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Abstract

Following Bernard, Redding and Schott (2010), we have constructed product and firm level data on Japanese manufacturing firms using the *Census of Manufactures*. Employing this data, we have found that multiple-product firms show better performance than single-product firms and product switching behavior in incumbent firms leads to greater output growth in the Japanese manufacturing sector, more so than in entry and exit. Empirical studies at industry level show that an unregulated, competitive environment stimulates product switching. At firm level, labor productivity growth and an unregulated, competitive environment encourage product switching behavior. Such product switching behavior improves firm performance in the areas of output, employment and labor productivity, etc.

Keywords: Entry, Exit, Multiple-Product firm, Product switching, Labor productivity, TFP

JEL Classification Numbers: L11, L21, L25, L60

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1. Introduction

A number of papers written on firm dynamics have focused on the effects of entry and exit behavior on productivity growth at the firm and industry levels.[†] Nishimura, Kiyota, and Nakajima (2005), and Fukao and Kwon (2006) examined the effects of entry and exit behavior on productivity growth at both the firm and industry levels in Japan. However, they found that the major factor affecting productivity growth at the industry level was not the entry or exit effect, but the within effect. Furthermore, the entry and exit rates in Japan were lower than those in other developed countries.

From the above empirical results, we would expect that the Japanese economy might have higher productivity growth as incumbent firms make changes to their product composition. For example, Toray Co.'s main products are now chemical products, while its main products thirty years ago were textile products. The main product for Canon Co. is now office machinery, while its main products thirty years ago were cameras.

Bernard, Redding and Scott (2003, 2006, 2010, hereafter we refer to as BRS) called the change in product composition within a firm 'product switching'.[‡] They examined how product switching in U.S. firms affected the firm performance using the U.S. Manufacturing Censuses from 1987 to 1997. Following their studies, we construct a product–firm level database from *the Census of Manufactures* in Japan and examine the effect of product switching, industry switching and sector switching on firm performance.

Our paper is constructed as follows. In the next section, we provide an overview of firm dynamics literature that led to the study on product switching. In the third section, we define the terms 'sector', 'industry', and 'product', and explain how we construct the product-firm level data from *the Census of Manufactures* in Japan. In the fourth section, we compare the performances between multiple-product firms and single-product firms and describe product switching behavior in Japanese manufacturing firms from 1998 to 2005. In the fifth section, we examine why firms switch products and how product switching affects firm performance. In the last section, we summarize our study and discuss topics that remain to be explored.

[†] In line with this field of research, Jovanovic (1982) and Hopenhayn (1992) developed the theoretical foundations behind this study. For empirical works, see Baily,, Hulten and Campbell (1992), Dunne, Roberts and Samuelson (1989a,b) and Foster Haltiwanger and Krizan (2006).

[‡] BRS (2003, 2006, 2010) called the change in product composition within an industry 'product switching'. When a firm starts to make a product that is categorized in a different industry from the original industry to which the firm belongs, they called this 'industry switching'. 'Sector switching' is an analogous concept to 'industry switching'.

2. An overview of the related literature

Theoretical models incorporating the entry and exit behaviors of firms were developed by Jovanovic (1982) and Hopenhayn (1992). Melitz (2003) examined entry and exit behavior under monopolistic competition and applied his model to international trade. However, these previous models assumed that changes in product variety were associated with firm entry and exit and did not consider product changes in surviving firms.

BRS (2003) developed a model that incorporates not only entry and exit behavior but also product switching behavior. They extended Melitz's model into a two-sector model. Both goods are differentiated in each sector and consumed by a representative household. Fixed costs between the two sectors are different. In Melitz (2003), entry and exit behavior was determined by the zero profit cutoff and free entry conditions. In BRS (2003), product switching behavior was also determined by the product indifference cutoff condition as well as these two conditions.

However, the model developed by BRS (2003) can explain product switching behavior, but cannot explain why some firms produce multiple products. Afterwards, they provided a model incorporating firms that produce multiple-products as well as entry, exit, and product switching, in BRS (2010). In BRS (2010), shocks in consumer tastes determine the product composition of a firm that selects products among a continuum of products $i \in [0,1]$. Productivity shocks that are common to all products increase the range of products in a firm.

On the empirical side, studies on industry switching started in the 2000s. In Swedish manufacturing firms, Greenaway, Gullstrand and Kneller (2008) found that the probability of firm exits caused by switching industries is higher in industries with known comparative disadvantages. Chan and Chen (2005) and Newman, Rand and Trap (2007) also examined industry switching behavior in manufacturing firms in Taiwan and Vietnam respectively. In contrast to the above studies which focused on industry switching, BRS (2003, 2006, 2010) studied product switching within a industry. Using the U.S. Manufacturing Censuses from 1987 to 1997, they examined how their theoretical model can explain product composition and product switching in U.S. manufacturing firms.

As for the related studies to product switching, Shimizu and Miyagawa (2003) studied the diversification of Japanese firms using Input-Output Tables. Broda and Weinstein (2007) studied product differentiation by using price data read by scanners. Sakai and Watanabe (2009)

examined product differentiation in Japan by using price data found on-line.

3. Construction of product and firm level database in the Japanese manufacturing sector

We use *the Census of Manufactures* conducted by the Ministry of Economy, Trade, and Industry (METI) to examine product switching behavior in the Japanese manufacturing industry.[§] The Japanese government publishes the survey results of *the Census of Manufacture* in the following five types of compilation; "industry", "product", "city, town and village", "industrial site and water", and "enterprise". Enterprise-level data has been reported since 1997. In the first stage, we construct product-establishment level data by using establishment identity codes. In the second stage, we integrate product-establishment data into product-firm level data by using the address, telephone number, and names of firms.

The Census of Manufactures is conducted annually, but it only covers all Japanese manufacturing establishments in the years that end in 0, 3, 5, or 8. Although the survey has been conducted since 1909, we can integrate establishment level data into firm level data from only the 1998 survey. Consequently, our study focuses on product switching behavior based on the 1998, 2000, 2003, and 2005 surveys. The data in 2005 covers 498,923 establishments and valid responses to the questionnaires were received from 468,841 establishments (a response rate of 94.2%).

The Census of Manufactures consists of three types of surveys by size of establishment; Form A ("Kou Hyou" in Japanese) is for establishments with 30 or more employees, Form B ("Otsu Hyou" in Japanese) is for those with 4 to 29 employees, and Form C ("Hei Hyou" in Japanese) is for those fewer than 4 employees. For our study, we used the surveys of the first two forms.[**] 276,686 establishments responded to the survey in the year 2005, accounting for 55.5% of all Japanese manufacturing establishments.

The Census of Manufactures contains data on the number of employees, raw material costs, fuel and electricity costs, value of shipments of manufactured goods and tangible fixed assets. Using this data, we measure multilateral TFP (total factor productivity) as suggested by

[§] In our study, we examined product-switching using not only *the Census of Manufactures* but also *the Basic Survey of Japanese Business Structure and Activities* which covers enterprises with 50 or more employees. However, we do not show the results obtained from *the Basic Survey of Japanese Business Structure and Activities*, because the coverage in *the Census of Manufactures* is larger than *the Basic Survey of Japanese Business Structure and Activities*, and we cannot get data of products in the six-digit level from *the Basic Survey of Japanese Business Structure and Activities*.

[**] Because we are not allowed to use Form C, it remains to be a problem that firms that employ over 4 but reduces employees to fewer than 4 in periods between t-1 and t are counted as an "exit firm", and vice versa with entry.

Caves, Christensen and Diewert (1982) and expanded by Good, Nadiri and Sickeles (1983), using capital intensity, labor productivity and PCM (price cost margins) at the establishment level.[††] Because product switching decisions are made not at the establishment but at the firm level, we aggregate establishment-level TFP, capital intensity, labor productivity and PCM into a firm-level measure using the weight of the shipment value at the establishment level. We measure the TFP and capital intensity in firms with more than 10 employees, because *the Census of Manufactures* does not show capital data in firms with fewer than 10 employees.

BRS (2006, 2010) referred to two digit SIC categories as sectors, four-digit SIC categories as industries, and five-digit SIC categories as products. Following their example, we define two digit JSIC categories as sectors, four-digit JSIC categories as industries, and six-digit JSIC categories as products using *the Census of Manufactures*.[‡‡] Table 1 shows an example of sectors, industries, and products in *the Census of Manufacturers* in Japan according to BRS (2006).

(Place Table 1 around here)

Table 2 shows the share of products in an industry and product characteristics by sector. We find the Japanese distribution of products to be similar to the US. There are many kinds of products in the food, the chemical products, the general machinery, and the electric machinery sectors. As seen in the US, we find the highest capital intensity in the coal and petroleum products sector.

(Place Table 2 around here)

4. Product switching in Japanese manufacturing firms

We outline the concepts of product switching in multiple product firms in Figure 1. Figure 1 has the definition of entry and exit behavior and product switching in our data. Firm entry and firm exit in traditional firm dynamics are defined as follows in our data, “Firm exit”

[††] The detailed calculation process is explained in Appendix A.

[‡‡] Industry classification in the Census of Manufactures follows Japan Standard Industry Classification (JSIC) in the case of 2-digit and 4-digit levels. JSIC which was started from 1949 is revised every five years. Every version of JSIC is adjusted to adhere to the International Standard Industry Classification (ISIC). However, in the case of the 6-digit classification, the Census of Manufacturers adopts its own classification. The Appendix table compares the similarities and differences between JSIC and ISIC.

denotes a firm which exists at year t and no longer exists in year $t+j$[§§], and a firm that does not exist at year t and enters the market by year $t+j$ is defined as a "firm entry". Meanwhile, a product that a firm doesn't produce at year t and starts to produce by year $t+j$ is defined as a "product add", and a product that a firm produces at year t but stops producing by year t+j is called as "product drop".

(Place Figure 1 around here)

4.1 Multiple-product firms vs. single-product firms

Following BRS (2006), we describe product switching behavior in Japanese manufacturing firms from 1998 to 2005. Table 3 shows the prevalence of firms producing multiple products, and being active in multiple industries and sectors. We find that the share of single product firms in total firms in Japan is 60%, which is similar to the corresponding share in the U.S. (59%). Likewise, the share of firms producing multiple products in multiple sectors is 13% which is same to the corresponding share in the U.S. (13%). Though the share of real output[***] in single product firms in the entire sample is 9% in the U.S., the corresponding share is 22% in Japan. The mean number of products in multiple-product firms in Japan is 2.8, while the corresponding number is 4 in the U.S. In the IT sector and the exporting sector, the shares of multiple-product firms are greater than that in the total manufacturing sector.[†††] As the number of products in these sectors is greater than that in the total manufacturing sector, products in these sectors are more diversified than those in other sectors.

(Place Table 3 around here)

In Table 4, we examine the output, employment, wages and labor productivity between single-product and multi-product firms. We find that the output of multiple-product firms is 0.49 log points higher than that of single-product firms. Employment in multiple-product firms is also 0.28 log points higher than that of single-product firms. In the

[§§] In empirical analysis using the Census of Manufactures, the interval of t and $t+j$ is inconsistent and this interval is two or three years because survey years are 1998, 2000, 2003 and 2005.

[***] The real output is deflated by Japanese deflated by output price in the Japanese Industrial Productivity database. Detailed calculation process is explained in Appendix A.

[†††] The share of exports in the export sector is 63% in the total economy.

U.S, the output of multiple-product firms is 0.66 log points higher than that of single product firms and employment in multiple-product firms is also 0.58 log points higher than that of single-product firms. Moreover, labor productivity in multiple-product firms is 0.20 log points higher than that of single-product firms in Japan, while labor productivity in multiple-product firms is only 0.08 log points higher than that of single-product firms in the U.S.

(Place Table 4 around here)

4.2 Product switching in the Japanese manufacturing firms

We examine product switching behavior of the Japanese manufacturing firms in Table 5. We find that the share of firms that did not change the composition of their products in Japan was 67% in the period from 1998 to 2003. The share is greater than that in the U.S. (32%).[###] In the case of the output share of firms that did not change their product mix in Japan, this is also greater than the share in the U.S. These results imply that Japanese manufacturing firms are more conservative than U.S. firms. In the case of industry switching and sector switching, we also find that the U.S. firms switch products more aggressively than Japanese firms.

(Place Table 5 around here)

We break down the total output growth in the manufacturing sector from 1998 to 2005 into three factors; the firm's entry and exit effects, its extensive, and its intensive margins (Table 6). Among these three factors, the firm's extensive margins by product switching is the major factor in total output growth. The net effects of the firm's entry and exit on total output growth are negative. We divide our study period into three sub-periods; from 1998 to 2000, from 2000 to 2003, and the period from 2003 to 2005. In the first period, the Japanese economy had recovered from the financial crisis, but financial institutions in Japan still held huge non-performing loans. In the second period, the Japanese economy suffered from a recession resulting from the burst of IT bubble in the U.S. In the last period, the Japanese economy

[###] The comparison was not accurate because the period when we measured product switching is different between Japan and the U.S. In BRS (2010), the share of firms that did not change their composition of products in the U.S. in the from 1987 to 1997 was 46%

recovered again due to increased exports. In the first two periods, entry and exit behavior and product switching in the Japanese manufacturing firms were more active than in the last period. This implies that Japanese firms searched for their optimal product compositions through the restructuring periods. After 2003, they tried to maintain their product mix.

(Place Table 6 around here)

5. Determinants of product switching and its effects on firm performance

In this section, we examine why firms switch products and how product switching affects firm performance. At first, we estimate the following equation to examine product switching behavior at the industry level.

$$PSrate_{t+j,m} = const. + \alpha_1 \Delta REG_{t,m} + \alpha_2 PCM_{t,m} + \alpha_3 \Delta y_{t,m} + \alpha_4 \ln(K_{t,m} / L_{t,m}) + u_{t+1,m} \quad (1)$$

In Equation (1), $PSrate_{t+j,m}$ denotes the product adding rate, entry rate, product dropping rate or exit rate in industry *m* during the period from *t* to *t*+*j*. The product adding and entry rates are the number of firms evaluated at *t*+*j* and the product dropping and exit rates are the number of firms evaluated at *t*. $\Delta REG_{t,m}$ denotes the change in regulatory measures by industry as compiled by the Cabinet Office, Government of Japan from t to *t*+*j*.[§§§] A high value in $REG_{t,m}$ implies that industry *m* is highly regulated.

$PCM_{t,m}$ represents the price cost margin in industry *m* that shows the competitive environment in the industry. As Baldwin and Gorecki (1985) show that firm entries decrease and firm exits increase when the market becomes more competitive, α_2 is positive when the product adding dummy is a dependent variable, and α_2 is negative when the product dropping dummy is a dependent variable.

$\Delta y_{t,m}$ represents the growth rate in gross output in industry m in the sample period.

[§§§] The levels of regulatory measures do not reflect the difference in market regulation by industry, because the indicator is normalized to 1 in 1995. Hence, we take the change in regulatory measures as an independent variable. The detailed calculation process is explained in Appendix B.

Capital intensity ($\ln(\frac{K_{t,i}}{L_{t.i}})$) shows fixed costs when a firm enters a market or switches products. In BRS (2003, 2010), the increase in fixed entry costs makes firm entry difficult and product switching of incumbent firms easy. On the other hand, the increase in fixed switching costs makes product switching in incumbent firms difficult.

Table 7 shows the OLS regression results of Equation (1). The negative and significant signs in the regulatory measure variable in all equations imply that the product adding rate or entry rate decreases in a highly regulated industry. In a non-competitive market environment, it is not only difficult for firms to enter and exit, but also for incumbent firms to switch products. The coefficients of high capital intensity are negative and significant in all product adding, entry and exit rate estimations. These results imply that firms are restrained from product switching due to high fixed entry costs and fixed switching costs.

(Place Table 7 around here)

Next, we examine the determinants of product switching at the firm level to estimate the following equation.

$$(2) \qquad \begin{aligned} PS_{t+j,i} &= const. + \beta_1 PRO_{t,i} + \beta_2 PCM_{t,i} + \beta_3 RSIZE_{t,i} \\ &+ \beta_4 \ln(K_{t,i} / L_{t,i}) + e_{t,i} \end{aligned}$$

In Equation (2), $PS_{t+j,i}$ represents a product switching dummy in firm *i* from *t* (1998, 2001, or 2003) to *t* +*j* (2001, 2003, or 2006). We consider three kinds of dummies: a dummy that shows that firm *i* adds products, a dummy that shows that firm *i* drops products, and a dummy that shows that firms both add and drop products.

$PRO_{t,i}$ represents productivity in firm *i* at *t*. We create two types of productivity measures: TFP and labor productivity. In BRS (2010), productivity improvement increases the range of products that firms can produce. Then, β_1 is positive when a firm adds product. $PCM_{t,i}$ represents the price cost margin in firm *i* that shows the competitive environment of firm *i*.

We estimate Equation (2) with an instrumental variable estimation with sector and year

dummies, because productivity is endogenously determined in BRS (2003, 2010). Estimation results are shown in Table 8. The result in the product adding estimation in the first column shows that labor productivity is positive and significant. This implies that the increase in productivity encourages product adding. In the product dropping estimation in the second column, labor productivity is also a positive and significant factor, which is not consistent with our hypothesis that firms with good performance are aggressive in exiting or product dropping. However, the result is consistent with Nishimura, Kiyota, and Nakajima (2005) and Fukao and Kwon (2006) who argued that relatively high performance firms exited from the market in Japan. As we expected, high capital intensity discourages firm exits or product dropping, because high fixed costs protect incumbent firms.

In both product adding and dropping estimations (Estimations (3) and (5)), positive signs in labor productivity imply that firms with high performance switch products aggressively. However, these estimations may include firm-specific effects over the years. Therefore, we estimate Equation (2) by a fixed effect model in the case of product switching in the fifth and sixth columns. In these estimations, coefficients in labor productivity are still positive and significant. On the other hand, coefficients in TFP are positive but not significant.

Coefficients in price cost margin are negative. These results imply that a competitive market condition stimulates product switching. An alternative interpretation is as follows: Price cost margins are equal to fixed costs under the zero profit condition in the model in BRS (2003, 2010). Therefore, the low price cost margin means low fixed costs that encourage firms to enter the market or add new products.

(Place Table 8 around here)

Finally, we examine the effects of product switching on firm performance by estimating the following equation:

$$(3) \qquad FP_{t,t+j,i} = const. + \gamma_1 PS_{t,t+j,k,i} + \gamma_2 RSIZE_{t,i} + \varepsilon_{t+j,t+j,i}$$

In Equation (3), $FP_{t,t+j,i}$ denotes the change in firm performance of firm *i* from *t* to *t+j*. We choose change in real gross output, number of employees, labor productivity or TFP as a

dependent variable. $PS_{t,t+j,i}$ is the product switching dummy described in Equation (2).

We estimate Equation (3) by an instrumental variable model to avoid simultaneous biases. Estimation results are shown in Table 9. The estimation results from (1) to (4) show that product switching increases output. The estimation results from (5) to (8) show that product switching creates employment. Labor productivity is also enhanced by product switching in the results from (9) to (12). However, the effects of product switching on TFP shown in the results from (13) to (16) are indefinite.[****]

Additionally, we estimate Equation (3) by an instrument variable model with a fixed effect in (17)-(20). The results of these estimations also support the theory that product switching enhances firm performance though not TFP growth.

(Place Table 9 around here)

Our empirical results on product switching are summarized as follows. At the industry level, a competitive market environment stimulates product switching and growth in industry output promotes entry and product adding behavior. At the firm level, an improvement in labor productivity encourages product switching behavior. Although the result that product dropping is active in high productivity firms contradicts our hypothesis, it is consistent with the results of Nishimura, Kiyota, and Nakajima (2005) and Fukao and Kwon (2006). The negative and significant coefficients in such competition measures as price cost margin imply that intense competition encourages product switching. These product switching behaviors improve firm performance such as output, employment and labor productivity. The effect of product switching on TFP growth is indefinite.

6. Concluding remarks

Japanese empirical studies on firm dynamics showed that productivity growth in incumbent firms dominated aggregate productivity growth. Innovative products like the Prius and Walkman were produced by incumbent firms. Therefore, we focus on the product switching in incumbent firms as well as entry and exit. Following BRS (2003, 2006, 2010) who studied product switching in the U.S. manufacturing firms, we construct product-firm level data from

[****] BRS (2010) showed that the effect of net dropping on TFP growth is negative, while the effect of net adding on TFP growth is positive.

the Census of Manufactures. This database covers 1,812 kinds of products produced by 277 thousands establishments from 1998 to 2005.

From our database, we find that the share of multiple-product firms of all manufacturing firms in Japan is similar to that in the U.S. and that multiple-product firms show better performance than single-product firms. Examining product switching behavior as well as exit and entry in Japanese manufacturing firms, we find that output growth from 1998 to 2005 was dominated by product switching behavior in incumbent firms, although the share of firms that did not change their product composition was larger than that in the U.S.

We examine the determinants of product switching at both the industry and firm levels by estimation. The results of industry-level estimation show that competitive market environments stimulate product switching, and growth in industry output promotes entry and product adding behavior. At the firm level, improvements in labor productivity encourage product switching behavior. The positive effects of a competitive market environment on product switching are also observed at firm level.

When we examine the effects of product switching on firm performance, product switching behaviors improve firm performance such as output, employment and labor productivity. The effect of product switching on TFP growth, however, is indefinite.

Our empirical results support the theory that product switching of incumbent firms is a crucial factor to output growth and productivity improvement in the Japanese manufacturing sector. These results imply that policies that stimulate product switching in incumbent firms are helpful for economic or productivity growth in the Japanese economy. For example, more financial support may be needed for firms who want to make a new innovative product or diversify their products. We find that lower entry costs stimulate product switching as well as the entry of new firms. Deregulation is also an effective way to decrease entry costs and to stimulate product switching. If it is difficult to deregulate the market, an alternative way to encourage product switching is to expand the second hand market of capital goods, because it decreases entry costs.[††††]

Our remaining tasks are as follows: First, in our study, we focused on only the domestic market. Table 6 shows that the effects of product switching on output growth in the Japanese manufacturing sector have been decreasing for years. The result suggests that many firms are

[††††] Farinas and Ruano (2005) used the availability of the second hand market in capital goodsas one of indexes of sunk cost. They showed that this index affects firm dynamics of Spanish manufacturing firms.

transferring their production plants abroad. As the plants transferred abroad are recognized to be a plant that has exited from the market, we should distinguish the plants which have been moved abroad from plants that are simply exiting the market. Second, due to the limited availability of data, we focused on the manufacturing sector. However, as Morikawa (2007) pointed out, firm dynamics in the service sector may be more important than in the manufacturing sector when we consider the low productivity growth in the Japanese economy.[‡‡‡] Thus, we need to apply our work to the Japanese services sector. Third, Toray co. and Canon co. might have succeeded in product switching through huge R&D investments. When we consider the causality from R&D investment to product switching, we may find additional policy implications for encouraging product switching.

[‡‡‡] Morikawa (2007) found that "level" of productivity in the Japanese services sector is not less than the manufacturing sector from firm-level data.

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Appendix A. TFP Construction

To compute establishment-level TFP, we adopt the multilateral index introduced by Caves, Christensen and Diewert (1982) and expanded on by Good, Nadiri and Sickeles (1983). This index compares the productivity between each firm and a representative firm calculated by the industry average. The equation to calculate TFP is below.

$$\begin{aligned}\ln TFP_{k,t} &= (\ln Q_{k,t} - \overline{\ln Q_t}) - \sum_{l=1}^{n} \frac{1}{2}(S_{k,l,t} + \overline{S_{l,t}})(\ln X_{k,l,t} - \overline{\ln X_{l,t}}) \\ &+ \sum_{s=1}^{t}(\overline{\ln Q_s} - \overline{\ln Q_{s-1}}) - \sum_{s=1}^{t}\sum_{l=1}^{n} \frac{1}{2}(\overline{S_{l,s}} + \overline{S_{l,s-1}})(\overline{\ln X_{l,s}} - \overline{\ln X_{l,s-1}})\end{aligned} \tag{A1}$$

$\ln TFP_{k,t}$ is a multilateral index of establishment k at year t. The classification of industry for calculating TFP is the 4-digit classification. We also grouped the establishment into the industry to which the greatest share of its product belongs. $\ln Q_{k,t}$ indicates the natural logarithm of the real gross output of establishment k at year t. The real gross ouput is measured by shipment deflated by output price in the Japanese Industrial Productivity database[§§§§]. $X_{k,t}$ is the natural logarithm of input factors (labor, capital and intermediate input) of establishment k at year t. The overline on the variables indicates the geometric averages of the variables across all establishments in the industry to which establishment k belongs. S_{klt} is firm k's cost share of input factor l in total cost.

Labor is expressed in terms of the number of employee working in the establishment. For capital, we use tangible assets on the Census of Manufactures as a proxy for capital. Because tangible assets are book values, we convert the book values to market values by multiplying it by the ratio of the market to book value, which is constructed from the Development Bank of Japan (DBJ) Database. Intermediate input is calculated as the sum of values of raw materials, fuels and electricity consumed.

We need real wages as labor cost, real intermediates, and the cost of capital for calculating cost share, and so we adopt real wages, as labor cost, by the establishment-level samples from Census of Manufactures. In order to calculate the cost of capital, we use the corporate income tax rate, the government bond rate, the long-term prime rate, the price of capital goods, and the

§§§§ See detailed on the website (http://www.rieti.go.jp/en/database/JIP2008/index.html).

consumption of fixed capital. The cost of capital is defined as follows:

$$c_{jt} = K_{jt} \frac{1-u_t z_t}{1-u_t} P_t \left\{ r_t + i_t + \delta - \frac{\dot{P}_t}{P_t} \right\} \qquad \text{(A2)}$$

c_{jt} is the cost of capital, while u is the effective corporate tax rate from the *Ministry of Finance Statistics Monthly* by Minister of Finance Japan, r is the bond rate from *Economic Statistics Annual* by the Bank of Japan, i is the long-term prime rate and δ is the consumption of fixed capital. z indicates the expected present value of tax savings due to depreciation allowances on one unit of investment.. And we aggregate establishment-level TFP into firm-level TFP by totaling the establishment TFP in their firm using shipment share weights.

Appendix B: Regulation Index

Government regulations may have an important impact on the performance of an industry by affecting the allocation of resources and productive efficiency. In order to assess the impact of regulation on economic performance, we use a regulation index recently created by the Cabinet Office (2006). This regulation index is available for the period 1995 to 2005 and measures the degree of regulation in each industry by using information on the number of regulatory laws and rules pertaining to that industry. For the calculation of the index, laws and regulations are weighted by the extent to which they restrict activity. For example, regulations which completely prohibit particular business activities in an industry receive a weight that is 1,000 times greater than regulations that simply require firms to report to or inform the authorities.

Specifically, the index is calculated as follows:

$$RS_{mt} = \sum_{jk} \left\{ \left(WM_j \times WT_k \right) \times N_{jk}^{mt} \right\} \quad \text{(A3)}$$

where

RS_{it}= the weighted number of laws and rules in industry m (1-97)[*****] in year t (1995-2002);

WM_j= the weight used for each regulation and the method of regulatory enforcement;

there are 5 categories in increments of a factor of 10 representing the extent to which regulations restrict activity: WM_1=1, WM_2=10, WM_3=100, WM_4=1,000 and WM_5=10,000;

WT_k= regulations are also classified into 4 categories, each with its own weight: WT_1= regulations based on ministerial announcements; WT_2= regulations based on ministerial ordinance; WT_3= regulations based on government ordinance; and WT_4= regulations based on law; the weight for each type is 1, 2, 3 and 4, respectively;

N^{mt}_{jk}= the number of regulations in industry I in year t, enforced by method j and type k of regulatory law and rules.

Finally,

$$\text{Reg}_{mt} = (\text{RS}_{mt}/\text{RS}_{m},1995) \quad \text{(A4)}$$

where RI_{mt} =the regulation index in industry m and year, using 1995 as the base year.

[*****] The industrial classification used here is the same as in the JIP 2006 database.

Figure1. Definition of Product Switching

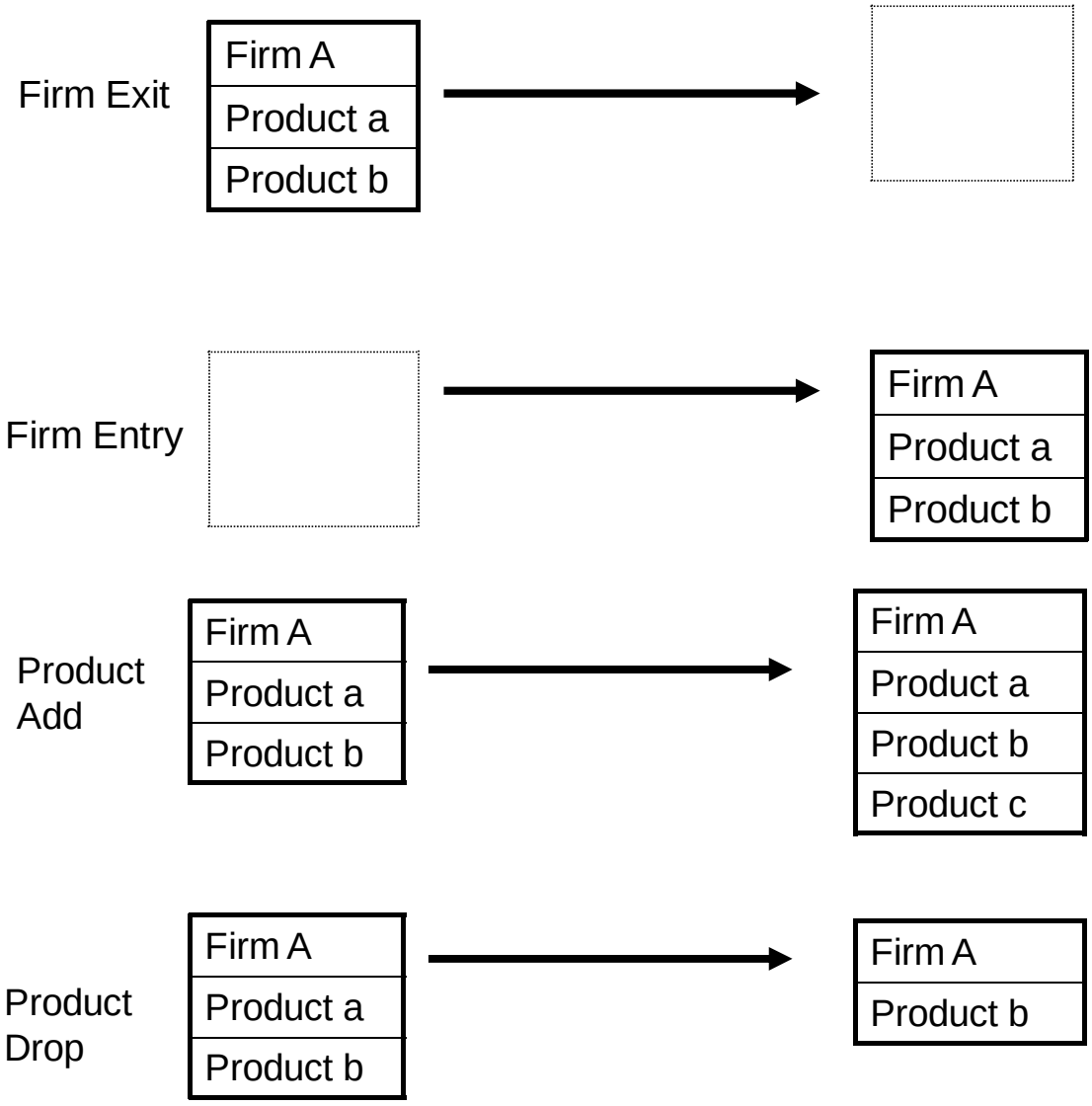

Table 1. Example of Sectors, Industries and Products in *The Census of Manufactures*

Sector		Industry		Product	
2-digit SIC		4-digit SIC		6-digit SIC	
18	Manufacture of Petroleum and Coal Products	1811	Petroleum refining	181111	Gasoline
				181112	Naphtha
				181113	Jet fuel oil
				181114	Kerosene
				181115	Light oil
				181116	Heavy fuel oil A
				181117	Heavy fuel oil B
				181118	Heavy fuel oil C
				181121	Lubricating oil, including grease
				181122	Paraffin
				181123	Asphalt
				181124	Liquefied gas
				181125	Stock oil for refining and mixing
				181126	Petroleum gas
		1821	Lubricating oils	182111	Lubricating oils made of mineral, animal and vegetable oil purchased
		1822	Greases	182211	Greases made of mineral, animal and vegetable oil purchased
		1831	Coke	183111	Coke
				183112	Fuel gases, including blast furnace gas and coke oven gas
				183113	Crude coal tar
				183114	Pitch coke
		1841	Paving materials	184111	Asphalt paving admixture and tar paving admixture, including asphalt block and tar block
		1891	Briquettes and briquette balls	189111	Briquettes and briquette balls
				189911	Recovered sulfur
		1899	Miscellaneous petroleum and coal products	189919	Miscellaneous petroleum and coal products

Note: This classification of goods conforms to The Census of 2005. The Japan Standard Industrial Classifications (4-digit SICs) were revised in 2002 and 6-digit SICs were revised in 2001. We convert the revision in 2002 by using the converter made by METI (http://www.meti.go.jp/statistics/tyo/kougyo/gaiyo/sonota/bunrui/txt/h-cnv14.txt) and convert the revision in 2001 using our own methods.

Table 2. Number of Products per Industry and Product Characteristics by Sector

Sector	Industries	Products	Industries /Products	Goods Shipments (million yen)	Number of Employees	Shipments per Employee (million yen)
09 FOOD	40	95	2.38	22,677,541	1,104,292	20.54
10 BEVERAGES, TOBACCO AND FEED	13	28	2.15	9,665,997	103,010	93.84
11 TEXTILE MILL PRODUCTS, EXCEPT APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS	39	114	2.92	2,231,736	136,425	16.36
12 APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS	32	72	2.25	2,108,709	243,927	8.64
13 LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE	20	37	1.85	2,497,913	126,404	19.76
14 FURNITURE AND FIXTURES	10	21	2.10	2,161,703	129,238	16.73
15 PULP, PAPER AND PAPER PRODUCTS	19	59	3.11	7,089,182	210,460	33.68
16 PRINTING AND ALLIED INDUSTRIES	5	9	1.80	6,945,444	340,890	20.37
17 CHEMICAL AND ALLIED PRODUCTS	40	214	5.35	25,027,125	342,481	73.08
18 PETROLEUM AND COAL PRODUCTS	7	24	3.43	13,429,286	23,824	563.69
19 PLASTIC PRODUCTS, EXCEPT OTHERWISE CLASSIFIED	23	43	1.87	10,905,871	436,897	24.96
20 RUBBER PRODUCTS	13	41	3.15	3,098,894	124,613	24.87
21 LEATHER TANNING, LEATHER PRODUCTS AND FUR SKINS	10	34	3.40	477,770	31,972	14.94
22 CERAMIC, STONE AND CLAY PRODUCTS	49	112	2.29	7,480,109	293,013	25.53
23 IRON AND STEEL	23	65	2.83	16,896,431	213,056	79.31
24 NON-FERROUS METALS AND PRODUCTS	20	56	2.80	6,711,626	132,753	50.56
25 FABRICATED METAL PRODUCTS	31	104	3.35	14,015,901	657,942	21.30
26 GENERAL MACHINERY	47	236	5.02	31,210,883	983,449	31.74
27 ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES	24	114	4.75	18,812,387	559,413	33.63
28 INFORMATION AND COMMUNICATION ELECTRONICS EQUIPMENT	11	52	4.73	11,534,270	205,331	56.17
29 ELECTRONIC PARTS AND DEVICES	9	41	4.56	18,720,153	492,512	38.01
30 TRANSPORTATION EQUIPMENT	16	77	4.81	53,999,911	944,352	57.18
31 PRECISION INSTRUMENTS AND MACHINERY	22	62	2.82	3,784,716	151,188	25.03
32 MISCELLANEOUS MANUFACTURING INDUSTRIES	37	102	2.76	4,316,743	171,922	25.11

Note: We calculate these values using the report by industry of the 2005 Census.

Table 3. Share of Firms Producing Multiple Products, and Activity in Multiple Industries and Sectors

		Percent of Firms				Percent of Real Output				Mean Products, Industries or Sectors per Firm			
		Single-Product	Multiple-Product	Multiple-industry	Multiple-sector	Single-Product	Multiple-Product	Multiple-industry	Multiple-sector	Single-Product	Multiple-Product	Multiple-industry	Multiple-sector
27,28	IT Sector	54.0	46.0	33.2	26.3	13.6	86.4	79.7	68.7	1.0	3.0	3.3	3.4
26-31	Export Sector	54.4	45.6	34.7	24.2	17.5	82.5	74.8	60.0	1.0	2.9	3.2	3.3
9	FOOD	60.3	39.7	27.5	2.4	30.7	69.3	57.6	18.9	1.0	2.7	2.9	3.8
10	BEVERAGES, TOBACCO AND FEED	45.5	54.5	23.1	14.4	11.6	88.4	80.0	55.8	1.0	2.6	3.3	3.4
11	TEXTILE MILL PRODUCTS, EXCEPT APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS	73.7	26.3	13.9	5.2	37.2	62.8	48.0	22.6	1.0	2.5	2.8	3.1
12	APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS	73.3	26.7	16.7	4.2	53.6	46.4	32.1	12.4	1.0	2.6	2.8	3.0
13	LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE	35.0	65.0	34.4	7.8	29.3	70.7	57.1	18.2	1.0	3.5	3.6	3.2
14	FURNITURE AND FIXTURES	56.6	43.4	27.0	12.3	43.0	57.0	44.2	30.6	1.0	2.8	2.8	3.1
15	PULP, PAPER AND PAPER PRODUCTS	59.5	40.5	27.1	9.9	24.7	75.3	69.3	23.1	1.0	2.8	3.0	3.2
16	PRINTING AND ALLIED INDUSTRIES	71.6	28.4	12.0	3.2	49.7	50.3	35.5	26.4	1.0	2.4	2.7	2.9
17	CHEMICAL AND ALLIED PRODUCTS	43.3	56.7	39.7	16.1	19.6	80.4	72.5	42.2	1.0	3.7	4.2	4.8
18	PETROLEUM AND COAL PRODUCTS	67.4	32.6	29.3	24.7	1.7	98.3	98.1	97.6	1.0	3.5	3.6	3.9
19	PLASTIC PRODUCTS, EXCEPT OTHERWISE CLASSIFIED	59.3	40.7	27.0	14.1	30.6	69.4	62.7	46.5	1.0	2.6	2.9	3.1
20	RUBBER PRODUCTS	64.2	35.8	19.4	10.8	18.7	81.3	74.4	64.5	1.0	2.8	3.2	3.4
21	LEATHER TANNING, LEATHER PRODUCTS AND FUR SKINS	76.3	23.7	12.6	5.8	54.3	45.7	30.8	22.9	1.0	2.5	2.8	3.0
22	CERAMIC, STONE AND CLAY PRODUCTS	70.7	29.3	17.5	4.3	40.4	59.6	49.8	30.5	1.0	2.5	2.7	3.3
23	IRON AND STEEL	56.2	43.8	30.0	17.6	11.3	88.7	78.0	60.5	1.0	2.8	3.1	3.4
24	NON-FERROUS METALS AND PRODUCTS	55.2	44.8	34.1	17.9	13.9	86.1	79.2	65.9	1.0	3.0	3.2	3.7
25	FABRICATED METAL PRODUCTS	63.6	36.4	23.7	15.9	40.1	59.9	49.9	42.7	1.0	2.6	2.9	3.0
26	GENERAL MACHINERY	51.8	48.2	36.5	21.2	24.7	75.3	63.9	43.7	1.0	2.9	3.2	3.4
27	ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES	54.8	45.2	30.9	23.7	17.6	82.4	73.1	63.1	1.0	3.0	3.2	3.3
28	INFORMATION AND COMMUNICATION ELECTRONICS EQUIPMENT	49.5	50.5	45.7	40.2	9.1	90.9	87.2	75.2	1.0	3.4	3.5	3.6
29	ELECTRONIC PARTS AND DEVICES	63.9	36.1	30.4	24.5	23.1	76.9	70.3	57.2	1.0	2.8	3.0	3.1
30	TRANSPORTATION EQUIPMENT	57.3	42.7	33.8	30.1	9.5	90.5	84.8	70.5	1.0	2.9	3.1	3.2
31	PRECISION INSTRUMENTS AND MACHINERY	56.5	43.5	32.5	25.0	20.4	79.6	73.2	60.0	1.0	2.9	3.2	3.3
32	MISCELLANEOUS MANUFACTURING INDUSTRIES	65.4	34.6	17.2	13.8	45.0	55.0	43.5	31.6	1.0	2.5	2.8	2.9
Total: Japan (2005)		60.3	39.7	26.0	13.1	22.1	77.9	69.5	51.1	1.0	2.8	3.1	3.3
U.S. (1972-1997)		59.0	41.0	29.0	13.0	9.0	91.0	87.0	76.0	1.0	4.0	3.1	2.5

Note: The results for the U.S.(1972-1997) are from BRS(2006). The columns under "Percent of Firms" and "Percent of Output (Real Value)" show the distribution of firms and output (in our case, the real value of shipments) of single and multiple-product producing firms, and firms active in multiple industries and sectors. The columns under "Mean Products, Industries or Sectors per Firm" shows mean numbers of products of multiple-products firms, industries of multiple-industries firms, and sectors of multiple-sectors firms.

Table 4. Mean Differences of Firm Characteristics between Single and Multiple Product, Industry and Sector

	Multiple product	Multiple industry	Multiple sector
Output	0.490	0.545	0.617
Employment	0.282	0.349	0.403
Wage	0.345	0.406	0.460
Labor Productivity	0.197	0.178	0.190

Note: We calculate mean percentage differences of firm characteristics in 2005 between single and multiple product, industry and sector by using a fixed effect model whose fixed effect is at the industry level. The values of output and wage are real. All differences are significally significant at the 1% level.

Table 5. Product Switching between Single-and Multiple-Product Firms in Japan

		Japan			U.S.		
		All Firms	Single-Product Firms	Multiple-Product Firms	All Firms	Single-Product Firms	Multiple-Product Firms
Percent of Firms (%)	None	67	79	49	32	46	11
	Add Product(s) Only	7	7	7	11	13	8
	Drop Product(s) Only	7	n.a.	17	12	n.a.	30
	Both Add and Drop Products	19	14	28	45	41	50
Percent of Firms (%) weighted by Shipment Value	None	54	82	37	7	49	3
	Add Product(s) Only	13	9	15	5	20	3
	Drop Product(s) Only	9	n.a.	14	7	n.a.	8
	Both Add and Drop Products	25	9	34	81	31	86

Note: Japanese values are the aggregated surviving firms' product switching calculated between 1998 and 2003. U.S values are from BRS (2006) and aggregated surviving firms' switching profiles between t and t+5 from 1972 to 1997.

Table 6. Breakdown of Total Shipment Growth

		Extensive Margins			Firm Entry and Exit			Intensive Margins
	Aggregate Growth	Net	Added Products	Dropped Products	Net	Firm Entry	Firm Exit	Net
(billion yen)								
1998–2000	7.3	15.9	53.8	37.8	9.9	42.0	32.1	−18.5
2000–2003	−13.8	19.1	48.2	29.1	−10.6	40.8	51.4	−22.2
2003–2005	5.8	13.0	26.4	13.4	−19.4	27.2	46.6	12.2
(%)								
1998–2000	100	218.7	737.6	518.9	135.3	575.4	440.2	−254.0
2000–2003	100	138.4	349.3	211.0	−77.1	295.7	372.7	−161.3
2003–2005	100	223.5	452.9	229.3	−333.5	465.9	799.4	210.0

Note: The table shows the breakdown of the change in total shipment in Japanese manufacturing into extensive margins, intensive margins and firm entry and exit. Extensive margins indicate the sum of change by product adding, less the change by product dropping in each firm. Extensive (Intensive?) margins indicate the sum of changes as increases less the decrease of continuing same products in each firm.

Table 7. Estimation of Product Add and Firm Entry Rates and Industry Characteristics with Industry-Level Data

	Add Rate $_{t-i,\,t}$		Entry Rate $_{t-i,\,t}$		Drop Rate $_{t-i,\,t}$		Exit Rate $_{t-i,\,t}$	
	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient
⊿REG $_{t-1,\,t}$ (Regulation)	−0.1697 ***	−0.1611 ***	−0.0092 **	−0.0091 **	−0.5952 ***	−0.6023 ***	−0.2175 ***	−0.2166 ***
	(−4.540)	(−4.360)	(−1.960)	(−1.970)	(−6.110)	(−6.310)	(−4.160)	(−4.150)
ln(K/L) $_{t-i}$ ogarithm of Capital Intensity)	−0.0178 ***	−0.0155 ***	−0.0060 ***	−0.0055 ***	−0.0090 *	−0.0053	−0.0369 ***	−0.0365 ***
	(−5.510)	(−4.810)	(−3.970)	(−3.640)	(−1.810)	(−1.080)	(−13.720)	(−13.470)
⊿lnY $_{t-1,\,t}$ (Growth of Market Size)	0.0804 ***	0.0850 ***	0.0266 ***	0.0249 ***	0.0301	0.0333	−0.0802 ***	−0.0798 ***
	(4.070)	(4.350)	(2.770)	(2.620)	(0.910)	(1.030)	(−4.510)	(−4.480)
PCM $_{t-i}$ (Price Cost Margins)		−0.2484 ***		−0.1169 ***		−0.3792 ***		−0.0790 *
		(−5.070)		(−4.820)		(−5.110)		(−1.780)
constant	0.3536 ***	0.4093 ***	0.1528 ***	0.1818 ***	0.2979 ***	0.3756 ***	0.4165 ***	0.4346 ***
	(18.740)	(18.860)	(17.590)	(17.390)	(10.370)	(11.750)	(26.940)	(23.620)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1080	1080	1076	1075	540	540	539	538
R-squared	0.1413	0.1623	0.0645	0.0832	0.0743	0.1157	0.3272	0.3286
F-value	44.2321	41.6052	18.4667	19.4042	14.3479	17.5081	86.7173	65.2234

Note: All regressions are estimations of the industry-level sample that we created by aggregating firm-level samples of *The Census of Manufactures*. All estimations include the year dummy as control variables. The asterisks (*, **, ***) represent significance levels at 10%, 5%, and 1% respectively. Each value in parentheses below the coefficients is the t-value.

Table 8. Estimation of Product Switching and Firm-Level Productivity

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	IV	IV	IV	IV	IV-FE	IV-FE
Dependent Variable	$Add_{t, t+i}$	$Drop_{t, t+i}$	Both Add and $Drop_{t, t+i}$	Both Add and $Drop_{t, t+i}$	Both Add and $Drop_{t, t+i}$	Both Add and $Drop_{t, t+i}$
	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient
$lnLP_t$ (Logarithm of Labor Productivity)	0.003 ***	0.006 ***	0.011 ***		0.014 ***	
	(2.68)	(7.47)	(9.66)		(10.82)	
TFP_t (Total Factor Productivity)				0.482		0.665
				(0.92)		(1.13)
PCM_t (Price Cost Margins)	−0.068 ***	−0.039 ***	−0.050 ***	−0.172 ***	−0.029	−0.187 ***
	(−8.24)	(−6.30)	(−6.60)	(−6.04)	(−1.44)	(−3.18)
$ln(K/L)_t$ (Logarithm of Capital intensity)	0.006 ***	0.004 ***	0.010 ***	−0.001	0.014 ***	0.006
	(6.17)	(5.85)	(12.73)	(−0.17)	(9.44)	(1.21)
$RSIZE(lnL)_t$ (Logarithm of Employees)	0.017 ***	0.010 ***	−0.002 ***	0.028	−0.006 ***	0.035
	(27.78)	(23.14)	(−3.82)	(1.37)	(−10.68)	(1.46)
constant	−0.018 **	−0.037 ***	−0.071 ***	−0.017		
	(−2.51)	(−7.50)	(−10.45)	(−0.32)		
Observations	520294	684232	867983	110894	867982	110889
R-sq	0.011	0.009	0.031	0.027	0.002	0
Hansen J Statistics	10.33	12.01	1.50	0.05		
	(0.01)	(0.00)	(0.22)	(0.83)		
Sargan Statistics					5.08	0.463
					(0.08)	(0.79)

Note: IV indicates the instrumental variable model estimation and IV-FE indicates the fixed effect with the instrumental variable model. The level of the fixed effect is firm-level industry classification. All estimations include a sector dummy and a year dummy. We omitted the estimation result of the random effect model because the Hausman test indicated that the fixed effect model was more relevant. The instrumental variables are the business form dummy and the lag of the regulation index in (1)-(2), business form dummy in (3)-(4) and business form dummy and industry-level price cost margins in (5)-(6). Dependent variable *Add* is 1 when the firms add new product(s) between t and t+i, 0 when they do not add or drop products between t and t+i vice versa for the dependent variable *Drop*. On the other hand, dependent variable *Both Product Add and Drop* is 1 when the firms both add and drop product(s) between t and t+i, and is 0 otherwise. The asterisks (*, **, ***) represent significance levels at 10%, 5%, and 1% respectively. Each value in parentheses below the coefficients is the t-value.

Table 9. Estimation of Firm Performance and Product Switching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation Method	IV	IV	IV	IV	IV	IV	IV	IV
Dependent Variable	$\Delta \ln Y_{t,t+i}$	$\Delta \ln Y_{t,t+i}$	$\Delta \ln Y_{t,t+i}$	$\Delta \ln Y_{t,t+j}$	$\Delta \ln L_{t,t+i}$	$\Delta \ln L_{t,t+i}$	$\Delta \ln L_{t,t+i}$	$\Delta \ln L_{t,t+j}$
	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient
Add $_{t, t+i}$ (Product Adding Only Dummy)	5.0600 ***				4.8110 ***			
	(19.24)				(14.82)			
Drop $_{t, t+i}$ (Product Dropping Only Dummy)		8.0000 ***				4.3570 ***		
		(11.22)				(16.06)		
Both Add and Drop $_{t, t+i}$ (Both Product Adding and Dropping Dummy)			5.1070 ***	5.1810 ***			3.7880 ***	3.9560 ***
			(12.77)	(12.34)			(12.74)	(12.12)
lnY $_t$ (Logarithm of Output)	−0.0950 ***	−0.1810 ***	−0.1250 ***	−0.1660 ***				
	(−36.00)	(−27.00)	(−34.67)	(−32.43)				
lnL $_t$ (Logarithm of Employment)	0.0540 ***	0.1720 ***	0.2150 ***	0.2510 ***	−0.1040 ***	−0.0690 ***	0.0030	−0.0300 ***
	(8.63)	(30.85)	(30.59)	(30.68)	(−21.14)	(−26.65)	(0.75)	(−7.90)
constant	0.2200 ***	0.6420 ***	0.0010	0.1970 ***	−0.1290 ***	−0.0980 ***	−0.3840 ***	−0.2630 ***
	(8.51)	(24.38)	(0.02)	(3.54)	(−7.71)	(−7.16)	(−9.98)	(−7.09)
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	576058	576064	575760	326631	576636	576653	576273	326934
R−sq	−7.69	−20.316	−19.074	−13.089	−15.766	−12.718	−22.438	−16.067
F−value	194.981	78.591	84.503	93.414	36.871	44.686	26.519	34.794
Sargan Statistics	6.669	27.795	0.106	5.457	7.045	18.658	0.111	4.526
	(0.036)	(0.000)	(0.949)	(0.065)	(0.030)	(0.000)	(0.946)	(0.104)

Note: All results are based on instrumental variables estimation (IV). The instrumental variables are the business form dummy and logarithm of capital stock in (1)−(8). All estimations include sector dummy and year dummy variables as control variables. Subindex t+i indicates t+2 or t+3 (2000 or 2003 when t is 1998 or 2000) and t+j indicates t+5 (2003 or 2005 when t is 1998 or 2000). The asterisks (*, **, ***) represent significance levels at 10%, 5%, and 1% respectively. Each value in parentheses below the coefficients is the t−value.

Table 9. Estimation of Firm Performance and Product Switching (continued)

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Estimation Method	IV	IV	IV	IV	IV	IV	IV	IV
Dependent Variable	$\Delta \ln LP_{t,t+i}$	$\Delta \ln LP_{t,t+i}$	$\Delta \ln LP_{t,t+i}$	$\Delta \ln LP_{t,t+j}$	$\Delta TFP_{t,t+i}$	$\Delta TFP_{t,t+i}$	$\Delta TFP_{t,t+i}$	$\Delta TFP_{t,t+i}$
	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient	coefficient
Add $_{t,t+i}$ (Product Adding Only Dummy)	3.288 ***				0.000			
	(14.40)				(0.01)			
Drop $_{t,t+i}$ (Product Dropping Only Dummy)		3.876 ***				−0.193 **		
		(11.57)				(−2.01)		
Both Add and Drop $_{t,t+i}$ (Both Product Adding and Dropping Dummy)			1.350 ***	1.649 ***			−0.023 ***	0.040 ***
			(20.31)	(17.12)			(−4.22)	(4.76)
lnL $_t$ (Logarithm of Employment)	0.032 ***	0.059 ***	0.094 ***	0.129 ***	−0.010 ***	−0.007 ***	−0.010 ***	−0.015 ***
	(8.64)	(24.48)	(84.01)	(79.00)	(−10.98)	(−4.71)	(−46.04)	(−38.23)
lnLP $_t$ (Logarithm of Labor Productivity)	−0.163 ***	−0.203 ***	−0.169 ***	−0.235 ***				
	(−89.14)	(−64.00)	(−138.80)	(−115.76)				
TFP $_t$ (Total Factor Productivity)					−0.349 ***	−0.351 ***	−0.351 ***	−0.492 ***
					(−46.23)	−70.430	(−135.60)	(−118.23)
constant	0.655 ***	0.886 ***	0.675 ***	0.874 ***	0.044 ***	0.044 ***	0.044 ***	0.059 ***
	(33.95)	(65.03)	(52.20)	(45.63)	(41.87)	(29.49)	(56.33)	(43.85)
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	576058	576064	575760	326631	85857	85858	85129	47169
R−sq	−3.528	−5.192	−1.344	−1.397	0.196	−2.162	0.133	0.133
F−value	577.491	421.696	1115.038	999.815	744.843	189.653	687.792	561.793
Sargan Statistics	6.602	22.524	0.018	7.499	82.093	16.852	0.026	10.998
	(0.037)	(0.000)	(0.991)	(0.024)	(0.000)	(0.000)	(0.872)	(0.004)

Note: All results are based on instrumental variables estimation (IV). The instrumental variables are business form dummy and price cost margin in (9)–(12), and business form and capital stock in (13)–(16). All estimations include sector dummy variables and year dummy variables as control variables. Subindex t+i indicates t+2 or t+3 (2000 or 2003 when t is 1998 or 2000) and t+j indicates t+5 (2003 or 2005 when t is 1998 or 2000). The asterisks (*, **, ***) represent significance levels at 10%, 5%, and 1% respectively. Each value in parentheses below the coefficients is the t−value.

Table 9. Estimation of Firm Performance and Product Switching (continued)

	(17)	(18)	(19)	(20)
Estimation Method	IV-FE	IV-FE	IV-FE	IV-FE
Dependent Variable	$\Delta \ln LP_{t,t+i}$	$\Delta TFP_{t,t+i}$	$\Delta \ln Y_{t,t+i}$	$\Delta \ln L_{t,t+j}$
	coefficient	coefficient	coefficient	coefficient
Both Add and Drop $_{t,t+i}$ (Both Product Adding and Dropping Dummy)	0.683 ***	−0.001	2.853 **	1.831 **
	(11.79)	(−0.12)	(2.46)	(2.33)
$\ln LP_t$ (Logarithm of Labor Productivity)	−0.978 ***			
	(−442.91)			
TFP_t (Total Factor Productivity)		−1.019 ***		
		(−232.55)		
$\ln Y_t$ (Logarithm of Output)			−0.9280 ***	
			(−144.99)	
$\ln L_t$ (Logarithm of Employment)	0.071 ***	−0.006 ***	0.190 ***	−0.881 ***
	(21.51)	(−12.09)	(6.76)	(−44.48)
Sector Dummy	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes
Observation	510675	71627	510675	511226
R-sq	0.285	0.568	−4.066	−3.228
F-value	9020.758	2129.541	1171.178	1328.658
Sargan Statistics	6.501	0.47	1.06	1.171
	(0.039)	(0.493)	(0.589)	(0.557)

Note: All results are based on instrumental variables estimation with fixed effects model (IV-FE) with industry the firm produce the most in their products as fixed effect. The instrumental variables are the business form dummy and the logarithm of capital stock in (18), the business form dummy, the logarithm of capital and price cost margin in (18) and the logarithm of capital stock and business form dummy in (19)-(20). All estimations include sector dummy variables and year dummy variables as control variables. Subindex t+i indicates t+2 or t+3 (2000 or 2003 when t is 1998 or 2000) and t+j indicates t+5 (2003 or 2005 when t is 1998 or 2000). The asterisks (*, **, ***) represent significance levels at 10%, 5%, and 1% respectively. Each value in parentheses below the coefficients is the t-value.

Appendix Table. Correspondence table between JSIC and ISIC

Japan Standard Industrial Classification (Rev. 11)		International Standard Industrial Classification of All Economic Activities Third	
911	Meat products	1511	Production, processing and preserving of meat and meat products
912	Dairy products	1514	Manufacture of vegetable and animal oils and fats
919	Miscellaneous livestock products	1520	Manufacture of dairy products
982	Animal oils and fats	1549	Manufacture of other food products n.e.c.
9321	Slaughterhouses		
921	Canned seafood and seaweed	1511	Production, processing and preserving of meat and meat products
922	Seaweed products, except canned	1512	Processing and preserving of fish and fish products
923	Fish paste products	1514	Manufacture of vegetable and animal oils and fats
924	Salted		
925	Frozen seafood products (unprocessed and packaged)		
926	Frozen seafood products (processed and packaged)		
929	Miscellaneous seafood products		
982	Animal oils and fats		
961	Rice cleaning and polishing	1531	Manufacture of grain mill products
962	Wheat and barley cleaning and polishing		
963	Wheat flour milling		
969	Miscellaneous flour and grain mill products		
931	Canned and preserved fruit and vegetable products, except vegetables	1513	Processing and preserving of fruit and vegetables
932	Vegetables pickled or in brine, not in air	1514	Manufacture of vegetable and animal oils and fats
941	Miso (fermented soybean paste)	1531	Manufacture of grain mill products
942	Shoyu (soy sauce), and edible amino acids	1532	Manufacture of starches and starch products
943	Umami seasoning	1541	Manufacture of bakery products
944	Sauces	1542	Manufacture of sugar
945	Vinegar	1543	Manufacture of cocoa, chocolate and sugar confectionery
949	Miscellaneous seasonings	1544	Manufacture of macaroni, noodles, couscous and similar farinaceous products
951	Sugar, except refined sugar	1549	Manufacture of other food products n.e.c.
952	Refined sugar products		
953	Glucose, starch syrup and high		
971	Bread		
972	Pastries and cakes		
973	Biscuits, crackers and other dry bakery products		
974	Baked rice confections		
979	Miscellaneous bakery and confectionery products		
981	Vegetable oils and fats		
983	Edible oils and fats		
991	Starch		
992	Noodles, macaroni and spaghetti		
993	Tofu(bean curd)and Aburage(fried bean curd)		
994	Anko(sweet bean paste)and other related products		
995	Precooked frozen packed foods		
996	Sozai(side		
999	Food and related products, n.e.c		
919	Miscellaneous livestock products		
1011	Soft drinks and carbonated water	1513	Processing and preserving of fruit and vegetables
1021	Wine, except sake (Japanese rice wine)	1549	Manufacture of other food products n.e.c.
1022	Malt liquors	1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from
1023	Sake (Japanese rice wine)	1552	Manufacture of wines
1024	Distilled, rectified and blended liquors	1553	Manufacture of malt liquors and malt
1031	Tea	1554	Manufacture of soft drinks; production of mineral waters
1032	Coffee		
1041	Manufactured ice		
999	Food and related products, n.e.c		
1061	Balanced compound feeds	1533	Manufacture of prepared animal feeds
1062	Elemental feeds	1512	Processing and preserving of fish and fish products
1063	Organic fertilizers	1533	Manufacture of prepared animal feeds
1051	Cigarettes, cigars and pipe tobacco, except tobacco stemming and redrying	1600	Manufacture of tobacco products
1052	Tobacco stemming and redrying	111	Growing of cereals and other crops n.e.c.
1111	Silk reeling plants	1711	Preparation and spinning of textile fibres; weaving of textiles
1121	Spinning mills, cotton	1712	Finishing of textiles
1122	Spinning mills, man	1721	Manufacture of made
1123	Spinning mills, wool	1722	Manufacture of carpets and rugs
1129	Miscellaneous spinning mills	1723	Manufacture of cordage, rope, twine and netting
1131	Twisting yarns, except bulky yarns	1729	Manufacture of other textiles n.e.c.
1132	Bulky yarns	1730	Manufacture of knitted and crocheted fabrics and articles
1141	Fabric mills, woven cotton and spun rayon	1810	Manufacture of wearing apparel, except fur apparel
1142	Fabric mills, woven silk and rayon	1820	Dressing and dyeing of fur; manufacture of articles of fur
1143	Fabric mills, woven woolen and worsted		
1144	Fabric mills, woven hard and bast fiber		
1149	Miscellaneous woven fabric mills		
1151	Tubular knit fabrics		
1152	Warp knit fabrics		

Appendix Table. Correspondence table between JSIC and ISIC		
Japan Standard Industrial Classification (Rev. 11)	International Standard Industrial Classification of All Economic Activities Third	
1153 Flat knit fabrics		
1161 Machine dyed and finished cotton, spun rayon, hard and bast fiber fabrics		
1162 Machine dyed and finished silk and rayon fabrics		
1163 Machine dyed and finished woolen and worsted fabrics		
1164 Finished woven fabrics		
1165 Hand dyed and finished woven fabrics		
1166 Dyed and finished quasi		
1167 Dyed and finished knit and lace		
1168 Dyed and finished miscellaneous textiles		
1171 Rope		
1172 Fishing net		
1179 Miscellaneous netting		
1181 Embroidery lace		
1182 Knit lace		
1183 Bobbin lace		
1184 Braids		
1185 Narrow fabrics (under 13cm width)		
1189 Miscellaneous lace and textile goods		
1191 Scouring and combing plants		
1192 Wadding		
1193 Felt and bonded fabrics		
1194 Carpets and other textile mats		
1195 Coated, water		
1196 Textile		
1199 Textile mill products, n.e.c.		
1211 Men's and boy's outer garments		
1212 Ladies' and girl's outer garments		
1213 Infant's outer garments		
1214 Shirts		
1215 Business, work, sanitary and sport clothing		
1216 School uniforms		
1221 Knitted garments, except outer shirts and sweater		
1222 Knitted outer shirts		
1223 Sweaters		
1229 Miscellaneous knitted garments and shirts		
1231 Textile underwear		
1232 Knitted underwear		
1233 Textile nightclothes		
1234 Knitted nightclothes		
1235 Foundation garments		
1241 Japanese style apparel		
1242 Japanese tabi		
1251 Ties		
1252 Scarfs and mufflers		
1253 Handkerchiefs		
1254 Hosiery		
1255 Gloves		
1256 Hats, including hat bodies		
1257 Fur apparel and apparel accessories		
1259 Textile apparel and accessories, n.e.c.		
1291 Bedding		
1292 Blankets		
1293 Canvas products		
1294 Textile bags		
1295 Embroidery		
1296 Towels		
1299 Fabricated textile products, n.e.c.		
1311 General sawing and planning mills	1920	Manufacture of footwear
1312 Veneer wood	2010	Sawmilling and planing of wood
1313 Flooring mills	2021	Manufacture of veneer sheets; manufacture of plywood, laminboard, particle
1314 Wood chip mills	2022	Manufacture of builders' carpentry and joinery
1319 Sawing and planning mills, n.e.c.	2023	Manufacture of wooden containers
1321 Millwork, except lumber for fixtures	2029	Manufacture of other products of wood; manufacture of articles of cork, straw
1322 Plywood		
1323 Grued laminated timber mills		
1324 Prefabricated wooden buildings and structural members		
1325 Particle board		
1326 High		
1331 Bamboo, rattan and willow baskets		
1332 Chipping boxes		
1333 Wooden boxes		

Appendix Table. Correspondence table between JSIC and ISIC

Japan Standard Industrial Classification (Rev. 11)		International Standard Industrial Classification of All Economic Activities Third	
1729	Miscellaneous industrial inorganic chemicals	2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds
1752	Soaps and synthetic detergents	2412	Manufacture of fertilizers and nitrogen compounds
1753	Surface	2421	Manufacture of pesticides and other agro
1754	Paints	2422	Manufacture of paints, varnishes and similar coatings, printing ink and
1755	Printing ink	2424	Manufacture of soap and detergents, cleaning and polishing preparations,
1756	Cleaning and scouring preparations	2429	Manufacture of other chemical products n.e.c.
1757	Candles		
1771	Makeup and skin care products, including perfume and eau de cologne		
1772	Hair care products		
1779	Miscellaneous cosmetics, toothpaste and toilet preparations		
1791	Explosives		
1792	Agricultural chemicals		
1793	Perfumes and fragrances		
1794	Gelatin and adhesives		
1795	Photosensitive materials		
1796	Natural resin and wood chemical products		
1797	Reagents		
1799	Chemicals and allied products, n.e.c.		
1811	Petroleum refining	2320	Manufacture of refined petroleum products
1821	Lubricating oils		
1822	Greases		
1899	Miscellaneous petroleum and coal products		
1831	Coke	1010	Mining and agglomeration of hard coal
1841	Paving materials	1020	Mining and agglomeration of lignite
1891	Briquettes and briquette balls	2310	Manufacture of coke oven products
1911	Plastic plates, bars and rods	2520	Manufacture of plastics products
1912	Plastic pipes and tubes		
1913	Plastic pipe fittings		
1914	Plastic profile extrusions		
1915	Fabrication of plastic plates, bars and rods, pipes and tubes, pipe fittings and		
1921	Plastic film		
1922	Plastic sheets		
1923	Plastic floor coverings		
1924	Synthetic leather		
1925	Fabrication of plastic film, sheets, floor coverings and synthetic leather		
1931	Industrial plastic products, except made by fabrication		
1932	Fabrication of industrial plastic products		
1941	Foamed plastic products, flexible and semi		
1942	Foamed plastic products, rigid		
1943	Reinforced plastic plates, bars and rods, pipes and tubes, and pipe fittings		
1944	Reinforced plastic containers, bathtubs, etc.		
1945	Fabrication of foamed and reinforced plastic products		
1951	Compounding plastic materials		
1952	Reclaimed plastic products		
1991	Plastic tableware, kitchenware and other household articles		
1992	Plastic containers		
1997	Plastic products, n.e.c.		
1998	Fabrication of finished plastic products, n.e.c.		
2011	Tires and tubes for automobiles	1920	Manufacture of footwear
2012	Tires and tubes for bicycles	2511	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber
2021	Rubber footwear and its findings	2519	Manufacture of other rubber products
2022	Plastic footwear and its findings		
2031	Rubber belts		
2032	Rubber hoses		
2033	Mechanical rubber products		
2091	Rubber coated fabric and its products		
2092	Medical and sanitary rubber products		
2093	Rubber sheet (repairsheet)		
2094	Retreaded tires		
2095	Reclaimed rubber		
2099	Rubber products, n.e.c.		
2111	Leather tanning and finishing	1820	Dressing and dyeing of fur; manufacture of articles of fur
2121	Mechanical leather products, except gloves and mittens	1911	Tanning and dressing of leather
2131	Cut stock and findings for boots and shoes	1912	Manufacture of luggage, handbags and the like, saddlery and harness
2141	Leather footwear	1920	Manufacture of footwear
2151	Leather gloves and mittens		
2161	Baggage		
2171	Small leather cases		
2172	Handbags		
2181	Fur skins		
2199	Miscellaneous leather products		

Appendix Table. Correspondence table between JSIC and ISIC		
Japan Standard Industrial Classification (Rev. 11)	International Standard Industrial Classification of All Economic Activities Third	
2211 Flat glass	2610	Manufacture of glass and glass products
2212 Processed flat glass		
2213 Glass processing materials		
2214 Glass containers		
2215 Scientific glass instruments		
2216 Table and kitchen glassware		
2217 Glass fiber and its products		
2219 Miscellaneous glass and its products		
2221 Cement	2692	Manufacture of refractory ceramic products
2222 Fresh concrete	2694	Manufacture of cement, lime and plaster
2223 Concrete products	2695	Manufacture of articles of concrete, cement and plaster
2229 Miscellaneous cement products		
2241 Sanitary pottery	2691	Manufacture of non
2242 Tableware pottery	2692	Manufacture of refractory ceramic products
2243 Pottery ornaments	2693	Manufacture of structural non
2244 Porcelain electrical supplies		
2245 Scientific and industrial ceramic products		
2246 Tile and mosaic, except quarry tile		
2247 Pottery decorating		
2248 Preparing pottery clay		
2249 Miscellaneous pottery and related products		
2231 Clay roofing tile	2692	Manufacture of refractory ceramic products
2232 Building brick	2693	Manufacture of structural non
2233 Clay pipes	2694	Manufacture of cement, lime and plaster
2239 Miscellaneous structural clay products	2695	Manufacture of articles of concrete, cement and plaster
2251 Fire bricks	2696	Cutting, shaping and finishing of stone
2252 Unshaped refractories industry	2699	Manufacture of other non
2259 Miscellaneous clay refractories		
2261 Carbonaceous electrodes		
2262 Carbon fiber		
2269 Miscellaneous carbon and graphite products		
2271 Abrasive grains		
2272 Abrasive products		
2273 Abrasive cloth and paper		
2279 Miscellaneous abrasive products		
2282 Artificial aggregate		
2283 Cut		
2284 Diatomaceous earth and its products		
2285 Minerals and stones crushed or otherwise treated		
2291 Enameled iron ware		
2292 Cloisonne		
2293 Artificial jewels		
2294 Rock wool, slag wool and its products		
2295 Asbestos products		
2296 Gypsum products		
2297 Lime products		
2298 Molds, including cores		
2299 Ceramic, stone and clay products, n.e.c.		
2311 Iron industries, with blast furnaces	2710	Manufacture of basic iron and steel
2312 Iron smelting, without blast furnaces	2731	Casting of iron and steel
2313 Ferro	2891	Forging, pressing, stamping and roll
2321 Steel manufactured, including converters and electric furnaces and with		
2331 Hot rolling		
2332 Cold rolling		
2333 Cold rolled steel shapes		
2334 Steel pipes and tubes		
2335 Re		
2336 Cold finished steel bars		
2337 Pipes and tubes drawing		
2338 Wire drawing		
2339 Miscellaneous steel materials, except made by smelting furnaces and steel		
2341 Galvanized steel sheets		
2342 Coated steel pipes		
2349 Miscellaneous coated steel		
2351 Iron castings, except cast iron pipes and malleable iron castings		
2352 Malleable iron castings		
2353 Steel castings		
2354 Secondary forgings		
2355 Steel forgings		
2391 Iron and steel shearing and slitting		
2392 Iron and steel scrap preparation for smelting		

Appendix Table. Correspondence table between JSIC and ISIC		
Japan Standard Industrial Classification (Rev. 11)	International Standard Industrial Classification of All Economic Activities Third	
2393 Cast iron pipe		
2399 Iron and steel, n.e.c.		
2411 Primary smelting and refining of copper	2720	Manufacture of basic precious and non
2412 Primary smelting and refining of zinc		
2413 Primary smelting and refining of aluminum		
2419 Miscellaneous primary smelting and refining of non		
2421 Secondary smelting and refining of lead, including lead alloys		
2422 Secondary smelting and refining of zinc, including zinc alloys		
2423 Secondary smelting and refining of aluminum, including aluminum alloys		
2429 Miscellaneous secondary smelting and refining of non		
2431 Rolling and drawing of copper and copper alloys	2330	Processing of nuclear fuel
2432 Rolling of aluminum and aluminum alloys, including drawing and extruding	2720	Manufacture of basic precious and non
2439 Miscellaneous rolling of non	2732	Casting of non
2441 Electric wire and cable, except optical fiber cable	2891	Forging, pressing, stamping and roll
2442 Optical fiber cables, including telecommunication composite cables	2899	Manufacture of other fabricated metal products n.e.c.
2451 Copper and copper	3130	Manufacture of insulated wire and cable
2452 Non-ferrous castings, except copper and copper-base alloy castings and die		
2453 Aluminum and aluminum alloy die castings		
2454 Non-ferrous die castings, except aluminum and aluminum alloy die castings		
2455 Non-ferrous metal forgings		
2491 Nuclear fuel		
2499 Non-ferrous metal products, n.e.c.		
2541 Fabricated construction	2811	Manufacture of structural metal products
2542 Fabricated architectural metal products, except structural hardware		
2511 Tin cans and other plated sheet products	2812	Manufacture of tanks, reservoirs and containers of metal
2521 Tableware (occidental type)	2891	Forging, pressing, stamping and roll
2522 Edge tools for machinery	2892	Treatment and coating of metals; general mechanical engineering on a fee or
2523 Edge tools, artisans' tools and hand tools, except files, saws and knives for	2893	Manufacture of cutlery, hand tools and general hardware
2524 Work tools, except files	2899	Manufacture of other fabricated metal products n.e.c.
2525 Files	2919	Manufacture of other general purpose machinery
2526 Hand saws and saw blades	2930	Manufacture of domestic appliances n.e.c.
2527 Agricultural tools, except agricultural machinery		
2529 Miscellaneous hardware		
2531 Plumbers' supplies, except valves and cocks		
2532 Gas and oil appliances		
2533 Heated air and hot water heating systems		
2539 Miscellaneous heating and cooking apparatus, except electrical appliances		
2543 Fabricated plate work and sheet metal work		
2551 Stamped and pressed aluminum products and aluminum alloys		
2552 Stamped and pressed metal products, except aluminum and aluminum alloys		
2553 Powder metallurgy products		
2561 Coating metal products		
2562 Galvanized and other hot		
2563 Engraving on metal		
2564 Electroplated metal products, except coated steel		
2565 Heat treated metal		
2569 Miscellaneous treatment of metal surface		
2571 Nails		
2579 Miscellaneous fabricated wire products		
2581 Bolts, nuts, rivets, machine screws and wood screws		
2591 Safes		
2592 Metallic springs		
2599 Fabricated metal products, n.e.c.		
2611 Boilers	2813	Manufacture of steam generators, except central heating hot water boilers
2612 Steam engines, turbines and water wheels, except marine engines	2893	Manufacture of cutlery, hand tools and general hardware
2613 Internal combustion engines	2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle
2619 Miscellaneous engines and turbines	2912	Manufacture of pumps, compressors, taps and valves
2644 Machinists' precision tools, except powder metallurgy products	2913	Manufacture of bearings, gears, gearing and driving elements
2668 Vacuum equipment and vacuum component manufacture	2914	Manufacture of ovens, furnaces and furnace burners
2671 Pumps and pumping equipment	2915	Manufacture of lifting and handling equipment
2672 Air compressors, gas compressors and blowers	2919	Manufacture of other general purpose machinery
2673 Elevators and escalators		
2674 Conveyors and conveying equipment		
2675 Mechanical power transmission equipment, except ball and roller bearings		
2676 Industrial furnaces and ovens		
2677 Oil hydraulic and pneumatic equipment		
2679 Miscellaneous general industry machinery and equipment		
2682 Refrigerating machines and air conditioning apparatus		
2697 Packing machines		
2621 Agricultural machinery and equipment	2919	Manufacture of other general purpose machinery
2631 Machinery and equipment for construction and mining	2921	Manufacture of agricultural and forestry machinery

Appendix Table. Correspondence table between JSIC and ISIC

Japan Standard Industrial Classification (Rev. 11)	International Standard Industrial Classification of All Economic Activities Third	
2641	Metal machine tools	2922 Manufacture of machine
2642	Metal working machinery, except metal machine tools	2923 Manufacture of machinery for metallurgy
2643	Parts and accessories for metal working machines and machine tools, except	2924 Manufacture of machinery for mining, quarrying and construction
2651	Machinery for man	2925 Manufacture of machinery for food, beverage and tobacco processing
2652	Weaving and knitting machinery	2926 Manufacture of machinery for textile, apparel and leather production
2653	Dyeing and finishing machinery	2929 Manufacture of other special purpose machinery
2654	Textile machinery parts, attachments and accessories	
2655	Sewing machinery and equipment	
2661	Food processing machinery and equipment	
2662	Woodworking machinery	
2663	Pulp and paper industry machinery	
2664	Printing, bookbinding and paper converting machinery	
2665	Foundry equipment	
2666	Plastic working machinery and accessories	
2667	Semiconductor manufacturing equipment	
2669	Miscellaneous special industry machinery	
2678	Chemical machinery and its equipment	
2698	Industrial robots	
2655	Sewing machinery and equipment	2912 Manufacture of pumps, compressors, taps and valves
2691	Fire extinguishing equipment and its apparatus	2913 Manufacture of bearings, gears, gearing and driving elements
2692	Valves and fittings	2919 Manufacture of other general purpose machinery
2693	Fabricated pipe and fittings	2926 Manufacture of machinery for textile, apparel and leather production
2694	Ball and roller bearings	2929 Manufacture of other special purpose machinery
2695	Piston rings	2930 Manufacture of domestic appliances n.e.c.
2696	Molds and dies, parts and accessories	
2699	Machine shops (jobbing and repair)	
2681	Office machines	2929 Manufacture of other special purpose machinery
2683	Amusement machines manufacture	3000 Manufacture of office, accounting and computing machinery
2684	Vending machines manufacture	
2689	Miscellaneous office, service industry and household machines	
2721	Kitchen ware	2930 Manufacture of domestic appliances n.e.c.
2722	Home comfort	3230 Manufacture of television and radio receivers, sound or video recording or
2723	Clothes treatment and cleaner	
2729	Miscellaneous household electric appliances	
2742	Video recording and duplicating equipment	
2813	Radio and television set receivers	
2814	Electric audio equipment	
2821	Computer, except personal computer	3000 Manufacture of office, accounting and computing machinery
2822	Personal computer	
2823	Storage	
2824	Printer	
2829	Miscellaneous peripheral equipment	
2811	Communication equipment wired	3190 Manufacture of other electrical equipment n.e.c.
2812	Radio communication equipment	3220 Manufacture of television and radio transmitters and apparatus for line
2815	Railway signal and safety appliances	
2819	Miscellaneous communication equipment and related products	
2741	X-ray equipment	3311 Manufacture of medical and surgical equipment and orthopaedic appliances
2743	Medical instruments electronic equipment	3312 Manufacture of instruments and appliances for measuring, checking, testing,
2749	Miscellaneous electronic equipment	3313 Manufacture of industrial process control equipment
2751	Electric measuring instruments, except otherwise classified	
2752	Industrial process controlling instruments	
2753	Medical measuring instruments	
2912	Semiconductor devices	3210 Manufacture of electronic valves and tubes and other electronic components
2913	Integrated circuits	
2793	Magnetic tapes and discs	3210 Manufacture of electronic valves and tubes and other electronic components
2911	Electron tubes	3230 Manufacture of television and radio receivers, sound or video recording or
2914	Resistors, capacitors, transformers and composite parts	
2915	Electro acoustic transducers, magnetic heads and small motors	
2916	Connectors, switches and relays	
2917	Switching power supplies high	
2918	Printed circuit	
2919	Miscellaneous electronic parts	
2711	Generators, motors and other rotating electrical machinery	2914 Manufacture of ovens, furnaces and furnace burners
2712	Power and distribution transformers, except electronic appliances	2922 Manufacture of machine
2713	Relay switches, switchboards and electrical control equipment	3110 Manufacture of electric motors, generators and transformers
2715	Electrical welding equipment	3120 Manufacture of electricity distribution and control apparatus
2719	Miscellaneous industrial electrical apparatus, including those for vehicles and	3190 Manufacture of other electrical equipment n.e.c.
2714	Wiring devices and supplies	3120 Manufacture of electricity distribution and control apparatus
2716	Auxiliary equipment for internal combustion engines	3140 Manufacture of accumulators, primary cells and primary batteries
2731	Electric bulbs	3150 Manufacture of electric lamps and lighting equipment
2732	Electric lighting fixtures	3190 Manufacture of other electrical equipment n.e.c.

Appendix Table. Correspondence table between JSIC and ISIC		
Japan Standard Industrial Classification (Rev. 11)	International Standard Industrial Classification of All Economic Activities Third	
2791 Storage batteries		
2792 Primary batteries (dry and wet)		
2799 Electrical machinery equipment and supplies, n.e.c.		
3011 Motor vehicles, including motorcycles	3410	Manufacture of motor vehicles
	3591	Manufacture of motorcycles
3012 Motor vehicles bodies and trailers	3410	Manufacture of motor vehicles
3013 Motor vehicles parts and accessories	3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers
	3430	Manufacture of parts and accessories for motor vehicles and their engines
	3591	Manufacture of motorcycles
3021 Train's coach	2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle
3022 Train's coach	2915	Manufacture of lifting and handling equipment
3031 Shipbuilding and repairing	3511	Building and repairing of ships
3032 Hull blocks	3512	Building and repairing of pleasure and sporting boats
3033 Small watercraft building and repairing	3520	Manufacture of railway and tramway locomotives and rolling stock
3034 Marine engines	3530	Manufacture of aircraft and spacecraft
3041 Aircraft	3592	Manufacture of bicycles and invalid carriages
3042 Aircraft engines	3599	Manufacture of other transport equipment n.e.c.
3049 Miscellaneous aircraft parts and auxiliary equipment		
3051 Forklift trucks and parts and accessories		
3059 Miscellaneous industrial trucks and parts and accessories		
3091 Bicycles and parts		
3099 Transportation equipment, n.e.c.		
3111 Universal measures	3311	Manufacture of medical and surgical equipment and orthopaedic appliances
3112 Volumeters	3312	Manufacture of instruments and appliances for measuring, checking, testing,
3113 Balances and scales	3320	Manufacture of optical instruments and photographic equipment
3114 Manometers, flowmeters and quantity gauges	3330	Manufacture of watches and clocks
3115 Precision measuring machines and instruments		
3116 Analytical instruments		
3117 Testing machines		
3119 Miscellaneous measuring instruments, analytical instruments and testing		
3121 Surveying instruments		
3131 Medical instruments and apparatus		
3132 Dental instruments and apparatus		
3133 Veterinary instruments and apparatus		
3134 Medical supplies		
3135 Dental materials		
3141 Physical and chemical instruments		
3151 Microscopes and telescopes		
3152 Cameras and their parts		
3153 Motion picture equipment and their parts		
3154 Optical lenses and prisms		
3161 Ophthalmic goods, including frames		
3171 Watches, clocks and parts, except watchcases		
3172 Watchcases		
3211 Jewelry products of precious metal and precious stone	2029	Manufacture of other products of wood; manufacture of articles of cork, straw
3212 Findings and materials of jewelry	2213	Publishing of recorded media
3219 Miscellaneous precious metal products and precious stone products	2230	Reproduction of recorded media
3221 Pianos	2927	Manufacture of weapons and ammunition
3222 Guitars	3691	Manufacture of jewellery and related articles
3229 Miscellaneous musical instruments, parts and materials	3692	Manufacture of musical instruments
3231 Games and toys, except dolls and children's vehicles	3693	Manufacture of sports goods
3232 Dolls	3694	Manufacture of games and toys
3233 Children's vehicles	3699	Other manufacturing n.e.c.
3234 Sporting and athletic goods		
3241 Pens, mechanical pencils and pen nibs		
3242 Ball		
3243 Lead pencils		
3244 Calligraphy brushes and painting materials, except pencils		
3249 Office supplies, n.e.c.		
3251 Costume jewelry and costume accessories, except precious metals and		
3252 Artificial flowers and ornamental feathers		
3253 Buttons		
3254 Needles, pins, hooks, snaps and related articles		
3255 Wigs of human hair		
3261 Lacquer ware		
3271 Straw, panama hats and straw goods		
3272 Tatami mats (straw		
3273 Fans and lanterns (Japanese style)		
3274 Brooms and brushes		
3275 Umbrellas, parasols and parts, of wood and paper		
3276 Matches		

Appendix Table. Correspondence table between JSIC and ISIC	
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3277 Smoking accessories and supplies, except precious metals and jewelry	
3278 Thermos bottles	
3281 Manufacture of ordnance and accessories	
3291 Fireworks	
3292 Signboards and signs	
3293 Pallets	
3294 Models and patterns, except of paper	
3295 Pattern manufactured of industrial use	
3296 Information recording materials, except newspapers, books, other printed	
3299 Miscellaneous manufacturing industries, n.e.c.	
4121 Recording and disk production	