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Chapter 5

The Study of Japanese Companies' Per Hour Labor Productivity

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1. Introduction

Generally, studies clarifying the relationship between work duration and productivity in Japan thus far have had the following characteristics:

(1) macro-level analytical comparison of countries' indexes,
(2) references to case studies of Japanese companies under micro-level analysis, e.g., Kyocera Corp.

Some previous studies have also analyzed the relationship between work duration and productivity in Japan. However, few studies have investigated the relationship between time labor productivity and the corporate profitability index.

Sustainability investing, also known as environmental, social, and governance (ESG) investing, has recently garnered attention and is related to the sustainable development goals (SDGs). The study of time labor productivity is closely connected with Goal 8. Therefore, we should clarify whether time labor productivity impacts the stock price-related index.

This research used a proxy variable given the difficulty of strictly measuring the productivity indexes because of disclosure constraints. In this chapter, the author analyzes the impact of the proxy variable for time labor productivity on profitability and the stock price-related index. Finally, results-based implications for Japanese companies regarding solving some of the problems they face are shared.

2. Research Background

The novel coronavirus (COVID-19) has largely impacted — and continues to affect — many Japanese companies. However, it is very difficult to measure its influence on productivity under the circumstances. Productivity can be measured according to some factors, such as sales, operating profit, labor costs, interest, dividends, and taxes. Calculating operating profit before taxes entails consideration of interest, dividends, and taxes. Labor costs are subtracted from the gross margin when calculating operating profit. Therefore, we used the sum of labor costs and operating profit as a proxy variable of value-added because due to disclosure constraints, we could not use the value-added less material costs from sales. Furthermore, because of COVID-19's enormous influence, we analyzed pre-COVID-19 data.

Presently, many Japanese companies and the government are focusing on reducing working hours under the work reform system and amidst digitization. Accordingly, we used time labor productivity as a proxy variable. Even if per person productivity increases with a given number of employees, time labor productivity might not increase in the presence of long working hours. Many employees will be exhausted in such an environment, which will lower productivity. Improving time labor productivity is one of the best ways to achieve sustainable employees.

3. Survey of Previous Research

Cascio (2006) compared the per hour salary difference between Walmart and Costco and found that the higher the per hour salary, the higher the operating profit. Per hour salary is the first factor comprising per hour time labor productivity, and operating profit is the second factor.

According to Strain (2019), employee salary growth rate is related to that of productivity. Lazear (2000) showed that the shift from piecework to a per hour salary improved productivity at Safelite Glass Corp. We can assert that an employee can earn a higher per hour salary if they can produce a larger volume within the same number of hours. Sato (2008) pointed out that working hours will lengthen when employees want to work until they achieve the desired results.

Ono (2018) enumerated the disadvantages of long working hours and workdays as follows:

(1) Long workdays produce waste and inefficiency with respect to human capital.
(2) Long workdays make it difficult for employees to balance work and life.
(3) Long workdays slow the progress of diversity.
(4) Long workdays could restrain innovation.
(5) Long working hours negatively affect well-being.

Additionally, he indicated the necessity of a specific measurement index related to the shift from input to output toward shortening working hours and workdays.

According to research conducted by the Cabinet Office (2017), the shorter an employee's working hours, the higher the per person productivity. In 2015, total working hours in Japan were about 1.25 times those of Germany, and Germany's per person productivity exceeded Japan's by nearly 50%. When applying this principle to the correlation between per person hours of labor and labor productivity, it is estimated that a 10% reduction in an employee's working hours produces a 25% improvement in labor productivity. Many companies expect hybridized telework to increase productivity. Japan reported a 10% reduction in working hours and a 20% improvement in labor productivity during the 20 years spanning 1995–2015. However, Germany and France reported that labor productivity increased by 30% during the same period. Although the reduction in hours of labor in Sweden and the United States was smaller than that in Japan, those countries' labor productivity grew by 40%.

According to Yamamoto and Kuroda (2014), Japan's per hour labor productivity ranked 19th among Organization for Economic Cooperation and Development (OECD) member countries. In 2016, Maeda (2018) showed that Japan's per hour labor productivity ranked 20th among OECD member countries and that Japan was the least productive of the G7 nations, among which the shorter the working hours, the higher the per hour time labor productivity.

Suda *et al*.'s (2011) empirical study confirmed strong relationships between average annual salary and market capitalization and sales per employee, respectively. However, their research did not include a working hours index.

In the area of management accounting, some studies have investigated the relationship between working hours and productivity. Hamada (1989) was the first to examine per hour value-added considering labor costs in the case of Kyocera. Mizuno (2013) posited labor costs as a result distributed from value-added. Mizushima (2015) also emphasized the importance of per hour value-added through the case of Kyocera.

Unfortunately, none of the abovementioned studies explained the level of per hour time labor productivity as a benchmark index for specific industries or across all industries. In the case of Japan, the differences between industries and the gap between companies have not yet been explained. How strong are the relationships between per hour time labor productivity and profitability and stock indexes, respectively? The uniqueness of this research lies in its attempt to answer that question.

4. Empirical Research

4.1 *Data sources and target period*

This research referenced the following data sources:

(1) CSR Data Book, 2018–2021,
(2) Stock Price Data Book, 2018–2021,
(3) Corporate Financial Karte, 2018–2021.

The above are special editions of *Weekly Toyo Keizai*. We obtained the

following indexes from those data sources:

(1) average annual salary per person,
(2) average annual total working hours per person,
(3) per person operating profit,
(4) sales per person,
(5) net assets per share,
(6) number of employees at the end of the period,
(7) return on equity,
(8) return on assets,
(9) return on sales,
(10) closing stock price at the end of the period.

Table 1 shows the number of companies that we obtained each year. All companies are listed on the stock exchange in Japan.

4.2 *Calculating per hour labor productivity*

Per hour labor productivity comprises the following two factors:

(1) average salary per working hour (ASPH),
(2) operating profit per working hour (OPH).

The sum of (1) and (2) is the proxy variable for per hour labor productivity.

Table 1. Number of Companies with All the Data

Year	Number of Companies
2016	508
2017	609
2018	671
2019	730
Total	2,518

The amount distributed to suppliers represents sales of supplies, which produce salaries and the operating profit on supplies. Sales per working hour (SPH) roughly constitute a productivity index for measuring customer value. However, the correlation coefficient of ASPH and SPH for the period 2016–2019 was 0.268, while that of OPH and SPH was 0.303, neither of which is significant. Therefore, we excluded SPH from our analysis. Although a significant correlation may be found in some industries, this research did not consider that possibility. We measured per hour labor productivity as follows based on the available data:

Per hour labor productivity
= Average annual salary per person
÷ Average annual total working hours per person
+ Per person operating profit
÷Average annual total working hours per person

In this study, the productivity distribution factors were salary, interest, dividends, taxes, and retained earnings, where salary is a distribution source for employees and operating profit is a source for distributing other factors.

4.3 *Average per hour labor productivity and country ranking*

Table 2 shows the average per hour labor productivity and the ranking by industry for the period 2016–2019. The difference between the maximum and the minimum tends to widen year by year. Among 29 industries, only nine (i.e., mining, real estate, oil and coal, pharmaceuticals, banking, other finance, construction, chemistry, and telecommunications), representing 31% of all industries, had an above-average value.

4.4 *Relationship between per hour labor productivity and profitability*

Are per hour labor productivity and profitability correlated? Table 3 shows the correlation coefficients between per labor productivity and the profitability indexes (ROE, ROA, and ROS).

Table 2. Average Per Hour Labor Productivity and Ranking

Type of Industry	Labor Productivity Per Hour (Yen)	Rank	Type of Industry	Labor Productivity Per Hour (Yen)	Rank
Oil & coal	11,832	3	Transportation & warehouse	5,286	14
Pharmaceuticals	9,872	4	Machine	5,051	17
Mining	39,367	1	Telecommunications	5,877	9
Real estate	19,716	2	Land transportation	5,517	13
Wholesale	5,779	10	Non-ferrous metal	4,797	20
Fisheries	5,005	18	Other products	4,124	24
Construction	6,555	7	Fiber products	4,357	22
Electrical equipment	4,776	21	Pulp & paper	4,122	25
Other finance	9,716	6	Transportation equipment	4,128	23
Electricity & gas	5,650	11	Steel	4,107	26
Bank	9,797	5	Rubber products	3,907	28
Precision equipment	4,928	19	Metal product	3,646	29
Chemistry	6,253	8	Service	5,166	16
Foods	5,587	12	Retailing	4,075	27
Glass, earth & stone	5,232	15	Average	5,869	

Table 3. Correlation Coefficients Between Per Hour Labor Productivity and Profitability

Type of Industry	Labor Productivity Per hour (Yen)	Rank	The Correlation Coefficient						Number of Samples
			ROE	Rank	ROS	Rank	ROA	Rank	
Oil & coal	11,832	3	0.559	6	0.878	6	0.877	1	12
Real estate	19,716	2	0.369	17	0.848	7	0.340	19	38
Pharmaceuticals	9,872	4	0.791	2	0.909	4	0.842	3	75

(*Continued*)

Table 3. (*Continued*)

Type of Industry	Labor Productivity Per hour (Yen)	Rank	The Correlation Coefficient ROE	Rank	ROS	Rank	ROA	Rank	Number of Samples
Mining	39,367	1	0.269	22	0.995	1	0.258	22	8
Wholesale	5,779	11	0.450	11	0.180	28	0.360	18	178
Construction	6,555	7	0.073	27	0.468	24	0.249	24	150
Electrical equipment	4,776	21	0.314	18	0.707	18	0.612	8	277
Fisheries	5,005	18	–0.152	29	0.753	14	0.542	12	7
Bank	9,797	5	0.095	26	0.285	27	0.027	28	49
Chemistry	6,253	8	0.503	9	0.801	11	0.684	6	250
Other finance	9,716	6	–0.116	28	–0.089	29	0.035	27	45
Electricity & gas	5,950	9	0.396	15	0.648	20	0.170	25	44
Foods	5,587	12	0.711	3	0.812	9	0.698	5	141
Glass, earth & stone	5,232	15	0.285	19	0.419	25	0.252	23	39
Transportation & warehouse	5,286	14	0.242	24	0.879	5	0.140	26	93
Precision equipment	4,928	19	0.538	7	0.547	23	0.520	13	43
Machine	5,051	17	0.285	19	0.797	12	0.484	15	148
Telecommunications	5,877	10	0.259	23	0.644	21	0.265	21	178
Land transportation	5,517	13	0.438	14	0.949	2	0.316	20	60
Non-ferrous metal	4,797	20	0.511	8	0.787	13	0.548	10	47
Fiber products	4,357	22	0.884	1	0.846	8	0.847	2	39
Other products	4,124	24	0.632	5	0.718	16	0.666	7	75
Steel	4,107	26	0.696	4	0.922	3	0.748	4	33
Transportation equipment	4,128	23	0.283	21	0.590	22	0.451	16	149
Rubber products	3,907	28	0.442	12	0.718	16	0.559	9	36
Pulp & paper	4,122	25	0.177	25	0.402	26	–0.129	29	25
Metal product	3,646	29	0.501	10	0.802	10	0.545	11	42
Service	5,166	16	0.390	16	0.750	15	0.429	17	153
Retailing	4,075	27	0.440	13	0.701	19	0.498	14	144
All industries	5,869		0.073		0.606		0.217		2,518

The correlation coefficient between per hour labor productivity and ROS was the highest (0.606), based on data for all industries. Among 29 industries, 21 had a correlation coefficient above 0.606.

Regarding specific industries, fiber products had the highest correlation coefficient between per hour labor productivity and ROE (0.884).

In pharmaceuticals, the correlation coefficients between per hour labor productivity and ROE, ROS, and ROA were 0.791, 0.909, and 0.842, respectively (with 75 samples). For the food industry, the correlation coefficient between per hour labor productivity and ROE was 0.711 (with 141 samples). In the steel industry, the correlation coefficients between per hour labor productivity and ROA and ROE were 0.748 and 0.696, respectively. For other products, the correlation coefficient between per hour labor productivity and ROA was 0.847. In four industries, namely oil and coal, fiber products, pharmaceuticals, and steel, the correlation coefficients between per hour labor productivity and ROA were just over 0.7. In conclusion, correlations were found between per hour labor productivity and profitability indexes in Japan, and there exists disparity between industries.

4.5 *Relationship between per hour labor productivity and some indexes related to stock price*

Finally, the author analyzes the relationship between per hour labor productivity and some indexes related to fiscal year-end stock price during the period 2017–2019.

The land transportation industry had the highest correlation coefficient between per hour labor productivity and stock price (0.844). That of the transportation and warehousing industry was also very high (0.822). In the fiber products industry, the correlation coefficient between per hour labor productivity and the Price Book-Value Ratio (PBR) value ratio was 0.735. The high correlation coefficients between per labor productivity and stock price at the 2017 fiscal year end are shown in Table 4.

No positive correlation coefficients between per hour labor productivity and indexes related to stock price were found using the data covering all industries. However, we found positive correlations in some industries.

Table 4. Relationship With Stock Price as of March 31, 2018

Industry	Correlation Coefficient
Food	0.962
Land transportation	0.851
Retail	0.839
Wholesale	0.811

5. Summary and Remaining Issues

In this study, the author calculated per hour labor productivity with a proxy variable. The relationships between per hour labor productivity and profitability and indexes related to stock price were analyzed, respectively. Given the restrictions on the available data, the sample size was 2,518 for the period 2016–2019. The sum of average salary and operating profit per working hour was available as a proxy variable for per hour labor productivity. The difference between the maximum and the minimum tended to increase year by year in all industries, despite the disparity between industries. That trend may be intensifying amidst the COVID-19 crisis.

The immediate goal of this study was to examine the correlation between per hour labor productivity and profitability and indexes related to stock price, respectively. According to the data for all industries, ROS was strongly correlated with per hour labor productivity. In addition to ROS, ROE and ROA had high correlation coefficients with per hour labor productivity in fiber products, pharmaceuticals, food, steel, and other products. The correlation between per hour labor productivity and stock price was also strong in transportation and warehousing, including land transportation. A similarly high correlation was found in fiber products. Other products, electrical equipment, transportation equipment, and fiber products had correlation coefficients between per hour labor productivity and stock price in the range of 0.5–0.6. Regarding other products, per hour labor productivity was positively correlated with PBR. Based on the data for the 2017 fiscal year, the food, land transportation, retail, and wholesale industries had correlation coefficients over 0.8. According to the above, we can confirm positive relationships between per hour labor productivity and profitability and indexes related to stock price, respectively.

Next, the author points out some problems facing Japanese companies. The per hour labor productivity disparity among not only industries but also companies predates COVID-19. Moreover, that tendency has increased year by year, depending on the type of industry. Some industries have 10–20 times the disparity. The service industry was probably the hardest hit by COVID-19. Could we, as expected, state that Japanese employees at some service companies provide low-quality labor, even given Japan's originally low per hour labor productivity?

Finally, the remaining issues are as follows:

- The author could only obtain data for 4 years. One reason is that annual total working hours by company have only been surveyed since the 2016 fiscal year. Hence, the sample size may be insufficient. There also exist differences between industries. Moreover, many companies do not publish total annual working hours, and the distribution depends on it.
- The author could not analyze the impact of company size differences. A company size index needs to be devised to facilitate future consideration of this factor.
- Regarding the differences in labor quality, is this aspect properly evaluated? Could we state that the labor quality is low in industries and companies that currently pay a low per hour salary? Is it just that the evaluation rate is low? We should first discuss an appropriate per hour salary.
- How should data representing the COVID-19 pandemic and post-COVID-19 society be analyzed? Is the research method used in this study actually suitable, as expected?
- What is the balance between annual salary and operating profit? The correlation coefficient between annual salary ranking and that of operating profit was high (0.764) for the fiscal years 2016–2019.
- Do companies and industries in other countries face the same problems as Japanese companies, or are some problems unique to Japan?

This study could show the benchmark levels for industries and companies. Work style reform, DX, and economy recovery post-COVID-19 will affect per hour labor productivity and should receive due attention. This paper is a partial revision of Hiraoka (2022).

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