# Characteristics and Effects of Japan's Inward FDI

**An Outline Prepared for the Pre-Conference Meeting of Authors**
***International Economic Relations and Structural Change:***
***Issues and Policy Options for Japan and the United States***

**March 13, 2004**

**Kyoji Fukao**
**Hitotsubashi University and RIETI**
**Keiko Ito**
**International Centre for the Study of East Asian Development (ICSEAD)**
**Hyeog Ug Kwon**
**Hitotsubashi University**

## 1. Introduction

According to economic theory, foreign direct investment (FDI) is a form of long-term international capital movement which is accompanied by investors' intangible assets. It is expected that the recipient country will benefit from such inflows.

In his general policy speech to the Diet on January 31, 2003, Prime Minister Junichiro Koizumi promised to increase efforts to attract FDI with the aim of doubling the cumulative amount of investment within the next five years.

Though foreign direct investment clearly is an important topic, reliable statistics on and analyses of inward FDI in Japan are very limited. Moreover, in the absence of any meaningful empirical studies on this subject, some observers argue that Japan does not need more FDI (Werner 2003, Nippon Keizai Shinbun-sha 2003).

In this paper we present an overview of recent foreign direct investment in Japan. We also compare the performance of foreign-owned and domestically-owned firms, using micro data of Japanese firms in the manufacturing sector for the period of 1994–1998.

## 2. An Overview of Inward FDI in Japan

### Japan's Inward FDI is Very Small

Compared to other countries, Japan's FDI inflows are extremely low. In other countries, foreign firms make significant contributions to employment and fixed capital investment.

Low FDI inflows cannot offset the "hollowing out" caused by FDI outflows.

### There Was a Boom in Inward FDI between 1997 and 2002.

In the five years from 1997 to 2002, Japan experienced an "FDI Boom" in the newly deregulated finance/insurance, telecommunications, services, and retail/wholesale industries. In the manufacturing sector, the machinery industry (mainly in the automotive field) and the chemical industry (mainly in the pharmaceutical sector) also saw strong FDI inflows. However, 72% of the investment during this period went into non-manufacturing industries, which is in striking contrast to the period from 1950 to 1995, when 54% of all investment went into the manufacturing sector.

During the five years from 1997 to 2002, inward FDI into Japan rose 2.7-fold to 9.4 trillion yen on a net foreign assets basis.

**The Global Boom in M&A Contributed to the Expansion of Inward Investment**

The globalization of markets brought a wave of large-scale M&As to Japan involving companies such as AT&T, Cable and Wireless, GE Capital and Ripplewood. M&As in Japan were also driven by the growing excess capacity resulting from the prolonged domestic recession, which prompted both domestic and foreign investors to choose acquisition over investing in new facilities.

**Government's Goal to Double FDI in Five Years Unlikely to be Met**

The first round of deregulation is over. Further large-scale deregulation will be necessary to attract more FDI. Such an effort does not appear to be on the government agenda today. The IT bubble in the US, the Enron scandal and the Iraq war have taken the steam out of the global M&A boom.

During the first half of 2003, FDI into Japan was 42% lower than during the same period the year before.

**Restrictions have created "sanctuaries," preventing the entry of foreign firms**

When compared with the US, inward FDI in Japan has been limited to a small number of industries. Some industries, such as medical services, education, electricity, gas, and water supply have been "sanctuaries" where almost no inward FDI is allowed.

Barriers to FDI often go beyond "national treatment" to more fundamental questions of market access. For example, market entry in areas such as medical service and education is limited even for Japanese companies.

**Estimation of the Gravity Model**

In order to test whether Japan's market is more closed to inward FDI than other countries, we estimated a gravity model for the regional distribution of sales by U.S. firms' foreign affiliates.

## 3. Performance of Foreign Firms' Japanese Affiliates

**Data Source**

We use the firm-level panel data underlying the *Basic Survey of Japanese Business Structure and Activities* conducted annually by the Ministry of Economy, Trade and Industry (METI). Our data covers the period of 1994–2000 (we can extend the period to 1994–2001 in April). After some screening of the data our unbalanced panel data set consists of 93880 observations.

**Two Definitions of Foreign-Owned Firms**

**Broad Definition**

In the survey, firms were asked what percentage of their paid-in capital was owned by foreigners. We use this information to determine whether a firm is foreign-owned, setting our cut-off capital participation rate at 33.4%. Thus, our data on foreign-owned firms include all those affiliates of which one or several foreigners owned 33.4% or more in total.

**Narrow Definition**

Firms were also asked whether they had a parent firm which had majority ownership and what the nationality of the parent firm was. Using this information we also identified narrowly defined foreign-owned firms, i.e. those majority-owned by a single foreign firm.

**"Entry" and "Exit" of Foreign-Owned Firms**

The increase in foreign-owned firms' market share was mainly caused by "M&As."

**Measurement of TFP**

In this paper we measure each firm's TFP level using the method developed by Good, Nadiri, and Sickles (1997).

**Comparison of Performance by Regression Analysis**

As a first step to compare foreign- and domestically-owned firms, firms' performance is regressed on the foreign-ownership dummy. In order to control for other factors which might affect firms' performance, we use industry dummies and year dummies as additional explanatory variables.

Our main results (using the broad definition of foreign-owned firms) are as follows.

1) Foreign-owned firms have about 8% higher TFP and a 2 percentage point higher current profit-sales ratio.
2) Foreign-owned firms spend proportionately more on R&D per worker. They also have a significantly higher capital-labor ratio. Probably because of this, the labor productivity of foreign-owned firms is higher than that of Japanese firms.
3) There is no significant difference between domestically-owned and foreign-owned firms in the growth rates of tangible assets, real sales, and employment.
4) Average wages at foreign firms are 1.30 million yen higher per year.

**Empirical Model of the Determinants of TFP**

As we have seen, foreign-owned firms tend to conduct more R&D and pay higher wage rates. Although their TFP level is significantly higher than that of Japanese firms, this difference might be caused not by the inflow of knowledge from their parent firms but by their own R&D activities and

the (potentially) higher quality of their labor. In order to test which of the above two hypotheses is correct, we estimate an empirical model of the determinants of each firm's TFP level and its growth rate of TFP. The model is estimated by OLS using pooled data for 1994–2000 (we will add the data of 2001).

Again, foreign-owned firms display a TFP level about 5% higher than that of Japanese firms even after controlling for other factors such as R&D intensity, the percentage of non-production workers, years passed since the firm was established, and firm size (sales) in addition to industry differences (industry dummies) and observation year. Foreign owned firms also have a higher TFP growth rate. When we add firm dummies to the regression model, the gap between the TFP level of foreign-owned firms and Japanese firms becomes insignificant.

**Dynamic Analysis of M&A**

There is, of course, the possibility that foreign-owned firms may enjoy greater productivity because foreign firms target domestically-owned firms with higher TFP for M&A investments.

In order to take account of this possibility, we will also test whether the TFP level of Japanese firms that merged with or were acquired by foreign firms improved after the investment.

## 4. Conclusions

To be completed.

**Estimation of the Gravity Model**

In order to test whether Japan's market is more closed to inward FDI than other countries, we estimated a gravity model for the regional distribution of sales by U.S. firms' foreign affiliates.[1] The results are summarized in Table 2.1. The dependent variables are the logarithm of sales by foreign affiliates of U.S. firms. As explanatory variables, we use the logarithm of each country's GDP, the logarithm of per capita GDP, the logarithm of distance from the U.S., a dummy for Japan, and a language dummy variable which indicates countries where English is the predominant language.[2] The equations are estimated for 1994, 1999, and 2000 for all industries, the manufacturing sector, the non-manufacturing sector, and sales of services, using the Ordinary Least Squares (OLS) method (Table 1). Table 2.1 shows that the estimated coefficient on the Japan dummy is negative in all cases except two. The coefficient on the Japan dummy is negative and significant in all the equations for the manufacturing sector, while they are not statistically significant in all the equations for the non-manufacturing sector. Moreover, looking at the estimated equations for the sales of services, a positive coefficient is estimated for the Japan dummy in two cases, although it is not statistically significant. This is a conspicuous difference between the manufacturing sector and the non-manufacturing sector. These results suggest that the Japan tends to be more closed to inward FDI in the manufacturing sector than other countries, although we cannot conclude that Japan is significantly more closed when it comes to services (non-manufacturing). The results imply that, in the manufacturing sector, sales by U.S. firms in Japan were more than 60% less than the predicted value in 1994 and 1999, and still 70% less than the predicted value in 2001, even after controlling for the language difference. Although the sales by U.S. firms in Japan were 2-20% less than the predicted value in the non-manufacturing sector, they were more than 40% less than the predicted value in all industries for the years 1994 and 1999. Furthermore, when we compare the coefficients on the Japan dummy for each year, it is found that the absolute value for the year 2001 is much smaller than that for the years 1994 and 1999 for the cases of all industries and the manufacturing sector.

---

[1] There are several empirical studies which estimated an econometric model explaining the regional distribution of U.S. direct investment abroad and found that a Japan dummy is negative and significant. These studies are based either on data of FDI in manufacturing industries (Grubert and Mutti 1991) or on data of FDI in all industries (Eaton and Tamura 1994). On this issue, also see Lawrence (1993) and Development Bank of Japan (1997).

[2] We also estimated the model excluding the language dummy variable. The results were very similar to those including the language dummy variable. Therefore, we report the results including the language dummy variable.

In addition, the estimated coefficients on GDP and per capita GDP are positive, as expected, and strongly significant in all the equations. The distance variable has a negative coefficient, as expected, but the estimated coefficients are not statistically significant in the equations of all industries and the manufacturing sector. On the other hand, a significantly negative coefficient is estimated in some cases for the non-manufacturing sector and the sales of services. This might imply that manufacturing firms undertake FDI and establish production bases in far-away countries in order to avoid the high transportation cost incurred when exporting. In contrast, in the case of services (non-manufacturing and sales of services), firms might find it easier to provide their services to countries close-by. The coefficient on the language dummy variable takes a positive value in all the cases, suggesting that U.S. outward FDI tends to go to countries where English is the main language. Although the coefficient is significantly positive and takes a relatively large value in the cases of all industries and the non-manufacturing sector, this is not the case in the manufacturing sector, where the coefficient is not statistically significant and the absolute value is much smaller. This suggests that language matters in non-manufacturing industry but not in the manufacturing sector.

**TFP Comparison of Foreign-Owned and Domestically-Owned Firms**

Preceding studies:

Kimura and Kiyota (2003), Fukao and Murakami (2003)

**Data Source and Definition of Nationality**

We use the firm-level panel data underlying the *Basic Survey of Japanese Business Structure and Activities* conducted annually by the Ministry of Economy, Trade and Industry (METI).[3] The survey covers all firms with at least 50 employees or 30 million yen of paid-in capital in the Japanese manufacturing, mining and commerce sectors. We use the data for manufacturing firms. Our data covers the period of 1994–2000 (we can extend the period to 1994–2001 this May). After some screening of the data our unbalanced panel data set consists of 68,641 observations.[4]

In the survey, firms were asked what percentage of their paid-in capital was owned by foreigners. We use this information to determine whether a firm is foreign-owned, setting our cut-off capital participation rate at 33.4%. Thus, our data on foreign-owned firms include all those affiliates of which one or several foreigners owned 33.4% or more in total.

**"Entry" and "Exit" of Foreign-Owned Firms**

Table 3.1, which is based on our data, shows how the presence of foreign-owned firms in Japan's manufacturing sector increased in 1994–98: their number grew from 180 in 1994 to 244 in 1998. During the same period, the sales of foreign-owned firms nearly doubled from 9.6 trillion yen to 18.2 trillion yen. 38 foreign-owned firms exited and 69 foreign-owned firms newly entered in this period.[5] 43 domestically-owned firms in 1994 had become foreign-owned by 1998. We regard these firms as merged with or acquired by foreign firms.

The increase in foreign-owned firms' market share was mainly caused by these 43 M&As. The total sales of these 43 firms amounted to 8.8 trillion yen in 1998, which is greater than the total

---

[3] The compilation of the micro-data of the METI survey was conducted as part of the project " The Internationalization of Japanese Firms" at the Research Institute of Economy, Trade and Industry.

[4] We exclude from our data set all observations with zero values of material costs, compensation of employees, and tangible fixed assets. We also exclude observations with an extremely high or low capital-labor ratio. As a result of this screening process, the number of observations declined by about 8% in comparison with our original set of observations.

[5] As already mentioned, the METI survey covers only those firms in the manufacturing and the commerce sector that are of a size that is greater than the cut-off level. Thus, our data on firms that "entered" includes firms which expanded or changed their main business.

increase in foreign-owned firms' sales of 8.6 trillion yen in the 1994–1998 period. We will study these 43 cases more closely in the following section.

**Measurement of TFP**

In this paper we measure each firm's TFP level using the methodology developed by Good, Nadiri, and Sickles (1997). This, in turn, is based on Caves, Christensen, and Diewert's (1982) "hypothetical firm" approach, which measures TFP as the gap between 1) the deviation of a firm's output level from the industry average output level and 2) the summation of the deviations of the firm's input level of production factor *i* from the industry average input level of that factor multiplied by the simple mean of the firm's cost share of that factor and the industry average cost share of that factor for all the production factors. This index is particularly useful for a comparison of the productivity level of more than two firms in one particular period. However, this method is not suitable for inter-temporal comparisons.

Good, Nadiri, and Sickles (1997) overcome this problem by combining the "chain index" approach with the "hypothetical firm" approach just described. They achieve this by assuming a hypothetical firm for each cross-sectional comparison and then chaining the hypothetical firms together over time. The productivity index thus obtained is particularly useful because it provides a consistent way of summarizing the cross-sectional distribution of firms' TFP and the inter-temporal change in the distribution over time. Aw, Chen, and Roberts (1997), Fukao and Ito (2002), and Hahn (2000) applied this approach to data of the manufacturing sector at either the firm or plant the level for Taiwan, Japan and Korea respectively.

Using the industry classification of the METI survey, we divided our data into 59 manufacturing industries. For each industry we measured the TFP level of firm *f* at time *t* by

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

where $Y_{ft}$ denotes the output level of firm *f* in year *t* and $X_{ift}$ the input level of factor *i* at firm *f* in year *t*. $S_{ift}$ stands for the cost share of input *i* at firm *f* in year *t*. Upper bars indicate the average value of that variable over all firms in that industry.

**Data Prepared for the Calculation of TFP**

We used each firm's total sales and cost of intermediate inputs as nominal gross output and nominal intermediate input data. We derived the deflator for each industry's gross output and

intermediate input by aggregating the deflator of METI's Extended IO Tables at the 3-digit level into our 59 industries for the period 1994–1998. For the period of 1998–2000 we used wholesale price statistics of Bank of Japan.

As physical capital stock, only nominal book value data are available in the METI survey. We compiled a converter from book value to real capital stock using investment flow data in METI's *Report on Industry Statistics*, which is based on the *Census of Manufactures*. First, we aggregated the data in the *Report on Industry Statistics* on investment in fixed assets for 1970–2000 into our 59 industries and then deflated these using the gross domestic capital formation deflator (plant and equipment) in the *Annual Report on National Accounts* released by the Cabinet Office, Government of Japan. We used the depreciation rates of the JIP database at the two-digit level (Fukao, Inui, Kawai, and Miyagawa 2003)[6] and estimated the real physical capital stock for 1994–2000 by the perpetual inventory method. As our converter, we used ratios of real capital stock and book value of capital reported in METI's *Report on Industry Statistics*, which we aggregated into our 59 industries. In order to derive the cost share of capital, we used capital cost data of the JIP database at the two-digit level (35 industries).

To obtain labor input, we multiplied each firm's total number of workers by the sectoral working-hour statistics of the Cabinet Office's *SNA Statistics*. We were not able not take account of differences in labor quality among firms, though it seems fair to assume that foreign firms probably tend to employ more educated workers. Our estimates of foreign-owned firms' TFP level might be biased upwards because of this neglect of the labor quality.

---

[6] The JIP Database has been compiled by those four authors, several economists at ESRI, and graduate students from Keio, Hitotsubashi, Tsukuba and other universities as part of an ESRI (Economic and Social Research Institute, Cabinet Office, Government of Japan) research project. The detailed result of this project is reported in Fukao, Miyagawa, Kawai, Inui, et al. (2003). The database contains annual information on 84 sectors, including 49 non-manufacturing sectors, from 1970 to 1998. These sectors cover the whole Japanese economy. The database includes detailed information on factor inputs, annual nominal and real input-output tables, and some additional statistics, such as R&D stock, capacity utilization rate, Japan's international trade statistics by trade partner, inward and outward FDI, etc. at the detailed sectoral level. An Excel file version of the JIP Database is available at http://www.esri.go.jp/en/archive/bun/abstract/bun170index-e.html.

**References**


Baily, Martin Neil (1986) “Productivity Growth and Materials Use in the U.S. Manufacturing,” *Quarterly Journal of Economics*, pp. 185-95.

Blomstrom, M., and F. Sjoholm (1998) "Technology Transfer and Spillovers? Does Local Participation with Multinationals Matter?" *NBER Working Paper* #6816.

Caves, Douglas W., Laurits R. Christensen, and W. Erwin Diewert (1982) “Output, Input and Productivity Using Superlative Index Numbers.” *Economic Journal*, vol. 92, no. 362: pp.73-96.

Fukao, Kyoji and Tomofumi Amano (2003) *Foreign Direct Investment in Japan*, mimeo, American Chamber of Commerce in Japan.

Fukao, Kyoji and Yukako Murakami (2003) “Do Foreign Firms Bring Greater Total Factor Productivity to Japan?” paper prepared for the Conference, *Rapid Economic Growth and Technology Transfers*, October 17-18, 2003, University Groningen.

Good, David H., M. Ishaq Nadiri, and Robin C. Sickles (1997) “Index Number and Factor Demand Approaches to the Estimation of Productivity,” *Handbook of Applied Econometrics vol.2*: *Microeconometrics*, pp. 14-80.

Ito, Keiko (2002a) "Are Foreign Multinationals More Efficient? Plant Productivity in the Thai Automobile Industry," ICSEAD Working Paper Series #2002-19, The International Centre for the Study of East Asian Development: Kitakyushu.

Ito, Keiko (2002b) “Foreign Ownership and Productivity in the Indonesian Automobile Industry: Evidence from Establishment Data for 1990-1999,” Paper presented at the NBER Thirteenth Annual East Asian Seminar on Economics, Productivity, June 20-22, 2002, Melbourne, Australia.

Ito, Keiko and Kyoji Fukao (2002) "Foreign Direct Investment in Japan: Empirical Analysis Based on the Establishment and Enterprise Census," in Robert M. Stern ed., *Issues and Options for U.S.-Japan Trade Policies*, the University of Michigan Press, Michigan.

Ito, Keiko and Kyoji Fukao (2003) "Foreign Direct Investment and Trade in Japan: An Empirical Analysis Based on the Establishment and Enterprise Census for 1996," Discussion Paper Series A, No.441, the Institute of Economic Research, Hitotsubashi University.

Kimura, Fukunari, and Kozo Kiyota (2003) “Foreign-Owned versus Domestically-Owned Firms: Economic Performance in Japan,” Yokohama National University Working Paper #185.

METI (Ministry of Economy, Trade and Industry) (2001) *Dai 34-kai Gaishi-kei Kigyo Doko Chosa Gaiyo* (*The Summary of the 34th Report on Trends of Business Activities by Japanese Subsidiaries of Foreign Firms*), Tokyo: METI (also available at <www.meti.go.jp>).

Murakami, Yukako, and Kyoji Fukao (2003) “Taigai Tainai Chokusetsu Toshi to Seizogyo Kigyo no Seisansei: Kigyo Katsudo Kihon Chosa Kohyo Deta ni Motozuku Jissho Bunseki (Outward

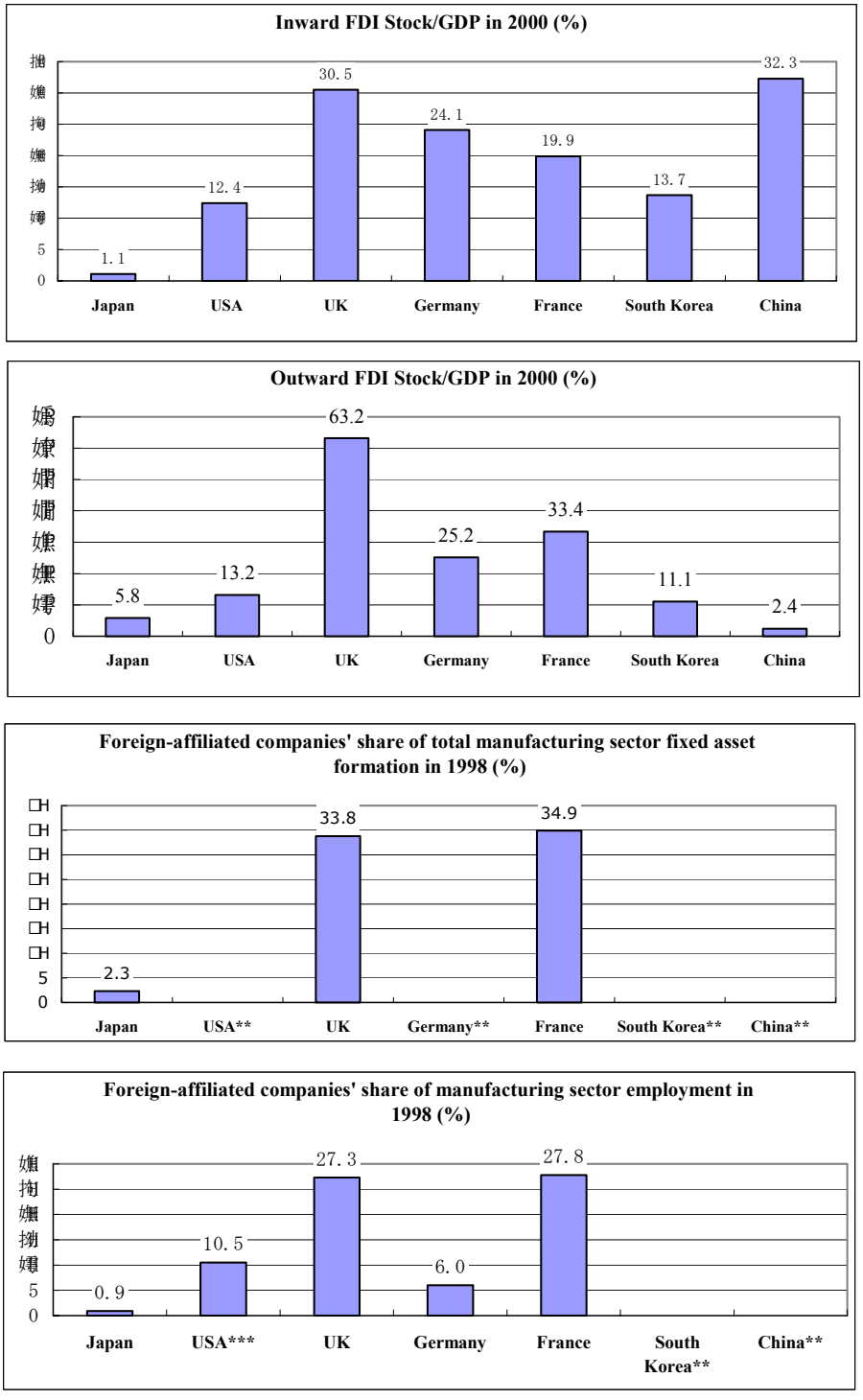
and Inward Foreign Direct Investment and Japan's Manufacturing Industry: Empirical Analysis Based on Firm-Level Data)," Economic and Social Research Institute Discussion Paper Series, #68, Economic and Social Research Institute, Cabinet Office.

Nihon Keizai Shinbun-sha (2003) "Haiena kara Hiro e: Gaikoku-jin Butai no Funsen (From 'Hyenas' to Heroes: Brave Fights of a Foreign Legion)," the evening edition of March 26, 2003.

Ramstetter, Eric D. (2002) "Does Technology Differ in Local Plants and Foreign Multinationals in Thai Manufacturing? Evidence from Translog Production Functions for 1996 and 1998," ICSEAD Working Paper Series, The International Centre for the Study of East Asian Development: Kitakyushu.

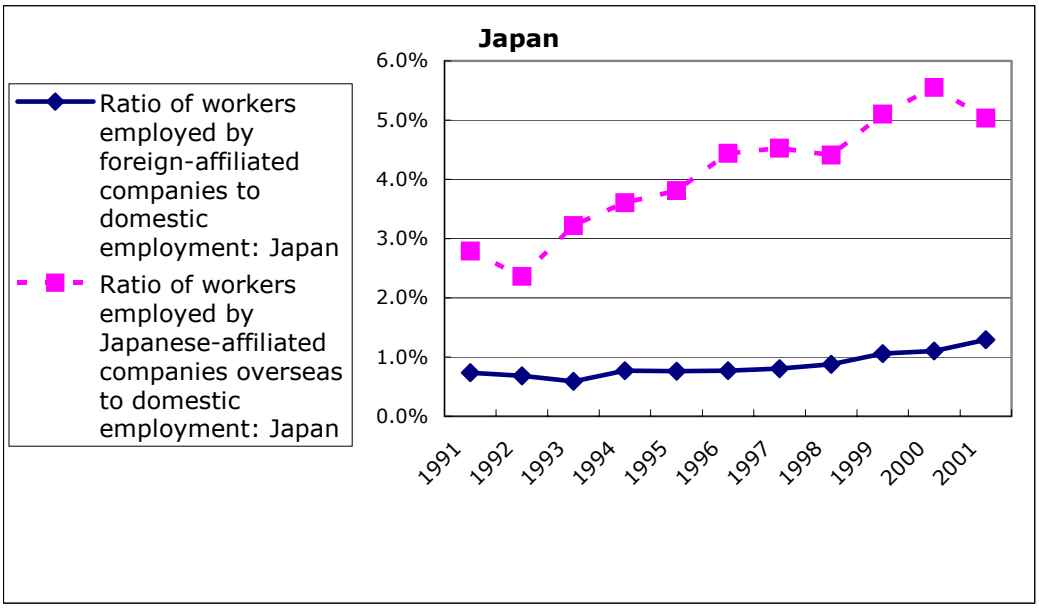
Werner, Richard A. (2003) "Foreign Money Won't Help Japan's Economy," The Daily Yomiuri.

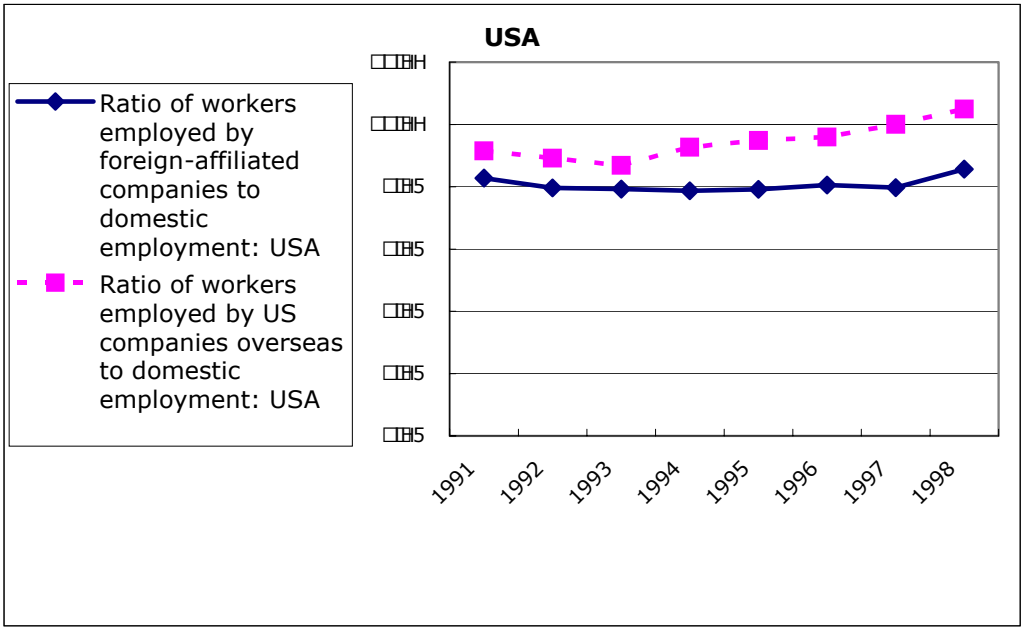
**Figure 2.1 International comparisons of inward and outward foreign direct investment**




Sources: UNCTAD *World Investment Report 2002,* OECD *Measuring Globalization 2002*
* As a rule, "foreign-affiliated companies" here are those which are more than half foreign-owned.
** Data unavailable.
*** 1992 employment data (based on Itoh and Fukao, 2003)

**Figure 2.1 Inward and outward foreign direct investment and domestic employment: US-Japan comparison**




The sources of the data on workers employed by foreign-affiliated companies in Japan and by Japanese companies abroad are as in Table 1.1.

The data on workers employed by foreign-affiliated companies in the USA and by US companies abroad are from OECD, Measuring Globalization.

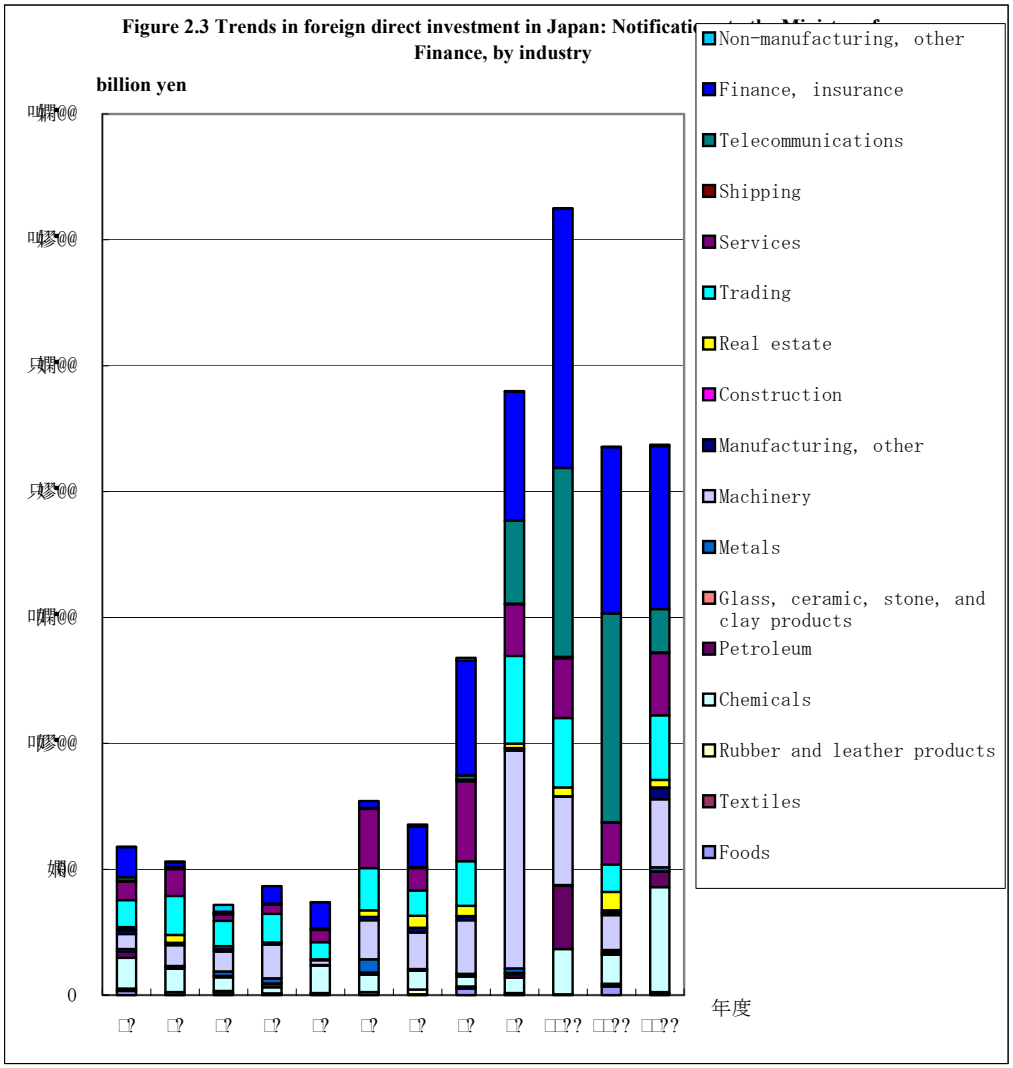



**Figure 2.3 Trends in foreign direct investment in Japan: Notificati... the Ministry of Finance, by industry**

**Table 2.1. Determinants of the Sales of U.S. Firms' Foreign Affiliates: Cross Country Estimation Based on Gravity Models (OLS estimation)**

<Panel A>

| | All affiliates of all US parents | | | | | |
|---|---|---|---|---|---|---|
| | *Dependent variables: ln (Sales by affiliates)* | | | | | |
| | All industries, 1994 | All industries, 1999 | Manufacturing, 1994 | Manufacturing, 1999 | Non-manufacturing, 1994 | Non-manufacturing, 1999 |
| ln GDP | 0.792 | 0.693 | 1.028 | 0.910 | 0.555 | 0.472 |
| | (8.94)*** | (7.71)*** | (7.78)*** | (9.19)*** | (5.69)*** | (4.40)*** |
| ln (per capita GDP) | 0.294 | 0.370 | 0.258 | 0.420 | 0.434 | 0.482 |
| | (2.66)** | (3.61)*** | (1.76)* | (3.15)*** | (3.22)*** | (4.03)*** |
| ln (Distance from Washington D.C. ) | -0.313 | -0.267 | -0.248 | -0.218 | -0.233 | -0.253 |
| | (-1.86)* | (-1.51) | (-0.87) | (-0.86) | (-1.43) | (-1.76)* |
| Japan Dummy | -0.333 | -0.440 | -1.041 | -1.138 | -0.034 | -0.081 |
| | (-1.57) | (-1.95)* | (-2.64)** | (-4.06)*** | (-0.13) | (-0.28) |
| Language Dummy | 0.713 | 0.536 | 0.011 | 0.189 | 0.682 | 0.562 |
| | (3.44)*** | (2.76)*** | (0.03) | (0.61) | (2.18)** | (2.14)** |
| _cons | 3.024 | 4.876 | -4.054 | -2.420 | 6.740 | 8.964 |
| | (1.85)* | (2.53)** | (-1.08) | (-1.11) | (3.42)*** | (3.67)*** |
| No. of observations | 48 | 47 | 42 | 41 | 39 | 40 |
| Adj. R-squared | 0.819 | 0.778 | 0.815 | 0.791 | 0.756 | 0.748 |
| Root MSE | 0.665 | 0.668 | 0.922 | 0.852 | 0.717 | 0.688 |

<Panel B>

| | Nonbank affiliates of nonbank US parents | | | | | |
|---|---|---|---|---|---|---|
| | *Dependent variables: ln (Sales by affiliates)* | | | | | |
| | All industries, 1994 | All industries, 1999 | All industries, 2001 | Manufacturing, 1994 | Manufacturing, 1999 | Manufacturing, 2001 |
| ln GDP | 0.845 | 0.690 | 0.679 | 1.028 | 0.910 | 0.885 |
| | (9.43)*** | (7.78)*** | (8.90)*** | (7.78)*** | (9.18)*** | (9.84)*** |
| ln (per capita GDP) | 0.262 | 0.374 | 0.355 | 0.258 | 0.420 | 0.368 |
| | (2.30)** | (3.64)*** | (3.76)*** | (1.76)* | (3.15)*** | (2.95)*** |
| ln (Distance from Washington D.C. ) | -0.247 | -0.282 | -0.240 | -0.247 | -0.217 | -0.201 |
| | (-1.42) | (-1.60) | (-1.34) | (-0.87) | (-0.86) | (-0.86) |
| Japan Dummy | -0.453 | -0.411 | -0.157 | -1.041 | -1.137 | -0.714 |
| | (-2.21)** | (-1.85)* | (-0.75) | (-2.64)** | (-4.06)*** | (-2.68)** |
| Language Dummy | 0.640 | 0.531 | 0.627 | 0.012 | 0.189 | 0.150 |
| | (3.13)*** | (2.75)*** | (3.36)*** | (0.03) | (0.61) | (0.48) |
| _cons | 1.319 | 5.020 | 5.167 | -4.067 | -2.417 | -1.431 |
| | (0.82) | (2.67)** | (3.12)*** | (-1.09) | (-1.10) | (-0.70) |
| No. of observations | 48 | 47 | 51 | 42 | 41 | 49 |
| Adj. R-squared | 0.834 | 0.779 | 0.781 | 0.815 | 0.791 | 0.768 |
| Root MSE | 0.654 | 0.667 | 0.675 | 0.921 | 0.852 | 0.841 |

<Panel C>

| | Nonbank affiliates of nonbank US parents | | | Nonbank MOFAs[a] | | |
|---|---|---|---|---|---|---|
| | *Dependent variables: ln (Sales by affiliates)* | | | *Dependent variables: ln (Sales by affiliates)* | | |
| | Non-manufacturing, 1994 | Non-manufacturing, 1999 | Non-manufacturing, 2001 | Sales of services, 1994 | Sales of services, 1999 | Sales of services, 2001 |
| ln GDP | 0.631 | 0.464 | 0.621 | 0.440 | 0.619 | 0.610 |
| | (5.67)*** | (4.41)*** | (8.19)*** | (2.80)** | (3.32)*** | (3.90)*** |
| ln (per capita GDP) | 0.410 | 0.492 | 0.402 | 0.764 | 0.504 | 0.420 |
| | (2.83)*** | (4.07)*** | (3.57)*** | (5.67)*** | (2.30)** | (3.58)*** |
| ln (Distance from Washington D.C. ) | -0.146 | -0.283 | -0.202 | -0.431 | -0.298 | -0.383 |
| | (-0.78) | (-1.97)* | (-1.22) | (-2.96)*** | (-2.01)* | (-2.73)** |
| Japan Dummy | -0.197 | -0.022 | -0.079 | 0.009 | -0.405 | 0.016 |
| | (-0.63) | (-0.08) | (-0.33) | (0.02) | (-0.87) | (0.04) |
| Language Dummy | 0.568 | 0.547 | 0.812 | 0.076 | 0.595 | 0.620 |
| | (1.81)* | (2.31)** | (3.73)*** | (0.18) | (1.57) | (2.00)* |
| _cons | 4.098 | 9.296 | 5.233 | 6.773 | 3.878 | 5.736 |
| | (1.60) | (3.84)*** | (3.42)*** | (1.46) | (0.80) | (1.22) |
| No. of observations | 39 | 40 | 48 | 28 | 23 | 30 |
| Adj. R-squared | 0.768 | 0.750 | 0.761 | 0.789 | 0.729 | 0.735 |
| Root MSE | 0.724 | 0.691 | 0.708 | 0.794 | 0.771 | 0.723 |

[a] Nonbank MOFAs refer to nonbank Majority Owned Foreign Affiliates.

Notes: The numbers in parentheses are t-statistics based on White's robust standard errors (White 1980).

*P=.10, **P=.05, ***P=.01

GDP and per capita GDP are in current U.S. dollars.

Sources: Authors' calculations.

Data sources: U.S. Department of Commerce (2004); World Bank (2003), *World Development Indicators,* CD-ROM;

Directorate-General of Budget (2004), *Statistical Abstract of National Income* , Accounting & Statistics, Executive Yuan, Republic of China, http://www.stat.gov.tw/bs4/nis/enisd.htm (Retrieved on 26/01/2004);

Haveman (2004), *International Trade Data: Useful Gravity Model Data* , http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Gravity (Retrieved on 20/01/2004 )

- Sales by Affiliates, Country by Industry, millions of dollars, All affiliates of all US parents (Table 1. E3)
- Sales by Affiliates, Country by Industry, millions of dollars, Nonbank Affiliates of Nonbank US Parents (Table 2. E3)

U.S. Department of Commerce (2004), U.S. Direct Investment Abroad: Operations of U.S. Parent Companies and Their Foreign Affiliates (Comprehensive financial and operating data), http://www.bea.doc.gov/bea/ai/iidguide.htm#link12b (Retrieved on 03/02/200).

- Sales of Services to Foreign Persons by U.S. MNCs Through Their Nonbank MOFAs, by Country, millions of dollars (T

U.S. Department of Commerce (2004), *U.S. International Services: Cross-Border Trade and Sales Through Affiliates, 1986-2002* , http://www.bea.doc.gov/bea/di/1001serv/intlserv.htm (Retrieved on 22/02/2004 )

**Table 2.2. Japan's International Transactions : FDI vs. Cross-Border Trade**

**<Panel A> Manufacturing Sector**

| Fukao-Ito Code | Industry | Inward | | | | Outward | | | U.S. Inward | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ratio of No. of Workers Employed by JAFF to Total No. of Domestic Workers 1996 (%) | **Ratio of No. of Workers Employed by JAFF to Total No. of Domestic Workers 2001** (%) | Ratio of Imports to Total Domestic Output 1995 (%) | **Ratio of Imports to Total Domestic Output 2000** (%) | Ratio of No. of Workers Employed by FAJF to Total No. of Domestic Workers 1996 (%) | Ratio of Exports to Total Domestic Output 1995 (%) | **Ratio of Exports to Total Domestic Output 2000** (%) | Ratio of No. of Workers Employed by USAFF to Total No. of Domestic Workers 1992 (%) | **Ratio of No. of Workers Employed by USAFF to Total No. of Domestic Workers 1997** (%) | Ratio of Imports to Total Domestic Output (%) |
| 201-204 | Food products | 0.11 | | 12.19 | | 5.03 | 0.48 | | 10.46 | | 5.21 |
| 205 | Beverages & tobacco | 1.91 | | 4.90 | | 6.28 | 0.37 | | 8.99 | | 5.37 |
| 206 | Prepared feed & fertilizers | 0.16 | | 0.89 | | 6.51 | 0.08 | | 10.06 | | 0.96 |
| 207 | Reeling plants & spinning mills | 0.01 | | 23.62 | | 73.25 | 4.17 | | 8.57 | | 3.94 |
| 208 | Woven & knit fabrics mills | 0.00 | | 13.59 | | 18.73 | 26.21 | | 4.40 | | 12.66 |
| 209 | Dyed & finished textiles | 0.13 | | 0.00 | | 9.41 | 0.00 | | 6.32 | | 12.66 |
| 210 | Other textile mill products | 0.04 | | 12.77 | | 12.40 | 10.19 | | 12.55 | | 13.28 |
| 211, 212 | Textile outer garments & apparel | 0.20 | | 27.83 | | 7.48 | 0.62 | | 2.75 | | 54.97 |
| 213, 214 | Sawmills & wood | 0.00 | | 22.54 | | 2.32 | 0.16 | | 2.26 | | 10.98 |
| 215 | Furniture & fixtures | 0.06 | | 6.59 | | 0.66 | 1.00 | | 3.71 | | 12.74 |
| 216 | Pulp & paper mills | 0.02 | | 8.19 | | 8.28 | 2.74 | | 9.23 | | 14.00 |
| 217 | Paper products | 0.16 | | 1.18 | | 2.68 | 1.46 | | 6.95 | | 2.46 |
| 218-220 | Publishing & printing | 0.13 | | 0.74 | | 1.07 | 0.36 | | 6.56 | | 1.81 |
| 221 | Industrial inorganic chemicals | 3.66 | | 9.58 | | 16.58 | 1.11 | | 22.79 | | 13.24 |
| 222 | Industrial organic chemicals | 3.55 | | 9.10 | | 22.54 | 17.55 | | 36.49 | | 13.24 |
| 223 | Oil products & detergents | 1.96 | | 4.44 | | 61.86 | 3.36 | | 19.23 | | 4.65 |
| 224 | Drugs & medicines | 7.21 | | 7.28 | | 10.04 | 2.15 | | 33.30 | | 21.17 |
| 225 | Toilet preparations & others | 4.83 | | 11.44 | | 31.36 | 19.45 | | 20.32 | | 6.33 |
| 226 | Petroleum refining | 12.27 | | 12.00 | | 5.26 | 2.82 | | 26.79 | | 8.53 |
| 227 | Petroleum & coal products | 0.99 | | 2.53 | | 0.10 | 2.89 | | 17.81 | | 0.65 |
| 228 | Plastic products | 0.41 | | 1.99 | | 3.91 | 3.31 | | 10.41 | | 10.58 |
| 229 | Tires & inner tubes | 4.03 | | 6.43 | | 226.60 | 27.98 | | 51.07 | | 22.71 |
| 230 | Rubber & plastic footwear | 0.46 | | 10.10 | | 5.44 | 7.77 | | 13.36 | | 10.58 |
| 231 | Leather products & fur skins | 0.00 | | 55.48 | | 2.95 | 2.70 | | 5.29 | | 134.45 |
| 232 | Glass & its products | 1.24 | | 5.60 | | 43.99 | 10.70 | | 22.13 | | 12.01 |
| 233 | Cement & its products | 0.00 | | 0.20 | | 1.59 | 0.83 | | 19.39 | | 2.12 |
| 234 | Clay, pottery & stone products | 0.20 | | 6.28 | | 9.07 | 8.30 | | 18.07 | | 27.94 |
| 235 | Blast furnace & basic steel | 0.02 | | 3.46 | | 20.03 | 9.18 | | 23.86 | | 17.96 |
| 236 | Iron & steel foundries | 0.00 | | 0.43 | | 27.75 | 0.34 | | 9.97 | | 5.72 |
| 237 | Nonferrous metals | 4.37 | | 108.04 | | 16.81 | 7.42 | | 19.01 | | 20.01 |
| 238 | Nonferrous rolling & castings | 0.96 | | 4.60 | | 12.35 | 9.72 | | 14.03 | | 7.09 |
| 239 | Fabricated structural metal | 0.27 | | 0.64 | | 0.66 | 0.37 | | 6.30 | | 1.26 |
| 240 | Miscellaneous metal work | 0.35 | | 2.78 | | 2.74 | 5.00 | | 7.65 | | 9.38 |
| 241 | Metal working machinery | 0.97 | | 2.42 | | 8.17 | 24.90 | | 6.85 | | 34.66 |
| 242 | Special industry machinery | 2.16 | | 5.19 | | 13.65 | 27.14 | | 16.18 | | 19.40 |
| 243 | Office & household machines | 4.31 | | 2.95 | | 10.65 | 16.42 | | 13.11 | | 18.79 |
| 244 | General industrial machinery | 0.98 | | 3.42 | | 4.61 | 18.84 | | 9.36 | | 16.32 |
| 245 | Electrical industrial machinery | 1.38 | | 6.12 | | 6.82 | 22.79 | | 17.03 | | 18.53 |
| 246 | Household electric appliances | 0.52 | | 3.19 | | 147.76 | 5.01 | | 20.10 | | 82.65 |
| 247 | Communication equipment | 0.68 | | 3.56 | | 36.60 | 24.44 | | 19.26 | | 12.31 |
| 248 | Electric equipment & computers | 7.94 | | 15.74 | | 5.71 | 28.43 | | 9.24 | | 53.50 |
| 249 | Electronic parts & devices | 2.11 | | 9.60 | | 27.11 | 31.26 | | 12.65 | | 28.92 |
| 250 | Miscellaneous electric equipment | 3.13 | | 7.57 | | 31.52 | 24.80 | | 13.36 | | 31.19 |
| 251 | Motor vehicles & parts | 4.72 | | 3.19 | | 42.05 | 20.64 | | 11.74 | | 34.24 |
| 252 | Miscellaneous transport equipment | 4.56 | | 9.12 | | 6.02 | 28.02 | | 3.43 | | 11.48 |
| 253, 256 | Miscellaneous precision instruments | 0.65 | | 14.65 | | 7.43 | 17.13 | | 13.99 | | 16.78 |
| 254 | Optical instruments & lenses | 0.11 | | 12.77 | | 22.71 | 41.40 | | 14.27 | | 33.06 |
| 255 | Watches, clocks & parts | 0.00 | | 42.62 | | 30.77 | 40.75 | | 14.23 | | 360.39 |
| 257 | Ordnance & accessories | 0.00 | | 8.07 | | 0.00 | 0.13 | | 12.36 | | 3.64 |
| 258 | Miscellaneous manufacturing | 0.60 | | 34.73 | | 6.41 | 10.36 | | 8.68 | | 57.72 |
| **Manufacturing Total** | | **1.36** | | **7.63** | | **14.29** | **11.66** | | **11.01** | | **16.89** |

Note: FAJF: Foreign Affiliates of Japanese Firms (10% or more Japanese-owned), JAFF: Japanese Affiliates of Foreign Firms (33.4% or more foreign-owned),
USAFF: U.S. Affiliates of Foreign Firms (10% or more foreign-owned)

Sources: Compiled from micro-data of the *Establishment and Enterprise Census* for 1996, MITI (1998b), and U.S. Department of Commerce (1995a). Also see Appendix.

**Table 2.2. Japan's International Transactions : FDI vs. Cross-Border Trade**

***--- Continued ---***

**<Panel B> Service Sector**

| Fukao-Ito Code | Industry | Inward | | | | Outward | | | U.S. Inward | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ratio of No. of Workers Employed by JAFF to Total No. of Domestic Workers 1996 | **Ratio of No. of Workers Employed by JAFF to Total No. of Domestic Workers 2001** | Ratio of Imports to Total Domestic Output 1995 | **Ratio of Imports to Total Domestic Output 2000** | Ratio of No. of Workers Employed by FAJF to Total No. of Domestic Workers | Ratio of Exports to Total Domestic Output | **Ratio of Exports to Total Domestic Output 2000** | Ratio of No. of Workers Employed by USAFF to Total No. of Workers | **Ratio of No. of Workers Employed by USAFF to Total No. of Domestic Workers 1997** | Ratio of Imports to Total Domestic Output |
| | | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) |
| 301 | Construction and civil engineering | 0.05 | | 0.34 | | 0.70 | 0.70 | | 1.97 | | 0.04 |
| 302 | Electricity | 0.02 | | 0.00 | | 0.12 | 0.15 | | 0.16 | | 0.36 |
| 303 | Gas supply | 0.00 | | 0.05 | | 0.08 | 0.01 | | 0.67 | | 0.00 |
| 304 | Steam and hot water supply | 0.00 | | 0.00 | | 0.00 | 0.00 | | 6.98 | | 0.00 |
| 305 | Water supply | 0.00 | | 0.02 | | 0.00 | 0.11 | | 8.69 | | 0.00 |
| 306 | Sewerage systems | 0.00 | | 0.00 | | 0.00 | 0.03 | | 8.69 | | 0.00 |
| 307 | Sanitary services | 0.00 | | 0.00 | | 0.01 | 0.01 | | 6.98 | | 0.00 |
| 308 | Wholesale trade | 2.31 | | 3.32 | | 5.85 | 4.87 | | 8.37 | | 9.45 |
| 309 | Retail trade | 0.29 | | 0.03 | | 0.66 | 0.05 | | 3.79 | | 0.00 |
| 310 | Financial intermediary services | 1.47 | | 2.98 | | 13.37 | 1.78 | | 6.62 | | 0.25 |
| 311 | Life insurance | 1.46 | | 2.60 | | 3.28 | 0.09 | | 14.34 | | 0.49 |
| 312 | Casualty insurance | 3.97 | | 1.87 | | 18.41 | 2.41 | | 14.34 | | 0.49 |
| 313 | Other insurance services | 0.18 | | n.a. | | n.a. | n.a. | | 14.34 | | 0.49 |
| 314 | Real estate | 0.02 | | 0.01 | | 1.38 | 0.01 | | 1.97 | | 0.00 |
| 315 | Railway transportation | 0.00 | | 1.30 | | 0.01 | 0.30 | | 0.00 | | 3.63 |
| 316 | Road passenger transportation | 0.00 | | 1.26 | | 0.01 | 0.21 | | 6.75 | | 4.10 |
| 317 | Road freight transportation | 0.05 | | 0.00 | | 0.27 | 0.03 | | 1.92 | | 0.77 |
| 318 | Water transportation | 1.42 | | 20.96 | | 17.34 | 19.53 | | 8.34 | | 48.85 |
| 319 | Air transportation | 17.26 | | 46.36 | | 12.61 | 14.23 | | 12.02 | | 8.16 |
| 320 | Storage facility services | 0.41 | | 0.00 | | 5.18 | 0.01 | | 1.92 | | 0.77 |
| 321 | Supporting services for transport | 1.02 | | 18.78 | | 4.34 | 16.72 | | 8.71 | | 18.71 |
| 322 | Postal service | 0.00 | | 0.35 | | 0.00 | 0.43 | | 0.00 | | 0.00 |
| 323 | Telecommunications | 0.22 | | 0.68 | | 0.19 | 0.39 | | 0.37 | | 3.36 |
| 324 | Broadcasting | 0.21 | | 0.00 | | 0.52 | 0.00 | | 1.28 | | 0.00 |
| 325 | Education | 0.05 | | 0.00 | | 0.00 | 0.00 | | 6.44 | | 0.84 |
| 326 | Research institutes (natural sciences) | 2.95 | | 1.71 | | 0.00 | 1.14 | | 6.44 | | 0.84 |
| 327 | Research institutes (soc. sci. & humanities) | 0.00 | | 2.15 | | 0.00 | 1.25 | | 6.44 | | 0.84 |
| 328 | Medical services | 0.02 | | 0.00 | | 0.01 | 0.00 | | 2.72 | | 0.00 |
| 329 | Health and hygiene | 0.01 | | 0.00 | | 0.11 | 0.00 | | 2.72 | | 0.00 |
| 330 | Private non-profit organization services | 0.00 | | 0.84 | | 0.00 | 1.01 | | 0.00 | | 0.00 |
| 331 | Advertising | 1.20 | | 4.85 | | 3.23 | 1.47 | | 7.55 | | 0.44 |
| 332 | Computer programming & software | 1.97 | | 1.42 | | 1.02 | 0.66 | | 4.08 | | 0.18 |
| 333 | Information services | 1.63 | | 6.77 | | 40.74 | 3.33 | | 4.08 | | 0.18 |
| 334 | Goods & equipment rental & leasing | 0.95 | | 2.33 | | 3.65 | 1.06 | | 5.36 | | 0.00 |
| 335 | Automobile renting | 0.34 | | 0.00 | | 1.76 | 0.00 | | 5.67 | | 0.00 |
| 336 | Automobile repairing | 0.12 | | 0.00 | | 0.31 | 0.00 | | 0.64 | | 0.01 |
| 337 | Machine repairing | 2.23 | | 0.00 | | 0.49 | 0.00 | | 2.88 | | 0.00 |
| 338 | Building maintenance services | 0.01 | | 0.00 | | 0.23 | 0.00 | | 7.85 | | 0.00 |
| 339 | Legal & accounting services | 0.00 | | 5.87 | | 0.01 | 2.18 | | 0.06 | | 0.25 |
| 340 | Civil eng. & construct. services | 0.07 | | 3.11 | | 0.01 | 2.45 | | 1.44 | | 0.50 |
| 341 | Personnel supply services | 1.19 | | 0.00 | | 0.12 | 0.01 | | 6.79 | | 1.67 |
| 342 | Other business services | 0.67 | | 3.02 | | 2.98 | 2.10 | | 4.10 | | 0.45 |
| 343 | Amusement & recreation services | 0.13 | | 1.62 | | 0.52 | 0.20 | | 4.32 | | 0.24 |
| 344 | Eating and drinking places | 1.58 | | 4.17 | | 0.55 | 0.56 | | 2.71 | | 2.05 |
| 345 | Hotels and lodging places | 0.20 | | 23.31 | | 4.46 | 3.97 | | 9.99 | | 19.63 |
| 346 | Individual education facilities | 0.23 | | 0.03 | | 0.01 | 0.01 | | 0.94 | | 0.00 |
| 347 | Other personal services | 0.02 | | 0.04 | | 0.06 | 0.01 | | 1.27 | | 0.04 |
| 348 | Agricultural services | 0.00 | | 0.00 | | 0.18 | 0.00 | | 0.82 | | 0.10 |
| 349 | Social insurance & welfare | 0.02 | | 0.00 | | 0.00 | 0.00 | | n.a. | | n.a. |
| 350 | Unclassified services | 0.01 | | n.a. | | n.a. | n.a. | | n.a. | | n.a. |
| **Services Total** | | **0.65** | | **2.11** | | **1.89** | **1.48** | | **4.03** | | **2.07** |

Note: FAJF: Foreign Affiliates of Japanese Firms (10% or more Japanese-owned), JAFF: Japanese Affiliates of Foreign Firms (33.4% or more foreign-owned),
USAFF: U.S. Affiliates of Foreign Firms (10% or more foreign-owned)
Sources: Compiled from micro-data of the *Establishment and Enterprise Census* for 1996, Toyo Keizai Shimpo-sha (1996), and U.S. Department of Commerce (1995a). Also see Appendix.

**Table 3.1 "Entry" and "Exit" of Domestically-Owned and Foreign-Owned Firms in the Manufacturing Sector**

(number of firms, values in parentheses are total sales)

| | 1994 | | | | | 2000 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total firms | Based on 33.4% Cut-Off Point | | Based on Location of Parent Firm | | Total firms | Based on 33.4% Cut-Off Point | | Based on Location of Parent Firm | |
| Manufacturing | | Domestic | Foreign | Domestic | Foreign | | Domestic | Foreign | Domestic | Foreign |
| Total | 13731<br>(250000) | 13536<br>(238000) | 195<br>(12200) | 13614<br>(246000) | 117<br>(4082) | 13486<br>(265000) | 13250<br>(241000) | 236<br>(23700) | 13384<br>(260000) | 102<br>(4517) |
| Firms that "exited" in 1994-2000 | 4207<br>(34044) | | | | | | | | | |
| Breakdown of "exited" firms | | 4145<br>(31900) | 62<br>(2124) | 4161<br>(32900) | 46<br>(1095) | | | | | |
| Firms that "entered" in 1994-2000 | | | | | | 3962<br>(32300) | | | | |
| Breakdown of "entered" firms | | | | | | | 3889<br>(31000) | 73<br>(1221) | 3927<br>(31700) | 35<br>(528) |
| Firms that "stayed" in 1994-2000 | 9524<br>(216000) | | | | | 9524<br>(233000) | | | | |
| Breakdown of firms that "stayed" | | | | | | | | | | |
| "Stayed" as domestically-owned | | 9330<br>(192200) | | 9439<br>(212000) | | | 9330<br>(205700) | | 9439<br>(227600) | |
| "Stayed" as foreign-owned | | | 102<br>(6785) | | 53<br>(2680) | | | 102<br>(8285) | | 53<br>(3326) |
| Changed from domestically-owned to foreign-owned | | 61<br>(13800) | | 14<br>(516) | | | | 61<br>(14100) | | 14<br>(662) |
| Changed from foreign-owned to domestically-owned | | | 31<br>(3215) | | 18<br>(298) | | 31<br>(4300) | | 18<br>(323) | |

Table3.2. Distribution of foreign firms by industry: Pooled Data for 1994-2000

| | Industry | Number of Domestic Firms | Number of Foreign firms | | | Number of Firms |
|---|---|---|---|---|---|---|
| | | | A or B | Majority-owned by a Foreign Firm | 33.4% or more is owned by foreigners | |
| 1 | Foods | 10968 | 68 | 39 | 65 | 11036 |
| | | (99.38) | (0.62) | | | (100.00) |
| 2 | Textiles | 6049 | 16 | 10 | 14 | 6065 |
| | | (99.74) | (0.26) | | | (100.00) |
| 3 | Woods and furniture | 2459 | 7 | 0 | 7 | 2466 |
| | | (99.72) | (0.28) | | | (100.00) |
| 4 | Pulp and paper | 3052 | 8 | 4 | 5 | 3060 |
| | | (99.74) | (0.26) | | | (100.00) |
| 5 | Printing and publishing | 5403 | 22 | 13 | 15 | 5425 |
| | | (99.59) | (0.41) | | | (100.00) |
| 6 | Industrial chemicals and chemical fibers | 2084 | 141 | 53 | 131 | 2225 |
| | | (93.66) | (6.34) | | | (100.00) |
| 7 | Oils and paints | 951 | 18 | 7 | 17 | 969 |
| | | (98.14) | (1.86) | | | (100.00) |
| 8 | Drugs and medicines | 1322 | 128 | 93 | 118 | 1450 |
| | | (91.17) | (8.83) | | | (100.00) |
| 9 | Other chemical products | 1657 | 159 | 86 | 141 | 1816 |
| | | (91.24) | (8.76) | | | (100.00) |
| 10 | Petroleum and coal products | 340 | 47 | 14 | 47 | 387 |
| | | (87.86) | (12.14) | | | (100.00) |
| 11 | Plastic products | 4512 | 53 | 19 | 44 | 4565 |
| | | (98.84) | (1.16) | | | (100.00) |
| 12 | Rubber products | 978 | 16 | 6 | 16 | 994 |
| | | (98.39) | (1.61) | | | (100.00) |
| 13 | Ceramics | 4070 | 29 | 11 | 24 | 4099 |
| | | (99.29) | (0.71) | | | (100.00) |
| 14 | Iron and steel | 2760 | 3 | 2 | 1 | 2763 |
| | | (99.89) | (0.11) | | | (100.00) |
| 15 | Non-ferrous metals and products | 2212 | 33 | 17 | 32 | 2245 |
| | | (98.53) | (1.47) | | | (100.00) |
| 16 | Fabricated metal products | 6862 | 16 | 11 | 10 | 6878 |
| | | (99.77) | (0.23) | | | (100.00) |
| 17 | Metal working machinery | 1815 | 12 | 3 | 10 | 1827 |
| | | (99.34) | (0.66) | | | (100.00) |
| 18 | Special industry machinery | 2767 | 37 | 22 | 27 | 2804 |
| | | (98.68) | (1.32) | | | (100.00) |
| 19 | Office, service industry and household machines | 1085 | 16 | 8 | 14 | 1101 |
| | | (98.55) | (1.45) | | | (100.00) |
| 20 | Miscellaneous machinery and machine parts | 5155 | 125 | 65 | 101 | 5280 |
| | | (97.63) | (2.37) | | | (100.00) |
| 21 | Industrial electric apparatus | 2798 | 21 | 3 | 19 | 2819 |
| | | (99.26) | (0.74) | | | (100.00) |
| 22 | Household electric appliances | 1180 | 13 | 6 | 10 | 1193 |
| | | (98.91) | (1.09) | | | (100.00) |
| 23 | Communication equipment and related products | 2086 | 24 | 4 | 23 | 2110 |
| | | (98.86) | (1.14) | | | (100.00) |
| 24 | Electronic data processing machine and electronic equipment | 1386 | 20 | 14 | 17 | 1406 |
| | | (98.58) | (1.42) | | | (100.00) |
| 25 | Electronic communication equipment and related products | 4745 | 80 | 49 | 72 | 4825 |
| | | (98.34) | (1.66) | | | (100.00) |
| 26 | Miscellaneous electrical machinery and supplies | 1411 | 38 | 25 | 35 | 1449 |
| | | (97.38) | (2.62) | | | (100.00) |
| 27 | Motor vehicles | 6247 | 85 | 28 | 76 | 6332 |
| | | (98.66) | (1.34) | | | (100.00) |
| 28 | Miscellaneous transportation equipment | 1529 | 29 | 2 | 29 | 1558 |
| | | (98.14) | (1.86) | | | (100.00) |
| 29 | Precision instruments | 2340 | 55 | 35 | 46 | 2395 |
| | | (97.70) | (2.30) | | | (100.00) |
| 30 | Other manufacturing | 2301 | 37 | 31 | 20 | 2338 |

**Table 3.3.a OLS Estimation Results: Comparison between Foreign-Owned and Domestically-Owned Firms**

| | TFP level | Growth rate of TFP | Capital-labor ratio | R&D-sales ratio (%) | Current profit per worker |
|---|---|---|---|---|---|
| Foreign-ownership dummy | 0.0809 *** | 0.0064 *** | 5.7805 *** | 0.0073 *** | 2.1479 *** |
| (foreign ownership>= | (27.92) | (2.82) | (8.53) | (8.44) | (15.40) |
| _cons | -0.0525 *** | 0.0024 *** | 8.5550 *** | 0.0037 *** | 0.6392 *** |
| | (-21.33) | (2.99) | (51.76) | (20.41) | (18.52) |
| Industry dummy | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes |
| Industry dummy*Year dumn | yes | no | no | no | no |
| No. of observations | 93880 | 70332 | 93880 | 93880 | 93880 |

| | Current profit-sales ratio (%) | Growth rate of real assets | Wage level (million yen per | Growth rate of workers | Labor productivity (million | Growth rate of real sales |
|---|---|---|---|---|---|---|
| Foreign-ownership dummy | 0.0244 *** | -0.0090 | 1.3031 *** | -0.0061 | 25.17698 *** | 0.0089 |
| (foreign ownership>= | (11.78) | (-1.01) | (25.39) | (-1.21) | (11.41) | (1.32) |
| _cons | 0.0168 *** | 0.0478 *** | 3.4702 *** | -0.0042 ** | 31.8494 *** | 0.0379 *** |
| | (20.04) | (12.79) | (178.77) | (-2.11) | (72.08) | (17.49) |
| Industry dummy | yes | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes | yes |
| No. of observations | 93880 | 70332 | 93880 | 70332 | 93880 | 70332 |

Notes) 1.Pooled data for 1994-2000 are used.
2. The figures in parentheses are z-statistics.
3.*P=.10, **P=.05, ***P=0.1 (two-tailed test).

**Table 3.2b OLS Estimation Results: Comparison between Foreign-Owned and Domestically-Owned Firms**

| | TFP level | Growth rate of TFP | Capital-labor ratio | R&D-sales ratio (%) | Current profit per worker |
|---|---|---|---|---|---|
| Foreign-ownership dummy (majority-owned by one foreign firm) | 0.0773 *** | 0.0037 | 2.7577 *** | 0.0065 *** | 1.4956 *** |
| | (18.35) | (1.09) | (4.00) | (5.80) | (9.79) |
| _cons | -0.0524 *** | 0.0025 *** | 8.5831 *** | 0.0038 *** | 0.6475 *** |
| | (-21.29) | (3.03) | (51.93) | (20.53) | (18.76) |
| Industry dummy | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes |
| Industry dummy*Year dummy | yes | no | no | no | no |
| No. of observations | 93880 | 70332 | 93880 | 93880 | 93880 |

| | Current profit-sales ratio (%) | Growth rate of real assets | Wage level (million yen per worker) | Growth rate of workers | Labor productivity (million yen per | Growth rate of real sales |
|---|---|---|---|---|---|---|
| Foreign-ownership dummy (majority-owned by one foreign firm) | 0.0192 *** | -0.0230 ** | 1.2754 *** | 0.0003 | 16.2696 *** | 0.0121 |
| | (6.36) | (-2.00) | (18.52) | (0.03) | (7.91) | (1.17) |
| _cons | 0.0169 *** | 0.0477511 *** | 3.4736 *** | -0.0042 ** | 31.9526 *** | 0.0379 *** |
| | (20.13) | (12.79) | (178.78) | (-2.13) | (73.06) | (17.51) |
| Industry dummy | yes | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes | yes |
| No. of observations | 93880 | 70332 | 93880 | 70332 | 93880 | 70332 |

Notes) 1.Pooled data for 1994-2000 are used.
2. The figures in parentheses are z-statistics.
3.*P=.10, **P=.05, ***P=0.1 (two-tailed test).

Table 3.4 Descriptive Statistics of the Main Variables Used in the Regression Analysis

| Variable | Number of observations | Average | Standard deviation | Minimum value | Maximum value |
|---|---|---|---|---|---|
| TFP level | 93880 | -0.0216 | 0.1022 | -0.4905 | 0.5076 |
| Growth rate of TFP | 70332 | 0.0058 | 0.0634 | -0.5430 | 0.6132 |
| R&D investment-sales ratio | 93880 | 0.0086 | 0.0202 | 0.0000 | 1.6391 |
| No. of years passed since established | 93880 | 36.6372 | 15.0046 | 0.0000 | 110.0000 |
| (No. of years passed since established)^2 | 93880 | 1567.42 | 1159.86 | 0.0000 | 12100.00 |
| Outsourcing ratio | 93880 | 0.1071 | 0.1496 | 0.0000 | 9.8890 |
| ln(Sales) | 93880 | 8.4190 | 1.2958 | 4.8255 | 16.0220 |
| (ln(Sales))^2 | 93880 | 72.5595 | 23.7767 | 23.2855 | 256.7040 |
| Share of non-production workers in total workers | 93880 | 0.3315 | 0.2492 | 0.0000 | 1.0000 |

**Table 3.4 Estimation Results: Determinants of TFP Level and TFP Growth Rate**
**Table 3.4 Panel A. Dependent variable: TFP level**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Foreign-ownership dummy (foreign ownership >=33.4%) | 0.0521 *** (18.43) | 0.0488 *** (17.26) | | | 0.0031 (0.96) | 0.0031 (0.96) | | |
| Foreign-ownership dummy (majority-owned by one foreign | | | 0.0480 *** (11.73) | 0.0426 *** (10.47) | | | -0.0038 (-0.76) | -0.0038 (-0.76) |
| Ratio of non-production workers | | 0.0377 *** (29.79) | | 0.0379 *** (29.88) | | 0.0003 (0.24) | | 0.0003 (0.24) |
| R&D investment-sales ratio | 0.2067 *** (7.02) | 0.1518 *** (5.96) | 0.2107 *** (7.07) | 0.1556 *** (6.04) | -0.1208 *** (-7.69) | -0.1208 *** (-7.70) | -0.1207 *** (-7.69) | -0.1207 (-7.69) |
| No. of years passed since established | -0.0007 *** (-9.43) | -0.0008 *** (-10.45) | -0.0007 *** (-9.30) | -0.0007 *** (-10.34) | 0.0004 *** (3.44) | 0.0004 *** (3.44) | 0.0004 *** (3.45) | 0.0004 (3.45) |
| (No. of years passed since established)^2 | 0.0000 *** (5.82) | 0.0000 *** (6.37) | 0.0000 *** (5.46) | 0.0000 *** (6.04) | 0.0000 ** (-2.11) | 0.0000 ** (-2.11) | 0.0000 ** (-2.12) | 0.0000 (-2.12) |
| Outsourcing ratio | 0.0087 *** (4.14) | 0.0064 *** (3.14) | 0.0083 *** (3.96) | 0.0060 *** (2.96) | -0.0030 (-1.58) | -0.0030 (1.58) | -0.0030 (-1.58) | -0.0030 (-1.58) |
| ln(Sales) | 0.1339 *** (66.71) | 0.1282 *** (63.96) | 0.1330 *** (66.45) | 0.1273 *** (63.71) | 0.2418 *** (35.21) | 0.2418 *** (35.20) | 0.2417 *** (35.20) | 0.2417 (35.19) |
| (ln(Sales))^2 | -0.0056 *** (-51.26) | -0.0053 *** (-49.00) | -0.0055 *** (-50.86) | -0.0053 *** (-48.62) | -0.0073 *** (-18.20) | -0.0073 *** (-18.20) | -0.0073 *** (-18.19) | -0.0073 (-18.19) |
| Constant | -0.7592 *** (-80.81) | -0.7419 *** (-79.25) | -0.7561 *** (-80.65) | -0.7390 *** (-79.10) | -1.5198 *** (-50.53) | -1.5199 *** (-50.53) | -1.5195 *** (-50.52) | -1.5196 (-50.52) |
| Industry dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Industry dummy*Year dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Firm dummy | no | no | no | no | yes | yes | yes | yes |
| Number of observations | 93880 | 93880 | 93880 | 93880 | 93880 | 93880 | 93880 | 93880 |
| Number of groups | - | - | - | - | 19652 | 19652 | 19652 | 19652 |

Notes) 1.The figures in parentheses are z-statistics.
2.*P=.10, **P=.05, ***P=0.1 (two-tailed test).

**Table 3.4 Estimation Results: Determinants of TFP Level and TFP Growth Rate**
**Table 3.4 Panel B. Dependent variable: TFP level**

| | | | | | |
|---|---|---|---|---|---|
| US firm dummy | 0.0538 *** | -0.0106 | Foreign-ownership dummy (0.1=<FO<0.334) | 0.0258 *** | 0.0036 |
| | (8.82) | (-1.49) | | (8.25) | (1.36) |
| European firm dummy | 0.0470 *** | 0.0002 | Foreign-ownership dummy (0.334=<FO<0.5) | 0.0496 *** | 0.0034 |
| | (7.84) | (0.03) | | (8.03) | (0.52) |
| Other country dummy | 0.0144 | 0.0027 | Foreign-ownership dummy (0.5=<FO) | 0.0537 *** | 0.0035 |
| | (1.33) | (0.24) | | (17.05) | (0.98) |
| R&D investment-sales ratio | 0.2103 *** | -0.1205 *** | R&D investment-sales ratio | 0.1995 *** | -0.1211 *** |
| | (7.06) | (-7.68) | | (6.88) | (-7.71) |
| No. of years passed since established | -0.0007 *** | 0.0004 *** | No. of years passed since established | -0.0007 *** | 0.0004 *** |
| | (-9.28) | (3.44) | | (-9.29) | (3.49) |
| (No. of years passed since established)^2 | 0.0000 *** | 0.0000 ** | (No. of years passed since established)^2 | 0.0000 *** | 0.0000 ** |
| | (5.44) | (-2.11) | | (5.64) | (-2.19) |
| Outsourcing ratio | 0.0083 *** | -0.0030 *** | Outsourcing ratio | 0.0087 ** | -0.0030 |
| | (3.98) | (-1.59) | | (4.14) | (-1.57) |
| ln(Sales) | 0.1330 *** | 0.2418 *** | ln(Sales) | 0.1366 *** | 0.2420 *** |
| | (66.46) | (35.21) | | (67.66) | (35.21) |
| (ln(Sales))^2 | -0.0055 *** | -0.0073 *** | (ln(Sales))^2 | -0.0057 *** | -0.0074 *** |
| | (-50.86) | (-18.21) | | (-52.42) | (-18.23) |
| Constant | -0.7560 *** | -1.5199 *** | Constant | -0.7701 *** | -1.5208 *** |
| | (-80.66) | (-50.53) | | (-81.61) | (-50.52) |
| Industry dummy | yes | yes | Industry dummy | yes | yes |
| Year dummy | yes | yes | Year dummy | yes | yes |
| Firm dummy | no | yes | Firm dummy | no | yes |
| Industry dummy*Year dummy | yes | yes | Industry dummy*Year dummy | yes | yes |
| Number of observations | 93880 | 93880 | Number of observations | 93880 | 63584 |
| Number of groups | - | 19652 | Number of groups | - | 93880 |

Notes) 1.The figures in parentheses are z-statistics.
2.*P=.10, **P=.05, ***P=0.1 (two-tailed test).

**Table 3.4 Estimation Results: Determinants of TFP Level and TFP Growth Rate**
**Table 3.4 Panel C. Dependent variable: growth rate of TFP**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| lagged TFP level | -0.2825 *** | -0.2800 *** | -0.2817 *** | -0.2792 *** | -0.8325 *** | -0.8324 *** | -0.8325 *** | -0.8324 |
| | (-86.69) | (-86.62) | (-86.60) | (-86.52) | (-223.08) | (-222.94) | (-223.08) | (-222.94) |
| Foreign-ownership dummy | 0.0173 *** | 0.0180 *** | | | 0.0027 | 0.0026 | | |
| (foreign ownership >=33.4%) | (8.10) | (8.40) | | | (0.71) | (0.70) | | |
| Foreign-ownership dummy | | | 0.0145 *** | 0.0155 *** | | | -0.0072 | -0.0076 |
| (majority-owned by one foreign | | | (4.56) | (4.92) | | | (-1.15) | (-1.21) |
| Ratio of non-production workers | 0.0073 *** | | 0.0074 *** | | 0.0021 | | 0.0021 | |
| | (7.52) | | (7.58) | | (1.37) | | (1.36) | |
| R&D investment-sales ratio | 0.0224 * | | 0.0234 * | | -0.1278 *** | | -0.1276 *** | |
| | (1.74) | | (1.81) | | (-7.38) | | (-7.37) | |
| No. of years passed since | -0.0004 *** | -0.0004 *** | -0.0004 *** | -0.0004 *** | 0.0006 *** | 0.0006 *** | 0.0006 *** | 0.0006 |
| established | (-7.24) | (-6.88) | (-7.24) | (-6.88) | (4.71) | (4.72) | (4.72) | (4.72) |
| (No. of years passed since | 0.0000 *** | 0.0000 *** | 0.0000 *** | 0.0000 *** | 0.0000 *** | 0.0000 *** | 0.0000 *** | 0.0000 |
| established)^2 | (4.69) | (4.49) | (4.57) | (4.37) | (-3.08) | (-3.06) | (-3.09) | (-3.07) |
| Outsourcing ratio | -0.0005 | -0.0001 | -0.0006 | -0.0002 | -0.0076 *** | -0.0079 *** | -0.0076 *** | -0.0079 |
| | (-0.31) | (-0.06) | (-0.41) | (-0.17) | (-3.36) | (-3.46) | (-3.36) | (-3.46) |
| ln(Sales) | 0.0425 *** | 0.0431 *** | 0.0421 *** | 0.0426 *** | 0.2369 *** | 0.2361 *** | 0.2369 *** | 0.2361 |
| | (28.14) | (28.57) | (27.92) | (28.34) | (29.16) | (29.05) | (29.16) | (29.06) |
| (ln(Sales))^2 | -0.0017 *** | -0.0018 *** | -0.0017 *** | -0.0017 *** | -0.0063 *** | -0.0063 *** | -0.0063 *** | -0.0063 |
| | (-22.10) | (-22.46) | (-21.82) | (-22.16) | (-13.40) | (-13.26) | (-13.40) | (-13.26) |
| Constant | -0.2268 *** | -0.2282 *** | -0.2250 *** | -0.2263 *** | -1.5209 *** | -1.5192 *** | -1.5209 *** | -1.5192 |
| | (-31.36) | (-31.56) | (-31.16) | (-31.34) | (-42.13) | (-42.06) | (-42.13) | (-42.06) |
| Industry dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Year dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Firm dummy | no | no | no | no | yes | yes | yes | yes |
| Number of observations | 70332 | 70332 | 70332 | 70332 | 70332 | 70332 | 70332 | 70332 |
| Number of groups | - | - | - | - | 16471 | 16471 | 16471 | 16471 |

Notes) 1.The figures in parentheses are z-statistics.
2.*P=.10, **P=.05, ***P=0.1 (two-tailed test).

**Table 3.4 Estimation Results: Determinants of TFP Level and TFP Growth Rate**
**Table 3.4 Panel D. Dependent variable: growth rate of TFP**

| | | | | | |
|---|---|---|---|---|---|
| lagged TFP level | -0.2796 *** | -0.8325 *** | lagged TFP level | -0.2806 *** | -0.8325 *** |
| | (-86.53) | (-223.07) | | (-86.68) | (-223.08) |
| US dummy | 0.0183 ** | -0.0043 | Foreign-ownership dummy (0.1=<FO<0.334) | 0.0089 *** | 0.0046 * |
| | (3.93) | (-0.49) | | (4.05) | (1.66) |
| European firm dummy | 0.0147 *** | -0.0097 | Foreign-ownership dummy (0.334=<FO<0.5) | 0.0173 *** | 0.0073 |
| | (3.21) | (-1.12) | | (4.03) | (1.05) |
| Other country dummy | -0.0003 | -0.0081 | Foreign-ownership dummy (0.5=<FO) | 0.0184 *** | 0.0019 |
| | (-0.03) | (-0.52) | | (7.60) | (0.45) |
| R&D investment-sales ratio | 0.0335 ** | -0.1275 *** | R&D investment-sales ratio | 0.0297 ** | -0.1281 *** |
| | (2.54) | (-7.36) | | (2.27) | (7.40) |
| No. of years passed since established | -0.0004 *** | 0.0006 *** | No. of years passed since established | -0.0004 *** | 0.0006 *** |
| | (-6.92) | (4.73) | | (-6.87) | (4.78) |
| (No. of years passed since established)^2 | 0.0000 *** | 0.0000 *** | (No. of years passed since established)^2 | 0.0000 | 0.0000 *** |
| | (4.37) | (-3.09) | | (4.42) | (3.19) |
| Outsourcing ratio | -0.0003 | -0.0077 *** | Outsourcing ratio | -0.0001 | -0.0076 *** |
| | (-0.17) | (-3.38) | | (-0.07) | (-3.35) |
| ln(Sales) | 0.0429 *** | 0.2370 *** | ln(Sales) | 0.0444 *** | 0.2374 *** |
| | (28.41) | (29.17) | | (28.78) | (29.20) |
| (ln(Sales))^2 | -0.0017 *** | -0.0063 *** | (ln(Sales))^2 | -0.0018 *** | -0.0064 *** |
| | (-22.27) | (-13.41) | | (-22.83) | (-13.47) |
| Constant | -0.2271 *** | -1.521 *** | Constant | -0.2332 *** | -1.5223 *** |
| | (-31.40) | (-42.11) | | (-31.72) | (-42.14) |
| Industry dummy | yes | yes | Industry dummy | yes | yes |
| Year dummy | yes | yes | Year dummy | yes | yes |
| Firm dummy | no | yes | Firm dummy | no | yes |
| Number of observations | 70332 | 70332 | Number of observations | 70332 | 70332 |
| Number of groups | - | 16471 | Number of groups | - | 16471 |

Notes) 1.The figures in parentheses are z-statistics.
2.*P=.10, **P=.05, ***P=0.1 (two-tailed test).