Wage Differentials between Men and Women An Approach Based on Labor Market Segmentation Theory*

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Abstract

This paper focuses on the wage differential between men and women from the viewpoint of "labor market segmentation theory," using micro-data. As an analysis framework, labor markets were separated into oligopolistic integrated industrial sectors and competing industrial sectors, and estimates made that take into account the simultaneity of wages and employment of men and women in each industrial sector. The results of analysis show that both men and women experience difficulty in finding employment in integrated sectors after leaving employment at a company, and that there are limits on the movement of labor between sectors. It also found that there is a sample selection functioning in the employment decisions made in each sector, and even when bias due to this factor is taken into account, the values of the production factors within integrated sectors are large compared to the differences for men and women in competing sectors. Further, approaching segregation structures by deriving expected wages for men and women who switch sectors suggested that the wages for both sectors may act as a limiting function on the movement of workers between sectors.

JEL: J21, J22, J23

Keywords: Wage Differentials, Segmented Labor Market

1. Introduction

The Equal Employment Opportunity Act was enacted in 1985. This law has the goal of (1) promoting the equality of women with men in all types of work and in all workplaces, and (2) improving the ability of women to accomplish professional duties by providing equal opportunities for training, and through this, to resolve the male-female wage differential. As intended by the Equal Opportunity Act, this disparity is certainly decreasing, but even now, after twenty years it has not yet been eradicated completely. This document uses analysis of actual proofs based on individual data collected for the "Working Person Survey 2002," which was conducted on workers in the Tokyo area by Recruit Co., Ltd.'s Works Institute, and discusses actual differentials in employment and in wages

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for men and women in a metropolis based on the "Labor Market Segmentation Hypothesis" from the standpoint of (1) (the goal of promoting equality, as mentioned above) and on the "Male / Female Wage Disparity Hypothesis" from the standpoint of (2).

Economic theories on wage differentials can be broadly categorized into "human capital theories" supporting the "male / female wage disparity hypothesis" and the "labor market segmentation hypothesis," which is from another school of thought. The former states that worker productivity is decided through the accumulation of human capital due to education and workplace. Here the wage differential is simply a difference in the attributes of the workers, and areas that cannot be explained by such differences can be attributed to discrimination in the labor market or employers' specific preferences with regard to their employees, or alternatively by factors unrelated to worker attributes, such as imperfect competition in the labor market.

Conversely, the "Labor Market Segmentation Hypothesis" states that rather than all workers being present in any single unified labor market, they are separated into different markets with different job characteristics, working conditions, and wage structures, and that movement between them is subject to divisive limitations. That is, workers do not choose the labor market they are present in of their own free will, but are placed there by the controlling power of the economic system. The "efficiency wage hypothesis" is part of this theory and claims that employers will set higher wages than the competition to retain staff, and in doing so, prevent movement of labor.

As regards the "Labor Market Segmentation Hypothesis," Horn-Kawashima (1985) and Kawashima and Tachibanaki (1986) differentiated between integrated industrial sectors centered around olipological enterprises, and competitive sectors consisting mainly of small-to-medium businesses, and used the 1978 Basic Survey on Wage Structure to analyze wage differentials between men and women in full-time employment. The results show that women are concentrated in competitive sectors, and that even female university graduates are excluded from integrated sectors at the core of the economy. They also identify the possibility that these two sectors have differing rules and disparate wage structures, and that wage differentials between men and women are larger in the integrated sectors. However, this research does not analyze the frequency of labor movement between sectors, which is one of the indices for market segmentation. Further, approximately 20% of the workers employed at small businesses were removed from the data subject to analysis, and part-time workers were removed from the validation analysis of sector segmentation.

Bulow and Summers (1986) explain the hypothesis that labor movement between sectors is exceedingly small through efficiency wage differentiation in the labor market. Employee motivation is decided through wage premiums that the workers accept, which affects industry productivity. Enterprises pay non-competitive wages that are higher than market rate (efficiency wages) to improve employee motivation, prevent negligence, ensure high quality work, and discourage employees from leaving. Similarly, Katz (1986) states that payment of efficiency wages is important in internal labor markets that have a direct relationship with wages and productivity, and points out that markets in

which efficiency payments are not made are competitive[1].

Recently in Japan, Ishikawa and Dejima (1994) use a switch regression model that does not require dual-layered labor market structures to be separated into two divisions (Primary and Secondary) in advance for their investigation. They find that the labor market in Japan can be summarized with differing formulas rather than with one single formula. They also show that the quality of these markets varies.

Nakata (1997) asserts that even when the primary goal of the Equal Employment Opportunity Act is evaluated in terms of the effects of the Act in supplying equal opportunities for all occupational categories, analysis of labor productivity factors is incomplete if these categories are not taken into consideration. Nakata also emphasizes the validity of the "Labor Market Differentiation Hypothesis," based on the significant differences in wages between men and women of similar ages originating in the market value assigned to "age" as a factor in labor productivity, while giving no credence to years of continuous service and years of work experience as significant factors in wage differentiation between men and women when estimating wage functions for occupational categories. Further, Furugori (1997) touches on the dual-layer structure of labor markets from the standpoint of full-time employees versus those not working full time.

Conversely, while a great deal of research has been done using "Human Capital" theory, Tomita (1988), Higuchi (1991), Mitani (1995) propose the hypothesis that there is little difference in training investment between men and women in businesses and industries with no discrimination between men and women in employment control, and apply it to show that male-female wage disparities based on years of continuous service will also be reduced, with Higuchi and Mitani showing promising results. A one-time cross-sectional analysis has been performed, but Hori (1998) used indices from the 1986 and 1994 Basic Survey on Wage Structure to show that improvements in the status of women due to the "Gap Effect," which cannot be observed statistically, have helped wage differentials between men and women[2]. However, analysis in these research efforts, which take a "Human Capital" approach, does not assume division in the marketplace.

This paper does not treat "Labor Market Segmentation" and "Human Capital" as exclusive, but attempts to use micro-data to show, from a "Human Capital" standpoint, that male-female wage discrepancies remain firmly rooted both within and between the markets analyzed, by showing that labor markets are clearly segregated by sex.

Section II below presents the data used, while Section III introduces the framework and methods used in analysis. Section IV presents the results of analysis, and provides an interpretation of them. A summary can be found in Section V.

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[1] Conversely, Becker (1971) identifies a trend towards discrimination due to prejudice that increases in proportion to the influence a business has in a market. We can therefore point to the possibility that there may be more prejudice against women in more integrated industries if there is a correlation between market influence and business scope.

[2] Nagase (1994) is present in analyses investigating wage disparities in part-time and full-time employees.

2. Data

Data was obtained from the "Working Person Survey 2002," which was conducted on workers in the Tokyo area by Recruit Co., Ltd.'s Works Institute. This survey was conducted between August and October of 2002, targeting an area within 50km of the capital (metropolitan Tokyo, Kanagawa prefecture, Chiba prefecture, Saitama prefecture, and part of Ibaraki prefecture), the Kansai region (Hyogo prefecture and metropolitan Osaka and Kyoto), and the Tokai region (Aichi and Gifu prefectures). There were 17,105 samples returned in total, 13,085 of which were from the Tokyo region (with 9,010 responses from men and 4,075 from women). There were 2010 responses from Aichi and 2010 from the Kansai region, but this document only analyses the sample from the capital. The samples analyzed in this paper are specific to the metropolitan area, and show the current state and problems present there. The capital of Japan, Tokyo is adjacent to three prefectures, Chiba, Kanagawa, and Saitama. The aggregate of these three prefectures and the Tokyo area is commonly referred to as the Tokyo area or the metropolitan area. Calculating the wage differential for male and female employees working full-time in fiscal 2002 from the wage census for fiscal 2003 shows that metropolitan Tokyo has the largest male-female wage differential in the country, and when calculations are weighted with the number of employers, this differential can be taken to represent approximately 36% of the differential for the entire country. Moreover, this region represents approximately 31% of Japan's total manufacturing (and 36% of the service industry) as of FY 2002, and therefore has significant influence.

The advantage of this data is that it is a large enough sample and that it has been weighted back against the population, so that it offers an extremely accurate picture of the true state of employment in the metropolitan area.[3] Moreover, in addition to being comparatively new micro-data, the content of the survey questions covers everything from hiring, industry, occupational category, and work content in detail.

As described above, this paper postulates that "Labor Market Segmentation" is at the root of male-female wage differentials. With regard to the dual-layer composition of labor markets, Kawashima and Tachibanaki (1985) follow Horn-Kawashima (1985) in saying that business size and market influence are linked in making long-term profit possible[4], and place the foundation of the dual-layer structure in the industries in both the competitive industrial sector and the integrated sector. Employment integration is at the foundation of the definitions of both industry sectors. When the number of people working for large companies with more than 1000 employees is more than 30% of the total number of workers in the industry, that industry can be defined as an integrated sector; areas where this figure is less than 30% are competitive sectors. This data covers 63 types of industry, with each item bearing a strong resemblance to the industry categories in the Basic Survey on Wage Structure[5]. With regard to bipolar categorization, Horn-Kawashima (1985) mentioned that it is

[3] Ages 35 through 39 are weighted lightly, and ages 50 and over are weighted heavily. Consequently, there is a low recovery rate in evidence for those in middle and old age.

[4] Horn-Kawashima (1985) mentions the necessity of using businesses as units in analysis, since small and medium enterprises exist in integrated sectors.

[5] Horn-Kawashima (1985) used production integration as an index to measure levels of integration for the manufacturing

essential to find the intrinsic differences between the integrated sector and the competitive sector when looking at them together; this document complies with this thinking. The next section will explain the analysis framework and methods. Results will be discussed in section IV.

3. Analysis Framework and Methods

When analyzing wage differences between men and women based solely on Human Capital Theory, only characteristics and their respective values are important enough to be considered. However, in analyzing the difference based on Human Capital Theory and Market Segmentation Theory, two assumptions should be added; 1) both sectors have differing wage structures, and 2) there is little movement between sectors.

First the wage function for male and female full-time employees is described in (1) and (2) below.

$$\ln W_{1i}^{m} = \beta_1^m X_{1i}^m + \varepsilon_{1i}^m \tag{1}$$

$$\ln W_{2i}^{f} = \beta_2^f X_{2i}^f + \varepsilon_{2i}^f \tag{2}$$

Subscripts m and f denote male and female employees respectively. 1 and 2 are affiliation categories, e is an error term, X is a vector for explanatory variables contributing to wage functions for each category, and β is an unknown parameter.

Here, in accordance with "Labor Market Segregation Theory," workers are divided into the integrated sector and the competitive sector, and it can be supposed that economic system control is active in this segregation. That is to say, the hiring factors for male and female employees in each sector are decided by both the decisions of the employees themselves and by the controlling power of the market. This control might for example take the form of (non-competitive) efficiency wages set by businesses that pay more than the market rate to ensure the proficiency of employees.

First dependency determinations for both sectors in the first stage can be shown as follows.

$$I_i^* = \varphi Z_i + u_i$$
$$\begin{cases} I_i = 1 & if \quad I_i^* > 0 \\ I_i = 0 & if \quad I_i^* \le 0 \end{cases} \tag{3}$$

In stage 2, if X_{1i} is taken as the employee attribute that decides the wages of full-time employees, then the wages of employees in each sector is:

$$\begin{aligned} \ln W_{1i}^{m} &= \beta_1^m X_{1i}^m + \varepsilon_{1i}^m \qquad if \ I_i = 1 \\ \ln W_{2i}^{f} &= \beta_2^f X_{2i}^f + \varepsilon_{2i}^f \qquad if \ I_i = 0 \end{aligned} \tag{4}$$

industry, and confirms the close interactive relationship between production integration and employment integration. The industry categories in the "Working Person Survey" resemble those of the "Wage Census." Comparing sector categories derived from data from the "Working Person Survey" with sector categories that use cross tables of business size employment numbers and manufacturing categories from the "Wage Census," contradictions were apparent in sector categories in the three industries and three service industries at the top 30% on the borders dividing both sectors. However the "Wage Census" does not include micro-businesses with less than 10 employees, and since this may affect categories, this document divided sectors based on industrial categories and figures for business size-specific employee numbers from the "Working Person Survey."

In this paper, parameters for formulae (1) through (4) obtained through switching regression are estimated using the method of maximum likelihood.

Here it is assumed that error terms for each formula will exhibit multivariate normal distribution, and that a covariance matrix will be defined as follows.[6]

$$\log L(\alpha,\beta,\sigma_1,\sigma_2,\rho)=\sum_{i=1}^{n}\left\{I_i\log\left(\int_{-\infty}^{z_{i\gamma}} f(\varepsilon_{1i},u_i)\,du_i\right)+(1-I_i)\log\left(\int_{z_{i\gamma}}^{\infty} g(\varepsilon_{2i},u_i)\,du_i\right)\right\}$$

$$(\varepsilon_{1i},\varepsilon_{2i},u_i)\sim N(0,\Sigma)$$

$$\sum=\begin{bmatrix}\sigma_{11} & \sigma_{12} & \sigma_{1\varepsilon}\\ \sigma_{12} & \sigma_{22} & \sigma_{2\varepsilon}\\ \sigma_{1\varepsilon} & \sigma_{2\varepsilon} & 1\end{bmatrix} \qquad (5)$$

First $\sigma_{1\varepsilon}=\sigma_{2\varepsilon}=0$ is tested. In other words, for formula (3), employee hiring factors in each market are thought not to support the $\sigma_{1\varepsilon}=\sigma_{2\varepsilon}=0$ hypothesis in cases such as those where the economic control to divide markets into integrated and competitive sectors is present, regardless of the matching between supply and demand characteristics of employers and the employees themselves. If $\sigma_{1\varepsilon}=\sigma_{2\varepsilon}=0$ is provisionally true, then the exogenous switching regression model or the Ordinary Least-Squares method (OLS) is appropriate, but if it is not true, this model should use endogenous switching regression.[7]

Next, areas in which the structure of labor market segmentation is explained through disparities in male-female employment between two sectors, and areas where segmentation is ascribed to male-female wage disparities within the various sectors, are investigated separately.

Of the parameters listed in table 1, which contains male-female descriptive statistics, the significant variables included in vector Z for formula (3), which are used in estimates for men and women, are the square of the age, the age on joining the company, a dummy variable indicating whether the person had children when they joined the company, a dummy variable indicating whether they have a spouse, a dummy variable for academic achievement, a dummy variable for any experience of leaving employment or joining a company after the epoch-making changes to the industrial structure that occurred after the collapse of the bubble economy in 1993, and a dummy variable for leaving a company after 1993. These variables were chosen as being deciding factors in supply and demand for employment in each industrial sector. Dummies for age when joining the company, age squared, children when joining the company, spouses, experience leaving the company, experience joining a company after 1993, and experience leaving a company after 1993 were inserted as discriminant variables (operating variables) not included in wage functions.[8]

Further, in estimations of wage functions for stage 2, non-significant variables were dropped from

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[6] Maddala (1999) goes into detail regarding likelihood functions.

[7] Nielsen,Helena,S.and Verner(2003) are references for switching regression. In this research, sector determination is analyzed from the standpoint of self selection.

[8] To measure the propriety of operating variables, these first-stage dependencies were estimated for cases where variables were included in wage functions. However, since there were no changes inρ that would indicate an erroneous correlation, this was not deemed problematic.

Table 1. Descriptive Statistics (Mean)

	Integrated Sector Full-time		Competitive Sector Full-time	
Variable	Male	Female	Male	Female
Logarithm of Wage	6.435	5.751	6.233	5.660
Work Time	47.664	40.411	49.695	40.883
Higher-education	0.538	0.229	0.397	0.200
Junior College/Vocational School	0.129	0.391	0.179	0.446
High School	0.309	0.370	0.357	0.327
Junior High School	0.023	0.010	0.067	0.027
Age	39.370	35.079	38.356	36.383
Less than one year tenure	0.027	0.054	0.035	0.057
Less than two year tenure	0.053	0.135	0.082	0.123
Tenure	14.646	8.026	12.030	7.219
Experience in work	137.676	93.264	136.763	97.995
Manager	0.622	0.221	0.521	0.168
Science	0.250	0.034	0.121	0.031
Married	0.780	0.478	0.744	0.478
Children	0.677	0.449	0.663	0.480
Married at time of entry into company	0.163	0.313	0.279	0.379
Had children at time of entry into company	0.131	0.319	0.216	0.369
Age at time of entry into company	24.723	27.052	26.325	29.164
Has left a position	0.327	0.514	0.542	0.648
Has left a position since 1993	0.217	0.400	0.379	0.521
Joined company after 1993	0.442	0.711	0.562	0.763
Large company	0.524	0.484	0.191	0.114
Mid-size company	0.289	0.263	0.301	0.286
Small company	0.153	0.206	0.362	0.414
Very small business	0.034	0.047	0.147	0.186
Service/Security	0.185	0.071	0.364	0.225
Management	0.192	0.052	0.158	0.021
Office work/Sale	0.272	0.678	0.246	0.459
Technical	0.298	0.084	0.123	0.015
Specialist	0.045	0.106	0.088	0.252
Other job category	0.007	0.009	0.021	0.026
Construction	0.000	0.000	0.177	0.068
Manufacturing	0.525	0.288	0.162	0.102
Transport/Communications	0.128	0.043	0.107	0.031
Wholesale/Small retailer	0.027	0.069	0.173	0.185
Finance/Insurance	0.155	0.500	0.019	0.029
Servie	0.161	0.100	0.277	0.494
Other industry	0.004	0.000	0.084	0.091
Weight	0.905	1.317	0.920	1.455
Sample size	1991	609	3011	1048

Note) the statistics of dummy variables indicate % of 1.

the functions present in the descriptive statistics from tables 1, with variables with a significance level of 20% being used for estimation. However, most variables have a significance level of 10%. Since it is not difficult to think of disparate explanatory variables (explanations) for effects on wages in each sector when using switching regression to perform simultaneous inference, explanatory variables for wage functions differ for each sector.

Next, to gain a better understanding of the decisive factors in wage disparities using the wage functions estimated using the model above, factor analysis of wage disparities was carried out. The

method used by Brown (1980) for investigating male-female wage disparities due to occupation was applied as a disaggregating analysis technique. This method uses factor analysis that takes the effect of setting hiring factors in both sectors on wage differentials into account.

First, the ratios of male and female samples in each area are set as P^m and P^f. Formulas (1) and (2) above, which show the male-female wage differentials for the entire labor market, use the subscript "S" to denote each sector.

$$\overline{\ln W^m} - \overline{\ln W^f} = \sum_{s=1}^{S}\left(P_s^m \overline{\ln W_s^m} - P_s^f \overline{\ln W_s^f}\right) \qquad S = 1, 2 \tag{6}$$

Equation (10) is expanded polynomially as follows.

$$\begin{aligned}\overline{\ln W^m} - \overline{\ln W^f} &= \sum_{s=1}^{S} P_s^f \hat{\beta}_s^m \left(\bar{X}_s^m - \bar{X}_s^f\right) + \sum_{s=1}^{S} P_s^f \bar{X}_s^f \left(\hat{\beta}_s^m - \hat{\beta}_s^f\right) + \sum_{s=1}^{S} \overline{\ln W_s^m}\left(P_s^m - \hat{P}_s^f\right) \\ &+ \sum_{s=1}^{S} \overline{\ln W_s^m}\left(\hat{P}_s^f - P_s^f\right)\end{aligned} \tag{7}$$

Here P from formula (7) shows employment probabilities for female workers in each industrial section when men and women are employed under the same conditions. Parameters obtained using variables observed for male workers from the results of estimations made using switching regression from formula (3) were used to obtain P for employment probabilities for female workers in each industrial sector. The first two columns on the right show wage differentials within the same sector, while the last two show wage differentials between sectors. The first and third items on the right show wage differentials due to attributes observable in men and women, while the second and fourth show wage differentials that reflect differences in evaluation that include employment discrimination based on observable characteristics. The last column shows differences attributable to gender, including male-female employment differentiation for hiring factors for each sector.

For example, if the most commonly-used disaggregating technique to date (that of Oaxaca (1973)) is applied, the difference in male-female distribution across each industry sector provides no part of the structure of male female wage differential. However, the deaggregating technique proposed by Brown (1980) is able to show the possibility that differences and segregation in the employment of men and women in both industry sectors may affect male-female wage differentials. Because the wage assessment variables differ for men and women in each sector, coefficients that are not significant variables for one gender are estimated to be 0, and mean values for variables are used to measure the effect of attributes.

The main points for consideration in this document that can be taken from there above series of analysis are, based on labor market segmentation theory: (1) Whether there are barriers to movement between the two sectors. (2) Whether there are differing characteristics and wage structures in both sectors. (3) Showing the extent to which differences in employment in each sector, and wage differentials between men and women in each sector contribute to male-female wage disparities throughout the entire market.

4. Investigation and Interpretation of Analysis Results

This section looks at the results of analysis sectionally. Factor analysis is carried out on the functions for sector hiring factors in stage one, then for wage functions in each sector, and also for the wage differentials obtained from the results of analysis, and the causes for wage disparities assessed. Lastly, the anticipated values of wages when workers move from each sector are sought from the results of switching regression used in estimation, and investigations made into the explanations for measurement correlates, and the controlling factors at work in dividing markets so that labor movement is hindered.

4.1 Results of Estimations for Hiring Factors in Integrated Sectors

First the results displayed in table 2 for the switching regression in stage 1 were investigated. This illustrated that the explained variables targeted show the hire rates for men and women in the integrated sector as compared to the competitive sector. They show the results when employment of full-time personnel is limited. The investigation was conducted while comparing men and women. They show that the older the person at the time of entry to the company, the more difficult it is to find employment in the integrated sector. For women, where age is controlled, marital status and the presence of children have a positive effect on hiring in the integrated sector. This may be due to the survey being conducted on full-time employees only. With regard to academic achievement, predictions are that those with a higher degree of education will find it easier to find employment in the integrated sector. Those who have experienced leaving a company find it difficult to obtain employment in the integrated sector regardless of gender. This has a level of significance of 1% for estimation for both genders. That is to say, the existence of barriers to the movement of labor between both sectors is in agreement with the “Labor Market Segmentation” hypothesis. Moreover with the exception of full-time female employees, employment, or even a career change, within the integrated sector after the collapse of the bubble has become difficult.

Table 2. Estimations for Hiring Decisions at Integrated Sector

	Male		Female	
Explanatory Variable	Coefficient	Standard Error	Coefficient	Standard Error
Constant term	0.335	0.237	-0.285	0.277
Age when joining company	-0.069	0.015	-0.020	0.004
Square of age when joining company	0.001	2.1E-04	-	-
Children when joining company	-	-	0.196	0.077
Spouse present when joining company	-0.126	0.059	0.132	0.074
Higher education	0.593	0.098	0.577	0.279
Junior college	0.399	0.103	0.354	0.268
High school graduate	0.482	0.094	0.577	0.271
Experience leaving a position	-0.155	0.058	-0.157	0.093
Joined company after 1993	-0.074	0.047	-	-
Experience leaving a position after 1993	-0.243	0.072	-0.194	0.078
Graduated from a science university	0.375	0.060	-0.217	0.157
N	5002		1657	

Table3. Estimations for Wage Functions

Dependent variable/log of annual income	Male Full-time employees				Female Full-time Employees			
	Integrated		Competitive		Integrated		Competitive	
Explanatory Variable	Coef.	Sd.Error	Coef.	Sd.Error	Coef.	Sd.Error	Coef.	Sd.Error
Constant term	4.749	0.079	5.314	0.048	4.815	0.118	5.016	0.096
Working Hours	0.002	0.001	-	-	0.010	0.002	0.004	0.001
Higher education	0.288	0.043	0.221	0.028	0.124	0.043	0.545	0.082
Junior college/Vocational school	0.149	0.042	0.079	0.029	-	-	0.299	0.077
High school graduate	0.154	0.039	0.093	0.027	-	-	0.267	0.078
Science university graduate	0.064	0.022	0.108	0.022	-	-	-	-
Management	0.132	0.016	0.107	0.014	0.082	0.046	0.174	0.026
Age	0.014	0.001	0.011	0.001	-	-	-	-
Married	0.139	0.018	0.109	0.019	-	-	-	-
Have Children	-	-	0.036	0.017	-0.129	0.037	-	-
Tenure less than two years	-0.123	0.024	-0.147	0.023	-0.241	0.061	-0.101	0.035
Tenure	0.025	0.003	0.020	0.003	0.051	0.008	0.035	0.006
Square of tenure	-4.8E-04	6.2E-05	-2.6E-04	6.8E-05	-0.001	2.3E-04	-3.0E-04	2.0E-04
σ2	0.350	0.004			0.416	0.010		
ρ2	0.717	0.148			0.901	0.352		
σ1	0.299	0.008			0.415	0.029		
ρ1	0.632	0.471			0.532	1.855		
Log likelihood	-3870.787				-1532.517			

Note) Variables with significance and with a standard of 20% are used in the estimates. Estimate include factors for industry, occupation, business size, and years of experience in job if they are significant.

4.2. Results of Estimates for Wage Functions

Next, analysis moves to wage-related estimates. Table 3 lists the results of stage 2 wage functions from switching regression for male-female full-time employees. ρ_0 shows a positive level of significance for estimates for men, and with a correlation coefficient of 0.7. This validates support for endogenous switching regression. However, for women, ρ_0 is also significant, with a correlation of 0.9. Therefore the results of OLS estimation do not show consistency. Interpretation of this ρ will be examined in detail later.

Estimation results for each sector are compared while being examined, but variables with a significance level of other than 20% for men and women were not utilized in the estimates, so evaluation variables are different for each gender. Age was not significant for women, nor were variables related to job content. When comparing coefficients for each sector by gender, for men, evaluation coefficients for academic record, years of continuous service, and age were all higher in integrated sectors than in competitive sectors. However, evaluation related to time mastering work shows a larger trend towards coefficients for men in the competitive sector. Conversely, for women, academic record is more highly evaluated in the competitive sector, while years of continuous service are better evaluated in the integrated sector.

Next, comparing men and women shows that for women in the integrated sector, other than when a tangible ability for work shows a comparatively more significant effect on wages than for men, coefficients are lower than for men, and significant variables are limited. In the competitive sector, attributes such as academic record and years of service have more effect for women than for men.

Table 4. Causal Analysis of Wage Disparities

	Differences in wages for Each Sector		Differences in Hiring Factors in Each Sector	
	Differences in attributes	Differences in Coef.	Differences in attributes	Differences in Coef.
Integrated sectors	0.033	0.222	0.065	0.03
(Differences within sectors)	(0.093)	(0.603)		
Competitive sectors	0.048	0.225	0.023	0.005
(Differences within sectors)	(0.080)	(0.356)		
Difference Total	0.081	0.447	0.088	0.035
Contribution to Percentile differences	12.5	68.5	13.5	5.5

Note) Figures in brackets done wage differences with sectors from which Pf for which female hiring rations has been removed.

However evaluation regarding quality of work was comparatively less significant than for men[9].

4.3. Results of Brown (1980)'s Causal Analysis on Wage Disparity

Next, causal analysis on the male-female wage differential was performed using Brown's method (1980), based on the estimate results in tables 2 and 3, providing numerical comprehension of the differing wage structures in both sectors. The results are show in table 4.

In Formula (3) from the previous section $\hat{P}_s^f$ is the probability of hiring for women, obtained using coefficients for sector hiring functions for men. Results for each item in formula (7) are displayed. The overall male-female wage disparity (logarithm) is 0.654, Contributions to the disparity are calculated with this disparity set to 100%, and are shown on the bottom line. These results show that overall the production factor (coefficient) disparity for wages is approximately 75% of the male-female wage differential. Moreover, differences in male and female attributes affect the hiring disparities between men and women in integrated sectors (with a coefficient of determination of 13.5%), and while the numbers in brackets for the first and second expressions show differences in male-female attributes and attribute values (coefficients) within sectors before P^f is applied, the largest is a difference of 0.603 for coefficients within integrated sectors, which is approximately 1.7 times larger than that of competitive sectors. Multiplying this figure by the distribution P^f for women in each sector shows that figures for the competitive sector, in which more women work than men, contribute to the male-female wage disparity across the entire market. Put another way, expansion of the competitive sector in the future can be expected to contribute to the reduction of male-female wage disparities.

The results above show that male and female attributes affect which sector people employed in, and moreover, that women employed in integrated sectors are affected by gender discrimination based on production factor values. In particular, the results from wage estimation functions show that evaluation for "age," "years of service," and "quality of work" with regard to setting wages for

[9] It is conceivable that there is a correlation between job training time and abilities at work. For women in the competitive sector, when ability variables were dropped there were significant variables in proficiency time. Estimates using either one of those variables were trialed, but they did not have any large effect on the results of the causal analysis carried out later.

women working in integrated sectors is lower than for men, and illustrate that more research will be needed to investigate the reasons for this phenomenon.

4.4 Simulation and Interpretation of Results

ρ_2 figures denoting correlation with error clauses from the results of analysis of both men and women are related to error clauses in wage functions for competitive sectors, and are significantly positive. The following examines the interpretations of these results. Figures 5 and 6 show wage figures expected by men and women for each age bracket[10].

Formula (3) described above shows that two simultaneous determinations can be considered: hiring functions for businesses (demand causes) and worker selection functions (supply causes). In the results of the analysis in this document, there was no change in ρ figures even when variables related to self-selection are inserted into the parameters in stage 1. Further, the ρ correlate figures show that causes for hiring decisions (demand-side factors) can be considered to be significant, and an analysis based on this is performed[11]. Figure 6 shows age bracket-specific wage expectations derived for highly-educated (university graduate or above) men and women in each sector. The results for men from above are used for investigation. Definitions for anticipated values (1) through (8) are written in the notes below. Results (1) and (6) from OLS estimation can be explained through wage ratios presented for each sector displayed for the market prior to selection. Lack of correlation for ρ such as that described in this document can be interpreted as implying agreement between worker productivity and wages presented. However, non-observable worker attributes with an influence during hiring correlate with error terms in wage functions, and wage expectations (productivity) of workers assume different figures to OLS results. These are figures (3) and (8). This denotes anticipated conditional wage expectations for each sector covered.

It is obvious that in the integrated sector the values of conditional expectations for men are slightly higher than the OLS results[12], while the figures for men in the competitive sector (8) are lower. When non-observable attributes are taken into consideration, the workers in integrated sectors exhibit the same or greater productivity for equivalent suggested wages, while men in competitive sectors accept higher wages that their productivity would suggest (including attributes that cannot be taken into consideration). Based on this pre-condition, let us look at labor movement when moving sectors. The figures in (2) are the suggested wages when movement of workers from integrated sectors to competitive sectors is considered, while the figures in (4) are the wages expected when workers

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[10] Although the methods used (expansion of formula) for deriving figures for conditional expectations were omitted, the wage expectations of people employed in integrated sectors are $E(W_{1i}|I_i=1,x_{1i})=\beta x_{1i}+\sigma_1\rho_1 f(\varphi Z)/F(\varphi Z)$. Similarly, the wage expectations of those working in competitive sectors who wish to work in integrated sectors are $E(W_{1i}|I_i=0,x_{1i})=\beta x_{1i}-\sigma_1\rho_1 f(\varphi Z)/\{1-F(\varphi Z)\}$. The wage expectations for workers moving from integrated to competitive sectors and the wages of those hired in competitive sectors can be derived from σ and ρ.

[11] In reality, when a positive correlation is found with error terms in wage functions for the competitive sector, the degree of error term u in stage 1 (even when they can be employed in integrated sectors for observable attributes, they are actually dropped due to selection of unobservable attributes) and the error term ε for competitive sectors become negative, and it is difficult to think of a self-selection model for choosing a sector that fits oneself.

[12] However, it is necessary to pay attention to points that are no significant to ρ.

Table5. Wage Predictions for High educated workers

	Men in integrated sectors				Men in competitive sectors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age Chorhort	$E(W_{1i}\|x_{1i})$	$E(W_{2i}\|x_{1i})$	$E(W_{1i}\|S=1)$	$E(W_{2i}\|S=1)$	$E(W_{1i}\|x_{2i})$	$E(W_{2i}\|x_{2i})$	$E(W_{1i}\|S=2)$	$E(W_{2i}\|S=2)$
less than 25	5.85	5.86	6.02	6.08	5.81	5.81	5.68	5.64
25 to 39	6.13	6.11	6.29	6.34	6.02	6.03	5.90	5.87
30 to 34	6.38	6.34	6.55	6.55	6.28	6.25	6.15	6.08
35 to 39	6.57	6.50	6.73	6.71	6.44	6.40	6.31	6.23
40 to 44	6.70	6.61	6.86	6.82	6.56	6.50	6.43	6.33
45 to 49	6.80	6.72	6.95	6.92	6.66	6.59	6.52	6.41
50 to 54	6.86	6.79	7.00	6.98	6.73	6.67	6.59	6.49
55 to 59	6.90	6.84	7.05	7.04	6.79	6.75	6.65	6.56
Mean of Wage(log)	6.52	6.46	6.68	6.67	6.41	6.38	6.28	6.20

	Women in integrated sectors				Women in competitive sectors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age Chorhort	$E(W_{1i}\|x_{1i})$	$E(W_{2i}\|x_{1i})$	$E(W_{1i}\|S=1)$	$E(W_{2i}\|S=1)$	$E(W_{1i}\|x_{2i})$	$E(W_{2i}\|x_{2i})$	$E(W_{1i}\|S=2)$	$E(W_{2i}\|S=2)$
less than 25	5.54	5.67	5.76	6.03	5.56	5.67	5.42	5.43
25 to 39	5.78	5.83	5.99	6.19	5.72	5.77	5.59	5.54
30 to 34	5.97	5.98	6.19	6.36	5.80	5.87	5.67	5.65
35 to 39	6.05	6.04	6.27	6.42	5.88	5.99	5.76	5.79
40 to 44	5.57	5.85	5.80	6.24	5.88	6.01	5.76	5.81
45 to 49	6.25	6.27	6.50	6.70	6.02	6.10	5.91	5.91
50 to 54	6.39	6.37	6.65	6.81	6.01	6.12	5.89	5.92
55 to 59					6.45	6.59	6.32	6.36
Mean of Wage(log)	5.82	5.87	6.04	6.25	5.76	5.83	5.63	5.61

Note) (1)(2)(5) and (6) are the results of OLS estimates. (4) and (7) are conditional expectations when moving sectors. (3) and (8) are conditional expectations in current sectors.

Table6. Wage Predictions for Low educated workers

	Men in integrated sectors				Men in competitive sectors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age Chorhort	E(W1i|x1i)	E(W2i|x1i)	E(W1i|S=1)	E(W2i|S=1)	E(W1i|x2i)	E(W2i|x2i)	E(W1i|S=2)	E(W2i|S=2)
less than 25	5.74	5.75	5.94	6.02	5.68	5.70	5.59	5.57
25 to 39	5.97	5.95	6.18	6.23	5.91	5.89	5.82	5.78
30 to 34	6.18	6.14	6.39	6.41	6.08	6.05	5.98	5.92
35 to 39	6.34	6.27	6.54	6.54	6.22	6.17	6.13	6.05
40 to 44	6.46	6.39	6.65	6.65	6.33	6.26	6.24	6.14
45 to 49	6.55	6.48	6.74	6.74	6.41	6.35	6.31	6.21
50 to 54	6.59	6.54	6.79	6.80	6.52	6.45	6.41	6.32
55 to 59	6.63	6.62	6.82	6.88	6.58	6.53	6.48	6.40
Mean of Wage(log)	6.31	6.27	6.52	6.54	6.16	6.12	6.06	5.99

	Women in integrated sectors				Women in competitive sectors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age Chorhort	E(W1i|x1i)	E(W2i|x1i)	E(W1i|S=1)	E(W2i|S=1)	E(W1i|x2i)	E(W2i|x2i)	E(W1i|S=2)	E(W2i|S=2)
less than 25	5.92	6.14	6.21	5.99	5.82	5.70	5.70	5.36
25 to 39	6.06	6.30	6.35	6.08	5.96	5.87	5.84	5.42
30 to 34	6.17	6.45	6.47	6.12	6.05	5.98	5.94	5.43
35 to 39	6.25	6.55	6.57	6.23	6.09	6.05	5.99	5.42
40 to 44	6.31	6.62	6.61	6.26	6.19	6.16	6.08	5.47
45 to 49	6.44	6.75	6.73	6.35	6.33	6.30	6.21	5.62
50 to 54	6.58	6.90	6.87	6.49	6.35	6.32	6.23	5.54
55 to 59								
Mean of Wage(log)	6.01	6.25	6.30	6.04	5.90	5.08	5.78	5.38

Note) (1)(2)(5) and (6) are the results of OLS estimates. (4) and (7) are conditional expectations when moving sectors. (3) and (8) are conditional expectations in current sectors.

actually moved to competitive sectors. Although men working in integrated sectors can be expected to exhibit the same level of productivity after moving to the competitive sector, the suggested wages from industry (2) will be slightly lower than the wages in their current sector. Consequently, there is little these men to move to competitive sectors of their own accord. Similarly when workers in the competitive sectors are considered, the wages expected (productivity) (7) from a move to an integrated sector will rise above the current wages expected (8). However, since the productivity of workers is lower than the suggested wages of businesses in the integrated sector (5), there is no incentive for businesses in the integrated sector to hire workers who have moved from competitive sectors. Similarly, workers from competitive sectors moving to an integrated sector cannot expect a great increase over the suggested wages in their current sector (7), it is difficult to imagine any incentive to make the effort to move. Simulation figure 7 for women and those who have not graduated from university shows that a similar interpretation can be used in this case. As the descriptive statistics in figure 2 show, there is little difference between integrated and competitive sectors with regard to the degree of workers' satisfaction regarding work or the organizations they work in. There are mechanisms functioning that ensure a certain level of ambition and satisfaction with regard to work even though markets are segregated, and it is possible that workers are aware of this[13].

5. Summary

This paper hypothesized the segregation of markers represented by competitive sectors and olipological integrated industrial sectors, and examined male-female wage differentials.

Analysis used methods that gave consideration to the possibility that wages were set endogenously. The results of analysis show that it is difficult for both men and women to find employment in integrated sectors if they have experience leaving a position. They also show that there is a selection bias in setting supply and demand for laborers in each industrial sector and that even if this bias is taken into account, that "age" has a significant effect on wages for men in integrated sectors. This also conforms with theories regarding efficiency payments closely related to market segregation. Moreover the results of analysis of male-female wage differentials split into male-female employment disparity between sectors and intra-sector wage differences show that due to differences in male and female attribute, men are 13% more likely to find employment in integrated sectors. Additionally, it was clear that there are large differences within the same sector in the value (differences in coefficient) attached to production factors (attributes) for men and women, approximately 1.7 times that of competitive sectors.

However, since the competitive sector accounts for a larger percentage of the overall market, it makes a large contribution to male-female wage disparities for the overall market, and it is evident that

[13] Based on interpretations such as this, workers on borders between sectors, that is to say, workers who it is not difficult to imagine finding employment in integrated sectors, but who must work for low wages in competitive sectors, may exhibit low levels of satisfaction. It could be said that a more detailed analysis of this point is necessary. Additionally, the fact that the analysis in this document does not cover non full-time employees, which may merit further analysis.

the difference in male-female production factors (attributes) in each sector accounts for approximately 69% of the male-female wage differential.

The above results show that 1) labor markets are segregated, and there are limits on the movement of labor between each market, and 2) that wage structures are different within each market. Further, the results of simulations used to extrapolate the wages that workers hope to earn through moving imply that there market control is active in determining the workers' sectors, and works to limit the free movement of labor. However, this many not always be to the detriment of workers in each sector. This suggests that the results of this document do not contradict the market segmentation proposed by the "Labor Market Segmentation" hypothesis that may be at the root of this disparity. This is mostly in agreement with the results of previous research, and implies that market segmentation is the root cause of the wage differential that still exists between men and women.

Themes for future research may be a detailed investigation into labor movement between sectors that use workers past work history, and analysis that takes account of changes in setting sector boundaries, and of markets segmented by business scope.

References

Tsuneo I. and Takahisa D. (1994) *The Dual Layer Structure of Labor Markets (Rodoshijo no Nijukozo)* Tsueno Ishikawa editing, "*Distribution of Earning and Wealth in Japan"* (Nihon no Shotoku to Tomi no Bunpai)

Yasunobu T. (1998) *Male-Female Wage Differentials and Employment Control of Women (Joshi no Koyokanri to Danjokan Chinginkakusa)* Kazuo Koike / Yasunobu Tomita editing "*Career Women in the Workplace" (Shokuba no Kyariauman)*

Yoshifumi N. (1997) *Causal Analysis of Male-Female Wage Disparity in Japan - Do Wage Disparities Exist Between Men and Women Workers Doing the Same Job?* (Nihon ni Okeru Danjo Chingingakusa no Yoinbunseki Doitsu Shokushu ni Tuku Danjo Rodoshakan ni Chingingakusa ha Sonzai Suru no ka?) Hiroyuki Chuma, Terukazu Suruga editing, "*Change and Women Workers in Employment Practice"* (Koyokanko no Henka to Josei Rodo)

Nobuko N. (1994) *Proof Analysis Related to the State of Hiring Practices for Married Women – Part –Time and Regular Employees* (Kikonjoshi no Koyojokyokeitai no Sentaku ni Kansuru Jisshobunseki - Pato to Seishain),*" Japan Institute for Labor Policy and Training Magazine"* No.418

Yoshio H. (1991) "Japan's Economy and Employment Practices" Issue 8, Toyo Keizai Publishing

Yoko Horn-Kawashima (1985) "*Analysis of Female Labor and Labor Market Structure*" (Joshirodo to Rodoshijokozo no Bunseki) Nihon Keizai Hyouronsha Ltd.

Haruhiko H. (1998) *Downward Trends in Male-Female Wage Disparities and Their Reasons* (Danjokanchinginkakusa no Shukusho Keiko to Sono Yoin) "*Japan Institute for Labor Policy and Training Magazine"* No.456

Tomoko F. (1997) "*Economic Analysis of Temporary Workers*" (Hiseigirodosha no Keizaibunseki)

Toyo Keizai Publishing

Naoki M. (1995) *Womens' Employement and the Equal Employment Opportunity Act* (Joseikoyo to Danjokoyokikaikintoho), Inoki Takenori, Higuchi Yoshio "*Japan's Employment System and Labor Market"* (Nihon no Koyo Shisutemu to Rodoshijoyojijo), Nikkei Newpapers

Becker (1971) *The Economics of Discrimination, University of Chicago Press.*

Brown, R. S., Moon, M., Zoloth, S. (1980) "Incorporating occupational attainment in studies of male-female differentials." *Journal of Human Resources,* 15

Bulow, J. I. and Summers, L. H. (1986) "A Theory of Dual Labor Markets with Application to Industrial Policy, Discrimination and Keynesian Unemployment,"*Journal of Labor Economics*, Vol.4, No.3.

Katz, L. F.(1986) "Efficiency Wage Theories: A Partial Evaluation," Macroeconomics, MIT Press.

Maddala. G. S. (1999) *Limited-dependent and Qualitative variables in Econometrics*

Nielsen, Helena, S., Marianne S. and Metter V. (2003) "Does the Gap in Family-Friendly Policies Drive the Family Gap" *University of Aarhus Working Paper*, NO.2003-1

Oaxaca(1973) "Male-female wage differentials in urban labor market." *International Economic Review*, 14(3)

Yoko K. and Toshiaki T. (1985) "The effect of discrimination and of industry segmentation on Japanese wage differentials in relation to education" *International Journal of Industrial Organization* 4, pp43-68