



Impact of Firm's Characteristics on Gender Discrimination: Evidence from Vietnamese Firm-level Data*

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ABSTRACT

We use firm-level data from the World Bank Enterprise Surveys data to examine the gender discrimination within the Vietnamese labour market. In this study, we extended the works of Becker (1971), Arrow (1973) and Goldberg (1982) to derive an equation that identifies the firm's profit ratio at a function of the proportion of female employees and other control variables. To deal with possible endogeneity issues caused by unobservable demand or productivity shocks, we applied the proxy variables methods proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003), respectively. We find that there is a significant negative association between proportion of female employees and firm's profit in 2005, however, we could not find any evidence of this effect in 2009 and 2015. Moreover, our results suggest that gender discrimination depends on firms' characteristics such as ownership, market orientation and top manager's gender. This study's main contribution is to provide an approach that differs from previous research on gender discrimination in Vietnam.

INTRODUCTION

Since the *Doi Moi* reform in 1986, the Vietnamese economy has successfully transformed from a centrally planned to a market-based economy. To put this economic achievement into perspective, Vietnam's real gross domestic product (GDP) has grown at an annual average of 6.1% and its real GDP per capita at 5.04%, between 2007 and 2017. This impressive growth record has lifted Vietnam from one of the poorest countries in the world to a lower-middle income country, in just over a quarter of a century.¹ This achievement has seen the World Bank (2015) tout the Vietnamese experience as a valuable case study for other economies in transition.

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¹ According to the World Bank database, Vietnam's real income per capita increased from around \$100 in 1986 to over \$2,343 in 2014.

Apart from economic achievements, the Vietnamese labour market has been gradually liberalised by the Communist Party of Vietnam (CPV). Some of the most important amendments included legal termination of labour contracts, compulsory social security and health insurance schemes, non-discrimination practices and mandatory minimum wages. As a result, the labour force increased by an average growth rate of 2.3%, or 1.1 million people, per year (GSO, 2013). This rate grew at an annual average of around 4.0% in urban areas, three times higher than the rate for the rural areas. In part, this huge increase attested to the successful reform in the 1990s, which created many job opportunities in the urban areas. In addition, Vietnam has made considerable progress towards gender equality especially in closing gender gaps in employment and wages. According to Kabeer (2011), women's labour force participation rates in Vietnam are among the highest in the region, and the gender gap in earnings is lower in Viet Nam than many other East Asian countries. For example, in 2014, the labour force consisted of 27.56 million male workers and 26.19 million female employees (GSO, 2014).

However, it is still controversial whether labour market discrimination against women has declined or become more severe during this period of strong growth and improved employment opportunities. For example, the International Labour Organization's (ILO) 2015 report shows that despite accounting for nearly half of the labour force, working women in Viet Nam were under-represented in top business management and Viet Nam, ranked 76th out of 108 countries in its proportion of female managers. Women's limited access to decision-making positions is the result of various gender-based discrimination practices in the workplace, starting from recruitment process, through difficulties in balancing work and family life, to training opportunities and promotion. In addition, while job advertisements should avoid any mention of gender as this represents a direct form of gender-based discrimination, the relevant data has indicated that such practice is still common in Viet Nam. For instance, the review of job advertisements posted on Vietnam's four largest job portals between mid-November 2014 and mid-January 2015 found that one in five job postings included gender requirements.² Among the job postings that included a gender preference, 70 percent specifically requested that the positions be filled by men whereas only 30 percent wanted female applicants (ILO, 2015). Gender discrimination may exist in most parts of the economic sectors and can take many different forms including gender inequality in recruitment, employment, training, working hours and rest periods, wages and other policies. Of the different kinds of disparity, this paper investigates the existence of gender discrimination within Vietnamese labour market using firm-level data for the years 2005, 2009 and 2015.

According to Becker (1971), a gender wage gap that exceeds the productivity gap can be interpreted as evidence of gender discrimination. The majority of the previous research on gender discrimination in Vietnam concentrated on examining the gender wage gap using data from Vietnam Household Living Standard Survey (VHLSS) (Liu, 2004a, 2004b; Pham & Reilly, 2007). In these studies, a negative gender wage gap against women that was found after controlling for individual characteristics such as education and experience and other relevant characteristics is interpreted as evidence of gender discrimination. For example, Liu (2004a) provided the first systematic inquiry into the gender pay gap in Vietnam using data drawn from VHLSS conducted in 1993 and 1998. He found that the relative wage of men exceeded the relative wage of women during the period, however, this wage gap decreased over time by over six percent. Examining sectoral gender wage gap in 1998, Liu (2004b) noted that discrimination was the most important factor in explaining the gender pay gap in private firms, while this effect declined in state-owned enterprises (SOEs). Meanwhile, Pham and Reilly (2007) reach similar conclusions after studying gender pay gap during the period 1993-2002. For instance, the average gender pay gap halved between 1993 and 2002 with most of the reduction achieved by 1998. Recently, Fukase (2014) examined the 2002 and 2004 VHLSS and found that the gender gap is largest in the informal wage sector as the average female worker earns about 24 per cent lower wages relative to her male counterpart. In

² These four largest job portals include *VietnamWorks* (www.vietnamworks.com), *Job-Street* (www.jobstreet.vn), *Career-Builder* (www.careerbuilder.vn) and *CareerLink* (www.careerlink.vn).

formal sector, the gender wage gaps are found to be about 15 per cent for foreign and domestic private sectors. In contrast, female employees in state sector jobs received 8 per cent higher wages relative to their male counterparts.

However, the gender wage gap may partly reflect a male-female productivity differential and it is not clear whether the residual wage gap is attributable to labour market discrimination towards women or unobservable gender-based productivity differentials (Kawaguchi, 2007). Therefore, the OLS estimates might be biased in studies that did not effectively capture unobservable factors affecting productivity (Liu et al., 2016). Against this backdrop, this paper analyses the relationship between the proportion of female employees and the firm's profit to test for the existence of discrimination. Specifically, this method tests the discrimination hypothesis of Becker (1971) which states that firms can earn more profit by employing more minority workers if minority workers are paid less while minority and majority workers are equally productive. In addition, this paper applies proxy variable method proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003) in order to address possible endogeneity of female proportion induced by demand or productivity shocks. The Becker's theoretical prediction had been tested in the US (Hellerstein et al., 2002), Japan (Kawaguchi, 2007), China (Zhang & Dong, 2008) and Brazil (Liu et al., 2016). Using US employer-employee matched data, Hellerstein et al. (2002) found that an increase in the female proportion raised the firm's profit. They concluded that the existence of this correlation is an evidence of gender discrimination. This is consistent with Kawaguchi (2007) who uncovered a positive female employees proportion - firm's profit nexus using Japanese firm-level data. Recently, Liu et al. (2016) reached a similar conclusion based on evidence from 1,456 Brazilian firms in 2002. In contrast, Zhang and Dong (2008) examined the data of 1,500 firms in five cities of China for the period 1988 - 2000 and found that, in the manufacturing sector, state-owned enterprises (SOEs) preferred female employees to their male counterparts, while women in foreign-invested enterprises (FIEs) did not face discrimination. In addition, export-oriented enterprises offered wage premium to female employees as a reward for their high productivity.

This paper contributes to two strands of literature. Firstly, to the best of our knowledge, this is the first attempt to systematically analyse gender discrimination using Vietnamese firm-level data based on Becker's employer discrimination theoretical framework. Secondly, Vietnam is an ideal country for implementing the market test for transitional economics because it successfully adopted the economic reform and has been among the fastest growing economies. Therefore, this paper's results could be made to compare with experiences from other post-communist countries such as Russia, China and other Eastern European countries (EECs) as well as other developing countries. The rest of this paper is organised as follows. Section 2 discusses the theoretical background that motivates the empirical strategy. Section 3 provides a description of the datasets and empirical methodology. The empirical results are discussed in section 4, which is then followed by concluding remark section.

1. THEORETICAL FRAMEWORK

We adopted the theoretical model proposed by Becker (1971) and was extended by Arrow (1973) to examine gender discrimination at firm level. We begin by assuming that a firm, i , can produce an output Y_i by using labour input which contains male labour, M_i and female labour, F_i . Suppose the recruitment of female employees impacts the utility of the employers and the employers solve their utility maximisation by choosing M_i and F_i .³ The utility function can be defined as:

³ In this study, for simplicity, we suppose that there is no nepotism/discrimination toward male employees, but only nepotism/discrimination against female employees (Neumark, 1988).

$$U_i(\pi_i, M_i, F_i) = p_i Y_i(M_i, F_i) - w_{iM} M_i - (1 + d_i) w_{iF} F_i \quad (1)$$

where p_i is the price of output Y_i for firm i . w_{iM} and w_{iF} are wages for male workers and female employees, respectively. d_i is the discrimination coefficient capturing the extent of like/dislike for employing female employees and d_i is assumed to be a constant within a given firm but may vary across firms (Goldberg, 1982). Intuitively, if the employer has a preference for female employees, d_i will be negative; if the employer has a taste for discrimination against female employees, d_i will be positive (Marshall, 1974).⁴ The utility maximisation is given by:

$$MRP_{iM} = w_{iM}, MRP_{iF} - d_i = w_{iF} \quad (2)$$

where MRP_{iM} and MRP_{iF} are the marginal revenue product of male workers and female employees, respectively. Intuitively, equation (2) shows that male workers are receiving their marginal revenue product. In contrast, hiring female employees increases/decreases the non-pecuniary cost of discrimination/nepotism to employer, hence, the marginal revenue product of female employees is set above/under their wages. The managers in firm i solve the utility-maximisation problem by choosing male labour input and female labour input which are denoted as $M_i^*(p_i, w_{iM}, w_{iF}, d_i)$ and $F_i^*(p_i, w_{iM}, w_{iF}, d_i)$. Therefore, the profit function of firm i is given by:

$$\pi_i(p_i, w_{iM}, w_{iF}, d_i) = p_i Y_i - (w_{iM} M_i^* + w_{iF} F_i^*) \quad (3)$$

Without loss in generality, we assume that the product price and wages are homogenous across firms, conditioned on time, region and industry, hence, the profit is a function of the discrimination coefficient, d_i , conditioned on time, region and industry. With this simplification, a profit-maximisation firm, in the absence of discrimination, would have $d_i = 0$. If the employer discriminates against women, the profit decreases with an increase in d_i , which means $\frac{\partial \pi_i}{\partial d_i} < 0$ and $d_i > 0$. In contrast, if the employer pursues the political objective of gender equality beyond economic considerations, the profit increases with an increase in d_i , which means $\frac{\partial \pi_i}{\partial d_i} > 0$ and $d_i < 0$. In practice, the discrimination coefficient, d_i is not directly observable. Following Kawaguchi (2007) and Liu et al. (2016), we use female proportion, $\left(\frac{F_i}{M_i + F_i}\right)$, as a proxy variable for d_i . Assuming homogenous of degree zero with respect to male and females inputs, the comparative statics show that $\frac{\partial (F_i / (F_i + M_i))}{\partial d_i} < 0$.⁵ Intuitively, this implies that employer's utility is affected by the relative proportions of males and females but not the absolute numbers. As a result, the profit function is given by:

$$\pi_i \left(p_i, w_{iM}, w_{iF}, d_i \left(\frac{F_i}{M_i + F_i} \right); p_i, w_{iM}, w_{iF} \right) \quad (4)$$

Then, the employer discrimination model implies that

⁴ In this study, in order to combine both nepotism and discrimination into one model, we relax the assumption of positive d_i as in Hellerstein et al. (2002), Kawaguchi (2007) and Liu et al. (2016). Our assumption is similar to the work of Zhang and Dong (2008).

⁵ For details relating to this assumption, please refer to explanation in the study of Neumark (1988).

$$\left\{ \begin{array}{l} \frac{\partial \pi_i}{\partial (F_i / (F_i + M_i))} = \frac{\partial \pi_i}{\partial d_i} \frac{\partial d_i}{\partial (F_i / (F_i + M_i))} > 0 \text{ if } d_i > 0 \\ \frac{\partial \pi_i}{\partial (F_i / (F_i + M_i))} = \frac{\partial \pi_i}{\partial d_i} \frac{\partial d_i}{\partial (F_i / (F_i + M_i))} < 0 \text{ if } d_i < 0 \end{array} \right. \quad (5)$$

Intuitively, equation (5) indicates that, under the condition of homogenous output prices and wages, proportion of female employees in a firm will have positive effect on firm's profit if there is gender discrimination. In contrast, assuming nepotism toward female employees, proportion of female employees in one firm will have negative effect on this firm's profit.

Despite shedding qualitative insight into the relationship between gender discrimination and firm's profit, equation (5) has been criticised for potential endogeneity of the female proportion induced by temporary productivity and demand shocks (Kawaguchi, 2007). For example, a demand shock could naturally impact the firm's profit and create a variation in female proportion

because $\frac{\partial \left(\frac{F_i}{M_i + F_i} \right)}{\partial p_i}$ could be either positive or negative. Therefore, the market test may falsely reject the null hypothesis of the employer discrimination/nepotism model and result in biased OLS estimates (Wooldridge, 2002). In light of this possibility, we applied the proxy variable method, which is suggested by Olley and Pakes (1996) and Levinsohn and Petrin (2003), to deal with the endogeneity of the female proportion induced by demand or productivity shocks in the profit function.

Based on aforementioned discussion, we examine the following model to test for gender discrimination/nepotism in Vietnamese firms:

$$profit_i = \beta_0 + \beta_1 fp_i + \beta_x X_i + \varepsilon_i \quad (6)$$

where $i = 1, 2, \dots, I$ denotes the firm. $profit_i$ and fp_i , respectively, represent profit and female employees proportion of firm i . X_i is the set of control variables to be discussed in next section. Meanwhile, β_0 , β_1 and β_x are unknown parameters to be estimated. Finally, ε_i , the stochastic error term, can be further decomposed into firm-specific demand or productivity shocks (μ_i) and the idiosyncratic residual (u_i). Put differently, the μ_i captures the effect of the demand/productivity shock on profit and u_i contains all information not captured by μ_i .

2. VARIABLES, EMPIRICAL METHODOLOGY AND DATA

2.1 Variables

2.1.1 Dependent variable

The dependent variable, $profit_i$, in our study is the ratio of operating income relative total sales of the firm i which is essentially the price-cost margin (Hellerstein et al., 2002). Operating income is calculated by subtracting the labour costs, material costs and energy costs from total sales.

2.1.2 Female proportion

The focus of this study is to test whether or not there is gender discrimination/nepotism toward female within Vietnamese firms. Following the existing literature, we use the proportion of female employees compared to total employees, fp_i (Kawaguchi, 2007; Liu et al., 2016). If discrimination against female employees existed, then employing a higher proportion of female employees would result in higher profit. In contrast, if employers subsidised female employees, we expect this variable to have negative effect on firm's profit. Since skilled workers receive higher

wage compare to unskilled counterparts across provinces in Vietnam (Hoang et al., 2019), we also study the decomposition of female employment, including the proportion of skilled-female employees, proportion of unskilled-females workers, proportion of female production workers, and proportion of female non-production workers.

2.1.3 Control variables

Since older firms may perform efficiently for their higher-level intangible assets such as knowledge, research and development or rich experience, it is important to control for this effect. Therefore, the first control variable is firm' age, $firmage_i$. The second control variable is output variable, lts_i , which is the logarithm form of firm's total sales. This variable captures the scale effect on profit. In line with the existing literature, we include the ratio of fixed assets to total sales, occ_i , to account for the opportunity cost of capital (Kawaguchi, 2007; Liu et al., 2016). Since firms with female top manager and female participation in ownership might prefer female to male, we introduce female manager dummy, fm_i , and female ownership dummy, $fown_i$, and introduce them into (6) in order to capture these possibilities. To capture industry- and region-specific effects, we include both the industrial and provincial dummy variables into equation (6). Specifically, we capture the regional specific effect by introducing a region dummy, REG_i . In addition, industry dummy, IND_i , which is defined as two-digit industry, is used to control for industrial heterogeneity.

To discern behavioural differences between different types of firms, interactive dummy variables for private firms, foreign invested enterprises (FIEs) and export-oriented firms with respect to female employees proportion are introduced to the profit function regressions (Zhang & Dong, 2008). Specifically, we divide observations into three groups according to different ownership categories such that:

- Division according to ownership: privately-owned enterprises and state-owned enterprises (SOEs). Enterprises with over 50 percent of private equity ownership are defined as private enterprises. Whereas, enterprises with less than 50 percent of private equity ownership are defined as SOEs. Variable of private ownership is measured by a dummy variable as:

$$priv_i \begin{cases} = 1 \text{ if the share equity of private ownership in } i \\ \text{is greater than 50 percent} \\ = 0 \text{ if otherwise} \end{cases}$$

- Division according to the presence of foreign investment: foreign-invested enterprises (FIEs) and domestic-owned enterprises. According to the different studies, the definition of foreign equity capital varies. For example, Blomström and Sjöholm (1999) readily accepted any positive amount of foreign ownership, while Haddad and Harrison (1993) considered firms with at least 5% equity owned by foreigners. In this study, all firms with 15 percent of foreign assets will be considered as FIEs in the model (Zhang & Dong, 2008). Variable of foreign ownership is defined as:

$$fie_i \begin{cases} = 1 \text{ if the share equity of foreign ownership} \\ \text{in firm } i \text{ is greater than 15 percent} \\ = 0 \text{ if otherwise} \end{cases}$$

- Division according to export-orientation: export-oriented enterprises (EOEs) and domestic-oriented enterprises (DOEs). Enterprises whose exports account for over 15 percent (inclusive) of sales revenue are defined as EOEs, while enterprises whose exports account for less than 15 percent of the sales revenue are defined as DOEs. Variable of export-orientation is defined as:

$$export_i \begin{cases} = 1 \text{ if more than 15 percent of firm } i \text{'s sales} \\ \text{was exported directly or indirectly} \\ = 0 \text{ if otherwise} \end{cases}$$

2.2 Controlling the unobserved productivity shocks by proxy variables

To control for demand or productivity shocks, we employ the approach used by Kawaguchi (2007) to introduce the proxy variables for these shocks, μ_i , into the profit equation. Specifically, we use two types of proxy variables including investment variable following Olley and Pakes (1996) and intermediate inputs variable following Levinsohn and Petrin (2003).

Olley and Pakes (1996) suggested that investment could be used as a proxy for unobserved productivity shocks in the production function because current positive productivity shocks will affect firm's future investment. Specifically, they expressed the investment function as $i_i = i(k_i, \mu_i)$ and $\frac{\partial i_i}{\partial \mu_i} > 0$ where i_i is amount of investment and k_i is amount of capital stock. The last term, μ_i , is demand or productivity shock which can be expressed as an inverse function of investment and capital $\mu_i = f(i_i, k_i)$. Following Kawaguchi (2007), we assume the productivity function:

$$\mu_i = \alpha_1 \frac{i_i}{k_i} + \alpha_2 \left(\frac{i_i}{k_i} - \frac{\bar{i}_i}{\bar{k}_i} \right)^2 \quad (7)$$

Equation (7) will be substituted into equation (6) in order to estimate the profit function controlling for productivity shocks.

One major drawback of the investment proxy is that micro-level data indicated that a large number of firms reported zero investment. Therefore, we have to drop those sample from analysis. To counter this criticism, Levinsohn and Petrin (2003) introduced intermediate inputs as a proxy variable for productivity shocks. Specifically, the demand function of intermediate inputs is expressed as $m_i = m(\mu_i, k_i)$ where m_i is intermediate inputs and k_i is a state variable that cannot be instantaneously adjusted. Put differently, for the intermediate inputs to be a valid proxy for productivity shock, m_i should be monotonic in μ_i for given any k_i . Following Kawaguchi (2007), we specify the productivity shock as a function of the intermediate inputs and capital stock, that is,

$$\mu_i = \gamma_1 \frac{m_i}{C_i} + \gamma_2 \left(\frac{m_i}{C_i} - \frac{\bar{m}_i}{\bar{C}_i} \right)^2 + \gamma_3 \left(\frac{m_i}{C_i} - \frac{\bar{m}_i}{\bar{C}_i} \right) \times \frac{k_i}{y_i} \quad (8)$$

where C_i is the total production cost and $\frac{k_i}{y_i}$ is the ratio of assets to total sales. Equation (8) will be substituted into equation (6) in order to estimate the profit function controlling for productivity shocks.

2.3 The model

Based on these aforementioned hypotheses in section 1.3.1 and 1.3.2, we modified (6) and proposed the following specification:

$$profit_i = \beta_1 + \beta_2 fp_i + \beta_3 firmage_i + \beta_4 lts_i + \beta_5 occ_{it} + \beta_6 IND_i + \beta_7 REG_i + \mu_i + u_i \quad (9)$$

where subscript i denotes the firm. $profit_i$ denotes firm's profit, fp the female employees proportion, $firmage$ the firm's age, lts the logarithm of total sales, occ the ratio of fixed assets to total sales, IND the industry dummies, REG the region dummies and u_i the idiosyncratic residual. The productivity shock, μ_i , will be estimated by two types of proxy variables: i) investment variables following Olley and Pakes (1996) and ii) intermediate inputs variables following Levinsohn and Petrin (2003).

2.4 Data

Our analysis is based on the World Bank Enterprise Survey (WBES) dataset collected in Vietnam for the years 2005, 2009 and 2015. The survey provided the most comprehensive firm-level data including firm-level characteristics, gendered employment, annual sales, workforce

composition, infrastructure, innovation and technology, business-government relationships and performance measures.⁶

As discussed in previous, the proxy for dependent variable, operating income ratio, was defined as (total sales – (labour cost + material cost + energy cost)) / total sales. Since some observations had very small amount of total sales and led to extreme values in operating income ratio, we excluded observations whose operating income ratio was below -100 percent (Kawaguchi, 2007; Liu et al., 2016).

Tables 1 and 2 present summary statistics and correlation matrix of the variables used in the estimation, respectively. As a rule of thumb, a Pearson pair-wise correlation coefficient exceeding 0.6 could be a sign of potential multicollinearity between the variable pair (Gujarati, 2003). It can be seen from Table 2 that multicollinearity is not a concern in our model.

Table 1: Summary statistics

Variable		Observations	Mean	S.D	Observations	Mean	S.D	Observations	Mean	S.D
			2005			2009			2015	
<i>pr</i>	<i>Profit ratio (%)</i>	1119	16.84	16.36	970	43.21	35.80	932	50.70	35.37
<i>fp</i>	<i>Proportion of female employees</i>	1114	0.42	0.26	764	0.45	0.29	652	0.40	0.28
<i>fsp</i>	<i>Proportion of skilled female employees</i>	1027	0.37	0.27	....	....	....	661	0.30	0.26
<i>fusp</i>	<i>Proportion of unskilled female employees</i>	963	0.41	0.30	....	....	....	661	0.09	0.16
<i>fpp</i>	<i>Proportion of production female employees</i>	....	....	....	761	0.34	0.29	590	0.31	0.27
<i>npfp</i>	<i>Proportion of non-production female employees</i>	....	....	....	761	0.12	0.11	643	0.11	0.09
<i>lts</i>	<i>Total sales (logarithm)</i>	1128	9.62	1.83	996	23.63	1.87	978	23.31	2.00
<i>occ</i>	<i>Fixed assets/total sales</i>	1127	0.95	5.78	677	0.98	6.42	506	1.28	4.21
<i>firmage</i>	<i>Firm age</i>	1127	12.18	12.92	1044	11.85	11.15	994	22.84	142.70
<i>mctc</i>	<i>Material cost/total cost</i>	1115	7.06	213.76	693	0.63	0.27	554	0.59	0.30
<i>ifa</i>	<i>Investment/fixed assets</i>	960	0.68	4.03	418	0.25	0.24	245	0.73	2.00
<i>fowner</i>	<i>Female owner</i>	530	0.21	0.41	1043	0.53	0.50	984	0.48	0.50
<i>ftop</i>	<i>Female top manager</i>	....	....	....	1045	0.21	0.41	988	0.22	0.42
<i>export</i>	<i>Export-oriented firm</i>	1122	0.41	0.49	1042	0.30	0.46	988	0.24	0.43
<i>fie</i>	<i>Foreign-invested firm</i>	1125	0.11	0.31	1043	0.13	0.34	993	0.08	0.27
<i>priv</i>	<i>Private firm</i>	1129	0.87	0.34	1043	0.97	0.18	993	0.98	0.12

Source: Compiled from the World Bank's Enterprise Survey (ES) data

⁶ Details of sample design and sampling procedures could be accessed at Enterprise Survey website: <https://www.enterprisesurveys.org/en/data>.

Table 2: Correlation matrix

2005	<i>pr</i>	<i>fp</i>	<i>lts</i>	<i>occ</i>	<i>firmage</i>	<i>mctc</i>	<i>ifa</i>
<i>pr</i>	1.00						
<i>fp</i>	0.04	1.00					
<i>ts</i>	0.10	0.05	1.00				
<i>occ</i>	0.01	0.01	-0.14	1.00			
<i>firmage</i>	0.03	0.02	0.28	0.00	1.00		
<i>mctc</i>	0.05	0.01	0.10	0.00	-0.02	1.00	
<i>ifa</i>	-0.05	0.00	0.02	-0.01	0.02	0.01	1.00
2009	<i>pr</i>	<i>fp</i>	<i>lts</i>	<i>occ</i>	<i>firmage</i>	<i>mctc</i>	<i>ifa</i>
<i>pr</i>	1.00						
<i>fp</i>	-0.04	1.00					
<i>lts</i>	0.05	0.01	1.00				
<i>occ</i>	-0.07	0.04	-0.17	1.00			
<i>firmage</i>	-0.08	-0.07	0.30	-0.02	1.00		
<i>mctc</i>	-0.26	-0.21	0.34	-0.18	0.05	1.00	
<i>ifa</i>	0.06	0.01	0.07	-0.03	-0.02	0.03	1.00
2015	<i>pr</i>	<i>fp</i>	<i>lts</i>	<i>occ</i>	<i>firmage</i>	<i>mctc</i>	<i>ifa</i>
<i>pr</i>	1.00						
<i>fp</i>	-0.06	1.00					
<i>lts</i>	0.17	0.03	1.00				
<i>occ</i>	-0.06	-0.04	-0.07	1.00			
<i>firmage</i>	0.00	0.02	0.07	0.00	1.00		
<i>mctc</i>	-0.16	-0.09	0.39	-0.07	0.07	1.00	
<i>ifa</i>	0.02	-0.03	0.01	-0.01	-0.03	0.04	1.00

Source: Authors' estimation

3. Empirical results

3.1 Baseline results

We first take a look at the impact of total female employees proportion on the firm's profit ratio. Table 3 shows the estimated OLS results of equation (9), where the results of the year 2005 are reported in columns (1)-(3), the results of the year 2009 are reported in columns (4)-(6), and the results of the year 2015 are reported in columns (7)-(9). In order to save space, we have not listed the estimation results of industry dummies and region dummies. However, it is worth noting that the inclusion of these dummies increased the fit of the estimated model, since dummies are significant at conventional levels. Therefore, we continue to employ these dummies in the next section, as well as in the robustness check section.

Column (1), (4) and (7) reports the basic estimation results, columns (2), (5) and (8) apply the proxy variables for demand or productivity shocks using Levinsohn and Petrin's (2003) method, and columns (3), (6) and (9) use Olley and Pakes's (1996) method, respectively. Some observations are dropped in each columns because of the missing values. As can be seen from Table 3, the investment/fixed asset ratio, *IFA*, does not enter the model significantly. This is a sign suggesting that the investment does not effectively capture demand or productivity shocks in our model. In contrast, results of Levinsohn and Petrin's (2003) method show that the coefficients of proxy variable are significant at 5% level and 1% level. These suggests that intermediate inputs does effectively capture demand or productivity shocks. In addition, the adjusted R-square statistics show that the Levinsohn and Petrin's (2003) method can explain the variation of firm's profit better than the other methods. Therefore, in the next estimations, we use the Levinsohn and Petrin's (2003) proxy variables for demand or productivity shocks when estimating equation (9) with firms' characteristics. Generally, the adjusted R-square statistics in columns (2), (5) and (8) mean that our model can explain from 17% to 24% of the variation in firm's profit ratio. In addition, the F-statistics show that we can reject the null hypothesis and conclude that estimated coefficients are jointly significantly different from zero.

Table 3: OLS estimation results for 2005, 2009 and 2015

	2005			2009			2015		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>fp</i>	-2.427 (2.511)	-5.232** (2.614)	-0.821 (2.754)	-3.369 (5.180)	-4.390 (4.661)	-11.74** (5.969)	-3.714 (6.869)	0.718 (6.100)	6.745 (9.768)
<i>lts</i>	1.328*** (0.406)	2.231*** (0.490)	0.671* (0.393)	1.793*** (0.599)	3.526*** (0.668)	1.520** (0.734)	2.416*** (0.742)	4.157*** (0.854)	3.280*** (1.214)
<i>occ</i>	0.086** (0.034)	2.391 (2.582)	0.0649* (0.039)	-0.196** (0.0804)	-2.489*** (0.803)	-1.735** (0.742)	-0.00000845*** (0.00000208)	0.0257 (0.0342)	0.0154*** (0.00592)
<i>firmage</i>	-0.014 (0.036)	-0.050 (0.036)	0.0098 (0.036)	-0.151 (0.103)	-0.214** (0.088)	-0.133 (0.104)	-0.00460 (0.00959)	0.000641 (0.00958)	0.0724 (0.204)
<i>mctc</i>		-25.89*** (9.075)			-48.88*** (5.897)			-29.06*** (5.704)	
$(mctc - \text{mean}(mctc))^2$		0.0036*** (0.0013)			-35.08** (14.11)			12.30 (18.59)	
$(mctc - \text{mean}(mctc)) * occ$		0.361 (0.407)			2.904 (2.442)			0.0573 (0.0760)	
<i>ifa</i>			-0.664* (0.398)			4.39e-10 (3.06e-10)			1.83e-09 (6.58e-09)
<i>ifa2</i>			6.616 (5.611)			-7.38e-19 (5.50e-19)			-7.71e-17 (3.25e-16)
Constant	5.563 (4.034)	17.21*** (4.875)	11.51*** (4.073)	-11.73 (13.66)	-17.00 (13.68)	-0.723 (17.31)	-23.62 (18.57)	-51.76*** (18.91)	-55.46* (29.91)
Region dummies	yes	yes	yes	yes	yes	yes	yes	yes	Yes
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	1099	1094	934	664	643	482	497	463	241
R ²	0.067	0.256	0.058	0.063	0.196	0.085	0.094	0.188	0.172
adj. R ²	0.046	0.237	0.031	0.034	0.166	0.043	0.042	0.131	0.063
F test's p value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Standard errors are in parentheses; *, ** and *** denote 10%, 5% and 1% levels of significance, respectively; standard errors adjusted for arbitrary heteroskedasticity; and for brevity, the coefficients of provincial dummies and industrial dummies are not reported here

Source: Authors' estimation.

We first consider the results of the year 2005. The coefficients on female proportion on columns (1) and (3) of Table 3 are insignificant at all level of confidence, suggesting that the proportion of female employees (*fp*) has no effect on firm's profit. However, such a conclusion may be premature because in column (1) and (3) the demand or productivity shocks are not effectively captured. As shown in column (2), the coefficient on *fp* is negative and significant at 5% level, indicating that instead of discrimination, there were nepotism toward female employees within Vietnamese firms in 2005. Particularly, the magnitude of this coefficient implies that a firm's profit will decrease 0.052 % when female employees proportion increase 1%, *ceteris paribus*. In addition, coefficient of the logarithm of total sales, *ts*, is positive and significant at 1% level in column (2), suggesting that larger firms tend to be more efficient than smaller firms in Vietnam. To put this 30

finding into perspective, we estimated that a 1% increase in total sales is likely to raise firm's profit by roughly 0.022%, all things constant. In contrast, the coefficients for firm age and the ratio of fixed assets to total sales only significant in a few columns and their magnitudes are too small to be considered meaningful. Columns (4) and (7) report the basic estimation results for 2009 and 2015, respectively. The insignificant coefficients of *fp* variable suggest that there is neither discrimination nor nepotism against female employees within Vietnamese labour market in these years. Columns (5), (6), (8) and (9) report the estimation results after the productivity shocks are controlled by Levinsohn and Petrin's (2003) method and Olley and Pakes's (1996) method. The coefficients of the proxy variables are significant, however, the coefficients of *fp* are insignificant at conventional level. These findings confirm the basic estimation results in (4) and (7).

3.2 Skilled and unskilled decomposition

The results thus far treated skilled and unskilled workers equivalently. In order to verify whether the results are reliable, we decompose female employees proportion into skilled-female employees proportion, *sfp*, and unskilled-female employees proportion, *fusp*, and re-estimate equation (9). Since the dataset for 2009 does not have information of skilled and unskilled female employees, we have to use proportion of female production workers, *fpp*, and proportion of female non-production workers, *npfp*, in estimating equation (9). Moreover, due to availability of 2015 dataset, we estimate one equation with *sfp* and *fusp*, and one equation with *fpp* and *npfp* for comparison purposes. The estimation results of the specification that includes intermediates inputs for demand or productivity shocks are presented in Table 4. The coefficients of these proxy variables are significant and almost similar to the coefficients reported in Table 3. Therefore, these proxy variables presumably capture the demand or productivity shocks to the firms and we can confirm the robustness of the OLS estimates.

Table 4: Skilled- and unskilled-female workers proportion, OLS estimates

	2005	2009	2015	
	(1)	(2)	(3)	(4)
<i>fsp</i>	-8.130*** (2.411)		-2.544 (6.846)	
<i>fusp</i>	-0.600 (1.638)		16.76 (17.22)	
<i>fpp</i>		-6.827 (4.799)		0.427 (6.695)
<i>npfp</i>		11.75 (8.028)		-2.250 (9.397)
<i>lts</i>	1.869*** (0.503)	3.729*** (0.691)	3.727*** (0.917)	4.314*** (0.847)
<i>occ</i>	17.74 (13.15)	-2.414*** (0.780)	0.0695*** (0.0132)	0.0263 (0.0341)
<i>firmage</i>	-0.0269 (0.0364)	-0.200** (0.0885)	0.00251 (0.0110)	0.000544 (0.00957)
<i>mctc</i>	-27.48*** (9.421)	-50.50*** (6.050)	-30.06*** (6.242)	-29.56*** (5.836)
<i>(mctc-mean(mctc))²</i>	0.00386*** (0.00132)	-36.09** (14.26)	13.54 (19.60)	12.81 (18.45)
<i>(mctc-mean(mctc))*occ</i>	2.852 (2.121)	3.106 (2.430)	0.154*** (0.0294)	0.0586 (0.0759)
Constant	23.41*** (5.343)	-21.88 (14.08)	-40.04* (20.58)	-54.98*** (18.70)
Region dummies	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes
N	946	640	413	469
R ²	0.260	0.205	0.195	0.189
adj. R ²	0.237	0.174	0.129	0.131
F test's p_value	0.000	0.000	0.000	0.000

Notes: Standard errors are in parentheses; *, ** and *** denote 10%, 5% and 1% levels of significance, respectively; standard errors adjusted for arbitrary heteroskedasticity; and for brevity, the coefficients of provincial dummies and industrial dummies are not reported here

Source: Authors' estimation.

Columns (1) of Table 4 report the estimation results for 2005, column (2) for 2009, and columns (3)-(4) for 2015, respectively. The results show that, with the exception of the coefficient for the skilled-female employees proportion in column (1), coefficients for skilled-female proportion, unskilled-female proportion, production female proportion and non-production female proportion are insignificant at all conventional level across all columns of Table 4. This results are in line with previous findings in Table 3 and suggest that employers only promote and subsidise for skilled-female employees in their firms in 2005. It could be concluded that decomposition of female employees proportion does not alter the results of this study.

3.3 Proportion of female employees and firms' characteristics

We turn to examine how firms' characteristics impact gender discrimination in the sample. As mentioned in above, we include dummy variables and their interaction term with proportion of female employees (fp) into equation (9), including $fp*fm$, $fp*fown$, $fp*private$, $fp*fie$, and $fp*export$. In constructing these interaction terms we demeaned fp , before multiplying it by each of fm , $fown$, $private$, fie and $export$. Some studies include only the interaction term and omit the original variables used to construct the interaction term from the model to avoid multicollinearity. However, Aiken et al. (1991) and Jaccard and Turrisi (2003) argue that including the original variables, as well as the interaction term, enables one to disentangle the main effects from the interaction effect. Adhering to their advice, we included both the interaction term and the original variables used to construct it, to ensure that the interaction term does not capture either the female employees proportion or types of firms. ⁷ Table 5 shows the estimated OLS results of equation (9), where the results of the year 2005 are reported in columns (1) and (2), the results of the year 2009 are reported in columns (3)-(5), and the results of the year 2015 are reported in columns (6) and (7).

As can be seen from Table 5, in 2005, the estimate shows that export-oriented firms earned higher profit than domestic-oriented enterprises. The parameter of interest is on the interaction term $fp*export$. The coefficient on the interaction term is negative and significant at 1% level, suggesting that export-oriented firms, compared with domestic-oriented firms, preferred female employees to male employees. In column (2) of Table 5, coefficients of $private$ dummy variable and its interaction term with fp are insignificant. In addition, there is no evidence of female employment differential between FIEs and their domestic counterparts since coefficient of interaction term, $fp*fie$, is also insignificant. These suggest that differences in ownership did not have effect on the relationship between firm's profit ratio and proportion of female employees in 2005. Nevertheless, coefficient of fie is positive and significant at 10% level. The result indicates that profit ratio is higher in FIEs compared to firms without foreign investors' involvement.

In 2009, as can be seen from columns (3) and (4), coefficients of $fowner$ and $ftop$ dummies indicate that women-owned firms earn less than their male counterparts. The coefficient of interaction term, $ftop*fp$, in column (4) is positive and significant at 10% level indicates that there is discrimination against women in firms with female top manager. For export-oriented firms, in line with results for the year 2005, the coefficient of $export*fp$ suggests that these firms prefer to hire female over male.

Results for 2015 in columns (6) and (7) are in line with estimates for 2009. Specifically, female top manager or female participation in the ownership tend to have negative effect on firm's profit. The coefficients of interaction terms are positive and significant, thus confirm the previous findings that discrimination against female employees continue to exist within those firms. As can be seen from Table 5, the results for remaining variables largely unchanged, with the magnitudes of the coefficients on total sales (ts), fixed assets (occ) and firm age ($firmage$) being affected moderately. Notably, coefficients of the proxy variables for productivity shocks are statistically significant at conventional levels across all columns in Table 5. The adjusted R-square results are similar to the baseline model (Table 3), confirming the goodness-of-fit of our models. Taken together, Ta-

⁷ In order to save space, we only report results with significant coefficients.

ble 5 shows that firms' characteristics have significant effect on male-female discrimination in Vietnam for the years of analysis.

Table 5: Firm's characteristics and proportion of female employees, OLS estimates

	2005		2009			2015	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>fp</i>	-0.0923 (2.758)	-7.132 (5.506)	-8.932 (5.670)	-7.660 (4.993)	1.392 (5.473)	-6.234 (7.892)	-4.261 (6.680)
<i>fowner</i>			-6.014* (3.543)			-8.433* (4.543)	
<i>Fowner*fp</i>			8.779 (6.610)			15.85* (9.596)	
<i>ftop</i>				-4.226 (4.803)			-12.75* (6.762)
<i>ftop*fp</i>				14.10* (8.021)			21.32* (11.28)
<i>export</i>	3.975** (1.920)				6.495 (4.294)		
<i>export*fp</i>	-10.89*** (3.761)				-15.13* (7.718)		
<i>fie*fp</i>		-8.447 (6.627)					
<i>Fie</i>		6.947* (3.931)					
<i>priv*fp</i>		2.745 (5.221)					
<i>priv</i>		-0.155 (2.306)					
<i>its</i>	2.241*** (0.502)	2.125*** (0.545)	3.560*** (0.675)	3.696*** (0.685)	3.721*** (0.716)	4.295*** (0.834)	4.133*** (0.844)
<i>occ</i>	2.365 (2.545)	2.039 (2.598)	-2.536*** (0.808)	-2.376*** (0.794)	-2.405*** (0.778)	0.0315 (0.0334)	0.0349 (0.0303)
<i>firmage</i>	-0.0517 (0.0377)	-0.0284 (0.0391)	-0.202** (0.0896)	-0.213** (0.0884)	-0.212** (0.0876)	0.00149 (0.0102)	-0.000167 (0.00894)
<i>mctc</i>	-25.68*** (9.119)	-25.40*** (9.099)	-48.75*** (5.899)	-49.31*** (5.916)	-49.33*** (6.029)	-28.88*** (5.663)	-29.27*** (5.684)
$(mctc - \text{mean}(mctc))^2$	0.00360*** (0.00128)	0.00356*** (0.00128)	-35.78** (14.09)	-36.71*** (14.12)	-31.74** (14.35)	12.90 (18.37)	12.63 (18.33)
$(mctc - \text{mean}(mctc)) * \text{occ}$	0.358 (0.401)	0.308 (0.410)	2.750 (2.424)	2.727 (2.403)	2.906 (2.386)	0.0700 (0.0743)	0.0777 (0.0673)
<i>constant</i>	15.56*** (4.808)	17.36*** (5.364)	-14.65 (13.83)	-19.35 (13.98)	-23.62 (14.88)	-51.08*** (18.49)	-48.52*** (18.73)
<i>Region dummies</i>	yes	yes	yes	yes	yes	yes	yes
<i>Industry dummies</i>	yes	yes	yes	yes	yes	yes	yes
<i>N</i>	1087	1088	642	642	641	461	462
<i>R²</i>	0.260	0.260	0.200	0.202	0.201	0.195	0.199
<i>adj. R²</i>	0.240	0.238	0.168	0.170	0.169	0.134	0.139
<i>F test's p_value</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Standard errors are in parentheses; *, ** and *** denote 10%, 5% and 1% levels of significance, respectively; standard errors adjusted for arbitrary heteroskedasticity; and for brevity, the coefficients of provincial dummies and industrial dummies are not reported here.

Source: Authors' estimation

CONCLUSION

Based on the employer discrimination hypothesis proposed by Becker (1971), this paper investigate whether nepotism or discrimination for female employees exists in Vietnam over ten years, from 2005 to 2015. To provide a theoretical foundation of the empirical analysis, we extended the works of Becker (1971), Arrow (1973) and Goldberg (1982) to derive an equation that identifies the firm's profit ratio at a function of the proportion of female employees and other control variables. The most important finding to surface in this research is controlling for unobservable demand or productivity shocks by using the proxy variables proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003). It is necessary to point out that Levinsohn and Petrin's proxy variables effectively capture the demand and productivity shocks in our study and are robust to alternative model specifications. Therefore, we would recommend future studies on gender discrimination in Vietnam have to control for this effect in order to get consistent OLS estimates.

Our results suggest that proportion of skilled-female employees has negative effect on firms' profit in 2005. However, we could not find any evidence of nepotism/discrimination towards unskilled-female employees in this year. Results for 2009 and 2015 also indicate that proportion of female employees does not have any impact on firm's profit. Moreover, the results show that firm's characteristics, such as female ownership, female top manager, export-oriented, private and foreign-invested firms have significant impact on gender discrimination within our sample data.

Nevertheless, our results should be interpreted with caution because of the lacking time dimension in our data set. Becker (1971) noted that, in the long term, discriminatory firm will be pushed out of the market by non-discriminatory one because the former suffers a non-pecuniary loss. On the contrary, the nepotistic firm enjoys a non-pecuniary gain and may survive in the long run (Goldberg, 1982). Therefore, a long term firm-level panel data are preferred in our future study to assess those hypotheses.

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