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INDUSTRIAL PERFORMANCE AND COMPETITION IN DIFFERENT BUSINESS CYCLES: THE CASE OF JAPANESE MANUFACTURING[1]

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Keywords: Profitability, Concentration and Profit Adjustments

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Abstract

The international competitiveness of the Japanese manufacturing sector has been diminishing since 1985 due to the 'hollowing out' effect. In the early phase of its industrialisation program Japan had protected its domestic market. Japanese industries are more concentrated compared to their U.S. counterpart. Recent Japanese governments have embarked on a policy of structural reforms. Industrial policies play a major role in this respect. Technological changes, international competition and reducing barriers in domestic and international markets will help to speed up this reform process. The paper analyses the competitive process and performance behaviour of Japanese manufacturing over the period from 1985 to 1997. Variables representing scale economies, size and openness are used in explaining profit behaviour of manufacturing firms. Findings are compared with other developed countries such as the U.S. and Australia.

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I. INTRODUCTION

Seventy-five percent of global GDP comes from seventeen countries in the world. Japan is third among them after the USA (22%) and China (11.5%), contributing 7.3% to the world's GDP in 2000-2001. Net household wealth (financial and non-financial assets - liabilities) in Japan has been the highest among the OECD countries for the last twenty years, even though it has been falling slowly over time. Flath (2000) reports Japan has experienced twelve recessions since 1960.

These recent recessions contrast starkly with the exemplary success story of the sixties and seventies, when an average growth rate of about 4% was achieved. The Japanese growth model was held up as a case study for other developing countries. Lifetime employment, the long-term relationship between businesses and banks, high savings and investment are believed to have created the strong growth. While the nature and the frequency of the current recessions appear to be cyclical in nature, the underlying macro-economic indicators, the severity of each recession, and relative ineffectiveness of the remedial measures point to deep-seated problems in the economy which are structural in nature.

Combinations of development policies since World War II have transformed Japan slowly into a deformed dual economy. Productivity of manufacturing has declined substantially over time to support the inefficient service sectors. [2] Since the Plaza Accord (an agreement among representatives of the monetary authorities of the USA, Japan, the UK, West Germany, and France to coordinate their monetary policies so as to precipitate a depreciation of the US dollar) started in 1985, there has been a so-called 'hollowing out' of Japan's manufacturing industries. This was due to the strong yen and to the massive increase in outward foreign direct investment (FDI). This resulted in a net loss of Japanese jobs to the rest of Asia, the USA and South America.

Since 1995, the Bank of Japan has intervened in the money market to gradually devalue the yen as a remedial measure. The current Japanese government has fundamentally overhauled and strengthened its program for structural reform stressing the slogan 'no growth without reform'. The analysis of performance in manufacturing during the mid 1980s and 1990s is important in analysing the changes in reform programs.

This paper has two objectives. The first objective is to investigate whether differences in performance (measured in profits) persist over time for Japanese manufacturing and relate this with different phases of business cycle. We then present evidence on the relationship between the inter-temporal characteristics of industry profit rates and other industry attributes. Secondly, we identify important factors, which may influence the adjustment of profits during this period of time.

The paper is organised as follows. Section II reviews the relevant literature. Section III describes the short-run and long-run versions of the profit model and data sources of the variables. Section IV analyses the empirical findings. Section V summarises the major findings and indicates policy implications of our results.

[2] See Sumiya, M. (2000) for the history of Japanese industry and trade policy.

II. CHANGES IN PROFITS: AN INDICATOR OF COMPETITIVE FORCES

In Japan, companies like Fuji Film, Toyota, Matsushita, Nippon Steel and others enjoy commanding positions compared to their domestic rivals. Japanese industries are more concentrated compared to their U.S. counterpart.[3] Market power of big businesses allows firms to make economic profits.[4] In a highly competitive industry, the economic profit of a firm will compete away swiftly, while a firm in a less competitive industry can use its market power to raise the price it charges and maintain positive economic profits. Mueller (1977, 1985) discusses the reasons for the persistence of profits above the long-run competitive level. This is due to the entry barriers and strategic behaviour by the incumbents. Levy (1987) considers a dynamic profit model with panel data for U.S. manufacturing industries. An incomplete adjustment is considered when past profits differs from future expected profits. The conclusion suggests that the adjustment process is relatively fast.

Using data from Japanese manufacturing for 1964-80, Odagiri and Yamawaki (1986) find that the profit level persists over time for Japanese manufacturing but the movement of profits is much more volatile in Japan compared to the U.S. industries. Using a similar data set for 1958-82, Odagiri and Yamashita (1987) establish that the high mark-up for concentrated industries varies due to business fluctuations.

[3] Flath (2000), see figure 12.1, pp248.
[4] For discussion on Japanese industrial organization, see Caves, R.E. and Uekusa, M (1972).

III. PROFIT MODELS AND DATA

A. When Profit is At Equilibrium Level

Do dominant firms tend to maintain, or even increase, their market dominance? This has policy implications in competition policy arena and has relevance in current structural reform programs in industrial sector. To answer this, first we consider a short-run (equilibrium) profit model across industries. In a simple world, in the absence of dynamic adjustments, we explain the industry price-cost margins (an indicator of performance) using the following equation:

$$PROFIT^{*}_{it} = a_0 + a_1 \underset{+}{CR4_{it}} + a_2 \underset{+}{INVEST_{it}} + a_3 \underset{+}{ADV_{it}} + a_4 \underset{+}{RD_{it}} + a_5 \underset{-}{EXPINT_{it}} + a_6 \underset{-}{IMPINT_{it}} + \varepsilon_{it} \qquad (1)$$

On the L.H.S. of (1), the price-cost margin variable is not directly observable, so that PROFIT is used as the dependent variable.[5] Concentration (CR4) is the market share of the top four firms, representing the degree of monopoly power.[6] Therefore, a positive relationship is expected with mark-up. Following Imai (1980), industry concentration in Japan declined in the 1960s but has increased in the 1970s.[7]

From the 1950s till the mid 1980s Japanese autos, electronics and other export industries developed and used world-class technology, which gave rise to the nickname "Japan Inc". To capture the technology, a investment-sales-ratio

[5] PROFIT is (price-marginal cost)/price, as marginal cost is not observable we consider here average cost and hence gross price margin.
[6] See Senö, A.(1983), Unotoro, K. (1988)

(INVEST) is introduced. A positive sign is expected with PROFIT. ADV, which is advertising-intensity, increases the degree of product differentiation and may act as an entry barrier to new firms. RD represents research and development intensity. It requires entrants to spend heavily on new technology and products. This is also an entry barrier and has a positive effect on PROFIT.[8]

The impact of export intensity (EXPINT) on profits depends upon the degree of competitiveness of industry at home compared to the world market. In the case of Japanese manufacturing, the strong yen persisted over the period of our study. The 'hollowing out' effect has a negative effect on domestic profit.[9] A negative sign is expected with the PROFIT of domestic industries.[10]

PROFIT will be lower in industries with a greater degree of competition from imports. Hence a negative sign can be expected with import intensity (IMPINT). A highly protected domestic market creates inefficient industries.[11]

Finally, we have included a disturbance term ε_{it} in equation (1), which is normally distributed with zero mean and constant variance, and includes all other omitted random factors for each industry at a particular time period 't'.

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[7] Ryan (1997) compares the trends in market power and productivity growth of manufacturing in US and Japan between 1965 and 1984. For both countries productivity and market power declined over the period, which implies competition is increasing.

[8] The Japanese Science and Technology Agency (STA) surveyed the research activities of 1,301 private sector manufacturing firms in 1996 with a 63.9% response. According to the report, R&D expenditures of the respondent companies totalled 7,402.20 billion yen against sales of 207,700 billion yen in 1990.

[9] Doi (1990) explains the damaging effect on profit performance of exporters due to the strong yen during the period of our study.

[10] In the early 1990s, the share of exports out of total sales was 25 percent for the top 1,000 companies; by 1996 it had declined to 20 percent.

[11] In the case of Japan, barriers to imports result in barriers to exports. This is due to the higher domestic prices of inputs, which are used in the export sector.

B. Adjustment Process: when Profits Differ from Short-run Equilibrium

Adjustment of Profits are Similar Across Industries

A standard partial adjustment model is adopted. The direction of the change in profits is a function of actual profits relative to the steady-state level ($PROFIT^*$). Unlike standard models, the steady-state profit ($PROFIT^*$) is a function of the determinants explained in equation (1). Any deviation of the actual level of profits from its steady-state level results in an adjustment process that leads to changes in profits for industry 'i' for the 't' period. An incomplete adjustment is allowed for in a partial adjustment model given by:

$$\Delta PROFIT_{it} = PROFIT_{it} - PROFIT_{it-1} = \xi (PROFIT^*_{it} - PROFIT_{it-1}) \qquad (2)$$

Where $\Delta PROFIT_t$ is the change in profits (in absolute term) between two periods. For empirical purposes, we assume t=current period and t-1=previous period. ξ is the rate of adjustment and remains *constant*. ξ is between zero and one. $PROFIT^*_t$ is the equilibrium level of profits in period t and is determined as in (1).

Substituting (1) into (2) to remove the unobservable equilibrium profits level, $PROFIT^*_t$ and solving for $PROFIT_t$ gives the following equation for the dynamic model.

$$PROFIT_{it} = \xi (a_0 + a_1 CR4_{it} + a_2 INVEST_{it} + a_3 ADV_{it} + a_4 RD_{it} + a_5 EXPINT_{it}$$

$$\qquad\qquad + \qquad\qquad + \qquad\qquad + \qquad\qquad + \qquad\qquad -$$

$$+ a_6 IMPINT_{it}) + (1-\xi) PROFIT_{it-1} \tag{3}$$

$$- \qquad\qquad +$$

When equations in the form of (3) are estimated using ordinary least squares technique, the coefficient of the lagged margin variable $PROFIT_{t-1}$ gives the estimate of one minus the partial adjustment. The coefficients of the remaining explanatory variables are estimates of the long-run impact multiplied by the partial adjustment. Both equilibrium and linear versions of the dynamic profit models are estimated by the Ordinary Least -Squares method.

Adjustment of Profits Vary Across Industries

Adjustment process may varies across industries, this is considered as follows:

$$\Delta PROFIT_{it} = PROFIT_{it} - PROFIT_{it-1} = \xi_i (PROFIT^*_{it} - PROFIT_{it-1}) \tag{4}$$

Where ξ_i is the partial adjustment for the ith industry. ξ_i should be non-negative and less than one for all values of its determinants. ξ_i is specified as a function of variables related to the internal and external adjustment process of the industry.[12] We consider ξ_i to be a function of lagged concentration, measured by the four-firm concentration ($CR4_{t-1}$), RD and growth (G).

[12] Bhattacharya and Bloch (2000a) considers the dynamics of concentration for Australian manufacturing.

High lagged concentration may cause higher profit in the previous period due to market power or superior performance of the larger firms. In the absence of effective barriers, this may lead to faster adjustment of profits towards equilibrium in period t. However, if entry barriers are effective, industries with high lagged concentration may generate higher profit in period t. In this situation, profit adjustment will be slower. The effect of $CR4_{t-1}$ on ξ can be in either direction.[13]

Research and development intensity (RD) as an entry barrier should be negatively related to the speed of adjustment. High growth in demand ($G_{t,\,t-1}$) will lead to faster adjustment of profit; therefore a positive sign is expected. If the relationship between the variables of interest and the degree of adjustment is assumed to be linear, we have

$$\xi_i = \alpha_0 + \underset{+/-}{\alpha_1 CR4_{it-1}} + \underset{-}{\alpha_2 RD_{it}} + \underset{+}{\alpha_3 G_{it,\,t-1}} \tag{5}$$

The partial adjustment coefficient in (5) is not directly observable. Substituting (1) and (5) into (4) and solving for $PROFIT_{t-1}$, gives a non-linear form as follows with all variables observable:

$$PROFIT_{it} = (\alpha_0 + \alpha_1 CR4_{it-1} + \alpha_2 RD_{it} + \alpha_3 G_{it,\,t-1})(a_0 + a_1 CR4_{it-1} + a_2 INVEST_{it} + a_3 ADV_{it} + a_4 RD_{it} + a_5 EXP_{it} + a_6 IMP_{it} + PROFIT_{it-1}) + PROFIT_{it-1} \tag{6}$$

The signs of the above variables are followed from equations (1) and (5). Equation (6) will be estimated using the non-linear estimation technique; each coefficient gives a direct estimate of the parameter of the underlying model. The estimated partial adjustment coefficient for profits for each industry will be determined indirectly by multiplying the industry value of each of the variables, $CR4_{t-1}$, RD_t and $G_{t,\,t-1}$, by its estimated coefficient, and then adding the estimated constant, α_0.

C. *The Data*

The Japanese industries are matched with the U.S. Standard Industrial Classification. Data for most of the variables are taken from *Census of Manufacturers* and *Input-Output table* published by the Ministry of Economy, Trade and Industry (METI) and the concentration data are from the Japan Fair Trade Commission (JFTC). The choice of the time period i.e., between 1985 and 1997 was dictated by the availability of data. Considering all variables after matching industries we ended up with 76 industries. The descriptions of the variables together with detailed data sources are given in the Appendix 1a.

IV. THE EMPIRICAL FINDINGS

Watchel and Adelsheim (1977, hereafter WA) and Cowling (1983) argue the firms in concentrated industries tend to increase their profits during the recessionary

[13] Doi, N. (2001) reports that the larger concentration coexists with less volatility in case of Japanese manufacturing.

phase of a business cycle compared to an expansionary one.[14] WA argues that the firms try to recover their lost revenue from the declining sales during recession through increasing the mark-up. Following Cowling's argument, the existence of excess capacity during recession encourages the threat of retaliation and collusion among firms.

The fluctuations of mark-up with business cycle in concentrated industries may vary across countries. Qualls (1979) using US data for manufacturing and Neumann, Bobel and Haid, (1983) with German manufacturing produce different results. Their findings support the positive effect of concentration on price-cost margin during the peak years of the business cycle. Odagiri and Yamashita (1987) also found different results using Japanese manufacturing data from 1958-82. They conclude "...the Japanese evidence is inconsistent with the WA hypothesis and, if there is any systematic tendency at all, the high-concentration industries seem to be relatively decreasing their mark-ups in recession and increasing them in expansion".

PLEASE INSERT TABLE 1 NEAR HERE

Table 1 presents the average percentage change in mark-up (or profit) for each period and for high-concentration industries (50≤CR4) and low-concentration industries (CR4<50), where CR4 is four-firm concentration ratio.[15] Annual percentage change in mark-up was the largest and positive for high-concentration

[14] Watchel and Adelsheim (1977) use data from the U.S. manufacturing whereas Cowling (1983) uses U.K. data.

industries during 1991-95, while it is negative both for the expansionary phase (1985-90) and recovery phase (1996-97) of the business cycle.[16] It is apparent from Table 1; at least for the period of our analysis, the WA or Cowling hypotheses are supported for Japanese manufacturing industries, which is contrary to the findings of Odagiri and Yamashita (1987).[17]

Although WA and Cowling's analysis of the profit-concentration relationship in business cycles was quite popular during the 1970s and 1980s, many studies have established that the concentration (or market share of the leading firms in industries) is not the only determinant of profits. To get the complete picture, we consider the short- run and long-run versions of the profit model as discussed in Section III.

Table 2 presents the estimation results when PROFIT is estimated for short-run and long run periods considering other control variables. Columns (1), (3) and (5) present the findings from the short-run model for the years 1990, 1995 and 1997. CR4 is significant and positive at the one-percent level for all three years. The coefficient of CR4 is slightly smaller for 1995, the recessionary period, compared to the coefficients for 1990 and 1997. The INVEST and ADV variables are not significant. The RD variable is positive and significant at the one percent level for all three years. This suggests that R&D expenditure is significant in increasing the profit level of Japanese manufacturing industries.

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[15] Average CR4 of the full sample is 0.505.

[16] Phases of business cycles are considered from the Economic Planning Agency.

[17] The period considered by Odagiri and Yamashita (1987) had six very short-lived recession periods. The downturn in our analysis is long-lived and had a significant negative impact on the Japanese economy.

PLEASE INSERT TABLE 2 NEAR HERE

Among the foreign influence variables, EXPINT has negative and significant influence for all three years, but the effect is stronger during the 1995 recession compared to 1990 and 1997. IMPINT is insignificant and has a negative effect on PROFIT for 1995 and 1997. The explanatory power for the short-run regression models, which varies from 14 to 19 percent, is low but comparable with other studies.[18]

Columns (2), (4) and (6) present the findings from the long-run model for the periods 1985-90, 1991-95 and 1996-97 while Column (7) gives the long-run profit for the full period i.e. 1985-97. Except for 1996-97, CR4 is insignificant for the other two time periods. Even for 1996-97, it is positive and significant only at the ten percent level. The K/S variable is positive and significant for the period of expansion i.e., for 1985-90 and it also has a strong positive effect on PROFIT for the full period i.e., 1985-97. The ADV and RD variables are not significant in determining profits for any of these time periods.[19] Except for 1996-97, EXPINT variable is negative and significant for the other time periods. The IMPINT variable is also negative and significant only for 1991-95, 1996-97 and for the full period i.e. 1985-97. The lagged profit (PROFITLAG) variable is positive for every period and significant at the one percent level. Hence the restriction that full adjustment to

[18] Odagiri and Yamashita (1987) estimate the rate of change of mark-up for the period of 1958-82. The R^2 varies from 0.03 to 0.29. Bhattacharya and Bloch (1997) estimate profit models with t Australian manufacturing data for 1984-85. The value of R^2 (adjusted) varies from 0.04 to 0.16.

long-run equilibrium is achieved during the period, and ξ=1, is clearly rejected. The partial adjustment over the period is 1 minus the estimated coefficient of PROFITLAG.

Using the formula in Appendix 1b, the annual rate of adjustment for the expansion period is 8.53 percent while the same value is 8.08 percent during recession i.e., 8.08 percent. The annual adjustment of the full twelve-year period is 9.45 percent. Bhattacharya and Bloch (2000b) find the annual adjustment of profit for Australian manufacturing was 10 percent per annum between 1977-78 and 1984-85. This suggests that the adjustment of profits in Japanese manufacturing is considerably slower even after a decade compared to other developed countries such as Australia. This is also supported by the only existing study by Odagiri and Yamawaki (1986). They compare the persistence of profits between the US and Japanese industries over 1964-80 using company level data.[20]

The adjusted R^2 varies from 77 percent for the regression of the full period model to 92 percent for the regression of the recovery period. These are significantly higher than the steady-state or short-run versions of the model.

Table 3 presents the findings of the non-linear version of dynamic model, when ξ varies across industries. The maximum likelihood estimation technique is used to estimate the equations in Equation (6).

[19] ADV and RD variables may act as endogenous sunk costs to the firms, hence the simultaneous technique could be more relevant in this respect.

[20] Producer coordination in the form of collusive arrangement or temporary cartels make the cost structure of the firms similar within an industry. Lower diversification and the Japanese management system results in the equalisation of profits across companies. But the persistence of inter-industry profits was much higher than the U.S. counterpart.

PLEASE INSERT TABLE 3 NEAR HERE

Columns (1), (2), (3) and (4) present the regression findings of the considered four periods. Section (a) of each column represents the steady-state part of the equation; CR4 is significant with a positive sign only for the recovery period, i.e., 1996-97 but has negative signs for 1985-90 and 1991-95.[21] INVEST is significant and positive for the expansionary period i.e. 1985-90 and for the full period 1985-97. RD has a positive and significant effect on PROFIT only for the expansion phase. The sign of EXPINT is always negative and significant except for the recovery period. IMPINT has a negative influence on PROFIT only for the recessionary period, i.e., 1991-95.

Section (b) of each column presents the findings for determining the rate of adjustment of PROFIT. Lagged concentration (CR4LAG) has a significant positive effect for the expansionary and recovery periods but has a significant negative effect for the full period i.e., between 1985 and 1997.

The research and development intensity (RD) variable has the expected negative sign and is significant at the one percent level for all four periods. This implies R&D intensity was a driving force of competitiveness and profit adjustment during the full period irrespective of the phases of the business cycle.

[21] In presence of cartel and formal agreements among business groups create 'excessive competition' among firms.

The GR variable is positive and significant both for the expansionary and recovery periods. This suggests that growth in demand had a significant effect on profit adjustment during 1985-90 and 1996-97.

Multiplying the estimated coefficients by the values of the variables yields estimates of the partial adjustment of profits for each industry. The mean value for the expansionary period is seven times higher than the recession period. Over forty percent of industries partial adjustment lies above the average value for 1985-90. Table 4 presents the detailed descriptive statistics for the four periods. Except for the recovery period i.e., 1996-97, the non-linear version is found to be superior compared to the linear one.[22]

PLEASE INSERT TABLE 4 NEAR HERE

V. CONCLUDING REMARKS

The late 1980s bubble was a major source of current macroeconomic crisis. This study examines the profit behaviour of manufacturing industries from 1985 to 1997, which captures a very important time period for the Japanese economy. Profit margins of industries are considered as an indicator of performance. Profit models are developed from the traditional industrial organisation (IO) literature on structure-conduct-performance. We consider the periods of expansion, recession

[22] We performed the likelihood ratio test. The log-likelihood ratio is 17.72, 17.48, 8.13 and 35.55. Thus, except for the third period the null hypothesis is rejected .The critical value is χ^2_4=13.277 at the one percent level.

and recovery through analysing data for the full economic cycle. Traditional structural variables like concentration, R&D intensity and export intensity are found to be significant in the case of the short-run equilibrium model. Concentration and R&D intensity have a significant positive effect on industry profits while export intensity has a significant negative effect on expansion, recession and recovery periods.

In the case of the dynamic model with constant adjustment among industries, adjustment varies from 5 to 9 percent per annum. This is slower than other industrialised countries such as Australia. In case of U.S. industries, Levy (1987) suggests that the profit adjustment process was complete within a four to five year period. Recent government initiatives in industrial reform programs in Japan may help in changing adjustment process of company/business performance. However this is heavily dependent on current macroeconomic and fiscal barriers in relation to international market, which is not considered in this study.

The variable adjustment model suggests the importance of lagged concentration, research and development intensity and growth in domestic demand for each industry in determining the adjustment process. To place more emphasis, our findings suggest that the adjustment on industrial performance is sensitive to industry structure, scope on research and development and domestic market demand in case of Japan.

Moreover, the variable adjustment model performs better in terms of both signs and significance during 1985-90 and 1996-97. Following the non-linear version of our model, the average value of adjustment is greater than one during expansion and recovery periods, which implies excessive adjustment towards the equilibrium level. Industries with estimated adjustment coefficient greater than one mostly centre on automobile and electronic products. These industries have gone through significant changes over this period.

There are several limitations of our study. Variables of tariff protection, foreign investment and uncertainties are not considered in the model due to the absence of proper data source at the industry level. Also the inter-industry type study may not capture the intra-industry variations in explaining the competitive process.

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Table 1: Average Percentage Changes in Mark-up (PROFIT) by Degree of Concentration

Period	High-concentration industries	Low-concentration industries
1985-90 expansion	-1.063	-1.160
	(1.021)	(2.291)
1991-95 recession	0.264	-0.071
	(1.562)	(1.591)
1996-97 recovery	-10.075	0.027
	(3.494)	(0.125)

Notes: High-concentration industries are with $50 \leq CR4$, Low-concentration industries are with $CR4 < 50$. Values in parentheses are the variances.

Table 2: Findings from the Short-run Model and Long-run Model, when ξ is Constant Across Industries

Period/ Variable	Short-run version, 1990	Long-run version 1985-1990, expansion	Short-run version, 1995	Long-run version 1991-1995, recession	Short-run version, 1997	Long-run version 1996-1997, recovery	Long-run version 1985-1997, full period
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PROFITLAG	-	0.733[a] (9.392)	-	0.765[a] (14.880)	-	0.944[a] (22.870)	0.650[a] (15.951)
CR4	1.332[b] (2.453)	-0.035 (0.145)	1.207[a] (3.017)	0.196 (1.053)	1.269[a] (3.113)	0.306[c] (1.498)	0.188 (0.804)
K/S	0.660 (0.697)	1.466[b] (1.662)	0.321 (0.463)	-0.159 (0.324)	0.587 (0.854)	-0.501[b] (1.567)	1.062[a] (2.693)
ADV	-17.051 (1.132)	-3.275 (0.690)	-9.626 (0.810)	2.173 (0.430)	1.165 (0.060)	-1.262 (0.217)	4.848 (0.559)
RD	21.945[a] (3.126)	3.248 (1.188)	13.971[a] (2.653)	-0.513 (0.296)	15.669[a] (2.926)	1.029 (0.895)	3.136 (0.559)
EXPINT	-1.500[b] (2.078)	-0.796[c] (1.587)	-2.143[a] (3.523)	-0.99[a] (2.451)	-1.333[c] (1.402)	-0.373 (0.766)	-1.818[b] (1.890)
IMPINT	0.150 (0.099)	0.292 (0.517)	-0.085 (0.139)	-0.231[c] (1.409)	-0.703 (0.573)	-0.359[c] (1.567)	-0.068[b] (1.841)
Intercept	-1.978	-0.506	-1.623	-0.090	1.994	0.005	-0.663
R^2 (adjusted)	0.152	0.781	0.147	0.810	0.193	0.922	0.774

Note: PROFIT is the dependent variable.

Figures in parentheses are heteroscedastic consistent t-ratios.

a Indicates coefficient is significant at the 0.01 level using a one-tailed t-test.

b Indicates coefficient is significant at the 0.05 level using a one-tailed t-test.

c Indicates coefficient is significant at the 0.10 level using a one-tailed t-test.

Table 3: The Findings from the Long-run model, when ξ varies across Industries (Non-Linear Maximum Likelihood Estimation)

Period	1985-1990 Expansion (Column 1)		1991-95 Recession (Column 2)		1996-97 Recovery (Column 3)		1985-97 Full Period (Column 4)	
Variable	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
CR4	-0.405[c] (1.307)	-	-1.659[b] (2.120)	-	2.693[a] (5.919)	-	-0.369 (1.134)	-
K/S	2.636[a] (3.520)	-	-0.771 (0.658)	-	-0.746[b] (1.690)	-	1.975[a] (2.778)	-
ADV	0.650 (0.068)	-	-2.259 (0.182)	-	-2.494 (0.294)	-	7.590 (0.502)	-
RD	9.680[c] (1.460)	-	-9.024[c] (1.462)	-	-0.407 (0.294)	-	5.125 (0.679)	-
EXPINT	-2.026[b] (2.106)	-	-1.634[c] (1.343)	-	-0.558 (1.039)	-	-1.415[c] (1.333)	-
IMPINT	0.391 (0.586)	-	-1.582[b] (1.815)	-	0.498 (1.210)	-	-0.015 (0.041)	-
CR4LAG	-	0.946[c] (1.311)	-	0.609 (1.113)	-	2.041[a] (4.487)	-	-2.002[b] (2.079)
RD	-	-16.568[a] (4.760)	-	-11.134[a] (2.780)	-	-7.519[a] (2.452)	-	-16.958[a] (3.957)
G	-	1.704[c] (1.648)	-	1.342 (1.170)	-	2.908[a] (4.148)	-	0.674 (0.958)
Intercept	-0.355	1.349	2.201	0.249	-0.577	-1.586	-0.394	2.420
Likelihood Ratio Test Statistic	17.72[d]		17.48[d]		8.13		35.55[d]	

Notes: PROFIT is the dependent variable.

Figures in parentheses are t-ratios.

a Indicates coefficient is significant at the 0.01 level using a one-tailed t-test.

b Indicates coefficient is significant at the 0.05 level using a one-tailed t-test.

c Indicates coefficient is significant at the 0.10 level using a one-tailed t-test.

d Critical value is χ^2_4=13.277 at the one percent level

Table 4: Descriptive Statistics of Adjustment Coefficients over the Periods of Business Cycle with Varying Adjustment Rate

Period	Mean	Maximum	Minimum	Variance
Expansionary (1985-90)	1.932	3.409	0.631	0.354
Recessionary (1991-95)	0.258	1.183	-0.612	0.150
Recovery (1996-97)	0.874	1.766	-0.214	0.376
Full Period (1985-97)	1.129	2.077	0.126	0.355

Appendix 1a: Description of the Variables with Data Sources

Variables	Definition	Data Source
PROFIT	(Value added – Wages and salaries)/(Value added + Cost of Input)	1
CR4	Industry sales accounted by the top four firms divided by total industry sales	3
INVEST	Fixed Asset/Total Sales	2
ADV	Advertising costs/Total Sales	2
RD	Research & development expenses/ Total Sales	2
EXPINT	Exports/Total Sales	2,4
IMPINT	Imports/Total Sales	2,4
G	Changes in Total Sales between two periods	2

Note: 1. METI (various years), *The Census of Manufacturers, Report by Industry*. 2. Financial Sheets of each firm are accessed from the Nikkei Economic Electronic Databank System (NEEDS) of the Nihon Keizai Shinbun Inc. 3. Fair Trade Commission (JFTC, various years), Cumulative Production Concentration and Herfindahl Index in Major Industries, Tokyo: JFTC (in Japanese) . 4. METI (various years), *The Input-Output Table*.

Appendix 1b: Calculation of Annual Adjustment Rates of Profits

<u>Linear Model</u>

$PROFIT_t - PROFIT_{t-1} = \xi\,(PROFIT_t^* - PROFIT_{t-1})$

$PROFIT_t - PROFIT_{t-n} = [1 - (1-\xi)^n]\,(PROFIT_t^* - PROFIT_{t-n})$

$PROFIT_t = [1 - (1-\xi)^n]\,PROFIT_t^* + (1-\xi)^n\,PROFIT_{t-n}$

Let, $X = (1-\xi)^n$

Then $\xi = 1 - X^{1/n}$

i) Expansionary Period (1985-1990)

$n = 5$, $X=0.733$ hence $\xi=0.0853$

ii) Recessionary Period (1991-1995)

$n = 4$, X=0.0.765 hence $\xi=0.0808$

iii) Recovery Year 1996-1997

$n = 1$, $X=0.944$ hence $\xi=0.056$

iv) Full Period (1985-1997)

$n = 12$, $X=0.650$ hence $\xi=0.0945$

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