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Merging Firms: Keiretsu-related and Independent Mergers

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Productivity and Operating Performance of Japanese Merging Firms:

Keiretsu-related and Independent Mergers

Abstract

Our empirical analysis of 86 Japanese corporate mergers, in the period from 1970 to 1994, probes productivity and operating performance of the merging firms, indicating that merging firms suffer particularly in terms of productivity, profitability, sales growth and employee growth. However, Keiretsu-independent mergers beat intra-Keiretsu mergers in the sense that the latter produced worse consequences than the former. The results suggest a higher agency cost for the conventional mergers used mainly to maintain or strengthen Keiretsu group unity. On the other hand, Keiretsu-independent mergers are more strategically oriented and similar to Anglo-American M&A.

Classification

D24, G34

Keyword

Japanese mergers, Keiretsu, total production factor (TPF), financial performance.

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1. Introduction

It is well known that corporate mergers and acquisitions (M&A) in Japan are

different in the nature from Anglo-American M&A. Japanese corporate culture and

business practices have been making the M&A market in Japan quite different from that

of U.S. or other Western advanced economies. For example, Sheard (1989) stated that

the practice of inter-corporate shareholdings has been a reason for the missing of a

corporate takeover market in Japan. Hostile takeovers are almost non-existent in Japan

because of the harmony-emphasizing, conflict-avoiding corporate culture and mutual

shareholding practice. Japanese M&A activity is characterized with a friendly atmosphere

in the deal making. Most Japanese mergers are used in a passive sense: the sellers are

only willing to be merged when having financial problems (rescue-oriented merger).

Such mergers are frequently used as a tool for maintaining or strengthening Keiretsu

group unity, in which a poorly performing firm is arranged to be merged with another

firm within the Keiretsu group[1].

With these differences in the nature of M&A activity, we might well expect a

disparity in the consequences between Japanese and Anglo-American corporate mergers.

Japanese corporate mergers, unlike their counterparts in U.S., usually accompany little

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[1] Keiretsu is a complex network of companies interlinked with capital and transactional

relations in Japan. At the center of the Keiretsu network is a bank or a core company,

acting as a leading standard-bearer in the group.

drastic changes in policies dealing with workers and managers of the merged firms. Harsh layoffs are rarely adopted after mergers in Japan. Such paternalism can be observed in most of the Japanese mergers so far. Theories on Anglo-American M&A have suggested that M&A act as a discipline for managers to maximize the firm value, and as a mechanism by which the market system replaces incompetent management. When there is little change in the merged firm's governance system, it would be hard to expect the amalgamating firm to improve efficiency. Previous studies have indicated generally disappointing results on the post-merger performance of Japanese merging firms. Studies examining accounting performance of merging firms have reported little changes or deteriorating trends in the merging firms' profitability and growth following mergers [for instance, see Hoshino (1982, 1992); Muramatsu (1986); Odagiri and Hase (1989)]. These findings contrast with Western evidence, which has varying results [for instance, Ravenscroft and Scherer (1989) find profitability declined following a merger, whereas Lev and Mandelker (1972), Smith (1990), Healy et al (1992), and Cornett & Tehranian (1992) report an improvement in profitability after the merger]. On the other hand, the evidence on Japanese mergers' impact on stockholders' wealth, according to Pettway et al. (1986, 1990), shows insignificantly positive excess stock returns, a result similar to findings in the U.S. [for example, see Jensen et al (1983)].

One purpose of this study is to supplement the empirical literature on merger effect in Japan with an extensive investigation of mergers from 1970s to early 1990s. In addition to traditional accounting ratios used in previous works, we also examine the merging firms' productivity, or technical efficiency. The productivity is measured by total productivity factor (TPF), or the output per unit of total input. Previous studies have

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demonstrated that productivity is positively correlated with both profitability and stock prices, but that productivity is more fundamental: it determines the other two variables [see Baily and Schultze (1990), and Allen, Faulhaber, and MacKinlay (1989).] Many of the mergers in Japan have cited improvement in productivity as a main objectivity of the merger. We will examine the change in merging firms' productivity and other relevant accounting performance in relation to the mergers.

Another feature of this study is that we also distinguish between mergers of companies within a Keiretsu and mergers of companies belonging to a different Keiretsu or not belonging to any Keiretsu. The former type of mergers has been very popular in Japan. In Japan, when contemplating a merger, a firm would prefer to make a deal with those it is associated with. For the most part, companies within the same Keiretsu firms are the first to be considered as a possible candidate. If a firm decides to merge with another firm of a different Keiretsu group, it is deemed as an unusual event in corporate Japan. Apart from rescue purpose, mergers are often used as a restructuring means to reorganize overlapping businesses within the portfolio of the Keiretsu. The core firm or bank in a Keiretsu mostly initiates or brokers the deal with the help of its shareholding and directorate ties. However a trade-off emerges in such intra-Keiretsu mergers: although Keiretsu association smoothes the processes of the negotiation and facilitate the post-merger integration as Keiretsu firms share similar management styles and corporate cultures, the close links between the firms involved may yield paternalism and stifle changes and reforms. These keiretsu-related mergers also tend to be less strategically oriented in the nature. On the other hand, Non-intra-Keiretsu mergers, without Keiretsu-related interlocks, tend to be more strategically oriented and similar to

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Anglo-American M&A. In this study, we explore how these two different types of mergers would yield different consequences.

This paper is outlined as follows. Section 2 describes the data sources and methodology. Section 3 reports the empirical results for changes in the merging firms' performance following the merger. Section 4 distinguishes between intra-Keiretsu and Keiretsu-independent merger in terms of the effects on firm performance. In section 5 we discuss the results and their implications. Section 6 gives a summary.

2. Data and Methodology

2.1. Sample and data sources

The merger events were mainly identified in the Nihon Keizai Shimbun (Japan Economic Newspaper). The mergers occurred in the period ranging from 1970 to 1994. Our sample is confined to mergers among domestic non-financial Japanese companies. Also excluded are mergers between parent company and its subsidiary, since in these cases the merged firm had been under complete control of the merging firm before the merger. In final there are 86 cases of mergers, of which the merging firms are public traded companies in the Tokyo Stock Exchange. We confine to public corporations because their financial data are available and complete. In this study we focus our concern on the merging firms, since most of the merged are non-public companies and their financial data are unavailable (only 30 of the merged firms are public companies in our sample.)

The newspaper coverage of these merger events provides an informative account of the details of the deals, including the relations between the merging and the merged firms. Based upon the coverage, we categorize our merger sample into two types: (1)

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intra-Keiretsu merger, or merger of firms belonging to the same Keiretsu, and (2) cross-Keiretsu or independent merger, or merger of firms belonging to different Keiretsu or not belonging to any Keiretsu.

The financial data of the merging firms are colleted from the NEEDS (Nikkei Economic Electronic Databank System), documented by Nihon Keizai Shimbun. For our purpose of investigating merger's long-term effect, we use financial data of the merging firms for 5 years before and after the merger year, hence 10 years in total for each firm. Data for the merger year are omitted to avoid the biases caused by varying accounting practices.

Table 1 reports the frequency distribution of the merging firms in terms of merger completing year. The 86 merger deals are comprised of 51 intra-Keiretsu mergers (59 percent) and 35 cross-Keiretsu or independent mergers (41 percent.) Industry frequency distribution is shown in Table 2. The industry categories are based on NEEDS five-digit industry codes. Trade companies have the largest number of mergers (n=11), followed by chemistry industry (n=10), pulp and paper industry (n=9), electronics industry (n=9), auto industry (n=7) and steel and iron industry (n=6).

Insert Table 1 here

Insert Table 2 here

2.2. Estimation model for productivity

We use total factor productivity (TFP) in measuring a firm's technical efficiency. The productivity estimation follows the methodology of Lichtenberg (1994). Productivity can be represented as the ratio of output to input

$$TE = Q/I \qquad (1)$$

where TE denotes technical efficiency, and Q, I denote output and input of a firm, respectively. For simplicity, suppose the input contains only labor input (denoted by L) and capital input (denoted by K). Hence the input can be considered as a function of the level of L and K. If we assume the function form of the input as a Cobb-Douglas function, (1) can be rearranged as:

$$Q = TE * I = TE * F(L, K) = TE * L^{\alpha} * K^{\beta} \qquad (2)$$

Taking the logarithm, we obtain

$$\ln Q = \ln TE + \alpha \ln L + \beta \ln K \qquad (3)$$

Now (3) looks like a production function. In fact, given a set of data $\{Q_i, L_i, K_i\}$, i = 1,...,N, for a set of N firms in an industry, we can under certain assumptions use (3) as an approximation of the production function to infer the unobservable TE. In (3), the level of lnQ can be explained by the level of lnL and lnK, and the remaining factors unexplained by input levels are those firm-specific management factors, such as productivity or efficiency, which are varying from firm to firm. Suppose the parameters α and β are invariant across firms in the same industry, and TE varies across firms but is unobservable. Under these assumptions, (3) can be rewritten as:

$$\ln Q_i = \alpha \ln L_i + \beta \ln K_i + \mu_i \qquad (4)$$

where $\mu_i = \ln(TE_i)$. Equation (4) looks like a regression equation, and the error term μ_i is equivalent to firm i's technical efficiency. If the error term is uncorrelated with regressors L and K, then the ordinary least squares (OLS) estimators of α and β (denoted by $\hat{\alpha}, \hat{\beta}$) are the best linear unbiased estimators. Moreover, the residuals of this fitted production function,

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$$e_i = \ln Q_i - (\hat{\alpha} \ln Q_i + \hat{\beta} \ln K_i) \qquad\qquad (5)$$

are also the best linear unbiased estimators of the corresponding error terms μ_i and can be used as proxy of a firm's productivity.

For each merging firm in this study, we estimate the residuals of OLS estimates by pooling all firms with the same NEEDS five-digit industry code for pre-merger five-year period and post-merger five-year period. We also include in the estimation model the ratio of selling, general, and administrative expenses to sales (SGA) to control for sales intensive firms, and fixed effect year dummy variables to account for growth in productivity over time. Thus for each merging firm the estimation model for the production function is

$$\ln Q_i = \alpha \ln L_i + \beta \ln K_i + \gamma SGA_i + \delta 1Y1 + \delta 2Y2 + \delta 3Y3 + \delta 4Y4 + \mu_i$$

$$(6)$$

where i represents the firms in the same NEEDS 5-digit industry code as the merging firm, and Y1, Y2, Y3, and Y4 are the dummy variables of the year relative to merger year. For instance, if merging firm A completed the merger in year 1985, then we use data of all the firms in A's industry from 1980 to 1984 to estimate (6) for the pre-merger production function. The 4 dummy variables (Y1 to Y4) then represent year 1981 to 1984. Dummy variable for 1980 is omitted to avoid exact linearity problem. Subject to the assumptions discussed above, each residual from the regression is an estimate of the deviation of the firm's productivity from mean productivity in that industry for the pre-merger period. The post-merger production function is estimated in a similar way.

In estimating (6), we use the sales as proxy for Q, the number of employees as proxy for L, and raw material costs and depreciable tangible fixed assets as proxy for K.

However, it must be noted that a potential problem arising from using these nominal figures for Q and K is that, if the market is imperfect, residuals will reflect price variation as well as efficiency variation. That is, suppose the markets are imperfectly competitive, and a firm's willingness to exploit its market power by raising prices is higher after a merger than before, then the pre-merger versus post-merger change in the firm's residuals overstates the change in its relative efficiency (Lichtenberg, 1990).

2.3. Other relevant accounting ratios

To acquire a more comprehensive account of the merger effect on the firm's performance, we also examine the firm's other related behaviors by using accounting measures. Specifically we calculated the merging firms' return on assets (ROA), return on equity (ROE), growth in sales (SALES), growth in employment (EMPL), and research and development ratio (RD). These ratios are calculated as follows:

$$ROA = \text{operating income/total assets} \tag{7}$$

$$ROE = \text{current income/equity} \tag{8}$$

$$SALES = (\text{sales of current year/sales of previous year}) - 1 \tag{9}$$

$$EMPL = (\text{employee number of current year/employee number of previous year}) - 1 \tag{10}$$

$$RD = \text{research and development expenses/sales} \tag{11}$$

For our purpose of investigating merger's long-term effect, these five measures are calculated for each merging firm for each year from four years before merger (year -4, -3, -2, -1, respectively) to four years after the merger (year 1, 2, 3, 4, respectively). Year zero is the year a merger is completed for a particular firm and will be a different calendar

year for different firms. Data for year zero is omitted for the reason of minimizing the "noises" caused by different merger accounting practices in the year of consolidation. Note that since calculation of SALES and EMPL involves two years of data, these two variables in year 1 are not available because the data for year zero are required. Henceforth, there are only seven years of data for SALES and EMPL, from year -4, to year -1 and from year 2 to year 4.

Since pre-merger versus post-merger change in these accounting measures may be subject to economy-wide or industry factors other than the merger, we need to account for these factors. One frequently used way is to compare with the industry median or mean, a measure of how the overall industry behaves on average. For each merging firm in our sample, we compute the median measures of all the other firms with the same five-digit NEEDS industry code. These industry median accounting ratios are computed for each year corresponding to each merging firm.

3. Pre-merger versus post-merger change in firm performance

In this section, we estimate the difference in firm performance between merging firms and the industry median in pre-merger and post-merger years, and test the null hypothesis that the pre-merger versus post-merger change in the difference is zero. The statistical model is formulated as a set of equations,

$$R_t = \theta_t M_t + \varepsilon_t \tag{12}$$

where R denotes a firm's performance; M denotes a dummy variable, that M=1 for merging firms and M=0 for the industry medians; ε is the error term. In the following analyses, we use productivity (TE) and other accounting ratios computed in preceding sections to measure the firm performance R. In (12), t=-4, -3, -2, -1, 1, 2, 3, 4,

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representing 4 years before and after the mergers, so there are eight regression equations, each representing a year of data. Note that for SALES and EMPL, since data for year 1 are not used, there are only seven equations, with $t=-4, -3, -2, -1, 2, 3, 4$. The parameter θ_t measures the difference in merging firms' performance relative to the industry benchmark in year t. Since (12) is estimated as a set of equations, if we want to know the change in the pre-merger versus post-merger difference, we can test the null hypothesis, for instance, that $\theta_1 = \theta_{-1}$.

Instead of estimating equations in (12) for each individual year, we estimate (12) as a single statistical model to take account of the fact that the errors for the equations, ε_t, may be correlated since the equations are in chronological order. With the equations combined and equation error information used, we gain an improvement in the precision with which the unknown parameter is estimated. We report the estimated generalized least squares estimators of θ_t ($t= -4,...-1,1,...4$), and the test results for hypotheses that pre-merger θ is equal to post-merger θ.

3.1. Productivity

Table 3 reposts the estimation results for productivity. The θ estimates are not significantly different from zero in pre-merger years except year -4, meaning that there is little difference in the productivity level between merging firms and their industry median before mergers. In year -1, one year before merger, the merging firms are 5.8% less productive than their industry medians, which is insignificant at level of ten percent. After mergers, however, the θ_2 estimate is -11.7 percent (significant at one percent level) and θ_3 is -7.2 percent (significant at the level of ten percent), although in year 1 and year

4, the productivity differences are insignificant. It turns out that the merging firms are

significantly less efficient in productivity than the industry medians in year 2 and 3.

<center>Insert Table 3 here</center>

The pre-merger vs. post-merger changes in the productivity difference, tested in

the lower part of Table 3, are generally insignificant. For example, the post-merger four

year average of productivity difference, $(\theta_1+\theta_2+\theta_3+\theta_4)/4$, is not significantly different

from the pre-merger four year average of productivity difference, $(\theta_{-1}+\theta_{-2}+\theta_{-3}+\theta_{-4})/4$, at

the level of 10 percent. As far as productivity is concerned, our data have only shown a

slightly negative merger impact in the post-merger years, although the change is

insignificant.

3.2. Profitability

Table 4 shows the results for ROA and ROE, both representing a firm's

profitability. In Panel A, which reports ROA estimation model, it can be seen that θ

estimates in pre-merger years are ranging from 5.3 percent to 5.7 percent, all significant

at the level of 0.1 percent. Merging firms are more profitable than their industry medians

before merger years. In post-merger years, the θ estimates are decreasing to a level in the

range of 4.3 percent to 4.8 percent, also significant at the level of 0.1 percent. The

merging firms still outperform their industry medians in terms of profitability after the

mergers, but at a relatively weaker magnitude than in pre-merger years.

<center>Insert Table 4 here</center>

The pre-merger vs. post-merger changes in the ROA difference, tested in the

latter part of Panel A, are consistently indicating a significant downward trend after

merger. For example, the mean productivity difference of the post-merger four years

<center>11</center>

minus the mean productivity difference of the pre-merger four years is -0.9 percent, significant at the level of one percent. The decline in ROA difference illustrates a negative merger effect on the firms' profitability. Similar findings can be also obtained in Panel B, which gives the estimation model results for ROE. Merger has a negative impact on the firms' profitability in the wake of mergers.

3.3. Growth

Table 5 gives the results for SALES in Panel A and for EMPL in Panel B. In SALES estimation model, the θ estimates in pre-merger years are all positive, significant at the level of 0.1 percent. Merging firms are growing in terms of sales at a greater rate than their industry medians before merger. For instance, in year -1, one year before the merger, merging firms achieve 9.8 percent more sales growth than their industry medians. In post-merger years, the θ estimates are dropping to a level in the range of 4.9 percent to 6.2 percent, but they are still significant at the level of 0.1 percent. The merging firms still outperform their industry medians in sales growth in post-merger years, but only at a slower pace than in pre-merger years.

The pre-merger vs. post-merger change in the SALES difference consistently shows a downward shift at a significant magnitude. For example, the mean SALES difference of the post-merger three years minus the mean SALES difference of the pre-merger three years is -3.9 percent, significant at the level of 0.1 percent. These results indicate a negative merger impact on the merging firms' sales growth after the mergers.

Insert Table 5 here

Results for estimation model for EMPL are shown in Panel B of Table 5. In pre-merger years, the θ estimates, except in year -2, are positive and significant. For example,

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the estimate is 7.2 percent (significant at the level of 0.1 percent) in year -1, meaning that

merging firms are expanding their workforce 7.3 percent larger than the industry

medians. However, the estimate turns out to be -1.5 percent (significant at the level of

five percent) in year 2, but in subsequent year 3 and year 4, the estimates are not

significantly different from zero.

The pre-merger vs. post-merger changes in the EMPL difference are all showing

negative sign with a significant level. For example, the mean employee growth difference

of the post-merger three years minus the mean employee growth difference of the pre-

merger three years is -3.9 percent, significant at the level of 0.1 percent. Mergers put the

squeeze on the growth in employment after the mergers.

3.4. R&D

Table 6 gives the results for RD. The estimates for θ have been in the range of

1.3 percent to 1.5 percent and significant at the level of 0.1 percent in both pre-merger

and post-merger years. Means merging firms are spending more in research and

development than their industry medians in pre- and post-merger years. The pre-merger

vs. post-merger changes in the estimates in general show no significant difference, with

the exception in pre-merger one year vs. post-merger one-year change, which is negative

at a significant level of one percent. The results indicate that merger activity only causes

a slight drop in the firms' R&D expenditure in initial years following mergers, but the

change is not significant in the longer-term view.

Insert Table 6 here

4. Intra-Keiretsu versus cross-Keiretsu or independent mergers

Thus far we have examined merger's impact on the productivity and other related accounting performances of the merging firms as a whole. In this section, we distinguish Keiretsu-related and Keiretsu-independent mergers. In our sample, we have identified two types of mergers, intra-Keiretsu mergers and independent or cross-Keiretsu mergers, from the sources of newspaper coverage, as described in section 2.1. We add this information regarding Keiretsu relationship to the analysis model similar to those employed in the preceding analyses. Our interest is now turning to the question that whether the effects are different between intra-Keiretsu mergers and independent or cross-Keiretsu mergers. The estimation model is reformulated as follows:

$$R_t = \iota_t Ind_t + \kappa_t KR_t + \omega_t \qquad (13)$$

where R_t represents the performance measures TE and other related accounting ratios in year t; Ind is a dummy variable that Ind=1 for independent or cross-Keiretsu mergers, otherwise Ind=0; KR is a dummy variable that KR=1 for intra-Keiretsu mergers, otherwise KR=0; Ind=0 and KR=0 for the corresponding (non-merger) industry median; ω is the error term. Parameters ι and κ measure the difference in performance relative to the industry medians for independent or cross-Keiretsu mergers and intra-Keiretsu mergers, respectively.

4.1. Productivity

Table 7 reports the results for productivity. The ι estimates in year -4 and -3 are -12.4 percent (significant at the level of five percent) and -11.4 percent (at the level of one percent), respectively, but in year -2 and -1, although the estimates are still negative, they are not significantly different from zero. In the post-merger years, however, the ι

estimates are significantly negative except in year 4. The pre- vs. post-merger ɩ estimate changes show a downward shift but they are insignificant. On the other hand, estimates for x are not different from zero significantly for all pre- and post-merger years. And tests of the pre- vs. post-merger changes in x estimates also show no significant difference.

Insert Table 7 here

Although either Keiretsu-independent or intra-Keiretsu merging firms see no statistically significant changes in the pre- vs. post-merger productivity difference, there is a discrepancy in the patterns of productivity estimates the two types of mergers. Keiretsu-independent merging firms have been less efficient in productivity than the industry medians in pre-merger years, but this disparity diminished to an insignificant level as approaching merger year. In the ensuing three years after merger, Keiretsu-independent merging firms turn out to be less efficient in productivity than the industry medians, at significant levels. On the other hand, the merging firms of intra-Keiretsu mergers have been behaving in line with the industry medians in terms of productivity through the pre- to post-merger years.

4.2. Profitability

The results for ROA and ROE are reported in Table 8. As shown in Panel A, where ROA is the dependent variable of the equations, both estimators for ɩ and x are positive figures at a significant level in pre- and post-merger years. Merging firms, Keiretsu-independent or intra-Keiretsu, are more profitable than the industry medians through the pre- to post-merger years. Also noteworthy is that the ɩ estimates are consistently larger than x estimates in all the years, indicating merging firms of Keiretsu-

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independent or cross-Keiretsu mergers are more profitable than industry medians to a larger extent than the merging firms of intra-Keiretsu mergers are.

Insert Table 8 here

The pre- vs. post-merger change in ROA difference is not the same between the two types of mergers. For independent or cross-Keiretsu mergers, the change is downward but it is insignificant. For instance, the post-merger four-year average of t estimate minus the pre-merger four average of t estimate is -0.5 percent, which is insignificant at the level of ten percent. On the other hand, intra-keiretsu merging firms see a steeper fall in their ROA difference following mergers. For instance, the change in x estimator from pre-merger four-year average to post-merger four-year average is -1.2 percent, which is significant at the level of one percent. Results for ROE in Panel B are demonstrating the same findings as ROA. Intra-Keiretsu mergers have a much greater negative impact on profitability of merging firms than Keiretsu-independent mergers do.

4.3. Growth

In Table 9, Panel A shows the results for SALES. Estimates for t and x are positive figures at significant levels before merger, and they are still positive at significant levels after the mergers. Merging firms of both merger types are growing at a faster pace than their industry medians in pre- and post-merger years. However the pre- vs. post-merger changes in SALES difference show different results for Keiretsu-related and Keiretsu-independent mergers. For instance, the post-merger three-year average minus the pre-merger three-year average for t estimator is -1.5 percent, which is insignificant, while the corresponding figure for x estimator is -5.6 percent, which is significant at one

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percent level. Intra-Keiretsu mergers have a much greater negative impact on sales

growth rate of merging firms than Keiretsu-independent mergers do.

Insert Table 9 here

Panel B in Table 9 shows the results for EMPL. In the pre-merger years, the t

estimates are all positive figures, but they are insignificant except for year -3. In the post-

merger years, the t estimates turned out to be negative figures in year 2 and year 3,

turning positive again in year 4, but they are all insignificant. The pre- vs. post-merger

change in t estimates is showing only a small degree of significance. For instance, the

post-merger three-year average minus the pre-merger three-year average is -3.2 percent,

significant at the ten percent level. On the other hand, the estimates for x are on average

positive in the pre-merger years, with the exception for year -2, where the x estimate is

negative at a significant level. In year -1, one year before the merger, the x estimate is 9.4

percent, significant at one percent level. In the post-merger years, the x estimate

becomes -2 percent (significant at five percent level) in year 2, 1.6 percent (insignificant)

in year 3, and -3.4 percent (significant at five percent level) in year 4. As for the pre- vs.

post-merger difference in estimates for x, it demonstrates a significant downward change.

The post-merger three-year average minus pre-merger three-year average for x estimator

is -4.5 percent, significant at the level of one percent. The employee growth rate is

diminishing following mergers for both Keiretsu-independent and intra-Keiretsu

mergers, but intra-Keiretsu mergers are downsizing the workforce to a greater extent

than Keiretsu-independent mergers.

4.4. R&D

Table 10 shows the results for RD. The ι estimates are around 1.1 percent or so

in pre-merger years, but they fall to 0.8 percent in year 1 and year 2, and then go up to

1.0 percent in year 3 and 1.2 percent in year 4. The pre- vs. post-merger one-year and

two-year average changes in estimates for ι show a significant decline at the level of five

percent, but the three-year average and four-year changes are insignificant. As for x

estimates, they are also positive figures and remain steady through the pre- to post-

merger years. The pre- vs. post-merger change in x estimates is not significantly different

from zero. Keiretsu-independent mergers observe some reduction in research and

development expenditures in the initial two years after merger, whereas intra-Keiretsu

mergers have no significant impact on research and development.

Insert Table 10 here

5. Discussion

Our results regarding merger effect on various performance measures, in general,

indicate a negative impact. The results on profitability and sales growth coincide with

most previous empirical studies on Japanese mergers [Hoshino (1982, 1992); Muramatsu

(1986); and Odagiri & Hase (1989).] The results of insignificant decline in productivity

contrast strikingly with the findings by Lichtenberg and Siegel (1990), which show

leveraged buyouts have a strongly positive effect on productivity of U.S. manufacturing

plants. Corporate mergers in Japan apparently are not as effective as they were intended.

Few studies so far regarding Japanese mergers and acquisitions (M&A) have

demonstrated favorable consequences. However, considering the characteristics and the

nature of M&A in Japan, where stockholder value is usually outweighed by other

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corporate objectives, it is not so surprising that mergers produce such disappointing results. Unlike Anglo-American M&A, a great deal of M&A in Japan have been used as a rescue means to secure financially troubled or mismanaged companies, or as a restructuring tool to consolidate affiliated firms. Strategic M&A are less prevalent in Japanese markets than in the Western advanced economies. Hostile takeovers are almost nonexistent in corporate Japan due to cross-shareholding practices among Japanese corporations and an antipathy towards the "corporate raider". The Western theories on M&A have suggested that M&A act as a discipline for managers to maximize the firm value and, a mechanism by which the market system replace incompetent management. But in Japanese M&A, no significant reshuffles of the management in the merged firms were carried out after the merger and layoffs remain a taboo. In many cases, the merged firm's CEO remained in the director board of the amalgamating firm. Under these circumstances it would be hard to expect the amalgamating firm to be capable of realizing the potential synergy, if any.

The newspaper coverage of our mergers sample reports that the employees of the merged firms, in many cases, are absorbed into the new amalgamating firms and no harsh layoffs are carried out following the mergers. But our empirical results show that the employee growth rate is declining following the mergers. This implies that although Japanese mergers usually accompany little layoffs, the new amalgamating firms restrain employment growth following the mergers. Such moderate practices can also be observed in corporate Japan during hard times or economic recessions.

Our results on R&D investment are somewhat consistent with Lichtenberg and Siegel (1990), which also reposts an insignificant decline in post-merger years relative to

pre-merger years. According to Lichtenberg et al (1990), " previous studies have documented, and we confirm, that targets of LBOs tend not to be R&D-intensive, because R&D-intensive businesses are not good buyout candidates." In the our data, merging firms have higher R&D expenditures than industry medians at a 1.4 percent margin one year before the mergers, however, this difference falls to 1.3 percent at a significant level of 10 percent one year following mergers. In the subsequent years, the R&D ratio rises up gradually to its pre-merger levels. The drop in the first year after merger is likely to be related to combining with a non-R&D-intensive firm, which, as a result, leads to lower levels of R&D ratio after consolidation of the two firms.

In this study, we also distinguish between intra-Keiretsu mergers and Keiretsu-independent mergers. Our empirical results indicate some discrepancies in the direction of shifts of post-merger performance between the two types of mergers. With respect to productivity, cross-Keiretsu or independent mergers have a slightly negative impact on productivity, but intra-Keiretsu mergers observe a steady, unchanged performance in the merging firms. This may be because firms within the same Keiretsu are more homogeneous in the management efficiency since they are well connected and collaborative in capital or transactional aspects, so intra-Keiretsu mergers are showing little sensitivity in productivity. On the other hand, cross-Keiretsu or independent mergers are more likely to be subject to conflicts in consolidating two firms with different management styles and corporate cultures.

However, intra-Keiretsu merging firms turn out to have lower profitability and sales growth following the mergers to a greater extent than Keiretsu-independent mergers. Keiretsu-independent mergers beat Keiretsu-related mergers in terms of post-

merger profitability and growth performance. In fact, most of the intra-Keiretsu mergers are used as a restructuring or rescue means, and they are less strategically oriented. The negative impact on the merging firms' profitability and sales growth for intra-Keiretsu mergers is likely to result from the poor performance of the merged firms and the ill-matched fitness of the combination. On the other hand, the magnitude of downward changes in the profitability and sales growth are smaller and insignificant for cross-Keiretsu or independent mergers, as they are more strategically oriented in the nature.

With regard to employment policy, both Keiretsu-independent and intra-Keiretsu mergers have curtailed the employee growth rate following the mergers, but intra-Keiretsu mergers show a larger scale of downsizing than Keiretsu-independent mergers. This suggests that mergers of firms within the same keiretsu are more likely to produce excessive personnel. This may be reflected in a Japanese corporate employment practice that workers of one company, at a later stage in one's career, would usually be redeployed to its affiliated companies. So when mergers occur within a Keiretsu, it inevitably yields more excess workforce in the amalgamating organization than an independent or cross-Keiretsu merger. This is especially the case for the mergers in our sample since most of the mergers are those among firms with related businesses.

The results regarding changes in R&D expenditures also indicate a disparity between Keiretsu-independent and intra-Keiretsu mergers. The Keiretsu-independent mergers observe a significant decline in R&D expenditures in the initial two years after merger, but returns back to pre-merger levels in the third and fourth year, whereas intra-Keiretsu mergers have no significant changes in R&D spending following the mergers. This implies that the acquired firms in cross-Keiretsu or independent mergers are non-

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R&D-intensive firms, while in intra-Keiretsu mergers the acquired firms are as much R&D-intensive as the merging firms. As suggested by previous studies, R&D-intensive businesses are not good buyout targets. If this holds true, then the intra-Keiretsu mergers may not be so wise in this sense. This reinforces our earlier conjecture that intra-Keiretsu are less strategically oriented in the nature.

Generally speaking, the evidence corroborates our conjecture that Keiretsu-independent mergers are more strategically oriented and similar to Anglo-American M&A. The results also reinforce the study by Pettway et al. (1990) which found that non-Keiretsu acquisitions in Japan produced significantly positive cumulated abnormal returns (CAR) but Keiretsu acquisitions resulted in insignificant and even negative CAR. The non-strategic intra-Keiretsu M&A were "punished" not only in the stock market but also in terms of the corporate performance. On the other hand, Keiretsu-independent and cross-Keiretsu mergers tend to be more strategic, and their corporate performance beats that of intra-Keiretsu mergers.

6. Summary

Our empirical analysis of 86 Japanese corporate mergers, in the period from 1970 to 1994, probes various aspects for post-merger performance of the merging firms, indicating a negative merger impact in general. The merging firms suffer particularly in terms of productivity, profitability, sales growth and employee growth. Our results, combined with previous studies, reinforce the commonly held impression in Japan that merger is not an effective way of improving financial performance. As a matter of fact, in Japan, where stockholder value is outweighed by other corporate objectives, mergers are adopted more in a defensive sense, as a means to restructure slack businesses or to

stave off hard times caused by intensive competition or recession. Unique business systems and paternalistic practices in corporate Japan have stifled radical reforms and changes following the consolidation. The turf battles and a tattoo against layoffs also make it difficult to achieve efficiency. These factors have kept many analysts skeptical about the workability of mergers in Japan.

However we do find some discrepancies in the direction of changes in post-merger performance between Keiretsu-independent and Keiretsu-related mergers. Intra-Keiretsu merging firms show steady, unchanged productivity performance through mergers, whereas Keiretsu-independent mergers have a slightly negative impact on productivity. This may be because firms belonging to a same Keiretsu group are similar in the management style and efficiency, but Keiretsu-independent mergers need more time to integrate firms with different management efficiency. However, intra-Keiretsu mergers have a greater negative impact on profitability, sales and employment growth sales than Keiretsu-independent mergers. Also intra-Keiretsu mergers are not as much a wise decision as Keiretsu-independent in the sense that the merged firms in intra-Keiretsu mergers are R&D-intensive firms, which as suggested by previous studies, are not a good buyout candidate.

In general, the merging firms of intra-Keiretsu merger performed worse than those of Keiretsu-independent mergers did. Mergers of firms among the same Keiretsu tend to be aimed at reorganization or rescue in order to maintain or strengthen group unity, and thus be less strategically oriented in the nature. They are also confined to a more limited choice set of potential partners, which lowers the possibility of reaching an optimal fit of businesses. On the other hand, cross-Keiretsu or independent mergers are

more strategically oriented and similar to Anglo-American M&A, and they result in a relatively "better" performance than intra-Keiretsu mergers.

Summarizing, corporate mergers in Japan are undertaken mostly in a defensive or passive sense, and few studies, including this study, support their validity of achieving efficiency. However, mergers among firms within the same Keiretsu produce worse consequences than mergers among firms belonging to different Keiretsu or not belonging to any Keiretsu. The relatively "better" performance of Keiretsu-independent mergers suggests that they are more strategically oriented in the nature. Our empirical results also suggest a higher agency cost for the conventional mergers that are used mainly to maintain or strengthen Keiretsu group unity.

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TABLE 1: The frequency distribution of mergers in terms of merger completing year.

Year of merger completion	The number of mergers	The number of intra-Keiretsu mergers	The number of cross-Keiretsu or independent mergers
1970	3	2	1
1971	4	2	2
1972	3	2	1
1973	0	0	0
1974	1	1	0
1975	1	1	0
1976	0	0	0
1977	1	0	1
1978	5	3	2
1979	2	1	1
1980	3	1	2
1981	2	0	2
1982	4	3	1
1983	8	4	4
1984	6	6	0
1985	4	2	2
1986	3	1	2
1987	4	1	3
1988	3	3	0
1989	5	4	1
1990	3	3	0
1991	3	2	1
1992	6	3	3
1993	7	5	2
1994	5	1	4
In total	86	51	35

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TABLE 2: The industry frequency distribution for the merging firms. The industry categories are based on NEEDS five-digit industry codes.

Industry of the merging firms	Number
Construction	3
Foods	2
Faber	1
Pulp and Paper	9
Chemical	10
Pharmaceutical	1
Petroleum	4
Pottery	5
Steel and Iron	6
Non-metal	3
Machinery	4
Electronics	9
Ship-building	1
Automobile and Parts	7
Other Manufacturing	2
Trade companies	11
Retailing	1
Railway	1
Land	1
Marine	2
Communications	1
Service	2
In total	86

Table 3: The difference in productivity between merging firms and the industry median in pre-merger and post-merger years, and tests of the null hypothesis that the pre-merger versus post-merger change in the difference is zero. The model is formulated as a set of equations, $TE_t = \theta_t M_t + \varepsilon_t$, where TE denotes a firm's productivity; M denotes a dummy variable, that M=1 for merging firms and M=0 for the industry medians; ε is the error term. In the model, t=-4, -3, -2, -1, 1, 2, 3, 4, representing 4 years before and after the mergers, so there are eight regression equations, each representing a year of data. The parameter θ_t measures the difference in merging firms' productivity relative to the industry benchmark in year t. To know the change in the pre-merger versus post-merger difference, we can test the null hypothesis, for instance, that $\theta_1 = \theta_{-1}$.

Productivity (TE) as the dependent variable (the number of observations for each year = 166)

	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
Estimate for θ	-0.083	-0.063	-0.036	-0.058	-0.049	-0.117	-0.072	-0.067
P-Value	0.034	0.141	0.369	0.116	0.193	0.002	0.076	0.119

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_1 - \theta_{-1} = 0$	0.009	0.739
$(\theta_1 + \theta_2) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.036	0.165
$(\theta_1 + \theta_2 + \theta_3) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.027	0.318
$(\theta_1 + \theta_2 + \theta_3 + \theta_4) / 4 = (\theta_{-1} + \theta_{-2} + \theta_{-3} + \theta_{-4}) / 4$	-0.016	0.558

Table 4: The difference in profitability between merging firms and the industry median in pre-merger and post-merger years, and tests of the null hypothesis that the pre-merger versus post-merger change in the difference is zero. The model is formulated as a set of equations,

$R_t = \theta_t M_t + \varepsilon_t$, where R denotes a firm's profitability (ROA and ROE); M denotes a dummy variable, that M=1 for merging firms and M=0 for the industry medians; ε is the error term. In the model, t=-4, -3, -2, -1, 1, 2, 3, 4, representing 4 years before and after the mergers, so there are eight regression equations, each representing a year of data. The parameter θ_t measures the difference in merging firms' profitability relative to the industry benchmark in year t. To know the change in the pre-merger versus post-merger difference, we can test the null hypothesis, for instance, that $\theta_1 = \theta_{-1}$.

Panel A

ROA as the dependent variable (the number of observations for each year = 149)

	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
Estimate for θ	0.057	0.055	0.054	0.053	0.047	0.048	0.046	0.043
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_1 - \theta_{-1} = 0$	-0.007	0.034
$(\theta_1 + \theta_2) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.007	0.017
$(\theta_1 + \theta_2 + \theta_3) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.007	0.010
$(\theta_1 + \theta_2 + \theta_3 + \theta_4) / 4 = (\theta_{-1} + \theta_{-2} + \theta_{-3} + \theta_{-4}) / 4$	-0.009	0.001

Panel B

ROE as the dependent variable (the number of observations for each year = 146)

	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
Estimate for θ	0.119	0.092	0.083	0.081	0.070	0.074	0.077	0.058
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_1 - \theta_{-1} = 0$	-0.012	0.071
$(\theta_1 + \theta_2) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.010	0.062
$(\theta_1 + \theta_2 + \theta_3) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.012	0.020
$(\theta_1 + \theta_2 + \theta_3 + \theta_4) / 4 = (\theta_{-1} + \theta_{-2} + \theta_{-3} + \theta_{-4}) / 4$	-0.024	0.000

Table 5: The difference in growth between merging firms and the industry median in pre-merger and post-merger years, and tests of the null hypothesis that the pre-merger versus post-merger change in the difference is zero. The model is formulated as a set of equations, $R_t = \theta_t M_t + \varepsilon_t$, where R denotes a firm's sales growth (SALES) and employment growth (EMPL); M denotes a dummy variable, that M=1 for merging firms and M=0 for the industry medians; ε is the error term. In the model, t=-4, -3, -2, -1, 2, 3, 4, representing 4 years before and 3 years after the mergers, so there are seven regression equations, each representing a year of data. The parameter θ_t measures the difference in merging firms' growth relative to the industry benchmark in year t.

Panel A
SALES as the dependent variable (the number of observations for each year = 167)

	Year -4	Year -3	Year -2	Year -1	Year 2	Year 3	Year 4
Estimate for θ	0.129	0.112	0.077	0.098	0.059	0.062	0.049
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_2 - \theta_{-1} = 0$	-0.039	0.062
$(\theta_2 + \theta_3) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.027	0.044
$(\theta_2 + \theta_3 + \theta_4) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.039	0.000

Panel B
EMPL as the dependent variable (the number of observations for each year = 167)

	Year -4	Year -3	Year -2	Year -1	Year 2	Year 3	Year 4
Estimate for θ	0.020	0.031	-0.011	0.072	-0.015	0.001	-0.012
P-Value	0.071	0.025	0.101	0.000	0.020	0.887	0.273

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_2 - \theta_{-1} = 0$	-0.087	0.000
$(\theta_2 + \theta_3) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.038	0.003
$(\theta_2 + \theta_3 + \theta_4) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.039	0.000

Table 6: The difference in R&D expenditures between merging firms and the industry median in pre-merger and post-merger years, and tests of the null hypothesis that the pre-merger versus post-merger change in the difference is zero. The model is formulated as a set of equations, $R_t = \theta_t M_t + \varepsilon_t$, where R denotes a firm's R&D to sales ratio (RD); M denotes a dummy variable, that M=1 for merging firms and M=0 for the industry medians; ε is the error term. In the model, t=-4, -3, -2, -1, 1, 2, 3, 4, representing 4 years before and after the mergers, so there are eight regression equations, each representing a year of data. The parameter θ_t measures the difference in merging firms' R&D expenditures relative to the industry benchmark in year t. To know the change in the pre-merger versus post-merger difference, we can test the null hypothesis, for instance, that $\theta_1 = \theta_{-1}$.

RD as the dependent variable (the number of observations for each year = 116)

	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
Estimate for θ	0.013	0.013	0.014	0.014	0.013	0.013	0.014	0.015
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\theta_1 - \theta_{-1} = 0$	-0.001	0.070
$(\theta_1 + \theta_2) / 2 = (\theta_{-1} + \theta_{-2}) / 2$	-0.001	0.255
$(\theta_1 + \theta_2 + \theta_3) / 3 = (\theta_{-1} + \theta_{-2} + \theta_{-3}) / 3$	-0.000	0.717
$(\theta_1 + \theta_2 + \theta_3 + \theta_4) / 4 = (\theta_{-1} + \theta_{-2} + \theta_{-3} + \theta_{-4}) / 4$	0.000	0.821

TABLE 7: The difference in impact on productivity between Keiretsu-related and Keiretsu-independent mergers. The estimation model is, $TE_t = \iota_t Ind_t + \kappa_t KR_t + \omega_t$, where TE_t represents a firm's productivity in year t; Ind is a dummy variable that Ind=1 for independent or cross-Keiretsu mergers, otherwise Ind=0; KR is a dummy variable that KR=1 for intra-Keiretsu mergers, otherwise KR=0; Ind=0 and KR=0 for the corresponding (non-merger) industry median; ω is the error term. Parameters ι and κ measure the difference in productivity relative to the industry medians for independent or cross-Keiretsu mergers and intra-Keiretsu mergers, respectively.

Productivity (TE) as the dependent variable (the number of observations for each year = 166)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
ι	-0.124**	-0.114*	-0.102	-0.093	-0.104*	-0.184***	-0.127***	-0.061
κ	-0.055	-0.027	0.009	-0.034	-0.012	-0.070	-0.033	-0.071

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_1 - \iota_{-1} = 0$	-0.011	0.797
$\kappa_1 - \kappa_{-1} = 0$	0.023	0.517
$\frac{1}{2}\sum_{t=1}^{2}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.047	0.248
$\frac{1}{2}\sum_{t=1}^{2}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	-0.028	0.397
$\frac{1}{3}\sum_{t=1}^{3}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.035	0.400
$\frac{1}{3}\sum_{t=1}^{3}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	-0.021	0.549
$\frac{1}{4}\sum_{t=1}^{4}\iota_t - \frac{1}{4}\sum_{t=-1}^{-4}\iota_t = 0$	-0.011	0.803
$\frac{1}{4}\sum_{t=1}^{4}\kappa_t - \frac{1}{4}\sum_{t=-1}^{-4}\kappa_t = 0$	-0.020	0.579

$*$ p<0.1, $**$ p<0.05, $***$ p<0.1

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TABLE 8: The difference in impact on profitability between Keiretsu-related and Keiretsu-independent mergers. The estimation model is, $R_t = \iota_t Ind_t + \kappa_t KR_t + \omega_t$, where R_t represents a firm's profitability (ROA and ROE) in year t; Ind is a dummy variable that Ind=1 for independent or cross-Keiretsu mergers, otherwise Ind=0; KR is a dummy variable that KR=1 for intra-Keiretsu mergers, otherwise KR=0; Ind=0 and KR=0 for the corresponding (non-merger) industry median; ω is the error term. Parameters ι and κ measure the difference in profitability relative to the industry medians for independent or cross-Keiretsu mergers and intra-Keiretsu mergers, respectively.

Panel A: ROA as the dependent variable (the number of observations for each year = 149)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
ι	0.060***	0.058***	0.057***	0.058***	0.053***	0.053***	0.054***	0.053***
κ	0.055***	0.052***	0.052***	0.050***	0.042***	0.044***	0.040***	0.036***

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_1 - \iota_{-1} = 0$	-0.005	0.335
$\kappa_1 - \kappa_{-1} = 0$	-0.008	0.048
$\frac{1}{2}\sum_{t=1}^{2}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.005	0.265
$\frac{1}{2}\sum_{t=1}^{2}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	-0.008	0.027
$\frac{1}{3}\sum_{t=1}^{3}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.004	0.295
$\frac{1}{3}\sum_{t=1}^{3}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	-0.009	0.013
$\frac{1}{4}\sum_{t=1}^{4}\iota_t - \frac{1}{4}\sum_{t=-1}^{-4}\iota_t = 0$	-0.005	0.207
$\frac{1}{4}\sum_{t=1}^{4}\kappa_t - \frac{1}{4}\sum_{t=-1}^{-4}\kappa_t = 0$	-0.012	0.001

Panel B: ROE as the dependent variable (the number of observations for each year = 146)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
ι	0.124***	0.094***	0.084***	0.085***	0.076***	0.081***	0.082***	0.073***
κ	0.114***	0.091***	0.082***	0.078***	0.064***	0.067***	0.074***	0.045***

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_1 - \iota_{-1} = 0$	-0.009	0.343
$\kappa_1 - \kappa_{-1} = 0$	-0.014	0.114
$\frac{1}{2}\sum_{t=1}^{2}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.006	0.487
$\frac{1}{2}\sum_{t=1}^{2}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	-0.014	0.058
$\frac{1}{3}\sum_{t=1}^{3}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.008	0.296
$\frac{1}{3}\sum_{t=1}^{3}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	-0.015	0.028
$\frac{1}{4}\sum_{t=1}^{4}\iota_t - \frac{1}{4}\sum_{t=-1}^{-4}\iota_t = 0$	-0.016	0.043
$\frac{1}{4}\sum_{t=1}^{4}\kappa_t - \frac{1}{4}\sum_{t=-1}^{-4}\kappa_t = 0$	-0.029	0.001

*p<0.1, **p<0.05, ***p<0.1

TABLE 9: The difference in impact on growth between Keiretsu-related and Keiretsu-independent mergers. The estimation model is, $R_t = \iota_t Ind_t + \kappa_t KR_t + \omega_t$, where R_t represents a firm's sales growth (GROWTH) and employment growth (EMPL) in year t; Ind is a dummy variable that Ind=1 for independent or cross-Keiretsu mergers, otherwise Ind=0; KR is a dummy variable that KR=1 for intra-Keiretsu mergers, otherwise KR=0; Ind=0 and KR=0 for the corresponding (non-merger) industry median; ω is the error term. Parameters ι and κ measure the difference in growth relative to the industry medians for independent or cross-Keiretsu mergers and intra-Keiretsu mergers, respectively.

Panel A:
SALES as the dependent variable (the number of observations for each year = 167)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 2	Year 3	Year 4
ι	0.127***	0.108***	0.048**	0.070***	0.061***	0.057***	0.064***
κ	0.131***	0.115***	0.097***	0.118***	0.058***	0.066***	0.038***

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_2 - \iota_{-1} = 0$	-0.009	0.771
$\kappa_2 - \kappa_{-1} = 0$	-0.060	0.027
$\frac{1}{2}\sum_{t=2}^{3}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.000	0.987
$\frac{1}{2}\sum_{t=2}^{3}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	-0.046	0.008
$\frac{1}{3}\sum_{t=2}^{4}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.015	0.303
$\frac{1}{3}\sum_{t=2}^{4}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	-0.056	0.000

Panel B
EMPL as the dependent variable (the number of observations for each year = 167)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 2	Year 3	Year 4
ι	0.014	0.044**	0.002	0.041	-0.009	-0.019	0.018
κ	0.024*	0.021	-0.019***	0.094***	-0.020***	0.016	-0.034***

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_2 - \iota_{-1} = 0$	-0.050	0.137
$\kappa_2 - \kappa_{-1} = 0$	-0.114	0.000
$\frac{1}{2}\sum_{t=2}^{3}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.035	0.067
$\frac{1}{2}\sum_{t=2}^{3}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	-0.039	0.017
$\frac{1}{3}\sum_{t=2}^{4}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.032	0.055
$\frac{1}{3}\sum_{t=2}^{4}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	-0.045	0.002

*p<0.1, **p<0.05, ***p<0.1

TABLE 10: The difference in impact on R&D expenditures between Keiretsu-related and Keiretsu-independent mergers. The estimation model is, $R_t = \iota_t Ind_t + \kappa_t KR_t + \omega_t$, where R_t represents a firm's R&D expenditures to sales ratio (R&D) in year t; Ind is a dummy variable that Ind=1 for independent or cross-Keiretsu mergers, otherwise Ind=0; KR is a dummy variable that KR=1 for intra-Keiretsu mergers, otherwise KR=0; Ind=0 and KR=0 for the corresponding (non-merger) industry median; ω is the error term. Parameters ι and κ measure the difference in R&D expenditures relative to the industry medians for independent or cross-Keiretsu mergers and intra-Keiretsu mergers, respectively.

RD as the dependent variable (the number of observations for each year = 116)

Estimate	Year -4	Year -3	Year -2	Year -1	Year 1	Year 2	Year 3	Year 4
ι	0.011***	0.011***	0.010***	0.011***	0.008**	0.008**	0.010**	0.012***
κ	0.015***	0.016***	0.017***	0.017***	0.017***	0.018***	0.018***	0.018***

Hypothesis Testing: Null Hypothesis	Test Value	P-Value
$\iota_1 - \iota_{-1} = 0$	-0.002	0.012
$\kappa_1 - \kappa_{-1} = 0$	-0.000	0.943
$\frac{1}{2}\sum_{t=1}^{2}\iota_t - \frac{1}{2}\sum_{t=-1}^{-2}\iota_t = 0$	-0.003	0.022
$\frac{1}{2}\sum_{t=1}^{2}\kappa_t - \frac{1}{2}\sum_{t=-1}^{-2}\kappa_t = 0$	0.001	0.512
$\frac{1}{3}\sum_{t=1}^{3}\iota_t - \frac{1}{3}\sum_{t=-1}^{-3}\iota_t = 0$	-0.002	0.179
$\frac{1}{3}\sum_{t=1}^{3}\kappa_t - \frac{1}{3}\sum_{t=-1}^{-3}\kappa_t = 0$	0.001	0.408
$\frac{1}{4}\sum_{t=1}^{4}\iota_t - \frac{1}{4}\sum_{t=-1}^{-4}\iota_t = 0$	-0.001	0.581
$\frac{1}{4}\sum_{t=1}^{4}\kappa_t - \frac{1}{4}\sum_{t=-1}^{-4}\kappa_t = 0$	0.001	0.382

*p<0.1, **p<0.05, ***p<0.1

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