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Decomposing Vietnamese gender equality in terms of wage distribution

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Abstract

We decompose the gender wage gap in terms of wage distribution in Vietnam during 2002–2014 using two methods. The first method uses two estimated counterfactual distributions; the second uses an estimated recentred influence function. We focus on the formal sector and find evidence for a consistent gender wage gap, with the price of skills being the main contributor. In contrast, labour market discrimination does not have a crucial influence. Some gender equality gained by the distribution of skills can be explained by the rise in women's education and women's participation in specific industries, occupations and the growing private sector.

1 | INTRODUCTION

Economic growth has generally led to better employment opportunities for Vietnamese women. During 2002–2014, Vietnam experienced average annual GDP growth in excess of 5%. At the same time, as shown in Figure 1, a sharp increase occurred in the number of employees of private firms. Such firms replaced the collapsed state-owned enterprises which were once the most important employers in the economy. These changes, together with the US–Vietnam Bilateral Trade Agreement (BTA) in December 2001 and Vietnam's accession to the World Trade Organization (WTO) in 2007, have led to fierce competition among firms for labour and, consequently, an increased number of formal job offers. Vietnam's low overall fertility rate (currently less than 1.95 children per female) and improved levels of education have also provided the time and opportunity for Vietnamese women to participate in the labour force and accept these new job offers. This is evidenced by a female labour participation rate of 73% in 2014 compared with 82% for men (UNDP, 2015). Moreover, the ratio of women to men per type of job in some categories has increased, as shown in Figure 2.

However, it is not known whether labour market discrimination against women has declined or become more severe in terms of wage distribution during this period of strong growth and improved employment opportunities. In an increasingly competitive business market, firms must minimize costs or fail. However, according to Becker (1971), any discrimination against gender raises firms' costs. Thus, gender

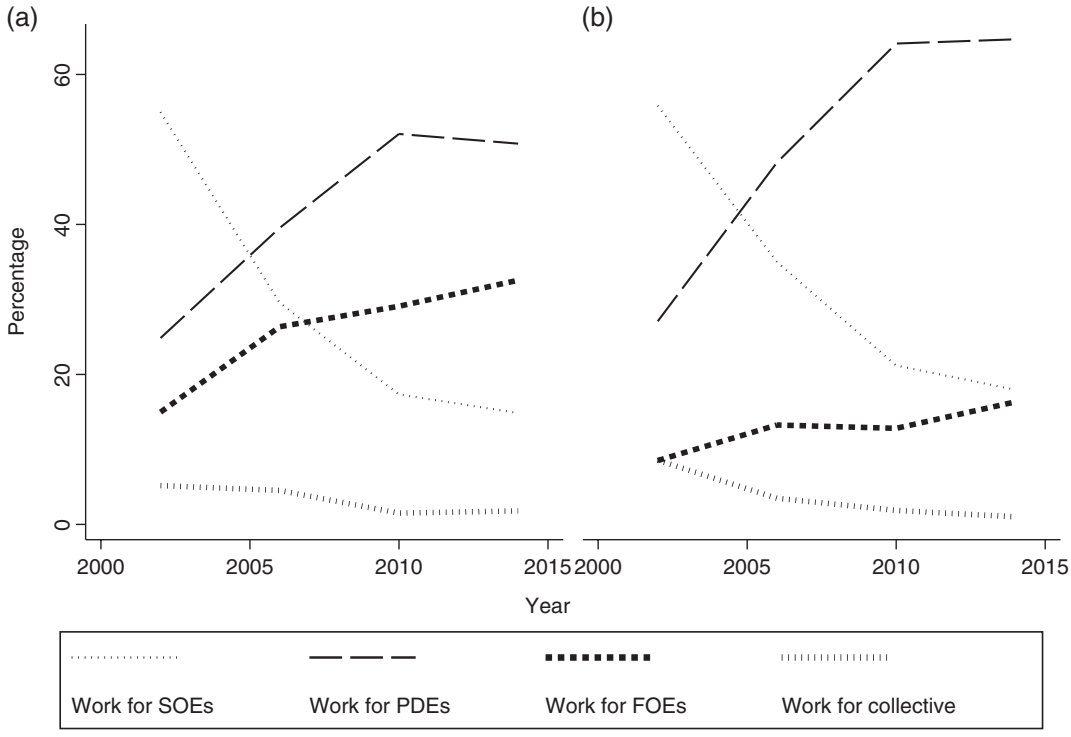

FIGURE 1 Percentage of employees by economic sector, gender and year: (a) female and (b) male
Source. Authors' calculations from the Vietnamese Household Living Standard Survey 2002, 2006, 2010 and 2014.
Notes. FOEs, foreign-owned (affiliated) enterprises; PDEs, private domestic (non-foreign) enterprises; SOEs, state-owned enterprises

discrimination should decline or even disappear in correspondence with the level of competitiveness, as Becker (1971) predicts. In addition, structural change (reallocating labour from agriculture, aquaculture and forestry to other industries), free trade (with greater job opportunities and increased competitiveness among firms) and professional specialization induce differences by gender in decisions to invest in human capital. Thus, gender wage equality may vary in terms of wage distribution. Indeed, evidence exists that general wage equality has both improved and worsened at various points during 2002–2014 (ILO, 2015).

In terms of empirical evidence, Sakellariou and Fang (2014) observe a decrease in overall private sector wage inequality in Vietnamese households owing to the increase in the minimum wage between 1998 and 2008. Unfortunately, it is not known whether the gender wage gap in Vietnam persisted. The preference for a son (Vu, 2014) and the dominance of Confucianism in the country could also be impediments to decreasing the gender wage gap and may perhaps even increase it. Other forms of derived discrimination are the so-called sticky floors and glass ceilings. These kinds of gender discrimination tend to remain severe in either the right or left tails of income distribution; thus, women are hindered in gaining access to better (and higher-paid) positions and are kept in low-paid positions. Consequently, detecting and tracking sticky floors and glass ceilings helps to provide valuable insights into labour market policies.

In such a context, this study's purpose is to decompose the gender wage gap in terms of wage distribution in Vietnam during 2002–2014, to identify the important factors which contribute to the gap, to examine how structural changes influence gender wage gap distribution, and to investigate the presence of labour market gender discrimination and any glass ceiling/sticky floor. We apply methods developed by Chernozhukov, Fernandez-Val, and Melly (2013) and Firpo, Fortin, and Lemieux (2009) to decompose the distribution of the gap into three components; namely,

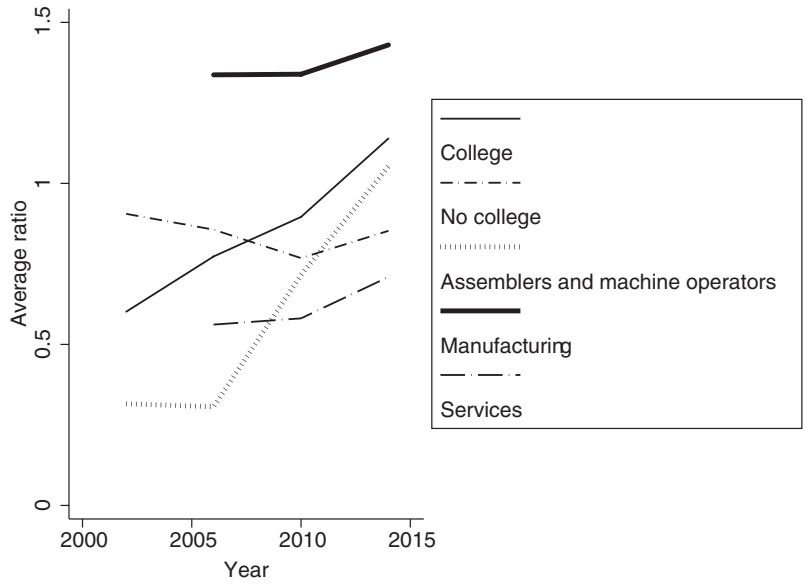

FIGURE 2 Average ratio of employed females to employed males by education, job and industry
Source. Authors' calculation from the Vietnamese Household Living Standard Survey 2002, 2006, 2010 and 2014

coefficients, characteristics/endowments and residuals/interactions. We then compare the distribution of each component across four Vietnamese household surveys, which occurred every 4 years between 2002 and 2014. We select individuals who are aged from 15 to 55 years, have only one job, are not students, are not self-employed, do not work for other households, and are not government officers. We further decompose each of the three components by a series of covariates: educational level, age, marital status, location (urban and region), employment status, occupation and industry.

Our analysis provides updated insights into the gender wage gap in Vietnam in terms of wage distribution during 2002–2014. We find that the total gender wage gap ("total gap" hereafter) persists and that the price of skills is the main contributor. In addition, basic human capital variables (*age* and *education*) are still the most important factors which are associated with differences in the price of skills. Furthermore, we find that labour market discrimination plays a minor role in terms of sticky floors and glass ceilings. Any gain in equality through the distribution of skills can be explained by a rise in employed women's education; the increase in opportunities to obtain jobs in foreign (private domestic) firms, manufacturing and processing industries, the wholesale and retail sectors, and the motor repair industry; and work as assemblers and machine operators. We also propose several explanations for the findings based on structural changes and free trade.

The rest of this paper is organized as follows. Section 2 reviews the related literature on the gender wage gap, discrimination and studies specifically concerning Vietnam. Section 3 describes the data, and Section 4 explains the methodology. Section 5 discusses the results, while Section 6 provides a conclusion.

2 | RELATED LITERATURE

2.1 | The gender wage gap and important theories on discrimination

Blau and Kahn (2017) consolidate from prior studies typical market-side factors which influence the gender wage gap. These factors are: labour force participation; self-selection; education; work

experience and work hours; formal training; the gender division of labour and the motherhood penalty; and differences in occupations, industries and firms. More specifically, women and men face different choices in the labour market and prepare differently for it. Before starting work, women and men have already made different choices about educational attainments. When they start work, they may also self-select (by gender) specific occupations (industries) and/or working hours (such as full-time and part-time jobs). Furthermore, during their careers, the two genders may face different decisions about human capital accumulation. For example, childbearing and childrearing may influence the time that women spend working; thus, they are unable to devote all their efforts to upgrading their skills and occupations. Changes in these factors also suggest corresponding variations in the gender wage difference. Factors and policies unrelated to the labour market, such as social norms, gender psychological characteristics and non-cognitive skills, may influence the gender wage gap (see Blau & Kahn (2017) for a comprehensive literature review).

Both the supply and demand sides decide the equilibrium price of labour. Thus, both genders may also confront different degrees of bargaining power and job matching in the labour market. Apart from any difference in terms of gender income elasticity, the discrimination and power of employers on the demand side are also crucial.

There are two important theoretical works on (gender) discrimination. First, from an economics perspective, Becker (1971) proposes a theoretical explanation, in 1957, for the gender wage gap in terms of discrimination by employers, co-workers and customers. For example, discriminatory employers only hire women at lower wages; discriminatory male workers ask for higher wages; and discriminatory customers do not want to buy goods and services produced by women. Becker (1971) also argues that competitiveness reduces gender discrimination in the long run because firms with gender discrimination bear higher production costs and will go bankrupt. Second, Phelps (1972) proposes models of statistical discrimination which assume uncertainty and imperfect information with regard to enduring discrimination. The models suggest that in the context of discrimination, firms rely on statistical information. For example, women statistically spend more time than men on childbearing and rearing; thus, they spend less time focusing on human capital building (on-the-job training). Firms may base their employment strategies on this fact and tend to exclude women from job training and promotion.

Various methods are available to decompose the gender wage gap; however, they all aim to identify differences in terms of (un)observable skills and the distribution of these skills. Fortin, Lemieux, and Firpo (2011) classify the major decomposition methods into: (a) mean decomposition, such as that employed by Oaxaca (1973) and Blinder (1973), and (b) beyond the mean, using variance decomposition. The latter includes: residual imputation, as employed by Juhn, Murphy, and Pierce (1993); quantile regression, as used by Machado and Mata (2005); inverse propensity reweighting, as described by DiNardo, Fortin, and Lemieux (1996); and the estimation of conditional distribution and recentred influence function (RIF) regression (Firpo et al., 2009). Each method has advantages and disadvantages. Most of the mean decomposition methods enable detailed decomposition; however, detailed decomposition is more limited in the approaches classified under (b) (with the exception of RIF regression). Nonetheless, the (b) group of methods facilitate the analysis of changes in wage distribution rather than just the mean. This analysis is crucial to gain insights when structural changes are present. Furthermore, the results obtained from decomposing the gender wage gap strongly depend on the country, when the survey was undertaken and the selected sample. Thus, Katz and Autor (1999) recommend that researchers should cautiously examine the robustness of their results in relation to their selection of data sources, samples and method.

2.2 | Prior empirical evidence

Generally, the level of development in all countries influences the degree of complexity of the gender wage gap in terms of wage distribution. Examining 26 European countries using 2007 data, Christofides, Polycarpou, and Vrachimis (2013) show that the size of the gender wage gap differs significantly across countries and that wage discrimination can appear in either the right or left tails of wage distribution. However, Schober and Winter-Ebmer (2011) find no causal effect of gender wage equality on economic growth in their meta-regression of 54 countries during 1975–1994. The type of discrimination can also be more complicated than simply paid observable skills. Albrecht, Björklund, and Vroman (2003) identify a glass ceiling in Sweden in 1998 in residuals (unknown factors), instead of in the differences in characteristics, sector, industry and occupation. Similarly, Fang and Sakellariou (2015) reveal the formation of glass ceilings in six Latin American countries, whereas sticky floors and mixed results are common in six Asian countries.

Comparing the 1980s and 1990s, Autor, Katz, and Kearney (2006) suggest that rapid employment growth in either of the two tails of skills distribution in the USA could be the source of the "polarization" of the wage structure. Using the method of Chernozhukov et al. (2013), Blau and Kahn (2017) find that the gender wage gap in the USA fell significantly during 1980–2010. They also suggest that traditional human capital factors reduce the gender wage gap's importance, while differences in occupation and industry remain crucial. These results motivated us to investigate a similar issue in a developing country which is experiencing structural changes.

Interestingly, Black and Brainerd (2004) compare the gender wage gap between 1976 and 1993 in US concentrated and unconcentrated manufacturing industries. The authors suggest that international trade benefits women because firms find it difficult to discriminate in such a context. Black and Brainerd (2004) also imply that international trade may increase inequality because of a relative reduction in the wages of less-skilled workers; however, equality in developing countries with labour-intensive factories is not straightforward and should be investigated.

The nature of the gender wage gap differs among transition economies. Investigating Russia during the early years of transition (1994–1996), Ogloblin (1999) finds that most of the gender wage gap is due to different distributions by gender in industries and occupations. Taking into account the selection issue,[1] Chi and Li (2014) use China's urban household data and estimate that the gender wage gap rose by 12–14% between 2005 and 2009. In contrast, Brainerd (2000) finds an increase in women's relative wage in six formerly socialist Eastern European countries because they faced less labour market discrimination than before. Pastore and Verashchagina (2011) show a mixed story in Belarus during 1996–2006: the observable price of skills increased the gender wage gap in Belarus, while the difference in skills distribution decreased the gap until 2001. These different findings encouraged us to investigate the gender wage gap in Vietnam from 2000 to 2014, when there were two distinctive features compared with other transition economies: (a) a significant increase in the number of firms and (b) structural changes combined with free trade.

Prior studies on wage equality in Vietnam suggest some gaps in the research. Using the method suggested by Juhn et al. (1993), Liu (2004) analyses two Vietnamese household data sets for 1992–1993 and 1997–1998, and identifies that a large positive gap effect overcomes observed skill and price effects. The author then suggests that Confucianism exerts an influence on the gender wage gap in Vietnam. Using quantile regressions, Pham and Reilly (2007) find that the average gender

[1]The gender wage gap in the employment rate has been increasing in China since the 1980s (Chi & Li, 2014).

wage gap in Vietnam decreases during 1993–2002. They also suggest that there is no "glass ceiling" in at least two of the surveyed years. However, by the mid- to late-2000s, the private sector began to dominate Vietnamese employment. Then, as aforementioned, the labour market became more competitive, with a larger proportion of female workers in paid employment. Thus, whether and to what extent the gender wage gap identified in Pham and Reilly (2007) in the early 2000s still exists remains to be investigated.

Using 1998 and 2008 household surveys, Sakellariou and Fang (2014) reveal evidence of greater equality in gender wage distribution in the Vietnamese private sector. This finding motivated us to investigate whether the spillover effect which Sakellariou and Fang (2014) identify in the private sector applies between 2002 and 2014, especially when the ownership of firms is specified. We also note that 2008 may be a year with unstable economic indicators because according to the International Financial Statistics (IFS) data provided by the International Monetary Fund (IMF), Vietnam experienced high consumer price inflation in April and May (21–25%) and August and September (28%). Unfortunately, this inflation occurred when the General Statistics Office (GSO) of Vietnam conducted its household survey; thus, the gathered wage figures may capture noise associated with the short-lived inflationary crisis. Finally, Fukase (2014) evaluates the wage premium for workers in foreign firms in Vietnam. The results indicate that the foreign sector absorbed more women and paid a larger wage premium for less-educated women during 2002–2004. However, uncertainty remains about any spillover effect from the private sector, which dominates the country's economy, and whether this has persisted over time.

3 | DATA

We use Vietnamese household living standard surveys for our analysis. The GSO conducted surveys at 2-year intervals using a two-stage stratified sampling method for country-representative samples. The design of the surveys follows the Living Standards Measurement Study by the World Bank. We employ studies undertaken at 4-year intervals for our analysis, thereby including the surveys conducted in 2002 (29 532 households), 2006 (9189 households), 2010 (46 995 households) and 2014 (9399 households). The surveys contain information on wages, age and gender, work hours per day, work days per month, work months per year, and occupational type and industry for all those who earned some income in the 12-month period prior to the surveys.

We attempt to focus on formal employment and select only those individuals closest to the definition of the International Labour Organization (ILO) for employment (ILO, 2013). Accordingly, we select individuals aged from 15 to 55 years who are not students, not self-employed, not working for other households, and not government officers; moreover, they have only one job at a time.[2] We trim the data by 0.1% at both ends of the income distribution.[3]

The wage per hour (in logarithms) is calculated using the total income from paid employment, including salary, related cash and goods in kind (comprising holiday bonuses, bonuses and subsidies), and the total working hours for the last 12 months prior to the surveys. Total working hours are

[2]The retirement age in Vietnam is 55 years for women and 60 years for men. One outcome is that women are more likely to work part-time or in the informal labor sector after retirement. Furthermore, those with two jobs or more at the same time are more likely to be employed part-time or in agriculture. Thus, our sample selection criteria are stricter than those of Pham and Reilly (2007); moreover, our approach increases the chances of finding individuals of opposite genders but with similar individual characteristics and employment.

[3]Approximately 75% (90%) of all individuals work more than 2112 (1414) hours per year or 40.6 (27.2) hours per week over 52 working weeks.

derived from the average working hours per day, average working days per month and average working months per year in a 12-month period. We convert the calculated log wage to 2010 base prices.

We note four important facts from the data's descriptive statistics (see Appendix A). First, while men are more likely than women to have university degrees in 2002, the proportion of men with degrees is lower than that of women in 2014. The proportion of women with college degrees also increases from 2 to 7% in the same period. Similarly, by 2014, the proportions of women who are manual (industrial) workers and unskilled workers have fallen. Second, foreign-owned firms absorb an increasing proportion of women, while privately-owned firms employ more women after 2002 and employ more men and women than other sectors after 2006. Third, after 2002, the proportions of men and women in agriculture, aquaculture and forestry compared with other employment sectors decline. At the same time, more men and women have jobs in other industries, which are mainly manufacturing and processing, and wholesale, retail, and motor repairs. Fourth, the proportion of women employed as assemblers and machine operators increases from 5 to 19% between 2006 and 2010.

4 | ECONOMETRIC METHOD AND SPECIFICATIONS

We apply two methods. The first is suggested by Chernozhukov et al. (2013) (known as the CFM method hereafter).[4] The second is the RIF of the unconditional quantile on the explanatory variables, based on Firpo, Fortin, and Lemieux (2009) (known as the FFL method hereafter).

The CFM method relies on two estimated counterfactual distributions. The first counterfactual distribution is estimated from the characteristic distribution (the distribution of skills) for the group of men, the median (mean) coefficients (the price of skills) for the group of men, and the residual distribution for the group of women. The second counterfactual distribution is estimated from the characteristic distribution for the group of men and the conditional distribution of the skills of women.[5] The two estimated distributions are then used to decompose the total difference into three components: coefficients, characteristics, and residuals (as suggested by Juhn et al., 1993).

More specifically, the method follows a procedure introduced by Melly (2005). Melly's (2005) suggestion is to estimate the counterfactual distribution of wages which would hold among women if their distribution of skills is the same as that for men. The quantile of the counterfactual distribution of the wage is then $\hat{q}\left(\hat{\beta}^f, x^m\right)$,[6] where $\hat{\beta}^f$ is the estimated coefficient of women from a linear quantile regression suggested by Koenker and Bassett (1978) and x^m is a vector of the characteristics of men. Similarly, changes in characteristics (skills) explain the difference between $\hat{q}\left(\hat{\beta}^f, x^m\right)$ and $\hat{q}\left(\hat{\beta}^f, x^f\right)$. Next, the distribution of the wage which would hold if the median return to skills for women is the same as among men, but the residuals are the same as among women, is $\hat{q}\left(\hat{\beta}^{med^m, resid^f}, x^m\right)$. Changes in the coefficients explain the difference between $\hat{q}\left(\hat{\beta}^{med^m, resid^f}, x^m\right)$ and $\hat{q}\left(\hat{\beta}^f, x^m\right)$. Similarly, the

[4]Following Chernozhukov et al. (2013), we employ the user-written Stata command, "cdeco_jmp." The package is available at https://sites.google.com/site/blaisemelly/home/computer-programs/inference-on-counterfactual-distributions.

[5]The linear quantile regression estimator in Koenker and Bassett (1978) and the rearrangement method in Chernozhukov, Fernández-Val, and Galichon (2010) are used to estimate the conditional distribution.

[6]See Melly (2005) for details.

gap between $\hat{q}\left(\hat{\beta}^m, x^m\right)$ and $\hat{q}\left(\hat{\beta}^{med^m, resid^f}, x^m\right)$ is explained by changes in the residuals. The total gender wage gap can be decomposed as

$$\hat{q}\left(\hat{\beta}^m, x^m\right) - \hat{q}\left(\hat{\beta}^f, x^f\right) = \left(\hat{q}\left(\hat{\beta}^{med^m, resid^f}, x^m\right) - \hat{q}\left(\hat{\beta}^f, x^m\right)\right) + \left(\hat{q}\left(\hat{\beta}^f, x^m\right) - \hat{q}\left(\hat{\beta}^f, x^f\right)\right) + \left(\hat{q}\left(\hat{\beta}^m, x^m\right) - \hat{q}\left(\hat{\beta}^{med^m, resid^f}, x^m\right)\right). \quad (1)$$

However, equation (1) can be simplified to

$$\textit{Total gender wage gap} = \textit{difference in coefficients} + \textit{difference in characteristics} + \textit{difference in residuals}. \quad (2)$$

The FFL method is based on estimating the RIF, *RIF*(*lwage*; *q*), suggested by Firpo et al. (2009). This estimate is the sum of the influence function, *IF*(*lwage*, *q*), and the distributional statistic of interest, *q* (lwage is the logarithm of real wage per hour). The estimated results are used to estimate the contribution of each explanatory variable in a procedure suggested by Oaxaca (1973) and Blinder (1973).[7] The difference in the logarithm of the real wage per hour between men and women at each quantile, τ, can be decomposed as follows:

$$\widehat{\Delta\tau} = \left(\widehat{RIF}\left(lwage_m, q_{m,\tau}\right)\right) - \left(\widehat{RIF}\left(lwage_f, q_{f,\tau}\right)\right), \quad (3)$$

and

$$\widehat{\Delta\tau} = \overline{X}_f\left(\hat{\delta}_{m,\tau} - \hat{\delta}_{f,\tau}\right) + \left(\overline{X}_m - \overline{X}_f\right)\hat{\delta}_{f,\tau} + \left(\overline{X}_m - \overline{X}_f\right)\left(\hat{\delta}_{m,\tau} - \hat{\delta}_{f,\tau}\right). \quad (4)$$

Equation (4) then becomes

$$\textit{Total gap} = \textit{Difference in coefficients} + \textit{Difference in endowments} + \textit{Interaction term} \quad (5)$$

Each method has advantages and disadvantages. An important advantage of the CFM method is that it undertakes a joint test for the positive gender wage gap (the constant effect) in all possible percentiles. The test answers directly whether the difference would polarize in different quantiles (centiles) along the distribution. This answer also highlights whether quantile regression is preferable to an estimation with a difference at the mean. Unfortunately, the method is unable to provide detailed decomposition as contributed by each of the covariates. In contrast, the FFL method solves this problem by providing a linear decomposition of the difference contributed by each explanatory variable. Moreover, the FFL method is path-independent; thus, the decomposition estimation results do not depend on the order in which the decomposition is executed (Fortin et al., 2011).[8] However, the FFL does not provide the above join tests. Consequently, we use both methods in our estimations with the

[7]Following Jann (2008), we employ the user-written Stata command "oaxaca8" to decompose the results from the RIF regression. The detailed guidelines for RIF regression and decompositions are available at http://economics.ubc.ca/faculty-and-staff/nicole-fortin/.

[8]DiNardo et al. (1996) suggest a method with path dependence and no detailed decomposition. The method does not provide tests for the positive gender wage gap (the constant effect). Moreover, Machado and Mata's (2005) method has several disadvantages because it requires intensive computing. Seeking the correct functional form of a conditional quantile regression would be time-consuming; in addition, linear specification is restrictive (Fortin et al., 2011). When the focus of counterfactual estimations is to interchange among the conditional distribution between the two groups, Chernozhukov et al. (2013) argue that Machado and Mata's (2005) method is not straightforward. The reason is that it estimates the inverse conditional distribution functions instead. See Fortin et al. (2011) for detailed explanations of other decomposition methods' advantages and disadvantages.

same specification. The CFM method tests for the positive gender wage gap and the shape of the distribution difference. The FFL method provides insights about the factors which may contribute most to the difference and suggests the trend of the contribution over time.

Furthermore, we establish the same setting for all the surveys in terms of two different specifications. With regard to the basic human capital specification, we define skills as an individual's education and age. We use dummy variables to identify the levels of education, which comprise a 3-year college degree, a 4-year university degree, senior high school (12 years of general education), junior high school (9 years of general education) and primary school (5 years of general education). We do not use projected experience, calculated by using an individual's age and subtracting from it the years of schooling and a further 7 years.[9] Instead, we use age and squared age as proximate values. Unfortunately, we do not have information on tenure or length of job, and acknowledge this limitation. We add additional covariates for marriage status, 3 dummies for types of ownership of firms, 9 occupation dummies, 6 regions, urban location or otherwise, and 23 industry dummies (based on the highest ranked industry definition available in the data). We report these covariates as the main results.

We also identify sticky floors/glass ceilings using the definition suggested by Arulampalam, Booth, and Bryan (2007). We define a sticky floor as being present when any estimated coefficient at any percentile between the 90th and 99th is 2% higher than any other estimated coefficient at any percentile in the middle of the distribution (the 11th to 89th percentiles). Similarly, a glass ceiling is present when coefficients at any percentile between the 1st and 10th are 2% higher than any coefficient of any percentile between the 11th and 89th.

5 | RESULTS

5.1 | Persistent gender wage gap and minor possible labour market discrimination

We find that the gender wage gap persists during 2002–2014 in Vietnam. All relevant test results shown in the T1 column of Table 1 support this argument. More specifically, the differences in coefficients[10] and characteristics are the two major components of the total difference. However, these two major components have different distribution and trend shapes. The differences in coefficients are constant along the distribution, as the test results in column T2 of Table 1 show (see also Figure 3). In contrast, the differences in characteristics are not constant, as can be seen in the test results of column T2 of Table 1 and the visual evidence in Figure 4. These findings confirm the rationale to avoid using decomposition for the mean wage. The difference in characteristics is at its lowest point in 2014.

The difference in human capital between men and women, specifically age and educational levels, explains most of the wage gap difference along the distribution. As can be seen in Tables 2 and 3, the coefficients of age and educational level have the largest volumes compared with the sum of the differences in coefficients (endowments). The graphical results shown in Appendix C provide similar visual evidence. The proportions for both genders in high-level and mid-level occupations are approximately 20%; thus, the difference by price in basic human capital skills is still an important factor for low-ranked occupations. Employers may pay particular consideration to experience, age and education when they make decisions about choosing workers for low-ranked occupations. The

[9]This is unreasonable because we find that some individuals acquired additional qualifications while working. Thus, some have negative projected experience. In addition, the available information on experience in the 2006 survey shows that the differences between projected and actual work experience are significant.

[10]We find that this is consistent in the CFM and FFL methods, as shown in Appendix B.

TABLE 1 Total gender wage gap and decomposed gaps by coefficients and residuals

Year	10th		25th		50th		75th		90th		T1	T2	T3
	Total difference												
2002	0.16 (0.03)		0.2 (0.02)		0.23 (0.02)		0.28 (0.02)		0.31 (0.04)		R	A-r	
2006	0.14 (0.04)		0.18 (0.03)		0.22 (0.03)		0.28 (0.04)		0.25 (0.05)		R	A-r	
2010	0.16 (0.02)		0.20 (0.01)		0.24 (0.01)		0.29 (0.02)		0.30(0.03)		R	A-r	
2014	0.22 (0.05)		0.16 (0.03)		0.18 (0.02)		0.22 (0.03)		0.24 (0.04)		R	A-a	
	Difference by coefficients												
2002	0.16 (0.03)	*97.11*	0.15 (0.02)	*78.05*	0.15 (0.02)	*65.03*	0.14 (0.03)	*49.77*	0.13 (0.03)	*41.27*	R	A-a	
2006	0.09 (0.05)	*61.84*	0.10 (0.04)	*53.57*	0.10 (0.04)	*46.09*	0.12 (0.04)	*42.61*	0.11 (0.06)	*45.43*	R	A-a	
2010	0.15 (0.02)	*91.20*	0.16 (0.01)	*80.46*	0.17 (0.01)	*68.87*	0.17 (0.01)	*57.11*	0.15 (0.02)	*49.07*	R	A-a	
2014	0.12 (0.03)	*56.49*	0.13 (0.03)	*79.61*	0.13 (0.02)	*73.18*	0.15 (0.03)	*67.80*	0.15 (0.04)	*60.96*	R	A-a	
	Difference by characteristics												
2002	0.01 (0.02)	*3.33*	0.04 (0.02)	*19.33*	0.07 (0.02)	*29.40*	0.10 (0.02)	*35.89*	0.12 (0.02)	*39.41*	R	A-r	
2006	0.06 (0.03)	*45.81*	0.09 (0.03)	*50.10*	0.12 (0.03)	*54.60*	0.14 (0.03)	*51.74*	0.15 (0.05)	*60.80*	R	A-r	
2010	0.03 (0.01)	*20.02*	0.05 (0.01)	*25.67*	0.07 (0.01)	*29.05*	0.09 (0.01)	*31.01*	0.10 (0.02)	*33.74*	R	A-r	
2014	0.00 (0.03)	*1.77*	0.01 (0.02)	*6.59*	0.04 (0.02)	*21.68*	0.06 (0.02)	*28.96*	0.09 (0.03)	*36.18*	R	A-r	
	Difference by residuals												
2002	0.00 (0.03)	*−0.45*	0.01 (0.02)	*2.62*	0.01 (0.01)	*5.58*	0.04 (0.02)	*14.34*	0.06 (0.03)	*19.32*	A	A-a	
2006	−0.01 (0.04)	*−7.65*	−0.01 (0.02)	*−3.67*	0.00 (0.02)	*−0.70*	0.02 (0.03)	*5.66*	−0.02 (0.04)	*−6.23*	A	A-a	
2010	−0.02 (0.01)	*−11.21*	−0.01 (0.01)	*−6.12*	0.01 (0.01)	*2.09*	0.03 (0.01)	*11.88*	0.05 (0.02)	*17.20*	R	A-r	
2014	0.09 (0.04)	*41.74*	0.02 (0.02)	*13.80*	0.01 (0.01)	*5.14*	0.01 (0.02)	*3.24*	0.01 (0.03)	*2.86*	A	A-a	S

Notes. Listed values are for the *i*th percentile. However, we estimated and conducted the hypotheses' tests for all percentiles and for each percentile from the 1st to 99th. Pointwise standard errors in parentheses are obtained from an empirical bootstrap of 100 repetitions. We employ Cramer–von Mises–Smirnov (main reference) and Kolmogorov–Smirnov statistics to decide the test results.
T1: Test results for H0: no effect, QE(tau) = 0 for all taus from 1 to 99. If H0 is rejected (10% level), then "R" is the result. If H0 is not rejected, then "A" is the result. This test is stronger than the absence of any mean effect. Figures in italics are percentages of the gender wage gap which contributed to the total gap. T2: Test results for two hypotheses in the following order. H0: stochastic dominance: QE(tau) > 0 for all taus from 1 to 99. If H0 is not rejected, then "A" is the result, otherwise "R". H0: constant effect: QE(tau) = QE(0.5) (10% level). If H0 is not rejected, then "a" is the result, otherwise "r". T3: H0: sticky floor/H0: glass ceiling. S (G) is denoted only if all the 1st–10th (90th–99th) percentiles passed at least 78 tests where the estimated difference of the percentile is 2% higher than those of the 11th–89th percentiles (5% level).

gender differences in terms of coefficients are explained by Phelps' (1972) statistical discrimination theory; moreover, the retirement age of men is 60 while that of women is 55. Thus, the gender difference in the discounted value of labour in terms of time may explain the consistent gap in the two basic factors of human capital, age and education.

We also have evidence that differences in human capital investment have changed over time. The differences in coefficients which the educational level contributes are only statistically significant in a few important percentiles and do not form any trend during 2002–2014, as shown in Table 2. We note that, as aforementioned, a greater proportion of women with college and university degrees have obtained formal jobs over time and that their share of such jobs reached the same level as men by 2014. This finding could indicate an important change in skills' distribution (or characteristic distribution). In corresponding estimations in Table 3, the differences in characteristic distribution which possession of university degrees contributes are statistically significant in all five important percentiles in 2002. However, this inequality of skills' distribution is gradually less serious in 2006 and becomes minor in 2010 and 2014.

We also find that the differences in residuals, the source of possible gender discrimination, are minor, except in 2010. Differences in residuals cannot be rejected for being equal to zero, as can be

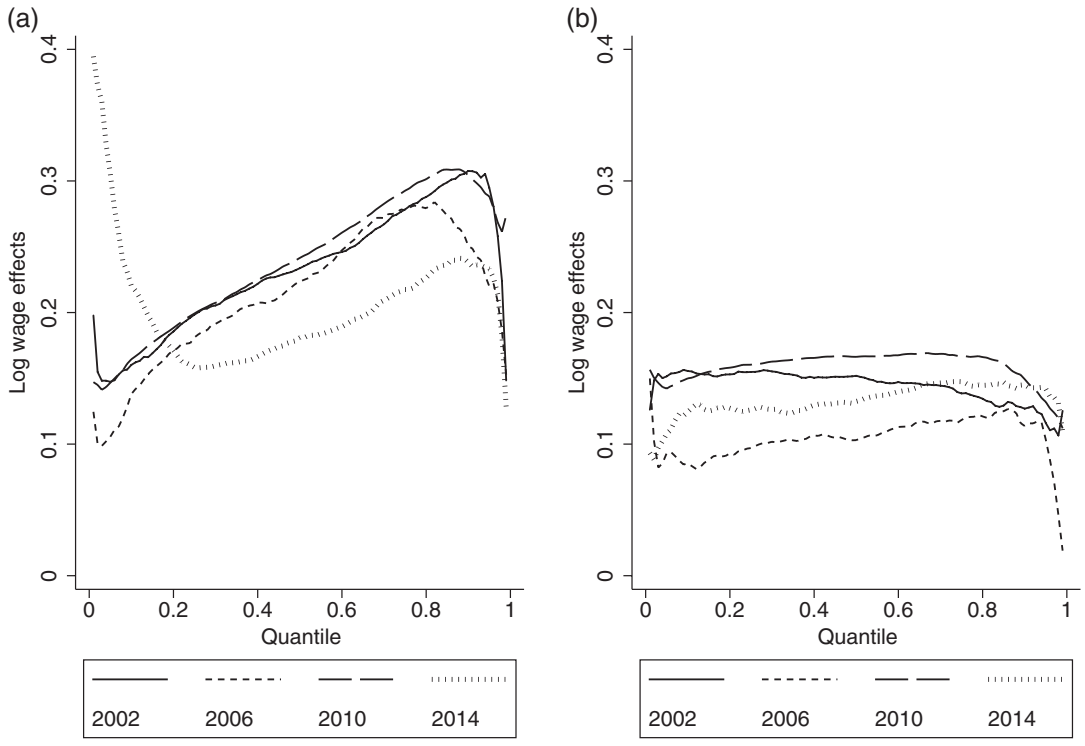

FIGURE 3 Total gender gap and decomposed gap by coefficients with main specification: (a) total differences and (b) coefficients' differences

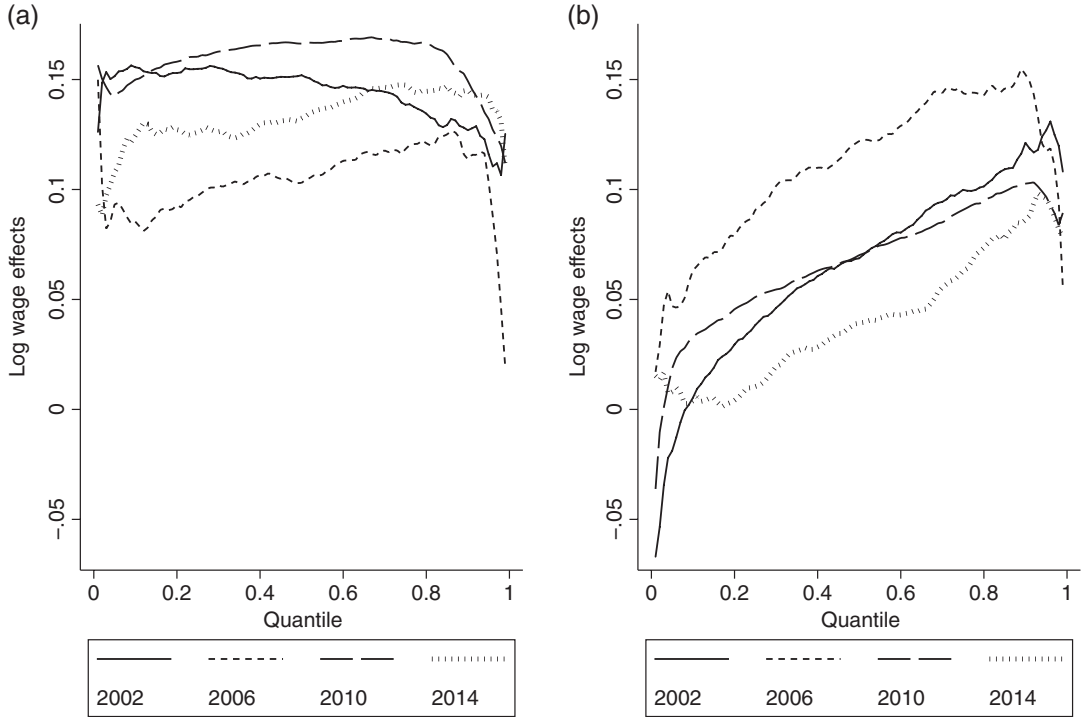

FIGURE 4 Decomposed difference by (a) coefficients and (b) characteristics

TABLE 2 Contribution of each covariate to the decomposed coefficients using the FFL method

	2002					2006				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
Age	1.04	0.78	1.33***	0.17	1.52	1.27	2.07***	0.73	0.93	1.33
Age*age	−0.52	−0.38	−0.69***	−0.16	−0.88*	−0.58	−0.86**	−0.22	−0.34	−0.44
Primary school	−0.02	−0.04	−0.03	0.01	0.02	0.02	0.06	0.04	−0.01	−0.04
Secondary school	0.00	−0.04	−0.04	−0.02	−0.03	0.01	0.03	0.03	0.00	0.02
High school	0.01	−0.03	−0.03*	−0.01	0.00	0.06	0.08	0.13***	0.05	0.07
College (3 years)	0.00	−0.01	−0.01	−0.01	−0.02	0.01	0.00	0.01	0.02	0.00
University (4 years)	0.00	−0.02	−0.01	0.01	−0.02	0.00	0.01	0.01	0.00	0.01
Vocational degree	−0.01	−0.04**	−0.03**	−0.02	−0.01	−0.01	0.01	0.01	0.00	0.02
Married	0.00	−0.04	−0.03	0.06*	0.03	−0.02	−0.01	−0.04	0.00	−0.07
SOE	0.03	0.06	−0.02	−0.01	0.01	0.03	−0.01	0.00	0.00	0.01
POE	0.03	0.04	−0.02	−0.02	0.00	0.04	0.00	0.01	−0.03	−0.05
FOE	0.01	0.02	−0.01	0.00	0.01	0.00	0.01	−0.01	0.07	0.01
High-level expert	0.01	0.00	−0.02**	−0.03**	−0.02	0.04	0.02	0.03	0.01	−0.05
Mid-level expert	0.02	0.02	−0.01	−0.02	0.02	0.05	0.04	0.01	0.00	−0.04
Office staff	0.02	0.00	−0.01	−0.03**	0.01	0.01	0.01	0.00	0.01	0.00
Service and sales staff	−0.01	−0.01	−0.01**	−0.01**	0.01	−0.01	0.00	−0.01	0.00	−0.01
Skilled labour	0.00	0.01	−0.01	0.00	0.01	0.00	0.00	0.00	−0.01	0.01
Manual (industrial) worker	0.06	0.00	−0.05	−0.08	0.04	0.08	0.1	0.03	0.06	−0.07
Assemblers & machine operators	0.02	0.01	−0.01	0.00	−0.01	0.02	0.03**	0.02*	0.02	0.00
Unskilled workers	0.03	−0.01	−0.06	−0.09*	0.02	0.11	0.07	0.02	0.03	−0.09
Other job	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-
Northern Midlands	0.00	−0.01	0.00	0.00	−0.01	0.02	0.00	−0.01	−0.01	0.00
North Central & Central Coast	0.01	−0.01	−0.02*	−0.02	0.00	−0.01	0.01	−0.01	0.00	0.03
Central Highland	0.00	0.00	0.00	0.00	−0.01	0.01	0.00	−0.01	−0.01	0.00
South East	0.01	−0.03*	−0.02	0.01	0.02	−0.04	−0.04	−0.03	−0.03	0.1**
Mekong River Delta	0.00	−0.01	0.01	0.00	−0.03*	−0.03	−0.03	−0.03*	−0.01	0.05
Urban	0.00	0.05*	0.06**	0.08***	0.09**	−0.04	−0.04	−0.04	−0.07*	−0.21***
Mining & quarrying	0.01	0.01	0.00	0.01	0.01	0.01	−0.01	−0.01	0.00	0.01

TABLE 2 (Continued)

	2002					2006				
	10th	**25th**	**50th**	**75th**	**90th**	**10th**	**25th**	**50th**	**75th**	**90th**
Manufacturing & processing	0.08	0.19***	0.14**	0.14**	0.14	0.25	−0.16	−0.07	0.08	0.58**
Water & environment service	0.00	0.00	0.00	0.01**	0.00	0.00	−0.01	0.00	0.00	0.00
Construction	0.00	0.00	0.01**	0.01***	0.01	0.00	0.00	0.00	0.01	0.02**
Wholesale, retail, motor repairs	0.02	0.02**	0.02**	0.01	−0.02	0.02	−0.02	−0.01	0.01	0.06
Transport & logistics	0.01	0.01**	0.01**	0.01	0.00	0.01	−0.01	0.00	0.00	0.02
Restaurants & hotels	0.01	0.01	0.01	0.01	0.00	0.02	−0.01	0.00	0.01	0.04*
Multimedia & ICT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Finance, banking, insurance	0.01	0.01*	0.00	0.01	−0.01	0.01	−0.01	0.00	0.00	0.01
Education	0.02	0.01	0.02**	0.00	0.00	−0.02	−0.04*	0.00	0.02	0.08*
Entertainment & arts	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	0.00	0.00	0.00
Other services	−0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03*
Home services	0.00	0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
International organization	0.00	0.00	0.00*	0.00*	0.00	0.00	0.00	0.00	0.00	0.00
Other industries	−0.01	0.00	0.00	0.00	−0.01	0.00	−0.01	0.00	0.01	0.03
Constant	−0.7	−0.4	−0.32	0.14	−0.7	−1.24	−1.19*	−0.45	−0.7	−1.37
Sum coefficient	0.16***	0.19***	0.16***	0.16***	0.19***	0.09	0.11***	0.11***	0.11***	0.11*
	2010					**2014**				
	10th	**25th**	**50th**	**75th**	**90th**	**10th**	**25th**	**50th**	**75th**	**90th**
Age	0.66	0.81***	1.06***	0.77**	0.83	0.25	−0.45	0.32	0.16	−2.13**
Age*age	−0.3	−0.37***	−0.47***	−0.37**	−0.48	0.04	0.21	−0.11	−0.04	1.03**
Primary school	−0.02	−0.01	−0.02*	−0.01	0.00	−0.05	0.02	−0.02	−0.02	−0.01
Secondary school	−0.03	−0.01	−0.01	−0.01	0.00	−0.06	0.02	0.01	0.00	0.00
High school	−0.05	0.00	−0.01	−0.04*	0.00	−0.07	0.04	0.03	0.00	−0.01
College (3 years)	0.00	0.01**	0.00	0.00	0.00	−0.02	0.01	0.01	0.02*	0.02
University (4 years)	−0.03*	0.01	0.01	0.00	−0.01	0.01	0.05	0.03	0.02	0.04
Vocational degree	0.00	0.01	0.01*	0.00	0.01	−0.02	0.02	0.02**	0.03**	0.06***
Married	0.01	0.03	0.00	0.01	−0.02	0.04	0.03	0.07**	0.09**	0.08

TABLE 2 (Continued)

	2010					2014				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
SOE	0.07**	0.04*	0.04**	0.02	−0.03	−0.06	−0.05*	−0.05**	−0.01	0.04
POE	0.15**	0.12**	0.08	−0.01	−0.14*	−0.02	−0.14*	−0.22***	−0.1	0.13
FOE	0.06	0.04	0.01	0.02	−0.05	0.06	−0.12**	−0.15***	−0.08	−0.02
High-level expert	−0.01	−0.01	−0.02**	−0.04***	−0.03	0.07	−0.02	0.00	−0.03	0.04
Mid-level expert	−0.01	0.00	−0.01	−0.02	0.03	0.03	−0.01	−0.01	−0.03	0.02
Office staff	−0.01	−0.01	−0.02**	−0.02*	0.03	0.03	−0.03	−0.01	−0.02	0.00
Service and sales staff	−0.03*	−0.02**	−0.03***	−0.04***	0.01	0.01	−0.02	−0.02	−0.04*	0.01
Skilled labour	0.00	0.00	0.00	0.00	0.00	0.01*	0.00	0.00	−0.01	0.00
Manual (industrial) worker	−0.02	0.01	−0.03	−0.06	0.1	0.15*	0.02	−0.01	−0.04	0.12
Assemblers & machine operators	−0.02	0.01	−0.01	−0.03	0.12	0.13	−0.01	−0.02	−0.04	0.15
Unskilled workers	−0.03	−0.01	−0.04***	−0.05*	0.06	0.05	0.01	−0.01	−0.02	0.08
Northern Midlands	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.01
North Central & Central Coast	0.01	0.00	−0.01	0.00	0.00	−0.01	0.01	0.02**	0.01	0.07***
Central Highland	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
South East	−0.01	−0.01	−0.02**	−0.03**	−0.02	0.05	0.01	0.00	0.04	0.13***
Mekong River Delta	0.00	−0.01*	−0.02**	−0.01*	0.01	0.03	0.01	0.01	0.00	0.03
Urban	0.02	0.03**	0.05***	0.03*	0.04	0.00	−0.05	0.01	0.00	−0.1**
Mining & quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing & processing	−0.1	−0.04	−0.01	0.00	0.12	0.01	0.02	−0.03	0.03	0.11
Electricity distribution	0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water & environment service	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	−0.01	0.00	0.00	0.00	0.01	−0.01	0.00	0.00	0.00	0.00
Wholesale, retail, motor repairs	−0.02	0.00	0.00	0.01	0.03	0.01	0.01	0.00	0.01	0.03
Transport & logistics	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Restaurants & hotels	0.00	0.01	0.00	0.01	0.02**	0.01	0.01	0.00	0.01	0.02
Multimedia & ICT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01
Finance, banking, insurance	−0.01	0.00	0.00	0.00	−0.01	−0.01	0.00	0.00	−0.01	−0.03
Property	0.00*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 2 (Continued)

	2010					2014				
	10th	**25th**	**50th**	**75th**	**90th**	**10th**	**25th**	**50th**	**75th**	**90th**
R&D, professional	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01
Administration & services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	0.00
Sociopolitical	−0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Education	−0.02	0.00	0.00	0.00	0.02*	0.00	0.00	0.00	0.00	0.02
Health care	−0.01*	−0.01***	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Entertainment & arts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other services	0.00*	0.00	0.00	0.00	0.00	−0.01	0.00	0.00	0.00	0.00
Home services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
International organization	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-
Rental	0.00***	0.00***	0.00***	0.00***	0.00***	0.00	0.00	0.00	0.00	0.00
Constant	−0.12	−0.45*	−0.37*	0.09	−0.48	−0.56	0.49	0.28	0.26	0.22
Sum coefficient	0.12***	0.13***	0.17***	0.23***	0.22***	0.19***	0.12***	0.12***	0.19***	0.17***

Notes. FFL method, Firpo, Fortin, and Lemieux method; FOEs, foreign-owned enterprises; POEs, privately owned enterprises; SOEs, state-owned enterprises.

***Significance at the 1% level. **Significance at the 5% level. *Significance at the 10% level.

TABLE 3 Contribution of each covariate to the decomposed endowment difference using the FFL method

	2002					2006				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
age	0.19***	0.18***	0.00	0.00	−0.23***	0.08	0.03	0.12*	0.02	−0.01
age*age	−0.15**	−0.13***	0.00	0.00	0.26***	−0.04	0.00	−0.09	0.01	0.03
Primary school	−0.01	−0.01**	0.00	0.00	0.00	−0.01	−0.01	0.00	0.00	−0.01
Secondary school	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.00	0.00
High school	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
College (3 years)	−0.01*	−0.01**	−0.01**	−0.01**	−0.01*	−0.01	−0.01	0.00	0.00	−0.01
University (4 years)	0.03**	0.03***	0.04***	0.04***	0.07***	0.02*	0.02*	0.01*	0.02*	0.02
Vocational degree	0.02**	0.02***	0.02***	0.01***	0.00	0.01	0.00	0.00	0.00	0.00
Married	0.00	0.00	0.01	0.00	0.02**	0.00	0.01	0.01	0.01	0.01
SOE	0.01	0.00	0.00	0.00	0.00	0.02	0.02*	0.01	0.00	0.00
POE	0.02	0.00	0.00	0.00	0.00	0.04*	0.02	0.01	0.01	0.00
FOE	−0.07***	−0.03***	−0.02***	0.00	0.01	−0.08**	−0.06***	−0.02*	0.00	0.01
High-level expert	0.00	0.00	0.00	0.01	0.00	−0.01	0.00	0.00	0.00	0.02
Mid-level expert	0.00	0.00	−0.01	0.00	0.02	0.00	0.00	0.00	0.00	−0.01
Office staff	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Service and sales staff	0.00	0.00	0.00	0.00	−0.04**	0.00	0.00	0.00	−0.01	−0.01
Skilled labour	−0.01	0.00	0.00	0.01*	0.01*	0.00	0.00	0.00	0.00	0.00
Manual (industrial) worker	0.00	0.01	0.00	0.02	0.06*	−0.02	0.00	0.01	0.04	0.02
Assemblers & machine operators	0.00	0.00	0.02	0.00	0.00	0.02	−0.01	−0.02	−0.03	−0.03
Unskilled workers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Other job	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-
Northern Midlands	0.00	0.00	0.00	0.00	0.00	−0.01	−0.01	0.00	0.00	0.00
North Central & Central Coast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01
Central Highland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South East	−0.03***	−0.04***	−0.04***	−0.03***	−0.04***	−0.01	−0.01	−0.01	−0.01	−0.01
Mekong River Delta	−0.01	−0.01	0.00	0.00	−0.01	−0.01	0.00	−0.01	0.00	0.00
Urban	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01*	0.01*	0.02*
Mining & quarrying	0.02**	0.02***	0.02***	0.01**	0.00	0.01	0.02*	0.01**	0.01	0.00
Manufacturing & processing	−0.05*	0.01	0.02	0.01	0.01	0.00	−0.05	0.00	0.07	0.14
Water & environment service	0.01**	0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.04**	0.01	−0.01	−0.02**	0.00	0.03	0.01	−0.02	−0.06*	−0.12**
Wholesale, retail, motor repairs	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	−0.01	−0.02
Transport & logistics	0.02**	0.01	0.00	0.01	0.03**	0.00	0.02	0.01	0.00	−0.04
Restaurants & hotels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Multimedia & ICT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Finance, banking, insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	0.00	0.00	0.01*	0.01	0.01	0.01	0.00	0.02*	0.03*	0.07**
Entertainment & arts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TABLE 3 (Continued)

	2002					2006				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
Other services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01
Home services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
International organization	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01	−0.01	−0.02
Sum endowment differences	0.03	0.08***	0.09***	0.09***	0.18***	0.08**	0.00	0.04	0.12***	0.1
	2010					**2014**				
	10th	**25th**	**50th**	**75th**	**90th**	**10th**	**25th**	**50th**	**75th**	**90th**
age	0.19***	0.14***	0.08***	0.01	−0.08	0.62***	0.28***	0.12***	0.1**	0.17**
age*age	−0.17***	−0.11***	−0.06***	0.01	0.12**	−0.57***	−0.25***	−0.1***	−0.07	−0.14*
Primary school	0.00*	0.00**	−0.01***	0.00**	0.00	−0.01	0.00	0.00	−0.01*	0.00
Secondary school	0.00*	0.00**	0.00**	0.00**	0.00	0.00	0.00	0.00	0.00	0.00
High school	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02**	0.01
College (3 years)	−0.01***	−0.01***	−0.01***	−0.01***	0.00	0.00	0.00	0.00	−0.01*	0.00
University (4 years)	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Vocational degree	0.01**	0.01*	0.01**	0.01***	0.00	0.02	0.00	0.00	0.01	−0.04**
Married	0.00	0.00	0.00***	0.00***	0.00*	0.01	0.00	0.00	0.00	0.00
SOE	−0.01	0.00	0.00	0.01*	0.01**	0.00	0.00	0.01	0.00	0.00
POE	−0.01	−0.01	−0.01	0.01	0.02**	−0.03	0.01	0.02*	0.02	−0.01
FOE	−0.01	−0.01	−0.01	−0.02	−0.05***	0.02	−0.03	−0.05***	−0.03**	−0.03
High-level expert	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.03
Mid-level expert	0.00	0.00	0.00	0.01**	0.04***	0.00	0.00	0.00	0.00	0.02
Office staff	0.00	0.00	0.00	0.01***	0.06***	0.02	0.00	0.00	0.02**	0.06**
Service and sales staff	0.00	0.00	0.00	−0.02***	−0.07***	−0.05**	−0.02	−0.01	−0.03**	−0.11**
Skilled labor	0.00	0.00	0.00	0.00	−0.01	−0.01	0.00	0.00	0.00	−0.01
Manual (industrial) worker	0.00	0.00	0.01**	0.02***	0.06***	−0.01	0.00	0.00	−0.01	−0.02
Assemblers & machine operators	0.01	0.00	−0.01**	−0.02***	−0.08***	0.01	0.00	0.00	0.01	0.03
Unskilled workers	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Northern Midlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
North Central & Central Coast	0.00*	0.00*	0.00**	0.00**	0.00*	0.00	0.00	0.00	0.00	−0.01
Central Highland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South East	−0.01***	−0.01***	−0.01***	−0.01***	−0.01***	−0.01	−0.01*	−0.01**	0.00	0.01
Mekong River Delta	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining & quarrying	0.02***	0.01***	0.01***	0.01***	0.01	−0.01	0.00	0.01	0.00	−0.01
Manufacturing & processing	−0.07**	−0.02	−0.01	0.01	0.03	0.03	0.04	0.02	0.04	0.06
Electricity distribution	0.01***	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Water & environment service	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.05***	0.02*	0.02**	0.01	−0.02	0.01	−0.01	−0.01	−0.01	−0.02
Wholesale, retail, motor repairs	0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.01

TABLE 3 (Continued)

	2010					2014				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
Transport & logistics	0.02*	0.01*	0.01**	0.01	0.01	−0.02	−0.03*	−0.01	−0.01	−0.03
Restaurants & hotels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multimedia & ICT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Finance, banking, insurance	0.00*	0.00	0.00	0.00	−0.01**	0.00	0.00	0.00	0.00	−0.01
Property	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R&D, professional	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Administration & services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sociopolitical	−0.01*	−0.01***	−0.01***	−0.01***	−0.01**	−0.02	−0.01*	0.00	−0.01	−0.02
Education	0.00	0.00	0.01***	0.01***	0.02**	0.01	0.01	0.01	0.01	0.02
Health care	0.00	0.00	0.00	0.00	0.00	0.01	0.01*	0.00	0.00	0.01
Entertainment & arts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Home services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
International organization	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-
Sum endowment differences	0.04***	0.03***	0.04***	0.07***	0.08**	0.08	−0.02	0.00	0.05*	−0.04

Notes. FOEs, foreign-owned enterprises; POEs, privately owned enterprises; SOEs, state-owned enterprises.

***Significance at the 1% level. **Significance at the 5% level. *Significance at the 10% level.

seen in the test results shown in column T1 of Table 1. Although there is a sticky floor in accordance with the difference distribution of the residuals in 2014, we emphasize that the difference in residuals cannot be rejected for being equal to zero. Furthermore, the total difference distribution in 2014 does not have a sticky floor in terms of the given definition. The total differences at the 8th–10th percentiles are somewhat lower than those of the percentiles in the middle of the distribution. However, a little caution may be necessary because the contribution of the difference in residuals, although not statistically insignificant, to the total difference at the 10th percentile is non-negligible (41.74%).

In addition, the statistical discrimination of married women is still not serious; however, it did become more significant in 2014. Married women are not always paid less in all five important percentiles, except for the 75th percentile in 2002 and the 50th and 75th percentiles in 2014. Table 2 presents the details. In addition, the ratio of married women increased among women with formal jobs, as shown in Appendix A. These findings have several possible explanations. First, having children (the motherhood penalty) has not critically affected career development in Vietnam. The experience (training) lost because of having children and caring for them may not be important because most women work in low-ranking jobs, as seen in Appendix A. Women also have few children (the fertility rate is approximately 1.95). Second, Vietnamese labour laws provide women with employment protection (firms cannot terminate contracts and discharge female workers because of marriage, pregnancy, childbearing, maternity leave and caring for children aged less than 12 months),[11] stipulate the working conditions for pregnant women (no nightshifts, no overtime and no long-distant business trips), and enable women to care for children less than 12-months old (a situation which is similar to the law regarding pregnancy plus a 60-min break per day on full salary).[12]

[11]See Amendments of Labour Law No. 35/2002/QH10, passed by the National Assembly on 2 April 2002.
[12]See Labour Law No. 10/2012/QH13, passed by the National Assembly on 18 June 2012.

5.2 | Contributions of other important covariates and possible explanations

Structural changes in firm ownership (the significant increase in private firms and the number of employment opportunities), industrial changes, increasing competitiveness and free trade are possible explanations for the differences in coefficients and characteristic (endowment) distribution during 2002–2010.

First, although privately owned enterprises (POEs) and foreign-owned enterprises (FOEs) increase their shares of employment of both genders in the Vietnamese economy from 2006 (see Appendix A), the differences in coefficients which POEs, FOEs and state-owned enterprises (SOEs) contribute are not significant and diversified until 2010. We hypothesize that access to the WTO in January 2007 may have increased competitiveness among firms. Table 2 shows that in 2010, FOEs provide the best opportunities for mid-income women and below. This finding is similar to that of Fukase (2014). However, in 2014, POEs supplant FOEs, placing the latter second. A possible explanation is that POEs are experiencing greater competition. Furthermore, POEs are more likely to be small and micro firms, while the average size of FOEs is 176–188 workers (Vu et al., 2017). These reasons provide more insightful explanations for the reduction in the gender wage gap found by Sakellariou and Fang (2014). They also serve to update Fukase's (2014) view of the importance of POEs.

In contrast, the differences in characteristics which FOEs contribute are significant for low-income women and below in 2002 and 2006, as shown in Table 3. The differences do not remain significant in 2010 but are still favourable for women.

Second, we consider two important industries for employment that have changed the most: manufacturing and processing, and wholesale, retail and motor repairs. Regarding manufacturing and processing in 2002, the differences in this coefficient which contribute to the gender wage gap are statistically significant at mid–low, middle and mid–high-income levels (see Table 2). However, this aspect of the gender wage gap is no longer significant in later surveys. The growth of private firms, the movement from agriculture, aquaculture and forestry, the increasing competitiveness among firms because of the expanding numbers, and free trade (exemplified by WTO access and US–Vietnam BTA) are possible explanations for this disappearance during 2006–2014. Meanwhile, differences in skills distribution in the manufacturing and processing industry are minor, as shown in Table 3, because the participation rate of women is already high (59%) in 2002. We also find a similar trend for the gender wage gap in the wholesale, retail and motor repair industry.

Third, in a similar manner, we consider the type of job which has changed most: assemblers and machine operators. We find that women have greater incentives to work in 2010 because the gender wage gap becomes negative and significant from the mid-income distribution and above. This situation may coincide with the growth of private firms and WTO access.

However, these changes would have taken place by 2014. Only three covariates beside age and educational achievement significantly contribute to the differences in characteristic distribution. They are FOEs, jobs as high-level experts (at the mid and mid–high-income levels), and jobs as service and sales staff (at the mid–high and high-income levels), as can be seen in Table 3. Other covariates are all statistically insignificant.

6 | CONCLUSIONS

We decompose Vietnamese wage inequality in terms of wage distribution by gender during 2002–2014. We find that the total gender wage gap appears to be persistent, mainly because of the

price of skills (the human capital difference). However, labour market discrimination against women is minor in this period. The differences in skills' distribution explain the second most important aspect of the gender wage gap. The differences in skills' distribution are wider in the right (upper) tail. Women achieve equality because of increasing educational attainment, joining the private sector (where equality has improved in the left tail), taking jobs as assemblers and machine operators, participating to a greater extent in two important industries, and perhaps increasing competitiveness among firms. The structural changes are also a possible explanation. Although the differences in residuals cannot be statistically rejected for being equal to zero, we identify a sticky floor in the differences in residuals in 2014. This finding could be an important starting point for future studies when further data are available.

We acknowledge several limitations in this study. First, we were unable to control for unobservable employable skills and policy changes in our estimations. Second, the nature of the two methods does not address the selection issue. We had to make a significant assumption in our estimates that women and men participate in the labour force at the same rate (in 2014, this assumption may indeed be true). Third, several control variables are endogenous; nonetheless, future studies can explore and overcome this issue when a dedicated decomposition method is available. Fourth, we did not capture lower-income workers who are in the informal sector and more likely to be influenced by minimum wage policies. Thus, the equality which we have found could be overestimated; however, this issue could be the focus of a future study if census data with more detailed information about employment are available.

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APPENDIX A: DESCRIPTIVE STATISTICS

	2002				2006				2010				2014			
	Male		Female		Male		Female		Male		Female		Male		Female	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Nominal wage p.a	12 463	10 083	9526	7178	18 561	13 247	14 288	10 351	41 311	39 105	31 035	28 027	66 025	41 709	54 278	37 501
Real wage p.a	25 049	20 266	19 145	14 426	28 843	20 586	22 202	16 085	41 311	39 105	31 035	28 027	45 964	29 037	37 786	26 107
Log real wage p.h	2.22	0.70	1.99	0.67	2.36	0.60	2.14	0.57	2.68	0.66	2.44	0.62	2.75	0.65	2.55	0.67
Age	34.00	9.91	30.61	9.83	32.64	10.73	28.56	9.58	32.62	9.92	29.58	8.85	33.03	9.76	30.19	8.75
Work hours p.a	2,198	610	2,213	629	2,315	701	2,234	701	2,296	679	2,247	682	2,497	503	2,484	458
Primary school	0.15	0.36	0.22	0.41	0.16	0.37	0.21	0.41	0.16	0.36	0.18	0.39	0.13	0.34	0.16	0.37
Secondary school	0.24	0.43	0.26	0.44	0.29	0.45	0.25	0.43	0.26	0.44	0.24	0.43	0.24	0.43	0.23	0.42
High school	0.19	0.39	0.19	0.40	0.35	0.48	0.36	0.48	0.36	0.48	0.35	0.48	0.36	0.48	0.30	0.46
College (3 years)	0.01	0.12	0.02	0.15	0.03	0.17	0.05	0.21	0.02	0.16	0.04	0.20	0.04	0.20	0.07	0.25
University (4 years)	0.14	0.35	0.09	0.28	0.11	0.31	0.08	0.27	0.14	0.35	0.13	0.34	0.18	0.38	0.19	0.39
Vocational degree	0.19	0.39	0.15	0.36	0.30	0.46	0.24	0.43	0.30	0.46	0.19	0.39	0.28	0.45	0.15	0.35
Married	0.66	0.47	0.54	0.50	0.57	0.50	0.47	0.50	0.64	0.48	0.59	0.49	0.66	0.47	0.63	0.48
Red River Delta	0.32	0.47	0.28	0.45	0.30	0.46	0.29	0.45	0.28	0.45	0.27	0.44	0.29	0.45	0.25	0.43
Northern Midlands	0.09	0.28	0.07	0.25	0.08	0.28	0.06	0.24	0.07	0.25	0.06	0.24	0.08	0.27	0.07	0.26
North Central & Central Coast	0.19	0.40	0.17	0.38	0.20	0.40	0.17	0.37	0.19	0.39	0.17	0.37	0.18	0.39	0.17	0.37
Central Highland	0.04	0.19	0.03	0.17	0.03	0.17	0.03	0.17	0.03	0.16	0.02	0.15	0.03	0.17	0.03	0.18
South East	0.24	0.43	0.32	0.47	0.24	0.43	0.27	0.44	0.28	0.45	0.32	0.47	0.26	0.44	0.31	0.46
Mekong River Delta	0.12	0.32	0.13	0.34	0.15	0.35	0.18	0.39	0.16	0.36	0.16	0.37	0.15	0.36	0.17	0.38
Urban	0.54	0.50	0.52	0.50	0.55	0.50	0.50	0.50	0.55	0.50	0.52	0.50	0.55	0.50	0.53	0.50
SOE	0.56	0.50	0.55	0.50	0.35	0.48	0.30	0.46	0.21	0.41	0.17	0.38	0.18	0.38	0.15	0.36
POE	0.27	0.44	0.25	0.43	0.48	0.50	0.40	0.49	0.64	0.48	0.52	0.50	0.65	0.48	0.51	0.50
FOE	0.09	0.28	0.15	0.36	0.13	0.34	0.26	0.44	0.13	0.33	0.29	0.45	0.16	0.37	0.33	0.47
Collective	0.09	0.28	0.05	0.22	0.03	0.18	0.05	0.21	0.02	0.14	0.02	0.12	0.01	0.10	0.02	0.13
With leader title	0.04	0.19	0.01	0.12	0.03	0.17	0.03	0.16	0.03	0.17	0.01	0.08	0.03	0.18	0.01	0.09

APPENDIX A (Continued)

	2002				2006				2010				2014			
	Male		Female		Male		Female		Male		Female		Male		Female	
Variables	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
High-level expert	0.09	0.29	0.07	0.25	0.10	0.30	0.08	0.27	0.11	0.31	0.12	0.32	0.11	0.32	0.15	0.35
Mid-level expert	0.05	0.22	0.10	0.29	0.08	0.27	0.10	0.30	0.07	0.25	0.09	0.29	0.06	0.24	0.07	0.26
Office staff	0.06	0.23	0.08	0.26	0.04	0.20	0.07	0.25	0.05	0.22	0.08	0.27	0.05	0.22	0.09	0.29
Service and sales staff	0.07	0.26	0.03	0.18	0.08	0.27	0.05	0.21	0.12	0.32	0.08	0.28	0.14	0.34	0.08	0.27
Skilled labour	0.03	0.17	0.04	0.20	0.01	0.08	0.01	0.11	0.01	0.12	0.01	0.10	0.01	0.12	0.01	0.09
Manual (industrial) worker	0.26	0.44	0.34	0.47	0.24	0.43	0.34	0.47	0.23	0.42	0.26	0.44	0.22	0.41	0.21	0.41
Assemblers & machine operators	0.14	0.35	0.05	0.22	0.14	0.35	0.05	0.22	0.23	0.42	0.19	0.39	0.23	0.42	0.24	0.43
Unskilled workers	0.26	0.44	0.28	0.45	0.27	0.44	0.29	0.45	0.16	0.36	0.16	0.36	0.15	0.35	0.15	0.35
Other jobs	0.00	0.05	0.00	0.02	0.01	0.12	—	—	—	—	—	—	—	—	—	—
Agri(aqua)culture & forestry	0.10	0.30	0.08	0.27	0.03	0.18	0.03	0.16	0.03	0.17	0.02	0.14	0.03	0.18	0.02	0.14
Mining & quarrying	0.08	0.27	0.03	0.18	0.05	0.22	0.02	0.14	0.04	0.19	0.01	0.11	0.03	0.18	0.01	0.10
Manufacturing & processing	0.38	0.49	0.59	0.49	0.41	0.49	0.63	0.48	0.40	0.49	0.62	0.48	0.42	0.49	0.61	0.49
Electricity distribution	—	—	—	—	—	—	—	—	0.01	0.11	0.00	0.06	0.01	0.10	0.00	0.06
Water & environment service	0.03	0.16	0.01	0.09	0.02	0.14	0.01	0.11	0.01	0.07	0.01	0.07	0.01	0.09	0.01	0.08
Construction	0.12	0.33	0.03	0.17	0.12	0.32	0.01	0.11	0.14	0.34	0.03	0.16	0.11	0.31	0.02	0.15
Wholesale, retail, motor repairs	0.08	0.27	0.06	0.24	0.10	0.30	0.07	0.26	0.12	0.33	0.09	0.29	0.12	0.33	0.10	0.30
Transport & logistics	0.09	0.29	0.03	0.18	0.10	0.30	0.02	0.15	0.09	0.28	0.01	0.12	0.07	0.25	0.01	0.11
Restaurants & hotels	0.02	0.14	0.03	0.17	0.03	0.18	0.04	0.20	0.03	0.17	0.04	0.18	0.03	0.16	0.03	0.17
Multimedia & ICT	0.00	0.04	0.00	0.03	0.00	0.05	0.00	0.04	0.02	0.15	0.02	0.13	0.02	0.14	0.01	0.12
Finance, banking, insurance	0.02	0.14	0.02	0.15	0.01	0.11	0.02	0.15	0.02	0.13	0.03	0.16	0.02	0.14	0.03	0.17
Property	—	—	—	—	—	—	—	—	0.00	0.07	0.00	0.06	0.00	0.06	0.00	0.05
R&D, professional	—	—	—	—	—	—	—	—	0.02	0.14	0.01	0.12	0.02	0.14	0.02	0.14
Administration & services	—	—	—	—	—	—	—	—	0.01	0.11	0.01	0.11	0.02	0.14	0.01	0.11

APPENDIX A (Continued)

	2002				2006				2010				2014			
	Male		Female		Male		Female		Male		Female		Male		Female	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Sociopolitical	—	—	—	—	—	—	—	—	0.03	0.17	0.02	0.14	0.03	0.18	0.02	0.13
Education	0.01	0.10	0.06	0.24	0.01	0.11	0.07	0.25	0.01	0.10	0.04	0.20	0.02	0.13	0.05	0.22
Health care	—	—	—	—	—	—	—	—	0.01	0.08	0.01	0.11	0.00	0.06	0.01	0.12
Entertainment & arts	0.01	0.08	0.01	0.09	0.01	0.10	0.01	0.09	0.01	0.08	0.01	0.08	0.01	0.08	0.01	0.08
Other services	0.03	0.17	0.02	0.14	0.03	0.16	0.02	0.14	0.01	0.10	0.00	0.07	0.01	0.11	0.01	0.10
Home services	0.00	0.05	0.00	0.06	—	—	0.00	0.05	0.00	0.04	0.00	0.07	—	—	0.00	0.05
International organization	0.00	0.03	0.00	0.04	—	—	0.00	0.04	0.00	0.03	0.00	0.03	—	—	—	—
Rental	0.00	0.03	—	—	0.00	0.03	—	—	0.00	0.01	—	—	0.00	0.03	0.00	0.04
Other industries	0.02	0.15	0.02	0.15	0.06	0.24	0.04	0.19	—	—	—	—	—	—	—	—
Selected sample size	2407		2044		860		751		5243		4448		1181		1164	
Any employee[a]	15 841	15.19%	9962	20.52%	3965	21.69%	2558	29.36%	21 262	24.66%	14 474	30.73%	4418	26.73%	3158	36.86%
Any nonstudent[a]	32 547	7.40%	34 743	5.88%	10 185	8.44%	10 519	7.14%	57 229	9.16%	58 588	7.59%	10 764	10.97%	10 883	10.70%

Note. The real wage is based on 2010 prices using the World Bank consumer price index: http://data.worldbank.org/indicator/FP.CPI.TOTL?end=2015&locations=VN&start=2000). FOE, foreign-owned enterprises; Nominal (real) wage unit is thousand Vietnamese Dong. POEs, privately owned enterprises; SD, standard deviation; SOE, state-owned enterprises.

[a]Individuals are non-students and aged between 15 and 55 years.

APPENDIX B: COMPARING THE GENDER WAGE GAP BY DIFFERENT METHODS OF ESTIMATION

Methods		Total difference				By coefficients							
		2002	2006	2010	2014	2002	%	2006	%	2010	%	2014	%
OLS	Marginal effect	0.14***	0.11***	0.17***	0.16***								
OB	Raw	0.23***	0.19***	0.22***	0.19***		*55–68*		*59–80*		*77–80*		*82–87*
JMP	At mean	0.23***	0.19***	0.22***	0.19***	0.14***		0.13***		0.17***		0.16***	
FFL	10th	0.17***	0.15***	0.17***	0.20**	0.16***	*97*	0.09	*62*	0.12***	*75*	0.19***	*95*
	25th	0.22***	0.18***	0.19***	0.15***	0.19***	*87*	0.11***	*63*	0.13***	*71*	0.12***	*76*
	50th	0.23***	0.22***	0.24***	0.15***	0.16***	*69*	0.11***	*50*	0.17***	*69*	0.12***	*78*
	75th	0.28***	0.27***	0.30***	0.25***	0.16***	*58*	0.11***	*41*	0.23***	*75*	0.19***	*74*
	90th	0.29***	0.26***	0.30***	0.23***	0.19***	*66*	0.11*	*41*	0.22***	*76*	0.17***	*74*
CFM	10th	0.16***	0.14***	0.16***	0.22***	0.16***	*97*	0.09	*62*	0.15***	*91*	0.12***	*56*
	25th	0.2***	0.18***	0.2***	0.16***	0.15***	*78*	0.1**	*54*	0.16***	*80*	0.13***	*80*
	50th	0.23***	0.22***	0.24***	0.18***	0.15***	*65*	0.1***	*46*	0.17***	*69*	0.13***	*73*
	75th	0.28***	0.28***	0.29***	0.22***	0.14***	*50*	0.12***	*43*	0.17***	*57*	0.15***	*68*
	90th	0.31***	0.25***	0.3***	0.24***	0.13***	*41*	0.11**	*45*	0.15***	*49*	0.15***	*61*

Figures in italics are percentages of the coefficient-related component which contributed to the total gap. JMP (Juhn et al., 1993), FFL (Firpo et al., 2009) and CFM (Chernozhukov et al., 2013) estimations use the same explanatory variables.

***Significance at the 1% level.

**Significance at the 5% level.

*Significance at the 10% level.

OB, Oaxaca–Blinder; OLS, ordinary least squares estimation using gender as a dummy.

APPENDIX C: DECOMPOSED GENDER WAGE GAP BY COEFFICIENTS, WITH BASIC HUMAN CAPITAL SPECIFICATION AND FULL SPECIFICATION