive impact.

However, it is necessary to keep in mind that the above results might include the possibility of overestimation. This is because it is suggested that the post-merger sales of a merging firm have gone down or stagnated frequently compared to total pre-merger sales of the joining parties. The phenomena are, as indicated earlier, equivalent to the "merger paradox" or "merger puzzle" in merger literature. When the merger paradox takes place, R&D intensity might increase even in cases with no increase in R&D expenditures. Also, it is said that in some firms, the slump in sales post-merger had an adverse effect on R&D activities. In such case, both sales and R&D activity might decline, but the intensity does not necessarily decrease. Thus, this simple approach may not always provide a definite conclusion. As Colombo & Garrone [2006] emphasized, a "clinical"type of detailed analysis may be necessary.

Table 2 Pre- and Post-Merger Comparison: R&D intensity and Patent

	Pre-3/Post-3			Pre-3/Post-5			Pre-3/Post-3-to-5		
	＋	－	Total	＋	－	Total	＋	－	Total
R&D Intensity	17	22	39	17	17	34	14	17	31
No. of Patent Application	11	28	39	9	25	34	11	23	34

Note: Pre-3: 3-yearsaverage pre-merger; Post-3(5): 3(5)-yearsaverage post-merger; Post-3-to-5: 3years average for the 3rd to 5th year after merger; ＋: increased;－: decreased.

(2) Analysis of the Number of Patent Publications

Next, let us look at the transition in the number of patent publications which reflects patent filing trends, following Table 2 and 3.

1) Results

The first analysis compared the average number of "laid open patent application" for 3 years or 5 years post-merger (i) with pre-merger 3 years average (j), similarly to the examination of R&D intensity :

$$\sum_1^5 PTi/5 \text{ or } \sum_1^3 PTi/3 \quad \lessgtr \quad \sum_{-1}^{-3} PTj/3 \qquad i= 1,..,5(\text{post-merger}), \quad j= -3,-2,-1(\text{pre-merger})$$

Following Table 2, the post-merger 3-year average increased in 11 cases (28%) of 39 mergers, and the remaining 28 cases showed decrease. Also, the post-merger 5-years-averages increased in 9 cases (28%) of 34 mergers, and the remaining 25 cases showed decrease. From these results, merger with patent increase were merely responsible for less than 30% of the available cases. The results are roughly consistent with those in the case of R&D intensity.

Table 3 Results of Number of Patent Publications: Mergers from 2000 on

Patent Application Time	Increase	Decrease	Total
2-year lag (comparing pre-post3 with post3-5)	12	22	34
3-year lag (comparing post3 with post4-5)	12	22	34

Note: pre-post3: 3-year average from 1 year pre-merger and 2 years post-merger; post4-5: the 2-year average from the 4th to 5th year post-merger

However, the patent's results are necessary to be interpreted with caution, because the patent data involve the problem of a time-lag caused in the process to patent application disclosure. The lag involves the pregnancy period (from R&D activities to patent application) of R&D activities and the laying open system (publishing 1.5 years after the date of the filing of a patent application). The time-lag problems may obscure the effects of mergers on R&D activities. In addition, application may be affected by inventors' activities. For example, declining number of publications may not only reflect" more stagnant" R&D activities, but also capture "strategic restriction" of patent application. Thus, the above comparisons may have any bias.

Now, assume that technological development has been efficiently carried out, and that it takes 2 years on average from its start-up to invention. Under the assumption, inventions are originated

from the 3rd year after merger. In this case, as a method of assessing the merger effects, we can compare the average (post-merger results) of the 3 years period from the 3rd to 5th years after the merger with the average (pre-merger results) of the 3 years period from 1 year pre-merger to 2 years post-merger:

$$\sum_{3}^{5} PTi/\,3 \quad \lessgtr \sum_{-1}^{2} PTi/\,3 \qquad \text{i= 3,4,5(post-merger)}, \quad \text{j= -1,1,2(pre-merger, post-merger)}$$

where PT is number of patent publication, suffix ***i*** the i-th year after merger, suffix ***j*** the j-th year before merger and after merger. Notation "–"(minus) indicates the first year before merger, and suffix without minus notation the first and second years after merger.

Of the 34 available cases, 12 cases (35%) showed an increase, and the remaining 22 cases showed a decrease, as summarized above. If the time lag is assumed to be 3 years on average, then the comparison is between the average of the 2 years period comprising the 4th and 5th years post-merger which reflects the results of post-merger R&D activities and the average of the 3-years post-merger period which reflects the results of pre-merger R&D activities. The similar findings are found, suggesting that the cases where patent applications have increased post-merger are at the 30% level. These facts are not consistent with the argument that mergers promote R&D.

Also, when focusing on "progressive industries" with high R&D intensities, 5 companies have experienced post-merger increases in the average number of applications, out of the 14 cases which have an R&D intensity (average of 5 year period post-merger) of 3% or above. Also, when the cut-off level for progressiveness is defined to be 4% or greater, 4 firms out of 7 cases have experienced an increase. Therefore, different from the case of R&D intensity where a majority of the cases indicated an increase in the intensity, it does not show an increase in the number of applications in a majority of the merging firms.

Furthermore, looking at the results for the cases which received investigation from the Fair Trade Commission, similarly to the analysis of R&D intensity, out of the 5 available cases, only 2 cases experienced an increase in number of patent publications. These results differ from the results of R&D intensity in which the intensity increased in all 5 cases. It is also an interesting finding.

2) Some Questions Noted

In addition to the above-mentioned time-lag problems, the patent publication-based analysis may involve other problems as well. First, in recent years, there exists a tendency to strategically hold off on applications and prefer know-how. The behavior is known as "strategic application".[8] Then, there is a possibility that the change in numbers of publications does not sufficiently reflect the effects of R&D activity and mergers. Also, the used indicator is based on the data of merged

[8] Merging firms might take the strategy of “strategic application” after merger, only making applications for invented technologies which will be strategically effective. For example, some interviewees (for machinery and iron and steel firms) suggest that they don’t apply defensive type such as peripheral patents, and make applications only for patents (effective patents) which other firms may be forced to use in the process of manufacture and sales.

companies, and does not involve the R&D activities of its subsidiaries or affiliated firms; in other words, the count was based on a parent firm's data, not on its consolidated data. Therefore, merger effects may not be sufficiently grasped. Also, when joining firms both are diversified, the indicator used was not likely to accurately grasp the effects of mergers on R&D activities of the associated product fields, since this is from data of the whole company. In these cases, it is necessary to strictly examine the changes in patents by each of product fields.

Finally, the quality of invented technologies is not grasped, since the number of publications is a simple count of applications, not granted patents. For example, those patents which are called as peripheral patents and defensive patents are not necessarily of a higher technological value. Therefore, whether post-merger developed technologies are more valuable than pre-merger technologies is attracting attention. Such analysis can probably be attempted by, for example, calculating and comparing the adoption ratio and registration ratio of applied-for technologies pre- and post- merger, and also the ratio of citation (citations by patent examiners, citations referred to in patent application forms), and the ratio of renewal of registered patents. Because this paper's scope is limited to recent merger cases, the above analysis cannot be carried out sufficiently.

(2) Findings and their Interpretation

Thus, although most of proposed mergers emphasize the strengthening of technological capability and R&D as sources of competitiveness and differentiation, the findings suggest that there is definitely not a large number of cases which suggest clearly the evidence that mergers had considerably strengthened R&D. This conclusion is roughly consistent with existing studies in recent Japan (for example Yamauchi & Nagaoka [2010]), and also in Europe and US.

Several reasons can be provided for an adverse effect of merger on R&D. They pose problems for assessing proposed mergers. First, the adverse effects may come from internal factors of a merging firm. An organizational integration between different firms is essentially a "troublesome process", which may lead to a negative effect on R&D.

In addition, the adverse effects may come from problems in competition. For example, first, in horizontal mergers, in order to reduce substitutability between products post-merger, and thereby avoid cannibalisation between products, the merging firms may endeavor toward a reduction in product variety. This strategy holds the potential to lead to a decline in R&D. Also, relatedly, they may adjust overlapping R&D in order to increase R&D efficiency, or adjust parts of R&D in order to change (or diversify) the post-merger product strategy.

Second, even when conversely increasing product variety post-merger, there is a possibility that this will form entry barriers and intra-industry mobility barriers, resulting in a potential weakening of R&D incentive. Therefore, broadly and in general, as the "quiet life" hypothesis asserts, when competitive restrictions take place, technological competition may decline, and then R&D incentive may be weakened as well.

Third, as suggested above, the effects of mergers on buyer preference and loyalty ("brand

repositioning") are also important. The influence is reduction in post-merger sales, which is frequently called as "merger puzzle" in business world. A case in point is a big pharmaceutical merger (between *Sankyo* and *Daiichi Pharmaceuticals*); Sales of the merging firm (*i.e.*, *Daiichi-Sankyo*) declined, compared to total sales of the partners pre-merger. In this case, one can also think that reduced customer loyalty and its resulted sales reduction post-merger may lead to R&D decline. However, there is no analysis which has looked at this problem in detail.

Finally, after merger, the time horizon of R&D project becomes shorter, and faster outcomes from research projects are required. This can result in sluggishR&D activities. This stagnation is found not only in quality of R&D activities but also in their quantity, and as a result, the quality stagnation is likely to interact to lead subsequently to further stagnation in quantity.

Before concluding the chapter, we will note the methodological qualifications. This paper's analysis is a simple comparison of pre- and post-merger indicators, not a comparison with anappropriate "counterfactual" which conjectures what would have prevailed with no merger. This paper assumes that post-merger the same level of input and output is maintained from pre-merger, and the pre-merger numbers are used as the counterfactual (*i.e.*, the "*status quo ante* counterfactual"). However, this method doesn't reflect the tendencies predicted post-merger. Also, as suggested above, although unmerging firms may have an influence, the paper does not take into consideration the activities or reactions of non-merging firms or the trend of the industry in question.

The problems due to such endogenous relationships are shared with the analyses of comparisons with non-merging firms which are used in many studies, because the indicators of non-merging firms may not play a role of an appropriate counterfactual as well. That is, as suggested by recent theories focusing on the reactions of non-merging firms, there is a possibility that the R&D activities of non-merging firms may be affected by the mergers. Thus, analyses of merger evaluation frequently involve the problem of criteria for relative evaluation. Also, there are frequently differences in product configurations between merging firms and non-merging firms compared. Such differences may have an effect on the scope and scale of R&D activities. Also, this problem holds for analyses of using the industry average as comparison. Therefore, considering these problems, this paper made no attempt here to conduct a "relative evaluation" with other firms.

V. Policy Implications: “Dynamic Assessment”?

The important findings are that; 1)there were different results between the merger cases, suggesting diversity in merger effect, and that 2) more of the consummated mergers have failed to increase R&D activities, although at the outset of consolidation the joining firms had emphasized a better effect on innovation. Now, we discuss some implications for merger regulation from the above findings, although the present findings, strictly speaking, are suggestive rather than definitive. But, we think that

the findings from the simple and descriptive analysis may imply the relation between merger and R&D activity, and also potential policy issues.

First, the finding suggests that the relation between mergers and innovation is a major focus in competition policy. If a big merger has a negative influence on R&D and innovation, then the merger may involve not only the effects of restricted price competition (market power), but also induce less innovation. Then, merger regulation is important.

Therefore, the "dynamic consideration" is more important in competition policy. Also, it is important to reevaluate the technological performance of merging firms post-merger, which forms an indispensable part of remedy.

Second, the findings suggest that some of the merging firms might have improved R&D. Therefore, we should note the diversity of effects as well as the deterioration of R&D performance post-merger. The diversity may depend on structural characteristics of joining firms pre-merger and post-merger and of their relevant industry(ies). Then, competition policy's inquiry is to find out those conditions under which different effects respectively can take place.

Third, an effect-based approach is usually emphasized for antitrust enforcement. It is important to examine possible or actual effects of proposed or consummated mergers on R&D activities, taking into account the hypothetical post-merger situation (*ex ante* counterfactuals) or no-merger situation (*ex post* counterfactuals) as comparator. For example, an *expost* evaluation of remedy requires the "counterfactuals". But, it is difficult to build or estimate counterfactuals, since the scinarios are inherently speculative and hypothetical. In particular, it is more difficult to build counterfactuals for merger effects on innovations ("dynamic counterfactuals"), since dynamic competition with innovation is likely to involve a lot of complicated aspects and relations of business behavior.

Thus, the analysis suggests methodological difficulties in merger assessment, in particular based on dynamic consideration. In fact, the existing studies have not provided more efforts for the "dynamic assessment" problem.

Finally, in merger regulation, the above-mentioned "clinical test" may be useful and necessary. Investigation by a competition authority is in itself equivalent to such type of test. The before-and-after test used here is simple comparison with variables pre-merger and post-merger, and does not involve the appropriate counterfactuals. The qualification suggests that it is necessary to complementally apply some tests including the relative or counterfactual tests.

Thus, although there is no doubt that dynamic consideration is important in merger regulation, enforcement based on the dynamic consideration may involve many theoretical and practical problems. Many existing studies have empirically examined

the effects of mergers on R&D. The derived finding is the diversity of effects, depending on characteristics of merging firms and industries in which they operate. Therefore, it is important to apply "specific assessment criteria" which can take into account factors inducing the diverse effects. But, existing studies address less the assessment, in particular the "dynamic assessment" of merger effects for its regulation. Now, an economic analysis should be directed to merger review process issues such as criteria and procedure of assessment as well. Such suggestion may hold true of many business practices which are likely to involve pro-competitive or efficiency-enhancing and anti-competitive effects, since competition policy requires to make a distinction between those effects.

IV. Concluding Remarks

The review of existing theoretical and empirical studies suggests that cross-industry analyses at the firm level are not appropriate, and it is preferable to examine the results of mergers focusing on a single industry. After simple review of existing studies, this paper has attempted a pre-and post-merger comparison of merging firms, using the two indices of R&D costs (as a percentage of sales. R&D intensity) and the number of patent publication.[9] As a result, it was made clear that for both indices, there are many cases in which, contrary to the initial slogan by merging firms, R&D performance rather declines after merger. These results are consistent with the results in most of the existing studies. However, the fact that, in R&D-intensive industries, there are many cases where the level of R&D intensity increases is also worthy of attention.

Although this paper is a descriptive empirical analysis, not an econometric analysis, the results are likely to involve significant suggestions. The above results suggest the possibility of diverse effects, supporting the policy examination and implementation on a case-by-case basis. Also, they suggest that policy officers should regularly re-evaluate and monitor the *ex post* results of their enforcements. Such monitoring will furthermore have an effect on merger incentive of firms as well, and fulfill a useful pro-competitive function in competition policy.

Thus, this paper emphasizes the importance of dynamic consideration, clinical in-depth test, dynamic counterfactual test, and dynamic assessment. Unfortunately there is scarcely discussion on the problems of the methodology for assessment from both competition law and economics in Japan.

However, this paper, as alluded to above, may involve many problems in empirical methodology.[10] The resolution of these problems is indispensable. In addition, some more

[9] We interviewed with some merging firms regarding the unification and restructuring of R&D systems after merger in 2 cases (horizontal mergers). Also, we gained information regarding R&D management, relationship between "merger puzzle" (reduction in sales) and R&D, the relationship between cannibalisation and R&D.

[10] Some merging firms taken up engaged in merger several times, not only one time during the period of analysis. Such cases are not explicitly considered here.

problems are paid attention to. First, not just a simple before-and-after comparison, but, as many of the existing studies have examined, it is also necessary to analyze quantitatively the results of mergers, using fuller samples including both merging and non-merging firms in order to add and supplement evidence.

Second, when R&D efficiency rises via a merger, the intensity will not necessarily rise after merger. Therefore, it is necessary to precisely clarify the effect of mergers on R&D efficiency. Third, considering the fact that the processes of merger effects are varied between companies, it is also necessary to analyze the results of mergers in a particular industry in detail. Such detailed individual case studies such as Ornaghi [2006] and Sengoku *et al.* [2008] are very useful.

Forth, the present study is not based on the "innovation balance" test. It is important to complementally examine the impacts of mergers on the R&D activities of non-merging firms and, also of the whole industry in question. It is because the effects of a merger should be evaluated, taking into account the reactions of rivals (see Appendix 1).

Fifth, this paper includes only 2 international merger cases. But it is necessary to take up more international mergers, bearing in mind the fact that international mergers and acquisitions are increasing.

Sixth, in Japan many of mergers are of a form of joint venture (JV), that is, a separate company created for a special purpose and typically fully-owned by the two or more parent companies (called as equity JV). For example, large diversified firms have separated a division whole respectively and then integrated those divisions into a newly-established JV company with full functions. The example is *Mitsubishi-HitachiMetalsMachinery* (between *Mitsubishi Heavy Industries*and *Hitachi*). Equity JVs also have been frequently emphasized as the "catalyst of innovation and efficiency". But, there is scarcely study focusing on the relationship between equity JV and dynamic efficiency. Equity JVs are a form of merger, but at the same time have their own traits such as higher termination rate or a limited term, and thereby may have specific effects on R&D and innovation. It is necessary to examine the effects of equity JVs on R&D and innovation.

Finally, as suggested earlier, the 1997 revision of the Anti-Monopoly Act prescribes the removal of the ban on holding company to promote business restructuring. As a result, many recent mergers have been conducted by establishment of a holding company. As it has been over 10 years since the removal, it is now an important issue to clarify the effects of holding companies on R&D and innovation in detail.

References

Caldenrini, M. *et al.* (eds.), 2003, *Corporate Governance, Market Structure and Innovation*, Edward Elgar.

Cassiman, B. and M.G. Colombo (eds.), 2006, *Mergers & Acquisitions: The Innovation*

Impact, Edward Elgar.

Coate, M.B. & A.J. Heimert, 2009, "Merger Efficiencies at the Federal Trade Commission, 1997-2007," Economic Issues, FTC.

Colombo, M.G. & P. Garrone, 2006, "The Impact of M&A on Innovation: Empirical Results," in Cassiman & Colombo [2006], pp.104-133.

Davis, P. & C. Huse, 2010, "Estimating the 'Coordinated Effects' of Mergers," Competition Commission, UK.

Davies, S., P.L. Ormosi, and M. Graffenberger, 2014, "Mergers after Cartels: How Markets React to Cartel Breakdown," Discussion Paper, University of East Anglia.

Doi, N., 1996, "Performance of Japanese Firms in Patented Inventions: An Analysis of Patents Granted in the U.S.," *Review of Industrial Organization*, Vol.11, No.1, pp.49-68.

Doi, N., Y. Kudo and M. Kato, 2014, "Competition and International Competitiveness: Evidence from Japanese Industries," Discussion Paper, Competition Policy Research Center, Fair Trade Commission, Japan.

Doi, N., Y. Honjo and Y. Kudo, 2014, "Changes in Market Structure in Japanese Industries: Measurement and Application of 'Mobility Index'," Joint Research Report, Competition Policy Research Center, Fair Trade Commission, Japan. In Japanese.

Fair Trade Commission, Japan (JFTC), 2008, "Ex-post Evaluation of Business Combination,"in *The 2007 Fair Trade Commission Annual Report*. In Japanese.

Farrell, J. & C. Shapiro, 2010, "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition," *THE B.E. Journal of Theoretical Economics*, Vol.10, Iss.1, Article 9.

Gilbert, R., 2006, "Looking for Mr. Schumpeter: Where Are We in the Competition-Innovation Debate?," in A. B. Jaffe, J. Lerner and S. Stern (eds.),*Innovation Policy and the Economy*, Vol.6, NBER, pp.159-215.

Gilbert, R. and D.L. Rubinfeld, 2011, "Revising the Horizontal Merger Guidelines: Lessons from the U.S. and the E.U.," in M. Faure and X. Zhang (eds.), *Competition Policy and Regulation: Recent Developments in China, Europe and the US*, Edward Elgar, pp.262-279.

Hirsch-Kreinsen, H. and D. Jacobson (eds.), 2008, *Innovation in Low-Tech Firms and Industries*, Edward Elgar.

Ikeda, K. and N. Doi, 1983, "The performance of Merging Firms in Japanese Manufacturing Industry: 1964-75," *Journal of Industrial Economics*, Vol.31, No.3, pp.257-66.

Katz, M.L. and H.A. Shelanski, 2007, "Mergers and Innovation," *Antitrust Law Journal*,

Vol.74, No.1, pp.1-85.

Kwoka, Jr. J.E., 1989, "The Private Profitability of Horizontal Mergers with Non-Cournot and Marverick Behavior," *International Journal of Industrial Organization*, Vol.7, Issue 3, pp.403-411.

Olczak, M., 2010, "Unilateral versus Coordinated Effects: Comparing the Impact on Consumer Welfare of Alternative Merger Outcomes," CCP Working Paper 10-3, Centre for Competition Policy, University of East Anglia.

Ornaghi, C., 2006, "Mergers and Innovation: The Case of the Pharmaceutical Industry," Discussion Paper No.0605, School of Social Science, University of Southampton.

Schulz, N., 2007, "Review of the Literature on the Impact of Mergers on Innovation," Discussion Paper No.07-061, Zentrum fur Eupaische Wirtschaftforschung Gmbh.

Sengoku, S., Y. Murasawa, and H. Kimura, 2008, "Expression of Post-merger Effect in R&D Function of Japanese Pharmaceutical Companies: ACase of Astellas Pharma," *Medicalcare and Society*, Vol.18, No.2, pp.273-89. In Japanese.

Yamauchi, I.and S. Nagaoka, 2010, "Do Mergers Improve the Capabilities of Developing and Using Technology?," *Journal* of *Japan Intellectual Property Association*, Vol.7, No.1,pp.14-27. In Japanese.

Appendix 1　Industry Effects of Mergers : "Innovation Balance"

		R&D of mergingfirms	
		Expansion	Decline
R&D of non-merging firms	Expansion	＞0	＞ **or** ＜0
	Decline	＞ **or** ＜0	＜0

Note: Innovation Balance = effect of a merging firm(inside effect)＋effects of non-merging firms (outside effect); ＞ or ＜0.

Appendix 2 Major Merging Firms from 2000 and Later (39 Companies)

Merging Firms	Surviving/Acquiring Firm	Dismantled/Acquired Firm	Type / Industry / Existence of Antitrust Examination / Other
JFE HD	NKK	Kawasaki Steel Corporation	Horizontal / Iron and Steel / Antitrust Examination
Daiichi Sankyo HD	Sankyo	Daiichi Pharmaceutical	Horizontal / Pharmaceutical / Antitrust Examination
Taiyo Nippon Sanso	Nippon Sanso	Taiyo Toyo Sanso	Horizontal / industrial gas
Nihon Unipack HD	Nippon Paper Industries	Daishowa Paper Manufacturing	Horizontal / paper manufacturing / Antitrust Examination
Astellas Pharma	Yamanouchi Pharmaceutical	Fujisawa Pharmaceutical	Horizontal / Pharmaceutical / Antitrust Examination
Mitsubishi Tanabe Pharma	Tanabe Pharma	Mitsubishi Pharma	Horizontal / Pharmaceutical / Antitrust Examination
Dainippon Sumitomo Pharma	Dainippon Pharmaceutical	Sumitomo Pharmaceuticals	Horizontal / Pharmaceutical
KONICA MINOLTA HD	Konica	Minolta	Horizontal / photocopy machines / Minolta camera department sellout
Showa Shell Sekiyu	Showa Shell	Toa Oil	Horizontal / petroleum refining
Sumitomo Rubber	Sumitomo Rubber	THE OHTSU TIRE & RUBBER CO.	Horizontal / tire
KROSAKI HARIMA	Kurosaki Yogyo	Harima Ceramic	Horizontal / firebricks
GS Yuasa HD	Nippon Denchi	Yuasa	Horizontal / storage batteries
Nabtesco HD	Teijin Seiki	Nabco	Horizontal; diversified / control units; machine tools
JTEKT	Koyo Seiko	Toyoda Machine Works	diversified / bearings; machine tools
Nippon Sheet Glass	Nippon Sheet Glass	Pilkington Group Limited (England)	Horizontal (international) / sheet glass

Dynapac	Dainippon Paper	Nihon Dynapac	Horizontal / packaging material
Mitsui Sugar	Shin-Mitsui Sugar	Taito Sugar	Horizontal / sugar
JS Group HD	TOSTEM	INAX	diversified / housing machinery
NIDEC SANKYO	Nidec	Sankyo Seiki	Horizontal / electronic components
Kao	Kao	Kanebo COSMETICS	Horizontal / cosmetics / Kanebo cosmetics unlisted
The Nisshin OilliO Group	Nisshin Oil Refining	Linol Nikko	Horizontal / cooking oil
J-OIL MILLS	Honen Ajinomoto	Yoshiwara	Horizontal / cooking oil
NEOMAX	Hitachi Metals	Sumitomo special metals	Horizontal / special metals
Hitachi Kokusai Electric	Kokusai Electric	Hitachi Electric	Horizontal / electronic components
Sankyo Tateyama HD	Sankyo Aluminium	Tateyama Aluminium	Horizontal / aluminum sash
AHRESTY	AHRESTY	Kyoto Die-cast	Horizontal / die-cast
TCM	Hitachi Construction Machinery	TCM	Horizontal / industrial machinery
Nitto Fuji Flour Milling	Nitto Flour Milling	Fuji Flour Milling	Horizontal / milling
AKS	NSK	AKS	top-down / bearings; steel balls / Antitrust Examination
TOMY COMPANY	TOMY	TAKARA	Horizontal / toys
Calsonic Kansei	Calsonic	Kansei	Horizontal / automobile components
Maruha Nichiro HD	Maruha	Nichiro	Horizontal / fisheries
SEGA SAMMY HD	Sega	Sammy	Horizontal / entertainment devices
SAXA HD	Tako Electric	Tamura Electronics	Horizontal / information-communication devices
Nissin Food Products HD	Nissin Food Products	MYOJO FOODS	Horizontal / instant noodles

AICHI CORPORATION	Toyota Industries	AICHI CORPORATION	diversified / customized cars
ASKA Pharmaceutical	Teikoku Zoki	Gureran pharmaceutical	Horizontal / Pharmaceutical / Gureran pharmaceutical unlisted
Electrochemical Engineering	Electrochemistry	Toyo Chemical Co.	Horizontal / electronic materials
Chugai Pharmaceutical	Roche (Switzerland)	Chugai Pharmaceutical	Horizontal (international) / Pharmaceutical