Gender discrimination and firms' profit: evidence from Brazil

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Received 11 June 2014
Revised 8 September 2015
1 December 2015
Accepted 4 December 2015

Abstract

Purpose – This paper investigates discrimination against women within the Brazilian labour market using firm-level data from the World Bank Investment Climate Survey. The purpose of this paper is to determine whether the female employees in the Brazilian labour market are paid less than their productivity warrants due to the existence of discrimination.

Design/methodology/approach – Based on employer discrimination model proposed by Becker (1971) that considered the proportion of female employees as a proxy for the extent of discrimination, the authors estimate the profit function using OLS analysis, and regress it on the proportion of female employees and other firm characteristics. To address the endogeneity problem caused by unobservable productivity shocks, the authors employed the methods proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003), respectively.

Findings – The results indicate that the proportion of female employees has positive effect on firms' profit in 2002, but has no effect in 2007. This finding gives evidence of the existence of discrimination against female employees within the Brazilian labour market in the early 2000s, while the gender discrimination was reduced overtime.

Originality/value – This paper's main contribution is to provide an approach that differs from that of previous research to determine whether discrimination exists within the Brazilian labour market. This paper also provides policy insights for Brazilian labour market.

Keywords Brazil, Gender discrimination, Firms' profit

Paper type Research paper

1. Introduction

Discrimination within any society can lead to the distortion of resources allocation, and may discourage economic growth. Authorities including the World Bank (2001) claim that gender inequality causes damage not only to women but also to the entire society, and hinders economic development, particularly in low-income countries.

Discrimination against women takes on numerous forms and exists in all sectors of society, including the labour market. Regarding the causes of discrimination, inequality of educational opportunity is considered the root cause of many other forms of inequality. In most countries, especially in developing countries, limitations on

The authors are very grateful to the editor and anonymous referees for their valuable comments that improved this paper. The authors would also like to thank the World Bank Group for allowing the authors to have access to the data used in this paper. This work was supported by JSPS KAKENHI Grant Number 21730228. All the analysis, interpretations and conclusions drawn from the data in this paper are entirely and solely those of the authors.

Journal of Economic Studies
Vol. 43 No. 5, 2016
pp. 801-814

0144-3585
DOI 10.1108/JES-06-2014-0093

women's access to education and inequality in education are the root causes of many aspects of gender inequality.

It is well known that Brazil has achieved significant economic growth over the past two decades, and is also notable for its remarkable inequality. In 2002, Brazil was the eighth most unequal country in the world, based on Gini coefficient conducted by UNDP (2006)[1]. Notably, high levels of inequality appear to be closely linked to issues of gender and race, as the income of women and non-whites is ranked at the end of income distribution (Ñopo, 2012). Gender inequality in Brazil is characterized by lower female labour participation, lower female salaries and limited social protection (Wajnman and Neto, 2000). The gender inequality is rooted in cultural and social norms in Brazil, but changes in economic and social environment have led to declining gender disparities over time. For example, according to the data from the World Development Indicators, Human Development Report and Global Gender Gap Report, the female-to-male ratio of labour participation increased by six points from 0.67 in 2000 to 0.73 in 2010 (see Figure 1), and the female-to-male ratio of earned income increased by 19 points from 0.42 to 0.61 during the same period (see Figure 2).

However, the educational attainment of women in Brazil and several other Latin American countries is currently higher than that of men. In one study, the *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira/Ministério da Eduçacão* (INEP/MEC, 2004) found that in 2001, Brazilian women had attained an average of 6.2 years of education whereas Brazilian men had attained an average of 5.9 years[2]. Despite women's higher educational attainment, discrimination exists within Brazilian labour market. For instance, Lovell (2000) empirically proved that discrimination did indeed exist in Brazilian labour market using a sample of 1991 census data, Loureiro *et al.* (2004) also tested for the existence of racial and gender discrimination in Brazilian labour market.

The majority of the previous research on gender discrimination in Brazil, including Lovell (2000) and Loureiro *et al.* (2004) mentioned above, estimated the wage functions for men and women separately and considered the difference between the coefficients as a measurement of discrimination. However, these estimated coefficients reflected the bias that inevitably arises due to the existence of unobservable factors which affecting productivity. If such unobservable factors systematically differ according to gender,

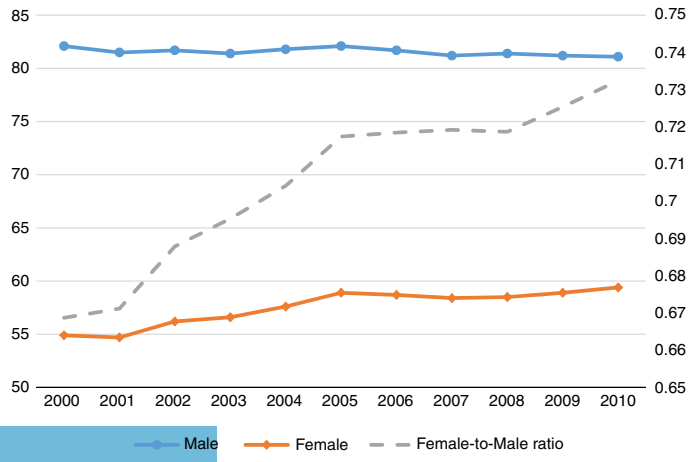

Figure 1.
The female-to-male ratio of labour participation in Brazil (2000-2010)

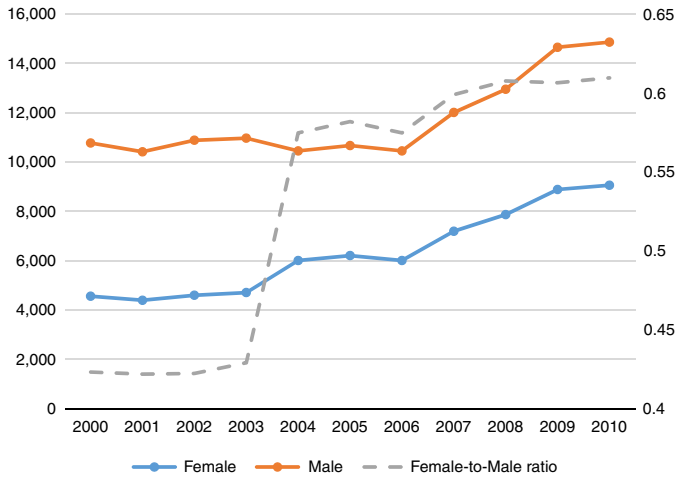

Figure 2.
The female-to-male ratio of earned income in Brazil (2000-2010)

the variable of "discrimination" as measured by this method would be little more than a measure of the gender difference in productivity. To address this concern, we employed an approach that differs from that of previous research to determine whether discrimination exists within the Brazilian labour market. Specifically, we assumed that if female employees were paid less than their productivity warrants due to the existence of discrimination, firms could increase their profitability by employing more women. Based on this assumption, we intend to analyse the relationship between the proportion of female employees employed by a firm and the firm's profit to test for the existence of discrimination by using firm-level data from the World Bank Investment Climate Survey.

The remainder of this paper is organized as follows. Section 2 reviews the literature regarding gender discrimination while Section 3 discusses the theoretical background. Next, Section 4 describes the empirical strategy that we employed, and Section 5 describes the data and the variables that we examined and our justification for doing so. Section 6 discusses our results before closing the study with concluding remarks.

2. Literature review

Many researches into male-female wage discrimination have been conducted using the human capital approach. According to this approach, discrimination against women is considered to exist whenever the relative wage of men exceeds the relative wage that would have prevailed if men and women had been paid equally according to the same criteria (Oaxaca, 1973), with the market discrimination coefficient being defined as the percentage wage differential between two types of perfectly substitutable labour (Becker, 1971). Blinder (1973) and Oaxaca (1973) developed a simple means of decomposing wage differentials into the proportion of the differential arising from differences in productivity and discrimination. Blinder-Oaxaca decomposition has been employed in many empirical studies on gender discrimination (see Altonji and Blank, 1999 for more details). Focusing on the Brazilian labour market, Lovell (2000) estimated the monthly wages of white, black, and mixed-race women and men working in the states of São Paulo and Bahia using a sample of 1991 census data. She found that discrimination did indeed exist in Brazilian labour market, with women and blacks

working in São Paulo experiencing greater discrimination compared to their counterparts in Bahia, but that occupational and wage distributions were more equal in São Paulo. Using data collected by the National Household Survey (PNAD) of 1992 and 1998, Loureiro *et al.* (2004) also tested for the existence of racial and gender discrimination, accounting for sample selection bias by simultaneously estimating the labour market participation function and the wage function following Heckman (1979). Even after controlling for sample selection bias, they found that more than 50 per cent of the male-female wage differential could be attributed to discrimination, with the discrimination differential being larger in urban areas.

In this study, we faced several limitations in using Blinder-Oaxaca decomposition to measure discrimination. First, we were unable to distinguish between discrimination due to unequal pay for equal work and discrimination due to unequal occupational distribution, i.e., occupational segregation. Several researchers have addressed this issue. Birdsall and Fox (1985) analysed the male-female wage differential of primary and secondary Brazilian school teachers, they found evidence of only a low level of occupational segregation, and that the opportunity to be promoted to a secondary school position, which paid a higher salary than that of a primary school position, was relatively equal for men and women when the differences between the observable characteristics of male and female teachers were taken into account. Nomura (2010) followed Brown *et al.* (1980) by including more comprehensive occupations in his analysis, and found that wage discrimination for the same position was greater than that of occupational segregation. His result was consistent with the findings of Birdsall and Fox (1985).

The second limitation that we faced is the possible existence of unobservable factors affecting productivity that systematically differs according to gender. Although Griliches (1977) and Card (1999) demonstrated that the impact of unobservable factors on wages was limited, the measurements of discrimination using wage regression could have led them to overestimate the extent of discrimination. To address this problem, Hellerstein *et al.* (2002) tested the discrimination hypothesis of Becker (1971) more directly by using a "market testing" approach. Using US firm-level data, they found a positive correlation between profitability and the proportion of female workers in the workforce. Since firms can earn more profit by employing more women when women are paid less than their productivity warrants, Hellerstein *et al.* (2002) considered the existence of this correlation as evidence of gender discrimination. When Kawaguchi (2007) performed market testing using Japanese firm-level panel data while maintaining a strong focus on unobservable productivity shocks, he identified the existence of a positive correlation between female employment and firm profitability within the Japanese labour market. Since the costs of gender discrimination and inequality are larger in less developed countries (World Bank, 2001), market testing should be performed using data from developing countries as well. In addition, as we mentioned in the previous section, the issue of discrimination in Brazil has garnered much attention from researchers. Nevertheless, no study before the present one has performed market testing using Brazilian firm-level data.

This study, therefore, addressed a research gap by examining the relationship between the proportion of female employees and firms' profit using Brazilian firm-level data to test the discrimination hypothesis proposed by Becker (1971). It is necessary to point out that the approach in our research generally accords with that of Hellerstein *et al.* (2002) and Kawaguchi (2007).

3. Theoretical background

We based our method on the employer discrimination model proposed by Becker (1971), who assumed that an employer working for a firm prefers to maximize his or her utility instead of the firm's profit taking wage and product price as given.

Consider that a firm can produce an output Y using the inputs of male labour M, female labour F, and other inputs O. The utility function of an employer who prefers not to employ female workers and thus pays a psychic cost when forced to employ women can be defined as:

$$U = pY - w_M M - w_F F - d\left(\frac{F}{M+F}\right) - w_O O, \tag{1}$$

where p is the price of the output; w_M and w_F are the wages of male and female employees, respectively; w_O is the price of other inputs; and d is the discrimination coefficient representing the extent of the employer's discrimination against women, which we assumed to vary across firms.

The employer's utility maximization is given by:

$$MRP_M + \frac{dF}{(M+F)^2} = w_M, \tag{2}$$

$$MRP_F - \frac{dM}{(M+F)^2} = w_F, \tag{3}$$

where MRP_M and MRP_F are the marginal revenue products of male and female workers, respectively. The marginal revenue product of female workers is set above their wages while that of male workers is set below their wage. The solution to the utility maximization problem is denoted as $M^*(p, w_M, w_F, d)$ and $F^*(p, w_M, w_F, d)$. Then, the profit function of the firm is:

$$\pi(p, w_M, w_F, d) = pY - w_M M^* - w_F F^* - w_O O^*, \tag{4}$$

The firm's profit maximization becomes $MRP_{M^*} = w_M$ and $MRP_{F^*} = w_F$. Since the product price and wages are assumed to be identical across firms, the profit is decreasing in the discrimination coefficient d, which means $\partial\pi/\partial d < 0$. Therefore, only firms whose employers do not engage in discrimination ($d = 0$) can maximize their profit, and the profit decreases with an increase in d.

In practice, the discrimination coefficient d cannot be observed directly. Thus, we used female proportion $F/(M+F)$ as a proxy variable. If we assumed that males and female were highly complementary, then an increase in the discrimination coefficient d reduced female employment, it shows that $\partial d/\partial(F/(M+F)) < 0$. Then, the employer discrimination model indicates:

$$\frac{\partial\pi}{\partial(F/(M+F))} = \frac{\partial\pi}{\partial d}\frac{\partial d}{\partial(F/(M+F))} > 0. \tag{5}$$

Under the condition that the output prices and wages are identical across firms, the profit of firms is determined by their specific characteristics. Among the many factors that likely impact profit, we examined the impact of discrimination against women using the proportion of female employees as a proxy for the extent to which an

employer engages in discrimination. In other words, assuming the existence of discrimination, a firm with a high proportion of female workers will have a higher level of profit than a firm employing a low proportion of female workers.

Considering the fact that firms' profit may be affected by a demand or price shock, we used proxy variables to control for demand or productivity shocks. To address this issue, Olley and Pakes (1996) assumed that a firm's investment could be used as the proxy variable of unobserved shocks. Since some firms may report zero investment in micro-level data, Levinsohn and Petrin (2003) proposed to use firms' intermediate inputs as the proxy variable for unobserved shocks. Following Kawaguchi (2007), we used the two proxy variable method to deal with the endogeneity of the female proportion in the profit function.

4. Empirical strategy

4.1 Determinants of profit

To investigate the dependency of a firm's profit on its female proportion, we estimated the profit on female proportion and several control variables. The determinant model of profit is expressed as:

$$profit_i = \beta_0 + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \beta_3 Z_{3i} + \beta_4 Z_{4i} + ind_i \beta_5 + v_i + \varepsilon_i \quad (6)$$

where the dependent variable $profit_i$ is defined as the ratio of operating income relative total sales of the ith firm; β is a vector of the parameters that are being estimated. Z_{1i} is the proportion of female employees compared to total employees. If workplace discrimination against women existed, then employing a higher proportion of female workers would result in higher profit. Thus, a positive β_1 would lead to rejection of the null hypothesis that there is no gender discrimination. The variable of firm age, Z_{2i}, may or may not have positive effect on firm performance. The double-sided effects of firm age on profit are the result of competition between experience and organizational rigidity. On one hand, older firms may perform efficiently for their rich experience; on the other hand, older firms may change to be a bureaucratic organization, which has negative effect on firms' performance. Z_{3i} is an output variable (the logarithm of total sales) that captures the scale effect. To account for the opportunity cost of capital, we included the ratio of fixed assets to total sales, Z_{4i} in the equation. We also introduced industry dummies, ind_i to control industrial heterogeneity; a proxy, v_i, to capture demand or productivity shocks; the idiosyncratic error term, ε_i. With regard to the proxy, v_i we employed the approach used by Kawaguchi (2007) to control demand or productivity shocks, which he based on consideration of two types of proxy variables: one is investment following Olley and Pakes (1996) and the other is intermediate inputs following Levinsohn and Petrin (2003).

4.2 Controlling the unobserved productivity shocks

Assuming that current positive productivity shocks will affect a firm's future level of investment, Olley and Pakes (1996) suggested that a firm's level of investment could be used as a proxy of unobserved productivity shocks in the production function. When, according to their suggestion, the investment function is expressed as $I_i = I(k_i, v_i)$ and it is assumed that $\partial I_i / \partial v_i > 0$, where I_i is the amount of investment, k_i is the capital stock, and v_i is the productivity shock, productivity shock can be expressed as an inverse function of investment and capital. Following Kawaguchi (2007),

we specified the function as:

$$v_i = \lambda_1 \frac{I_i}{k_i} + \lambda_2 \left(\frac{I_i}{k_i} - \frac{\overline{I_i}}{k_i} \right)^2, \quad (7)$$

At this point, we omitted from our sample those firms whose micro-level data indicated that they made no investments. Levinsohn and Petrin (2003) suggested using intermediate inputs as a proxy variable for productivity shocks to avoid omitting firms without reporting investments, explaining that if the demand function of intermediate inputs is expressed as $m_i = m(v_i, k_i)$, productivity shock can be expressed as a function of intermediate inputs and capital stock. Again following Kawaguchi (2007), we specified the function as:

$$v_i = \delta_1 \frac{m_i}{C_i} + \delta_2 \left(\frac{m_i}{C_i} - \frac{\overline{m_i}}{C_i} \right)^2 + \delta_3 \left(\frac{m_i}{C_i} - \frac{\overline{m_i}}{C_i} \right) \times \frac{k_i}{y_i}, \quad (8)$$

where C_i is the total production cost, m_i is the cost of intermediate inputs, and k_i/y_i is the ratio of asset to total sales.

4.3 Dynamic test

Becker's (1971) hypothesis also implied that a firm with higher female proportion grows faster because a non-discriminatory employer gain higher profits than discriminatory one. We employed the growth of total sales and employee numbers as proxies for a firm's growth, and specified the function as:

$$g_i^j = \gamma_0 + \gamma_1 Z_{1i,2002} + \beta_2 Z_{2i,2002} + ind_i \beta_5 + \mu_i, \quad (9)$$

where g_i^j is the growth of total sales as $j =$ total sales, and becomes the growth of employee numbers as $j =$ employee numbers. g_i^j can be calculated by the functions as: $g_i^j = \left(j_{i,2007} - j_{i,2002}\right) / \left(\left(j_{i,2007} + j_{i,2002}\right)/2\right)$. $Z_{1i,2002}$ is the female proportion of firm in year 2002, and $Z_{2i,2002}$ is the firm's age in 2002.

5. Data

We obtained the data that we analysed in this paper from the World Bank Investment Climate Survey, which used standardized survey instruments and a uniform sampling methodology to analyse firm performance and the business environment of developing countries[3]. The available survey of Brazil covers the reference years of 2002 and 2007, in which contain 1,641 and 1,802 firms, respectively. The 2002 survey was sampled only from nine manufacturing industries, while the 2007 survey was sampled from nine manufacturing (1,505 firms) and seven services industries (297 firms)[4]. Among the two-year surveys, there was a panel sample that consisted of 452 firms. After excluding observations with missing values, 1,456 firms in 2002 and 1,090 firms in 2007 were used as our working samples.

Operating income was defined as total sales – (labour cost + material cost + energy cost), the labour cost consists of the total annual cost of paying wages, salaries, bonuses, and social security payments to employees; material cost consists of the total annual cost of raw materials and intermediate goods used in production; and energy cost is composed of the total annual costs of fuel and electricity. The Kernel density estimators of operating income ratio looked suspicious for the 2007 sample.

This result suggested that there may be some outliers in the sample. After excluding the observations whose operating income ratio was below −100 per cent, 11 observations in the 2007 sample were deleted, and the new Kernel density estimators of operating income ratio became normal. Then, there are 1,090 firms remained in the 2007 sample.

The variable of fixed assets was defined as the book value of machinery, vehicles, equipment, land, and buildings, while investment was defined as the purchased assets value of machinery, vehicles, equipment, land, and buildings in the reference year. The descriptive statistics of our data set are presented in Table I.

As shown in Table I, the mean value of firm's sales growth was 1.04 and that of firms' employment growth was 0.13 between 2002 and 2007, reflecting a positive growth during the period[5].

6. Empirical results

6.1 Proportion of female employees and firm's profit

We regressed Equation (6) by using the 2002, 2007 and panel sample. The results are presented in Table II, where the results for the year of 2002 are reported in Columns (1)-(3), the results for the year of 2007 are reported in Columns (4)-(6), and the panel result was reported in Column (7).

Let's see the results for the year of 2002 first. As shown in Column (1), which reports the basic estimation result, the coefficient of the proportion of female employees is 5.29 and statistically significant at the 10 per cent level. The magnitude of this coefficient means that a firm's profit will increase 0.05 of one percentage point when the female proportion increases 1 point. The result suggests that a proportion of female workers has a positive effect on firm's profit, and thus provides evidence for the existence of gender discrimination within the Brazilian labour market in 2002.

As shown in Column (2), which reports the result of the OLS estimation using Olley and Pakes (1996) proxy variables for demand or productivity shocks, we omitted

	2002		2007	
Variable	Mean	SD	Mean	SD
Profit ratio (%)	28.62	22.51	37.66	28.56
Total sales (R$ in millions)	24.70	134.00	110.00	516.00
Employee number	124.76	321.68	145.22	548.97
Proportion of female employees	0.37	0.30	0.35	0.29
Firm age	19.72	17.34	22.72	17.22
Fixed assets/total sales	0.44	4.88	1.83	11.37
Investment/fixed assets	0.74	5.27	2.93	24.51
Material cost/total cost	0.62	0.21	0.54	0.23
Log(wage)	9.02	0.92	11.29	2.53
Growth of total sales			1.04	1.08
Growth of employee numbers			0.13	0.63
Number of firms	1,456		1,090	

Notes: The study sample excludes observations whose profit ratio is below −100 per cent. Growth of total sales and employee numbers are gained from the panel sample using the definitions in Section 4.3. To avoid the effect of inflation, Producer Price Index of Brazil from 2002 to 2007 was used to deflate the values of total sales, labour cost, material cost, and energy cost, while Fixed Asset Investment Price Index was used to deflate the value of fixed assets and investment

Table I.
Descriptive statistics of study data set

Table II. Estimation results of the profit determinant model

	2002 (1)	(2)	(3)	2007 (4)	(5)	(6)	Panel (7)
Constant	−34.871 (5.764)***	−34.150 (6.051)***	−37.514 (5.745)***	20.178 (9.808)**	20.435 (9.745)**	24.625 (9.867)**	6.319 (6.820)
Proportion of female employee	5.286 (3.139)*	6.523 (3.320)**	4.264 (3.124)	−0.020 (3.970)	0.945 (3.988)	−0.498 (3.942)	−1.362 (4.588)
Firm age	0.026 (0.035)	0.049 (0.037)	0.019 (0.036)	0.049 (0.055)	0.054 (0.055)	0.058 (0.054)	0.014 (0.053)
Log (output)	3.890 (0.339)***	3.747 (0.355)***	4.346 (0.385)***	1.212 (0.306)***	1.124 (0.307)***	1.468 (0.315)***	2.316 (0.357)***
FA/TS	−0.072 (0.115)	−0.069 (0.115)	−0.045 (0.132)	−0.060 (0.088)	−0.056 (0.087)	−0.057 (0.101)	−0.359 (0.126)***
I/FA		0.201 (0.319)			0.403 (0.102)***		
(I/FA−mean (I/FA))^2/1,000		−3.046 (3.370)			−0.844 (0.261)***		
MC/TC			−8.590 (3.302)***			−15.735 (5.109)***	
(MC/TC−mean (MC/TC))^2			34.483 (11.011)***			26.785 (15.022)*	
(MC/TC−mean (MC/TC))×(FA/TS)			−0.351 (0.993)			0.223 (0.360)	
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	No	No	No	No	No	No	Yes
R^2	0.108	0.107	0.124	0.052	0.071	0.082	
Number of firms	1,456	1,338	1,456	943	925	943	378
Number of observations	1,456	1,338	1,456	943	925	943	756

Notes: The results in Columns (1)-(3) are gained from the 2002 survey, the results in Columns (4)-(6) are gained from 2007 survey, and the one in Column (7) are gained from the panel survey. FA/TS denotes fixed assets/total sales, I/FA denotes investment/fixed assets, MC/TC denotes material cost/total cost. Standard errors are presented in parenthesis. *,**,***Significant at 10, 5, 1 per cent levels, respectively

several observations from the sample shown in Column (1) because of the unavailability of investment data. As can be observed, the coefficients are statistically significant, and suggest that investment does effectively capture demand or productivity shocks. It is notable that the coefficient of the proportion of female employees becomes larger than that in Column (1), which is inconsistent with the expectation of an upward bias of the OLS estimator. However, as being explained in Kawaguchi (2007), the overlapped confidence intervals of the two estimates indicate that OLS results are robust. Column (3) reports the result of the estimation including Levinsohn and Petrin (2003) proxy variables for demand or productivity shocks, the coefficients of the proxy variables are significant. This means that intermediate inputs does effectively capture demand or productivity shocks.

Column (4) reports the basic estimation result for the year of 2007. The insignificant coefficient of the proportion of female employees does not reject the null hypothesis that the proportion of female workers has no effect on firm's profit. This finding does not give evidence of the existence of discrimination against female employees within the Brazilian labour market in 2007. As shown in Column (5), after the productivity shocks are significantly controlled by Olley and Pakes (1996) method, the sign of proportion of female employees becomes positive but still insignificant. Moreover, Column (6) reports the result of the estimation including Levinsohn and Petrin (2003) proxy variables for demand or productivity shocks, the coefficients of the proxy variables are significant but the coefficient of female proportion is insignificant. These findings confirm the basic estimation result in Column (4).

It is noteworthy that the finding from the 2002 survey gives strong evidence of the existence of discrimination against women within the Brazilian labour market while the finding from the 2007 survey does not. The inverse results between the two years indicate that discrimination against women was reduced during the period of 2002-2007. Does the reality of Brazilian labour market match these findings? As being reported in World Development Indicators, Human Development Report and Global Gender Gap Report (see Figures 1 and 2), the female-to-male ratio of labour participation in Brazilian labour market increased from 0.69 in 2002 to 0.72 in 2007, and female-to-male ratio of wage also increased from 0.42 to 0.60 during the same period. Thus, the reality of Brazilian labour market is in line with our findings.

Further, to address the change of female discrimination over time, we estimated Equation (6) by applying panel data analysis approach. The Hausman test statistic does not reject the null hypothesis that the random effect model is preferred for our panel sample. The result is reports in Table II, Column (7). The coefficient of the proportion of female employees is insignificant, thus cannot reject the null hypothesis that female proportion has no effect on firms' profit. This result confirms the previous findings that discrimination against women within Brazilian labour market was reduced during the period.

In addition, our finding that the logarithm of total sales has positive effect on firms' profit in all specifications suggests that larger firms tend to be more efficient than smaller firms within the Brazilian manufacturing industry. In contrast, we found that firm age and the ratio of fixed assets to total sales have no significant effect on firm profit ratio. As discussed in Section 3, firm age may have positive effect on firm performance (greater age brings with it greater knowledge) or negative effect (greater age brings with it greater organizational rigidity). We, therefore, interpreted our finding as the latter factor having a greater impact on firm performance than the former factor does.

6.2 Dynamic test

To test the hypothesis that a firm with higher female proportion whether grows faster or not, we estimate Equation (9) by using the panel sample. The results are presented in Table III. Column (1) reports the OLS regression of the growth index of total sales. The coefficient of female proportion has a negative and significant effect on firms' sales growth. This finding rejects the hypothesis that a firm with higher female proportion will grows faster. Column (2) reports the OLS regression of the growth index of employee numbers. The insignificant coefficient of female proportion also cannot support the hypothesis that a firm with higher female proportion will grows faster.

There are two meanings of the dynamic test result. First, the result is consistent with the finding in the panel data model, and gives evidence that discrimination against women within Brazilian labour market was reduced over time. Second, as being discussed in Kawaguchi (2007), the variation between the cross-sectional analysis for the year 2012 and the panel analysis suggests that the labour market is not competitive enough to eliminate gender discrimination.

6.3 Proportion of female employees and total cost

If female employees are paid a lower wage than male employees due to the existence of workplace discrimination, a firm can achieve higher profit by substituting male labour with female labour to decrease the labour cost. Thus, it is worth to confirm whether higher female proportion leads to lower labour cost. Following Kawaguchi (2007), we employed a wage bill function to test the hypothesis that employing a higher proportion of female employees leads to lower labour cost. The wage bill function is defined as:

$$\log(wagebill_i) = \gamma_0 + \gamma_1 Z_{1i} + \gamma_2 \log(output)_i + \gamma_3 ind_i + u_i \quad (10)$$

where $wagebill_i$ is the total labour cost of firm i and Z_{1i} is the proportion of female employees to total employees. If female employees are paid a lower wage than male employees due to the existence of workplace discrimination, the proportion of female employees would have negative effect on labour cost, given the same level of output. We estimated Equation (10) by OLS and tested the null hypothesis $\gamma_1 = 0$ against the alternative hypothesis $\gamma_1 < 0$.

The estimation results for the year of 2002 and 2007 are reported in Table IV. The coefficient of the proportion of female employees in Column (1) is −0.23 and

	(1)	(2)
Constant	1.015 (0.543)*	−0.559 (0.305)*
Proportion of female employee	−0.509 (0.329)	−0.145 (0.181)
Firm age	0.000 (0.003)	−0.001 (0.002)
Log(output)	−0.015 (0.032)	0.064 (0.018)***
FA/TS	0.006 (0.011)	0.008 (0.006)
Industry dummies	Yes	Yes
R^2	0.038	0.077
Number of firms	398	421

Notes: The dependent variable in Column (1) is the growth index of total sales, the one in column is the growth index of employee numbers. FA/TS denotes fixed assets/total sales. Standard errors are presented in parenthesis. *,**,***Significant 10, 5, 1 per cent levels, respectively

Table III. Estimation results of the growth index

	2002 (1)	2007 (2)	Panel (3)
Constant	4.952 (0.181)***	0.004 (0.491)	−2.098 (0.589)***
Proportion of female employees	−0.228 (0.100)**	0.132 (0.201)	−0.605 (0.365)*
Log(output)	0.258 (0.010)***	0.651 (0.015)***	0.827 (0.020)***
Industry dummies	Yes	Yes	Yes
R^2	0.467	0.652	0.823
Number of observations	1,456	1,090	812

Table IV. Estimation results of wage bill

Notes: The results in Columns (1), (2), and (3) are gained from the 2002 survey, the 2007 survey, and the panel survey, respectively. Standard errors are presented in parenthesis. *,**,***Significant 10, 5, 1 per cent levels, respectively

significant at the 5 per cent level, suggesting that employing a higher proportion of female employees leads to a lower labour cost. This result suggests that a higher proportion of female employees lead to a higher profit within Brazilian labour market in 2002. While in Column (2) for the year of 2007, the coefficient of the proportion of female employees is found to be insignificant, which means that female proportion does not have effect on the labour cost of a firm. That is to say, we cannot conclude that discrimination against women exists within the Brazilian labour market in 2007. In Column (3), the results of panel data analysis suggests that proportion of female employees is positively related to firms' profit over the period from 2002 to 2007. In summary, the empirical results in this section confirm the previous findings that discrimination against women within Brazilian labour market was reduced from 2002 to 2007.

7. Concluding remarks

Brazil has recently experienced very rapid economic growth, especially after the implementation of the Real Plan in 1994. Nevertheless, income inequality remains a serious concern, one that has been attributed to discrimination against women and racial minorities. As such, discrimination impedes fair competition and confounds equality of opportunities and outcomes, it likely distorts resource allocation and hinders economic growth, negatively impacting not only women and discriminatory employers but also Brazilian society as a whole.

To investigate whether discrimination against female exists within the Brazilian labour market, we tested implication of the employer discrimination model proposed by Becker (1971) that considered the proportion of female employees as a proxy for the extent of discrimination. We gained our empirical results from the Brazil data of World Bank Investment Climate Survey. Our results indicate that the proportion of female employees has positive effect on firms' profit in 2002, but does not have effect in 2007. These findings are robust when we used several different methods and specifications. Therefore, we conclude that discrimination against female employees within the Brazilian labour market had existed in 2002, but was weakened from 2002 to 2007. Fortunately, our findings are in line with the reality of Brazilian labour market that is characterized by declining gender disparities over the period.

Moreover, the results gained from the 2002 survey indicate that a firm employing a high proportion of female workers incurs a lower labour cost while producing the same level of output compared with a firm employing a low proportion of female employees.

Our findings are in accord with those reported in previous studies (e.g. Lovell, 2000; Loureiro *et al.*, 2004; Nomura, 2010) that estimated workplace gender discrimination using Blinder-Oaxaca decomposition. Along with this, the results gained from the 2007 survey did not confirm the hypothesis that higher proportion of female employees lead to higher profit of firms in Brazil. These findings confirm the results in Garcia *et al.* (2009) and Madalozzo (2010) that founded that the reduced gender discrimination in Brazilian labour market contributed to the decreasing wage gap overtime.

It should be noted that, the present empirical results gained from only the two years data. To investigate the long-term trend of gender discrimination in Brazilian labour market, a long-term firm-level panel data are preferred in our future research. In addition, the results of our analysis indicate that employer discrimination against female employees leads to a loss of profit. A serious concern remaining is to estimate the loss. We plan to address this concern, as well as identify the ultimate bearers of discrimination, in our future research.

Notes

1. According to UNDP (2006), the Gini coefficient value of Brazil is 0.58 in 2002.
2. Based on the National Household Survey (PNAD) in 2009, we found that women in Brazil had attained an average of 7.4 years of education whereas men had attained an average of 7.1 years.
3. For more information about the survey, see www.enterprisesurveys.org
4. In order to make the two samples comparable, the observations of services industries in 2007 were removed from our working samples.
5. Given data availability, the value of firm's sales growth and employee growth could be calculated only from the panel samples. We calculated the mean value of firms' growth by using the mean value of total sales and employee numbers that gained from the two cross-section samples, and found that firms' sales growth was 1.13 and firms' employment growth was 0.16. These results confirmed that the Brazilian firms had a positive growth from 2002 to 2007.

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