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Inward Foreign Direct Investments and Productivity Growth in Japan

Yukako Murakami
Kyoji Fukao

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Yukako Murakami[1]

and

Kyoji Fukao[2]

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Abstract

Firstly, this paper shows that before M&A the foreign firms value the facility and scale economy in target firms which have greater capital stock and sales in the host country. Secondly, out-in M&A firms acquired by foreign firms saw an improvement in their business efficiency after the acquisition. This finding suggests that out-in M&As involve a transfer of business resources or technological knowledge that help to further lift the efficiency of firms.

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[1] Ph. D. in Graduate School of Economics, Hitotsubashi University

E-mail:ged9205@srv.cc.hit-u.ac.jp

[2] Professor, Institute of Economic Research, Hitotsubashi University
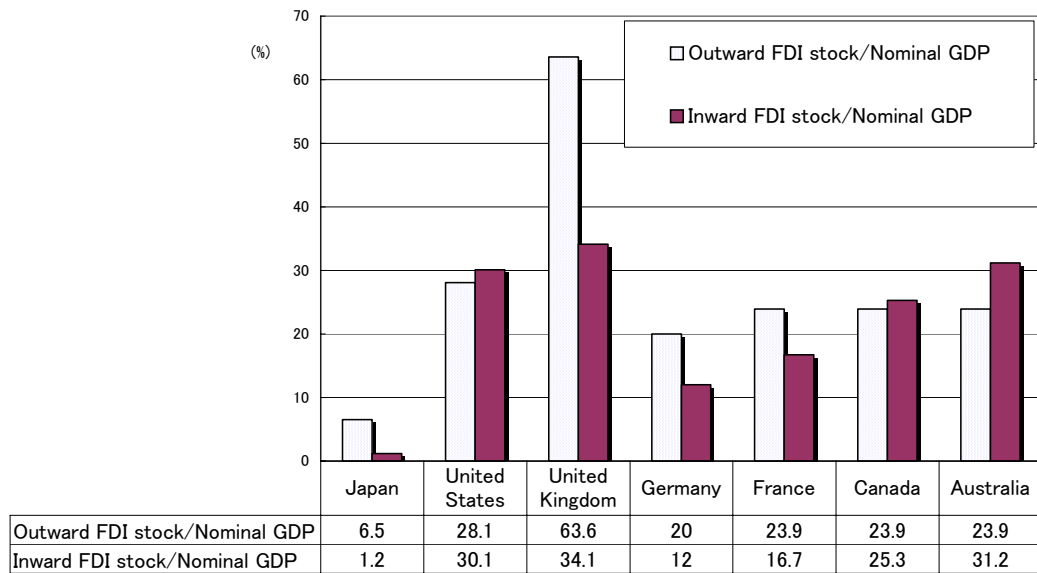
1   Introduction

Recent years have seen a large increase in foreign direct investment (FDI) by firms worldwide, as companies transfer production abroad. There are a number of reasons for this increase: firstly; the firms make profits to expand their business opportunities and new discoveries through R&D activities in the foreign countries. Second, the opening and rise of China and India provide firms not only with growing markets but also with large pool of cheap labor. And third, countries in Eastern Europe and throughout the developing world have been implementing policies to attract foreign firms in order to strengthen their export competitiveness and benefit from technology spillovers. Foreign direct investment (FDI) is a form of long-term international capital movement which is accompanied by investors' intangible assets.[3] Examples of such intangible assets are the stock of technological knowledge accumulated by R&D or the accumulation of marketing know-how from past advertising activity, and it is expected that the recipient country will benefit from such inflows.

As shown in the figure1, the ratio of FDI to GDP of Japan is lower than the other developed countries. Japan historically restricted free entry of firms in the market. Therefore it limited the inward FDI. Lall (2003) analyzed the determinants of the export competitiveness of the nation by discussing two factors, one of which is the firms' own research activities in their home country and the other is the degree of inward FDI as the means of technology transfer. According to his analysis, Japan focused the indigenous research activity to gain high technology compared to the other OECD countries. However, as the table 1

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[3] See, for example, Caves (1996) and Dunning (1992) on the standard theory of foreign direct investment.

shows, in recent years Japan is also to receive the benefit of globalization gradually.

Figure 1 The Ratio of FDI to GDP in OECD countries

	Japan	United States	United Kingdom	Germany	France	Canada	Australia
Outward FDI stock/Nominal GDP	6.5	28.1	63.6	20	23.9	23.9	23.9
Inward FDI stock/Nominal GDP	1.2	30.1	34.1	12	16.7	25.3	31.2

Note: Data of Japan and U.K. are of 2000 CY.The others are of 1999CY.
Source: METI (2001)

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Table 1 Inward FDI in Japan

Fiscal Year	1950−95	96	97	98	99	2000	Total
Manufacturing Total	2,065.4	311.1	267.4	312.6	979.7	790.7	5,324.0
Food	65.3	0.3	2.2	25.8	1.5	0.0	110.0
Textiles	13.4	0.9	1.9	3.6	0.2	2.4	23.8
Rubber and leather products	20.7	10.7	18.8	4.8	7.0	1.1	82.1
Chemicals	679.4	69.5	74.0	39.7	60.3	178.8	1,272.5
Petroleum products	127.5	8.2	5.8	8.4	13.5	253.4	443.3
Stone, clay and glass products	21.3	0.0	0.7	−	5.7	0.0	30.0
Metal products	102.4	52.8	0.3	2.0	17.9	1.9	219.6
Machinery	952.2	155.8	145.2	212.9	865.2	351.9	2,978.1
Others	83.1	12.9	18.5	15.3	8.5	1.2	164.5
Non−Manufacturing Total	1,503.0	459.5	410.8	1,027.8	1,419.6	2,334.4	7,880.0
Construction	16.0	0.0	0.3	1.4	2.2	0.0	20.5
Real estate agents	126.7	26.5	48.2	41.6	16.8	34.6	339.0
Commercial and trading	591.8	166.4	99.6	175.9	348.5	276.1	2,027.8
Services	273.1	236.0	88.8	318.1	205.8	236.5	1,526.4
Transportations	24.6	1.0	0.4	6.1	2.2	5.7	48.3
Telecommunications	39.7	2.1	3.3	16.8	330.0	750.8	1,155.1
Finance and insurance	316.7	27.3	161.6	456.9	511.5	1,029.3	2,595.2
Others	114.7	0.2	8.7	11.1	2.5	1.3	168.0
Total	3,567.8	770.7	678.2	1,340.4	2,399.3	3,125.1	13,203.3

Notes: Notification value of inward foreign direct investment since 1950.
Sources: MOF (1999). MOF Homepage ⟨www.mof.go.jp⟩

The actual presence of foreign-owned firms in Japan, which summarized *Basic Survey of Business Activity*[4] edited by the Ministry of Economy, Trade, and Industry, shows that from 1994 to 1998, their number of the foreign-owned firms increased from 180 to 244, while their share in total sales expanded from 3.9% to 7.6%. The number of firms which changed its ownership from domestically to foreign-owned is 43, who were the targets of out-in M&As. While the number of newly foreign-owned firms during this period is 69. Their sales amounted only to 900 billion yen, Out-in M&As thus were responsible for most of the 8,800 billion yen increase of foreign-owned firms' sales. M&As played an

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[4] Data compilation and estimations were conducted as part of project "Development of a RIETI Manufacturing Database and Study of Productivity by Industry" at the Research Institute for Economy, Trade and Industry (RIETI).

important role in the expansion of foreign-owned firms' activities in Japan.

There are two possible reasons why firms that have been acquired by foreigners through M&As may be more productive than domestically-owned ones. The first is that the target companies are more productive than the average domestic firm (i.e. foreigners target higher-productivity firms for M&As). The second possible reason is that the target companies indeed enjoyed productivity gains through resource transfers (technology, management know-how, etc.) from the foreign parent firm after the M&A. Therefore, in order to investigate whether inward M&A investment influences host country productivity, it is necessary to analyze whether there has been a significant change in the productivity of the target firm after the M&A. In addition, it is useful to investigate whether the sales of targeted firms increase after an M&A investment: if, as a result of being acquired by a foreign company, the target companies further increase their market share, this would lead to a rise in overall productivity in Japan through the share effect.

The aim of this paper is to take a look at the effects of M&A investment and analyze these issues in greater detail. The analysis consists of the following components. First, the productivity and other business indicators of out-in M&A target firms, in-in M&A target firms (i.e. cases where both the acquiring and the acquired firm are domestically-owned), and other firms are compared. Second, business indicators before and after the M&A are compared in order to investigate whether out-in M&A target firms were already superior to other firms before being acquired. In other words, the selection hypothesis is examined. And thirdly, we conducted a regression analysis including the industry dummy variables or the passed years after M&A in order to investigate whether firms show an improvement in their business

indicators after the M&A as a result of the transfer of technological knowledge from the foreign parent firm.

The remainder of this paper is organized as follows. Section 2 provides an overview of the related literature. Section 3 describes the method used to measure Total Factor Productivity (TFP) in the analysis and offers a summary of the data set. Section.4 compares the simple average between out-in M&A firms and the other firms. Section 5 firstly investigates whether out-in M&A target firms are superior to the other firms before M&A. Secondly, this section investigates whether firms that were M&A targets saw an increase in TFP growth, sales, employment, and improvements in other business performance indicators. Section 6 concludes.

2   Literature Survey and Outline of Research Approach

A number of studies have empirically examined the effects of M&As on profit ratios and business performance. The empirical studies are divided into event studies and those based on balance sheet data. Studies relying on the former approach analyze changes in the stock price of the acquiring and the acquired firms before and after the announcement of the M&A deal. Studies following the latter approach examine business performance indicators such as the current-profit-to-sales ratio, the growth rate of profits, ROA, ROE, etc. of both the acquiring and the acquired firm.

An example of a study using the latter approach is Odagiri and Hase (1988), which analyzes the business performance of Japanese manufacturing firms acquired by another firm. They found that M&As in the 1980s aimed mainly at business diversification or the continuation of firms in declining industries.

They also analyzed in-in M&As and found that the profit rate and the growth rate of the targeted firms declined after the M&A.

Looking at firms in Britain, Conyon et al. (2002) observed that both the growth of wages and labor productivity of domestic firms acquired by foreign firms increased. Chudnovsky and López (2000), in their empirical study on firms in Argentina during the 1990s, came to the conclusion that the business indicators of firms targeted by out-in M&As showed a better performance than in-in M&A targets and other, independent firms. Meanwhile Gugler and Yortoglu (2004) demonstrated that mergers and acquisitions are used as a restructuring device. Using data on U.S. and European companies, they found that in the case of European companies, employment at the acquired companies on average fell by 10% when companed with pre-M&A levels. In contrast, because of lower labor costs, companies saw no need to reduce employment levels at acquired U.S. firms. Finally, Danzon, Epstein, and Nicholson (2004), in their study on the pharmaceuticals industry suggest that M&As have a positive effect on the R&D intensity of the acquired company as well as number of patents, which serves as an indicator of R&D output. The related studies on M&As use the profit rate and labor productivity, employment, or R&D intensity as indicators of business performance rather than total factor productivity. In sum, empirical studies on the effect of M&As on acquired companies suggest that business indicators improved after the merger or acquisition.

3.   *Data Sources and TFP Measurement*

Description of Data Sources and Variables

The paper uses the data set which consists of a panel of firm level data from the *Basic Survey of Business Activity* of the Ministry of Economy, Trade and Industry for the period from 1994 to 1998. The survey covers all firms that have more than 50 workers and 30 million yen in capital. This paper concentrates on manufacturing firms only.

When constructing the data set, we excluded firms whose sales, tangible fixed assets, payments, material costs (total operating costs minus other costs such as rent, depreciation, wage payments and taxes in the statistics) were negative and whose number of workers was less than 50. This leaves us with a total of 68,641 observations for the 5-year period (for about 13,700 firm observations in each year).

A number of records had to be modified because the foreign-ownership ratio was problematic. For example, firms with a foreign-ownership ratio of 33.4% or more in 1994 but 0% in the following years were classified as having a foreign-ownership ratio of less than 33.4%. On the other hand, a firm whose parent firm's nationality is recorded, though the foreign-ownership ratio is given as 0%, is counted as more than 33.4% foreign-owned (the ratio that we use as the cut-off for our definition of foreign or domestic ownership). The choice of this value is based on the fact that if we were to choose a ratio of 50%, there would hardly be any firms left that would be counted as foreign. Moreover, 33.4% is the minimum share that grants investors veto rights on important matters such as changes in the articles of incorporation, the dismissal of COEs, organizational changes, etc. In order to test the robustness of our results, we also run a few regressions using 50% as the cut-off ratio. However, it should be noted that even when using the 33.4% cut-off ratio, data limitations do not allow us to distinguish whether capital investors have any management control of firm's business and whether a firm has a single or multiple foreign owners.

Moreover, as pointed out by Fukao and Amano (2004), there are some firms in the electrical machinery industry in which foreigners own more than one-third of shares as portfolio investment; however, the number of such firms in the manufacturing sector overall is small.

TFP Measurement

The discussion now turns to the measurement of TFP that will be used to analyze the international activities of heterogeneous firms. In this context, the work by Caves, Christensen, and Diewert (1982) and by Good, Nadiri, and Sickles (1997) serves as a useful point of departure to devise a way of measuring the relative productivity of firms. Caves et al. introduce the concept of a multilateral productivity index, which is calculated as follows: subtract average output of the industry, the factor of production of each firm, and the average factor of the industry from the output of each firm. The industry average factor which is multiplied by the average cost share of the industry is subtracted from each firm's factor of production multiplied by each firm's cost share. This index is very useful when the object is to compare the productivity of more than two firms at a particular point in time. However, it is inappropriate in a dynamic context, i.e., when allowing for the passage of time and the entry and exit of firms, which lead to changes in the number of observations, in average productivity within the industry, and in the productivity of individual firms. Good, Nadiri, and Sickles (1997) overcome this problem by using a Divisia Index, which reflects changes in the distribution of productivity and changes in the productivity of the representative firm as time passes. Because this paper deals with a longitudinal panel data set, TFP measurement based on Good et al.'s approach is appropriate.

Following this example, the TFP level of a firm here is calculated as the difference with the representative firm within the same industry. Thus, the TFP level (in logarithmic form) of firm f at time t is defined as follows:

$$
\begin{aligned}
\ln TFP_{ft} = &\left(\ln Y_{ft} - \overline{\ln Y_t}\right) + \sum_{s=2}^{t}\left(\overline{\ln Y_s} - \overline{\ln Y_{s-1}}\right) \\
&- \left[\sum_{i=1}^{n} 1/2\left(S_{ift} + \overline{S_{it}}\right)\left(\ln X_{ift} - \overline{\ln X_{it}}\right)\right] \\
&+ \sum_{s=2}^{t}\sum_{i=1}^{n} 1/2\left(\overline{S_{is}} + \overline{S_{is-1}}\right)\left(\overline{\ln X_{is}} - \overline{\ln X_{is-1}}\right)
\end{aligned}
\tag{1}
$$

where Y_{ft} is the output of firm f at time t, we use sales from data set, X_{ift} is factor input i, S_{ift} is the cost share of factor i in total costs. The overbar indicates industry averages. The TFP level of each firm is calculated using equation (3) which considers not only the relative TFP level compared with a representative firm at time t in the same industry but also changes in the productivity distribution as time passes. We use the 3-digit industry classifications of the *Kigyo Kastudo Kihon Chosa*.

The following variables are used to calculate TFP. Output obtained from the *Kigyo Katsudo Kihon Chosa*, while deflators by industry is obtained by dividing nominal output with real output using the IO Tables of the Management and Coordination Agency. Capital stock is estimated as follows. First, plant and equipment investment (excluding expenses for land and buildings) at the 3-digit-level, obtained from *Census of Manufactures* published by the Ministry of Economy, Trade and Industry, is divided by the SNA deflator and accumulated by the perpetual inventory method. Next, we calculate the real market price/nominal book value ratio, which is the real capital stock divided by nominal tangible fixed assets

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(book value, end of year) obtained from the *Census of Manufactures*.

We use tangible fixed assets from the *Kigyo Katsudo Kihon Chosa* as the real capital stock of each firm, which is multiplied by this preceding real market price/nominal book value ratio. We adjust the utilization. Cost shares are calculated using capital service price data by industry from the JIP database in Fukao et al (2003).

Costs for materials are calculated as total operating costs minus other expenses such as rent, wages, depreciation and taxes, while material costs at constant prices are obtained in the same way as in the calculation for output above. In order to calculate productivity precisely, we exclude raw material, energy and other costs from output. The amount of raw materials and energy used reflects firms' utilization ratio which is determined by the demand conditions firms face.

Constant labor input is calculated by multiplying the number of employees by the labor hour index of the SNA divided by 100. Both 0.1% tails of the distribution of output, capital stock, employee, payment, and material are deleted as outliers.

4   Comparison Tests between Out-in M&As and the Other Firms

Data Set

This section looks at the performance of domestic firms after they have been acquired by a foreign firm, comparing such 'out-in' M&As with M&As involving only Japanese firms, i.e. 'in-in' M&As, and other firms. Out-in M&As here are defined as cases where the foreign-ownership ratio of a firm changed from less than to more than 33.3%. In contrast, in-in M&As here are defined as cases where firms

previously had no parent firm but later reported belonging to a Japanese parent firm. In contrast, in-in M&As here are defined as cases where firms previously had no parent firm but later reported belonging to a Japanese parent firm. It should also be noted that the cut-off ratio for the definition of a parent firm used in the *Basic Survey of Business Activity* for domestic firms is different from that for foreign firms: while for foreign firms it is one-third, for domestic firms it is 50%.[5] It should be noted that the definition in this paper of out-in M&A and in-in M&A differs because the data set is restricted.

Table 2 provides summary statistics of our data set on out-in and in-in M&As in the manufacturing ector from 1994 to 1998. The number of firms which were in business throughout this period is 10,152[6]. Out-in M&A target firms are those firms whose foreign-ownership ratio was under 33.4% in 1994 but above 33.4% in 1998. Our data set includes 43 such firms. In-in M&A target firms are those firms that had no parent firm with an ownership share exceeding 50% in 1994 but did have one in 1998. Our data set includes 347 such firms.

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[5]A further shortcoming of the data is that it allows us only to consider M&A cases where a firm became the subsidiary of another firm. Therefore, cases where the unification of management was achieved through a merger between equals or a holding company are not considered here.

[6] There is a possibility the firms are counted to exit, if the firms reduce the production of manufacturing

Table 2 Out-In and In-In M&A Target Firms' Share in Total Sales by Industry

(Unit of sales: million Yen) 1998	(1) No. of firms Out-In M&A	(2) No. of firms In-In M&A	(3) Sales of Out-In M&A firms	(4) Sales of In-In M&A firms	(5) Total Sales of all firms	(3)/(5)*100 Share of Out-In M&A firms' sales	(4)/(5)*100 Share of In-In M&A firms' sales
1 Food	0	34	0	276567.48	14900289.95	0.0	1.9
2 Beverages	1	2	5645.71	96648.57	11651302.47	0.0	0.8
3 Spinning	0	11	0	34337.1	1993638.57	0.0	1.7
4 Textiles	0	12	0	8258.24	1785852.19	0.0	0.5
5 Lumber and wood products	0	3	0	6536.38	955534.24	0.0	0.7
6 Furniture	0	4	0	11961.62	1145921.86	0.0	1.0
7 Pulp, paper and paper prods.	0	17	0	148979.76	5312168.01	0.0	2.8
8 Publishing and printing	4	8	22865.14	50860	8818887.3	0.3	0.6
9 Chemicals	12	18	472610.05	198706.81	25467941.51	1.9	0.8
10 Petroleum products	1	2	246089.53	658191.43	8209450.59	3.0	8.0
11 Plastics	1	21	923.81	99898.48	5105039.15	0.0	2.0
12 Rubber products	1	3	2680.95	4099.1	2476892.95	0.1	0.2
13 Leather and leather products	0	2	0	5054.05	123148.33	0.0	4.1
14 Stone, clay and glass products	1	18	7917.14	66637.9	4880591.24	0.2	1.4
15 Steel	0	8	0	60052.19	9834066.76	0.0	0.6
16 Nonferrous metals	3	7	9444.76	210650.33	6290433.74	0.2	3.3
17 Metal products	0	18	0	80556.19	8128543.02	0.0	1.0
18 General machinery	4	42	13822.67	283060.38	21943895.19	0.1	1.3
19 Electrical machinery	9	68	3182814.15	862130.81	54883065.28	5.8	1.6
20 Transportation machinery	6	44	4809342.93	1385077.14	42425528.39	11.3	3.3
21 Precision machinery	0	5	0	114577.48	3200188.68	0.0	3.6
Total	43	347	8774156.85	4662841.43	239532379.5	3.7	1.9

As shown in Table 2, the greatest number of out-in M&As can be found in the chemical and electrical machinery industries. In contrast, the greatest number of in-in M&As took place in the electrical machinery sector, followed by the transportation and general machinery industries. Using sales rather than number of cases as a yard-stick, the most important industries for out-in M&A activity were transportation, electrical machinery and chemicals. On the other hand, in-in M&As were much less concentrated. Another interesting point to note is that although there were more cases in-in M&As than out-in M&A, the combined sales of out-in M&A target firms were almost twice as large as the combined sales of in-in M&A target firms. In other words, the average scale of out-in M&As is much larger than that of in-in M&As.

and classified in the non-manufacturing industry after M&A.

Tests of Averages

As a first approach to comparing the business performance of out-in and in-in M&A target firms as well as other firms, we conduct tests of averages. The results are displayed in Table 3. The business performance indicators used are the TFP level in 1994, the TFP level in 1998, the TFP growth rate from 1994 to 1998, the growth rate of current sales, the growth rate of the capital-labor ratio, the growth rate of the wage level, the growth rate of the number of workers, the growth rate of labor productivity, the growth rate of the ratio of current profits to tangible fixed assets, the growth rate of tangible fixed assets, the growth rate of the R&D intensity, current profits per worker, and the growth rate of the ratio of current profits to sales. As above, the TFP level is measured as the deviation from the average of each industry and each year. The growth rate is measured from 1994 to 1998.

Table 3 Average Tests of Business Activities of Out-In M&A, In-In M&A and the Other Firms

Varibles	Type of Firms	Obser-vations	Average	Compared with In-in M&A Firms	Compared with Other Firms	Standard error
TFP level in 1994 (logarithm, deviation from industry average)	Out-In M&A	43	−0.019			0.227
	In-in M&A	346	−0.024			0.222
	Other firms	9753	−0.025			0.193
TFP level in 1998 (logarithm, deviation from industry average)	Out-In M&A	43	0.023			0.213
	In-in M&A	346	−0.034			0.215
	Other firms	9753	−0.021			0.191
TFP growth rate from 1994 to 1998	Out-In M&A	43	0.042 *			0.241
	In-in M&A	346	−0.010			0.163
	Other firms	9753	0.000			0.148
Growth rate of real sales from 1994 to 1998	Out-In M&A	43	0.160 *	**		0.359
	In-in M&A	347	0.046			0.353
	Other firms	9762	0.016			0.333
Growth rate of capital-labor ratio from 1994 to 1998	Out-In M&A	43	0.330	*		1.303
	In-in M&A	347	0.165			0.882
	Other firms	9762	0.121			0.579
Growth rate of wages from 1994 to 1998	Out-In M&A	43	0.289 ***	***		0.578
	In-in M&A	347	0.113			0.435
	Other firms	9762	0.088			0.384
Growth rate of no. of workers from 1994 to 1998	Out-In M&A	43	−0.040			0.291
	In-in M&A	347	−0.039			0.276
	Other firms	9762	−0.050			0.229
Growth rate of labor productivity from 1994 to 1998	Out-In M&A	38	0.373 ***	***		0.818
	In-in M&A	345	0.081			0.565
	Other firms	9627	0.086			0.528
R&D intensity 1998−R&D intensity 1994 (R&D intensity=R&D costs/workers)	Out-In M&A	30	0.672			1.769
	In-in M&A	110	0.181			0.884
	Other firms	4021	0.115			0.715
R&D intensity 1998−R&D intensity 1994 (R&D intensity=R&D costs/sales)	Out-In M&A	30	0.010			0.040
	In-in M&A	110	0.006			0.028
	Other firms	4021	0.003			0.020
Current profit per worker 1998 −current profit per worker 199	Out-In M&A	43	2.737 ***	***		9.254
	In-in M&A	347	0.038			3.181
	Other firms	9762	−0.183			3.475
Current profit−sales ratio 1998−current profit−sales ratio 199 (before taxes)	Out-In M&A	43	2.110			14.202
	In-in M&A	347	−0.594			7.324
	Other firms	9762	−0.934			19.202
Current profit−fixed asset ratio 1998 −Current profit−fixed asset ratio 1994 (before taxes)	Out-In M&A	43	−75.003			405.065
	In-in M&A	347	−98.796			1179.638
	Other firms	9762	−22.447			900.426
Growth rate of capital stock	Out-In M&A	43	0.290 *	**		1.321
	In-in M&A	347	0.127			0.902
	Other firms	9762	0.071			0.579
Growth rate of tangible fixed assets	Out-In M&A	43	0.280 **	**		1.309
	In-in M&A	347	0.116			0.896
	Other firms	9762	0.071			0.569

Note: * shows that the average is significantly higher. ***1% level, **5% level and *10% level.

The test of average does not provide any clear evidence whether the TFP level of firms targeted by out-in M&A was higher in 1994 than that of other firms. However, in 1998, the TFP level of out-in M&A target firms was slightly positive, while that of in-in M&A target firms and other firms was negative. Moreover, out-in M&A target firms enjoyed a significantly higher TFP growth rate during the observation period than in-in M&A target firms, though no significant difference with all other firms (i.e. those that remained independent) can be observed. However, out-in M&A target firms did significantly better than not only in-in M&A target firms but also other firms in the following business performance indicators: the growth rates of sales, you mean in constant prices, i.e. inflation adjusted the growth rate of labor productivity, the growth rate of the wage level, the growth rate of current profits per worker. and the growth rate of capital stock. Higher also, though not statistically significantly so, were the growth rates of the capital labor ratio, and R&D intensity. Comparing in-in M&A target firms with non-targeted firms, no significant differences in their performance indicators can be observed.

Looking at employment levels, we find that, as a result of the prolonged recession in Japan, the growth rate of the number of workers decreased for all three groups of companies during this period. The growth rate of the number of workers at out-in M&A target firms is -4% and it is lower than that of in-in M&A target firms (-3.9%) but slightly higher than that of the other non-targeted firms (-5%). But the statistical test can not show that the difference of employment growth between groups is significant. *A priori*, we would expect foreign firms to adjust workforces more drastically to demand fluctuations than domestically-owned firms where life-time employment practices are common. However, we found no

evidence that this was the case, refuting the argument that improvements in productivity and profit rates were achieved through lay-off.

To summarize: the tests of averages suggest that out-in target firms showed a higher growth rate of labor productivity during the observation period; they also enjoyed slightly higher TFP levels in 1998 and higher TFP growth rates during this period when compared with the other two groups of firms. What is more, the findings suggest that out-in M&A target firms actively invest in R&D, enjoy increased current profits, they did not reduce employment by more than non-M&A target firms, and they show a significantly higher growth in wages. This means that out-in M&A target firms invest more in equipment and R&D per worker, which helps them to raise labor productivity.

The following criticism may be leveled against the above analysis: even if out-in M&A target firms are more productive and do invest more actively in equipment and R&D, the fact that they are more productive may not necessarily be the result of a transfer of business resources through M&A. Instead, it may be possible that foreign firms tend to choose more productive firms as M&A targets.[7]

In order to test this selection hypothesis, Table 4 compares the business performance indicators of M&A target firms before the take-over and other, non-targeted, firms during 1994–1996. The results, however, suggest that firms targeted by out-in M&As do not enjoy significantly higher TFP growth than other firms before being taken over. On the other hand, though, most other business indicators such as the growth rate of wages, R&D intensity, and current profits per worker of out-in M&A target firms indicate a

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[7] The regression analysis of the TFP level including firm fixed effects shows positive sign on the foreign-ownership dummy. Therefore, this argument does not apply to the TFP level.

slightly better performance than other firms. This test is no more than a simple comparison before the

event. However, this comparison hints at the possibility that companies may be targeting

better-performing firms.

Table 4 Average Tests of Business Activities of Out-in M&A, In-in M&A, and the Other Firms
before M&A

Varibles	Type of Firms	Obser-vations	Average	Compared with In-in M&A Firms	Compared with Other Firms	Standard error
Growth rate of TFP over previous year	Out-In M&A	83	0.0202			0.1483
	In-in M&A	680	0.0136			0.1071
	Other firms	24370	0.0189			0.1203
Growth rate of capital-labor ratio over previous year	Out-In M&A	83	0.0986			0.7572
	In-in M&A	680	0.0225			0.4879
	Other firms	24370	0.0224			0.4058
Growth rate of wage over previous year	Out-In M&A	83	0.1191	**	**	0.4096
	In-in M&A	680	0.0426			0.2432
	Other firms	24370	0.0469			0.2545
Growth rate of no. of workers over previous year	Out-In M&A	83	0.0125			0.1274
	In-in M&A	680	0.0020		*	0.1297
	Other firms	24370	−0.0084			0.1280
Growth rate of labor productivity over previous year	Out-In M&A	78	0.1474			0.6414
	In-in M&A	679	0.0696			0.4103
	Other firms	24116	0.0884			0.4079
R&D intensity current year − R&D intensity preceding yea (R&D intensity=R&D costs/sales)	Out-In M&A	54	0.0014			0.0168
	In-in M&A	230	−0.0005			0.0122
	Other firms	10412	0.0003			0.0108
R&D intensity current year − R&D intensity preceding yea (R&D intensity=R&D costs/workers)	Out-In M&A	54	13.6009	***	**	59.2739
	In-in M&A	230	0.4504			34.0906
	Other firms	10412	2.5847			42.7899
Current profit per worker current year − current profit pe worker preceding year	Out-In M&A	83	1.2098	***	***	4.3345
	In-in M&A	678	0.2087			1.5491
	Other firms	24286	0.1407			2.8744
Current profit/ sales ratio this year −current profit/sales last year (before taxes)	Out-In M&A	83	1.4491			6.6375
	In-in M&A	678	0.3846			4.2605
	Other firms	24286	0.2601			26.0705
Current profit/fixed asset ratio this year −current profit/ asset ratio last year (before taxes)	Out-In M&A	83	−36.8018			294.1306
	In-in M&A	678	−17.4829			366.0023
	Other firms	24286	−6.8998			1438.6160
Growth rate of capital stock	Out-In M&A	83	0.1110		*	0.7651
	In-in M&A	678	0.0240			0.4780
	Other firms	24286	0.0142			0.3952
Growth rate of tangible fixed assets	Out-In M&A	83	0.1110		*	0.7559
	In-in M&A	678	0.0241			0.4578
	Other firms	24286	0.0205			0.3780

Note: * shows that the average is significantly higher. ***1% level, **5% level and *10% level.

5   Regression Analysis

Strictly speaking, the previous tests of averages only show changes in firms' business indicators during the observation period. They do not tell us anything about the relationship between M&As and changes in these indicators. What is more, they also do not consider potential inter-industry differences. It is therefore theoretically possible that out-in M&A target firms show a superior performance simply because such M&As are concentrated in particular growth industries such as the chemical and the electrical machinery industries. In order to examine these issues, regression analyses including industry dummies are conducted to investigate whether before M&A more productive firms are selected by foreign firms and to investigate whether M&As improve the performance of target firms. The specifications of the equation to be estimated are as follows:

$$out - in \quad M \& Adummy_{i,t} = \alpha_0 + \beta_1 * Indicator_{i,1994} + \beta_2 * INDUSTRYdummy_{i,t}$$

$$(2)$$

$$Indicator_{i,1998} = \alpha_0 + \beta_0 * Indicator_{i,1994} + \beta_1 * out - inM \& Adummy_{i,t}$$
$$+ \beta_2 * in - inM \& Adummy_{i,t} + \beta_3 * INDUSTRYdummy_{i,t}$$

$$(3)$$

In specification (2), the independent variable (*Indicator_{i, 1994}*) consists of the business indicators of each firm in the year 1994. The dependent variable is a dummy for out-in. In specification (3), where the dependent variable (*Indicator_{i, 1998}*) consists of the business indicators of each firm in the year 1998. The independent variables are the variables of each firm in 1994 (*Indicator_{i,1994}*), a dummy for out-in M&As, a

dummy for in-in M&As, and industry dummies using a 3-digit industry classification. The computer industry is used as the benchmark industry and has no industry dummy. The descriptive statistics is shown in Table 5. Conducting regression analysis, it excludes the observations which belong to the industry in which any M&A did not occur.

What kind of characters do the foreign firms value in the target firms before M&A? The results of this question are summarized in Table 6a. Our results show that the foreign firms select the local firms of which employment, capital stock, sales, R&D intensity and capital labor ratio are greater. However, TFP, labor productivity and current profits per worker of the target firms are not statistically high. The foreign firms make much of the facility or scale economies. They do not necessarily take great care of the ratio of efficiency, TFP or labor productivity. By using the same specification we examined the character of in-in M&A target firms. The results, summarized in the Table-6b, show that in-in M&A target firms have fewer workers and less R&D intensity. Odagiri and Hase (1988) found that Japanese firms in 1980's aimed through in-in M&A mainly at business diversification or the continuation of firms in declining industries. The explanatory variables, we prepare here, could not test the business diversification so that the other paper should study.

Turn to the effect of M&A. The results in Table 7 show clearly that out-in M&A target firms enjoyed a significantly higher TFP level in 1998, as the result of the transfer of business resources from the foreign parent firms. What is more, the coefficients on labor productivity, the capital labor ratio, the wage level, current profits per worker, and R&D costs per worker are positive and significant, suggesting that out-in M&As indeed improve the business efficiency of target firms through the transfer the business resources.

In contrast, none of the indicators showed that in-in M&As improved the efficiency of target firms.

Table 5. Panel A Descriptive Statistics of the Variables Used in the Regression Analysis for M&A

Variable	Obs	Mean	Std. Dev.	Min	Max
TFP	12339	−0.03	0.19	−2.23	1.17
Sales	12339	19155.01	129096.20	150.00	7827143.00
Labor Productivity	12339	5.54	4.00	−108.22	160.11
Capital Labor Ratio	12339	4.80	5.40	0.00	108.84
Wage	12339	4.52	1.69	0.05	17.01
No. of Workers	12339	455.97	1982.06	50.00	77185.00
Capital Stock	12339	3221.53	20412.67	0.26	873380.30
Fixed Asset	12339	6114.60	38638.50	1.00	1327445.00
R&D Costs per worker	6134	0.60	1.03	0.00	24.29
R&D Costs per Sales	6134	0.02	0.03	0.00	0.55
Current Profit per Worker	12339	0.77	3.01	−111.29	107.37
Current Profit per Sales	12339	1.92	12.77	−913.79	192.38

Table 5. Panel B Numbers of M&As in Each Year

	1995	1996	1997	1998
No. of out−in M&As (firms)	0	1	6	36
No. of in−in M&As (firms)	138	70	67	71

Table 6-a. Probit Estimation for the Selection Hypothesis

Dependent variable is a dummy for firms which merged with or were acquired by a foreign firm.

TFP level in 1994	0.18845	Wage level in 1994	−0.002196	R&D Costs per worker	0.101169 ***
	(0.54)		(−0.06)	in 1994	(3.35)
_cons	−2.4665 ***	_cons	−2.46864 ***	_cons	−2.3573 ***
	(−15.42)		(−11.67)		(−13.31)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	6674	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.0436	Pseudo R^2	0.043	Pseudo R^2	0.0594
Labor Productivity	0.00307	Employments in 1994	0.0000334	R&D Costs per Sales	2.99152 **
in 1994	(0.29)		(4.10)	in 1994	(2.21)
_cons	−2.4938 ***	_cons	−2.5087 ***	_cons	−2.3573 ***
	(−14.78)		(−15.6)		(−13.31)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	6674	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.043	Pseudo R^2	0.067	Pseudo R^2	0.0453
Sales in 1994	0.0004 ***	Capital Stock in 1994	0.0004 ***	Current Profits per Worker	0.0021326
	(3.76)		(3.76)	in 1994	(0.14)
_cons	−2.4911 ***	_cons	−2.4911 ***	_cons	−2.4796 ***
	(−15.57)		(−15.0)		(−15.52)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	6674	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.0637	Pseudo R^2	0.0637	Pseudo R^2	0.0431
Capital Labor Ratiio	0.02073 ***	Fixed Asset in 1994	0.02073 ***	Current Profits to Sales	−0.002557
in 1994	(3.42)		(3.42)	in 1994	(−0.50)
_cons	−2.6293 ***	_cons	−2.6293 ***	_cons	−2.472012 ***
	(−15.33)		(−15.21)		(−15.52)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	6674	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.6067	Pseudo R^2	0.6067	Pseudo R^2	0.0434

Table 6-b. Probit Estimation for the Selection Hypothesis

Dependent variable is a dummy for firms which merged with or were acquired by a local firm.

TFP level in 1994	0.102149	Wage level in 1994	0.003292	R&D Costs per worker	−0.09288 *
	(0.76)		(0.23)	in 1994	(−1.8)
_cons	−1.69062 ***	_cons	−1.70911 ***	_cons	−1.79469 ***
	(−21.17)		(−17.27)		(−14.87)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	12084	Number of observations	12084	Number of observations	6674
Pseudo R^2	0.0164	Pseudo R^2	0.0162	Pseudo R^2	0.0308
Labor Productivity	−0.00273	Employments in 1994	−0.000005 **	R&D Costs per Sales	−4.40705 **
in 1994	(−0.45)		(−2.41)	in 1994	(2.36)
_cons	−1.68193 ***	_cons	−1.65601 ***	_cons	−1.75164 ***
	(−19.77)		(−20.41)		(−14.18)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	12084	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.0162	Pseudo R^2	0.0188	Pseudo R^2	0.0326
Sales in 1994	−0.000008	Capital Stock in 1994	−0.000004	Current Profits per Worker	−0.00986
	(−1.61)		(−1.59)	in 1994	(−1.47)
_cons	−2.4911 ***	_cons	−1.68673 ***	_cons	−1.69 ***
	(−15.57)		(−20.99)		(−21.21)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	12084	Number of observations	6674	Number of observations	6674
Pseudo R^2	0.0174	Pseudo R^2	0.0172	Pseudo R^2	0.0167
Capital Labor Ratiio	0.003536	Fixed Asset in 1994	−0.000002	Current Profits to Sales	−0.00123
in 1994	(0.92)		(−1.47)	in 1994	(−0.98)
_cons	−1.71463 ***	_cons	−1.68673 ***	_cons	−1.69331 ***
	(−20.85)		(−21.13)		(−21.27)
Industry dummy	yes	Industry dummy	yes	Industry dummy	yes
Number of observations	12084	Number of observations	12084	Number of observations	12084
Pseudo R^2	0.0164	Pseudo R^2	0.0172	Pseudo R^2	0.0164

Table 7. OLS Estimation Results: the Effects of Out-In M&A, In-In M&A and the Other Firms

	TFP level in 1998		Labor Productivity in 1998		Constant Sales in 1998		capital labor ratio in 1998	
Dummy for firms which merged with or were acquired by a foreign firm.	0.0448	**	0.3059	***	0.0877	*	0.2092	**
	(2.43)		(4.66)		(1.95)		(2.51)	
Dummy for firms which merged with or were acquired by a domestic firm	−0.0043		−0.0189		0.0121		0.0199	
	(−0.65)		(−0.85)		(0.75)		(0.67)	
_cons	−0.0429	***	1.0865	***	0.5608	***	0.5195	***
	(−8.44)		(52.70)		(23.13)		(21.68)	
Industry dummy	yes		yes		yes		yes	
Number of observations	10142		10002		10142		10142	
Adjusted R^2	0.6067		0.3267		0.9542		0.704	

	Wage in 1998		Employment in 1998		Capital Stock in 1998		Fixed Assets in 1998	
Dummy for firms which merged with or were acquired by a foreign firm.	0.1551	***	0.0136		0.2333	***	0.2340	***
	(3.81)		(0.39)		(2.65)		(2.69)	
Dummy for firms which merged with or were acquired by a domestic firm	0.0220		0.0089		0.0272		0.0239	
	(1.51)		(0.72)		(0.86)		(0.77)	
_cons	0.9650	***	0.1477	***	0.9108	***	0.8718	***
	(68.62)		(9.01)		(25.14)		(23.84)	
Industry dummy	yes		yes		yes		yes	
Number of observations	10142		10142		10142		10142	
Adjusted R^2	0.4151		0.0304		0.8654		0.8667	

	R&D expenditure per worker in 1998		R&D expenditure-sales in 1998		Current Profit per Worker in 1998		Current Profit to Sales in 1998		Current Profit to Fixed Assets in 1998	
Dummy for firms which merged with or were acquired by a foreign firm.	0.6389	***	0.0072	*	2.8790	***	2.4448		5.7092	
	(4.81)		(1.90)		(5.55)		(0.89)		(0.11)	
Dummy for firms which merged with or were acquired by a domestic firm	0.0602		0.0023		0.2072		−0.0466		−13.5021	
	(0.86)		(1.15)		(1.12)		(−0.05)		(−0.70)	
_cons	0.3457	***	0.0122	***	0.2976	**	0.6313		1.2888	
	(7.58)		(9.23)		(2.09)		(0.83)		(−0.09)	
Industry dummy	yes		yes		yes		yes		yes	
Number of observations	4160		4161		10142		10142		10142	
Adjusted R^2	0.6443		0.614		0.2218		0.0188		0.1575	

Note: In the compilation of industry dummies, computer industry is treated as the benchmark industry without an industry dummy variable.

Another factor that may play an important role in determining firms' business efficiency is the number of years passed since an M&A. Therefore, we also include the following independent variables in the regression: the out-in M&A target firm dummy multiplied by the number of years since the M&A; and the in-in M&A target firm dummy multiplied by the number of years since the M&A. The results are summarized in Table 8.

Table 8 OLS Estimation Results: Effects of Out-In M&A, In-In M&A and Other Firms: Including No. of Years Passed since M&A

	TFP level in 1998	Labor Productivity in 1998		Sales in 1998	Capital labor ratio in 1998
Dummy for firms which merged with or were acquired by a foreign firm.	0.0225 (1.54)	0.2311	*** (4.35)	0.0271 (0.76)	0.1398 ** (2.12)
Dummy for firms which merged with or were acquired by a domestic firm	−0.0006 (−0.26)	0.0009	(0.13)	0.0058 (1.09)	0.0014 (0.15)
_cons	−0.0428 *** (−8.43)	1.0857	*** (52.66)	0.5600 *** (23.10)	0.5208 *** (21.73)
Industry dummy	yes	yes		yes	yes
Number of observations	10142	10002		10142	10142
Adjusted R^2	0.6067	0.3265		0.9541	0.704

	Wage in 1998	Employment in 1998	Capital Stock in 1998	Fixed Assets in 1998
Dummy for firms which merged with or were acquired by a foreign firm.	0.1137 *** (3.54)	−0.0034 (−0.13)	0.1364 ** (1.96)	0.1373 ** (2.00)
Dummy for firms which merged with or were acquired by a domestic firm	0.0090 * (1.84)	0.0074 * (1.82)	0.0087 (0.84)	0.0075 (0.73)
_cons	0.9649 *** (68.62)	0.1465 *** (8.94)	0.9113 *** (25.15)	0.8723 *** (23.85)
Industry dummy	yes	yes	yes	yes
Number of observations	10142	10142	10142	10142
Adjusted R^2	0.4151	0.9503	0.8653	0.86666

	R&D expenditure per worker in 1998	R&D expenditure−sales in 1998	Current Profit per Worker in 1998	Current Profit to Sales in 1998	Current Profit to Fixed Assets in 1998
Dummy for firms which merged with or were acquired by a foreign firm.	0.4069 *** (4.08)	0.0069 ** (2.44)	1.8271 *** (4.47)	1.1620 (0.53)	3.8305 (0.09)
Dummy for firms which merged with or were acquired by a domestic firm	0.0137 (0.58)	0.0005 (0.77)	0.0804 (1.32)	0.0216 (0.07)	−3.8693 (−0.61)
_cons	0.3489 *** (7.64)	0.0122 *** (9.26)	0.3010 ** (2.11)	0.6342 (0.84)	1.2328 (0.08)
Industry dummy	yes	yes	yes	yes	yes
Number of observations	4160	4161	10142	10142	10142
Adjusted R^2	0.6437	0.6142	0.221	0.0188	0.1575

Note: In the compilation of industry dummies, computer industry is treated as the benchmark industry without an industry dummy variable.

The estimation including the number of years since the M&A shows that the coefficient on the TFP level is not statistically significant. However, firms acquired by a foreign company show an increase in business efficiency, as indicated by higher labor productivity, R&D intensity, and current profits per worker. In contrast, the business performance indicators of in-in M&A targets do not show a significant improvement, although in comparison with other firms, the scale of their operations, as measured by the

number of workers, increases.

6   Conclusion

Using firm level data of the Japanese manufacturing sector, this paper investigated what kind of characters the foreign firms value in the target firms before M&A, and investigated whether the technology transfer are there through out-in M&A.

. Firstly, productivity and business performance indicators were compared between out-in firms and in-in firms. Secondly, it was investigated whether out-in M&As raise the performance of target firms.

The results of the investigation can be summarized as follows.

Tests of averages which compare out-in firms and in-in firms show that as a whole the productivity and other performance indicators, such as labor productivity, the current profit-to-sales ratio, and the R&D intensity of out-in target firms are significantly higher than those of in-in M&A target firms.

The regression analysis showed the foreign firms value the facility and the scale of the target firms. Before M&A business efficiency such as TFP, and labor productivity is not statistically high. However, the regression analysis showed that firms acquired by foreign firms saw an improvement in their business efficiency after the acquisition. This finding suggests that out-in M&As involve a transfer of business resources or business know-how that help to further lift the efficiency of firms.

These findings suggest that because foreign-owned firms are more productive than domestic ones, out-in M&As help to raise the productivity level of Japanese industry overall. Therefore, if the target set

out by Prime Minister Koizumi[8] to double the cumulative amount of foreign direct investment is achieved, this would help to raise the productivity of the Japanese economy because out-in M&As lift the productivity of the acquired firms.

Bibliography

Caves, R. E. (1996) *Multinational Enterprises and Economic Analysis*, Cambridge, MA: Cambridge University Press.

Caves, D. W., L. R. Christensen, and W. E. Diewert (1982) "Multilateral Comparisons of Output, Input and Productivity Using Superlative Index Numbers," *Economic Journal* 92(362): 73-96.

Chudnovsky, D., and A. López (2000) "The Impact of M&As in Argentina in the 1990s," United Nations Conference on Trade and Development, Geneva (unpublished).

Conyon, M. J., S. Girma, S. Thompson, and P. W. Wright (2002) "The Productivity and Wage Effects of Foreign Acquisition in the United Kingdom," *Journal of Industrial Economics* 50(1): 85-102.

Danzon, P. M., A. Epstein, and S. Nicholson (2004) "Mergers and Acquisitions in the Pharmaceutical and Biotech Industries," *NBER working paper 10536.*

Dunning, J. H. (1992) *Multinational Enterprises and the Global Economy,* Cambridge, MA: Addison-Wesley.

Fukao, K., and T. Amano (2004) *Tainichi Chokusetsu Toshi to Nihon Keizai [Inward FDI and the Japanese Economy],* Tokyo: Nihon Keizai Shimbun-sha.

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[8] See Koizumi (2003).

─, Inui, T. Miyagawa, and H. Kawai (2003) "Industry Growth and Productivity: 1970-98," *Keizai Bunseki* 170, Economic and Social Research of Institute, Cabinet Office, Government of Japan.

Good, D. H., M. I. Nadiri, and R.C. Sickles (1997) "Index Number and Factor Demand Approaches to the Estimation of Productivity," *Handbook of Applied Econometrics vol. 2: Microeconomics*, 14-80.

Gugler, K., and B. B. Yortoglu (2004) "The Effects of Mergers on Company Employment in the USA and Europe," *International Journal of Industrial Organization* 22(4): 481-502.

Koizumi, J. (2003) *General policy speech to the Diet*.

Online: http://www.kantei.go.jp/jp/ koizumispeech/2003/01/31sisei.html

Lall, Sanjaya (2003) "Foreign Direct Investment, technology development and competitiveness: issues and evidence "*Competitiveness, FDI and Technological Activity in East Asia:* in Sanjaya Lall Shujiro Urata (Eds.), Edward Elgar.

Odagiri, H., and T. Hase (1988) "Are Mergers and Acquisitions Going to be Popular in Japan, too? An Empirical Study," *International Journal of Industrial Organization* 7(1): 49-72.