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A Study of Company Profit-Rate Time Series: Japan and the United States

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Abstract

Following the methodology originated by D.C. Mueller, this paper first estimates the long-run profit rate (normalized to the cross-company mean in each year to eliminate the effect of the general rise or decline in profitability) of each of 294 major Japanese manufacturing corporations using the time series of its profit rate over 1964-80. Three of the major findings are (1) a company with a high (low) initial profit rate tended to earn a high (low) profit rate even in the long run, implying a persistence of intercompany profit-rate differences; and (2) across companies, the estimated long-run profit rates were similarly distributed between Japan (our estimates) and the United States (Mueller's estimates); but (3) the reliability of the estimated rate was weaker in Japan. Further studies on the time series of the company profit rate revealed that the cross-company variance of the normalized profit rate (which equals the coefficient of variation of the unnormalized profit rate) was smaller in Japan in every year from 1964 to 1972, which together with the observed larger interindustry profit-rate differences, suggests smaller intraindustry intercompany profit-rate differences in Japan. Some preliminary discussions are given to explain these findings.

1. Introduction

That under perfect competition with free entry excess profits disappear in the long run and the rate of return equalizes across industries and firms has been one of the basic propositions students are expected to learn. Yet it has been a proposition not easy to convince them of its practicability. This is perhaps not without reason, for everyone easily finds that the actual profit rate widely differs across companies. A common explanation has been that the ideal perfect competition does not prevail in reality and the profit rate varies reflecting the different market power of each company, namely, the different structure of the market and the different position of the company in the market. Empirical examination of this explanation abounds, most of them supporting it (Weiss, 1974; Scherer, 1980, chapter 9 for the United States; Uekusa, 1982, chapter 9 for Japan). A criticism may be made, however, against those studies considering only the profit rate at one time (or as an average over a period) on the grounds that they do not truly test the equalization of the profit rate in the long run. For instance, Brozen (1970, p. 292) argued for the "lack of persistence of high rates of return in highly concentrated industries" by showing that most of the rates of return in these industries declined after the original work of Bain (1951).

Mueller (1977), criticizing Brozen, argued that the tendency of high profit rates to fall does not guarantee that they fall to competitive levels, and proposed to estimate the long-run profit rate of a company by means of a regression equation fitted to the time series of the company's profit rate. His estimates revealed that the 101 companies with the highest initial profit rates among the entire sample of 603 U.S. companies will earn a long-run average profit rate which is 32.2 percent higher than the entire average (Mueller, 1983, Table 1). It also revealed a tendency for the profit rate of these high-profit companies to fall, which apparently was not sufficiently strong to drive it to the competitive level even in the long run.

The present paper applies the Mueller methodology to the Japanese data to examine if similar persistence of profits is observed in Japan, and then studies the company profit-rate time series from a few additional viewpoints for both Japan and the United States. The only previous study we know of that addressed to a similar question is Jacquemin and Saez's (1976) study of the 28 Japanese companies from Fortune's directories of the largest industrial companies outside the United States. They regressed the rate of profit averaged over 1967-72 to that over 1962-67 cross-sectionally, to obtain a highly significant coefficient of 0.91. Thus a company that earned a higher profit rate in 1962-67 than average tended to enjoy a higher rate in 1967-72 as well. Although the sample was small and the methodology not as sophisticated as Mueller's, the study suggested that the profit-rate differences in Japan were not a short-term phenomenon.

If the profit-rate differences have been in fact persistent in Japan, then an interesting question is how persistent relatively to the United States. This is interesting because the extent of persistence should reflect differences in economic environment between the two countries, in particular the differences in the extent that an entry or exit takes place in response to profit differences. These may depend on many factors, such as the returns to scale that determine the minimum efficient size required in entry, and the governmental policy. Most importantly, in our opinion, the internal structure of the firm and its behaviour differ between Japan and the United States, thereby resulting in different strategies in such policies as research and development, investment to both physical and human capital, finance, advertising, and diversification that greatly affect entry and other activities.

To investigate the determinants of profitability differences is beyond the scope of this study, except for a preliminary discussion to be made in Subsection 4.6. Instead, the study is basically confined to fact-finding, namely, to examine the time series of the company profit rate, discover interesting patterns, and compare them between Japan and the United States. We do not claim therefore that interesting welfare implications are readily obtainable from this study. In fact, we are aware that the lack of persistence in profit-rate differences may not imply the functioning of market competition because the firm with a strong market power and initially a high profit rate may have started indulging in inefficient management, over-payment to the employees, or non-profit objectives, which resulted in subsequent poorer profit performances. Nor does the persistence necessarily imply the lack of market competition because the firm may earn a high profit rate due to superior entrepreneurship and innovational ability.

The paper is organized as follows. Section 2 explains the data, variables and models. Section 3 presents our results for the Japanese companies, and Section 4 compares them with those for the American companies. A brief summary will be given in Section 5.

2. Data, Variables and Models

2.1 Data

The first question to arise is whether industrial or company data should be used. Mueller used company data on the grounds that "when important product differentiation exists,..., the definitions of markets, concentration levels and entry barriers all become arbitrary," and "the higher-than-normal profits of those firms which have, for example, successfully differentiated their products may simply be 'averaged out' against the losses of other firms unsuccessfully trying to differentiate theirs" (Mueller, 1977, p. 370). We will also use company data in this analysis, partly because we agree with Mueller's argument and partly because we want our results to be comparable with his. With this by no means do we imply that studies with industrial data are meaningless. Just as in the above example of Mueller we will only observe intercompany profit differences but not an interindustry difference, we can think of another extreme case in which interindustry differences but not an intercompany difference will be observed, such as when every diversified company operates in both an industry with a higher-than-normal profit rate and an industry with a lower-than-normal profit rate. An allocative inefficiency likely arises in both these cases though for different reasons.

In selecting the companies to be studied, we first chose those 368 Japanese manufacturing companies that have been listed on the Tokyo Stock Exchange (First Market) through 1964-80 and have had no such large-scale merger in the same period as to change the size of the company more than a quarter. From these 368 companies we had to eliminate 74 because of the differences in the accounting period system. An explanation may be needed here.

The accounting rule in Japan only requires that a company publishes the financial statement at least once a year. Thus whether a company should report once or twice a year is left to the company's discretion as well as the choice of the month to conclude an accounting period; that is, even if a company is to report once a year, it need not coincide the accounting year with the calendar year. Until 1975, the majority of the companies reported twice a year; yet, there were companies reporting only once a year. Following the revision of the Commercial Code in 1974 to allow for the companies to pay out dividends in the middle of an accounting period, most of the companies adopted the once-a-year reporting system. Thus the standard case was that a company reported twice a year with six-month accounting periods until 1974 and once a year since 1975. 294 out of the above mentioned 368 companies fitted this pattern. In fear of possible biases due to differences in the pattern of time series and in the number of observations, we will only examine these 294 companies in this analysis. Fortunately, the eliminated 74 companies were not concentrated to any particular industry.

The period of investigation is 1964-80 because due to the change in the accounting rule in 1963 the figures before 1963 are not directly comparable to those after 1964.[1] Hence, there are 22 six-month periods (1964-74) and 6 one-year periods (1975-80). Out of these, two series have been constructed for the purpose of our statistical analyses. One, called a twice-a-year series, consists of the original 22 six-month-period figues (the profit rates have been doubled to make them comparable to the yearly rates), and 12 artificially created six-month-period figures on the assumption that the profit rates were the same between the first six months and the second six months of each accounting year during 1975-80. The other, called a once-a-year series or a yearly series, consists of 11 yearly figures obtained as an average of the first and second six-month-period figures for each year during 1964-74 and 6 original yearly figures. The former thus has 34 observations for each company and the latter, 17.

It is noted that the period t for company A may not cover the same time period as the period t for company B because companies may set their accounting periods differently. The first period, for instance, ended in April 1964 in the earliest case and in November 1964 in the latest case; hence, seven-month discrepancy occurred at most.

2.2 Variables

The profit rate variable used in this analysis is the ratio of profits inclusive of tax and interest payments to the total assets; P_{it} for firm i (i=1,...., 294) and period t (t=1, 2, ..., 17 in the yearly series and t=0.5, 1, 1.5, ..., 16.5, 17 in the twice-a-year series). This measures the rate of return to the entire capital of the firm. Another popular measure is the rate of return to the stockholders' equity, namely, the ratio of profits exclusive of interest payments to the stockholders' equity (total assets less total debts). It appears that a potential entrant, usually a firm planning to diversify into that industry, will likely estimate the return to the entire asset it has to invest in the industry and compare it to the cost of financing it - be it through loan, retained earnings, or new share issue - to make the entry decision. Arguably this is especially true with respect to the Japanese companies where the shareholders' equity (at book value) on average accounts for a mere twenty percent of the total assets.[2] [3] For this reason, this analysis only uses P_{it}. Mueller also used this variable though his is the after-tax rate whereas we will use the before-tax rate, for it seems that a firm planning an entry into a certain new market should be more concerned with the before-tax profitability of the target industry than the after-tax one, since the tax it has to pay after the entry should depend on the combined before-tax profits (i.e. the profits from the industries in which the firm is currently operating plus the profits from the target industry).

To eliminate the effect of year-to-year variation in the level of average profitability due to business fluctuation and such, we define the normalized profit rate π_{it} by the following:

$$\pi_{it} = \frac{P_{it} - \bar{P}_t}{\bar{P}_t}$$

for all i and t where $\bar{P}_t$ is the mean of P_{it} over i defined for each t. By definition $\sum_i \pi_{it} = 0$; hence, if for a certain firm i, π_{it} is positive for every t in the sample and is expected to be so even as t extends to infinity, then it should be reasonable to say that the firm i is persistently making above-normal profits.

2.3 Models

In order to obtain a measure of the long-run profit rate, a model of single equation is desired with π_{it} as the dependent variable and time t as the independent variable but not other exogenous variables, because we want to avoid interpolating, say, the expected rate of economic growth in the year 2000. It is preferred that the model has a convergence property such that the limit of π_{it} as t goes infinity is finite. The simplest model to satisfy these conditions is the one used by Mueller, namely:

$$\pi_{it} = \alpha_i + \beta_i/t + u_{it} \tag{1}$$

This equation assumes a monotonic convergence of π_{it} to α_i. Cases may occur, however, that the convergence is not monotonic, for instance, increasing during the first several years but then declining gradually approaching to the long-run rate. In these cases, an equation with the inverse of t squared (and that of t cubed) may fit better; thus, alternative models are:

$$\pi_{it} = \alpha_i + \beta_i/t + \gamma_i/t^2 + u_{it} \tag{2}$$

$$\pi_{it} = \alpha_i + \beta_i/t + \gamma_i/t^2 + \delta_i/t^3 + u_{it} \tag{3}$$

where the coefficients and the error terms, even though denoted by same symbols, are naturally different across the models. Figure 1 illustrates how these equations result in differently shaped curves. Following Mueller, the "best-fit" model is defined for each company as the model yielding the highest $\bar{R}^2$ among (1), (2) and (3).[4] Thus the best-fit model may vary from company to company in contrast to the "standard" model in which (1) is applied to all the companies.

A disadvantage of these models is that the estimates are not free from the choice of unit in measuring time. That is, depending on whether we choose in once-a-year series for instance, t=64, 65, ..., 80 or t=1, 2, ..., 17, the estimates vary. Following Mueller the latter is adopted here. Then 1/t=1, 0.5, 0.33, 0.25, 0.2, 0.17, ..., 0.063, 0.059. Evidently the period-to-period change in 1/t is relatively large during the first two to three periods but afterwards is very small.[5] This suggests that, on the one hand, the estimate of the slope coefficient β_i will be more strongly influenced by the profit rates during the first several years while, on the other hand, the estimate of the intercept α_i will be more strongly influenced by the profit rate in later years. In this sense a fairly rapid convergence, if any, of the profit rate is presupposed in the model.

This disadvantage is resolved in the following partial adjustment model commonly used in the investment theory and the inflation theory, because in this model all the data are equally used in the estimation of the two parameters:

$$\pi_{it} = \kappa + \lambda\pi_{i,t-1} + \mu_{it} \tag{4}$$

where μ_{it} is the error term. This may be rewritten as

$$\pi_{it} - \pi_{i,t-1} = (1-\lambda)\{\kappa/(1-\lambda) - \pi_{i,t-1}\} + \mu_{it} \quad .$$

Obviously $1-\lambda$ indicates the speed of adjustment and $\kappa/(1-\lambda)$, the long-run normalized profit rate because

$$\pi_{iT} = \kappa/(1-\lambda) \text{ implies } \pi_{it} = \pi_{iT} \text{ for all } t \geq T. \quad .$$

The model has the desired convergence property provided $-1 < \lambda < 1$, and the long-run profit rate may be estimated by $\hat{\kappa} / (1-\hat{\lambda})$ where the capped symbols denote the estimated parameters.

An ordinary least-squares estimation of each of the three models -- the standard model (1), the best-fit model (either (1), (2) or (3)), and the partial adjustment model (4)-- was made for each firm using the time-series data of the firm -- either once-a-year series or twice-a-year series. To remedy the effect of serial correlation the Cochran-Orcutt procedure was applied.

3. Results

3.1 Fit

Four different sets of estimates for α and β were obtained for each company: (i) estimates of the standard model with the twice-a-year series, $\hat{\alpha}$(ST) and $\hat{\beta}$(ST); (ii) estimates of the standard model with the once-a-year series; (iii) estimates of the best-fit model with the twice-a-year series, $\hat{\alpha}$(BF) and $\hat{\beta}$(BF); and (iv) estimates of the partial adjustment model with the once-a-year series, $\hat{\alpha}$(PA) and $\hat{\beta}$(PA), where $\hat{\alpha}(PA) = \hat{\kappa}/(1-\hat{\lambda})$ and $\hat{\beta}(PA) = 1-\hat{\lambda}$ with $\hat{\kappa}$ and $\hat{\lambda}$ being the estimates of equation (4). These combinations of the models and the time series have been chosen for the following reason. Basically we preferred to use the twice-a-year series for its larger sample. However, due to its assumed identity in profit rate between the first six months and the second six months during 1975-80, it is not suited to the partial adjustment model in which the profit rate is regressed to its lagged value. Hence the partial adjustment model was fitted only to the once-a-year series. To see if the difference in the mode of time series affects the estimates seriously, the standard model was also estimated with the once-a-year series.

The result showed little difference between (i) and (ii) with the correlation coefficient between the two estimates of α reaching 0.99. Thus it is inferred that the difference in the mode of time series does not cause any significant bias and that the difference in results between (i) and (iv), if any, is mostly due to the difference in the model. In the following analysis, the result of (ii) will not be presented to save space.

The first impression from the regression results was the lack of good fit. $\bar{R}^2$ (adjusted for degrees of freedom) was more often negative than positive in the standard model. In fact, it exceeded the modest criteria of 0.1 only in 19 (6.5%) of the 294 companies. By the definition of the best fit, $\bar{R}^2$ is higher or equal in the best-fit model for each company; hence, the number of companies with $\bar{R}^2$ exceeding 0.1 increased to 51 (17%) in the best-fit model. Interestingly, the number further increased to 112 (38%) in the partial adjustment model, though this still may not appear impressive.

Mueller did not provide any figure concerning $\bar{R}^2$ in his paper but an oral correspondence with him indicates that on average he found much higher $\bar{R}^2$ for the American companies. Another difference concerns the significance of $\hat{\alpha}$. In the standard model Mueller found 404 cases out of 603, a little more than two thirds, to have significant $\hat{\alpha}$ at the five-percent-level two-tailed test, whereas in ours only 98 out of 294, exactly a third, were significant. Thus the fit was poorer and $\hat{\alpha}$ was less significantly different from zero on average in Japan compared to the United States insofar as the standard model was concerned. One possible reason is that our data covers 1964-80 including the years before the oil crisis. Thus the disequilibrium phenomenon following the oil crisis may have caused the poorer fit for Japan. To see if this in fact was the case, estimation using only the data before the crisis, namely 1964-72 (in the twice-a-year series), was also made.

The result, as expected, showed a considerable improvement of the fit. The number of companies with $\bar{R}^2$ greater than 0.1 increased to 57 (19.4%) in the standard model and 147 (50%) in the best-fit model. Hence the oil crisis was indeed a disturbing factor causing a poorer fit of the regression equation. Still, however, the fit is hardly satisfactory and poorer than Mueller's result on American companies. The number of companies with $\hat{\alpha}$ being significant at the five percent level was 115 in the standard model, which is 39 percent of the total number of companies, far less than the 67 percent of the American result. Thus, although the oil crisis was indeed responsible for the observed poorer fit, it cannot totally explain it. That is to say, the time series of profit rate of a Japanese company tends to have a larger part unexplained by the model than that of an American company. More will be said about the Japan - United States differences in Section 4.

Also noted at this introductory stage is that the required convergence condition for the partial adjustment model, i.e. $-1<\hat{\lambda}<1$, was satisfied for all the companies except four. In these four companies $\hat{\lambda}$ exceeded one which implies that the profit rate will explode as time goes on; hence, although we can still calculate $\hat{\alpha}(PA)$ by $\hat{\kappa}/(1-\hat{\lambda})$, this rate is unstable and will never be attained unless the initial rate happens to be the same.

3.2 Persistence

The main results are summarized in Tables 1 and 2. Table 1 gives the correlation coefficient matrix calculated with 294 samples except for the bracketed figures which were calculated with the 290 samples that exclude those four companies with unstable $\hat{\alpha}(PA)$. In Table 2, the companies were grouped into six subsamples in the order of the initial profit rate, $\pi(IN)$, calculated as the average over the beginning two years (four six-month periods) 1964-65, and the mean of $\hat{\alpha}$ was calculated for each subsample. This methodology follows Mueller (1983, Table 1). As for $\hat{\alpha}(PA)$, the means vary accordingly as the four companies estimated to have unstable $\hat{\alpha}(PA)$, which were in subsamples 2, 3, 5 and 6, are included or excluded. The third column of Table 2 shows the means when they are included and the fourth column, when they are excluded. Hence the number of companies in a subsample is 48 in subsamples 2, 3, 5 and 6 of the fourth column and 49 elsewhere.

Before discussing the extent of the persistence of intercompany profit-rate differences we will check the robustness of the result in two regards. First, the differences across the three models are not serious. As the first three columns of Table 1 indicate, the correlation between any two of the three estimates exceeds 0.8 when the unstable cases of $\hat{\alpha}$(PA) are excluded, which of course is highly significant. We can also see from Table 2 that the pattern of the mean estimates across the six subgroups is quite similar among the three models. Thus the choice of the model is unlikely to be critical to the following discussion.

Secondly, we examined the impact of the oil crisis in 1973, which hit Japan with particularly grave consequences because of her heavy dependence on Arabic countries as the source of energy. Output decreased, inflation worsened, and profitability went down. The effect was not uniform across industries and firms; hence, one may naturally suspect if a structural change of some sort took place around the year and the long-run profit rates estimated with the pre-crisis time series of 1964-72 importantly differ from those with the entire time series of 1964-80. To examine this, $\hat{\alpha}$(ST) and $\hat{\alpha}$(BF) were estimated using the twice-a-year series for 1964-72 and the results were summarized in the fourth and fifth columns of Table 1 and the fifth and sixth columns of Table 2.

Except for the improvement of the fit which has been already discussed in Subsection 3.7, the result does not suggest a substantial change. The correlation coefficients in Table 1 between the estimates with the 1964-80 data and those with the 1964-72 data reached 0.88 for $\hat{\alpha}$(ST) and 0.59 for $\hat{\alpha}$(BF), both highly significant, whereas the means in

Table 2 imply a pattern across the subsamples quite similar whether the 1964-80 time series or the 1964-72 time series are used. Therefore, the argument that the oil crisis caused an important structural change does not seem supported.[6]

We now examine the extent of the persistence of profits. The sixth column in Table 1 shows that the estimated long-run profit rates are all significantly correlated with the initial profit rate. The coefficient exceeded 0.6 with respect to $\hat{\alpha}$(ST) and $\hat{\alpha}$(PA) (when unstable cases were excluded). It is lower with respect to $\hat{\alpha}$(BF) but still is significantly positive. This of course implies that a company initially earning a higher-than-average profit rate tends to earn a higher-than-average profit rate even in the long run, whichever model is used to estimate the long-run profit rate.

This tendency is also evident in Table 2, which shows that the ordering of the estimates among subsamples agrees with that of the initial profit rate except for a few cases. The orderings between subsamples 3 and 4 and subsamples 5 and 6 are ambiguous but the first subsample always has the highest estimate, followed by the second, then by the third or fourth, and finally by the two subsamples at the bottom. For instance, the 49 companies in subsample 1 which on average earned 69 percent higher profit rate in 1964-65 than the average of all the companies in the sample, are estimated to earn 34 to 47 percent higher rate even in the indefinite future. Hence, it is again estimated with whichever model that a company initially earning a higher (lower)-than-average profit rate tends to earn a higher (lower)-than-average profit rate in the long run. In other words, even if any convergence to the average rate has taken place, it has not been strong enough to attain the long-run equalization of profit rate.

Interestingly, the deviation of $\hat{\alpha}$ from the total average is noticeably larger with respect to subsample 1 than subsample 6, suggesting that the distribution of $\hat{\alpha}$ is skewed upward. A detailed look at the first subsample revealed that several companies were estimated to have exceptionally high values in both $\hat{\alpha}$ and $\pi(IN)$. Thus when the 49 companies were further divided into 25 and 24 in the order of the initial rate, the mean of $\hat{\alpha}(ST)$ was 0.7096 for the first group and 0.2300 for the second. The distribution of $\hat{\alpha}$ was therefore indeed skewed upward.

3.3 Cross-Section Analyses with Averages

In order to investigate how over-time averages are related with our estimates of long-run profit rates and to conduct the analysis à la Jacquemin and Saez, the entire period, 1964-80, was divided into three periods, 1964-67, 1968-72, and 1973-80, and the average profit rate (not normalized), P, during each period was calculated for each firm. The first two periods roughly correspond to the first and second halves of the era of rapid economic growth and the third period, to the years following the oil crisis.

The seventh to tenth columns of Table 1 presents the correlation coefficients of these over-time averages with the estimated αs. All the coefficients are positive and significant at the one percent level. There are two important findings. First, the estimates are highly correlated with the average profit rates. It is therefore conjectured that the determinants of interfirm variation in an average profit rate will also explain the major part of the variation in $\hat{\alpha}$. The importance of this result lies in suggesting that the influences of market structure, confirmed on average profit rates by a number of researchers (see Uekusa, 1982, chapter 9), will be also present on our estimate of the long-run profit rate, although we should note that in a long-run analysis as in here, market structure may itself become endogenous and the simultaneity problem may become serious.

It is found that $\hat{\alpha}$(BF) is somewhat less correlated with the average than $\hat{\alpha}$ (ST), which is not surprising because in the former we allowed the time pattern of profit rate to vary across companies. Also found is that $\hat{\alpha}$ (ST) and $\hat{\alpha}$(BF) are more strongly correlated with the average in later periods, confirming our argument in Subsection 2.3 that in the standard and best-fit models the profit performance in later year tends to influence $\hat{\alpha}$ more strongly than that in earlier years. Interestingly, when the unstable cases are excluded, $\hat{\alpha}$(PA) exhibited the same tendency.

Second, the average profit rates are highly correlated across periods, with somewhat weaker correlation between before and after the oil crisis perhaps reflecting the different impact of the crisis across industries and companies. The regression results are as follows with the t-values in parentheses:

$$\bar{P}_{68-72} = \underset{(3.6935)}{0.01464} + \underset{(21.605)}{0.8472} \; \bar{P}_{64-68}, \quad \bar{R}^2 = 0.6139 \tag{5}$$

$$\bar{P}_{73-80} = \underset{(7.8348)}{0.02716} + \underset{(16.220)}{0.5498} \; \bar{P}_{68-72}, \quad \bar{R}^2 = 0.4721 \tag{6}$$

The first result is roughly comparable to the result of Jacquemin and Saez because the latter regressed the average profit rate over 1967-72 to that over 1962-67 with most of the years thus overlapping with ours. Both their coefficient, 0.91, and $\bar{R}^2$, 0.71, are slightly higher than ours but quite similar. Hence their result based on only 28 observations is supported by ours based on a much larger sample of 294 observations, and we may reasonably argue that, whether the methodology of Mueller or that of Jacquemin and Saez is used, profit-rate differences were persistent in Japan.

The estimated coefficient in (6) is smaller than that in (5). Arguably this is partly due to the general decline in profitability after the oil crisis -- the across-company averages of the profit rates were 0.95 in both 1964-67 and 1968-72 and 0.79 in 1973-80 -- and partly due to the uneven impact of the oil crisis to the firms, which probably worked against the persistence of profits.[7]

3.4 Industrial Differences

Table 3 gives the means of $\hat{\alpha}$ by industry. The industrial classification is coarse, basically at the two-digit level, except that the transportation equipment industry is divided into shipbuilding and others. To classify each company into one of the industries, we followed the classification by the Tokyo Stock Exchange in 1980. Although this is not necessarily the most appropriate classification, any attempt to reclassify the firms, we found, is bound to another arbitrariness because of their diversification and change of business composition over time.

Table 3 gives the means of three different estimates of α and the number of companies (n) for each industry. The most obvious finding is the exceptionally high values of $\hat{\alpha}$ for the drugs and medicines industry. The companies in the industry are estimated to earn 64 to 72 percent higher profit rate on average. The mean normalized initial profit rate for these companies was 0.8265, again the highest among all the industries. Hence, the industry was most profitable in 1964-65 and is expected to remain so in the future as well.

The second largest value is found in the precision instruments industry, with the estimate being around 0.3. Its strangely negative value of $\hat{\alpha}$(PA) is due to the estimate for one of the companies that does not satisfy the stability (convergence) condition. Eliminating this, $\hat{\alpha}$(PA) = 0.3473 agreeing with the other estimates.[8]

In the negative side, the shipbuilding industry is with the lowest estimate, followed by a group of industries producing more or less intermediate goods; paper and pulp, chemicals, textile, nonferrous metals and metal products.

With the pre-oil-crisis time series (the results are not given here), the general impression is that the industrial differences are less obvious than those in 1964-80, suggesting that the oil crisis intensified industrial differences. Nevertheless, the drugs and medicines industry was again the highest estimate -- in fact, both $\hat{\alpha}(ST)$ and $\hat{\alpha}(BF)$ increasing to 0.73 and 0.75, respectively.

4. Japan - U.S. Comparison

4.1 Comparing the Estimates

Table 4 was compiled to facilitate a comparison between our result for Japan and Mueller's (1983) result for the United States. There are differences in the nature of samples between the two -- 294 companies in 1964-80 for Japan and 603 companies in 1950-72 for the United States. Furthermore, the profit-rate figures are before-tax for Japan and after-tax for the United States. Still, the comparison is hoped to give some ideas on the differences (or similarity) in profit persistence between the two countries.

The distribution of the mean of $\hat{\alpha}$ across subsamples is in fact similar between the two contries. The mean for the first subsample is noticeably higher in Japan, which may suggest that the upward skewness of the distribution is stronger there. The columns in Table 4 next to the means of $\hat{\alpha}$ show the percentage of the number of companies with positive $\hat{\alpha}$ thus, for example in the first subsample in Japan $\hat{\alpha}$ was positive for 41 companies out of 49, namely 83.7 percent. Again not much difference is found between the two countries here.

By contrast, the distribution of the mean of $\hat{\beta}$, the measure of the speed of convergence to the normal rate, differs. The absolute values of the mean βs are all larger in the United States and five times larger in the first subsample in particular. This difference is somewhat narrowed when estimated with the once-a-year time series (the result is not shown) as in the United States, in place of the twice-a-year series the result of which is shown in Table 4. Then, the absolute value of the mean $\hat{\beta}$ is found to increase in subsamples 1, 2, 3 and 6, to stay about the same in subsample 4, and to turn negative (as it should) in subsample 5.[9] Still the mean in subsample 1, for instance, is 0.1407, far less than the corresponding value in the United States.

In terms of the percentage of the number of firms with positive $\hat{\beta}$, the difference between the countries is not as obvious as with the mean $\hat{\beta}$, except for subsample 6. Thus in subsample 1 for instance, about two thirds of the companies have been subject to the deterioration of their initially superior profitability in both countries.

In sum, in comparing our estimates for Japanese companies to Mueller's estimates for American companies, we found $\hat{\alpha}$s to be similar but $\hat{\beta}$s to be larger in the United States. Note that $\hat{\alpha} + \hat{\beta}$ is the predicted initial normalized profit rate, namely, $\hat{\pi}_{it}$ at t=1. Hence the findings imply that initial profit rate differed more widely across subsamples in the United States but the tendency of profit rate convergence was stronger there so that, in the long run, the profit rate distribution tends to approach to a common one between the two countries.

A more careful examination of the profit-rate time series will be needed before establishing or interpreting this difference between Japan and the United States not only because the nature of the data, especially the time period, is not common, but also because the fit of the model was so poor in Japan as explained in Subsection 3.1 that the discussion solely relying on the Mueller model is dangerous. Some attempts will be made in the following subsections.

4.2 Comparing the Time Series of Individual Firms

To reduce differences due to definition, the discussion here and in the following subsections utilizes the after-tax profit rate for both Japan and the United States. Thus π_{it} in the following is the normalized after-tax profit rate of i-th company in year t. This subsection examines the hypothesis that i-th firm's normalized profit rate is zero, which by the definition of the normalized rate, implies that the profit rate does not differ across firms.

We first calculated the average and the variance of the profit rate from each firm's time series, denoted by $\bar{\pi}_i$ and σ_i^2 , respectively. By definition the average of $\bar{\pi}_i$ over i equals zero. The average of σ_i^2 over i we found to be 0.20 in Japan and 0.25 in the United States; that is, the variance, on average, was somewhat smaller in Japan. We then calculated the t statistics and tested the null hypothesis above. At the one-percent significance level in a two-tailed test we found the null hypothesis to be rejected by 31.6 percent of the Japanese firms and 61.4 percent of the American firms; hence, we may say that a relatively profitable American firm is more likely to maintain its profitability than a similar Japanese firm. It is perhaps not surprising that these percentages are quite similar to the percentages of firms having significant $\hat{\alpha}$, 33.3 percent in Japan and 67.0 percent in the United States, given in Subsection 3.1. Note however that the analysis there eliminated the trend effect whereas the analysis here does not.

4.3 Comparing the Intercompany Variance

We next calculated the standard deviation of π_{it} over firms for each year t, to compare the extent of profitability differences across companies at a given year. In Subsection 4.1 we conjectured that the profit-rate differences at the initial year were larger in the United States. In fact the standard deviation of the normalized profit rate, which is equal to the coefficient of variation of the unnormalized rate, was 0.43 in 1950 in the United States and 0.29 in 1964 in Japan, confirming the conjecture.

Moreover, in 1964-72 during which the data of the two countries overlap, the standard deviation for the United States always exceeded that for Japan, the difference reaching 0.44 (0.90 for the United States less 0.46 for Japan) in 1971, which is the year both countries showed the largest standard deviation during 1964-72. That is, intercompany profit-rate differences were always larger in the United States.

Another interesting finding was that the standard deviation moved almost parallely during the period between the two countries. More precisely, except for 1964-65, the standard deviation moved in the same direction from a year to the next. Thus suggested are the common determinants of the extent of intercompany profit-rate differences across countries.

4.4 Comparing the Regressions *à la* Jacquemin and Saez

We calculated the average of π_{it} over 1964-67 and that over 1968-72 for each firm and conducted the cross-section regression as in Subsection 3.3. Since the average of the variables over i is now zero by the use of the normalized rate here, we suppressed the constant term. The results were as follows:

$$\text{Japan:} \quad \bar{\pi}_{68-72} = \underset{(16.170)}{0.7347} \; \bar{\pi}_{64-67}, \quad \bar{R}^2 = .4716$$

$$\text{U.S.:} \quad \bar{\pi}_{68-72} = \underset{(26,352)}{0.8151} \; \bar{\pi}_{64-67}, \quad \bar{R}^2 = .5352$$

Thus a company earning a twice larger profit rate than average in 1964-67 tended to earn, in 1968-72, 82 percent larger profit rate in the United States and 73 percent larger rate in Japan. In this sense the profit-rate differences persisted more strongly in the United States.

4.5 Summarizing the Comparison

In sum, for the Japanese firms relatively to the American firms, we observed, on average, (1) poorer fit of the regression model, be it standard or best-fit, (2) poorer significance of both $\hat{\alpha}$ and $\hat{\beta}$, (3) a similar distribution of $\hat{\alpha}$ across subsamples, (4) smaller absolute values of $\hat{\beta}$, (5) a somewhat smaller variance of the normalized profit rate of individual firm over time, (6) in spite of (5), less frequent rejection with the t-test of the null hypothesis that the profit rate does not differ across companies, (7) a smaller intercompany standard deviation in the normalized profit rate in every year from 1964 to 1972, and (8) regressions à la Jacquemin and Saez indicating a weaker persistence of profit rates.

Out of these are speculated the following. First, as for the United States, the stronger significance of $\hat{\beta}$ may suggest a tendency of equalization of company profit rates at least in the first several years of the time series, namely, in the early fifties. These years are not in the Japanese time series; hence, it is impossible to answer the question of whether it really owes to the intercountry difference or simply to the difference in time period.

Second, the weaker significance of $\hat{\alpha}$ and the less frequent rejection of the null hypothesis in (5) may suggest that the intertemporal profitability change of a company has been more frequent in Japan in the sense that the probability that an initially profitable company goes behind the rivals in later years was higher in Japan. The evidence for this speculation was not sufficient, however.

Third, consider the question of whether the intercompany profit-rate differences owe more to interindustry differences or to intraindustry intercompany differences. Look at Table 5. The figures in the first three rows have been compiled from the profit rates in the 18 two-digit-level industries and those in the following two rows, from the price-cost margins in the 74 four-digit-level industries. The latter has an advantage in that a careful examination has been made so as to match the industrial classification between the two countries, but also a disadvantage of partial coverage because only the matching industries have been included.[10] Reflecting the fact that the share of stockholders' equity in total assets is small, the average profit rate differs between the two definitions in Japan. Whichever definition is used, however, we can see that the coefficient of variation is substantially smaller in the United States. This is also true with respect to the price-cost margin where even though the mean is slightly smaller in Japan the standard deviation is larger and consequently so is the coefficient of variation.

Hence the interindustry profit-rate differences were larger in Japan and, together with the finding (7) that the intercompany differences were smaller there, it is conjectured that intraindustry intercompany profit-rate differences have been smaller in Japan, though noted are that the data sources are not quite comparable between the industrial and company data, and that the conjecture above may not necessarily hold for all industries.

4.6 The Causes of the Japan - U.S. Differences: A Preliminary Inquiry

It is beyond the scope of this study to find out the causes of these Japan - U.S. differences; nonetheless, here we make a few preliminary arguments neither offering a quantitative evidence, nor claiming that they are exhaustive. Perhaps the big differences between the two economies are found on (i) the extent of international openness, (ii) the past economic growth performance, (iii) the behaviour of the firms, their employment policy in particular, and (iv) market competitiveness. We therefore inquire into the impact of these factors in turn on the performance of company profit rates.

First, needless to say, Japan is more dependent on exporting. The existence of export opportunities implies, on the one hand, the additional demand and the opportunity to discriminate the price between the export and domestic markets, which probably have a favourable effect on the profit rate, but on the other hand, the influences of miscellaneous disturbances in the international market to the profitability of the producer which are sometimes favourable and sometimes adverse. With the varying importance of exports across industries, the stronger dependence on exporting therefore causes a wider interindustry (probably more than intraindustry intercompany) profit-rate differences. Furthermore, it may cause a more volatile movement of a company's relative profitability because the factors affecting the export and import of a product often change independently of those affecting the demand and supply of other products, particularly, of those sold only in the domestic market or only by the domestic producers.

Second, Japan has attained faster economic growth after the World War II than the United States. During this period of economic growth, the companies made efforts to invest and expand the production facilities. In many instances, the companies in an oligopolistic industry (particularly of homogeneous products) constructed the facilities of similar size and technology at about the same time in order not to be left behind the rivals.[11] The result was the similarity in the age structure of the assets of the companies within an industry. From this is conjectured that if the economic forces cause the equalization of the rate of profits to assets at current value, intraindustry intercompany equalization of the rate of profit to assets at book value (which is basically evaluated at acquisition cost) is likely observed more often in Japan where the discrepancy of the two profit rates should be more alike among the companies.

Third, one of the most prominent features of the so-called Japanese management is the quasi-permanence of employment relationship. We call it quasi-permanence because the Japanese companies never guarantee lifetime employment. Nonetheless, the avoidance of layoffs and dismissals appear to have been the prime goal of the Japanese management, obviously more important than the pursuit of profits. Thus during recession, the companies tended to do their best to maintain the employees even if it may result in too large output, too low price and hence too low profitability or too much loss. This makes a contrast to the observation in the United States that, at least in concentrated industries, the firms tend to increase their price-cost margins in order to maintain their profits (Wachtel and Adelsheim, 1977) forcing the workers to accept greater instability in employment (Feinberg, 1979). Obviously if the Japanese companies behave as suggested here, then because the extent and impact of demand fluctuation varies between industries and firms, the result would be a frequent change in the relative profitability of a company over time.

Fourth and finally, the extent of profit-rate differences will be certainly influenced by market structure. The fiercer the competition and entry activity the smaller will be the profit-rate differences, for a profitable company will more easily maintain its superior position when there is no strong actual or potential rival. Our Japan - U.S. comparison suggested a larger interindustry profit-rate difference but a smaller intraindustry intercompany difference for Japan. The first seems to suggest fewer occurrences of an entry into a remote industry, consistently with the observed less diversification of the Japanese companies compared to the American ones (Yoshihara, et al, 1981), which may have resulted due to the more fixed nature of the human resources (which tend to be specific to the firm and the industry) and their importance in the Japanese management (Odagiri, 1984). The second, by contrast, shows more equalization of profit rate across companies in the same market and seems to suggest more intense market competition in Japan. Although the evidence is by no means strong enough to confirm this conjecture, it seems no coincidence that the businesses as well as MITI have often complained of "excessive" competition in the Japanese markets.

5. Summary

It has been rare in the previous literature on industrial organization to analyze the company financial data in time series. Mueller's study of the American companies was pioneering in estimating the long-run (normalized) profit rate of each company with the time series of its past profit rates. The present study applied the same methodology to estimate the long-run (normalized) profit rate of each of 294 Japanese companies, and compared it to the American estimate of Mueller's. In addition, a few comparisons were made on the company profit-rate time series themselves between the two countries.

The result suggested, among other things, that the profit-rate differences are persistent in Japan as in the United States in the sense that the company initially earning a higher (lower) normalized profit rate tended to be estimated with a higher (lower) long-run normalized profit rate, but the reliability of the estimates was weaker in Japan because of the poorer fit of the models. We have also conjectured that in Japan the interindustry differences in the profit rate were larger but the intraindustry intercompany differences smaller.

FOOTNOTES

1 The data was obtained from the NEEDS Financial Data Tape (Tokyo: Nihon Keizai Shimbunsha).

2 The average of 1979 and 1980 for the manufacturing industry. Source: The Corporation Enterprise Survey (Japan, Ministry of Finance).

3 Uekusa (1982, p. 324) argued similarly to explain the findingthat "all the past studies have revealed that the total-asset profit rate correlates with the seller concentration more strongly than the stockholder-equity profit rate".

4 In a few cases (1) was chosen as the best-fit model over the one with the highest $\bar{R}^2$ (R^2 adjusted for degrees of freedom) because of the evident multicollinearity in the latter model.

5 The variance of 1/t is 0.056 for all the samples but mere 0.003 when the first three periods are excluded.

6 It was found that the best-fit model changed between 1964-72 and 1964-80 in 150 of the 294 companies; for instance, among the 175 companies which showed the highest $\bar{R}^2$ in equation (1) with the 1964-80 data, only 87 remained so with the 1964-72 data. Also the number of companies with equation (1) as the best fit decreased from 175 in 1964-80 to 113 in 1964-72, whereas the number of companies with equation (2) and with equation (3) as the best fit both increased. Thus which equation fits the company's time series of the profit rate best is not free from the choice of period to be studied.

7 When the regressions were made with respect to the normalized profit rate, the coefficients were 0.8456 in (5) and 0.6575 in (6), which imply that even when the influence of the change of the level of the averages is eliminated,

the coefficient is still smaller in (6).

[8] The other three unstable cases were found in (i) paper and pulp, (ii) chemicals, and (iii) machinery industries. With stable cases only, $\hat{\alpha}$(PA) for these industries are (i) -0.1453 (ii) -0.0979 and (iii) -0.0201.

[9] The mean $\hat{\alpha}$ stays about the same in every subsample.

[10] The coverage rate is roughly a half in terms of the value of shipment.

[11] The Ministry of International Trade and Industry of Japan (MITI) was worried about the possibility of excess capacity as a consequence of this investment competition. See Caves and Uekusa, 1976, pp. 53-6.

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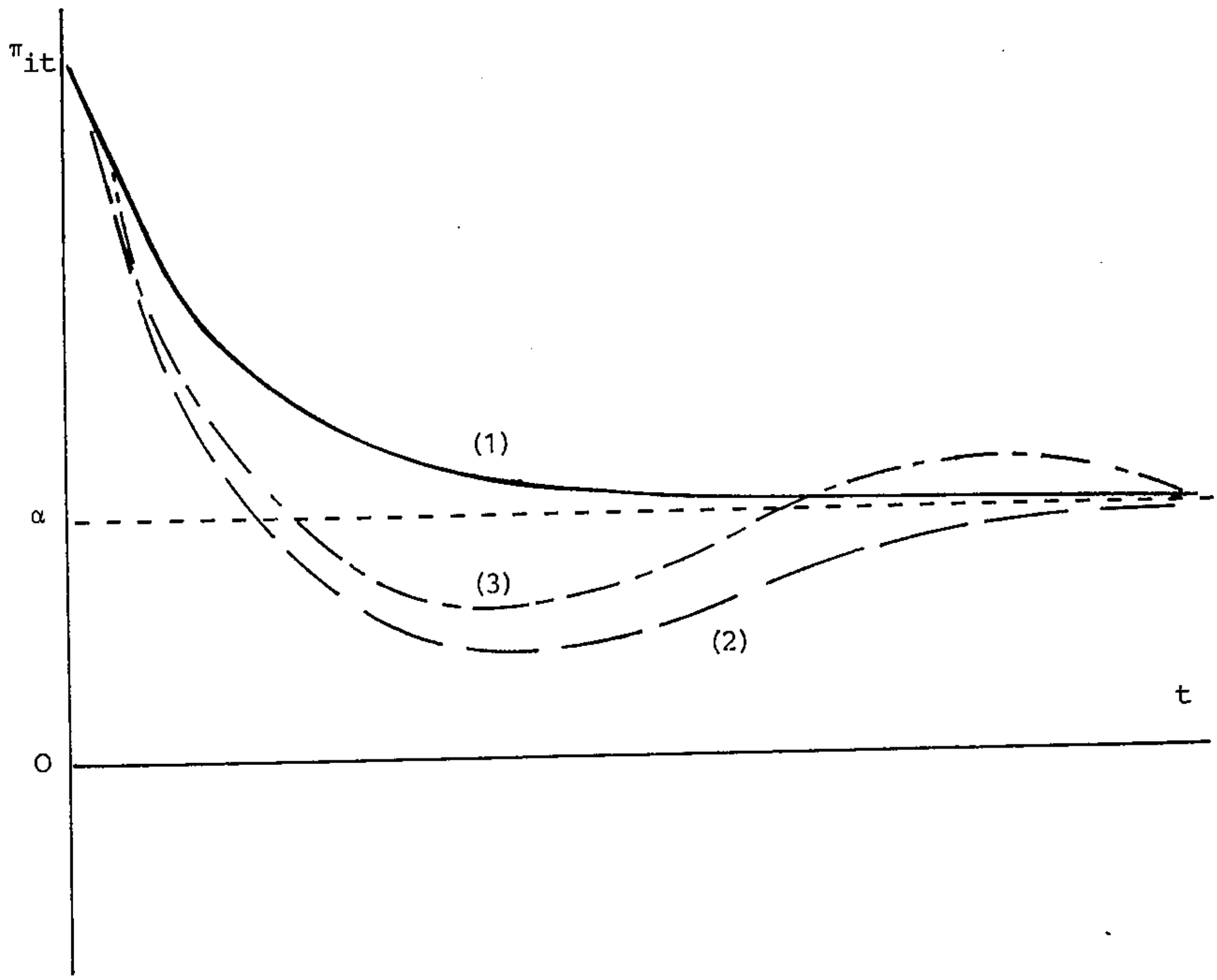
Figure 1



The curves correspond to the following equational forms:

(1) $\pi_{it} = \alpha_i + \beta_i/t\ ,\ \ \beta_i > 0$

(2) $\pi_{it} = \alpha_i + \beta_i/t + \gamma_i/t^2,\ \ \ \beta_i < 0,\ \gamma_i > 0$

(3) $\pi_{it} = \alpha_i + \beta_i/t + \gamma_i/t^2 + \delta_i/t^3,$

$\beta_i > 0,\ \gamma_i < 0,\ \delta_i > 0$

Table 1: The Matrix of Simple Correlation Coefficients

No. Variable Period	1 $\hat{\alpha}$(ST) 64-80	2 $\hat{\alpha}$(BF) 64-80	3 $\hat{\alpha}$(PA) 64-80	4 $\hat{\alpha}$(ST) 64-72	5 $\hat{\alpha}$(BF) 64-72	6 π(IN) 64-65	7 $\bar{P}$ 64-67	8 $\bar{P}$ 68-72	9 $\bar{P}$ 73-80	10 $\bar{P}$ 64-80
Variable No.										
1	1	.8024	.2923 (.9726)	.8815	.5852	.6642	.7499	.8528	.9443	.9720
2		1	.1802 (.8134)	.5507	.5886	.3049	.3664	.5891	.8535	.7253
3			1	.3161	.2190	.2390 (.6563)	.2721 (.7320)	.3147 (.8572)	.2750 (.9328)	.3225 (.9607)
4				1	.6389	.7317	.8335	.9381	.7284	.9242
5					1	.2532	.2792	.7044	.5312	.5910
6						1	.9315	.6840	.5385	.7665
7							1	.7843	.5995	.8516
8								1	.6884	.9147
9									1	.8957
10										1

Notes: 1) In brackets are the coefficients when the number of observations is 290 (excluding those with $\hat{\lambda}>1$).

2) The critical value for the one percent significance is approximately 0.23

Table 2: Means of Estimated α by Subsample Based on the Initial Profit Rate π(IN)

Subsample	$\hat{\alpha}$(ST)	$\hat{\alpha}$(BF)	$\hat{\alpha}$(PA)	$\hat{\alpha}$(PA) (stable cases only)	$\hat{\alpha}$(ST)	$\hat{\alpha}$(BF)	π(IN)
1	.4747	.3457	.4391	.4391	.5247	.3836	.6869
2	.0913	.0382	.1200	.1033	.1050	.0972	.1827
3	-.0566	-.0592	-.0839	-.0539	-.0678	-.2105	.0373
4	-.0657	-.0554	-.0674	-.0674	-.1085	-.1071	-.0986
5	-.2225	-.1938	-.5727	-.2119	-.2006	-.1234	-.2559
6	-.2218	-.0470	-.2384	-.2317	-.3012	-.0110	-.5523
Period	1964-80	1964-80	1964-80	1964-80	1964-72	1964-72	1964-65

Table 3: Means of $\hat{\alpha}$ by Industry

Industry	$\hat{\alpha}$(ST)	$\hat{\alpha}$(BF)	$\hat{\alpha}$(PA)	n
Food	-.1202	-.1881	-.1170	17
Textiles	-.1412	-.1862	-.1246	24
Paper and Pulp	-.1510	-.0850	-.0630	13
Chemicals	-.0896	-.0667	-.1327	41
Drugs and Medicines	.7164	.6439	.6651	14
Petroleum Refining	-.0711	-.0562	-.1197	5
Rubber Products	.1093	.0446	.0816	6
Glass, Stone, Clay Products	.1414	.0426	.1385	16
Iron and Steel	-.0210	.0440	-.0331	25
Nonferrous Metals	-.1142	-.1755	-.0998	19
Metal Products	-.1595	-.0810	-.1340	8
Machinery	-.0395	.0446	-.0343	38
Electrical Equipment	.0763	.1414	.0546	35
Shipbuilding	-.3501	-.3281	-.3624	5
Other Transportation Equipments	.0307	-.0825	.0259	20
Precision Instruments	.2983	.3441	-1.9325	8

Table 4: Summary of Estimates (Standard Model) by Subsample: Japan - U.S. Comparison

Subsample	JAPAN				THE UNITED STATES			
	Mean $\hat{\alpha}$	Percentage of $\hat{\alpha} > 0$	Mean $\hat{\beta}$	Percentage of $\hat{\beta} > 0$	Mean $\hat{\alpha}$	Percentage of $\hat{\alpha} > 0$	Mean $\hat{\beta}$	Percentage of $\hat{\beta} > 0$
1	.4747	83.7	.0933	63.3	.322	70.3	.457	67.3
2	.0913	63.3	.0498	53.1	.093	53.0	.218	67.0
3	-.0566	28.6	.0717	57.1	-.018	44.6	.086	55.4
4	-.0657	38.8	-.0322	44.9	-.053	33.0	-.094	49.0
5	-.2225	16.3	.0253	36.7	-.122	27.7	-.202	30.7
6	-.2218	14.3	-.1605	34.7	-.228	17.0	-.448	17.0

Source for the American result: Mueller (1983, Table 1)

Table 5: Summary of Industrial Profit Rates

Country	Year	Variable	Number of Industries	Mean	Standard Deviation	Coefficient of Variation
JAPAN	1978	ratio of profits* to total assets	18	3.90	2.45	0.627
		ratio of profits* to stockholders' equity	18	21.95	7.11	0.324
USA	1978	ratio of profits to stockholders' equity	18	14.79	3.02	0.204
JAPAN	1968	price-cost margin	74	0.242	0.105	0.432
USA	1967	price-cost margin	74	0.269	0.095	0.355

Source: Rows 1 and 2; Ministry of Finance, The Corporation Enterprise Survey

Row 3; F.T.C., Quarterly Financial Report for Manufacturing, Mining and Trade Corporations, reproduced in The Statistical Abstract of the United States

Rows 4 and 5; The Census of Manufactures

* After interest payment and before tax