

## I Introduction

Studies of the relationship between profits and growth using micro financial data of listed companies were spurred by Penrose (1959), who pointed out the increase in corporate growth costs and the existence of business limits, and Marris (1964), who theoretically showed the possibility of a trade-off between profits and growth. Empirical studies on this relationship have been conducted mainly using two methods. In the first method, the focus of analysis is profit rate differentials by firm size. Here, the research question is how companies are distributed on a plane where the horizontal axis shows firm size and the vertical axis shows the profit rate. If the slope of the regression line of the distribution is negative, it can be said that the profit rate declines as the firm size increases.

In the second method, the focus of analysis is the relationship between profit rates and corporate growth rates. These studies tried to examine, using regression analysis, whether the profit rate has a positive or negative effect on the corporate growth rate, and conversely, whether the corporate growth rate has a positive or negative effect on the profit rate. As relatively long-term financial data became available and panel data analysis became easy to use in statistical software, recent studies often use panel data analysis, such as fixed-effect estimation, in both of the above two methods.

However, as far as I can see, there is no previous study on the relationship of corporate growth and profits by panel data analysis of financial data of listed companies in Japan<sup>1</sup>. This paper tries to analyse the relationship between profits and growth using the above two methods and the financial data of the listed companies in Japan from 1991-2001, included in Toyo Keizai Inc. “Financial Data Digest, 2003 Edition”.

I made efforts to overcome two weaknesses found in most of the recent studies. The first of these weaknesses is that the definitions of profit and profit rate do not fit into contemporary companies. For example, many studies regarded only “operating income” as profits. However, the larger the firm size, the larger the investment in subsidiary or affiliate companies and the short-term equity investment, and the greater the financial income such as interests and dividends obtained from it. If the amount of profits, which is the numerator of the profit rate, does not include financial income, the larger the firm size, the more the amount of profits and the profit rate would be underestimated. Also, in order to analyse contemporary companies under the trend of financialization, not only tangible fixed assets and intangible fixed assets, but also “investments and other assets”, and current assets should be included in the

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<sup>1</sup> Nakano (2009, 2010) and Kameda and Takagawa (2003) analyse the profit rates differential using financial data of listed companies in Japan, but they did not use panel data analysis.

denominator of the profit rate<sup>2</sup>. As described in the Appendix, the profit rate in this paper is defined as (“operating income”+“interest and dividend income”+“equity in earnings of affiliates”) / “total assets”.

The second weakness in most of the previous studies is that the business cycle is not explicitly considered. In particular, when considering whether the profit rate has a positive or negative effect on the corporate growth rate, it is crucial to take the business cycle into account. If there is a lag or a lead between the profit rate cycle and the corporate growth cycle, such as the asset growth rate cycle, there is no unique relationship between the two variables because the following two phase would alternate. In one phase, the profit rate and the corporate growth rate move in the same direction and in another phase, they move in the opposite direction. It is also a well-known fact that investment is a leading index in business cycles, and employment and wages are lagging indexes. In this paper, where asset growth and labour cost growth are indexes of corporate growth, the business cycle is explicitly considered in the interpretation of the results of the panel data analysis to clarify the relationship between the profit rate and the corporate growth rate.

The structure of this paper is as follows: In Section II, I show the trends in average profit rates and growth rates of the sample companies analysed in this paper. Characteristics of the business cycle in the 1990s Japan are also explained. In Section III, I introduce two previous studies that use the first method mentioned above, namely, the studies on profit rate differentials by firm size, and I analyse Japanese data following the same method as these two previous studies. As a result, the conclusion of Wittington (1971) that the average profit rates are almost equal regardless of firm size is also valid for Japan in the 1990s. On the other hand, the analytical method of Shaikh (2016), which concluded that the profit rate declines as the firm size increases, contains problems. Namely, loss-making companies are excluded from

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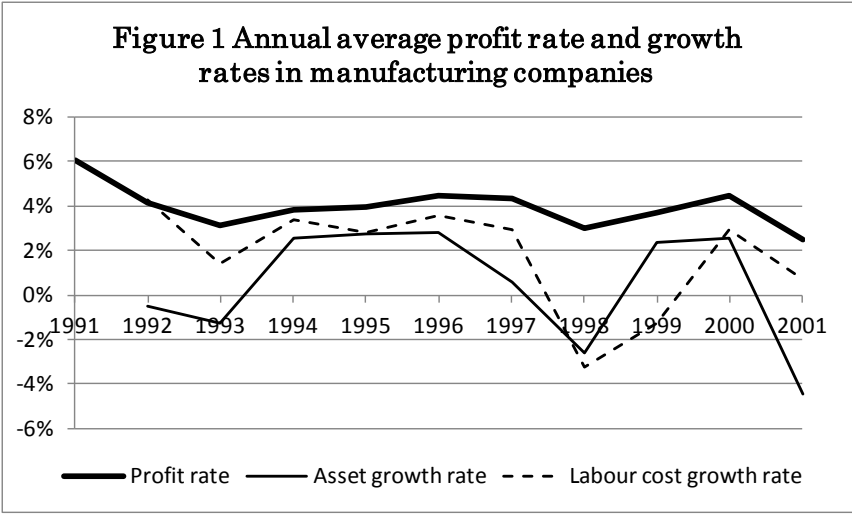
<sup>2</sup> Sato (2016) measured profit rate differentials by firm size not only in large listed companies but also in unlisted SMEs using the aggregated data of Ministry of Finance “Financial Statements Statistics of Corporations by Industry”. Sato defined firms with capital of over 1 billion yen as “large scale”, those with capital of from 50 million yen to 1 billion yen as “medium scale”, and those with capital of from less than 50 million yen as “small scale”. In addition to the measurement of differentials in classically defined profit rates (=added value–wage cost) / fixed assets), he measured differentials in “capital return rates” (=ordinary income / total assets), which is close to the profit rate defined in this paper. The former classically defined profit rate declines greatly as the firm size increases, and for example, the average profit rate in small firms exceed that in large firms by about 30 to 50 percentage points (Sato 2016, p. 29). There appears no tendency for the profit rate to equalize as the classical economists assumed. Regarding the latter “capital return rates”, their differentials by firm size are very small, and from the 1980s, large firms outperformed small firms only by 1 to 2 percentage points (Sato 2016, p. 29). Sato’s (ibid) results suggest that the classical concept of profit rate, which limited capital to fixed capital, became extremely insufficient as an analytical concept of contemporary capitalism where surplus money is generally invested in subsidiary and affiliated companies and in short-term financial investments. When Commons (1934) criticized classical economics, one criticisms was that the classical economists analysed only tangible property and excluded intangible property and incorporeal property.

the sample and profits are defined only by operating income. In Section IV, I analyse the relationship between the profit rate, the asset growth rate, and the labour cost growth rate using the second method described above. I find that the profit rate in the previous year has a negative effect on the asset growth rate in the current year. Lee (2014), who obtained similar results to this, interprets this based with the hypothesis of a “growth and profit trade-off”. I, however, interpret it as the result of investment behaviour based on adaptive expectation. Also, it can be inferred that the estimated coefficients of the explanatory variables reflect not only the strength of the effect operating between the variables at the individual firm level, but also the length of lead or lag between cycles of these variables. However, the quantitative meanings of these coefficients are unclear in the raw data of estimated coefficients. This paper proposes a new method to clarify the strength and the length of lead and lag of the above effects by explicitly considering the business cycle and assuming that the profit rate cycle can be expressed as a sine wave. Section V summarizes the results obtained in this paper.

## II Trends and cycles of profit rates and corporate growth rates in the 1990s in Japan

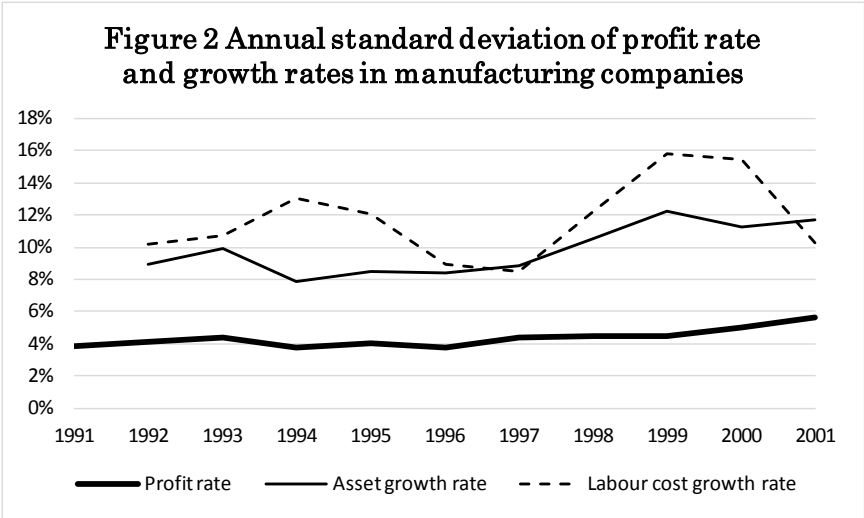
Figure 1 shows the trends in average profit rates, average asset growth rates and average labour cost growth rates in 779 manufacturing companies that were listed on the Japanese stock markets continuously from 1991 to 2001. For these three variables, approximately two cyclical fluctuations are observed within this period. The first cycle has a peak in February 1991, a trough in October 1993, and the next peak in May 1997, according to the Cabinet Office’s “The reference dates of the business cycle”. The collapse of the asset bubble in the late 1980s was a trigger of this cycle. The second cycle has a peak in May 1997, a trough in January 1999, and the next peak in November 2000. A domestic trigger for this second cycle was financial crises such as bankruptcies of Yamaichi Securities Co., Ltd. and the Hokkaido Takushoku Bank in 1997-98, as a result of postponement of the bad debt disposal after the bubble burst. Another trigger was the Asian currency crisis in 1997-98. In addition to the above two cycles, Figure 1 includes the economic downturn to the next trough in January 2002. Based on such cyclical characteristics of the period, I will compare the following two sub-periods: “sub-period 1” from 1991-96, and “sub-period 2” from 1997-2001. Although it is difficult to understand from Figure 1 that the average profit rate decreased slightly in sub-period 2 compared to sub-period 1, and that the average asset growth rate and the average labour cost growth rate significantly decreased, I will explain these decreases in detail later. In addition, Figure 1 shows that the amplitude of the cyclical fluctuation of the profit rate is smaller than that of the asset growth rate and the labour cost growth rate. In other words, the average profit rate had been relatively stable at around 4%, while the average asset growth rate and the average labour cost growth rate fell to negative in the

troughs. As the primary goal of capitalist companies is the pursuit of profit, it is natural that employment, wages and investment tend to be sacrificed in order to secure profits.



Sources: Made by the author using the data of Toyo Keizai Inc. “Financial Data Digest, 2003 Edition”.

Figure 2 shows the annual standard deviation of the above three variables measured in the same samples as Figure 1. In other words, it indicates how much the profit rate etc. varies among 779 companies. According to this figure, the profit rate differential was smaller than the differentials in asset growth rates and labour cost growth rates. Also, the temporal change in the profit rate differential and the asset growth rate differential was small, but the labour cost growth rate differential became larger or smaller in conjunction with the business cycle to some extent. The standard deviations of these three variables show a gradual upward trend, indicating that so-called “company heterogeneity” increased gradually.



Sources: See Figure 1.

Although omitted here, I made figures that show the trends in average profit rates, average asset growth rates and average labour cost growth rates of 389 non-manufacturing companies<sup>3</sup> listed on the Japanese stock markets continuously from 1991 to 2001. In these, similar characteristics to the above-mentioned manufacturing companies can be observed in the non-manufacturing companies.

### III Empirical analysis of the relationship between the profit rate and the firm size

#### 1. Whittington's measurement of profit rates by firm size

In the 1960s, a large amount of research sought to clarify statistically the relationship between the profit rate and firm size using financial data of listed companies, mainly in the United Kingdom and the United States<sup>4</sup>. The main triggers were Penrose (1959), who first pointed out the increase in corporate growth costs and the existence of managerial limits, and the theoretical study of Marris (1964) on the possibility of a "growth and profit trade-off". In order to test the hypotheses derived from these theoretical studies, empirical analysis on the relationship between profitability and corporate growth accumulated, as represented by Singh and Whittington (1968). As a representative study in this era, I introduce Whittington (1971), which extended the analysis of Singh and Whittington (1968) to more subdivided industries. I compare the result of Whittington (1971) with the results of analysis on Japanese companies in the 1990s.

Whittington (1971) conducted a statistical analysis using financial data of the UK manufacturing, construction and distribution companies (about 2400) listed continuously in two periods. As panel data analysis such as fixed-effect estimation was not popular in those days, he calculated period averages for each company, and their cross-section average within

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<sup>3</sup> As explained in the Appendix, samples with missing or incomplete labour cost data are not included in the 389 companies. Moreover, I excluded one company with an extremely high profit rate before tax because business income accounts for 90% of corporate tax.

<sup>4</sup> One can refer to Eatwell (1971) and Chapter 1 of Sherman (1968) for a survey article covering many empirical studies in those days. As far as I can see, in the 1970s and 80s, there seems to be less empirical studies on the relationship between profitability and corporate growth. One of the reasons is probably that the high inflation in developed countries made it difficult to evaluate assets and profits (annual inflation rates in the developed countries were 8.73% in the 1970s, 6.22% in the 1980s, according to IMF, *IFS*). Whittington also became devoted to theoretical research on inflation accounting. One of the results is Whittington (1983). The decline in inflation in the developed countries since the 1990s, particularly zero inflation in Japan, may provide desirable environment for such empirical studies (annual inflation rates in the 1990s is 2.77% in the developed countries and 1.21% in Japan). In fact, empirical analysis using data in the 1990s gradually appeared from around 2000 (Cowling (2004), Goddard et al. (2004), Coad (2007), Coad (2010), Coad et al. (2011), Jang and Park (2011), etc.). An overview of these studies is briefly shown in Lee (2014).

each of 21 industries, and compared them as cross-section data (known as “between data analysis” at present) <sup>5</sup>. He set two averaging periods: “sub-period 1” from 1948-54, and “sub-period 2” from 1954-61, and he analysed temporal changes between these two periods. Figure 3 shows profit rates (the pre-tax rate of return on net assets) by firm size classified by the initial asset value. The mean and the standard deviation by firm size and by period are shown. The number of samples in each firm size class is about 200-600.

According to Figure 3, the average profit rates in each firm size class are almost equal regardless of the firm size. According to him, “there is no systematic relationship between the average profitability of firms and their size within our broad industrial groups.” (Whittington 1971, p. 46)<sup>6</sup> However, regarding the standard deviation of the profit rate indicated by the dotted line in Figure 3, the larger the firm size, the lower the standard deviation. As an explanation for the diminishing standard deviation with firm size, Whittington adopted “the hypothesis that the large firms were a random collection of independent small firms” (Ibid., p. 51). That is:

[I]f a large firm could be regarded as a collection of independent small firms, then the inter-firm variance of profitability of large firms should be less than that of small firms, because the profitability of large firms would be the average of that of its independent components, and would therefore tend to be closer to the average for all companies. (Ibid., pp. 66-67)

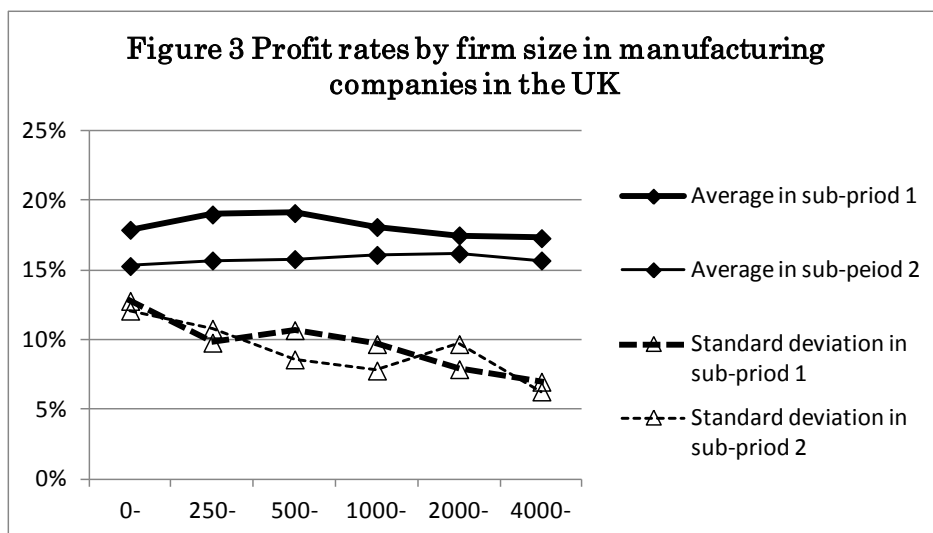
In other words, the larger the firm is, the more diversified businesses and products this firm has. This diversification can secure a certain profit rate for the whole company even under various changing external environments<sup>7</sup>. Therefore, the larger the firm size, the smaller the profit rate differential among firms.

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<sup>5</sup> He also used regression analysis (pooling data analysis by industry), where the dependent variable was ROA and the explanatory variable was a natural logarithm of total assets, but the estimated coefficients of the explanatory variable were significant only in three of 21 industries.

<sup>6</sup> This remark is consistent with the following Sherman’s remark. Sherman analysed profit rates (=profit before taxes / equity) in all corporations including non-listed small firms in the United States from 1931-61, and concluded that “the profit rate rises significantly with corporate size up to some point, though it shows little or no significant variation above that point. This is one reason why samples consisting only of medium and large corporations may show no significant difference in profit rates” (Sherman 1968, pp. 44-45).

<sup>7</sup> Sherman (1964, 1968) also found “the decreasing profit-rate variation as corporate size increases” (Sherman 1968, p. 117) in the United States and mentioned a similar reason to this.



Note: The horizontal axis shows firm size classes. For example, “0–” refers to firms with total assets of 0–250 thousand pound, and “250–” to firms with total assets of 250–500 thousand pound. “Sub-period 1” refers to 1948-54 and “sub-period 2” to 1954-61.

Sources: Made by the author using the data of “Pre-Tax Rate of Return on Net Assets by Opening Size Class” in “All Industries” in Tables 3.3 and 3.4 of Whittington (1971).

## 2. Measurement of profit rates by firm size in Japan

Figures 4 and 5 show the results of measuring profit rates by firm size of listed companies in 1990s Japan using the same method as Whittington (1971). The period is divided into “sub-period 1” from 1991-96 and “sub-period 2” from 1997-2001. According to these figures, the average profit rates shown by solid lines are around 4%, both in the manufacturing and the non-manufacturing companies<sup>8</sup>. Regarding the companies with an asset value of 100 billion yen or more, the profit rate is slightly higher in the manufacturing companies and slightly lower in the non-manufacturing companies<sup>9</sup>. Based on this result, when considering all companies including manufacturing and non-manufacturing, the average profit rates in each firm size class are almost equal regardless of firm size. In other words, even in 1990s Japan, there is no regular relationship between the average profit rate of firms and their size, as is the case in the 1950s in the United Kingdom.

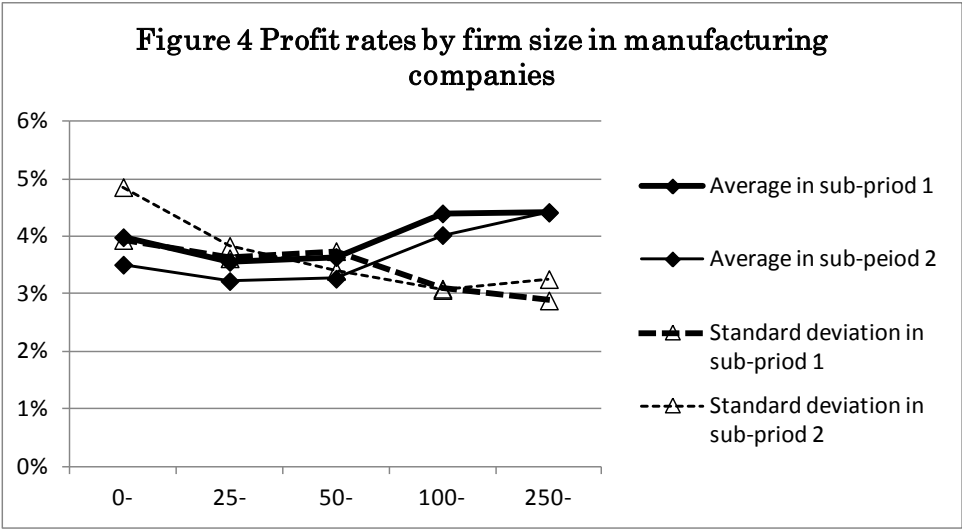
Comparing the two sub-periods, with the exception of companies with an asset value of 250 billion yen or more, in all firm size classes, the level of profit rates dropped slightly in the latter sub-period. However, the decline in profit rates is smaller than the decline in asset

<sup>8</sup> As explained in the Appendix, “non-manufacturing industry” does not include banks, insurance companies and typical securities companies.

<sup>9</sup> As a reason for this, economy of scale may have a strong effect in the manufacturing industry, and large non-manufacturing companies include utilities companies, such as electric power companies and railway companies, whose profit rates are restricted by price regulation.

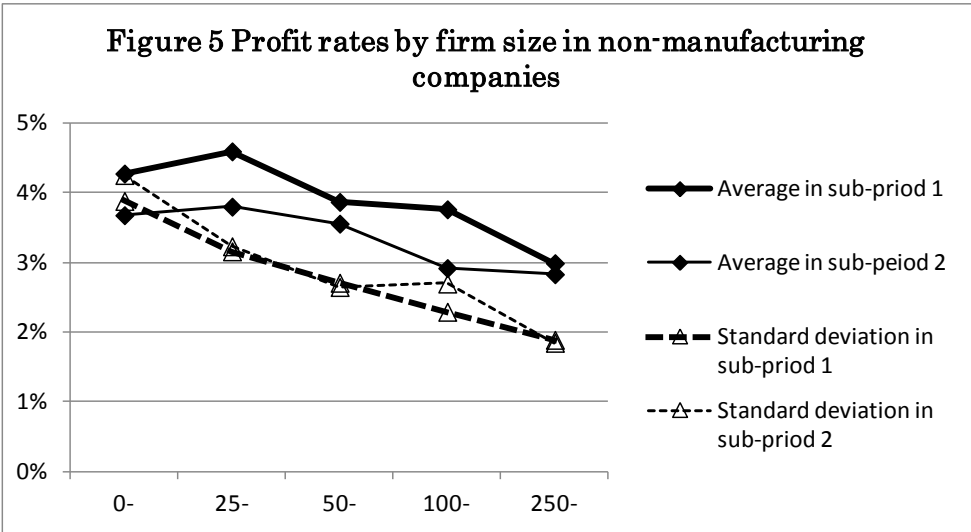
growth rates and labour cost growth rates. In other words, the temporal change in profit rate is relatively small and the profit rate is relatively stable. In particular, mega-firms with an asset value of 250 billion yen or more have a high ability to maintain profit rate through various cost and asset adjustments.

Next, the standard deviation of profit rates shown by the dotted lines, both in the manufacturing companies in Figure 4 and in the non-manufacturing companies in Figure 5, tends to decrease as the firm size increases. In other words, even in 1990s Japan, as in 1950s UK, profit rate differentials by firm size tend to decrease as the firm size increases.



Note: The horizontal axis shows firm size classes. For example, “0-” refers to firms with total assets of 0–25 billion yen, and “25-” to firms with total assets of 25–50 billion yen. “Sub-period 1” refers to 1991-96 and “sub-period 2” to 1996-2001.

Sources: Made by the author using the data of Toyo Keizai Inc. “Financial Data Digest, 2003 Edition”.

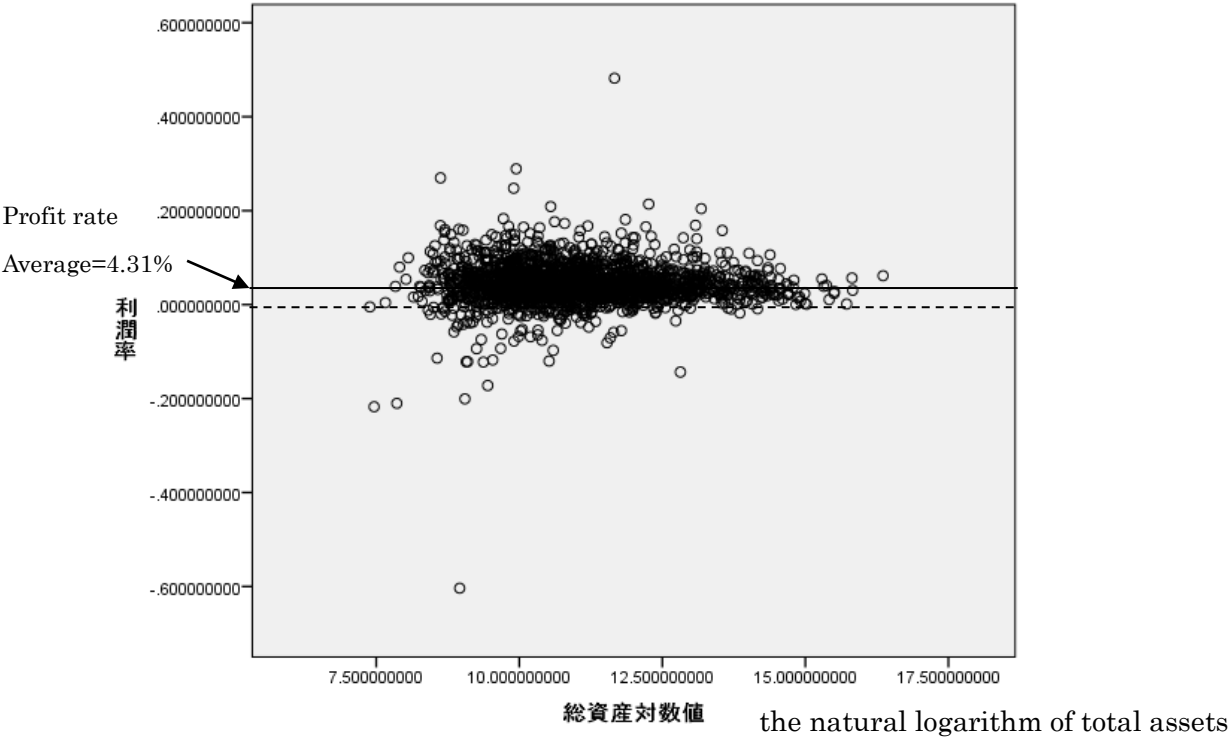


Note and Sources: See Table 4.



When average values in each firm size class are almost equal regardless of the firm size, and the standard deviation decreases as the firm size increases, how are these samples distributed? Figure 6 is a scatter plot of all the 2047 sample companies (825 manufacturing companies + 1222 non-manufacturing companies)<sup>10</sup> in 1996 on a plane where the vertical axis shows the profit rate and the horizontal axis shows . The height of the horizontal solid line AA' in this figure indicates the average value of the profit rates. The distribution of these samples has a shape of an isosceles triangle whose central axis is the horizontal straight line AA'. On the left side where the firm size is small, the vertical variation is large. The larger the firm size, that is, moving rightward, the smaller the vertical variation. With this shape of distribution in mind, it will be easier to understand the content described in the next section.

**Figure 6 Distribution of all samples in 1996.**



Note: The vertical axis shows the profit rate and the horizontal axis shows the natural logarithm of the total assets. The average profit rate of all 2047 samples is 4.31% and the standard deviation is 4.36%.

Sources: Made by the author using the data in 1996 of Toyo Keizai Inc. “Financial Data Digest, 2003 Edition”.

<sup>10</sup> These samples include companies that was not listed continuously from 1991-2001.

### 3. Shaikh's measurement of elasticity of the profit rate to the total asset

Shaikh (2016) measured the relationship between firm size and the profit rate from large-scale panel data of financial statements of US listed companies using a fixed-effect estimation method. Specifically, he used total costs, sales, profits (= sales – costs) and assets data of the non-financial listed companies in the Standard & Poor's Compustat Segment File database. He converted these data to values in fixed prices in 2005. In addition, he excluded samples in which any of the above four variables are negative<sup>11</sup>. Finally, he used unbalanced panel data with a sample size of 38948. Then, the following equation was estimated using the fixed effect estimation method.

$$\log(\textit{profit}) = a + b \cdot \log(\textit{asset})$$

As

$\log(\textit{profit\_rate}) = \log(\textit{profit} / \textit{asset}) = \log(\textit{profit}) - \log(\textit{asset}) = a + (b - 1) \cdot \log(\textit{asset})$ , the value of  $(b - 1)$  indicates the elasticity of the profit rate to the total assets. It was  $-0.263$  in Shaikh (2016). In other words, the profit rate falls as the firm size increases.

Shaikh (2016) mentioned “aggressive price-cutting behaviour” by large companies as the reason for this negative elasticity. This aggressive price-cutting behaviour by large companies characterizes his “real competition” theory, which is his original competition theory. According to Shaikh (2016), although the post-Keynesian and other imperfect competition theories also take into account the price differential and the profit rate differential between companies, they explain them only by the difference in costs or mark-up rates. The “aggressive price reduction behaviour” by large companies is the feature that distinguishes his “real competition” theory from the imperfect competition theories.

However, in the results of analyses using data in 1950s UK and in 1990s Japan mentioned above, the average profit rates in each firm size class are almost equal regardless of the firm size, and there was no tendency for the profit rate to decline as the firm size increases. Although Shaikh (2016) found this tendency, is it unique to American companies, or is it due to differences in measurement methods? In order to elucidate this point, in the next section, I use the same method as Shaikh (2016) to measure the elasticity of the profit rates to the total asset in the listed companies in the 1990s Japan.

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<sup>11</sup> According to Nakano (2009), the percentage of net loss-making companies in the US listed companies was about 10 to 20%, like in Japan, until the end of the 1990s, but exceeded 30% since 1999 (Nakano 2009, p. 29). Nakano (2010) explained reasons for the increase in the proportion of loss-making companies in the US listed companies as follows, based on Fama and French (2004): First, the amount of funds supplied to the IPO of companies increased due to the downward shift of the equity funds supply function. Second, the decrease in the cost of equity capital (returns required by shareholders) made it possible for even low-profit companies (or loss-making companies) to raise funds. In order to eliminate the time series bias caused by such changes, Shaikh (2016) may have decided to exclude the loss-making companies from analysis.

#### 4. Measurement of the elasticity of the profit rates to the total asset in Japan

Using the unbalanced panel data (sample size 20291) of the listed companies in Japan from 1991-2001, included in Toyo Keizai Inc. “Financial Data Digest, 2003 Edition”, the relationship between the profit rate and the firm size was measured by the fixed effect estimation method. In the first estimation, like Shaikh (2016), I excluded samples with negative profits. Moreover, as price fluctuations are very small from the 1990s in Japan, I did not apply the inflation adjustment which Shaikh (2016) applied. The results are as follows.

The elasticity of the profit rate to the total asset is negative ( $-0.172$ )<sup>12</sup>. This is the result of measurement for all companies, but the measurement was also performed by dividing it into manufacturing companies (sample size: 11771) and non-manufacturing companies (sample size: 8531). As a result, as can be expected from Figures 4 and 5 shown above, this elasticity in the manufacturing companies is positive (0.068), and that in the non-manufacturing companies is negative ( $-0.385$ )<sup>13</sup>. According to this result, the tendency for the profit rate to decline as the firm size increases is not valid for the manufacturing companies in Japan.

In addition, I did fixed-effect estimation using data including companies with negative profits, that is, loss-making companies, which account for about 10% of all listed companies in Japan. It was conducted for samples of all companies including both manufacturing and nonmanufacturing companies. Since the logarithmic value cannot be calculated when the profit is negative, rather than the natural logarithm of the profit rate, the profit rate itself is used as a dependent variable, and the natural logarithm of the total asset is used as an explanatory variable. As a result, the estimated coefficient is positive (0.010). And, in the fixed effect estimation of the same estimated equation using data excluding the loss-making companies, the estimated coefficient is negative ( $-0.007$ )<sup>14</sup>. According to these results, the tendency for the profit rate to decline as the firm size increases is likely to be the phenomenon caused by the method adopted by Shaikh (2016) in which he excludes loss-making companies from the samples. This can be understood easily from the fact that the distributions shown in Figure 6 are in the shape of an isosceles triangle whose central axis is the horizontal straight line indicating the average profit rate. Loss-making companies are distributed in the lower half of this isosceles triangle. If one excludes these samples, the isosceles triangle loses most of its lower half and turns into a shape close to a right triangle. In the distribution with a shape of an isosceles triangle, the regression line would be a horizontal straight line, but in the distribution with a shape of a right triangle, the regression line would be a downward

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<sup>12</sup> The t-statistic is 29.19 and the adjusted R-squared is 0.7271.

<sup>13</sup> The t-statistics are 24.22 and 17.69, and the adjusted R-squared are 0.7402 and 0.7197, in the estimation of the manufacturing companies and that of the non-manufacturing companies respectively.

<sup>14</sup> The t-statistics are 8.56 and  $-7.27$ , and the adjusted R-squared are 0.0006 and 0.0178, in the estimation with loss-making companies and that without them respectively.

straight line. According to Nakano (2009, 2010), the ratio of loss-making companies in the US listed companies is much higher than that in Japan, so the change in the slope of the regression line due to excluding loss-making companies from the sample seems to be larger in the US than in Japan.

In the capitalistic competition process, loss-making companies are also essential components, and it is impossible to think of a competition theory that excludes them. Whittington also criticized Samuels and Smyth (1969), who found a tendency for average profitability to decline as the size of company increased by excluding loss-making companies from the samples, as follows:

Their results differed from ours in that they found a tendency for average profitability to decline as the size of company increased. This result can be attributed to the fact that they excluded loss-making companies. We have found that the smaller firms have a higher inter-firm dispersion of profitability than large firms, although average profitability is the same for both classes of firm. This means that the small firms include a higher proportion of highly profitable firms and highly unprofitable firms. Excluding the loss-makers will therefore favour the small firms relative to the large firms. (Whittington 1971, p. 73)

When taking loss-making companies into account as components of capitalistic competition, there is no tendency for the profit rate to decline as the firm size increases. And, the average profit rates in each size class are almost equal regardless of the firm size. These facts discovered by Whittington et al. in the 1950s UK seems to be quite valid even today.

In addition to this, the definition of profits (= sales - costs) in Shaikh (2016) also seems to contribute to making the slope of the regression line negative. In this definition, the profits include only operating income. However, the larger the firm size, the larger the investment in subsidiary or affiliate companies and the short-term equity investment, and consequently the greater the financial income such as interests and dividends obtained from them. In definition of the profit rate in Shaikh (2016), the denominator of the profit rate is the amount of total assets, which includes the above mentioned investments. However, as the numerator of the profit rate does not include financial income, the result is that, the larger the firm size, the more the profit rate is underestimated.

In order to analyse contemporary companies under the trend of financialization, not only tangible fixed assets and intangible fixed assets, but also assets corresponding to financial activities should be included in the denominator of the profit rate, and the financial income obtained from these financial assets should be included in the numerator of the profit rate.

#### IV Analysis of the relationship between profit rates and corporate growth rates

##### 1. Lee's measurement of the effect of profitability on sales growth and employee growth

As shown in the Cambridge equation (capital accumulation rate = capitalists' propensity to save  $\times$  profit rate), at the macroeconomic level, the profit rate and the capital accumulation rate (in this paper, it is called the asset growth rate) are connected by the positive parameter of capitalists' propensity to save (= investment / profit income) in an identity. However, according to Lee (2014), at the micro level (firm level), the effects of profit rate on the corporate growth rate measured by sales or employment may be positive or negative. Lee (2014) points out the following two reasons for the positive effect of the profit rate on the growth rate. First, profit realization is the criterion according to which successful firms are selected. Second, as firms prefer internal finance to external finance for their investments, an increase in retained earnings leads to an increase in investment and consequently to further expansion. On the other hand, he mentioned the following cases where the profit rate has a negative effect on the growth rate. "Profit-oriented managers often choose to forgo growth opportunities to maintain high levels of profit. In this case, high profits are obtained as a result of profit-focused management at the expense of growth" (Lee 2014, p. 2).

Although most of the previous studies on European or the US companies surveyed by Lee (2014) detected positive effects, the result of Lee's panel data analysis using the financial data of 606 listed companies in Korea from 1999-2008 showed that the one-period lag ratio of net income to sales and this two-period lag ratio have a negative effect on the current sales growth rate<sup>15</sup>. In addition, although the influence is relatively small, these two ratios of net income to sales have a negative effect also on the current employee growth rate. Lee tentatively interpreted these empirical results that had not be found in the previous studies as follows:

Here, we focus on the possibility that empirical results may be different across countries, depending on the institutional circumstances specific to a country. The finding of the negative effect may reflect the national context of weak investor protection and institutional environment in Korea. Furthermore, since the financial crisis in 1997, the Korean government has actively undertaken policy reforms to restructure its economy, driving thereby corporate downsizing of private sector companies. The reforms force profit-oriented firms to forgo growth opportunities; consequently, the firms may refuse to

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<sup>15</sup> As explanatory variables, in addition to the ratio of net income to sales, he adopted year dummies, the ratio of debt to assets and the natural logarithm of total assets. Moreover, although the sales growth rate may be relatively close to the asset growth rate, the ratio of net income to sales and the profit rate differ in various extents by industry. To avoid this problem, Lee used as an explanatory variable the gap between the median value of the ratio of net income to sales in each industry and the value of each company. However, even with such procedure, the problem of deviation of the ratio of net income to sales from the profit rate would remain. None of the previous studies surveyed by Lee (2014) have adopted the profit rate and the asset growth rate as variables, and it seems that they have similar problems. Also, most of these previous studies have the same defect as Lee (2014) that they do not take the business cycle into account.

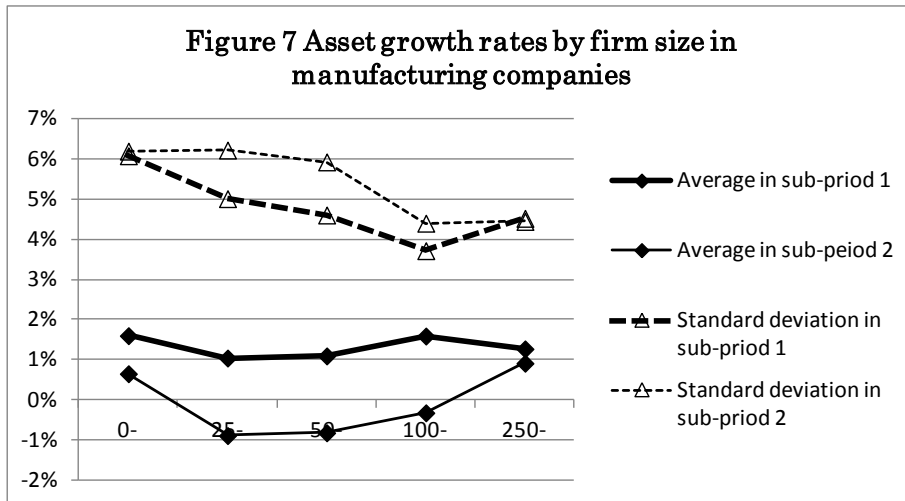
increase their capacity through additional investments and tend to take a short-term view to maintain profitability. (Lee 2014, p. 10)

During a downturn after financial crisis, some companies are likely to curb investment for securing profits as Lee described. Although Lee (2014) does not take the business cycle into account explicitly, if taking it into account, his results show that, in most of the period from 1999-2008, and in most listed companies, the sales growth rate moves counter-cyclically, with one or two period lag, whereas the ratio of net income to sales moves pro-cyclically. As such cyclical fluctuation is unrealistic, Lee's estimation method or its interpretation has room for reconsideration.

In the following analysis of Japanese listed companies in the 1990s, I try to explain the relationship between profitability and corporate growth realistically through an estimation and an interpretation that explicitly takes into account the business cycle.

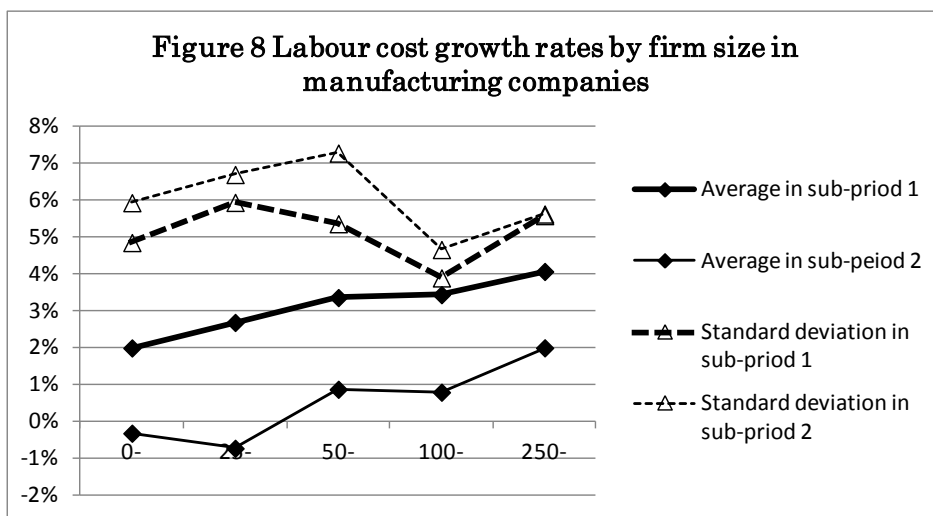
## 2. Analysis of profits and growth in Japanese firms using aggregated data by period and by firm size

Before conducting a panel data analysis of the relationship between the profit rate and the corporate growth rates using financial data of listed companies in Japan, I confirm characteristics in the movement of these variables in the 1990s using aggregate data. First, Figure 1 in Section II shows the average asset growth rate and the average labour cost growth rate, along with the average profit rate in the manufacturing companies. Although the average profit rate shows only a small pro-cyclical change, the asset growth rate and the labour cost growth rate show quite a large pro-cyclical change. Also, Figure 3 and Figure 4 in Section II shows the profit rates by firm size in two sub-periods: “sub-period 1” from 1991-96, and “sub-period 2” from 1997-2001. It was found that the average profit rates in each size class are almost equal and their temporal changes between the two periods were small. It was also found that the standard deviation of the profit rate in each size class tends to be smaller as the firm size increases. Figure 7 shows the asset growth rates in the Japanese manufacturing companies by period and by firm size. Regarding the average value shown by the solid line, the difference by firm size is small in sub-period 1. However, in sub-period 2, except for mega-firms with assets of 250 billion yen or more, the asset growth rate significantly declined by about 1 to 2% point. In addition, the asset growth rate differentials shown by the dotted line generally decreases as the firm size increases.



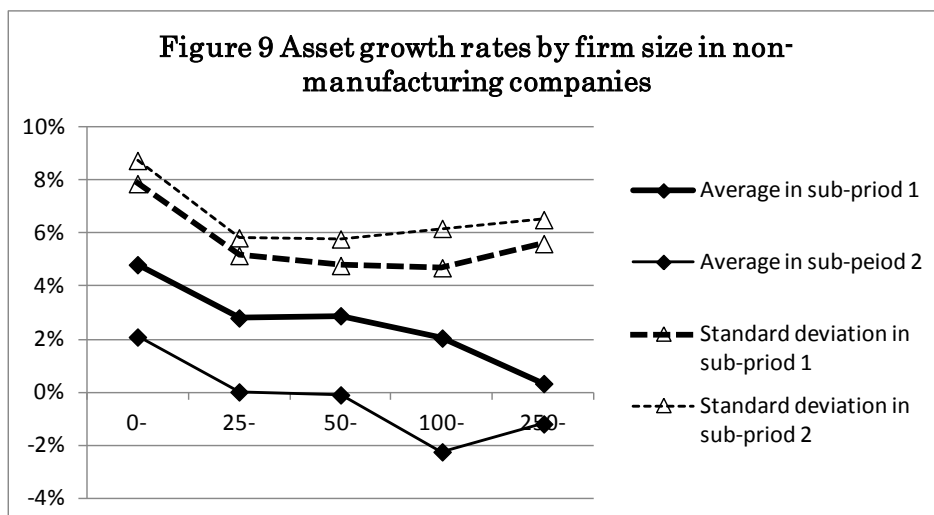
Note and Sources: See Table 4.

Figure 8 shows the labour cost growth rates in the Japanese manufacturing companies by period and firm size. The average values shown by the solid lines tend to increase as the firm size increases. Moreover, in all firm size classes, it significantly declined by about 2 to 3 percentage points between the two sub-periods. The labour cost growth rate differentials shown by the dotted lines have no general tendency corresponding to the firm size.

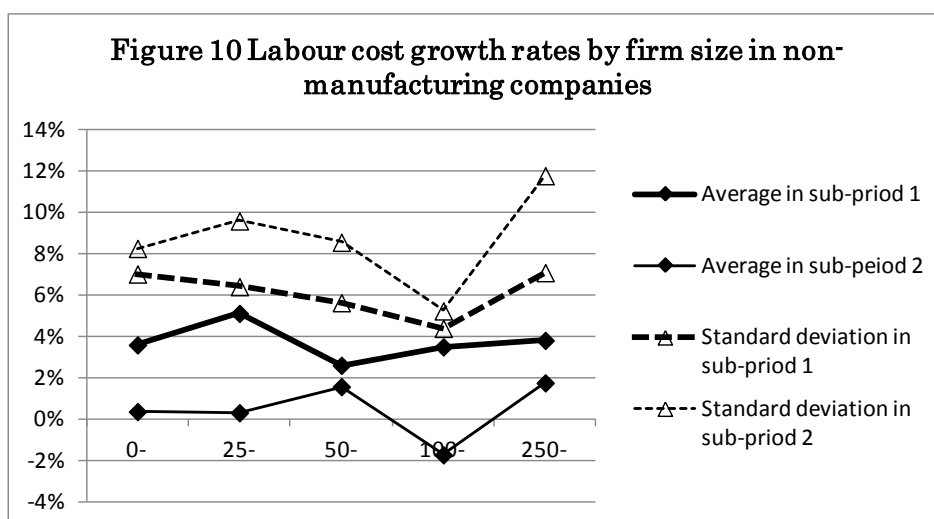


Note and Sources: See Table 4.

Figures 9 and 10 show the asset growth rate and the labour cost growth rate, respectively, in the non-manufacturing companies by period and by firm size. The average values in all size classes significantly declined between the two sub-periods in the non-manufacturing companies, as well as the manufacturing companies. Moreover, a general tendency corresponding to the firm size in the non-manufacturing companies is that the average asset growth rate tends to decline as the firm size increases.



Note and Sources: See Table 4.



Note and Sources: See Table 4.

### 3. Measurement of the effect of profitability on corporate growth in the Japanese firms

Based on the above observations of averages and standard deviations by period and by firm size, many listed companies in Japan seemed to adjust assets and labour costs in response to declining profit rates in the 1990s. The decline in asset growth rates suggests that many companies suppressed or reduced their investment. The decline in labour cost growth rates also suggests that many companies suppressed or reduced employment and wages<sup>16</sup>. However,

<sup>16</sup> The measures taken by large companies to reduce total labour costs from the 1990s to the 2000s include the introduction of a “performance-based pay system”, the neglect of market rates in wage negotiations, and replacement of regular workers with relatively high wages by low-paid dispatch workers and contract workers. For more details, please refer to Chapters 3 and 4 of Uni (2009).



from the observation of the average values and standard deviations by period and by firm size (so-called between data analysis), it cannot be clarified how much the profit rate affected on the asset growth rate and the labour cost growth rate at the individual company level, and with how long of a lead or lag the asset growth rate and the labour cost growth rate fluctuated with respect to the profit rate cycle.

The fixed-effects estimation, which is the main method of panel data analysis, enables an approach to addressing the above two issues. Estimates are calculated using mainly the following fixed-effect model:

$$Y_{it} = a + b_1X_{it} + b_2X_{it-1} + d_1D_1 + d_2D_2 + d_3D_3 + \dots + u_{it} \quad (1)$$

where  $Y$  refers to the dependent variable,  $X$  to the explanatory variables, and  $D$  to the dummy variables for each firm  $i$  in time period  $t$  (year), with  $t-1$  a one-period lag. In such a fixed-effect model, the characteristics possessed by each firm not explained by the explanatory variable are quantified fixedly as the difference in intercepts by firm<sup>17</sup>.

First, a panel data analysis using the above equation was performed for 779 manufacturing companies (the same as the samples in Figure 1) listed continuously from 1991 to 2001. The result is shown in Table 1, where *rprofit* refers to the profit rate, *gasset* to the asset growth rate, and *glabourcost* to the labour cost growth rate. For example, in the fixed-effect regression model shown in column (1), the asset growth rate is a dependent variable, and the current profit rate and the one-period lag profit rate are explanatory variables. In this regression shown in column (1), the estimated coefficients of the current profit rate is positive (1.210) and that of the one-period lag profit rate is negative (-0.504), both of which are statistically significant at the 1% significance level. On the other hand, in the regression shown in column (2), where the labour cost growth rate is a dependent variable, the two estimated coefficients of the current and the one-period lag profit rates are positive and significant. In addition, in the regression shown in column (3), where the profit rate is a dependent variable and the current and the one-period lag asset growth rates are the explanatory variables, their estimated coefficients are positive and significant. Also in the regression shown in column (4), where the current and the one-period lag labour cost growth rate are the explanatory variables, their estimated coefficients are positive and significant.

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<sup>17</sup> I estimated an equation adding a 2-period lag variable as the third explanatory variable, but the estimated coefficient of 2-period lag variable were not statistically significant. In addition to the fixed-effects model, I estimated random-effects model and pooling regression model, and adopted the most desirable result based on the result of F test, Hausman test, and Breusch and Pagan test. As shown in Tables 1 and 2, the pooling regression model is desirable when the labour cost growth rate is a dependent variable and the profit rate is the explanatory variable, but the fixed-effects model is desirable in all other estimations.

Table 1 Main regression results (manufacturing companies).

	(1)	(2)	(3)	(4)
	$gasset_t$	$glabourcost_t$	$rprofit_t$	$rprofit_t$
$rprofit_t$	1.210*** (29.55)	0.395*** (8.57)		
$rprofit_{t-1}$	-0.504*** (-11.94)	0.330*** (6.894)		
$gasset_t$			0.096*** (26.91)	
$gasset_{t-1}$			0.049*** (13.24)	
$glabourcost_t$				0.038*** (12.28)
$glabourcost_{t-1}$				0.010*** (3.29)
Constant	-0.198*** (-9.75)	-0.011*** (-5.85)	0.036*** (106.97)	0.036*** (101.15)
N.Observations	7790	7790	7011	7011
Adj. R-Squared	0.1604	0.0607	0.1978	0.0656
Method	Fixed effects	Pooling	Fixed effects	Fixed effects

Notes: The table shows the results of the panel data regressions of the equation (1). Figures are regression coefficient estimates, and t-statistics are shown in parentheses below estimated coefficients. Adj. R-Squared refers to the adjusted R-Squared value. N. Observations refers to the number of observations used.

\* Significance levels at 5% level.

\*\* Significance levels at 1% level.

\*\*\* Significance levels at 0.1% level.

In addition, I estimated equations shown in columns (1) and (2) of Table 1, dividing the samples into four groups by firm size (the “mid-firm” with total assets less than 50 billion yen and the “mega-firm” with total assets more than 50 billion yen) and by period (“sub-period 1” from 1991-96 and “sub-period 2” from 1997-2001). The results are shown in Table 2. All estimated coefficients are significant. The signs of the estimated coefficients are the same as the result of Table 1, namely, only the estimated coefficients of the one-period lag profit rate is negative in the regression where the asset growth rate is the dependent variable, and all other estimated coefficients are positive. In some cases, the magnitudes of the estimated coefficients vary considerably depending on the firm size and the period. The magnitudes of these estimated coefficients reflect the strength of the effect of the profit rate on the asset

growth rate or the labour cost growth rate at the individual company level. Moreover, they reflect the length of lead or lag of these growth rate cycles when compared with the profit rate cycle. However, unfortunately, the quantitative magnitude is unclear in the raw data of these estimated coefficients. I will later propose a new way to derive the strength of the above effects and the lead or lag length from these estimated coefficients.

Table 2 Regression results (manufacturing companies, by firm size and by period).

	(1)mid-firm	(1)mega-firm		(2)mid-firm	(2)mega-firm
	<i>gasset<sub>t</sub></i>	<i>gasset<sub>t</sub></i>		<i>glabourcost<sub>t</sub></i>	<i>glabourcost<sub>t</sub></i>
<i>rprofit<sub>t</sub></i> (sub-period 1)	1.099***	1.199***	<i>rprofit<sub>t</sub></i> (sub-period 1)	0.408**	0.456***
<i>rprofit<sub>t</sub></i> (sub-period 2)	1.512***	1.044***	<i>rprofit<sub>t</sub></i> (sub-period 2)	0.370***	0.328***
<i>rprofit<sub>t-1</sub></i> (sub-period 1)	-0.338***	-0.503***	<i>rprofit<sub>t-1</sub></i> (sub-period 1)	0.352***	0.194**
<i>rprofit<sub>t-1</sub></i> (sub-period 2)	-1.064***	-0.507***	<i>rprofit<sub>t-1</sub></i> (sub-period 2)	0.475***	0.209**
Constant (sub-period 1)	-0.015***	-0.014***	Constant (sub-period 1)	-0.007	0.009***
Constant (sub-period 2)	-0.013**	-0.021***	Constant (sub-period 2)	-0.037***	-0.011***
N.Observations (sub-period 1)	1462	2229	N.Observations (sub-period 1)	1462	2229
N.Observations (sub-period 2)	1466	2230	N.Observations (sub-period 2)	1466	2230
Adj. R-Squared (sub-period 1)	0.153	0.1482	Adj R-Squared (sub-period 1)	0.0561	0.0684
Adj. R-Squared (sub-period 2)	0.2075	0.1358	Adj. R-Squared (sub-period 2)	0.1047	0.0262
Method	Fixed effects	Fixed effects		Pooling	Pooling

Note: See Table 1.

The first problem in the above results of panel data analysis is how to interpret the negative estimated coefficient of the one-period lag profit rate in the column (1) of Table 1. If taking into account the business cycle and extending the interpretation of Lee (2014), this result may be interpreted that the asset growth rate fluctuates counter-cyclically keeping the lag with respect to pro-cyclical fluctuation of the profit rate<sup>18</sup>.

Unlike an interpretation based on the hypothesis of “growth and profit trade-off”, I interpret this result based on a sort of the hypothesis of “adaptive expectation” as follows.

The right side of the estimated equation (1) can be modified as follows.

<sup>18</sup> The estimated equations in Lee (2014) did not include the current ratio of net income to sales as an explanatory variable. Although, values of estimated coefficients of year dummies are not shown in his paper, the current year dummy may play a role as an alternative to the current ratio of net income to sales, and its estimated coefficients may be positive.

$$\begin{aligned}
Y_{it} &= a + b_1 X_{it} + b_2 X_{it-1} + d_1 D_1 + d_2 D_2 + d_3 D_3 + \dots + u_{it} \\
&= (b_1 + b_2) X_{it} + (-b_2)(X_{it} - X_{it-1}) + d_1 D_1 + d_2 D_2 + d_3 D_3 + \dots + u_{it} \\
&= (b_1 + b_2) \left[ X_{it} + \frac{(-b_2)}{b_1 + b_2} (X_{it} - X_{it-1}) \right] + d_1 D_1 + d_2 D_2 + d_3 D_3 + \dots + u_{it} \tag{2}
\end{aligned}$$

If the estimated coefficients of the one-period lag profit rate  $b_2$  is negative, and if the value  $b_1 + b_2$  is positive,  $(-b_2)/(b_1 + b_2)$  is a positive value. Then, the equation in the brackets [ ] shows the adaptive expectation of a future value of  $X$  by adding  $\frac{-b_2}{b_1 + b_2} (X_{it} - X_{it-1})$  to the current value of  $X$ , where  $(X_{it} - X_{it-1})$  is the difference between the current value and the previous year value and  $\frac{-b_2}{b_1 + b_2}$  is a positive adjustment parameter. When the dependent variable is the asset growth rate and the explanatory variables are the profit rates, equation (2) represents an investment decision based on adaptive expectation of the future profit rate, where  $b_1 + b_2$  is a multiplier multiplied by the expected profit rate<sup>19</sup>.

In other words, according to this interpretation, the asset growth rate fluctuates pro-cyclically keeping a lead with respect to pro-cyclical fluctuations of the profit rate. This is the opposite interpretation in Lee (2014), according to which corporate growth rate fluctuates counter-cyclically keeping lags.

Table 3 shows magnitudes of multipliers and adjustment parameters by firm size and by period, which are calculated from the data of the estimated coefficients of the profit rates shown in Table 2. In particular, in mid-firms, the multiplier decreased and the adjustment parameters increased significantly between the two sub-periods. Although an increase in the adjustment parameter can be inferred to mean an increase in the length of the lead, it is desirable to express the length of the lead by the unit of month or year. I will offer a method for this.

Table 3 Multipliers and adjustment parameters of adaptive expectation in manufacturing companies.

Dependent variables	Period	Multiplier	Adjustment parameter
Asset growth rate in mega-firms	Sub-period 1	0.70	0.72
Asset growth rate in mega-firms	Sub-period 2	0.54	0.94
Asset growth rate in mid-firms	Sub-period 1	0.76	0.44
Asset growth rate in mid-firms	Sub-period 2	0.45	2.38

Sources: Calculated by the author from the data in Table 2.

<sup>19</sup> Commons (1934) called such evaluation of the future “futurity value”.

If assuming that the asset growth rate cycle precedes the profit rate cycle, and if assuming perfect foresight, regression analysis using lead variables, rather than lag variables, as explanatory variables would be more effective. Therefore, I replaced the one-period lag profit rate in the equation of column (1) of Table 1 by the one-period lead profit rate. The result of regression using this replaced equation is shown in the “(1a) total period” column of Table 4. Here, the estimated coefficient of the one-period lead profit rate is not significant, although the estimated coefficient of the one-period lag profit rate was significant in the result shown column (1) of Table 1. As shown in Table 4, also in the regression of sub-period 2, the estimated coefficient of the one-period lead profit rate is not significant. These results suggest that the perfect foresight hypothesis is less realistic than the adaptive expectation hypothesis.

Table 4 Regression results using a lead variable (manufacturing companies, by period).

	(1a) full period <i>gasset<sub>t</sub></i>	(1a) sub-period 1 <i>gasset<sub>t</sub></i>	(1a) sub-period 2 <i>gasset<sub>t</sub></i>
<i>rprofit<sub>t</sub></i>	0.941*** (20.87)	1.028*** (13.19)	1.013*** (14.30)
<i>rprofit<sub>t+1</sub></i>	0.057 (1.33)	0.291*** (3.73)	0.082 (1.37)
Constant	-0.028*** (-13.37)	-0.041*** (-10.78)	-0.032*** (-8.91)
Observations	7011	3116	3895
Adj R-Squared	0.1349	0.1603	0.1194
Method	Fixed effects	Fixed effects	Fixed effects

Note: See Table 1.

#### 4. Measurement of amplitude and initial phase of cyclical fluctuation

In some cases, the magnitudes of the estimated coefficients shown in Table 2 vary considerably depending on the firm size and the period. In addition, Table 3 shows that the multiplier decreased and the adjustment parameters increased significantly in mid-firms between the two sub-periods. These changes seem to reflect changes in the strength of the effect of the profit rate on the asset growth rate or the labour cost growth rate, at the individual company level. Moreover, they reflect changes in the length of lead or lag of these growth rate cycles, with respect to the profit rate cycle. However, the quantitative meaning is unclear in the raw data of these estimated coefficients. By assuming that the profit rate cycle can be expressed as a sine wave, I propose a new method to clarify the above-mentioned changes in the strength of the effect of the profit rate and changes in the length of lead or lag.

Assume that the cyclical fluctuation of the profit rate  $X$  is represented by a sine wave, whose amplitude is one and whose initial phase is zero, as expressed by the following equation (3).

$$X = \sin \omega t \quad (3)$$

$t$  refers to time (unit: year) and  $\omega$  to angular frequency. I assume that  $\omega = 2\pi / 5$ , taking into account the average cycle of business cycles in the 1990s Japan (ie. the cycle is 5 years).

Then, the second term and the third term of the right side of equation (1), that is, the cyclically changing part ( $Z$ ) of the asset growth rate or the labour cost growth rate can be expressed as

$$Z = b_1 \sin \omega t + b_2 \sin(\omega t - 2\pi / 5) \quad (4)$$

The right side of this equation (4) represents the synthesis of sine waves having the same angular frequency as shown in Figure 11, and the result of the synthesis is a sine wave having the same angular frequency as shown in equation (5).

$$Z = \sqrt{b_1^2 + b_2^2 + 2b_1b_2 \cos(2\pi / 5)} \sin[\omega t + \tan^{-1}\{b_2 \sin(-2\pi / 5) / (b_1 + b_2 \cos(-2\pi / 5))\}] \quad (5)$$

According to equation (5), the amplitude ( $A$ ) of the cyclically changing part of the asset growth

rate or the labour cost growth rate is  $A = \sqrt{b_1^2 + b_2^2 + 2b_1b_2 \cos(2\pi / 5)}$ . The magnitude of this

amplitude represents the ratio of these growth rate cycles' amplitude to the profit rate cycle's amplitude. Therefore, it represents the strength of the effect of the profit rate on the asset growth rate or labour cost growth rate. In addition, the initial phase ( $\varphi$ ) of the cyclically changing part of the asset growth rate or the labour cost growth rate is

$\varphi = \tan^{-1}\{b_2 \sin(-2\pi / 5) / (b_1 + b_2 \cos(-2\pi / 5))\}$ . The magnitude of this initial phase

indicates the length of lead or lag of these growth rate cycles, with respect to the profit rate cycle. When the initial phase is a positive value, it shows the length of lead, and when it is a negative value, it shows the length of lag.

Table 5 shows the amplitude ( $A$ ) and the initial phase ( $\varphi$ ) of the cyclically changing part of the manufacturing companies' asset growth rate or labour cost growth rate. They are calculated based on equation (5) and the estimated coefficients in Table 2. The initial phase is shown both in units of angles and in units of years. The amplitude of the asset growth rate is larger than that of the labour cost growth rate, in any period and in any firm size. It means that the profit rate has a greater effect on the asset growth rate, i.e. investment, than on the labour cost growth rate, i.e. employment and wages. In addition, the initial phase of the asset growth rate is positive, and the initial phase of the labour cost growth rate is negative, in any period and in any firm size.

The former result is consistent with the well-known fact that economic indicators related to investment are leading indicators in the business cycle. This is because capital investment is

made in advance based on the future forecasts, since a construction period is required. The latter result is also consistent with the well-known fact that economic indicators related to employment and wages are lagging indicators. This is because adjustment of wages and employment requires time-consuming institutional procedures such as labour-management negotiations, and there are restrictions on employment reduction and wage reduction due to labour laws and precedents.

In order to clearly show changes in amplitude and initial phase between two sub-period, I draw the synthesised sine waves shown in the equation (5) as static vectors in Figures 12-15. The static vector's polar coordinates displayed on rectangular plane, whose absolute value is the amplitude of the sine wave and whose argument is its initial phase. Particularly, great change occurred in the static vector of the asset growth rate of the mid-firms shown in Figure 13. In the mid-firms, both the amplitude and the initial phase increased significantly in sub-period 2 compared with sub-period 1. This means that the profit rate has a greater effect on the asset growth rate, and the lead of the asset growth rate cycle is longer in sub-period 2 than in sub-period 1. Taking into account the decline in the average profit rate in mid-firms as shown in Table 4, the asset growth rate dropped significantly by the 1.56 times amplified effect of the decline in the profit rate. In parallel with this, the lead in asset growth cycle lengthened from 0.25 years to 0.56 years because of withholdings, postponements or cancellations of planned investment.

Table 5 Amplitude and the initial phase of cyclical fluctuation in manufacturing companies.

	period	Amplitude	Initial phase Unit: angle	Initial phase Unit: year
Asset growth rate in mega-firms	Sub-period 1	1.15	24.6	0.34
Asset growth rate in mega-firms	Sub-period 2	1.01	28.5	0.40
Asset growth rate in mid-firms	Sub-period 1	1.04	17.9	0.25
Asset growth rate in mid-firms	Sub-period 2	1.56	40.5	0.56
Labour cost growth rate in mega-firms	Sub-period 1	0.55	-19.6	-0.27
Labour cost growth rate in mega-firms	Sub-period 2	0.44	-26.9	-0.37
Labour cost growth rate in mid-firms	Sub-period 1	0.62	-32.9	-0.46
Labour cost growth rate in mid-firms	Sub-period 2	0.69	-41.2	-0.57

Sources: Calculated by the author from the data in Table 2.

Figure 11 Synthesis of sine waves having the same angular frequency (the case when  $b_2$  is negative)

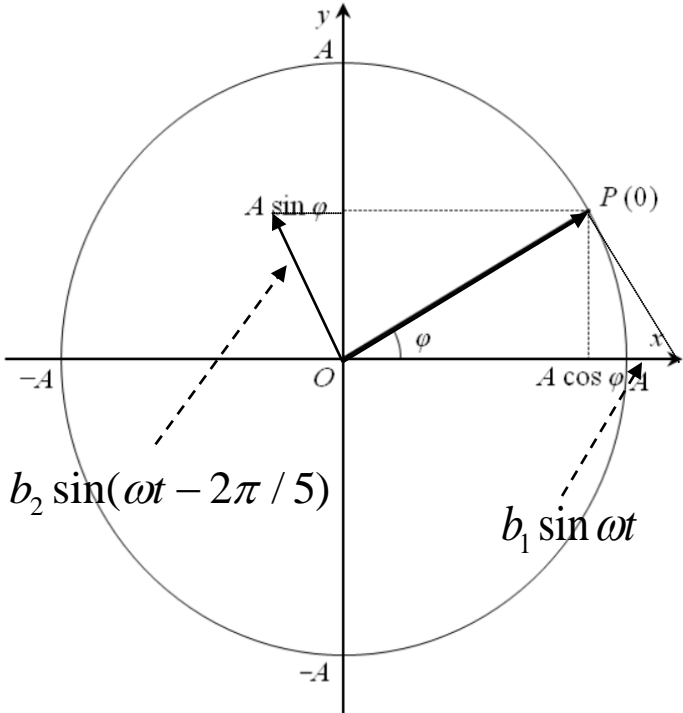
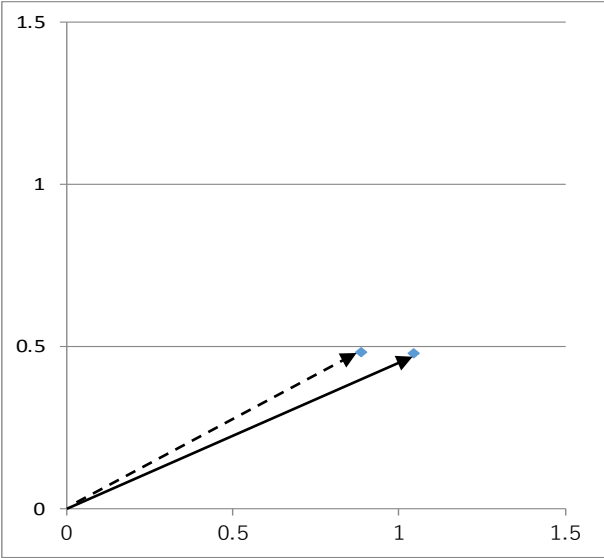


Figure12 Static vector of the asset growth cycle of manufacturing mega-firms.

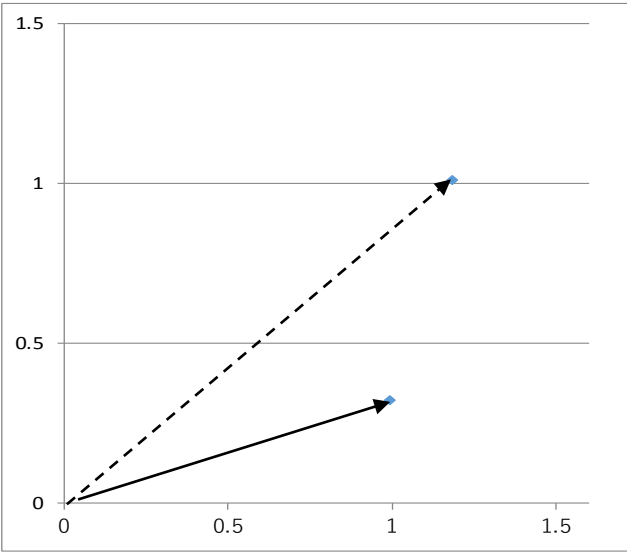


Note: The solid line shows the static vector in sub-period 1 and the dotted line shows that in sub-period 2.

Sources: Calculated by the author from the data in Table 2.

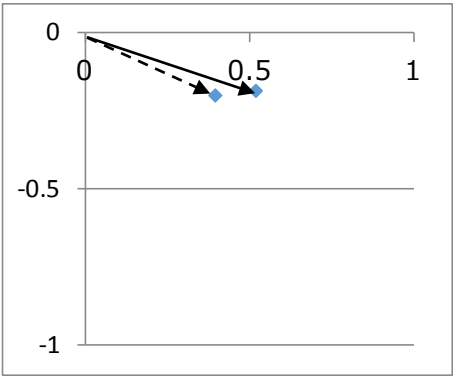


Figure13 Static vector of the asset growth cycle of manufacturing mid-firms.



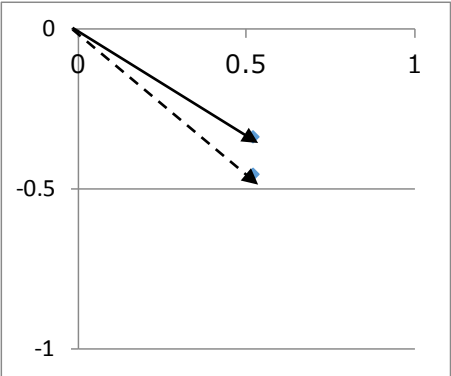
Note and sources: See Figure 12.

Figure14 Static vector of the labour cost growth cycle of manufacturing mega-firms.



Note and sources: See Figure 12.

Figure15 Static vector of the labour cost growth cycle of manufacturing mid-firms.



Note and sources: See Figure 12.

## V Conclusion

This paper attempted to analyse the relationship between profits and growth using two methods with the financial data of the listed companies of Japan from 1991-2001, included in Toyo Keizai Inc.'s "Financial Data Digest, 2003 Edition". In the first method, the focus of analysis is profit rate differentials by firm size. On the plane where the vertical axis shows the profit rate and the horizontal axis shows the natural logarithm of the total assets, the distribution of the samples has a shape of an isosceles triangle whose central axis is the horizontal straight line, the height of which indicates the average value of the profit rates. On the left side where the firm size is small, the vertical variation is large. The larger the company size, that is, moving rightward, the smaller the vertical variation.

Therefore, the results of Wittington (1971) is also valid in the 1990s Japan. The average profit rate in each firm size class is almost equal, but the standard deviation of profit rate decreases as the firm size increases. On the other hand, the method of Shaikh (2016), which led to the tendency for the profit rate to decline as the firm size increases, is problematic due to it excluding loss-making companies from the samples and in excluding financial incomes from the profits.

The second method adopted in this paper is panel data analysis on the relationship between the profit rate and the corporate growth rates. The panel data analysis by Lee (2014) using financial data of listed companies in Korea detected that the one-period lag and the two-period lag profit ratios had a negative effect on the current sales growth rate. The panel data analysis using financial data of Japanese listed companies in this paper also shows that the one-period lag profit rate had a negative effect on the current asset growth rate. However, unlike the interpretation in Lee (2014) based on the hypothesis of a "growth and profit trade-off", I interpret it as the result of investment behaviour based on adaptive expectation. According to my interpretation, the asset growth rate fluctuates pro-cyclically keeping a lead with respect to pro-cyclical fluctuation of the profit rate. This is the opposite interpretation in Lee (2014), according to which corporate growth rate fluctuates counter-cyclically keeping lags.

Also, it can be inferred that the estimated coefficients of the profit rate reflect not only the strength of the effect of the profit rate on the corporate growth rate at the individual firm level but also the length of lead or lag of the effect. However, the quantitative meanings of these coefficients are unclear in the raw data of estimated coefficients. This paper proposes a new method to clarify the strength and the length of lead and lag of the above effects by explicitly considering the business cycle and assuming that the profit rate cycle can be expressed as a sine wave. Based on this new method, this paper showed quantitatively that, in the 1990s Japan, the asset growth rate in mid-firms dropped significantly by the amplified effect of the decline in the profit rate, and the lead in asset growth cycle lengthened because of

withholdings, postponements or cancellations of planned investment.

## Appendix Sources of data and definitions of variables

### 1. Sources of data

Toyo Keizai Inc. “Financial Data Digest, 2003 Edition” includes financial data of companies (3882 companies in total, excluding insurance companies and typical securities companies) listed in five stock markets of Tokyo, Osaka, Nagoya, Sapporo and Fukuoka, Nasdaq Japan Market and JASDAQ, whose information has been disclosed in “the securities report” from the fiscal year 1991 to the fiscal year 2001. Each company is classified into manufacturing, non-manufacturing and banks, but in this paper, data of manufacturing and non-manufacturing are used.

Many companies disclosed both single and consolidated financial results, but this paper used consolidated financial data. This is because the growth and profits of large-scale companies are underestimated unless including assets and profits in subsidiaries and affiliates. For example, 1,477 companies in 1992 and 2,792 companies in 2001 disclosed consolidated financial data.

The analysis uses three data items described below, but there are some companies whose “labour cost” are missing or exists a clear disconnection in all or some years (28 manufacturing companies and 23 non-manufacturing companies). These companies were excluded from analysis. In addition, one company (Arabian Petroleum Co., Ltd.) whose profit rate calculated with pre-tax profit was abnormally high (about 40%), was excluded because the ratio of corporate tax to pre-tax profit accounted for 90%.

This paper includes an analysis comparing the period average values of the following two periods (“sub-period 1” from 1991-96 and “sub-period 2” from 1997-2001). In order to ensure comparability, samples using this comparison were limited to companies that were listed continuously during the period 1991-2001 (779 manufacturing companies and 389 non-manufacturing companies).

### 2. Definitions of variables

(1) Amount of profits: “Business income” in “Financial Data Digest, 2003 Edition” (= “operating income” + “interest and dividend income” + “equity in earnings of affiliates”) is regarded as the amount of profits. Therefore, the profit in this paper does not include depreciation. Although there is an opinion that part of the depreciation expense has a character of profit (Ohashi 1985), most of the data on “Operating income before depreciation” are missing in “Financial Data Digest, 2003 Edition”. In addition, taking into account that the fact that the proportion of over-depreciation differs considerably by company, the depreciation

expenses are not included in the profit in this paper.

(2) Amount of assets: “Total assets” in “Financial Data Digest, 2003 Edition” is regarded as the amount of assets. This is a major item on the balance sheet, which is the sum of current assets and fixed assets (including investments and other assets).

(3) Labour costs: “Total personnel expenses” in “Financial Data Digest, 2003 Edition” is regarded as labour costs. This is limited to personnel expenses within “selling, general and administrative expenses”. In consolidated financial results, it is impossible to grasp the labour costs included in manufacturing costs. In spite of this limit, this definition does not indicate the presence of a fatal defect because this paper analyses not the level of labour costs but the rate of change in labour costs.

(4) Profit rate = Amount of profits / Amount of assets

(5) Asset growth rate  $t = \ln(\text{Asset}_t / \text{Asset}_{t-1})$

(6) Labour cost growth rate  $t = \ln(\text{Labour cost}_t / \text{Labour cost}_{t-1})$

(7) Five year average profit rate = The sum of five year profits / The sum of five year assets

(8) Five year average asset growth rate =  $(\text{Assets in the last year} / \text{Assets in the first year})^{0.2} - 1$

(9) Five year average labour cost growth rate =  $(\text{Labour costs in the last year} / \text{Labour costs in the first year})^{0.2} - 1$

(10) Weights are not used to calculate the average or the standard deviation for each firm size class. Also, the firm size class is determined based on the amount of assets of the first year of each firm.

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