

Cardiff Economics Working Papers



Working Paper No. E2019/7

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February 2019

ISSN 1749-6010

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Gender wage gap across the quantiles:

What is the role of firm segregation?*

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Abstract

In this paper, we explore the role of firm segregation on the gender wage gap. Using linked employee-employer data for Turkey, we investigate whether female segregation into low-paying firms and into low-paying jobs within a firm influence the gender wage gap across the wage distribution. We find that there is a ‘glass ceiling’ effect in the Turkish labour market, but this effect is more apparent *within* a firm than *between* firms. We also find a ‘sticky floor’ effect, but only among workers employed at the same firm. Our results imply that the allocation of women into low-paying jobs *within* each firm accounts for the existence of these effects more than the segregation of women into low-paying firms.

JEL classification: C21, J31, J71

Keywords: gender wage gap, segregation, within- and between-firms, glass ceiling, sticky floor

1. Introduction

There has been a dramatic increase in income inequality in both developed and developing economies over several decades. In 2015, the average income of the top ten per cent was 9.6 times higher than that of the bottom ten per cent across the OECD, up from a ratio of seven to one in the

* An earlier version of this paper has been circulated under the title “Quantile regression and the gender wage gap: Is there a glass ceiling in the Turkish labor market?” I thank Ana Rute Cardoso, Rosario Crinò, Luca Gambetti, Anna Sanz-de-Galdeano, Pau S. Pujolàs Fons, and the participants in the Universitat Autònoma de Barcelona workshop. I also would like to thank Blaise Melly for helpful clarification about his work. This work was supported by the Cardiff Business School Research Committee Funding [Grant number 29300]. All the remaining errors are mine.

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1980s and eight to one in the 1990s (OECD 2015). The rising income inequality has been considered as a major contributor to increased poverty, economic deprivation and the potential cause of rising political polarisation and remains to be a major challenge to the established economic and political structures. The change in the wage distribution has been the main driver of rising income inequality (OECD 2011). The wage gap between the top ten per cent and bottom ten per cent has been increasing in almost all OECD countries since the mid-1980s. However, over the same period, another measure of inequality, the difference between women's and men's mean wages, has been declining (OECD 2017). Some argue that the gender wage gap would have declined even more if the wage inequality had not increased (Blau and Kahn 1997, 2017). According to this view, as women are more likely to work in low-paying jobs and hence be at the lower tail of the wage distribution than men, they have to 'swim upstream' in order to reduce the gender wage gap when wages become more dispersed. In fact, a number of recent studies analyse the gender wage gap across the wage distribution and find evidence of a 'glass ceiling', that is an enlarged gender wage gap at the top of the wage distribution (Albrecht et al. 2003; Arulampalam et al. 2007; De la Rica et al. 2008) and a 'sticky floor', that is a wider gender wage gap at the bottom of the wage distribution (Arulampalam et al. 2007; Christofides et al. 2013).

Traditional explanations of the gender wage gap, such as human capital theory stresses the supply side factors and attributes the existence of wage differentials to the lower levels of female productivity-related characteristics such as education and work experience (Mincer and Polachek 1974; Becker 1985). More recently, the focus of scholarly interest has shifted to the segregation as a further source of gender wage gaps. The seminal studies in this field emphasise the importance of segregation of women into low-paying jobs (see, for example, Groshen 1991; Reilly and Wirjanto 1999; Sorensen 1990). With the availability of linked employer-employee data, recent studies distinguish the two dimensions of segregation, segregation of women into low-paying firms and into low-paying jobs by highlighting the role of demand side factors on the gender wage

gap (see, for example, Bayard et al. 2003; Card et al. 2015; Cardoso et al. 2016; Hara 2018; Javdani 2015; Meng 2004).

Against this background, this paper investigates the gender wage gap across the wage distribution by assessing the role of firm segregation. Using a linked employer-employee dataset for Turkey, namely Structure of Earnings Survey (SES), we decompose the gender wage gap at each percentile of the wage distribution to its components, a part that can be explained by the differences in the productivity-related characteristics of men and women, and a part that is due to gender differences in the returns to those characteristics and remains unexplained. The SES data allows us to estimate that part of the gender wage gap that remains unexplained *within* a firm by controlling for firm fixed effects as well as the unexplained wage differential between men and women *across* firms. Using the two estimates, we are able to calculate the unexplained gender wage differential *between* firms, that is the portion of the gap that is due to allocation of women into low-paying firms. Our results show that there is a ‘glass ceiling’ effect in the Turkish labour market, but this effect is more apparent *within* a firm than *between* firms. We also find evidence of ‘sticky floor’ effect but only among those employed at the same firm. These results imply that the ‘glass ceiling’ effect in the Turkish labour market is mainly due to allocation of women into low-paying jobs *within* a firm rather than the female segregation into low-paying firms, while the ‘sticky floor’ effect is entirely due to segregation *within* firms.

The contribution of the current paper is twofold. First, it directly addresses the question of the effect of firms on the gender wage gap by quantifying the role of women’s segregation into low-paying firms and into low-paying jobs within a firm across the wage distribution. Despite the large literature on gender wage gaps across distribution, there are only a few studies that also control for firm fixed effects in exploring the gender wage gap across the quantiles. The notable exceptions include Javdani (2015), who investigates the existence of a ‘glass ceiling’ effect in Canadian labour market using data from a linked employer-employee data set, the Workplace and Employee Survey

(WES) 1999, 2001, 2003 and 2005, and employing a quantile regression decomposition method developed by Pendakur and Woodcock (2010). Javdani (2015) finds that women in Canada experience a ‘glass ceiling’, which is mainly driven by their segregation into low-paying firms. Another study that is particularly related to this paper is by Hara (2018). Using data from the Japanese Basic Survey on Wage Structure (BSWS) 1980-2015, Hara (2018) explores the gender wage gap across the wage distribution and finds that the unexplained portion of the gender wage gap is more prevalent *within* an establishment than *between* establishments. She also finds that the unexplained gap is wider at the two tails of the wage distribution than in the middle consistent with the existence of within establishment ‘sticky floor’ and ‘glass ceiling’ effects. Hara (2018) argues that the gendered career track job segregation system in Japan may account, at least to some extent, for the existence of ‘sticky floor’ effect within establishments, while gender promotion gap may be responsible for the ‘glass ceiling’ effect.

Second, this study contributes to the large literature on gender pay gaps, by focusing on Turkey which is especially interesting from a policy perspective. During the last two decades, Turkey experienced a series of structural, institutional and political changes including a number of policies enacted by Turkish government that increased the cost of hiring female employees (Anderson 2017; World Bank 2009), which we discuss in the next section. On the one hand, this policy driven change in the hiring costs of women may lead to a decline in the gender wage gap by moving females out of low-productive and low-paying firms. On the other hand, it may increase the gender wage gap by depressing female wages *within* each firm as a consequence of rising costs. The change in the gender wage gap due to changing relative labour costs of male and female employees is theoretically ambiguous and becomes an empirical question with implications relevant not only to Turkey but also other countries with similar policies in place. Although we do not infer causal relationship, our results provide supportive evidence for the argument that the policy-driven change in the hiring costs of women may increase the gender wage gap. We find that from 2006

to 2014, the gender wage gap in Turkey widened at all points of the wage distribution, the widening of the gap being more pronounced *within* each firm than *between* firms.

Most of the empirical studies on gender wage gap in Turkey are carried out using data from early 2000s or before (see, for example, Aktas and Uysal 2012; Dayioglu and Kasnakoglu 1997; Illkaracan and Selim 2007; Tansel 2005), and the gap in post-structural change is relatively poorly studied. The only exception is the study by Akhmedjonov (2012), who uses 2009 Household Budget Survey to decompose the gender pay gap in Turkey and finds that almost entirely explained by labour market discrimination toward women. However, his analyses are limited to the mean. If the gender wage gap widens at the top levels of the wage distribution, women's ability to upward advancement and access to high-paying jobs would be limited. The consequence is a labour market where "women remain concentrated in the lower levels of the job hierarchy: in the employment market, the company and the job category" (ILO 2004).

The paper is organised as follows. The next section provides a brief description of the policies enacted by Turkish government that changed the cost of hiring female employees for firms during the last two decades. Section 3 describes our data and sample and Section 4 discusses the methodology. In Section 5 we present our results. Concluding remarks are given in Section 6.

2. Background

Turkey became an official candidate for the European Union (EU) in 1999 and began the accession negotiations in 2005. As a part of this process, Turkey has adapted its legislation to EU standards, including the EU Directives on gender equality policies. The Constitutional amendments of 2001 and 2004, the adoption of the new Civil Code (2001), the new Labour Law (2003), and the new Penal Code (2005) are products of this process (Dedeoglu 2012, 2013).¹

¹ See Appendix Table A1 for a brief description of the policy changes during the last two decades.

Despite the legal basis for gender equality in the workplace, the female labour force participation in Turkey is the lowest among the OECD countries. In 2017, only 37.6 per cent of women were in the labour market, which was significantly behind the OECD average of 64 per cent and the EU's Lisbon goals of 60 per cent (OECD 2017).² Several authors argue that women's low labour force participation in Turkey is, at least to some extent, due to culture and social norms, which reinforce the position of women as wives and mothers (Baslevant and Onaran 2003; Dayioglu and Kirdar 2009; Gunduz-Hosgor and Smiths 2008; Ilkcaracan 2012; Kasnakoglu and Dayioglu 2002; Ozar and Gunluk-Senesen 1998; Uraz et al. 2009).^{3,4} Moreover, despite the improvements in the legal framework, the protective approach of the current labour regulation reinforces the traditional gender roles (Bugra 2012) and makes it constrained or more expensive for employers to hire women (Anderson 2017; Gedikli 2015; World Bank 2009). For instance, until recently the Labour Law prohibited women from night time work. The 2003 amendments lifted this ban but kept some others such as prohibiting to employ women (and young men) in mines, and in activities to be carried out underground or underwater such as cabling, canalisation or tunnel construction. The prime change in the Labour Law, the extension of the maternity leave from twelve weeks to a compulsory sixteen weeks (plus an additional six months of unpaid leave) is longer than the fourteen week-leave period of the EU and not transferrable to the spouse. Although the generous maternity leave in Turkey may encourage women to maintain their labour

² On the other hand, male labour force participation rate was 78.2 per cent in 2017, comparable the OECD average of 80.2 per cent.

³ Other factors frequently cited as affecting the labour force participation in Turkey are urbanisation and the consequent decrease in agricultural employment (Bugra and Cakar 2010; Dayioglu and Kirdar 2009; Erman 1998; Uraz et al. 2009; World Bank 2000, 2004); the low educational attainment of women (Baslevant and Onaran 2003; Dayioglu 2000; Dayioglu and Kirdar 2009; Gunduz-Hosgor and Smiths 2008; Ince and Demir 2006; Kasnakoglu and Dayioglu 1997; Tunali 1997; Tansel 2002; Taymaz 2009; Uraz et al. 2009); marital status and fertility (Dayioglu and Kirdar 2009; Dedeoglu 2010; Pancaroglu 2006; Kizilirmak 2008) and religion (Goksel 2016; Guner and Uysal 2014; O'Neil and Bilgin 2013).

⁴ The evidence suggests that if women in Turkey participate in the labour market, they work a 'double day', spending more than half of their total work time (4 hours per day) in unpaid care work, while men spend only half an hour (Memis et al. 2012). Due to family responsibilities, they are often pushed into low-paid jobs in the informal economy with flexible hours (Dayioglu and Kirdar 2010; Dedeoglu 2010; Ilkcaracan 2012; ILO 2018b). Women employed in formal economy, on the other hand, in addition to being concentrated in low-paying occupations and industries (Ilkcaracan and Selim 2007; Rich and Palaz 2008) such as sales and services, labour-intensive manufacturing and agriculture (KEIG 2009); and in lower grade classifications within occupations (see, for example, Gunluk-Senesen and Ozar 2001 within Turkish banking sector; and Healy et al. 2005 within academia), earn lower wages in comparison to their male counterparts (ILO 2018a). If they have children, they also face a double wage disadvantage in the labour market receiving 29.6 per cent less in wages than their non-mother counterparts (ILO 2018a).

market attachment, the lack of provision of paternity leave reinforces women's role as mothers (Dayioglu and Kirdar 2010; Ilkkaracan 2012) and may discourage employers to hire women (World Bank 2006).⁵ Additionally, the Labour Law grants women the right to terminate employment contracts within a year of marriage and acquire severance payments based on this reason, while men are not entitled to severance pay in the case of marriage and as such it encourages women to focus on their role as wives rather than their labour market careers (Dedeoglu 2012).⁶

Another primary change in the new Labour Law is the requirement for workplaces with 100 to 150 female employees to set up a nursing room separate from the workplace, but within a 250 metre distance for women to take care of their children under the age of one and for nursing women to breastfeed their children, and those with at least 150 female workers to provide childcare centres for children below six and a separate facility or nursery close to the workplace for breastfeeding mothers.⁷ The dependence of child care provision on the number of female workers not only regards childcare as women's responsibility but also increases the cost of female workers relative to male workers (Dayioglu and Kirdar 2010).

In terms of the institutional setting, Turkey has a statutory national minimum wage set by the government after non-binding tripartite consultations and the Minimum Wage Regulation (Law Number 25540) states that "no gender difference can be considered in setting minimum wage". However, the minimum wage is binding for formal sector, in particular low-skilled women (World Bank 2009). Thus, the increase in minimum wage between 2005 and 2015 (about 10 per cent each year on average corresponding to a cumulative real increase of 24 per cent) increased the cost of

⁵ A 10-day paternity leave is granted to civil servants whose wives have given birth. However, paternity leave is not foreseen for private sector workers. In practice, most employers provide paternity leave of up to three days following the delivery of the child.

⁶ Severance pay in Turkey is a lump-sum payment (equivalent to the thirty days salary for every year worked in the employer's workplace) made to the worker if he/she worked for at least one year and if his/her labour contract is terminated due to death, compulsory military service, retirement, disability benefits, female worker getting married, quitting with 'just' cause, and employer's termination of employment except for reasons of serious misconduct and immoral behaviour.

⁷ If the location of the facility is further than 250 meters, the employer is required to provide transportation free of charge. The employers are allowed to cooperate with other employers to offer a joint facility or make an agreement with an existing one.

low-skilled workers in the formal sector, many of whom are youth and women, lowering the demand for in this group and pushing them to informal economy (World Bank 2009).⁸ The 2008 Employment Package, on the other hand, introduced reforms that were designed to increase formal labour demand for individuals in these groups by reducing their employment costs in the form of subsidising the employer social security contributions for newly hired youth and female workers in the first year with reduced rates over a five-year period (See Appendix Table A1). However, the evidence suggests that this particular reform did not have an overall statistically significant effect on women's formal employment in Turkey (Balkan et al. 2014) possibly due to low levels of labour demand as a result of economic crisis during the period of implementation (World Bank 2009).

3. Data

The data for this study comes from the Turkish linked 'employer-employee' data set, Structure of Earnings Survey (SES). The SES is carried out regularly by the Turkish Statistical Institute, the official government agency commissioned with producing official statistics on Turkey, with four yearly intervals beginning from 2006 until 2014. The main aim of the survey is to give detailed information on the earnings and hours in formal employment in firms with more than ten employees. The SES data includes information provided by the employer on contractual working hours per week, monthly paid hours, hourly average gross wage, monthly average basic gross wage and monthly average gross wage of workers.⁹ It also provides information on personal and work-related characteristics of employees such as sex, age, educational attainment, tenure, and occupation as well as firm characteristics including firm size (measured by the number of

⁸ Despite the dramatic increase in minimum wage in Turkey during 2000s, the current minimum monthly gross wage is TL 2,558 (€ 423) ranking the country among the lowest in Europe.

⁹ The monthly basic gross wage includes the agreed upon and calculated gross wages paid to employees in November of the corresponding year for days worked and not worked, excluding bonuses, premiums, social contributions, and overtime payments, whereas the monthly gross wage includes the sum of monthly basic wages, overtime payments, payments for shift work/night work and other regular payments paid to employees. Monthly paid hours include the sum of contractual working hours pertaining to basic wage and overtime hours worked.

employees), economic activity and collective agreement coverage. The SES dataset has clear advantages over surveys based on household data as the information on hours and earnings are based on firm records considered to be most reliable (Cebeci 2015). Second, it allows comparing hourly wages of men and women working in the same firm through *within* firm analysis aligned with the aims of this study. The main limitation is, owing to its cross-sectional nature, we are not able to control for worker fixed effects that could enable us to account for gender differences in productivity and preferences. Moreover, SES covers only formal paid employment and excludes individuals who are self-employed, unemployed or out of labour force or those employees working in micro firms or agriculture. Therefore, all findings in this study adhere only to formal employment in firms with ten or more workers, excluding agriculture.

[Figure 1 here]

In our analysis, we use the first and last available SES data, for years 2006 and 2014 respectively. We restrict our sample to individuals of working age (between 15 and 64 years old) excluding paid staggers and apprentices and drop observations with missing values in any of the key variables used in our analysis. To examine the *within* firm gender wage gaps, we also restrict our sample to employees who are at only firms that employed both males and females.¹⁰ Our final samples include 241,361 observations from 12,874 firms in 2006 and 132,235 observations from 7,867 firms in 2014. Details of the explanatory variables and their sample means (by year and gender) are presented in Appendix Table A2. Our dependent variable (log) hourly wage is calculated as the simple division of monthly gross wage by monthly paid hours and deflated using the Consumer Price Index (CPI) base year 2003. We present the densities of log hourly wages for each gender in each year in Figure 1. As seen in the figure, the distribution of female log hourly wage in 2014 is slightly on the right compared to male log hourly wage distribution, which gives

¹⁰ We drop 13.67 per cent of the observations in 2006 and 19.13 per cent in 2014.

us a preliminary evidence of a gender wage gap, while for 2006 those two distributions are hardly distinguishable.

[Figure 2 here]

In Figure 2, we present observed gender wage gap in 2006 and 2014, calculated as the difference in the log hourly wages of men and women at each percentile in the wage distributions. As seen in Figure 2, in 2006, the observed gender wage gap in Turkey was zero at the lower end of the wage distribution. The gap widens as we move up in the wage distribution (starting at about the 40th percentile), then declines at the top and turns negative starting at about the 93th percentile. Although the shape for 2006 and 2014 is quite similar, the gender wage gap in 2014 is wider than the one in 2006 at all points in the wage distribution, except at the 20th percentile, where there is no wage differential between men and women gap in both years.

4. Methodology

The Oaxaca-Blinder decomposition technique has been the prominent method used in the literature to identify the sources of differences between the means of male and female log wage distributions by separating the gender wage gap into a part that is explained by differences in productivity-related characteristics of men and women and an unexplained component that is due to differences in the returns to these characteristics (Blinder 1973; Oaxaca 1973). However, a growing empirical literature emphasises that the gender wage differential is not constant across the wage distribution (see, for example Albrecht et al. 2003; Arulampalam et al. 2007; De la Rica et al. 2008). The decomposition method proposed by Machado and Mata (2005) extends the traditional Oaxaca-Blinder decomposition of the mean differentials to the entire distribution by combining the quantile regression model (Koenker and Bassett 1978) and bootstrapping approach. Formally, with $\ln w_{ij}$ being the hourly log wage of individual i (for $i = 1, \dots, N$) working in firm j (for $j = 1, \dots, M$), the θ th conditional quantile of the log of hourly wage distribution

$q_\theta(\ln w_{ij}|g_{ij}, \mathbf{x}_{ij})$ is assumed to be linear in the vector of covariates \mathbf{x}_{ij} along with the binary indicator of gender g_{ij} (for males $g=m$ and for females $g=f$) such that:

$$\ln w_{ij} = \alpha(\theta)g_{ij} + \mathbf{x}_{ij}\boldsymbol{\beta}(\theta) + u_{\theta ij} \quad \text{for } g = m, f; i = 1, \dots, N; \text{ and } j = 1, \dots, M; \quad (1)$$

where $u_{\theta ij}$ satisfies $q_\theta(u_{\theta ij}|g_{ij}, \mathbf{x}_{ij}) = 0$ and the gender wage gap adjusted for productivity-related characteristics between men and women at θ th quantile is given by $\alpha(\theta)$.

Note that equation (1) imposes the restriction that men and women are paid the same rewards for their characteristics. To examine the extent to which the returns to characteristics differ by gender, a version of equation (1) can be estimated separately for males and females:

$$\ln w_{ij,g} = \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\theta) + u_{\theta ij,g} \quad \text{for } g = m, f; i = 1, \dots, N_g; \text{ and } j = 1, \dots, M; \quad (2)$$

where $q_{\theta,g}(u_{\theta ij,g}|\mathbf{x}_{ij,g}) = 0$ and the coefficient vector $\boldsymbol{\beta}_g(\theta)$ can be obtained as the solution to following problem:

$$\min_{\boldsymbol{\beta}_g(\theta)} \left[\sum_{i:\ln w_{ij,g} \geq \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\theta)} \theta |\ln w_{ij,g} - \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\theta)| + \sum_{i:\ln w_{ij,g} < \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\theta)} (1 - \theta) |\ln w_{ij,g} - \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\theta)| \right], \quad (3)$$

using the optimisation techniques described in Koenker and Bassett (1978). The estimated vector of quantile regression coefficients $\widehat{\boldsymbol{\beta}}_g(\theta)$ then can be used to decompose the difference at different points in the male and female log hourly wage distributions into an explained and an unexplained component (Machado and Mata 2005), where the latter is typically interpreted as an upper bound measure of unequal treatment in the labour market.¹¹ The procedure to decompose the gender wage gap at θ th quantile is as follows:

(1) Generate a random sample of size n from a uniform distribution $(0, 1)$, that is $\{\theta_1, \theta_2, \dots, \theta_n\}$.

¹¹ The standard errors for the quantile regression coefficient estimates can be obtained by either using the asymptotic standard error of the estimator or by bootstrapping (Koenker and Hallock 2001).

- (2) For each θ in step (1), estimate the vector of quantile regression coefficients $\beta_g(\theta)$ for $g = f, m$.
- (3) For males and females separately generate a random sample of size n (with replacement) and use their characteristics, \mathbf{x}_g and the estimated vector of coefficients, $\hat{\beta}_g(\theta)$ to generate three sets of predicted earnings: (i) the simulated female log hourly wage distribution $\mathbf{x}_f \hat{\beta}_f(\theta)$, (ii) the simulated male hourly log wage distribution $\mathbf{x}_m \hat{\beta}_m(\theta)$, and (iii) the counterfactual distribution $\mathbf{x}_f \hat{\beta}_m(\theta)$, that is the log hourly wage distribution of females that would have prevailed if women had been endowed with their own characteristics but were paid like men.¹²
- (4) Finally, the difference between the θ th quantile of the male and female wage distributions can be decomposed into its components as follows:¹³

$$\mathbf{x}_m \hat{\beta}_m(\theta) - \mathbf{x}_f \hat{\beta}_f(\theta) = (\mathbf{x}_m - \mathbf{x}_f) \hat{\beta}_m(\theta) + \mathbf{x}_f (\hat{\beta}_m(\theta) - \hat{\beta}_f(\theta)). \quad (4)$$

In our empirical analysis, to explore the gender wage gap *across* firms, we first decompose the gender wage gap using equation (2). Included in the vector of covariates $\mathbf{x}_{ij,g}$ are personal characteristics such as educational attainment and potential experience (and squared), and work-related characteristics including tenure (and squared), full-time employment, permanent employment contract and occupation.¹⁴ Then, we use a version of equation (2) that controls for firm fixed effects in addition to personal and work-related characteristics to separate the gender wage gap *within* a firm into its components (see, Hara 2018 for a similar approach). For this

¹² In this procedure, the marginal distributions of male and female log hourly wage, $\mathbf{x}_m \hat{\beta}_m(\theta)$ and $\mathbf{x}_f \hat{\beta}_f(\theta)$ are generated using the same procedure to generate the counterfactual marginal distribution $\mathbf{x}_f \hat{\beta}_m(\theta)$ (see Arulampalam et al. 2007 for a similar approach). An alternative to this approach would be to use the empirical log hourly wage distributions of males and females in comparisons (see, for example De la Rica et al. 2008).

¹³ The decomposition of differences in wage distributions is applied using the Stata command `rqdeco` (see Melly, 2007). Melly (2006) shows that this procedure is numerically identical to the Machado and Mata (2005) decomposition method when the number of simulations used in Machado and Mata procedure goes to infinity. In the decomposition procedure of our study, rather than taking n random draws from (0,1) and estimating n quantile regression coefficients, the decomposition is performed for the 99 percentile differences in wages between men and women. The standard errors for the counterfactual densities are obtained by repeating the procedure 100 times.

¹⁴ Potential experience is calculated as age minus years of schooling minus six where years of schooling is taken as five years for primary school and below, eight years for primary education and secondary education, eleven years for high school and vocational high school and fourteen years for higher education following Cebeci (2015).

purpose, we follow the method proposed by Mundlak (1978) and calculate for each firm j the means of the same covariates included in vector $\mathbf{x}_{ij,g}$, $\bar{\mathbf{x}}_j$ and estimate a version of equation (2):

$$\ln w_{ij,g} = \mathbf{x}_{ij,g}\boldsymbol{\beta}_g(\boldsymbol{\theta}) + \bar{\mathbf{x}}_j\boldsymbol{\gamma}_g(\boldsymbol{\theta}) + u_{\theta ij,g} \text{ for } g = m, f; i = 1, \dots, N_g; \text{ and } j = 1, \dots, M. \quad (5)$$

The decomposition using equation (5) allows us to identify the unexplained gender wage gap *within* a firm, which occurs when women segregate into low-paying jobs within a firm. The difference between unexplained gender wage gap *across* and *within* firms (based on decomposition using equations (2) and (5), respectively), on the other hand, gives us the unexplained gap *between* firms, which occurs when women are systematically segregated to low-paying firms.

5. Findings

5.1. Gender wage gap across the wage distribution

In this section we present our main results, first looking at the adjusted gender wage gaps in 2006 and 2014. Table 1 presents the gender pay gaps at selected percentiles of the log hourly wage distributions calculated as the quantile regression coefficient estimate on the gender indicator variable (0 for female and 1 for male) using equation (1). For comparison, the OLS estimate is displayed in the last column. A positive coefficient implies that an unexplained gender wage gap remains even after the characteristics in the model are controlled for.

The top panel in Table 1 presents the coefficient estimates for 2006 and the bottom panel for 2014. Unadjusted gender wage gap presented in the first row is the basic model that controls for a gender indicator and a constant term without any additional control variables, while adjusted gender wage gap presented in following rows shows the wage differential between men and women with similar productivity characteristics. We do this adjustment by gradually adding to the basic model personal characteristics (educational attainment, experience and squared) in row a, plus work-related characteristics (tenure, full-time employment, permanent contracts, and

occupation) in row b, plus observed firm characteristics (firm size, collective agreement coverage and industry) in row c. In the final row of each panel (row d), instead of observed firm characteristics, we control for firm-fixed effects. As such the coefficient estimates identify the gender wage gap *within* a firm.

[Table 1 here]

The OLS coefficient estimates in Table 1 display a significant unadjusted gender pay gap *across* firms at the mean in both years with an increase in the gap from 2.4 log points (2.4 per cent) in 2006 to 8.4 log points (9.3 per cent) in 2014. When personal characteristics are controlled for, the mean gender wage gap increases in both years, indicating that men have, on average, lower levels of educational qualifications and experience than women. This result is consistent with Tekguc et al. (2017), who find that in Turkey the share of employed women with tertiary education is much greater than the share of men. In addition to personal characteristics, controlling for work-related characteristics increases the mean gender wage gap in 2006, while in 2014 the adjusted mean gender wage gap decreases, suggesting that a part of the observed gender pay gap *across* firms, in 2014 can be explained by gender differences in work-related characteristics, while in 2006, women earned less than men, despite having on average better work-related characteristics than men. When observed firm characteristics are controlled for, the mean gender wage gap *across* firms declines for both years. In fact, controlling for firm fixed effects instead of observed firm characteristics, further reduces the adjusted mean gender wage gap for both years, indicating that a part of the gap *across* firms is due to gender wage differential *between* firms. Nevertheless, the gap in row d is still positive and significant, indicating a wage differential between men and women also *within* a firm.

Turning our attention to the gender wage gap results across the wage distribution, the unadjusted gender wage gap in 2006 suggests that there is no significant difference at the lower end of the wage distribution. However, controlling for personal characteristics reveals an adjusted

gap at all quantiles and the gap widens as we move up the wage distribution. The former is consistent with women's higher levels of productivity characteristics relative to men at the lower end of the wage distribution. The latter, on the other hand, is consistent with the presence of a 'glass ceiling' effect.¹⁵ The 'glass ceiling' effect in 2006 is even more pronounced when work-related characteristics are controlled for indicating that the 'glass ceiling' effect exists *across* firms despite women having better work-related characteristics compared to men. When firm fixed effects are controlled for, this effect becomes less pronounced but still significant indicating the presence of a 'glass ceiling' effect among workers *within* a firm. In 2014, on the other hand, there is a significant unadjusted gender wage gap at the lower end of the wage distribution, the gap being widest at the 5th percentile. After adjusting for personal and work-related characteristics, the adjusted gender wage gap remains significant and this is consistent with an unexplained wage penalty for women *across* firms. Its magnitude decreases at the bottom end (at 5th and 10th percentiles) and at the median of the wage distribution parallel to the results at the mean but increases in magnitude above the median implying that women at the top of the wage distribution in 2014 earned less than men, despite having better personal and work-related characteristics. However, controlling for firm fixed-effects narrows the gap at all percentiles in the wage distribution, confirming the role of *between* firm segregation on gender wage gap, but there still exists a gender wage gap *within* each firm. In other words, a part of the gender wage gap in 2014 observed *across* firms is due to segregation of women into low-paying jobs *within* firms.

5.2. Decomposition of the gender wage gap within- and across-firms

We now turn our attention to the decomposition of the gender wage gap presented in Figure 3. The top and bottom panels of Figure 3 present the decomposition results using the 2006 and 2014

¹⁵ Following the previous literature (see, for example Albrecht et al. 2003; Arulampalam et al. 2007; Christofides et al. 2013; Hara 2018), we define the existence of 'sticky floor' and 'glass ceiling' effects if the gender wage gap at the 10th percentile and the 90th percentile exceed the gap at other reference points of the wage distribution (such as 25th or 50th percentile for the former, and 50th or 75th percentile for the latter) by at least two percentage points, respectively.

samples, respectively. Panels a and c present gender wage gap *across* firms controlling for the personal and work-related characteristics, while in panels b and d, in addition to personal and work-related characteristics, we also control for firm-fixed effects as described in section 4. As such the results presented in panels b and d are the decomposition of the gender wage gap *within* a firm. As seen in Figure 3, estimated gender wage gap in each panel, calculated using the conditional quantile regression model and integrating over the set of covariates, is broadly similar to the observed gender wage gap presented in Figure 2 suggesting that the approximation error is negligible.

[Figure 3 here]

First, focusing on the decomposition of the gender wage gap *across* firms (Panels a and c of Figure 3), we see that, in 2006, the explained gap that is due to gender differences in personal and work-related characteristics is either zero or negative across the entire wage distribution. Thus, keeping their own characteristics, if women would have been rewarded like their male counterparts they would earn at least as much as men at all percentiles in the wage distribution.¹⁶ Moreover, the explained gap in 2006 is always below the estimated gender wage gap while the unexplained gap is above, implying that gender wage gap *across* firms is due to differences in rewards between women and men for their observed productivity-related characteristics, rather than the differences in these characteristics. This effect becomes more pronounced across the wage distribution as we move from the lower tail to the upper tail, which indicates the existence of a ‘glass ceiling’ effect *across* firms in the Turkish labour market in 2006, while we find no evidence of a ‘sticky floor’. A comparison of Panels a and c of Figure 3 reveals that there has been an increase in the gender wage gap from 2006 to 2014, in particular at the lower tail of the wage distribution which is entirely unexplained. Nevertheless, the gap at the 10th percentile is no more than other reference points of

¹⁶ This result is consistent with the argument that in Turkey low-wage women might be relatively less likely than men to feature in observed wage distribution due to low female participation rates (Olivetti and Petrongolo 2008). In relation to this, between 2006 and 2014, the female labour force participation rate in Turkey increased, from 25.6 per cent to 33.6 (OECD stats, 2019).

the wage distribution (25th and 50th percentiles) providing no evidence for ‘sticky floor’ effects *across* firms, while the ‘glass ceiling’ effect is still present.

[Figure 4 here]

Turning our attention to Panels b and d of Figure 3, we observe that the shapes of the *within* and *across* unexplained gaps are quite similar, indicating that the ‘glass ceiling’ effect *across* firms is partially due to segregation of women into low-paying jobs *within* a firm. Moreover, the *within* unexplained gap is not greater than the *across* gap at all points in the wage distribution (except the top end of the wage distribution in 2014), indicating a positive *between* unexplained gender wage gap. This becomes more apparent in Figure 4 where we plot the estimated gender wage gap and *within* unexplained gap along with the *across* unexplained gap within the 95 per cent confidence interval. As seen in Figure 4, the difference between *across* and *within* gaps is always smaller than the *within* gap implying that the ‘glass ceiling’ effect is more apparent *within* a firm than *between* firms in both years. Moreover, from 2006 to 2014, the increase in the gender wage gap *within* each firm is greater than the increase in the gap *between* firms. In fact, the widening of the gender wage gap at the lower tail of the wage distribution, resulted in a *within* ‘sticky floor’ effect in 2014, which was not apparent *across* firms. Thus, the ‘sticky floor’ effect observed in Turkish labour market in 2014 was mainly driven by women’s segregation into low-paying jobs within a firm rather than segregation of women into low-paying firms.

6. Concluding remarks

Using the linked employee-employer data for Turkey, this study provides evidence on the role of firm segregation on the gender wage gap across the wage distribution. We find that there is a ‘glass ceiling’ effect *across* firms in the Turkish labour market which is due to both segregation of women into low-paying jobs *within* a firm and into low-paying firms, but this effect is more prevalent *within* a firm than *between* firms. We also find that from 2006 to 2014 the gender wage gap in Turkey widened at all points of the wage distribution, especially at the lower tail. The

widening of the gender wage gap was also more apparent *within* each firm than *between* firms. In fact, the widening of the gender wage gap at the bottom end of the wage distribution resulted in a ‘sticky floor’ effect which is observed only *within*- rather than *between* firms. As such, the ‘sticky floor’ phenomenon in Turkish labour market in 2014 was mainly driven by women’s segregation into low-paying jobs within a firm rather than segregation of women into low-paying jobs

The results of this study have important implications in terms of the policy, as distinguishing *within* and *between* firm gender wage gaps would lead to different policy recommendations. As argued by Hara (2018), a more pronounced gender wage gap *between* firms would require policies to promote equal opportunity in hiring practices, while targeting elimination of gender job segregation might be more effective if the gender wage gap *within* a firm is more pronounced. Policies that change the relative costs of female and male employees, such as the ones enacted by the Turkish government during the last two decades, may also influence the *within* firm segregation of male and female workers. Although our results provide supporting evidence for an increase in the gender wage gap due to the policy-driven change in the hiring costs of women, identifying a causal relationship between particular policies and the gender gaps goes beyond the scope of this study and we leave it for future research.

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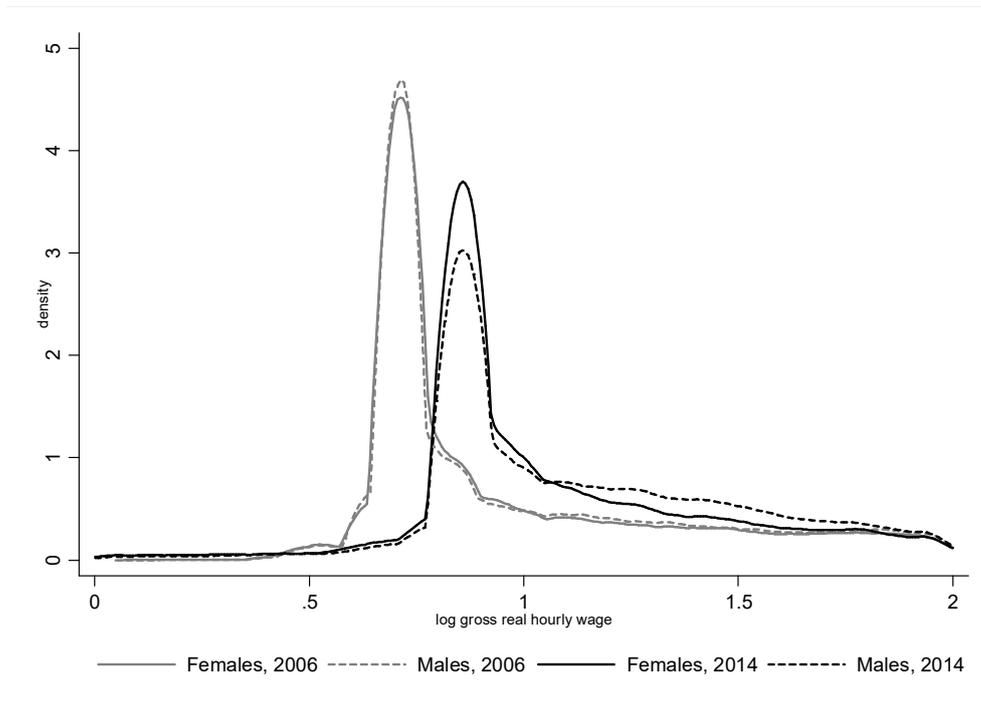
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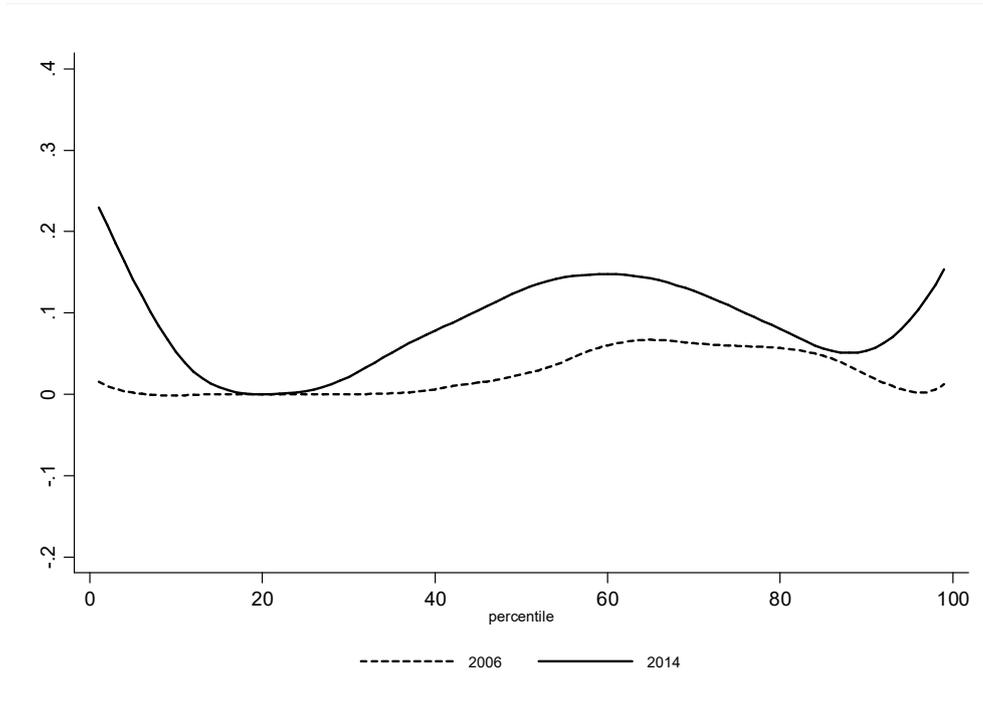
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FIGURES



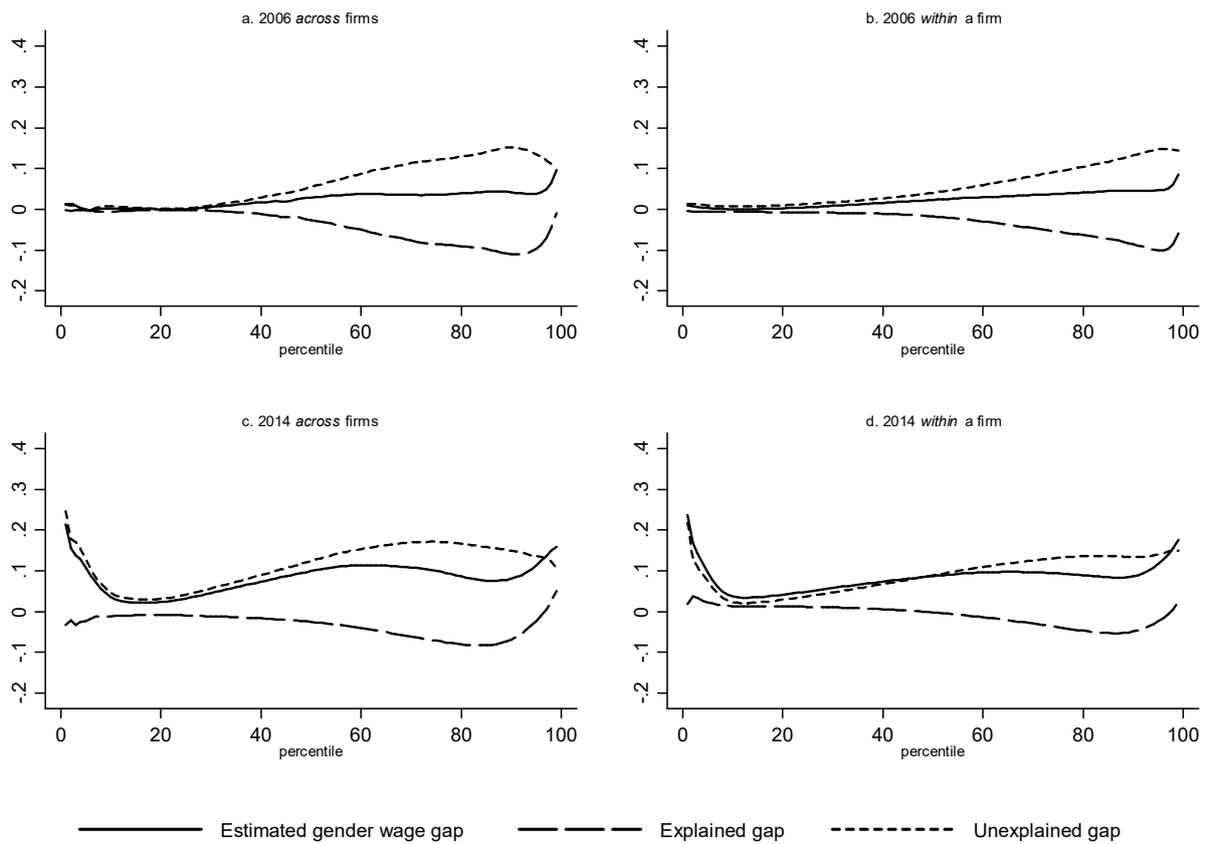
Data source: Structure of Earnings Surveys, 2006 and 2014. Notes: The density functions are estimated using Epanechnikov Kernel estimator.

Figure 1. Kernel density estimates of the wage distributions, by year and sex



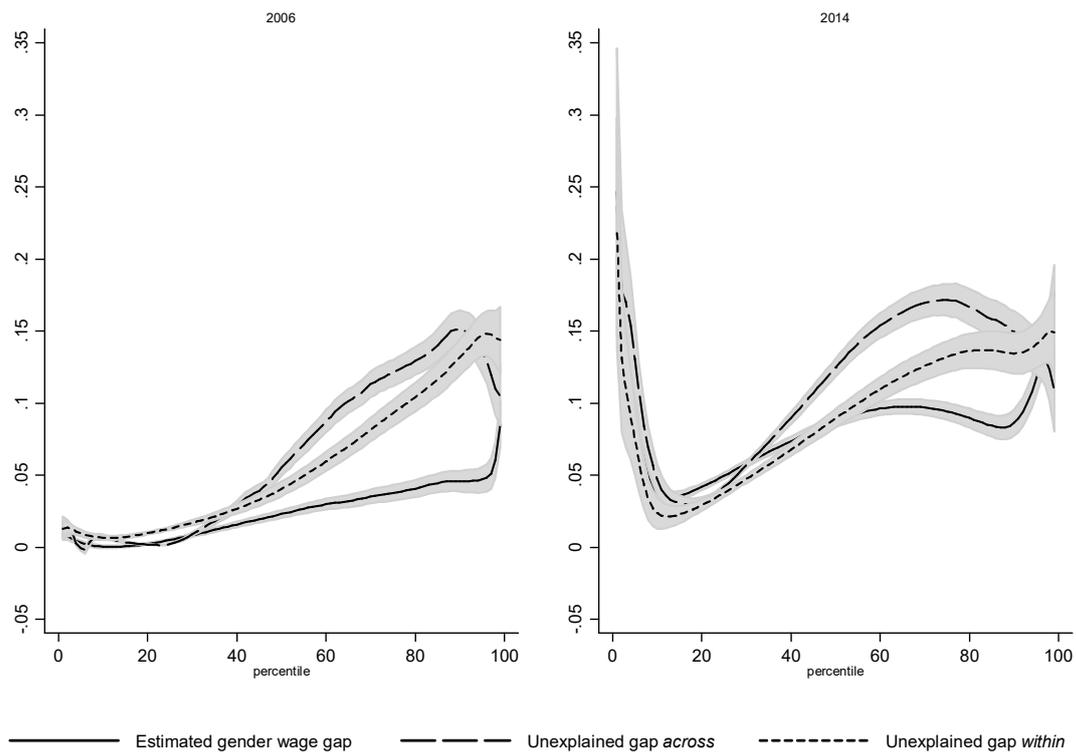
Data source: Turkish Statistical Institute, Structure of Earnings Surveys, 2006 and 2014. Notes: The observed gender wage gap is the difference between the log hourly wages of men and women. The graph is created using lowess smoother with bandwidth 0.25.

Figure 2. Observed gender wage gap, 2006 and 2014



Data source: Turkish Statistical Institute, Structure of Earnings Surveys, 2006 and 2014. Notes: ‘Estimated gender wage gap’ is calculated using the conditional quantile regression model and integrating over the set of covariates. *Across* gender wage gap controls for personal and work-related characteristics. Included in the personal characteristics are highest qualification, potential experience and experience squared. Work-related characteristics are tenure, tenure squared, full-time employment, permanent employment contract, and occupation. *Within* gender wage gap controls for firm fixed-effects in addition to personal and work-related characteristics. ‘Explained gap’ is the gender wage gap that is due to gender differences in productivity-related characteristics included in the model. ‘Unexplained gap’ is the gender wage gap that remains unexplained after controlling for the productivity-related characteristics.

Figure 3. Decomposition of the gender wage gap *within-* and *across-*firms, 2006 and 2014



Data source: Turkish Statistical Institute, Structure of Earnings Surveys, 2006 and 2014. Notes: The grey shaded area in figures is the 95 per cent confidence interval. ‘Estimated gender wage gap’ is calculated using the conditional quantile regression model and integrating over the covariates. ‘Unexplained gap *across*’ is the part of the gender wage gap *across* firms that remains unexplained after controlling for personal characteristics (highest qualification, potential experience and experience squared) and work-related characteristics (tenure, tenure squared, full-time employment, permanent employment contract, and occupation). ‘Unexplained gap *within*’ is the part of the gender wage gap *within* a firm that remains unexplained after controlling for firm fixed effects in addition to personal and work-related characteristics.

Figure 4. Unexplained gap *within*- and *across*-firms, 2006 and 2014

TABLES

Table 1. Unadjusted and adjusted gender wage gap at different quantiles of the wage distribution

Year and Specification	Quantile regressions (percentile of the conditional wage distribution)							OLS
	5 th	10 th	25 th	50 th	75 th	90 th	95 th	mean
2006								
(1) Unadjusted gender wage gap	0.000 (0.001)	0.000 (0.000)	0.000 (0.000)	0.004*** (0.000)	0.058*** (0.008)	0.032*** (0.008)	-0.007 (0.011)	0.024*** (0.007)
(2) Adjusted gender wage gap								
a. personal characteristics	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.027*** (0.002)	0.056*** (0.004)	0.064*** (0.003)	0.055*** (0.007)	0.051*** (0.005)
b. personal and work-related characteristics	0.001* (0.000)	0.001** (0.001)	0.002*** (0.000)	0.028*** (0.001)	0.065*** (0.002)	0.112*** (0.004)	0.116*** (0.006)	0.060*** (0.004)
c. personal, work-related and observed firm characteristics	0.005*** (0.001)	0.005*** (0.001)	0.011*** (0.001)	0.026*** (0.001)	0.048*** (0.002)	0.067*** (0.004)	0.081*** (0.006)	0.049*** (0.004)
d. personal and work-related characteristics and firm fixed-effects	0.004** (0.002)	0.003*** (0.001)	0.008*** (0.001)	0.020*** (0.001)	0.039*** (0.003)	0.068*** (0.004)	0.074*** (0.006)	0.040*** (0.002)
2014								
(1) Unadjusted gender wage gap	0.153*** (0.021)	0.065*** (0.003)	0.000 (0.001)	0.135*** (0.003)	0.103*** (0.008)	0.042*** (0.012)	0.089*** (0.014)	0.084*** (0.009)
(2) Adjusted gender wage gap								
a. personal characteristics	0.075*** (0.012)	0.038*** (0.004)	0.025*** (0.002)	0.096*** (0.003)	0.148*** (0.003)	0.153*** (0.005)	0.155*** (0.007)	0.122*** (0.007)
b. personal and work-related characteristics	0.072*** (0.009)	0.037*** (0.004)	0.039*** (0.002)	0.067*** (0.002)	0.121*** (0.004)	0.164*** (0.005)	0.177*** (0.007)	0.106*** (0.006)
c. personal, work-related and observed firm characteristics	0.081*** (0.009)	0.062*** (0.004)	0.052*** (0.002)	0.070*** (0.002)	0.100*** (0.003)	0.126*** (0.005)	0.145*** (0.007)	0.093*** (0.006)
d. personal and work-related characteristics and firm fixed-effects	0.041*** (0.009)	0.028*** (0.005)	0.033*** (0.002)	0.050*** (0.002)	0.085*** (0.004)	0.122*** (0.006)	0.129*** (0.007)	0.077*** (0.004)

Data source: Turkish Statistical Institute, Structure of Earnings Survey, 2006 and 2014. Notes: (i) For quantile regressions bootstrapped standard errors (100 replications) are in parentheses. For OLS regression, the numbers in parentheses are firm-level clustered standard errors. (ii) *, ** and *** significant at 0.001, 0.01 and 0.05 significance level respectively. (iii) Reported in the table are male dummy coefficient estimates from various specifications. Unadjusted gender wage gap includes a male dummy and a constant term without any additional control variables. Personal characteristics include sex, highest qualification and potential experience (and experience squared). Work-related characteristics are tenure (and tenure squared), full-time employment, permanent employment contract, and occupation. Observed firm characteristics include firm size, collective agreement coverage and industry. Firm fixed-effects are Mundlak fixed-effects. All specifications include a constant term.

APPENDIX

Table A1. List of selected gender equality policies, Turkey 2000-2018

Year	Policy	Description
2001	Amendment to the Constitution (Article 41)	Added “based on the equality between the spouses” to the previous version of the article which stated that “Family is the foundation of the Turkish society”.
2002	New Civil Code (Law no: 4721)	Increased legal marriage age to 18 for men (from 17) and women (from 15); established the equality of men and women in the family including the abolishment of the term “head of household” as well as of the permission of spouses to work; introduced the legal basis for the sharing of marital assets in case of divorce; granted the same heredity rights to children born out of wedlock with those of legitimate birth.
2003	New Labour Law (Law no: 4857)	Set the legal basis for equal pay for equal work; reinforced the equal treatment principle for women and men; decreased the restrictions on temporary employment; provided a legal basis for atypical employment; lifted the ban on employment of women in night shifts of manufacturing establishments; extended paid maternity leave from twelve weeks to sixteen weeks (eight weeks before and eight weeks after the child birth); introduced breastfeeding leave to a total of one and a half hour for mothers of children below the age of one; obliged companies employing 100 to 150 female workers to provide comprehensive nursery rooms for children under age of one, and companies employing more than 150 female workers to provide comprehensive childcare centres and pre-school facilities for children under age of six.
2003	Family Court Law (Law no: 4787)	Established Family Courts in districts with more than 100.000 population in order to enforce the Civil Code and ensure gender equality.
2004	Amendments to the Constitution (Articles 10 and 90)	Amendments to Article 10 reinforced equal rights of women and men and emphasised the responsibility of the State to ensure equality. Amendments to Article 90 ensured the supremacy of international laws (including the Convention on the Elimination of All Forms of Discrimination against Women in 1985 and European Social Charter in 1996) in the case of a conflict between Turkish law and international treaties with regards to human rights.
2005	New Penal Code (Law no: 5237)	Defined sexual harassment in work; reinforced prohibition of gender-based discrimination.
2006	Social Insurance and General Health Insurance Act (Law no: 5510)	Merged different security systems into one structure; adopted harmonised legislation for maternity and breastfeeding leaves as well as the pensions plans regulating the working conditions for women.
2008	Employment Package (Law no: 5763)	Introduced a direct employment subsidy programme (with a limit that corresponds to minimum wage level) with one-year participation period (extended to June 30, 2010 with Law 5838) by reducing the employers’ contribution to social security payment of new hires for five years, covering 100 per cent of social security payments of new employees for the first year and reducing its participation by 20 per cent each year for the following 4 years. Targeted young men (ages between 18 and 29) and women above 18 who were not employed as a tax-registered worker in the preceding 6 months.
2010	Amendment to the Constitution (Article 10)	Added “Measures taken for this purpose shall not be interpreted as contrary to the principle” to Article 10.

2011	Amendments to the Labour Law (Law No. 6111)	<p>Enforced the rules of maternity leave for women (mandatory for sixteen weeks and fully paid by the social security system); introduced the right to use paid leaves for breast feeding; ruled out terminating job contracts on grounds of pregnancy; brought new regulations for part time work; incorporated domestic help workers into the social security system; extended maternity leave to twelve months for civil servants and six months for others on an unpaid basis; granted ten days voluntary paid paternity leave to civil servants whose wives give birth.</p> <p>Extended the period (for the period between March 2011 and December 2015) and coverage (both men and women of all ages and relaxing the subsidy limit covering the total social security payment amount regardless of the wage level) of the 2008 employment subsidy programme.</p>
2016	Amendments to the Labour Law (Law no: 6663)	<p>Introduced unpaid maternity leave to mothers as half of their weekly working hours for sixty days in first birth, one hundred and twenty days in second birth and one hundred and sixty days in following births; introduced the right to request part-time work for the period between when maternity leave ends, up until the beginning of the month after the child's compulsory education begins for both parents whose spouse is also working; extended the coverage of maternity leave and the right to request part-time work to couples or individuals adopting a child under three years old.</p>

Sources: Anderson (2017), Balkan et al. (2016), Dedeoglu (2012), Gedikli (2015), Muftuler-Bac (2012), World Bank (2009).

Table A2. Sample means for explanatory variables

	2006		2014	
	Males	Females	Males	Females
Personal characteristics				
Educational attainment				
Primary school and below	0.31	0.19	0.19	0.15
Primary education and secondary school	0.16	0.11	0.18	0.11
High school	0.23	0.28	0.27	0.29
Vocational high school	0.11	0.09	0.10	0.06
Higher education	0.19	0.33	0.27	0.40
Potential labour market experience (years)	18.23	14.01	18.30	15.32
Work-related characteristics				
Tenure (years)	3.92	3.03	3.39	2.70
Full-time	0.99	0.99	0.98	0.98
Permanent contract	0.96	0.97	0.94	0.93
Occupation				
Legislators, senior officials and managers	0.06	0.05	0.06	0.05
Professionals	0.06	0.13	0.10	0.16
Technicians and associate professionals	0.16	0.21	0.10	0.09
Clerks	0.09	0.22	0.11	0.24
Service workers; shop and market sales workers	0.11	0.09	0.18	0.22
Skilled agricultural and fishery workers	0.003	0.001	0.001	0.001
Craft and related trade workers	0.21	0.11	0.17	0.05
Plant and machine operators and assemblers	0.15	0.06	0.15	0.07
Elementary occupations	0.15	0.13	0.12	0.13
Firm characteristics				
Firm size (number of employees)				
10-49	0.46	0.46	0.32	0.32
50-249	0.24	0.24	0.20	0.18
250-499	0.10	0.10	0.17	0.17
500-999	0.08	0.08	0.16	0.17
1000+	0.12	0.11	0.15	0.16
Collective agreement coverage	0.12	0.06	0.12	0.08
Industry				
Mining and quarrying	0.02	0.01	0.02	0.01
Manufacturing	0.44	0.37	0.36	0.25
Electricity, gas and water supply	0.03	0.01	0.02	0.01
Construction	0.05	0.02	0.04	0.02
Wholesale and retail trade	0.19	0.20	0.23	0.23
Hotels and restaurants	0.05	0.04	0.06	0.06
Transport, storage and communication	0.07	0.06	0.06	0.06
Financial intermediation	0.03	0.07	0.03	0.06
Real estate, renting and business activities	0.06	0.07	0.10	0.13
Education	0.03	0.07	0.03	0.06
Health and social work	0.02	0.06	0.02	0.08

Other social and personal service activities	0.02	0.02	0.03	0.03
Number of observations	175,938	65,423	91,881	40,354
Number of firms	12,874		7,867	

Data source: Turkish Statistical Institute, Structure of Earnings Surveys, 2006 and 2014. Notes: Sample is restricted to individuals of working age (between 15 and 64 years old) excluding paid staggers and apprentices, who are at only firms that employed both males and females and with non-missing values in any of the key variables used in the analysis.