Does Asymmetric Information Influence the Wage Differential between Men and Women? [1]

Masahiro Abe

Assistant Professor, Department of Economics, Dokkyo University

1. Understanding the Related Issues

In 1975, the regular cash earnings of female employees were only 58.9, when assuming that those of male employees were 100. In 2004, the regular cash earnings of women is still only 67.6, and thus the wage differential between men and women still exists today in Japan. During this period, both the Equal Employment Opportunity Law (implemented in 1986 and revised in 1996) and the Law Concerning the Welfare of Workers Who Take Care of Children or Other Family Members Including Child Care and Family Care Leave (implemented in 1991 and revised in 1996) were established and enforced in Japan, and the employment environment for women has gradually improved. Though the participation rate of women in the labor force was 45.7 percent in 1975, it was 48.3 percent in 2004, a 2.6 percent increase. In addition, more women are now receiving higher education in the same way as men. The percentage of women advancing on to university, which was 2.4 percent (13.1 percent for men) in 1955, rose to 33.8 percent (47.0 percent for men) in 2002. Yet even though the employment environment for women has improved and it is considered that participation of well-educated, skilled women in the labor force has increased, why does this remarkable wage differential between men and women still exist?

The real wages of the worker should become equal to the marginal productivity if the labor market is a perfectly competitive market. If a wage differential between men and women can be observed today, then this may reflect the difference in the marginal productivity of men and women. What stipulates the difference in the marginal productivity of men and women? Becker [1957], Madden [1975], Phelps [1972], Arrow [1974], etc. examined economic theories regarding wage differentials. These economic theories explain why wage differentials occur between genders and among different

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[1] This paper is written based on a report called "Seminar concerning the wage differential problem between men and women" (Chaired by Yoshio Sasajima). Suggestions and comments were made by attendees at the seminar.

races, but each of these theories considers different factors as important. The following four factors are typical:

a. Human Capital Theory

What causes the difference in productivity between men and women? One reason is the difference in the human capital that men and women have accumulated. If the amount of human capital differs between men and women, the difference in wages occurs as a consequence. The wage differential between men and women depends on the difference in investment in terms of schooling and on-the-job training as well as experience. Mincer and Polacheck [1974] pointed out that the division of domestic labor by gender greatly influences the wage differential between men and women.[2]

Under the division of domestic labor by gender, the period during which women supply labor is shorter than that of men due to housework and childcare. The labor force participation rate of women between the age of 25 and 39 years is lower than for Japanese women in other age groups, showing a period of interruption for working women. Therefore, the cost-effectiveness of women worsens compared with that of men, and the incentive for human investment in women is weakened. The existence of the division of labor by gender is a factor causing the gap between men and women in not only their income earning power, but also their accumulation of human capital. In addition, if there is an interruption in the work period, the human capital already accumulated may decline in value as a result of technological innovation during that period. As a result, women are at a disadvantage compared with men in terms of human investment.

b. Statistical Discrimination

The wage differential between men and women may also occur because it is difficult to measure each individual's productivity. The information on individuals' productivity is asymmetric among workers and employers, and a great cost is often required to compensate for this asymmetry. In this case, the average productivity of a group with similar attributes is measured instead of

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[2] Kawaguchi [1999] concluded, using the game theory, which the human capital investment of women decreases according to the traditional division of labor by gender.

individuals' productivity. Gender is one attribute, which is one reason why statistical discrimination between men and women occurs (Phelps, [1972] and Arrow, [1974]).

Higuchi [1991] pointed out that the difference in the number of years of service between men and women is a cause that gives rise to statistical discrimination. For a firm to provide human investment in its workers, higher investment-effectiveness can be expected by employing a group that will provide long years of service and by concentrating education and training efforts upon such a group. Though the average length of service of Japanese women is considered long by international standards, men's length of service is even longer. Therefore, the expected investment-effectiveness of women is not as high as that of men. As a result, even if the potential productivity between men and women is the same, there are differences in hiring, education, and training as well as the wage differential because the average length of service is different.

c. Discrimination by Difference in Preference

In the two hypotheses mentioned above, the wage differential can be considered as economically reasonable in the sense that the gap between men and women is based on the difference in marginal productivity. There may, however, be cases where the differentials are generated by a "discriminatory factor" where a reasonable explanation is difficult to find. According to Becker (1957), when a corporation has a discriminatory preference in employing women in a perfectly competitive market, the corporation bears the psychological cost for employing women and, therefore, the corporation will request compensation for it. Women's wages will decrease since the existence of such a cost may shift the labor demand curve of women to the left of the marginal revenue product curve.

One example is the discrimination caused by the preference and attitude of the employer, colleagues, or customers. For instance, the employer who has a bias might prefer to employ men instead of women, disregarding actual productivity. In such a situation, the additional (psychological) cost of employing women is borne by the employer. Moreover, in addition to the employer, women may also be discriminated against by colleagues in the workplace and by customers. Women's wages decrease since the existence of such additional costs may shift women's labor demand curve to the left of the

marginal revenue product curve.

d. Monopoly

There is a hypothesis that the wage differential between men and women is thought to reflect men's monopoly on power in the labor market (Madden, [1975]). Among the various kinds of jobs in the labor market, there are certain fields with more female employees and thus these jobs are generally thought of as women's work. Due to such a general tendency, if the labor supply of women is concentrated in certain jobs, the wages for those jobs will decrease. As a result, there is a gap between the wages of men and women. If the labor market is monopolized by a certain employer, there is a high possibility that the wage is decided at a lower level than that determined by marginal productivity. In particular, when the labor supply is inflexible, the wage level will be determined at a lower level. In addition, when there are two groups with different elasticity of supply, the enterprise can make more profits by proposing different wages for each group. For instance, if women's labor supply is inflexible compared with men's, women's wages will be suppressed at a lower level.

It is important to identify the factors, among those examined by the hypotheses, which explain the wage differential between men and women when considering policy. This is because the policy to be adopted will differ depending on the factors that give rise to the gap. If the psychological cost to the company is an important factor, it may be preferable to provide subsidies to the enterprise that employ women. If the issue of the demand monopoly is an important factor, a positive action (affirmative action) to reduce the occupational categories in which only men and women can be employed may be adopted as one of the approaches. If statistical discrimination is an important factor, a mechanism to prevent it, such as standardizing occupational ability and publishing the standards, may need to be implemented to address the problem.[3]

It is important to identify the causes of the wage differential between men and women, but to the author's knowledge, there has been almost no research that has sufficiently dealt with the issue to date. In the following analyses, the

[3] In our country, there is no general social standard on which to assess professional abilities in many types of jobs, and such assessment is only conducted within companies. Professional ability standards are used by companies for promotion, but they are seldom made public.

wage differential is examined based on the Basic Survey of Wage Structure and the Basic Survey of Employment Management of Women to determine whether the wage differential between men and women is explained by the statistical discrimination theory or if it is caused by other factors.

2. Working Hypothesis

Is the wage differential between men and women caused by statistical discrimination or by other factors such as difference in gender preference? The analysis done in the past has not necessarily succeeded in identifying the factor of the differential. Hori [2003], who examined the primary factor of the wage differential between men and women by using the Oaxaca decomposition, pointed out that the different price effect of men and women is the main factor of the wage differential between the sexes. This result suggests that the wage differential between men and women is caused by the extent of the difference of the price effect, even if attributes between men and women are equal. However, the question is why the price effect is different among men and women, and this cannot be explained by the Oaxaca decomposition.

I would like to examine whether the statistical discrimination theory forms the background of different price effects among men and women. The hypothesis below is examined for this purpose.

If the statistical discrimination theory explains the wage differential between men and women, the wages of men and women should be determined according to the difference of the average length of service and average productivity between men and women that the workplace has knowledge of. However, if the difference of the average length of service and average productivity between men and women at the corporation concerned does not influence the wage, then the wage differential between men and women is determined by the difference in gender, which cannot be explained by the statistical discrimination theory.

Foster and Rosenzweig [1996] and Neumark [1998] examined this hypothesis as outlined below, paying attention to the wage when starting work, race, gender, and (marginal) productivity. First of all, it is assumed that the accumulation of human capital is disregarded, marginal productivity is constant through life, and an incentive wage is not included in the wage. At this time, according to the statistical discrimination theory, the wage must correspond to expected value Ps* ($P_s^* = E(P \mid I_s)$) of productivity when starting work.

(1) $w_s = P_s^*$

where w_s is the wage when starting work and *Is* is the information concerning (the productivity of) the worker, which the employer can obtain when the employee starts working. In this case, if the wage differential between men and women reflects the difference in productivity, that is, if the statistical discrimination explains the wage differential, the parameter β of the following wage function should be zero:

(2) $w_s = \alpha P_s^* + \beta female + \varepsilon$

where w_s is the wage when starting work, *'female'* is the dummy for women, ε is the error term, and α and β are parameters.[4]

If parameter β in Equation (2) is a statistically significant value, it is suggested that even when the difference in the productivity between men and women is controlled, wage differential is still caused by difference in gender. It is difficult to precisely specify what this difference in gender reflects, but Foster and Rosenzweig and Neumark consider it discrimination by preference.

In the analyses above, the wage when starting work and the information about the worker which the employer obtains when the worker is hired and starts work cannot be used. Therefore, the hypothesis is examined by the method outlined below. First, since the wage level differs by age, number of years of service, academic background, company size, and industry, the influence of these factors is controlled. More specifically, we assume a wage function as shown in equation (3):

(3) $$\ln w_i = \alpha + b_1 \exp_i + b_2 \exp_i{}^2 + b_3 tenure_i + b_4 tenure_i{}^2 + \sum c_{1s} SCH_s + \sum d_{1s} IND_s + \sum e_{1s} SIZE_s + u_i$$

where *exp* is elapsed years[5], *tenure* is the number of years of service, *SCH* is the academic background dummy, *IND* is the industry dummy, *SIZE* is the

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4 Meanwhile, Foster and Rosenzweig and Neumark cannot use the difference in the average productivity as perceived by the enterprise, and thus use the variable that shows the individuals' productivity instead.

5 Here, the age when graduating from school is assumed to be the standard age (15 years old when graduating from junior high school, 18 years old when graduating from high school, 20 years old when graduating from junior college, and 22 years old when graduating from university). Therefore, the elapsed years *'kei'* after graduating from school are obtained by (age) minus (years in school) minus (six years).

employee dimension dummy, and *u* is the error term. Here, *kei*, which indicates years elapsed after graduating from school, is used instead of age, so that the parameter α is equal to the level of the first salary. Because α is the level of the initial salary (as indicated by natural logarithm), the expected value P* of the productivity as assumed by the employer and the female dummy *'female'* are substituted to the equation (3) in order to examine whether there is a difference in the initial salary of men and women even when controlling the difference in productivity is controlled.

$$(4)\quad \ln w_i = a_0 + a_1 P^* + a_2\, female + b_1 \exp_i + b_2 \exp_i^{\,2} + b_3 tenure_i + b_4 tenure_i^{\,2} + \sum c_{1s} SCH_s + \sum d_{1s} IND_s + \sum e_{1s} KIBO_s + u_i$$

In equation (4), it is suggested that there is a gap that cannot be explained by the statistical discrimination in the wage of men and women at the time of their initial salary, when the parameter α_2 is statistically significant.

3. Data

The data used in this paper have been calculated based on the Basic Survey of Wage Structure (2001) and the Basic Survey of Employment Management of Women (2001).

The Basic Survey of Wage Structure (designated statistics No. 94) is based on statistical research that aims to clarify the wage realities of full-time workers in major industries by type of worker, type of occupation, gender, age, academic background, length of service, and years of experience, etc. The survey items are industry, company size, gender, academic background, average age in each age group, year of service, scheduled working hours, extra working hours, regular cash earnings, regular cash earnings, and special cash earnings such as annual bonuses.

The Basic Survey of Employment Management of Women (approved statistics) is conducted each year to gain an overall understanding of the employment management situation of female workers in key industries. The survey items differ each year. In 2001 it focused on understanding the employment management situation of women after the amendment of the Equal Employment Opportunity Law was enforced in April 1999. Businesses are the subject of the survey.

These two kinds of statistical surveys are combined to obtain such information as the attributes and wages of workers, attributes of businesses,

and the employment management methods. In using this data, however, it is necessary to note the following:

Firstly, as the result of combining the two statistical surveys, only the data on comparatively large businesses remained. This is because comparatively large businesses responded to both surveys. As a result of combining the two investigations, we obtained 36,963 samples from 456 businesses with 500 or more employees.

Secondly, as a result of using the two surveys, the sampling rate of each individual survey could not be used. Each survey is conducted based on a list of names at the place of employment of the enterprise statistics research, but the sampling rate becomes meaningless when the two surveys are combined. Therefore, the results shown below are figures that have not been reconstructed to show the trends of the population.

Thirdly, because of the very low number of samples in which the employment situation is “temporary” and the working style is “part time”, these samples have been excluded from the analysis below.

To estimate the equation (4), it is necessary to set a variable that shows the difference in the productivity of men and women as understood by businesses. The analysis below uses the rate of average years of service of men and women in the place of business concerned, the rate of women in the place of business concerned, the degree of balance in the number of executives, the degree of balance in the allocation of employees in key duties, and the degree of balance in promotion.

The rate of average years of service of men and women is obtained by the following formula: (women’s average years of service)÷(men's average years of service). The data are taken from Question 1 of the Basic Survey of Female Employment Management.

The rate of women in the place of business concerned is obtained by the following formula: (number of full-time female workers)÷(total number of full-time male and female workers). The data are from the phase sheet of the Basic Survey of Employment Management of Women.

The degree of balance in the number of executives is obtained by the following formula: [(number of female executives irrespective of age)÷(number of full-time female workers irrespective of age)]÷[(number of male executives irrespective of age)÷(number of full-time male workers irrespective of age)]. The data are from Question 7 of the Basic Survey of Employment

difference in the average wages of men and women (hourly scheduled wage of women ÷ hourly scheduled wage of men) is about 67.4. The average wage is influenced by elapsed years, the number of years of service after graduating from school, and academic background. When these are compared by gender, the rate of elapsed years after graduating from school between men and women is 0.6958, the rate of years of service between men and women is 0.6039, and the rate of university graduates between men and women is 0.4300. In addition to these variables, Table 1 also shows that the percentage of executives and the industries to which workers belong differ greatly between men and women.

According to the index that shows the degree of utilization of women, it is clear that the average value of the degree of utilization of women is higher among women than among men when all other variables are the same. In men's and women's years of service, the ratio of women in the place of employment concerned, equality concerning assignment to the key duties, and equality in promotion, all have values that are larger for women than for men. This suggests that enterprises in which more women are employed have a high level of utilization of women and a higher degree of equality or that the degree of utilization of women and the degree of equality rises in enterprises that employs many women. The direction of the causal relation, however, is uncertain.

4. Analytical Result

4.1 Reality of the Wage Differential Between Men and Women

Before making the measurement with Equation (4), we will first grasp the reality of the wage differential between men and women by using the combined data. The combined data are unlikely to reflect the characteristics of the population assumed in the Basic Survey of Wage Structure and the Basic Survey of Employment Management of Women and it is also significant to discover the characteristics of the combined data. Figure 1 shows the distribution of the regular cash earnings per hour according to age, academic background,

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regular cash earnings by total actual working hours; and dividing the regular cash earnings plus the bonus converted per month by total actual working hours. Overtime is reflected in these, except for the regular cash earnings. Below, the wages between men and women are compared by the regular cash earnings, which do not reflect overtime.

Management of Women. This variable is calculated for each of the positions of chief clerk or equivalent, section chief or equivalent, and general manager or equivalent.

As for the degree of balance in the allocation of employees in key duties, the data are from Question 5(2) of the Basic Survey of Employment Management of Women. The gist of this question is: "How are full-time male and female workers, not including executives, distributed in the following areas of duty?" The duties in the question are “duties that a new employee would take a year or two to acquire the skills for,” “duties that a new employee would take three to five years to acquire the skills for,” and “duties that a new employee would take six or more years to acquire the skills for.” Here, for each are of duty, the dummy takes the value of 1 when “there are generally the same number of men as women (either gender making up 30 to 70 percent),” “almost all are women (80 to 90 percent),” and “all are women.” The dummy takes the value of 0 when “almost all are men (80 to 90 percent),” “all are men,” and “unknown.”

As for the degree of balance in promotion, the data are from Question 8 (1) of the Basic Survey of Female Employment Management. The question asks, "Is there any difference between men and women when an average college-educated worker is promoted after joining the firm?” The dummy takes the value of 1 when “there is no difference between men and women” and “women tend to be promoted earlier than men.” The dummy takes the value of 0 when “men tend to be promoted earlier than women,” “unknown,” and “there are no male (or female) employees so that comparison is not possible.”

These variables do not directly indicate the difference in the productivity of men and women, but rather show the degree to which women are utilized at the places of business concerned. This degree of utilization, however, is thought to reflect the difference in productivity of men and women as perceived by the businesses concerned.

Table 1 shows a list of variables and the basic statistical values of men and women for each variable. The wage used in the analysis below is the hourly scheduled wage. The scheduled wage is used to exclude the effect derived from the difference in overtime between men and women.[6] In Table 1, the

[6] When using the wage census, the hourly wage is obtained by three methods: dividing the scheduled cash earnings by the nominal working hours; dividing the

Table 1. Basic statistics of variables

Variable	Details	Men		Women	
		Average value	Standard deviation	Average value	Standard deviation
h_wage1	Regular wage per hour (100 yen)	25.3220	14.2572	17.0650	7.4047
exp	Elapsed years after graduating from shool	21.2611	11.5108	14.7928	11.3558
tenure	Years served	18.3765	11.4089	11.0973	9.4209
jh	Junior high school graduate dummy	0.0730		0.0466	
hs	High school graduate dummy	0.5043		0.4226	
jc	Junior college graduate dummy	0.0635		0.3763	
uni	University graduate dummy (High school graduates as reference group)	0.3593		0.1545	
blue	Production worker dummy (Clerical work and management as reference group)	0.3730		0.1977	
female	Female dummy(men as reference group.)				
def_tenure	Differential of years served between men and women	0.6766	0.2693	0.7844	0.4457
per_fem	Ratio of women of workplace concerned	0.1535	0.1479	0.4028	0.2677
per_bucho	Ratio of female general manager of workplace concerned(*1)	2.2715	37.5985	0.3449	14.0321
per kacho	Ratio of female section chief of workplace concerned(*1)	6.4301	108.5269	0.9846	40.5089
per kakari	Ratio of female chief clerk of workplace conerned(*1)	0.2103	1.0131	0.2577	0.6014
prod 1	Assignment to duties requiring 1-2 years to master(*2)	0.4088		0.6918	
prod_2	Assignment to duties requiring 3-5 years to master(*2)	0.2985		0.6177	
prod_3	Assignment to duties requiring six years or more to master(*2)	0.2143		0.4911	
ladder	Differential of wage progression and promotion	0.5996		0.6192	
size1	Firms with 5,000 employees or more	0.4199		0.3128	
size2	Firms with 1,000 to 4,999 employees or more (Firms with 500 to 999 employees or more as reference group)	0.3946		0.4111	
bucho	General Manager	0.0316		0.0025	
kacho	Section Chief	0.0721		0.0076	
kakaricho	Chief Clerk	0.0685		0.0176	
syokuc	Chief Clerk	0.0438		0.0026	
mining	Mining industry	0.0023		0.0010	
const	onstruction industry	0.0247		0.0119	
food	Food and beverage, tobacco, and feed manufacturing industry	0.0338		0.0385	
texti	Textile industry, clothes and other textile products manufacturing industry	0.0057		0.0196	
lumber	Wood, wooden goods manufacturing industry,furniture and equipment manufacturing industry	0.0037		0.0014	
pulp	Pilp, paper, and paper product manufacturing industry	0.0945		0.0436	
chemi	Chemicak industry, plastic product manufacturing industry, rubber product hoard industry	0.1473		0.0762	
ceramic	Pottery industry, earth and stone product manufacturing industry	0.0316		0.0182	
iron	Iron and steel industry	0.0409		0.0055	
nonfer	Nonferrors metals manufacturing industry	0.0373		0.0146	
fab_met	Metal manufacturing industry	0.0296		0.0328	
machine	Generalmachinery apparatus manufacturing industry	0.0415		0.0198	
ele_mach	Electric machine apparatus manufacturing industry	0.0970		0.0828	
transp	Machinery and appliances for transportation manufacturing industry	0.1258		0.0376	
precision	Precision machine apparatus manufacturing, and other manufcturing industry	0.0785		0.0768	
electricy	Electricity, gas, and water industry	0.0327		0.0149	
trans_com	Transportation and communication business industry	0.0251		0.0214	
trade	Wholesale, retail trade industry, restaurant	0.0317		0.0884	
finance	Wholesale, retail trade industry, restaurant Financial insurance business, real estate business industry(seivice industry as reference group)	0.0313		0.0354	
	Number of samples	28634		8329	

(*1) The ratio of women in managerial posts was calculated based on the formula:(number of women in managerial posts)÷(number of female employees)÷(number of female employees)÷(number of men in managerial posts)÷(number of male employees).

(*2) '1' if only women are employed, most employees are women, or number of men and women are almost same,.'0' if only men are employed or most employees are men

(*3) '1' if there is no differential between men and women in promotion or if women are promoted earlier than men. '0' if, men are promoted earlier than women, promotion situation is not understood, or there are no male employees who can be subjected to comparison

and gender. The square box in the figure shows the range from the 25th to 75th percentiles, and the horizontal line in the box shows the median. Moreover, short horizontal lines above and below the box correspond to x[75]+1.5×(x[75]−x[25]) and x[25]−1.5×(x[75]−x[25]), respectively. Values above or below these lines are negligible values. This figure shows that the older men and women grow, irrespective of academic background, the more the distribution of the scheduled cash earnings per hour expands. Moreover, paying attention to the size of the box, it shows that the distribution of the wage is wider among those with higher academic backgrounds and among women more than men. As to female university graduates in the over 35 years age group, it shows that in particular that the median is under the box, and that the distribution of the scheduled cash earnings per hour is skewed upwards. So far it has been pointed out that there is a sample selection bias[7] in women's wage, but the upward distortion of the female university graduate's wage suggests that this problem is especially important with respect to female university graduates.[8]

If we pay attention to the median in Figure 1, it is obvious that there is a wage differential between men and women, even amongst those with the same academic background and those in the same age group. The consequence being omitted, there is the wage differential between men and women in the average scheduled cash earnings per hour. However, this differential is also influenced by the industries in which the women are employed and the size of the businesses. Thus, in order to reexamine if there is a differential or not even when the effect of these industries and the size of the enterprises is controlled, the following Mincer type wage function was presumed:

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[7] Bias occurs since the wage is observed only in persons who are working. According to the theory of labor supply, whether people work or not is decided by the scale size of the prevailing wage and the reservation wage. The reservation wage shows the opportunity cost of the leisure sacrificed by working, and this opportunity cost rises in the case of housework and childcare by women. Therefore, only those women with a high prevailing wage work, which causes the bias in the wage distribution.

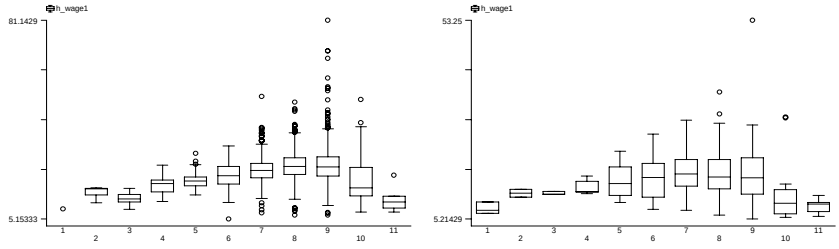
[8] Higuchi [1991], who analyzed the labor supply behavior of women, mentions that the ratio of female university graduates who rejoin the labor market after they left work due to marriage, childbirth and childcare is much lower compared with women from other academic backgrounds.

$$\ln w_i = a_1 + b_{11}exp_i + b_{12}exp_i^{\,2} + b_{13}tenure_i + b_{14}tenure_i^{\,2} + \sum c_{1s}SCH_s + \sum d_1 position + e_1 blue + a_2\, female + b_{21}exp\_f_i + b_{22}exp\_f_i^{\,2} + b_{23}tenure\_f_i + b_{24}tenure\_f_i^{\,2} \sum c_{2s}SCH_s\_f_i + \sum d_2 position\_f_i + e_2 blue\_f_i + \sum g_s IND + \sum h_s SIZE + u_i$$

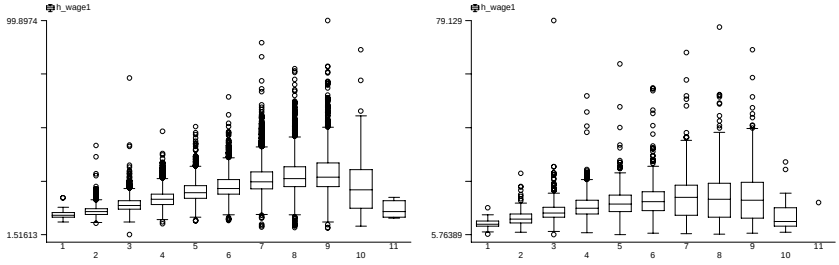
where *exp* is elapsed years after graduating from junior high school, *tenure* is years of service, *SCH* is the academic background dummy, *position* is the job title dummy, *blue* is the production business dummy, *IND* is the industry dummy, *SIZE* is the size of the enterprise, and *female* is the female dummy. The variable that has *_ f* at the end is the cross term with the female dummy. Moreover, *a, b, c, d, e, g,* and *h* are parameters, and *u* is the error term.

Figure 1. Distribution of regular cash earnings per hour according to academic background, gender and age group

Junior high school graduates



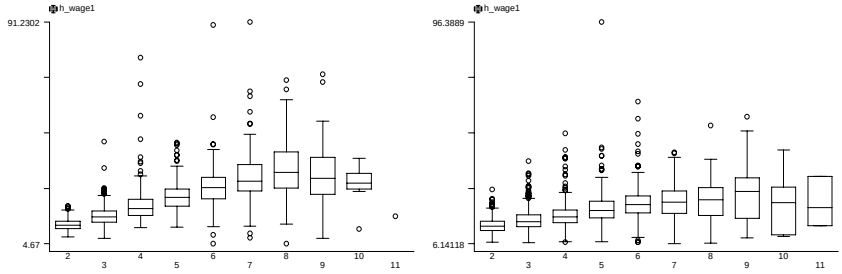
High school graduates



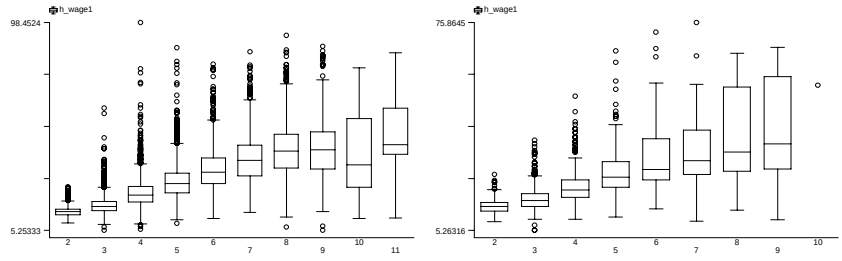
Note: In these figures, the vertical axis indicates the regular cash earnings per hour (the unit is 100 yen). The horizontal axis indicates the age group (at intervals of five years, according to classification by the Basic Survey of Wage Structure). The left side is men and the right side is women.

Figure 1 (continued)

Junior college graduates



University graduates



Note: In the figures the vertical axis indicates the regular cash earnings per hour. (the unit is 100 yen). The horizontal axis indicates the age group (the interval of five years, by the classification of the Basic Survey of Wage Structure). The left side is men and the right side is women.

The estimated results are shown in Table 2. The estimated results are omitted, but the firm size and industry dummies are included in the estimated equation. According to Model 1 of Table 2, the female dummy is -0.1668, and is statistically significant. After controlling elapsed years after graduating from school, years of service, academic background, job title category, industry, and enterprise size, women's wages are about 16.68 percent lower than men's. Table 3 shows the results estimated by Model 1 by academic background. Focusing on the female dummy, the coefficients are -0.3552 for junior high school graduates, -0.2063 for high school graduates, -0.0910 for junior college graduates, and -0.0816 for college graduates, which are all statistically significant. The estimated results by the academic background show that women's wages are approximately 8 to 36 percent lower than men's wages, regardless of academic background. The wage differential between men and women is large,

Table 2. Estimated result of the wage function

Dependent variable: regular cash earnings per hour
Estimation method: OLS

	Model1			Model2		
	Parameter	Standard deviation		Parameter	Standard deviation	
female	-0.1668	0.0036	***	-0.0067	0.0106	
exp	0.0338	0.0007	***	0.0416	0.0009	***
exp2	-0.0006	0.0000	***	-0.0007	0.0000	***
tenure	0.0129	0.0007	***	0.0110	0.0008	***
tenure2	0.0097	0.0017	***	0.0064	0.0019	***
jh	-0.0713	0.0060	***	-0.0692	0.0065	***
jc	0.1361	0.0047	***	0.0866	0.0064	***
uni	0.2691	0.0037	***	0.2688	0.0041	***
blue	-0.0592	0.0036	***	-0.0469	0.0039	***
bucho	0.2867	0.0086	***	0.2721	0.0086	***
kacho	0.1918	0.0059	***	0.1816	0.0060	***
kakaricho_f	0.0564	0.0057	***	0.0457	0.0059	***
syokuc	0.0184	0.0072	**	0.0029	0.0072	
exp_f				-0.0195	0.0016	***
exp2_f				0.0002	0.0000	***
tenure_f				0.0074	0.0015	***
tenure2_f				0.0046	0.3885	
jh_f				-0.0131	0.0164	
jc_f				0.0659	0.0093	***
uni_f				0.0238	0.0097	**
blue_f				-0.0737	0.0087	***
bucho_f				0.0703	0.0536	
kacho_f				0.0642	0.0314	**
kakaricho_f				0.1041	0.0213	***
syokuc_f				-0.0839	0.0520	
_cons	2.4230	0.0067	***	2.3521	0.0073	***
Number of samples	36835			36835		
F value	2183.92			1706.62		
Adjusted R-	0.6683			0.6805		

Note: ***, **, * indicate that the parameters are statistically significant at one percent, five percent, and 10 percent, respectively.

especially among those with lower academic backgrounds.

However, in Model 2 of Table 2 the female dummy is not assumed to be a statistically significant coefficient. Model 2 is different from Model 1 in that the cross term between each of the elapsed years after graduating from school, years of service, academic background, job category, job title category, and female dummy is included in Model 2. The cross term with the female dummy shows that the effects are different for men and women. The effect of elapsed years after graduating from school, years of service, job category, and job title

Table 3: Estimated result of the wage function according to academic background

Dependent variable: regular cash earnings per hour
Estimation method: OLS

	Graduated from junior high schoo			Graduated from high school			Graduated from junior college			Graduated from university		
	Parameter	Standard deviation		Parameter	Standard deviation		Parameter	Standard deviation		Parameter	Standard deviation	
female	-0.3552	0.0139	***	-0.2063	0.0049	***	-0.0910	0.0081	***	-0.0816	0.0079	***
exp	0.0192	0.0035	***	0.0202	0.0008	***	0.0170	0.0014	***	0.0456	0.0012	***
exp2	-0.0004	0.0001	***	-0.0005	0.0000	***	-0.0004	0.0000	***	-0.0008	0.0000	***
tenure	0.0193	0.0023	***	0.0163	0.0010	***	0.0206	0.0019	***	0.0044	0.0015	***
tenure2	-0.0113	0.0045	**	0.0065	0.0024	***	-0.0041	0.0055		0.0037	0.0044	
blue	-0.0497	0.0124	***	-0.0628	0.0043	***	-0.1036	0.0145	***	-0.1015	0.0121	***
bucho	0.3131	0.1023	***	0.3649	0.0178	***	0.3548	0.0368	***	0.2141	0.0110	***
kacho	0.2273	0.0453	***	0.2550	0.0102	***	0.2693	0.0213	***	0.1115	0.0080	***
kakaricho	0.1522	0.0266	***	0.0856	0.0084	***	0.1014	0.0182	***	-0.0014	0.0087	
syokuc	0.0399	0.0180	**	0.0229	0.0078	***	0.0168	0.0485		-0.1086	0.0293	***
_cons	2.3629	0.0487	***	2.5723	0.0093	***	2.6725	0.0117	***	2.8666	0.0094	***
Number of samples	2469			17903			4912			11551		
F value	106.57			1225.4			242.3			768.63		
Adjusted R-square	0.562			0.6795			0.6037			0.6732		

category—the coefficients of which are assumed to be statistically significant on the wage—is different for men and women. These causes of the wage differential between men and women are more important than the female dummy, which shows the differential between men and women in their initial cash earnings. In the meantime, among these variables the elapsed years after graduating from school and job category (production division) make women's wages lower. The influence of elapsed years after graduating from school, academic background, and job title on the wages is larger for women than for men.

Among these factors influencing the wage, the difference between men and women regarding the elapsed years after graduating from school has the biggest impact on the wage differential between men and women. Table 4 simulates the standard worker's hourly wage by academic background and gender using the results of Model 2 of Table 2. "Standard workers" mean workers who have continued to work at the same enterprise after graduating from school with elapsed years and years of service being the same. Table 4

Table 4. Simulated results of the regular cash earnings per hour

(unit: 100 yen)

	Graduated from junior high schoo			Graduated from high school		
	Male	Female	Differential	Male	Female	Differential
0 year	9.5387	10.0350	105.2033	10.2149	10.8478	106.1954
5 years	12.4141	12.3864	99.7771	13.2941	13.3896	100.7181
10 years	16.2066	15.3079	94.4552	17.3555	16.5478	95.3460
15 years	21.2236	18.9423	89.2510	22.7282	20.4765	90.0928
20 years	27.8804	23.4689	84.1770	29.8569	25.3697	84.9709
25 years	36.7392	29.1136	79.2441	39.3437	31.4716	79.9914
30 years	48.5636	36.1613	74.4617	52.0064	39.0900	75.1639
35 years	64.3937	44.9713	69.8380	68.9588	48.6136	70.4966
40 years	85.6501	55.9978	65.3798	91.7220	60.5332	65.9964

	Graduated from junior college			Graduated from university		
	Male	Female	Differential	Male	Female	Differential
0 year	11.2122	12.4018	110.6095	13.2834	14.4420	108.7222
5 years	14.5921	15.3077	104.9045	17.2876	17.8261	103.1145
10 years	19.0499	18.9183	99.3091	22.5690	22.0307	97.6146
15 years	24.9472	23.4098	93.8375	29.5557	27.2611	92.2363
20 years	32.7718	29.0040	88.5027	38.8258	33.7756	86.9926
25 years	43.1848	35.9800	83.3163	51.1624	41.8993	81.8947
30 years	57.0838	44.6899	78.2881	67.6289	52.0420	76.9523
35 years	75.6913	55.5777	73.4268	89.6737	64.7211	72.1740
40 years	100.6769	69.2048	68.7395	119.2749	80.5901	67.5666

Note: Simulation is based on regular employee.

shows that the greater the elapsed years after graduating from school, the greater the wage differential between men and women, even though there is some difference by academic background. With 10 elapsed years, the wage differential between men and women who graduated from high school is 95.35 and 97.61 for college graduates. With 20 elapsed years, the wage differential between men and women who graduated from high school is 84.97 and 86.99 for college graduates. What is behind the difference between men and women in the effect elapsed years has on wages and why is the effect smaller for women than for men? The effect of elapsed years may reflect the role of wages as guaranteeing livelihood of workers, which might bring about the difference between men and women. In the past, society's predominant view of the division of labor was by gender, with men being employed and women doing housework, and this concept was very likely to be reflected in wages. There is a high possibility that such a mindset about the role of wages still influences the wage differential between men and women.

A summary of the above-mentioned results is as follows: First of all, the wage differential between men and women exists even if worker attributes and the attributes of the workplace are controlled. The wage differential results from difference in academic background, but the scheduled wage of women per hour is about eight to 37 percent lower than that of men. This differential is influenced by elapsed years after graduating from school. Even for a standard worker, when 20 years have passed since joining a company, the wage level of women per hour is about 84 to 89 when that of men is 100.

4.2 Statistical Discrimination

As shown in the estimated results in Table 2, there is an apparent wage differential between men and women even after controlling the attributes of the workers and workplaces. In the following section, I would like to examine whether this differential between men and women is caused by statistical discrimination. The estimated results of Equation (4) shown in the working hypothesis are indicated in Table 5. The firm size and industry dummies are included in the estimated equation.

According to Model A of Table 5, the female dummy is estimated to be a statistically significant negative value even after controlling the attributes of the workers, workplace, and utilization level of women in the workplace. The estimated results of the above-mentioned working hypothesis show that the wage

Table 5. Utilization level of women and wage structure

Dependent variable: regular cash earnings per hour
Estimation method: OLS

	Model A			Model B		
	Parameter	Standard deviation		Parameter	Standard d Err	
def_tenure	-0.0015	0.0043		0.0078	0.0042	*
per_fem	0.0248	0.0101	**	0.0398	0.0101	***
per_bucho	-0.0021	0.0013		-0.0020	0.0013	
per_kacho	0.0006	0.0005		0.0005	0.0004	
per_kakaricho	0.0193	0.0033	***	0.0173	0.0032	***
prod_1	-0.0476	0.0069	***	-0.0448	0.0068	***
prod_2	0.0244	0.0082	***	0.0118	0.0081	
prod_3	0.0351	0.0074	***	0.0237	0.0073	***
ladder	0.0179	0.0048	***	0.0176	0.0047	***
female	-0.1830	0.0038	***	-0.0107	0.0106	
exp	0.0329	0.0007	***	0.0415	0.0009	***
exp2	-0.0006	0.0000	***	-0.0007	0.0000	***
tenure	0.0129	0.0007	***	0.0102	0.0008	***
tenure2	0.0083	0.0017	***	0.0056	0.0019	***
prod_1_ten	0.0009	0.0003	***	0.0010	0.0003	***
prod_2_ten	-0.0015	0.0004	***	-0.0005	0.0004	
prod_3_ten	0.0010	0.0004	***	0.0008	0.0004	**
ladder_ten	0.0005	0.0002	**	0.0004	0.0002	*
jh	-0.0658	0.0060	***	-0.0666	0.0064	***
jc	0.1204	0.0047	***	0.0650	0.0064	***
uni	0.2556	0.0037	***	0.2555	0.0040	***
blue	-0.0653	0.0036	***	-0.0559	0.0039	***
bucho	0.2871	0.0084	***	0.2695	0.0084	***
kacho	0.1854	0.0059	***	0.1726	0.0059	***
kakaricho	0.0560	0.0056	***	0.0449	0.0057	***
syokuc	0.0172	0.0071	**	0.0030	0.0070	
exp_f				-0.0215	0.0016	***
exp2_f				0.0002	0.0000	***
tenure_f				0.0070	0.0016	***
tenure2_f				0.2502	0.3856	
prod_1_ten_f				-0.0010	0.0006	*
prod_2_ten_f				-0.0014	0.0006	**
prod_3_ten_f				0.0039	0.0006	***
ladder_ten_f				0.0004	0.0004	
jh_f				0.0153	0.0161	
jc_f				0.0740	0.0093	***
uni_f				0.0181	0.0096	*
blue_f				-0.0546	0.0086	***
bucho_f				0.0990	0.0518	*
kacho_f				0.0641	0.0311	**
kakaricho_f				0.1033	0.0208	***
syokuc_f				-0.0791	0.0502	
_cons	2.4149	0.0092	***	2.3367	0.0096	***
Number of samples	35496			35496		
F value	1632.51			1298.71		
Adjusted R-square	0.6836			0.6973		

differential is still generated by gender, even after controlling the difference in productivity between men and women as perceived by the employer. It shows that the wage level of women is about 18.3 percent lower than that of men. Moreover, R-square of this Model A, where the degree of freedom is modified, is 0.6836. This is a 0.0153-point increase from R-square of 0.6683 from Model 1 in Table 2, resulting from adding the female utilization level in the workplace. In other words, the fitness of the wage function was improved about 1.53 percent by adding the female utilization level in the workplace. The power of explanation of this Model A is higher than 0.6805— R-square of Model A in Table 2 where the degree of freedom is modified—which means that the female utilization level in the workplace is an important factor when explaining the wage structure. It is also important that this female utilization level in the workplace has the following effects on the wage structure: That is, each estimated coefficient of the female ratio (per_fem) in the workplace concerned, the equality (per_kakari) in the ratio of the chief clerks, the equality (prod_2,prod_3) in assignment of duties that last for two to five years and for duties that last for six years or more, and the equality (ladder) in proportion is a statistically positive significant value, and the higher the female utilization level, the higher the wage level. While the direction of the cause and effect between the female utilization level and the wage level is not clear in this analysis, it is at least understood that there is a relationship between the two.[9]

As seen in Model 2 in Table 2, the female dummy that shows the differential of the initial cash earnings between men and women was not statistically significant, assuming that the effect of the elapsed years, years of service, and academic background on the wage was different between men and women. There the difference of the effect of elapsed years was important for the background of the wage differential between men and women. Consequently, in Model B in Table 5, the equality in the utilization of men and women was added to Model 2 to test if the female dummy was significant or not.

According to the results of Model B, the coefficient of the female dummy is assumed to be negative, but it is not statistically significant. According to Table 6 where Model B was estimated based on the academic background, it is

[9] This assumed consequence is thought to reflect the fact that the wage level is high because the enterprises which employ women have higher productivity, or that the wage level and women's utilization level are both high in workplaces that, for whatever reason, have sufficient management ability.

understood that the female dummy is a statistically significant negative value for junior high and the high school graduates. The size of enterprise and the industry dummies are included in this estimated equation. The value is negative for junior college and college graduates, but it is not statistically significant. Therefore, the initial cash earnings of women who are junior high or high school graduates are approximately 12 to 36 percent lower than those of men, even after controlling the difference in the productivity as perceived by the employer.

Will the difference in the degree of utilization equality influence the wage differential between men and women? According to Model B, the difference in the degree of utilization equality will not necessarily have no influence on the wage differential between men and women. Model B includes the cross term (prod_ten) of years of service and the degree of utilization equality, and the cross term (prod_ten_f) of years of service and the female dummy. An analysis indicating that the effect of years of service on the wage will differ depending on the degree of utilization of women has been made by Higuchi [1991] and Mitani [1997]. The analytical result here is consistent with the research done so far. That is, prod1_ten_f and prod2_ten_f are statistically significant negative values. This means that the effect of years of service by women on the wage is smaller than that of men in workplaces where many women are assigned to duties that require one to two years or three to five years to acquire the necessary skills. In addition, prod3_ten_f is a statistically significant positive value. This means that the effect of years of service of women on the wage is larger than that of men in workplaces where many women are assigned to duties that requires six years or more to master. Such a result seemed to be the same for those in all academic backgrounds. Meanwhile, in a simulation of the differential between men and women when men and women are regular employees and college graduates who have served for 10 years, the value of enterprises with high equality in the assignment of workers to duties requiring six years or more to master is 94.10, whereas the value of enterprises that are otherwise is 84.31. This means that the lower the equality of the enterprise is, the larger the wage differential between men and women.[10] Therefore, the effect of years of service on wages differs according to the degree of utilization

[10] The simulation was made by dividing those enterprises with high equality in the assignment to duties requiring six years or more to master and other enterprises, and by using the results estimated in the wage function of formula (2) by men and women.

Table 6: Utilization level of women and wage structure according to academic background

Dependent variable: regular cash earnings per hour
Estimation method: OLS

	Graduated from junior high schoo			Graduated from high school			Graduated from junior college			Graduated from university		
	Parameter	Standard deviation		Parameter	Standard deviation		Parameter	Standard deviation		Parameter	Standard deviation	
def_tenure	-0.0173	0.0188		-0.0004	0.0064		-0.0221	0.0070	***	0.0780	0.0090	***
per_fem	-0.1945	0.0516	***	-0.1231	0.0160	***	0.1561	0.0197	***	0.1079	0.0182	***
per_bucho	0.0071	0.0061		-0.0012	0.0014		0.0015	0.0082		-0.0079	0.0046	*
per_kacho	-0.0022	0.0021		0.0004	0.0005		-0.0009	0.0028		0.0025	0.0016	
per_kakaricho	-0.0341	0.0102	***	0.0028	0.0045		0.0454	0.0072	***	0.0321	0.0065	***
prod_1	-0.1479	0.0488	***	-0.0637	0.0101	***	-0.0385	0.0172	**	-0.0162	0.0117	
prod_2	0.1696	0.0585	***	0.0602	0.0127	***	-0.0437	0.0180	**	0.0003	0.0144	
prod_3	-0.0012	0.0533		-0.0055	0.0116		0.0393	0.0148	***	0.0076	0.0132	
ladder	0.0513	0.0312	*	-0.0056	0.0069		0.0199	0.0111	*	0.0189	0.0088	**
female	-0.3574	0.0949	***	-0.1208	0.0137	***	-0.0273	0.0191		-0.0172	0.0198	
exp	0.0182	0.0043	***	0.0273	0.0009	***	0.0273	0.0023	***	0.0448	0.0013	***
exp2	-0.0003	0.0001	***	-0.0006	0.0000	***	-0.0006	0.0001	***	-0.0008	0.0000	***
tenure	0.0172	0.0027	***	0.0116	0.0011	***	0.0243	0.0030	***	0.0062	0.0017	***
tenure2	-0.0096	0.0052	*	0.0079	0.0027	***	-0.0225	0.0080	***	-0.0031	0.0046	
prod_1_ten	0.0045	0.0015	***	0.0018	0.0004	***	0.0005	0.0012		-0.0006	0.0007	
prod_2_ten	-0.0044	0.0018	**	-0.0022	0.0006	***	-0.0003	0.0014		-0.0009	0.0009	
prod_3_ten	0.0011	0.0017		0.0022	0.0006	***	-0.0023	0.0013	*	0.0022	0.0008	***
ladder_ten	-0.0013	0.0010		0.0010	0.0003	***	0.0006	0.0009		0.0018	0.0005	***
blue	-0.0286	0.0131	**	-0.0489	0.0045	***	-0.0590	0.0158	***	-0.1012	0.0121	***
bucho	0.3120	0.1001	***	0.3626	0.0174	***	0.3251	0.0386	***	0.2144	0.0109	***
kacho	0.2371	0.0460	***	0.2474	0.0102	***	0.2005	0.0235	***	0.1066	0.0080	***
kakaricho	0.1500	0.0266	***	0.0734	0.0084	***	0.0610	0.0206	***	-0.0019	0.0087	
syokuc	0.0447	0.0183	**	0.0154	0.0076	**	-0.0431	0.0477		-0.1066	0.0291	***
exp_f	0.0116	0.0075		-0.0214	0.0017	***	-0.0166	0.0028	***	0.0028	0.0031	
exp2_f	-0.0004	0.0001	**	0.0003	0.0001	***	0.0002	0.0001	**	-0.0004	0.0001	**
tenure_f	0.0025	0.0053		0.0087	0.0023	***	-0.0049	0.0038		-0.0199	0.0049	***
tenure2_f	0.8026	1.0887		-0.8603	0.5695		1.8847	1.0866	*	5.8050	1.7261	***
prod_1_ten_f	-0.0021	0.0014		-0.0006	0.0007		0.0007	0.0016		0.0034	0.0025	
prod_2_ten_f	-0.0046	0.0015	***	-0.0007	0.0008		0.0028	0.0017	*	-0.0053	0.0029	*
prod_3_ten_f	0.0050	0.0014	***	0.0039	0.0007	***	0.0040	0.0016	***	0.0047	0.0026	*
ladder_ten_f	-0.0008	0.0010		0.0016	0.0005	***	-0.0015	0.0011		0.0008	0.0017	
blue_f	-0.0410	0.0322		-0.0703	0.0094	***	-0.1566	0.0299	***	-0.1007	0.0581	*
bucho_f	(dropped)			-0.1982	0.1006	**	0.0812	0.0848		0.0981	0.0924	
kacho_f	-0.0014	0.2349		0.0383	0.0626		-0.0730	0.0496		0.1745	0.0586	***
kakaricho_f	0.0612	0.2359		0.1717	0.0339	***	0.0591	0.0370		0.0476	0.0414	
syokuc_f	0.0199	0.1312		-0.0870	0.0576		0.0354	0.2247		-0.0773	0.1415	
_cons	2.4610	0.0655	***	2.5936	0.0136	***	2.5598	0.0222	***	2.7352	0.0159	***
Number of samples	2405			17375			4684			11032		
F value	61.14			725.96			146.38			440.32		
Adjusted R-square	0.5791			0.704			0.6389			0.6942		

equality, which influences the wage differential between men and women.

4.3 Employment Management System According to Employment Track and Wage Structure

The number of large firms and other enterprises that have introduced the employment management system by employment track has increased since the Equal Employment Opportunity Law was enforced. There are various reasons why these enterprises introduced this system; one of which is to address the "signaling problem". The signaling problem is the situation whereby the enterprises are hesitant to hire women or avoid human capital investment in women because the average productivity of women is lower than men, or because the average length of service by women is statistically shorter than men. If the relation-specific human capital[11] is important for the enterprise, then education and training to allow accumulation of such capital in the employees are indispensable. In this case, to improve the cost-effectiveness of the education and training, the employee's ability and long-term service become important preconditions. Thus, if women's average years of service are short when compared with men, the enterprise has an incentive for giving more education and training to men.

There are people with short periods of service regardless of gender, but it is difficult for the enterprise to acquire private information about an employee's abilities and to predict whether their years of service are likely to be short or not. The enterprise tries to compensate for the asymmetry of the information by using the average value of men and women (=signal). This signaling problem plays an important role as one of the causes of the wage differential between men and women. If the enterprise gives a lot of education and training opportunities to men and not to women because of the signal, then there will be differences in the marginal productivity of men and women. As a result, even if the wage is proportional to the marginal productivity, there will be a wage differential between men and women. This is a reasonable differential reflecting the difference in the marginal productivity. If the enterprise can solve the signaling problem, such a differential will not exist. One solution is

[11] The knowledge and skills useful for the enterprise are called the relation-specific human capital. This relation-specific human capital is useful in a specific enterprise, but not in any other enterprises. Therefore, the enterprise bears the cost which is required in educating and training employees to accumulate this human capital.

an employment management system by “employment tracks”. An enterprise which maintains this system generally has two or more courses or tracks, such as the comprehensive work track and the clerical work track, which differ according to the type of job assignment and career path. In the comprehensive or management work track, employment management is provided for employees who perform integral duties, more education and training opportunities are given, and there is no limit to promotions. In the clerical work track, the employment management is provided for employees who perform support duties, relatively few education and training opportunities are given, and there is limit to promotions. If it is possible to make employees select from among such career tracks, the signaling problem can be solved, because the employees will disclose their preferences by selecting one of the courses.

If the above holds as an explanation of the employment management system by employment track, then these systems and the wage system should be in a supplementary relationship. Is there actually a supplementary relationship? In addition, within the employment management system by employment track, some female workers are employed in the comprehensive work track, while others are employed in the clerical work track How is the wage differential among women in this employment system by employment track?

First of all, let us examine in Table 7 the difference in worker's attributes in enterprises that have adopted the employment management system by employment track and in enterprises that have not. First, there is no difference in the regular cash earnings per hour of men as a result of the employment management system by employment track, but the regular cash earnings per hour of women are higher in the enterprises that do not have the employment management system by employment track. Also, when the coefficient of variation of regular cash earnings per hour in the enterprises that have the employment management system by employment track is calculated, the coefficient is 0.4122 and 0.3589 for men and women, respectively. In the enterprises that do not have the employment management system, the coefficient is 0.6275 and 0.4519 for men and women, respectively, which means that the wage distribution is larger in the enterprises that do not have the employment management system by employment track.

The difference in the wage level and the wage distribution also occurs due to the difference in elapsed years and years of service after graduating from

Table 7: Existence of the employment management by employment track, basic statistics of samples

	Workplace with employment management by employment track				Workplace without employment management by employment track			
	Male		Female		Male		Female	
	Average value	Standard deviation	Average value	Standard deviation	Average value	Standard deviation	Average value	Standard deviation
h_wage1	25.2970	10.4306	16.1623	5.8003	25.3351	15.8968	17.3681	7.8477
def_tenure	0.6617	0.2273	0.7338	0.2557	0.6846	0.2889	0.8020	0.4936
per_fem	0.1365	0.1160	0.3180	0.2355	0.1624	0.1614	0.4314	0.2719
prod_1	0.3522	0.4777	0.6050	0.4890	0.4384	0.4962	0.7210	0.4485
prod_2	0.2451	0.4302	0.5119	0.5000	0.3263	0.4689	0.6533	0.4760
prod_3	0.1544	0.3613	0.3473	0.4762	0.2457	0.4305	0.5394	0.4985
ladder	0.6120	0.4873	0.6207	0.4853	0.5931	0.4913	0.6186	0.4858
exp	21.8969	11.6103	15.4900	11.5482	20.9287	11.4447	14.5583	11.2816
tenure	19.4532	11.5397	12.2801	9.9382	17.8135	11.2994	10.6995	9.2072
jh	0.0944		0.0744		0.0617		0.0372	
hs	0.4977		0.4451		0.5078		0.4150	
jc	0.0478		0.2963		0.0716		0.4032	
uni	0.3602		0.1842		0.3588		0.1446	
seisan	0.4191		0.2309		0.3489		0.1866	
size1	0.4488		0.3197		0.4048		0.3104	
size2	0.4645		0.4895		0.3580		0.3847	
bucho	0.0312		0.0024		0.0319		0.0026	
kacho	0.0717		0.0033		0.0723		0.0090	
kakaricho	0.0680		0.0248		0.0687		0.0152	
syokuc	0.0498		0.0029		0.0406		0.0026	
Number of samples	9832		2096		18802		6233	

school. In the enterprises that have the employment management system by employment track, elapsed years and years of service are 21.9 years and 19.5 years, respectively, for men and 15.5 years and 12.3 years, respectively, for women. However, in the enterprises that do not have the employment management system by employment track, elapsed years and years of service are 20.9 years and 17.8 years, respectively, for men and 14.6 years and 10.7 years, respectively, for women. It is understood that in the enterprises that have the employment management system by employment track, the average elapsed years and the average years of service are longer, while the difference between men and women with respect to the average elapsed years and the average years of service is small. Moreover, it is shown that the differences in elapsed years and years of service between men and women are small in the enterprises that have the employment management system by employment track. This suggests that, relatively, there are more workers who are working continuously for the same enterprise than those who are working for enterprises that do not have the employment management system by employment track.

In addition, the attributes of women workers differ depending on whether or not the employment management system by employment track has been adopted. In the enterprises that have the employment management system by employment track, the ratio of female university graduates is relatively high, whereas in the enterprises that do not have the employment management system by employment track, the ratio of female junior college graduates is higher. The ratio of female general managers and section chiefs is a little higher in the enterprises that do not have the employment management system by employment track, whereas the ratio of female chief clerks is higher in the enterprises that have the employment management system by employment track. Moreover, the ratio of women is higher in the enterprises that do not have the employment management system by employment track, and the equality in assignment to integral duties of the enterprise is also higher. However, there is no difference in the equality in wage increase and promotion depending on whether or not the employment management system by employment track is adopted.

Table 8 shows how the employment management system by employment track influences the wage structure. Here the estimation was made by dividing the samples based on whether or not the employment management system by employment track is adopted. The size of enterprise dummy and the industry

dummy are included in the estimated equation. First, the parameter of the female dummy was assumed to be statistically significant negative value in the enterprises that have the employment management system by employment track, while it was not assumed to be a statistically significant value in the enterprises that do not have the employment management system. Although the samples are limited, this result shows that in the enterprises that have the employment management system by employment track, the wage level of women is 3.1 percent lower than that of men, but there is no wage differential between men and women in the enterprises that do not have the employment management system. Moreover, one of the features of the wage structure of the enterprises which have adopted the employment management system by employment track is that the value of the constant term indicating the initial

Table 8. Existence of the employment management by employment track, estimated result of the wage function

Dependent variable: scheduled cash eranings per hour
Estimation method: OLS

	Workplace with employment management by employment track			Workplace without employment management by employment track		
	Parameter	Standard deviation		Parameter	Standard deviation	
female	-0.0310	0.0176	*	0.0112	0.0130	
exp	0.0384	0.0014	***	0.0431	0.0011	***
exp2	-0.0006	0.0000	***	-0.0007	0.0000	***
tenure	0.0132	0.0013	***	0.0098	0.0010	***
tenure2	-0.0003	0.0030		0.0097	0.0024	***
jh	-0.0596	0.0083	***	-0.0740	0.0090	***
jc	0.0953	0.0102	***	0.0821	0.0079	***
uni	0.2272	0.0063	***	0.2764	0.0051	***
seisan	-0.0627	0.0058	***	-0.0410	0.0051	***
bucho	0.2610	0.0123	***	0.2771	0.0112	***
kacho	0.1874	0.0085	***	0.1774	0.0078	***
kakari	0.0588	0.0083	***	0.0422	0.0076	***
syokuc	0.0056	0.0095		0.0044	0.0097	
kei_f	-0.0243	0.0026	***	-0.0198	0.0019	***
kei2_f	0.0002	0.0001	***	0.0002	0.0000	***
tenure_f	0.0083	0.0025	***	0.0082	0.0019	***
tenure2_f	-0.1282	0.6152		-0.0256	0.4862	
jh_f	-0.0136	0.0234		-0.0138	0.0217	
jc_f	0.0101	0.0156		0.0770	0.0114	***
uni_f	-0.0354	0.0154	**	0.0446	0.0121	***
seisan_f	-0.0054	0.0139		-0.0924	0.0108	***
bucho_f	0.2261	0.0905	**	0.0094	0.0651	
kacho_f	0.2298	0.0763	***	0.0336	0.0356	
kakaricho_f	0.1723	0.0298	***	0.0719	0.0280	***
syokuc_f	-0.0043	0.0822		-0.1099	0.0647	*
_cons	2.3900	0.0129	***	2.3343	0.0091	***
Number of samples	11893			24942		
F value	783.4			1094.24		
Adjusted R-square	0.7475			0.6636		

wage is large. In comparison, the effects of elapsed years and years of service are relatively small. To sum up, in the enterprises that have the employment management system by employment track, the level of the initial wage is relatively high, but elapsed years after graduating from school and years of service are not proportional to the wage. Additionally, the value of the cross term of the female dummy and elapsed years is estimated to be smaller in the enterprises that have the employment management system than in the enterprises that do not have this system. Also, the cross term of the executive position and the female dummy is estimated to be a statistically significant positive value in the enterprises that have the employment management system by employment track, and the wage increase due to women's promotion is larger compared with the men's. On the other hand, in the enterprises that do not have the employment management system by employment track, there is no difference in the effect of the executive post on the wage between men and women.

Using the estimated results, we simulate the theory value of regular cash earnings per hour by age group in Table 9. The simulation is based on regular workers who are high school graduates and university graduates. There is no great difference in the wage level among men depending on whether or not the employment management system by employment track is adopted, but there is a large difference in the wage level of women who are university graduates. The wage level of women who work at the enterprises using the employment management system by employment track is low, and their wages do not increase much even after long years of service.

Thus, it is clear that the wage structure is considerably different between the enterprises that do not have the employment management system by employment track and the enterprises that do. As for the wage mechanism at the enterprises that have the employment management system by employment track, the regular cash earnings per hour among women are low on average. Moreover, the longer the elapsed years, the larger the differential, which shows that the employment management system by employment track promotes the wage differential between men and women. The reason for this may be that many of the women employed at such enterprises are on the clerical work track. If the employment management system by employment track exists in order to reduce the problem of asymmetry of information, gender should not be an important piece of information as far as employment management is concerned.

Table 9. Existence of the employment management by employment track, estimated result of the regular cash earnings per hour

(unit: 100 yen)

Graduated from high school	With employment track			Without employment track		
	Male	Female	Differential	Male	Female	Differential
0 year	10.9131	10.5796	96.9444	10.3221	10.3221	100.0000
2 years	12.0996	11.3590	93.8788	11.4788	11.2148	97.7000
4 years	13.4145	12.1954	90.9119	12.7743	12.1936	95.4542
6 years	14.8715	13.0929	88.0403	14.2263	13.2676	93.2613
8 years	16.4859	14.0561	85.2610	15.8547	14.4468	91.1200
10 years	18.2747	15.0896	82.5709	17.6823	15.7424	89.0289
Graduated from university	With employment track			Without employment track		
	Male	Female	Differential	Male	Female	Differential
0 year	13.6969	12.8164	93.5719	13.6079	14.2290	104.5646
2 years	15.1861	13.7606	90.6130	15.1328	15.4596	102.1597
4 years	16.8364	14.7738	87.7492	16.8407	16.8089	99.8114
6 years	18.6651	15.8611	84.9775	18.7549	18.2895	97.5183
8 years	20.6913	17.0279	82.2949	20.9017	19.9150	95.2792
10 years	22.9364	18.2799	79.6984	23.3110	21.7009	93.0928

Note: Simulation is based on standard workers.

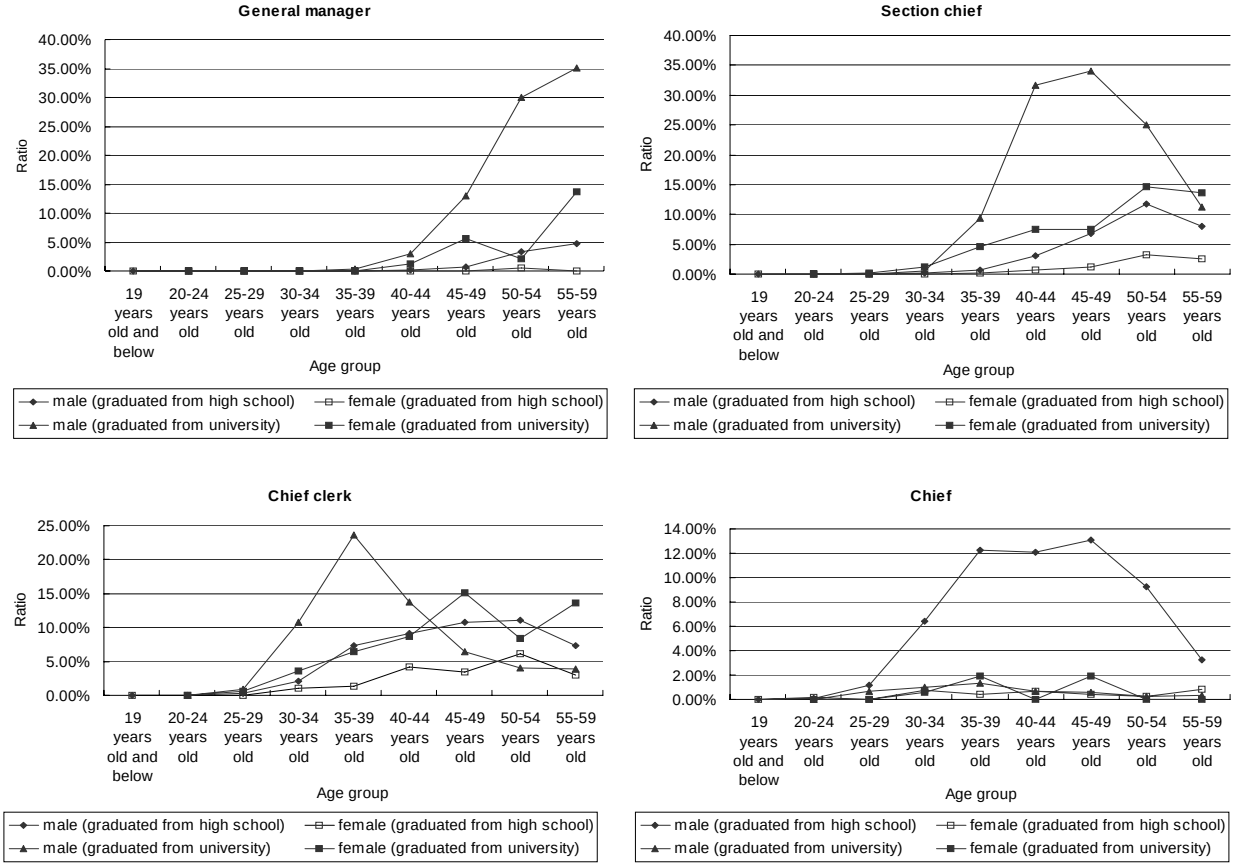
In actuality, however, it may be possible that such enterprises are distinguishing between men and women by putting men on the comprehensive work track and assigning women to the clerical work track, and by applying different wage structures to these tracks.

4.4 Promotion From Within and Wage Differentials

In this section, I would like to focus on promotions and the wage differentials between men and women. As shown in Table 5, the wage level at enterprises with a good level of equality in promoting men and women is relatively high. Let us examine below how much the wage differential between men and women accrues as a result of differences in promotion.

Firstly, let us see how different the promotion structure between men and women is. Figure 2 shows the ratio of male and female workers who hold the posts of general manager, section chief, chief clerk, and chief, broken down into age group and academic background. At all posts, except that of the chief, it is understood that a certain proportion of male university graduates were promoted to those posts. In contrast, a very small proportion female college graduates, and both male and female high school graduates, were promoted to those posts. For instance, in the 40 to 44 years age group, 31.7 percent of male college graduates hold the post of section chief, but only 7.5 percent of female

Figure 2: Differential of the promotion ratio between men and women



university graduates, 3.0 percent of male high school graduates, and 0.7 percent of female high school graduates hold this post. It is highly probable that the small proportion of certain workers being promoted and the slow speed at which they are promoted are contributing, to no small degree, to the wage differential between men and women and between those of difference academic backgrounds.

Then, to what degree does the effect of promotion on the increase of wages differ between men and women? If the effect of promotion of the increase of wages differs between men and women, the differential will become larger and larger between men and women. According to Model 2 of Table 2, statistically significant positive values are estimated for the general manager (*bucho*), section chief (*kacho*), and chief clerk (*kakaricho*), as the wage rises by promotion. The wage of the general manager is 27.2 percent higher, the wage of the section chief is 18.2 percent higher, and the wage of the chief clerk is 4.6 percent higher than workers not holding managerial positions. As for the cross term of the managerial post dummy and the female dummy, a statistically significant parameter was not estimated for the general manager, but a statistically significant positive value is estimated for the section chief and the chief clerk. The wage level of women who are promoted to section chief and chief clerk is higher than that males who are section chief and chief clerk.

Then, how important is the managerial post in explaining the wage structure? This is checked by examining how the addition of the managerial post dummy will explain the wage structure.

In Table 10, adjusted R-square of five estimation models is shown. First, the explanatory variables of Model 1 are elapsed years after graduating from school and its square term, years of service and its square term, academic background dummy, production worker dummy, enterprise size dummy, and industry dummy. Based on this formula, in Model 2, the managerial post dummy is added to the explanatory variables of Model 1. In Model 3, the female dummy is added to the explanatory variables of Model 1. In Model 4, the cross term among elapsed years after graduating from school and its square term, years of service and its square term, and a female dummy is added to the explanatory variables of Model 3. In Model 5, the cross term of the managerial post dummy and the female dummy is added to the explanatory variables of Model 4. By estimating the above models and comparing them with the R-square of the base estimation model, we can see by comparison which

variable increases the potency of explanation when added. The explanation is most convincing when the female dummy and the cross term of the female dummy are added. This is because when Model 2 is compared with Model 3 or Model 4, the latter has a higher R-square. Of course, the explanation is more convincing when the managerial post dummy is added, but it is not as high as when the female dummy is added.

From the above result, it is shown that the effect on wages after promotion to a managerial does not differ greatly between men and women. Contrary to expectations, when a woman is promoted the wage increases more than when a man is promoted. Moreover, the managerial post itself does not sufficiently explain the wage structure. However, there are relatively few women who are promoted to the managerial posts, which is one of the factors of the differential between men and women of the same academic background.

Table 10. Strength of explanation of the estimated model

	Model 1	Model 2	Model 3	Model 4	Model 5
Adjusted R-square	0.6296	0.6497	0.6514	0.6648	0.6805

Note : *The explanatory variables of Model 1 are elapsed years after graduating from school and its squared term years served and its squared term, academic background dummy, production worker dummy, enterprise size dummy, and industry dummy.

*In Model 2, the managerial post dummy was added to the explanatory variables of Model 1.

*In Model 3, the female dummy was added to the explanatory variables of Model 1.

*In Model 4, the cross term of the elapsed years after graduating from school and its squared term, years served and its squared term, and the female dummy were added to the explanatory variables of Model 3.

*In Model 5, the cross term of the managerial post dummy and female dummy were added to the explanatory variables of Model 4.

5. Conclusion

Various hypotheses on the factors of the wage differential between men and women have been examined in past research. In terms of policy, it is considered important to determine whether the wage differential between men and women is generated by statistical discrimination or if it is generated by economically irrational factors.

According to the analysis of this paper, there is a wage differential that cannot be explained by the difference in the average productivity of men and women as perceived by the employer. This wage differential existing as the effect on the wage of elapsed years after graduating from school, years of service, and other factors, is different between men and women. It is also

difficult to come up with an economically reasonable explanation for the fact that, even when the productivity gap between men and women as perceived by the employer is controlled, the effect of elapsed years after graduating from school and years of service on the wage differs between men and women. Because it is difficult for the enterprise to obtain personal information about workers' abilities and achievements, the enterprise tries to compensate for the asymmetry of the information by using statistically available information. An often-mentioned example is the employment management system by employment track. In the enterprises where the employment track is used, the wage differential between men and women is relatively large, and there is a tendency for the differential to grow larger as more years elapse after graduation from school. In the enterprises that do not have the employment management system by employment track, although there is a wage differential between men and women, it is not that large compared with enterprises that have the system. One of the reasons for this may be that the enterprises with the employment management system are in effect dividing the tracks by gender, and many women can only select the clerical work track. As a result, while there should be a difference in the wage depending on the type of courses, the difference is manifested as a difference between men and women.

Moreover, the promotion structure in the enterprise can also be considered as a factor of the wage differential between men and women. Yet, the effect of promotion to a managerial post on the wage did not differ greatly between men and women, and when women are promoted their wages tended to rise more than men. However, there are relatively few women who are promoted to managerial posts, and this is one of the factors of the differential between men and women of the same academic background.

As mentioned above, the asymmetry of the information on the average productivity gap between men and women as perceived by the employer is an important issue, and it needs to be addressed to eradicate the wage differential between men and women. It is also important to eradicate the gap that arises from other factors which do not make sense. To eradicate these unreasonable factors, it is necessary to ask to enterprises to make greater efforts to ensure equal employment opportunities. As was explained in the above analysis, the wage structure between men and women differs because the enterprises using the employment track are, in effect, allocating workers of a certain gender to

one track and the other gender to another track. It is necessary to review how the employment management system by employment track should be operated. In addition, the problem of the asymmetry of information also influences the wage differential. In order to address this problem, it may be possible to take measures to set down standards for workers' job ability.

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