Testing the Taste-Based Discrimination Hypothesis: Evidence from Data on Japanese Listed Firms*

Shinpei Sano
Kobe University

Using the "market test" methodology, we examine the employer discrimination theory. We use a set of data on Japanese listed firms which has detailed employee information. The "market test" is the methodology to demonstrate the causes of the differential wages, verifying the significance of the correlative profit and the number of female employee added. Existing literature does not control the factors which affect firms' profits, such as employees' age distribution and the share of married female employees. Unique Japanese firm-level panel data enable us to estimate a more efficient estimator than the previous research. We find that (i) estimation results indicate that an increase in the proportion of female workers increases the profit; (ii) a high proportion of female workers has a strong effect in concentrated industries. These results support the employer discrimination hypothesis. Next, we examine how firms with a high female proportion grow faster in more competitive industries. This is the long-run implication of the employer discrimination theory. As a result, adding a larger number of female employees does not seem to contribute to growth of companies in a competitive market environment.

I. Introduction

The wage gap between female and male workers can be observed in many countries. For example, on average, female workers earn less than 66% of the male workers' wage in Japan, about 81% in the U.S. and about 83% in the U.K.[1] The gender wage gap has been closing in recent years in Japan, but the gap is still larger than in other advanced countries.

Economic theory explains the existence of the gender wage gap. Becker's (1971) taste-based discrimination theory and Phelps's (1972) statistical discrimination theory explain the gender wage gap through the labor demand side. Taste-based discrimination theory assumes there are employers who discriminate against women. Discriminatory employers hire fewer women at the sacrifice of profit. Although the productivity of female workers is the same as that of male worker, there is the gender gap in the labor market. Statistical discrimination theory suggests that the gender wage gap reflects the gender productivity gap due to asymmetric information between firms and worker. Employers do not know when workers will leave their firms and employers give training opportunities to those workers with a lower probability of quitting. In general, the quitting rate of female workers is higher than male workers. As a result, on average the female wage is lower than the male

* This article is based on Sano (2005), with substantial editions and revisions.

[1] These figures are based on *Heisei 18-nen Chingin Kozo Kihon Chosa* (Basic Survey on Wage Structure) (Ministry of Health, Labour and Welfare 2006) for Japan, *Yearbook of Labour Statistics* (ILO 2006) for the U.S., and *Yearbook of Labour Statistics* (ILO 2003) for the U.K.

wage due to low productivity.[2]

To identify the reason for the gender wage differences, researchers often implement the wage regression method. To examine how the gender wage gap is due to the productivity gap, researchers estimate the wage equation by including proxy variables of productivity. However, it is difficult to justify the proxy variables for productivity (Neumark 1988, 1999; Altonji and Blank 2003). In Japan, in particular, the wage regression method using proxy variables is not available to us due to a lack of micro data. An alternative way to identify the productivity gap is the "market test" method as suggested by Hellerstein, Neumark, and Troske (2002). The market test is methodology to demonstrate the causes of the differential wages, verifying the significance of the correlative profit and the number of female employees added. If the female-male wage gap is due to employer discrimination, then non-discriminatory employers earn higher profits by hiring more women. On the other hand, if the gender wage gap is due to their productivity gap, then there is no correlation between the proportion of female workers and the firms' profit.

Hellerstein, Neumark, and Troske (2002) showed that an increase in the female proportion increased profits by using U.S. cross-sectional data. This result is consistent with Becker's employer discrimination hypothesis. However, an established fixed effect which is positively correlated with female proportion may have a positive effect on profit. Kawaguchi (2007) implements market tests using level panel data from Japanese firms to eliminate the fixed effect. Kawaguchi (2007) showed how a rise in female employment increased firms' profits. He also showed how the largest portion of gender gaps came from their productivity gap. Kodama, Odaki, and Takahashi (2005) examined the relationship between the proportion of female workers and the firms' profits using level panel data from Japanese firms. They found that additional employment of female workers increased firms' profits by the pooled OLS, but this relationship was eliminated by the fixed effect model. They insisted that the positive relationship between firms' profits and the proportion of female workers in cross-section analysis is spurious, but rather firms' management strategy truly affects firms' profits. The previous research does not control the factors such as employee characteristics directly related to firms' profits. For example, the age distribution of employees may affect both the firms' profits and hiring strategies.[3] If these variables are omitted, then the estimation result has an omitted-variable bias. To avoid this omitted-variable bias, we supplement financial data with survey data containing details about employees. A unique data set enables us to control these variables. By adding to these variables, we can test the taste-based discrimination hypothesis.

We find that (i) estimation results indicate that an increase in the proportion of female workers increases profits; (ii) a high proportion of female workers has a strong effect on concentrated industries. These results support employer discrimination hypothesis. Next,

[2] Kawaguchi (2008) explains other theory of the cause of wage gap.

[3] Nakamura (1988) points out that firms which allocated women to important positions increased their profit in the retail industry in Japan.

we examine how the firms with a high female proportion grow faster in a more competitive industry. This is the long-run implication of the employer discrimination theory. As a result, employing a larger number of females does not seem to contribute to the growth of the companies in a competitive market environment.

The remainder of this paper is organized as follows: First, we present the theoretical background. Second, we explain the data. Third, we discuss the empirical model and some potential bias. Fourth, we summarize the estimation results and discuss their implications. Finally, we provide some concluding remarks.

II. Theoretical Background

Employer taste discrimination implies that if the female-male wage gap is due to taste discrimination, then non-discriminatory employers earn higher profits by hiring more women. Here we summarize Becker's classical theory of employer taste discrimination: Suppose employers obtain their utility from their firms' profit and from the number of male employees. Employers maximize their utility. For simplicity, the only input is labor and the price of the product is normalized to the unity. Under this assumption, the utility function of employers and profits are expressed by the following equations.

$$U(\pi, L_M, L_F) \qquad (1)$$

$$\pi = f(L) - w_M L_M - w_F L_F \qquad (2)$$

where $L = L_M + L_F$. Utility function is strictly concave and $f(\bullet)$ is strictly concave and increasing.

Using first order condition for utility maximization,

$$U_\pi(f_{LM} - w_M) + U_M = 0 \qquad (3)$$

$$U_\pi(f_{LF} - w_F) + U_F = 0 \qquad (4)$$

f_i denotes marginal productivity of each employee. The discrimination coefficient is defined as $d_M = -U_M/U_\pi, d_F = -U_F/U_\pi$ and varies across employers. To solve equations (3) and (4), we can derive the following equations:

$$f_{LM} = w_M + d_M \qquad (5)$$

$$f_{LF} = w_F + d_F \qquad (6)$$

Firms which face a competitive market decide to hire each labor unit by filling these conditions.

In the static situation, if the female-male wage differential is due to employer discrimination in the labor market, the relative wage to men of women should be less than that of the relative productivity. In this case, non-discriminatory employers could gain more

profit through increasing the additional number of female employees. On the other hand, if the wage differential is due to statistical discrimination, the proportion of female workers should not be correlated with the profits of the firms.

In the long run, if the market is competitive, less discriminatory employers go into the market because they make more profit by increasing the number of female workers. As a result, discriminatory employers lose their market share and exit the market. In other words, less discriminatory employers earn higher profits and grow faster than discriminatory ones.

To sum up, the static Becker hypothesis is as follows: Employers who discriminate less against women hire female worker through earning higher profits. So, non-discriminatory employers earn higher profits by hiring more female workers. The dynamic Becker hypothesis implies that less discriminatory employers experience faster growth than the more discriminatory ones.

III. Data

We used the *NIKKEI-NEEDS* (hereafter *NEEDS*), which is financial data based on marketable securities reports about listed companies on the exchange markets. *NEEDS* contains all financial statements, including total sales and numbers of asset holdings. *NEEDS* covers almost all the listed companies in Japan and makes use of panel data.

However, *NEEDS* has limited details on employees, such as the total number of employees. We supplement details on employees with *Shushoku Shikiho Joshi Gakusei Ban* [Quatery company handbook for female students] (hereafter *Shikiho*). *Shikiho* is a basic survey of firms' activities collected by the publisher, *Toyo Keizai Shinposha* containing financial data and details about the firms' and employees' characteristics. These include such details as the number of full-time employees by sex, average age of employees, average years of employment, the number of female managers, and the number of married female employees.[4]

NEEDS and *Shikiho* use the same stock ID, so we can combine the two data sets and make use of the panel data. The available data cover 10 years (1992-2001), and the sample size is about 550 for each year. There were originally about 5500 observations in the 10 years of data, but after excluding observations with missing values, there remained 3664 observations.

IV. Econometric Specification

1. Static Analysis

Similar to Hellerstein, Neumark, and Troske (2002) and Kawaguchi (2007), we use the following equation to test the static Becker hypothesis—whether non-discriminatory

[4] Abe and Ouchi (1998) used *Shikiho* to identify the problem of the dual career ladder system.

employers earn higher profits by hiring more female workers.

$$profit_{it} = \beta_0 + \beta_1 \frac{L_F}{L}_{it} + \beta_2 capital_{it} + \beta_3 Debt_{it} + \beta_4 age\_firm_i + industry_i\beta_5 + time_t\beta_6 + \beta_7 age\_labor_{it} + \beta_8 tenure\_labor_{it} + \beta_9 KATSUYO_{it} + c_i + \varepsilon_{it} \quad (7)$$

where subscript i and t are indexes for firm and year, respectively, c_i is unobserved heterogeneity, and ε_{it} is idiosyncratic error.

Profit is a firm's operating profits[5] defined as "(total sales minus cost)/total sales."[6] L_F/L is the proportion of full-time female workers to the total number of employees.[7] If there is discrimination against women, a higher proportion of women increases the firm's profits: β_1 is positive. If no discrimination against women exists, the null hypothesis $\beta_1 = 0$ is not rejected.

To control other factors relating to a firm's profits, we include variables which are characteristics of the firms and the employees in the equation. *Capital* represents "fixed asset/ total sales." This variable captures the differences in accounting and economics cost. *Debt* is "debt/total sales." This variable captures the firms' behavior against the negative macro shock. If firms face negative macro shock, they react by increasing their borrowing. *Age_firm* is the years of operation of each firm. This variable captures the firms' brand effects on the profits.[8] Firms with longer operating year face higher capital replacement cost because of holding obsolete capital. It is important to include *age_firm* variable in the regression model. To control the industry and year specific effect, we include industry and year dummies in the regression model.

Employees' characteristics may affect firms' profits. *Age_labor* is the average age of full-time workers within firms, and *tennure_labor* is the average years of employment of full-time workers at the firms. These variables capture the intra firm demographic effect on the profit. For example, higher levels of human capital increase firms' profits. Higher levels of average age and years of employment within firms represent higher human capital level. Alternatively, firms which hire older workers pay more in wages than those hiring younger workers.

We add the *KATSUYO* variables to the estimation model in order to control the effect of the degree of gender equality on the firms' profits. The proportion of female managers to female workers and the proportion of married women to female workers are proxy variables for the degree of gender equality within firms. For example, firms obtain an advantage because they actively promote women to executive jobs, or firms provide working conditions that encourage the employment of married women. Women can continue working without depleting their accumulated human capital. The *KATUSYO* may be positively correlated

[5] We also estimated using current profit and found no significant difference from the results.

[6] *Shikiho* reports non-consolidation information. Therefore, we used the non-consolidation statement from NEEDS instead of the consolidation statement.

[7] The number of part time workers is not available due to limited data.

[8] *Age_firm* may capture the proxy of human capital accumulation (Brown and Meddof 2003).

with operating profit. Otherwise, firms need to improve the working environment for women for social requirement. The set up cost for the working conditions may exceed the benefit for hiring more women. In this case, the *KATUYO* is negatively correlated with profit. It is important to control these variables in order to avoid omitted variable bias.

2. Dynamic Analysis

To test the idea that non-discriminatory firms grow fast, which is an implication of the employer discrimination hypothesis, we regress the following equation.

$$growth_{i1992} = \delta_0 + \delta_1 \frac{L_F}{L}_{i1992} + \delta_3 age\_firm_{i1992} + industry_i\delta_3 + \delta_4 age\_labor_{i1992} + \delta_5 tenure\_labor_{i1992} + \delta_6 KATSUYO_{i1992} + \varepsilon_{i1992} \quad (8)$$

Where $growth_{i1992}$ is defined as $(sales_{i2001} - sales_{i1992})/sales_{i1992}$.[9]

The dynamic Becker hypothesis implies that less discriminatory employers grow faster than more discriminatory ones. If the dynamic Becker hypothesis is true, then the coefficient of L_F/L is positive, holding other factors fixed. We add firm's age, industry dummy, employees' characteristics variables and *KATSUYO* variables in the estimation model to control other factors about profit.

3. Potential Bias and Its Solutions

(1) Outliers

Several extreme cases can be observed from the financial data. Figure 1 shows the box plot for operating and current profit in our data set. Figure 1 illustrates the existence of outliers, especially above the 99th quartile. These outliers are due to the firms' unobserved heterogeneity.

The OLS estimator will be influenced by outlier data. Dropping these observations leads to two possible problems (Wooldridge 2008): First, estimation result may suffer from a small sample bias because there are many extreme observations in our data set. Second, outlying observations may provide important information about population data. To avoid these biases, we apply LAD method evaluated for the sample median. The LAD estimator minimizes the sum of the absolute deviations of residuals, instead of the sum of squared residuals. In other words, the LAD estimates the effect of explanatory variables on the conditional median of dependent variables, rather than conditional mean. LAD is robust estimator against the extreme observations.[10]

[9] Our measure of sales growth is limited through not including firms which ceased business in 2001. Alternative measures of sales growth can be defined as $(sales_{i2001} - sales_{i1992})/[sales_{i2001} - sales_{i1992}]/2$, thus enabling those closed firmed to be included (Genda 2004).

[10] For details, see Buchinsky (1998) or Koenker (2005).

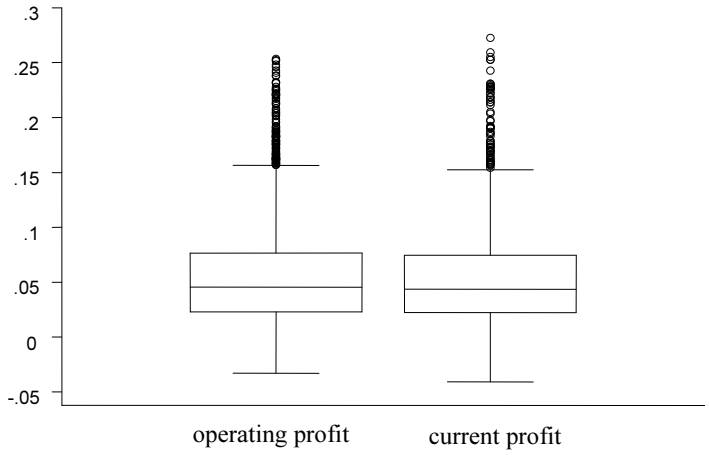

Figure 1. Box Plot (Operating Profit and Current Profit)

(2) Unobserved Heterogeneity

The firm's unobserved heterogeneity (c_i) may be correlated with L_F/L. Suppose that c_i captured idiosyncratic demand shock and production shock to a specific firm. If firms face new technological progress, and they hire more male workers who are able to adapt to new technology, then c_i and L_F/L are negatively correlated and the OLS estimator of β_1 is downward biased. Other interpretation of unobserved heterogeneity is that it represents firms' hiring or management strategy. Firms' unobserved strategy may affect profit. Fixed Effect estimation allowed us to eliminate unobserved heterogeneity and to obtain the consistent estimator of β_1 under the strict exogeneity assumption.[11]

(3) Sample Selection

Our data set covered only listed companies in Japan. Therefore, it is not population data about all firms existing in Japan. Although our data set is not free from sample selection problems, our data is representative of Japanese companies. Our result indicates *BIG* company behavior.

Sikiho is based on survey data. Respondents fail to answer certain questions, such as average age of full time workers or the number of female managers, leading to missing data for the independent variables. The direction of bias is not obvious. Firms which intend to hire more women tend to answer the questionnaire. Alternatively, firms answered the questionnaire due to their positive performances. On the other hand, the firms with poor performances use *Sikiho* as an employment advertisement. Due to the sample selection problem, the effects of proportion of female worker on profits are overestimated. We need exclusive variables to collect sample selection bias, but it is not available. Thus our result has sample selection bias.

[11] Strict exogeneity assumption means $E(\varepsilon_{it} \mid c_i, x_{i1} \cdots x_{iT}) = 0 \quad t = 1, \cdots, T$.

Table 1. Descriptive Statistics

	Number of observations	Mean	Standard deviation	Min.	Max.
Operating profit	3664	0.050	0.054	-0.231	0.430
Proportion of full-time female workers	3664	0.220	0.130	0.014	0.862
Fixed asset/total sales	3664	0.587	0.560	0.025	5.126
Debt/total sales	3664	0.558	0.203	0.053	2.456
Firm age	3664	50.831	19.027	3	116
Average age of employees	3664	35.871	3.784	21.2	46.2
Average years of employment	3664	12.799	4.469	1.2	24.6
Proportion of female managers to full-time female wokers	3664	0.053	0.090	0	0.811
Proportion of married female workers to full-time female workers	3664	0.201	0.141	0	0.885
Sales growth	397	0.083	0.540	-0.849	4.925

(4) Violation of Strict Exogeneity Assumption

The fixed effect model assumes a strict exogeneity assumption, which is error term ε_{it} and is uncorrelated with any independent variables. But this strict exogeneity assumption may be violated by simultaneously problem. Firms fire female workers due to bad performance, or good performance leads to more hiring of women. If these situations are true, our estimation result suffers from simultaneous bias. In this case, we need instrumental variables which correlate with hiring decisions but which do not correlate with profit. Unfortunately, potential instrumental variables are unavailable for our data.

V. Results

1. Static Analysis

We test the static Becker hypothesis based on equation (7). The descriptive statistics of the analysis sample for the test of static Becker hypothesis are shown in Table 1.

Table 2 shows the estimation results concerning the determination of firms' operating profit using panel data. In Table 2, column (1) presents the benchmark OLS estimates of equation (7) which exclude employees' characteristics. The coefficient for proportion of female workers is negative but is not significant. Other control variables are significant at the 1% level. *Capital* is positively correlated with firm's profit at the 1% significant level. And *Debt* is negatively correlated with firms' profits at the 1 % significant level. These results are consistent with theoretical prediction. Firms with longer operating year earn less profit.

Table 2, column (2) presents the OLS result, adding in the employees' characteristics variables. Holding the characteristics of firms and employees, the proportion of female worker is negatively correlated with profit. The magnitude of the coefficient implies that a

Table 2. The Determination of Operating Profit 1992-2001

	Dependent variable: Operating profit					
	(1) OLS	(2) OLS	(3) LAD	(4) LAD	(5) FE	(6) FE
Proportion of full-time female workers	-0.0049	-0.0154 **	0.0118 ***	0.0066	0.0261 *	0.0364 **
	(0.0073)	(0.0073)	(0.0044)	(0.0045)	(0.0158)	(0.0169)
Fixed asset/total sales	0.0315 ***	0.0320 ***	0.0313 ***	0.0311 ***	-0.0440 ***	-0.0441 ***
	(0.0022)	(0.0023)	(0.0010)	(0.0010)	(0.0029)	(0.0029)
Debt/total sales	-0.0873 ***	-0.0770 ***	-0.0581 ***	-0.0528 ***	-0.0201 **	-0.0205 **
	(0.0065)	(0.0065)	(0.0026)	(0.0029)	(0.0094)	(0.0094)
Firm age	-0.0004 ***	-0.0002 ***	-0.0003 ***	-0.0002 ***		
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
Average age of employees		0.0017 ***		0.0013 ***		0.0006
		(0.0006)		(0.0004)		(0.0007)
Average years of employment		-0.0033 ***		-0.0021 ***		-0.0010
		(0.0005)		(0.0003)		(0.0008)
Proportion of female managers		-0.0247 ***		-0.0080		0.0144
		(0.0073)		(0.0056)		(0.0102)
Proportion of married female workers		-0.0021		-0.0081 **		0.0263 ***
		(0.0067)		(0.0041)		(0.0085)
Constant	0.1107 ***	0.0785 ***	0.0717 ***	0.0474 ***	0.0875 ***	0.0712 ***
	(0.0153)	(0.0189)	(0.0089)	(0.0129)	(0.0069)	(0.0205)
Number of observations	3664	3664	3664	3664	3664	3664
Number of firms					811	811
(Pseudo) R^2	0.31	0.33	0.23	0.24	0.11	0.12
Year effect	yes	yes	yes	yes	yes	yes
Industry effect	yes	yes	yes	yes	-	-

Note: Standard errors are in parentheses. ***, ** and * are significant at the 1% level, the 5% level, and the 10% level, respectively. OLS stands for Ordinary Least Square, LAD indicates median regression, and FE indicates the fixed effect model.

10% increase in the proportion of female workers decreases the profits by about 0.15% point. The Firms' characteristics significantly affect their profit. A higher average age of full-time workers earns more profit. Average years of employment of full-time workers are negatively correlated with profit at the 1% significant level. Increasing the share of female managers decreases a firm's profit. The percentage of married female employees has no correlation with profit.

The OLS estimator is affected by the existence of outliers. Heterogeneity, which is unobserved by researcher may be a source of variation between firms' profits. The LAD estimator evaluated at sample median is resilient to the extreme observations. Table 2, column (3) shows the LAD results without controlling the employees' characteristics variables. Now, the most interesting coefficient for female workers is positive and significant at the 1% level. The magnitude of the coefficient implies that a 10% increase in the proportion of female workers decreases profits by about 0.1% point. Other variables affecting profit are the same as the OLS result. After controlling employees' characteristics variables (Table 2,

column [4]), the coefficient for the proportion of female workers becomes insignificant but the sign of the coefficient is positive. The effect of other variables on profit is the same as the OLS result without the significance of *KATUSYO* variables.

The differences between OLS and LAD results indicate that firm's unobserved heterogeneity is correlated with both the share of female workers and profit variables. Fixed effect estimation allowed us to eliminate unobserved heterogeneity, even if that is the case. Table 2, column (5) is the FE result without controlling employees' characteristics variables.[12] The share of female worker is positively correlated with profit at the 10% level. Capital and debt are also statistically significant. Adding employees' characteristics (Table 2 column [6]), the proportion of female workers and the firms' profit is positively correlated at the 5% level. In other words, firms increase profit about 0.36% with a 10% increase in the proportion of female workers. This estimation result is consistent with the static Becker hypothesis.

When compared with each estimation result, the coefficient of the share of female workers estimated by LAD and FE is larger than the OLS result. This indicates that the firms' unobserved heterogeneity is positively correlated with the proportion of female workers, and that the OLS estimate has a downward bias. This is consistent with theoretical prediction.

The average age of employees indicates a proxy variable for human capital. Our result finds that higher levels of human capital contribute to firms' profits. Otherwise, average length of employment is negatively correlated with profit. Conditions of the average level of human capital, such as longer years of employment which means higher hiring cost, for wages, may decrease profit.

KATUSYO variables have a negative effect on profit by OLS and LAD estimation. Otherwise, FE indicates that the proportion of married female employees has a positive effect on profit. Firms' unobserved heterogeneity is correlated with the working conditions for married woman and women who hold management posts. Thus, the OLS or LAD estimator has a downward bias.

Our data set covers only listed companies and full-time workers. Kawaguchi (2007) uses population data reports with a positive correlation share for female worker and operating profit. Hellerstein, Neumark, and Troske (2002) showed similar results. Kodama, Odaki and Takahashi (2005) found that the positive correlation between the proportion of females and profit is seemingly due firms' working conditions. Using working conditions such as the employees' age distribution and the degree of gender equity within firms directly, the firms obtain profits by increasing the proportion of female workers. Our result is consistent with Hellerstein, Neumark, and Troske (2002) and Kawaguchi (2007).

[12] Hausman test rejected the null hypothesis about no correlation with unobserved heterogeneity and explanatory variables at the 1% level. (Hausman statistics is 43.58: P-Value<0.00)

Table 3. The Determination of Operating Profit 1992-2001 by Degree of Concentration

	Dependent variable: Operating profit			
	(1)	(2)	(3)	(4)
	Bottom 25th quartile	25th to median	Median to 75th quartile	Above 75th quartile
Proportion of full-time female workers	0.0006	0.0271	0.0065	0.0938 *
	(0.0254)	(0.0799)	(0.0162)	(0.0562)
Fixed asset/sales	-0.0364 ***	-0.0854 ***	-0.0160 ***	-0.0502 ***
	(0.0057)	(0.0085)	(0.0028)	(0.0075)
Debt/total sales	-0.0926 ***	0.0193	-0.0158	0.0092
	(0.0184)	(0.0208)	(0.0106)	(0.0247)
Average age of employees	0.0003	-0.0011	0.0006	0.0023
	(0.0014)	(0.0017)	(0.0006)	(0.0023)
Average years of employment	-0.0031 **	0.0009	-0.0007	0.0012
	(0.0014)	(0.0018)	(0.0008)	(0.0022)
Proportion of female managers	0.0082	0.0165	0.0244 **	0.0192
	(0.0193)	(0.0282)	(0.0098)	(0.0257)
Proportion of married female workers	-0.0136	0.0411 **	0.0185 **	0.0044
	(0.0178)	(0.0179)	(0.0094)	(0.0241)
Constant	0.1684 ***	0.1165 **	0.0355 *	-0.0140
	(0.0418)	(0.0528)	(0.0194)	(0.0632)
Number of observations	1049	994	1040	581
Number of firms	245	216	217	133
(Pseudo) R^2	0.19	0.17	0.13	0.19
Year effect	yes	yes	yes	yes

Note: Standard errors are in parentheses. ***, ** and * are significant at the 1% level, the 5% level, and the 10% level, respectively. All specifications are estimated by FE. Degree of concentration is calculated by Herfindahl Index at 1991 (source: Japan Fair Trade Commission). Above quartiles indicate is more concentrated industry.

2. By Market Competition

Market competition conditions are a key feature of taste-based discrimination theory. Firms in the competitive market have no room for discrimination against woman. Conversely, firms that discriminate against woman do so because of lack of market competition. Hellerstein, Neumark, and Troske (2002) used fourth quartile product share variables proxy for market competition. They found that firms which have a large share of product market earn more profit by increasing the proportion of female workers. Kawaguchi (2007) used the Herfindahl-Hischman Index (hereafter HHI) proxy for market competition. He found that the HHI and the female proportion are negatively correlated. To test Becker's prediction, we regress by the degree of market competition.

HHI measures the degree of market concentration. HHI is calculated by squaring the market share for each firm's product shipment and totaling within the industry. A large value of HHI means a more concentrated market. We use proxy variable for market concentration by dividing by the fourth quartile dummy variables. To avoid correlation between HHI and

Table 4. The Determination of Sales Growth 1991-2001

	Dependent variable: Sales growth			
	(1) OLS	(2) OLS	(3) LAD	(4) LAD
Proportion of full-time female workers	-0.3876 *	-0.8059 ***	-0.4716 **	-0.5698 ***
	(0.2142)	(0.2432)	(0.2136)	(0.1926)
Firm age	-0.0069 ***	-0.0025 *	-0.0028 **	0.0008
	(0.0016)	(0.0013)	(0.0013)	(0.0013)
Average age of employees		-0.0282		-0.0213
		(0.0186)		(0.0151)
Average years of employment		-0.0201		-0.0133
		(0.0153)		(0.0132)
Proportion of female managers		0.8617 *		-0.0613
		(0.5095)		(0.2998)
Proportion of married female workers		0.1892		0.1219
		(0.2193)		(0.1598)
Constant	0.1040 ***	1.6520 ***	0.3035	1.1094 ***
	(0.0263)	(0.4818)	(0.2339)	(0.4072)
Number of observations	397	397	397	397
(Pseudo) R^2	0.15	0.22	0.09	0.14

Note: Standard errors are in parentheses. ***, ** and * are significant at the 1% level, the 5%level, and the 10% level, respectively. OLS stands for Ordinary Least Square and LAD indicates median regression. Industry dummies are included.

demand shock, we used the indicator for 1991.[13]

Table 3 shows fixed effect estimation results divided by the degree of concentration. The bottom 25th quartile represents the most competitive market and the top 75th quartile represents the most concentrated market. The coefficient of the female proportion is positive for all groups, but is statistically significant for only the top 75th quartile group. The magnitude of the coefficient implies that a 10% increase within the proportion of female workers increases the profit by about 0.94% of a point. This result is consistent with Becker's prediction.

3. Dynamic Analysis

The dynamic Becker hypothesis implies that less discriminatory employers grow faster than more discriminatory ones. We implement growth regression based on equation (8) to examine this prediction.

Table 4 is the estimation result for growth regression between 1992 and 2001. According to Table 4, column (1), the female proportion evaluated for 1992 is negatively correlated with firms' sales growth at the 10% level. Holding the effect of employees' characteristics, the female proportion evaluated for 1992 is negatively correlated with firms' sales growth at the 1% level (Table 4, column [2]). We cannot confirm Becker's' dynamic prediction by

[13] We obtain HHI from Japan Fair Trade Commission's *Monthly Report of Fair Trade Commission.*

Table 5. The Determination of Sales Growth

	Growth (1993-2001)	Growth (1994-2001)	Growth (1995-2001)	Growth (1996-2001)
Proportion of full-time female workers	-0.5951 ***	-0.4910 ***	-0.3985 **	-0.2256 *
	(0.1909)	(0.1840)	(0.1710)	(0.1268)
Number of observations	392	372	346	364
R^2	0.27	0.27	0.23	0.24

Note: All specifications include firm age, average age of employees, average years of employment, proportion of female managers and married female workers, and industry dummies. Standard errors are in parentheses. ***, ** and * are significant at the 1% level, the 5% level, and the 10% level, respectively. All specifications are estimated by OLS.

Table 6. The Determination of Sales Growth by the Degree of Concentration

	Dependent variable: Sales growth			
	(1) Bottom 25th quartile	(2) 25th to median	(3) Median to 75th quartile	(4) Above 75th quartile
Proportion of full-time females workers	-1.1803 *	3.9235 **	-25.2735 *	-4.2442 *
	(0.6347)	(1.6865)	(14.7549)	(2.1315)
Number of observations	117	114	105	61
R^2	0.09	0.08	0.09	0.22

Note: All specifications include firm age, average age of employees, average years of employment, proportion of female managers and married female workers and industry dummies. Standard errors are in parentheses. ***, ** and * are significant at the 1% level, the 5% level, and the 10% level, respectively. All specifications are estimated by OLS. Degree of concentration is caluculated by Herfindahl Index at 1991. Above quartile is more concentrated industry.

this result.

Indicator of sales growth may be affected by "outliers" in the same way as for operating profit. Extreme observations lead to this result. To examine this possibility, we implement the LAD estimation evaluated by sample median. The results by the LAD method are the same as the OLS result (Table 4, column [3]) and [4]).

Table 5 is growth regressions which change over time intervals. The initial value of the female proportion has a negative effect on profit at all specifications. We cannot confirm Becker's dynamic prediction by this result.

Similar to the static prediction, the degree of market competition is crucial for the dynamic model. Table 6 shows the estimation results by the degree of concentration using HHI. The female proportion is negatively correlated with sales growth for the bottom 25th quartile which means more competition (Table 6, column [1]). A mildly competitive market (bottom 25th quartile to median Table 6, column [2]) indicates that the female proportion accelerates sales. The female proportion is negatively correlated with sales growth at more concentrated and at the most concentrated market sections (Table 6, column [3] and [4]).

The dynamic Becker hypothesis predicts that firms which face more competitive mar-

kets grow faster. Our results indicate that firms do not grow fast in competitive markets and are similar to the results obtained by Hellerstein, Neumark, and Troske (2002) and Kawaguchi (2007). This implies that the Japanese market is not competitive enough to eliminate taste-based discrimination.

VI. Concluding Remarks

This paper examines the taste-based discrimination theory with a set of Japanese firm level panel data using the market test methodology. Market test is the methodology to demonstrate the causes of the differential wages, verifying the significance of the correlative profit and the number of female employees added. Existing literature does not control the factors which have an effect on firms' profit, such as employees' age distribution and the share of married female employees. Our data enables us to estimate a more estimator than the previous research. We find that (i) estimation results indicate that an increase in the proportion of female workers increases the profits; (ii) a high proportion of female workers has a strong effect in concentrated industries. These results support the employer discrimination hypothesis. Next, we examine how firms with a high female proportion grow faster in more competitive industries. This is the long-run implication of the employer discrimination theory. As a result, adding a larger proportion of female employees does not seem to contribute to growth of the company in a more competitive market environment.

Our paper had the following limitations: First, our estimation result may harm bias simultaneously. Firms fire female workers due to bad performance, or good performance leads to more hiring of women. We need instrumental variables to correct the bias. However, it is difficult to find suitable instruments. Second, our data set covers only listed companies. Estimation results are suitable for large and well-known companies in Japan but unsuitable for other companies due to the sample selection problem. To solve these problems, it is necessary to build a suitable data set.

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