Product Switching and Firm Performance in Japan

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Abstract

Following Bernard, Redding and Schott (2009), we investigate product switching behavior in Japanese manufacturing firms. Using the firm-commodity level database in *The Census of Manufactures*, we find that product adding accounts for 21.4% and product dropping, 21.7% in all manufacturing shipments in 2000. Empirical studies that examine the determinants of product switching show that productivity and the relative size of the firm encourage product switching, while high fixed costs discourage it. When we examine the effects of product switching on a firm's performance, only product dropping through restructuring contributes to improved performance such as growth in output, employment, labor productivity or TFP in the short run. However, product switching improves firm performance in the long run.

Keywords: Firm dynamics, Product switching, Productivity, Barrier to entry
JEL Classification: D21, E23, L11, L60

1. Introduction

A number of papers in firm dynamics have focused on the effects of entry and exit behavior on productivity growth at the firm and industry levels.[1] 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 in productivity growth at the industry level was not the entry or exit effect ,but the within effect. In addition, the entry and exit rates in Japan were lower than those in other advanced countries.

From the above empirical results, we would expect that Japanese firms might have improved productivity growth through product switching or industry switching. For example, the main products for Toray Co. are now chemical products, while its main product was textile products thirty years ago. The main product for Canon Co. is office machinery, while its main product thirty years ago was the camera.

Bernard, Redding, and Schott (hereafter referred to BRS) (2009) developed a model incorporating not only entry and exit behavior but also product switching behavior in incumbent firms. Using the U.S. Manufacturing Censuses from 1972 to 1997, BRS examined how U.S. firms changed their composition of products and how product switching affected firm performance. 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 disadvantage. Chan and Chen (2005) and Newman, Rand and Trap (2007) also examined industry switching behavior in manufacturing firms in Taiwan and Vietnam respectively.

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

Following BRS (2009), we examine the effect of product switching, industry switching and sector switching on firm performance, using the Manufacturing Survey in Japan. Our paper is constructed as follows. In the next section, we outline BRS's model that incorporates product switching. In the third section, we explain our data in detail and define the terms 'sector', 'industry', and 'product'. In the fourth section, we describe product switching behavior in Japanese manufacturing firms from 1998 to 2005. In the fifth section, we examine why they 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.

2. Why do firms switch products?

Theoretical models incorporating entry and exit behavior were developed by Jovanovic (1982) and Hopenhayn (1992). Melitz (2003) considered 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 change in surviving firms.

BRS (2009) 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. Fixed costs are different between the two sectors. In Melitz (2003), zero profit cutoff and free entry conditions determined entry and exit behavior. In BRS (2009), in addition to these two conditions, the product indifference cutoff condition determined product switching behavior.

Figure 1 describes entry, exit and product switching behavior in the BRS (2009) model. π_i (i=1,2) is the revenue function of sector *i*. It increases when the productivity level (φ_i) improves. As described in Figure 1, when fixed costs in sector 2 (f_2) are higher than that in sector 1 (f_1) and profit increases associated with productivity improvement in Sector 2 is larger than that in sector 1 ($\frac{d\pi_2}{d\varphi_2} > \frac{d\pi_1}{d\varphi_1}$), product switching occurs. In Figure 1, firms produce product 1 in the range from φ^* to φ^{**}. When the productivity level exceeds φ^{**}, production in firms is switched from product 1 to product 2. In a general equilibrium framework, BRS (2009) endogenized entry, exit and product switching behaviors and these behaviors are determined by the fixed cost in each sector, variable production costs, and consumer preference.

(Place Figure 1 around here)

3. Data description

We use *the Census of Manufactures* conducted by Ministry of Economy, Trade,a dn Industry (METI) to examine product switching behavior in the Japanese manufacturing industry. This is because the survey contains both establishment-level data and firm-level data. *The Census of Manufactures* is conducted annually, but it covers all Japanese manufacturing establishments only for the years that end in 0, 3, 5, or 8. Although the survey was started in 1909, we can integrate establishment level data into firm level data from the 1998 survey to study product switching as there is not sufficient data availability. Consequently, our study focuses on product switching behavior based on 1998, 2000, 2003, and 2005 surveys. The data in 2005 covers 498,923 establishments and valid questionnaires were received from 468,841 establishments (response rate is 94.2%).

The Census of Manufactures arranges the survey data by industry and commodity.[2] We match the two kinds of survey data by using establishment identity code, and integrate

[2] Technically, the database consists of reports by “industry”, “commodity”, “city, town and village”, “industrial site and water”, and “enterprise”. Enterprise-level data has been reported since 1997.

establishment data into firm level data by using the address, telephone number, and names of firms.

The Census of Manufactures consists of three types of surveys by size of establishment; Form A ("Kou Hyou" in Japanese) is applied to establishments with 30 or more employees, Form B ("Otsu Hyou" in Japanese) is applied to those with 4 to 29 employees, and Form C ("Hei Hyou" in Japanese) is applied to those with 4 or fewer employees. For our study, we used the surveys in the first two forms.[3] The number of establishments responding to the survey in year 2005 is 276,686 covering 55.45% of all Japanese manufacturing establishments.

The Census of Manufactures has information on the number of employees, raw material costs, fuel and electricity costs, value of shipments of manufactured goods and tangible fixed assets. Using this information, we measure multilateral TFP (total factor productivity) suggested by Caves, Christensen and Diewert (1982), capital intensity, and PCM (price cost margins) at the establishment level.[4] Because the product switching decision is made not at the establishment but at the firm level, we integrate establishment-level TFP, capital intensity and PCM into a firm-level measure weighted by the shipment value of each establishment that belongs to the firm, following BRS (2006, 2009).

BRS (2006, 2009) referred to two digit SIC categories as sectors, four-digit SIC categories as industries, and six-digit SIC categories as products. Following them, we define sectors, industries, and products using *the Census of Manufactures*.[5] Table 1 shows an example of sectors, industries, and products in *The Cencuc of Manufacuturers* in Japan according to BRS (2006).

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3 Because we are not allowed to use Form C, it remains to be a problem that the firm that employs 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.

4 The detailed calculation process is explained in Appendix A.

5 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 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 6-digit classification, the Census of Manufacturers adopts its own classification

(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 is similar to the US. There are many kinds of products in the food sector, the chemical products sector, the general machinery sector, and the electric machinery sector. 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

Using *the Census of Manufactures*, we examine the firm and product dynamics of Japanese manufacturing in the 1998-2005 period. Figure 2 shows 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" denotes a firm which exists at year t and no longer exists in year $t+j$[6], 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 defined as "product drop".

(Place Figure 2 around here)

[6] 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.

According to the above definitions, Table 3 describes the firm dynamics in Japanese manufacturing industries. In Table 3, we find that the number of total firms decreased drastically in the 21st century due to the increase in exit firms and the decrease in entry firms. This decrease was caused by the transfer of plants from Japan to overseas. However, the value of total shipments in 2005 were maintained at the 2000 level, implying that firms stopped making products that were less profitable and started to make new products that were more profitable. Gross shipments of product adding accounted for 21.4% and product dropping accounted for 21.7% of total shipments of all Japanese manufacturing in the year 2000. These percentages are larger than the percentages of entry and exit of firms. However, they were closing in by 2003. When we compare shipment amounts per firm between a new product and a product drop, the former is greater than the latter. When we compare shipment amounts per firm between an entry firm and an exit firm, we also find the same phenomenon as before.

(Place Table 3 around here)

Following BRS (2006), we describe product switching behavior in Japanese manufacturing firms from 1998 to 2005. Table 4 shows the prevalence of firms producing multiple products, industries and sectors. We find that the share of single product firms in total firms in Japan is 57%, which is similar to the corresponding share in the U.S. (59%). Likewise, the share of firms producing multiple products in multiple sectors is 15% which is also similar to the corresponding share in the U.S. (13%). Though the share of output in a single product firms in the entire sample is 9% in the U.S. -- which is smaller than the corresponding share of 19% in Japan -- the distribution of the with-in firm output share in Japan is also similar to that in the U.S. We also find that the distribution of the within firm output share in Japan shown in

Table 5 is similar to that in the U.S.

(Place Table 4 and Table 5 around here)

In Table 6, we examine the output, employment, wages, probability of export, and labor productivity between single-product and multi-product firms. We find that the output of multi-product firms is 59% higher than that of single product firms. Employment in multi-product firms is also 29% higher than that in single-product firms. In contrast to the result in the U.S., labor productivity in multi product-firms is 29% higher than that in single-product firms in Japan.

(Place Table 6 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 margins, and its intensive margins (Table 7). Among these three factors, the firm’s extensive margins by product switching are the major factors in total output growth. The net effects of the firm’s entry and exit on total output growth are negative. We decompose output growth into three periods; from 1998 to 2000, from 2000 to 2003, and the period from 2003 to 2005. In the first period, the Japanese economy recovered from the financial crisis, but the financial institutions in Japan still held huge non-performing loans. In the second period, the Japanese economy suffered from a depression due to the burst of IT bubble in the U.S. In the last period, the Japanese economy 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 those in the last period.

This implies that Japanese firms searched for their optimal product compositions through restructuring. After 2003, they tried to maintain their product mix.

(Place Table 7 around here)

Examining product switching behavior in detail in Table 8, the share of firms that did not change their composition of products in Japan was 39% form 1998 to 2003, and 55% from 2000 to 2005. The share is larger than that in the U.S. (32%).[7] In the case of output share of firms that did not change their product mix in Japan is also larger 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 Japanese manufacturing firms are more conservative than the U.S. firms.

(Place Table 8 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. Based on the theoretical model in BRS (2009), we estimate the following equation.

(1)

$$PS_{t+j,i} = const. + \alpha_1 PRO_{t,i} + \alpha_2 PCM_{t,i} + \alpha_3 RSIZE_{t,i} + \alpha_4 \ln(K_{t,i} / L_{t,i}) + e_{t,i}$$

[7] The comparison was not accurate because the period of measuring product switching is different between Japan and the U.S.

In Equation (1), $PS_{t+j,i}$ 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 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 (2009), when the productivity in a firm increases, it is easy for the firm to enter the market and to switch product. Then, α_1 is positive when a firm adds product, and vice versa. However, as the productivity is endogenously determined in BRS (2009), we take a lag in $PRO_{t,i}$ in our estimation.

$PCM_{t,i}$ represents the price cost margin in firm *i* that shows the competitive environment of firm *i*. As Baldwin and Gorecki (1985) show that firm entry decreases and firm exit increases 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.[8]

Capital intensity ($\ln(\frac{K_{t,i}}{L_{t.i}})$) shows fixed costs when a firm enters a market or switches products. In BRS (2009), the increase in fixed entry costs makes firm entry difficult and product switching in incumbent firms easy. On the other hand, the increase in fixed switching costs makes product switching in incumbent firms difficult. We expect that the increase in capital intensity in an incumbent firm protects firm entry and makes product switching difficult. We include relative firm size ($RSIZE_t$) measured by employment as a scale measure in our estimation.

We estimate Equation (1) by probit estimation with sector and year dummies. Estimation

[8] The construction of TFP and price cost margin is described in Appendix A1.

results are shown in Table 9-1, 9-2, and 9-3. In Table 9-1, both productivity measures are positive and significant. This implies that the increase in productivity encourages product adding. However, coefficients in price cost margin are negative in contrast to our hypothesis. The result implies that a firm looks for new products to make when the firm marks low returns. However, an alternative interpretation is possible. Price cost margins are equal to fixed costs under the zero profit condition in the model in BRS (2009). Therefore, the low price cost margin means low fixed costs that encourage firms to enter the market or add new products. The signs in capital intensity are negative. The result implies that high capital intensity in incumbent firms prevents product adding as we expected..

(Place Table 9-1around here)

In Table 9-2, coefficients in both productivity measures are positive and significant, which is inconsistent with our hypothesis -- 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. On the other hand, the negative sign in the price cost margin is consistent with our hypothesis. The low price cost margin means intense competition encourages firm exit or product dropping. The negative sign in the inverse Herfindahl index also supports our hypothesis. As we expected, high capital intensity discourages firm exits or product dropping, because high fixed costs protect incumbent firms.

(Place Table 9-2 around here)

Table 9-3 shows the estimation results when we use the dummy that shows product adding and product dropping of a firm. Positive signs in both productivity measures imply that firms with high performance switch products aggressively. Negative signs in price cost margin imply that intensely competitive environments encourage product switching. Negative signs in inverse Herfindahl index also support this argument. The coefficients in capital intensity are ambiguous.

(Place Table 9-3 around here)

We also estimate the following equation to examine product switching behavior at the industry level

$$PSrate_{t+j,m} = const. + \beta_1 \Delta REG_{t,m} + \beta_2 PCM_{t,m} + \beta_3 \Delta y_{t,m} + \beta_4 \ln(K_{t,m} / L_{t,m}) + u_{t+1,m} \qquad (2)$$

In Equation (2), $PSrate_{t+j,m}$ 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 denominators of the product adding and entry rates are the number of firms at $t+j$ and of product dropping and exit rates are the number of firms at t. Therefore, estimations of product adding and entry rate explain how an industry is entered or products are added by the firms. $\Delta REG_{t,m}$ denotes the change in regulation measure by industry compiled by the Cabinet Office, Government of Japan from t to $t+j$.[9] A high value in $REG_{t,m}$ implies that industry m is highly regulated. $\Delta y_{t,m}$ represents the growth rate in gross output in industry m in the sample period.

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9 The levels of the regulation measure does not reflect the difference in market regulation by industry, because the indicator is normalized at 1 in 1995. Hence, we take change in the regulation measure as an independent variable.

Table 10-1 and 10-2 show the OLS regression results in Equation (2). The negative and significant signs in the regulation measure in Table 10-1 imply that the product adding rate or entry rate decreases in a highly regulated industry. Monopolistic industries are difficult to not only enter for new firms but also to add products by incumbent firms. In industries where high returns are guaranteed, firm entry or product adding is not encouraged. In Table 10-2, coefficients in $\Delta REG_{t,m}$ are negative and significant when the drop rate is a dependent variable. As in Table 10-1, in industries where high returns are guaranteed, product dropping is not encouraged. On the other hand, coefficients in $\Delta REG_{t,m}$ are positive and insignificant when the exit rate is a dependent variable.

(Place Table 10-1 and 10-2 around here)

The coefficients in high capital intensity are negative and significant in all estimations in Table 10-1 and 10-2. The results imply that firms restrain product switching due to fixed high entry costs and fixed switching costs. Growth in gross output at the industry level stimulates firm entry, product adding, or product dropping.

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

$$(3) \qquad FP_{t,t+j,i} = const. + \sum_{k=1}^{3} \gamma_k PS_{t,t+j,k,i} + \varepsilon_{t+j,t+j,i}$$

In Equation (3), $FP_{t,t+j,i}$ denotes the change in firm performance of firm *i* from *t* to *t+j*. We choose real gross output, number of employees, labor productivity and TFP as variables that represent firm performance. $PS_{t,t+j,i}$ is the product switching dummy described in Equation (1).

Estimation results are shown in Table 11-1 and 11-2. In all estimations, product adding significantly improves growth in output, employment, labor productivity, and TFP. On the other hand, product dropping significantly decreases firm performance. When a firm adds and drops products simultaneously, firm performance, with the exception of labor productivity, improves significantly.

(Place Table 11-1 around here)

However, the above estimation results may include simultaneous bias. Therefore, we created another type of firm performance as an dependent variable: change in firm performance ($FP_{t,t+k,i}$) from 1998 (or 2001) to 2003 (or 2005). In Table 11-2, we estimate Equation (3) where $FP_{t,t+k,i}$ is a dependent variable. In this table, product switching contributes to output, employment and labor productivity, and product dropping contributes to TFP. The result implies that the selection of products through restructuring improves firm performance.

(Place Table 11-2 around here)

Our empirical studies on product switching are summarized as follows. Productivity encourages product switching or exit behavior. Although the results that product dropping and firm exit are stimulated in high productivity firms contradict our hypothesis, they are consistent with the results by Nishimura, Kiyota, and Nakajima (2005) and Fukao and Kwon (2006). The negative and significant coefficients in competition measures such as price cost margin and the inverse of the Herfindahl index imply that intense competition discourages product switching. The increase in fixed costs represented by capital intensity restrains product switching behavior. At industry level, product switching behavior is not stimulated in a highly regulated market.

When we examine the effects of product switching on firm performance, only product dropping through restructuring contributes to improved firm performance such as growth in output, employment, labor productivity or TFP in the short run. However, product switching improves firm performance in the long run.

6. Concluding Remarks

Following BRS (2009), we examined product switching behavior in Japanese manufacturing firms. Using firm-commodity level data in *The Census of Manufacturers*, we found the following results with respect to product switching in Japanese manufacturing firms.

(1) The prevalence of firms producing multiple products, industries and sectors and the distribution of within firm output shares by product in Japan are similar to those in the U.S. described in BRS (2006).

(2) Mean difference in labor productivity in Japanese manufacturing firms is higher than that of U.S. manufacturing firms. The average growth in output from 1998 to 2005 is dominated by the extensive margin in Japan, which is similar to the U.S.

(3) When we examine the determinants of product adding, product dropping and product switching (product adding and dropping), we find that productivity encourages product adding, dropping and switching while fixed costs measured as capital intensity discourages product switching (both product add and drop, and product dropping only), inversely, and encourages product adding only.

(4) At industry level data aggregated from firm level data in *The Census of Manufactures*, the

estimation results show that a regulation measure protects not only entry but also product adding and dropping, and capital intensity discourages all activity of firm dynamics. Moreover, consumer's demand measured as the growth rate of market size stimulates firms to switch their product and firm entry

(5) When we examine the effects of product switching on firm performance, only product dropping through restructuring contributes to improving firm performance measured as growth in output, employment, labor productivity or TFP in the short run. However, product switching improves firm performance in the long run.

From these results, 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. The product switching rate of regulated industries is low. Otherwise, an expansion of the secondhand market also decreases entry costs and encourages product switching.[10] In addition, the expansion of finance from the government owned financial institutions to firms that diversify their products is also helpful.

Our remaining tasks are as follows. First, in our study, we focus on only the domestic market. Table 7 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 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 move abroad from plants that are simply exiting the market. Second, due to the limited availability of data, we focus 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

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[10] Farinas and Ruano (2005) use the intensity of the second hand market as one of indexes of sunk cost. And the index affects firm dynamics of Spanish manufacturing firms.

we consider low productivity growth in the Japanese economy.[11] 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 an additional policy implication for encouraging product switching.

[11] 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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Table1. 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 gasses, 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: The classification of these goods conforms to the Census of 2005. The Japan Standard Industrial Classification (4-digit SICs) was revised in 2002 and the 6-digit SICs were revised in 2001. For consistency, we converted the 2002 revisions using the tool created by METI(http://www.meti.go.jp/statistics/tyo/kougyo/gaiyo/sonota/bunrui/txt/h-cnv14.txt) and converted the 2001 revision numbers on our own.

Table2. 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: These figures were calculated using the industry data in the 2005 Census

Table3. Composition of Total Shipment into Firm Dynamics

Year	Total Products	Continuing Products from t−1	Continuing Products to t+1	Products Added	Products Dropped	Entry Firms	Exit Firms
(billions of yen)							
1998	279.7		191.5		59.4		28.8
2000	291.2	191.2	173.2	62.4	63.2	37.6	54.8
2003	272.3	177.8	196.5	46.6	39.2	47.9	36.6
2005	294.3	229.9		38.3		26.2	
(%)							
1998	100.0		68.5		21.2		10.3
2000	100.0	65.7	59.5	21.4	21.7	12.9	18.8
2003	100.0	65.3	72.2	17.1	14.4	17.6	13.5
2005	100.0	78.1		13.0		8.9	

Table4. Prevalence of Firms Producing Multiple Products, Industries and Sectors

	type of Firm	Percent of Firms	Percent of Output	Mean Products, Industries or Sectors per Firm
Japan (2005)	Single-Product	60	21	1.0
	Multiple-Product	40	79	2.8
	Multiple-Industry	26	71	2.6
	Multiple-Sector	13	53	2.3
U.S. (1972-1997)	Single-Product	59	9	1.0
	Multiple-Product	41	91	4.0
	Multiple-Industry	29	87	3.1
	Multiple-Sector	13	76	2.5

Note: Results for the US (1972-1997) are figures from BRS (2006). The third and fourth columns show the distribution of firms producing single or multiple products, and firms in multiple industries and sectors, and their output (shipment value). The fifth column shows the mean number of products produced, industries and sectors of firms in multiple industries and sectors.

Table5. Distribution of Within-Firm Output Shares, by Product

Average Share of Products in Output of Firms	Number of Products: 1	2	3	4	5	6	7	8	9	10
1	100.0	78.4	67.2	58.7	55.0	51.8	54.2	47.6	45.2	46.3
2		22.0	24.2	24.8	24.2	23.3	22.1	21.7	21.9	22.5
3			9.5	12.2	13.0	13.1	12.5	13.3	14.0	13.0
4				5.5	6.8	7.7	7.6	8.5	9.0	8.1
5					3.0	4.3	4.7	5.4	5.9	5.4
6						2.2	2.6	3.2	3.7	3.9
7							1.1	1.9	2.4	2.7
8								0.9	1.3	1.6
9									0.6	0.9
10										0.4

Table6. Mean differences in some measures in Multiple Product, Multiple Industry and Multiple Sector firms.

	Multiple product	Multiple industry	Multiple sector
Real Output	0.515	0.573	0.632
Employment	0.380	0.492	0.592
Wage per Employment	−0.374	−0.470	−0.564
Labor Productivity	0.223	0.222	0.238
TFP	0.010	0.011	0.012

Note: We calculate the mean percentage differences of these firm measures in 2005 between single and multiple product firms, and multiple industry and sector firms with firm fixed effect. We use dependent variables except the TFP logarithm or employment into independent variables for the estimation of TFP. All differences are significant at the 1% level.

Table7. Breakdown of Total Shipment Growth

Year	Aggregate Growth	Extensive Margins			Firm Entry and Exit			Intensive Margins
		Net	Added Products	Dropped Products	Net	Firm Entry	Firm Exit	
(billions of yen)								
1998-2005	14.7	-14.5	147.3	161.8	-8.6	111.6	120.3	37.8
1998-2000	11.5	3.0	62.4	59.4	8.8	37.6	28.8	-0.2
2003-2000	-18.9	-16.6	46.6	63.2	-6.9	47.9	54.8	4.6
2003-2005	22.1	-0.9	38.3	39.2	-10.5	26.2	36.6	33.4
(%)								
1998-2005	100.0	-98.9	1005.1	1104.0	-58.8	762.0	820.8	257.7

Table8. Product Switching between Single and Multiple Product Firms in Japan

		Japan(98-03)			Japan(00-05)			U.S.		
		All Firms	Single-Product Firms	Multiple-Product Firms	All Firms	Single-Product Firms	Multiple-Product Firms	All Firms	Single-Product Firms	Multiple-Product Firms
Percent of Firms (%)	None	39	67	25	55	70	34	32	46	11
	Add Product(s) Only	7	10	6	8	9	7	11	13	8
	Drop Product(s) Only	14	n.a.	20	9	n.a.	20	12	n.a.	30
	Both Add nad Drop Products	40	23	48	28	21	40	45	41	50
Shipment Weighted Percent of Firms (%)	None	22	67	11	26	70	14	7	49	3
	Add Product(s) Only	7	14	6	7	12	6	5	20	3
	Drop Product(s) Only	10	n.a.	12	12	n.a.	15	7	n.a.	8
	Both Add nad Drop Products	60	18	72	55	17	65	81	31	86

Note: The summary for Japan shows surviving firms' switching behavior between 1998 and 2003. The summary in US is from BRS (2006) and it is aggregated surviving firms' switching profiles between from 1972 to 1997.

Table9-1. Product Switching and Productivity, 1998-2005

	Dependent Variable: Product Add Dummy $_{t, t+j}$					
	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect
PRO $_t$	0.0053	0.0273 ***	0.0410 ***			
(Total Factor Productivity)	0.84	4.12	6.09			
PRO $_t$				0.0074 ***	0.0109 ***	0.0018 *
(Logarithm of Labor Productivity)				10.01	14.17	1.89
PCM $_t$		-0.0039 ***	-0.0038 ***		-0.0043 ***	-0.0037 ***
(Price Cost Margins)		-5.29	-4.98		-6.74	-4.93
$\ln K_t/L_t$			0.0011 *			0.0012 *
(Logarithm of Capital Intensity)			1.82			1.86
RSIZE $_t$	0.0135 ***	0.0144 ***	0.0140 ***	0.0123 ***	0.0118 ***	0.0122 ***
(Relative Firm Size)	22.23	22.95	22.10	22.88	22.26	22.10
sector dummy	Yes	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	709514	709514	578013	709514	709514	578013
R-squared	0.0500	0.0509	0.0490	0.0501	0.0511	0.0489
Chi-squared	44265.20	44383.99	35173.05	44331.22	44607.32	35208.57
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: The table summarizes the probit estimation results of the firm level product switching indicator on the firm's productivity. PCM, capital intensity and firm relative size. We use firm-level sector dummy variables as control variables. The value below each coefficient. ***, **and * are statistical ssignificant at the 1%, 5% and 10% levels.

Table9-2. Product Switching and Productivity, 1998-2005 (continued)

	Dependent Variable Product Drop Dummy $_{t,t+j}$					
	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect
PRO_t	0.0827 ***	0.0840 ***	0.0983 ***			
(Total Factor Productivity)	12.46	12.64	14.78			
PRO_t				0.0129 ***	0.0131 ***	0.0076 ***
(Logarithm of Labor Productivity)				19.11	19.45	9.29
PCM_t		-0.0001 ***	-0.0001 ***		-0.0001 ***	-0.0001 ***
(Price Cost Margins)		-3.84	-3.87		-4.00	-3.79
lnK_t/L_t			-0.0014 **			-0.0016 ***
(Logarithm of Capital Intensity)			-2.45			-2.71
$RSIZE_t$	0.0156 ***	0.0157 ***	0.0153 ***	0.0111 ***	0.0111 ***	0.0111 ***
(Relative Firm Size)	16.88	16.88	16.58	18.00	17.98	17.56
sector dummy	Yes	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	709514	709514	578013	709514	709514	578013
R-squared	0.0398	0.0398	0.0383	0.0400	0.0400	0.0380
Chi-squared	30700.61	30711.16	24353.43	31265.28	31290.94	24530.66
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: See the note in Table 9-1.

Table9-3. Product Switching and Productivity, 1998-2005 (continued)

	Dependent Variable: Both Product Add and Drop Dummy $_{t, t+j}$					
	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect	marginal effect
PRO $_t$ (Total Factor Productivity)	0.0933 ***	0.0949 ***	0.1068 ***			
	16.35	16.64	18.43			
PRO $_t$ (Logarithm of Labor Productivity)				0.0054 ***	0.0056 ***	0.0009
				8.63	9.01	1.11
PCM $_t$ (Price Cost Margins)		-0.0001 ***	-0.0001 ***		-0.0001 ***	-0.0001 ***
		-4.00	-4.07		-4.00	-3.92
$\ln K_t/L_t$ (Logarithm of Capital Intensity)			-0.0015 ***			-0.0009 *
			-2.80			-1.77
RSIZE $_t$ (Relative Firm Size)	0.0114 ***	0.0115 ***	0.0114 ***	0.0079 ***	0.0079 ***	0.0081 ***
	17.30	17.31	16.99	17.11	17.08	16.83
sector dummy	Yes	Yes	Yes	Yes	Yes	Yes
year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	709514	709514	578013	709514	709514	578013
R-squared	0.0469	0.0469	0.0451	0.0465	0.0466	0.0445
Chi-squared	32977.20	33000.19	26286.10	33081.19	33107.56	26208.20
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: See the note in Table 9-1.

Table10-1. Estimation of Product Add and Firm Entry Rates and Industry Characteristics using Industry-Level Data

	Add Rate $_{t-j, t}$		Entry Rate $_{t-j, t}$	
	coefficietnt	coefficietnt	coefficietnt	coefficietnt
⊿REG $_{t-j, t}$ (Regulation)	-0.2442 ***	-0.2552 ***	-0.0129 ***	-0.0078 **
	-5.53	-5.09	-3.39	-2.01
ln(K/L) $_{t-j}$ ogarithm of Capital Intensity)	-0.0211 ***	-0.0217 ***	-0.0037 *	-0.0074 ***
	-3.87	-3.42	-1.77	-3.30
⊿lnY $_{t-j, t}$ (Growth of Market Size)	0.1179 ***	0.1428 ***	0.0179 **	0.0158 *
	6.24	5.74	2.45	1.79
PCM $_{t-j}$ (Price Cost Margins)		-0.0108 **		-0.0028
		-1.98		-1.46
constant	0.4596 ***	0.3955 ***	0.1423 ***	0.1462 ***
	14.35	10.76	11.69	11.23
Year Dummy	Yes	Yes		
Observations	1614	1145	1618	1149
R-squared	0.1501	0.1726	0.0778	0.1009
F-value	56.7989	39.5715	27.1987	21.3664
p-value	0.0000	0.0000	0.0000	0.0000

Table10-2. Estimation of Product Drop and Firm Exit Rates and Industry Characteristics using Industry-Level Data

	Drop Rate $_{t-j, t}$		Exit Rate $_{t-j, t}$	
	coefficietnt	coefficietnt	coefficietnt	coefficietnt
⊿REG $_{t-j, t}$ (Regulation)	-0.2310 ***	-0.2505 ***	-0.0156	0.0059
	-5.07	-4.88	-0.68	0.24
ln(K/L) $_{t-j}$ ogarithm of Capital Intensity)	-0.0280 ***	-0.0335 ***	-0.0417 ***	-0.0454 ***
	-4.13	-4.25	-12.37	-12.04
⊿lnY $_{t-j, t}$ (Growth of Market Size)	0.0981 ***	0.1534 ***	-0.0915 ***	-0.0936 ***
	3.96	5.04	-7.31	-6.32
PCM $_{t-j}$ (Price Cost Margins)		-0.0191 ***		-0.0044
		-2.77		-1.31
constant	0.3890 ***	0.4028 ***	0.4135 ***	0.4293 ***
	9.80	8.79	20.97	19.61
Year Dummy	Yes	Yes	Yes	Yes
Observations	1076	754	1079	756
R-squared	0.2158	0.2617	0.2350	0.2858
F-value	73.6993	53.0272	82.4986	60.0309
p-value	0.0000	0.0000	0.0000	0.0000

Table11-1. Product Switching and Change in Firm Performance

	⊿lnY$_{t, t+j}$		⊿lnL$_{t, t+j}$		⊿lnLP$_{t, t+j}$		⊿TFP$_{t, t+j}$	
	coefficient		coefficient		coefficient		coefficient	
Product Add Only $_{t, t+j}$	0.0494	***	0.0252	***	0.0187	***	0.0009	**
	17.99		13.50		7.24		2.34	
Product Drop Only $_{t, t+j}$	-0.0428	***	-0.0256	***	-0.0164	***	-0.0004	
	-10.69		-9.34		-4.55		-0.76	
Product Add and Drop $_{t, t+j}$	0.0093	***	0.0047	***	0.0012		0.0008	**
	3.42		2.61		0.46		2.26	
Year dummy	Yes		Yes		Yes		Yes	
Observations	706827		703741		703741		706827	
R-squared	0.5309		0.4267		0.5797		0.5473	
F-value	11644.46		5459.65		18220.70		14773.12	
p-value	0.0000		0.0000		0.0000		0.0000	

Note: This table summarizes the results of fixed effect estimation with industry fixed effect. Each dependent variable is a logarithm of differences in a firm's performance between t-j and t, and a switching dummy indicates a product add (or drop) between t-j and t. We use year dummy variables as control variables. The values below each coefficient are t-values and ***, ** and * are statistically significant a the 1%, 5% and 10% levels.

Table11-2. Product Switching and Change in Firm Performance

	⊿lnY$_{t, t+k}$		⊿lnL$_{t, t+k}$		⊿lnLP$_{t, t+k}$		⊿TFP$_{t, t+k}$	
	coefficient		coefficient		coefficient		coefficient	
Product Add Only $_{t, t+j}$	0.0102	**	0.0041		0.0043		-0.0019	***
	2.28		1.29		0.93		-2.96	
Product Drop Only $_{t, t+j}$	0.0030		-0.0008		0.0038		0.0012	*
	0.63		-0.25		0.79		1.87	
Product Add and Drop $_{t, t+j}$	0.0150	***	0.0067	**	0.0078	**	-0.0014	**
	3.96		2.54		2.01		-2.43	
Year dummy	Yes		Yes		Yes		Yes	
Observations	398965		396290		396290		398965	
R-squared	0.6318		0.4683		0.6238		0.5633	
F-value	10847.97		4105.97		14306.47		8514.55	
p-value	0.0000		0.0000		0.0000		0.0000	

Note: See the note of Table 11-1.

Figure1

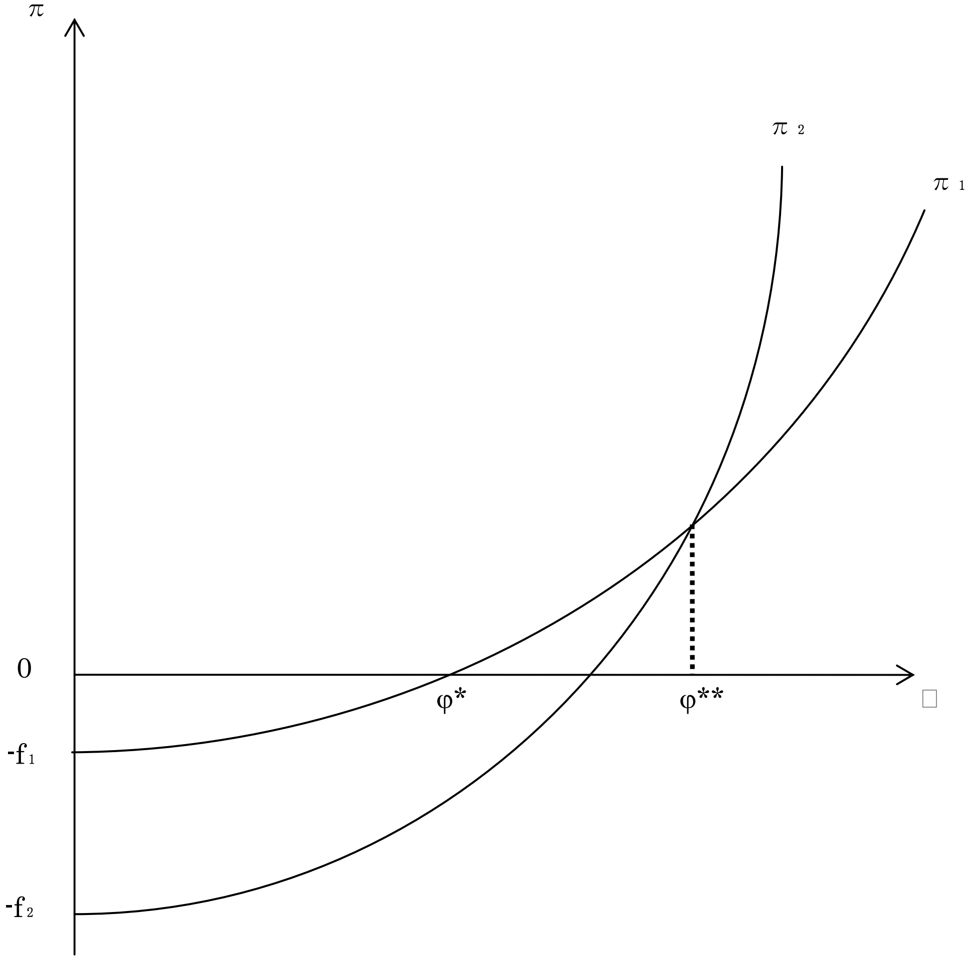

Figure2. Definition of Product Switching Definition of Product Switching