【研究ノート】

The Dynamics of Wage Differentials in Japan

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1　Introduction

Wage differentials exist in Japan[1). There are, however, few literatures that investigated the problem of whether wage differentials were reduced over time[2)]. In this paper we analyze empirically the long-run changes of wage differentials using the data of Japanese manufacturing firms.

2　Hypotheses and Estimation Models

We will test three hypotheses. The first hypothesis is that the wage rates of all firms converge to a single level. This case will be called the same wage-for-all model and represented by the following equation:

$$W_t^i - W_{t-1}^i = \theta_t (W^* - W_{t-1}^i) \qquad (1)$$

where W_t^i is the wage rate of the i-th firm, the subscript t stands for time t, θ_t is the speed of adjustment and W^* is the equilibrium wage rate that should prevail through the entire economy in the long-run. The second hypothesis is that the wage rates of firms in the same market converge to a single level. This case will be called the same wage-for-industry model and expressed by

1）Nakao (1980) showed that the firm's wage rate is positively related with the firm's market power.
2）Genda (1998) analyzed the changes of wage differentials in Japan. But, his approach was quite different from our study.

$$W_{t}^{ij} - W_{t-1}^{ij} = \theta_{t}(W^{j*} - W_{t-1}^{ij}) \qquad (2)$$

where W_{t}^{ij} is the wage rate of the i-th firm in the j-th market and W^{j*} is the equilibrium wage rate for all firms in the j-th market. The estimation equation for this model is given by

$$W_{t}^{i} - W_{t-1}^{i} = \theta_{t}(\sum \omega_{j} IND^{j} - W_{t-1}^{i}), \qquad (2a)$$

where $\omega_{j}(j=1,2,\cdots,75)$ are parameters which are supposed to be the equilibrium wage rate for each industry and $IND^{j}(j=1,2,\cdots,75)$ is the industry dummy.

The third hypothesis assumes that the equilibrium wage rates are different among firms. This case will be called the different wage model and expressed by

$$W_{t}^{i} - W_{t-1}^{i} = \theta_{t}(W^{i*} - W_{t-1}^{i}), \qquad (3)$$

where W^{i*} is the equilibrium wage rate for the i-th firm which is a function of firm specific variables such as productivity, scale, and growth. Based on the results of the pilot study, we use the sales per employee as the labor-productivity variable and the firm's total assets as the scale variable. To capture the effects of growth, two variables will be used; the rates of growth in sales of the firm and the industry. Thus, the estimation equation for this model is given by

$$W_{t}^{i} - W_{t-1}^{i} = \theta_{t}(b_{0} + b_{1}LP_{t}^{i} + b_{2}K_{t}^{i} + b_{3}GRS_{t}^{i} + b_{4}GRI_{t}^{i} - W_{t-1}^{i}), \qquad (3a)$$

where $b_{j}(j=0,1,2,3,4)$ are parameters, LP_{t}^{i} is the sales per employee, K_{t}^{i} is the total capital of the firm, GRS_{t}^{i} is the rate of growth in firm's sales, and GRI_{t}^{i} is the rate of growth in industry sales

3　Data

All the data used in estimation were obtained from NEEDS[3)]. The sample period covers between 1976 and 1999, and is divided into three sub-periods.

3）NEEDS stands for Nikkei Economic Electronic Databank System.

The first sub-period is between 1976 and 1983, the second is between 1984 and 1991, and the third is between 1992 and 1999. It should be noted that the second sub-period contains the bubble period and during the third sub-period Japanese economy was stagnant. The numbers of sample firms are 720 for the first sub-period[4), 600 for the second sub-period, and 727 for the third sub-period.

The data used in estimation are as follows:

Dependent Variable

$W_t^i - W_{t-1}^i$=the change in the wage rate of the i-th firm during each sub-period. For example, in the case of the first sub-period, W_t^i is the i-th firm's wage rate in 1983 and W_{t-1}^i in 1976.

Independent Variables

W_t^i=the wage rate of the i-th firm which was obtained by dividing the total amount of money paid to all workers by the number of regular workers[5)].

IND=75 industry dummy variables. We used NEEDS classification for the definition of markets, which divides the manufacturing industry into 89 sub-industries.

LP_t^i= the sales per employee of the i-th firm. For each sub-period, seven-year average values were calculated.

K_t^i= the i-th firm's assets. For each sub-period, seven-year average values of firm's assets were calculated.

GRS_t^i=the rate of growth in the i-th firm's sales during each sub-period.

GRI_t^i=the rate of growth in sales of the j-th industry during each sub-period.

4) We had to eliminate many firms for the lack of data.

5) Since the numerator includes the payments to part-time and temporary workers, our estimates for the wage rate could be higher than the real wage rate. But since we are investigating the changes in the wage rate, this would not cause serious problems.

4 Estimation Results[6)]

The estimation results for the same wage-for-all model are shown in Table 1. In all cases the speed-of-adjustment parameters are statistically significant at 10% level. Since its estimate for the first sub-period is positive, the wage differentials have increased between 1976 and 1983. But during the second and third sub-periods the firms' wage rates have converged to the equilibrium levels. In fact, the wage differentials were reduced by half between 1983 and 1999.

Table 1　Estimation Results for 1976-1999: The Same Wage-For-All Model

	1976-83	1984-91	1992-99
θW^*	1.54	3.15	2.59
	(10.87)	(4.20)	(13.61)
$-\theta$	0.14	-0.29	-0.26
	(2.85)	(-1.91)	(-9.41)
$\bar{R}^2$	0.02	0.10	0.11

The same wage-for-all model is given by Eq. (1) . The numbers in the brackets are t-values. This applies to the other tables.

The estimation results for the same wage-for-industry model are shown in Table 2. Since there are 75 estimates for the dummies, we showed only the average of estimates and t-values for the dummies. All the industry dummies become statistically significant at 10% level. The estimate of the speed-of-adjustment parameter for the first sub-period is close to zero and statistically insignificant. But it becomes statistically significant at 5% level for the second and third sub-periods. Thus, after the mid 1980s the firms' wage rates had a clear tendency to converge to the industry's equilibrium level. It should be emphasized that the wage

6) We used the method of ordinary least squares to estimate the parameters. When Breusch-Pagan test suggested the existence of heteroskedasticity, the heteroskedastic-consistent method was used to compute standard errors.

differentials among firms in the same industry were reduced by almost 40% during the bubble period.

Table 2　Estimation Results for 1976-1999: The Same Wage-For-Industry Model

	1976-83	1984-91	1992-99
Av. of $\theta\omega_j$	1.76	3.62	2.94
	(7.06)	(5.33)	(5.51)
$-\theta$	0.06	-0.38	-0.30
	(1.08)	(-3.23)	(-5.05)
$\bar{R}^2$	0.14	0.27	0.16

The same wage-for-industry model is given by Eq. (2a) .

The results shown in Tables 1 and 2 suggest that the wage differentials did not shrink during the first sub-period. But during the second and third sub-periods the wage differential shrunk rather rapidly. This result may be obtained because (1) until the middle of 1980s the traditional employment system was kept strictly, and (2) during the bubble period the shortage of labor enhanced the labor mobility by destroying at least partly the traditional employment system.

Finally, the estimation results for the different wage model are given in Table 3. As far as the speed of adjustment is concerned, the conclusions obtained from this case are almost the same with those obtained from the previous two models. Judging from the values of the adjusted R^2, for the first and second sub-periods the same wage-for-industry model seems to be better in explaining the wage adjustment process than the other two models. But the different wage model seems to be the best model for the third sub-period. Although the firms' wage rates were equalized during the stagnant period, the equilibrium wage rates of individual firms were not the same even among firms in the same industry. This result was obtained probably because during the stagnant period the firms could not afford to behave coordinately with other firms in the industry.

Table 3 Estimation Results for 1976 - 1999: The Different Wage Model

	1976-83	1984-91	1992-99
Intercept	1.10	3.43	1.48
	(6.70)	(3.67)	(5.26)
LP	0.14	0.00	0.26
	(2.68)	(-0.03)	(2.64)
K	0.02	0.06	0.03
	(1.67)	(2.97)	(3.29)
GRS	0.12	0.11	0.89
	(3.67)	(0.95)	(9.58)
GRI	-0.83	-28.47	-33.37
	(-0.17)	(-1.73)	(-1.71)
$-\theta$	0.16	-0.31	-0.22
	(4.56)	(-1.97)	(-8.14)
$\bar{R}^2$	0.05	0.14	0.22

The different wage model is given by Eq. (3a) .

5 Concluding Remarks

In this paper we investigated the long-run changes in the wage rates of Japanese manufacturing firms between 1976 and 1999. Our estimation results showed: (1) While wage differentials did not shrink before the bubble period, after the middle of 1980s they were reduced rather rapidly. (2) During the bubble period the firms' wage rates converged to the equilibrium levels that are different among industries. (3) In the recent stagnant period the equilibrium levels of the wage rates were different among firms.

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References

Genda, Y., (1998) "Japan: Wage Differentials and Changes since the 1980s," in Tachibanaki, T., ed. *Wage differentials: An international comparison*, New York: St. Martin's Press, pp.35-71.

Nakao, T., (1980) "Wages and Market Power in Japan," *British Journal of Industrial Relations 18*, pp.365-368.

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Abstract

Akira KOBASHI and Takeo NAKAO, *The Dynamics of Wage Differentials in Japan*

This paper investigates the long-run changes in the wage rates of Japanese manufacturing firms between 1976 and 1999. Our estimation results show that the wage differentials were reduced rather rapidly since the middle of 1980s.