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Firm-specific pay premiums and the gender wage gap in 21 European countries

JAN-LUCA HENNIG, BALAZS STADLER*

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Abstract

We study how firm premia influence the gender wage gap for 21 European countries over 12 years. We use a quadrennial harmonized matched employer-employee data set to estimate gender-specific firm premia. Subsequently, we decompose the firm-specific wage premia differential into a within- and between-firm component. We show that, on average in Europe, the former mainly accounts for the decline in the pay gap between 2002 and 2014, while the latter does not change significantly. An analysis of the subgroups by age and gender reveals heterogeneity in the development of the components. We pay particular attention to the development of each component across the life cycle and find that the between-firm component is associated with an increase in the gender pay gap across the life cycle. The decomposition of firm premia then allows us to investigate how institutional settings relate to each component. For the within-firm component we exploit firm-level differences in the collective bargaining regime, and we link family policies to the between-firm component. Centralized wage bargaining is associated with higher gender wage gaps, whereas family policies enabling and encouraging women to return to the labor market after family formation reduces the between-firm component.

(JEL J16, J18, J31, J52)

Keywords: Gender Wage Gap, Firm Premia, Decomposition, Institutional Settings

1 Introduction

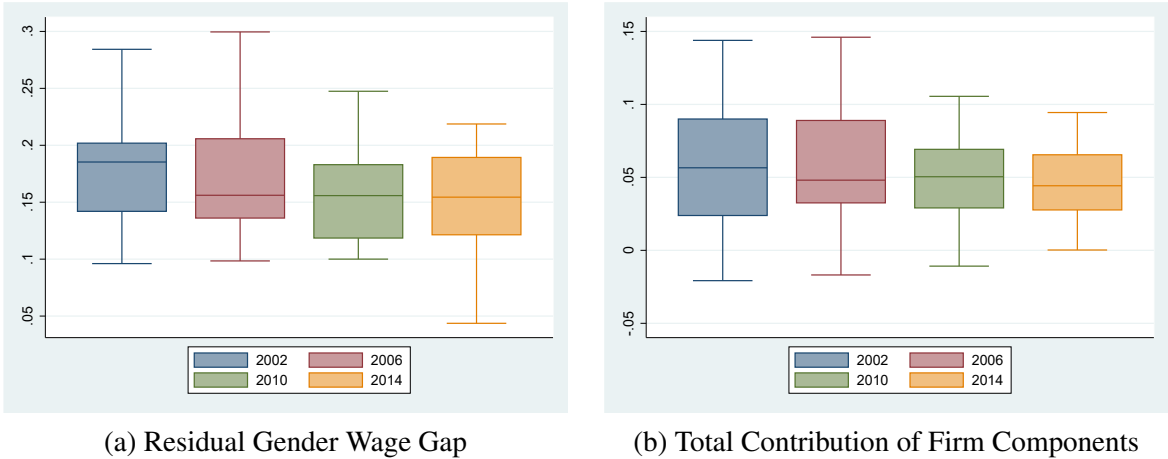
Despite strong convergence in the gender pay gap, defined as the gap in hourly wages between men and women with similar observable characteristics, in developed countries over the last decades, a persistent gap remains, see e.g. Blau and Kahn (2017) and Kunze (2018). The gender wage gap remains a pressing policy issue given that labor market participation rates have mostly converged already. The current crisis with the spread of Covid-19 renews the attention to gender gaps as it impacts women disproportionately relative to men. Alon et al. (2020) summarize the various dimensions through which the crisis affects women.

The left panel in Figure 1 shows the decline in the gender wage gap for the 21 European countries subject of our analysis between 2002 and 2014. In 2002, the average pay gap between men

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and women was 20%, and since then it has been falling by about one percentage point every four years, indicative of the slow progress during the last two decades. We focus on firm premia as an important determinant for the gender wage gap as it has been associated with overall wage inequality, e.g. for the United States by Song et al. (2019). On average, firm-specific pay differentials account for 35 to 39 percent of the gender wage gap, with strong country heterogeneity. For example, in 2014 the relative contribution of firm premia to the gender wage gap was the lowest in France with 11%, while it was the highest in Hungary with 77%.

Figure 1: Evolution of Firm’s Contribution to the Gender Wage Gap



The box plots show the absolute contribution of each component to the gender wage gap due to differential firm premia by gender for every year the SES was conducted. The left panel shows the wage gap that cannot be explained by observables, and the right panel presents absolute contribution of firms to the wage gap. The underlying country-specific results are shown in Columns (1) and (4), respectively, in Tables C2 to C5. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

Our first contribution is to disentangle the gender wage gap into a within- and between-component for 21 European countries over 12 years using a matched employer-employee data set. Previous studies, e.g. Card et al. (2016) and Coudin et al. (2018) investigate a single country, namely Portugal and France, respectively.¹ The authors use matched employer-employee data and estimate two-way fixed effects for firms and workers. For the identification of the fixed effects, both studies rely on worker moves across firms. However, this requirement can induce a bias if the movers are not representative of the overall workforce or, as Andrews et al. (2008) argue, if the number of movers is low. This bias is empirically confirmed for various countries by Bonhomme et al. (2020). While we use four different survey waves, we cannot estimate worker-fixed effects due to the rotating nature of the survey, i.e. the firms we observe change between waves.

We exploit four waves between 2002 and 2014 of the “Structure of Earnings Survey” (SES) provided by Eurostat. The SES is a matched employer-employee data set, which provides har-

¹These studies call the within-firm component the “bargaining” channel, and the between-firm component the “sorting” channel.

monized and accurate data across all countries in the sample with a special focus on hourly wages. It contains detailed information on the relationships between the level of remuneration, individual characteristics of employees and those of their employer. We also explore heterogeneity of each component with respect to education and age. To our knowledge, we are the first to exploit this data set for a decomposition of the gender pay gap into a within- and between-firm component based on firm premia. Boll and Lagemann (2019) use the 2014 survey to decompose the gender wage gap into observables and unobservables, and to investigate the relative importance of observable characteristics to the pay gap.

The second contribution is to systematically investigate each component of the firms' contribution to the gender wage gap by relating each to different institutional settings. Specifically, we exploit firm-level variation of the collective bargaining regime and explore its relationship with the within-firm component, i.e. the firm-specific pay differential between men and women. We choose to investigate the role of firm-specific wage setting for the gender wage gap as Card et al. (2018) document that it is an important determinant for wage inequality. Next, we study the role of various family policies, such as social spending on families, parental leave and enrolment rates of young children in pre-education facilities, to the between-firm component. We focus on family-related policies as Barth et al. (2017) suggest that the between-firm component is largely due to married workers, i.e. it occurs around family formation, while Coudin et al. (2018) show that the between-firm component is surging after women give birth to their first child. As we explain below, this component is measured - by definition - on a more aggregated level. Therefore, we determine how these family policies affect the between-firm component for the full sample and by age group.

We put an emphasis on the gender wage gap and the contribution of firm premia to it across the life cycle. Our decomposition into the within- and between-firm component is linked to three widespread explanations of the gender wage gap across the life cycle. The first explanation relates to non-pecuniary remuneration, i.e. women exchange higher-paying job for more family-friendly jobs in order to attain a career and a family. Hotz et al. (2017) provide evidence for this pattern of job changes after motherhood. Further, Lowen and Sicilian (2009) show that women receive family-friendly fringe benefits. If only non-pecuniary remuneration for women matters, then we would see a rise in the gender wage gap directly after motherhood, but it then stays constant over time. As it is related to job changes, we associate this explanation with a rise in the between-firm component around parenthood. The one-off increase can be stronger or weaker dependent on the availability of family-friendly workplaces.

The second explanation about the evolution of the gender wage gap across the life cycle relates to human capital depreciation. Angelov et al. (2016) provide evidence that women do not suffer strong immediate human capital depreciation, but wage trajectories over the lifetime differ strongly. Hence, breaks in employment around motherhood leads to a loss in human capital, which starts slowly, but accumulates over the life cycle. A similar argumentation resulting in the same pattern across life relates to losses in experience, as documented by Olivetti (2006).

Similar to non-pecuniary remuneration, we associate the depreciation of human capital to the between-firm component because it is often induced by a break and limited policies to grant job protection.

The third and final explanation relates to discrimination based on the seminal work by Becker (1957) and the subsequent literature. In this case, the gender wage exists from the start and stays unchanged over the working life. We tend to relate this explanation to the within-firm component because then women should earn less than men independent of where they are working. With the within-firm component, discrimination could also relate to differences in bargaining: Babcock et al. (2003) show that female graduate students bargain much less than their male counterparts do, and Säve-Söderbergh (2009) provides evidence that women ask for lower wages in a field experiment. Discrimination as we define it, could also relate to inefficient allocation across sectors and occupations (Blau and Kahn, 2017) or to preferences (Gelblum, 2020). The latter two explanations are associated with the between-firm component, but independent of the underlying reasons, the gender gap stays unchanged across the life cycle with this explanation.

Our decomposition results of firm premia indicate that, on average, the within-firm and between-firm component are equally important in the set of countries subject to investigation. In other words, each component is responsible for around 50% of the overall contribution of firms to the gender wage gap for the full sample. Due to the normalization of our estimated firm-fixed effects based on Card et al. (2016), the within-firm component constitutes a lower-bound estimate. Comparing the development of each component over the four waves, i.e. between 2002 and 2004, we observe a decline in the average within-firm component, but not in the between-firm component. Given the documented decline of the gender pay gap and the firms' contribution due to it in Figure 1, this finding implies that its decrease is entirely driven by the within-firm component.

Our heterogeneity analysis with respect to demographic characteristics such as age and education reveals further interesting insights. The decline of the within-component is largely shared across most demographic groups, i.e. it is independent of the level of education and affected workers across the whole life-cycle. A notable exception relates to workers with tertiary education, which we relate to the glass ceiling for women, as discussed e.g. by Christofides et al. (2013) for Europe. The between-firm component, however, varies strongly in their levels, and sometimes in their development over time, across demographic subgroups. The between-firm component rises strongly with age, and makes a jump between the first two age groups, i.e. between 20 to 29 and 30 to 39. This coincides largely with the age when women in Europe are giving birth to their first child, and this component tends to further increase at later stages in life.

Our analysis of the within-firm gender pay gap with firm observables puts an emphasis on the collective bargaining regime. We find negative correlations between the level of centralized wage bargaining and the within-firm wage gap, specifically relative to national bargaining. Two

explanations could be responsible for this. First, the decline in collective bargaining in recent decades had a larger adverse impact on men than on women. The argument is analogous to Even and Macpherson (1993), who show that the decline of unionism affected men disproportionately and contributed to the falling gender wage gap. Second, under centralized bargaining the gender wage gap rises along the distribution due to the difference between actual and negotiated wages, which is larger at the upper tail of the wage distribution, while this difference is less present with alternative collective bargaining regimes. As men are more likely to be present in this upper tail of the wage distribution due to better access to management positions, i.e. women face a glass ceiling (Antonczyk et al., 2010; Christofides et al., 2013), central wage bargaining can have an adverse impact on the within-firm wage gap relative to other wage setting regimes. As explained above, we find a strong increase in the between-firm component with age, in particular around family formation. Olivetti and Petrongolo (2017) assert that family policy tries to guarantee women to combine a career and a family. However, family policy is very complex and its effects on labor market outcomes depend on many details. Therefore, we focus on eight indicators of family policy on a national level and determine the association between these family policy indicators and the between-firm component. We pay attention to how these indicators relate to the between-firm component across different age groups in order to determine whether they impact all groups or specifically the ones after family formation. We find that expenditure on families in the form of services and child enrolment in pre-education programs leads to a decline in the between-firm component of the wage gap. Importantly, the effect only materializes after family formation and then peters out. On the other hand, and in line with previous research, we provide evidence that the length of maternity leave is associated with a higher wage gap for the same age group, while length of paternity leave tends to have the opposite effect. The paper is structured as follows: Section 2 introduces the matched employer-employee data set and explains subsample selection. Section 3 explains the estimation of the firm-fixed effects, their normalization, the decomposition in to the within- and between-firm component, and how we relate each component to institutional settings. Section 4 presents the results. Section 5 concludes.

2 A European Matched Employer-Employee Data Set

2.1 Structure of Earnings Survey

The data set is a matched employer-employee data set, implying that we observe information on both the worker and the firm. The advantage of the Structure of Earnings Survey (SES) is that it contains information on both sides of a match in the labor market for the majority of European countries.² Further, the information, in particular for earnings, which we are mainly

²It covers both member countries and candidate countries of the European Union. For a complete list, see Table A1 in Appendix A.

interested in for estimating the gender wage gap, are harmonized across all countries. The SES takes place every four years, and we use the waves from 2002 until 2014. Within a year, the majority of countries conduct the survey in the month of October because it is considered the most representative as it is least affected by absences due to annual leave or public holidays. The SES collects the data in a two-stage procedure: First, a sample of local units is drawn, and second a random sample of employees is drawn from the chosen local units. Only local units of enterprises with more than 10 employees are drawn.

Crucial to our analysis will be (log) earnings per hour, and while it is included in the survey, we conduct two main changes to it. First, earnings in the SES are measured in domestic currency. In order to obtain comparable estimates (and hence firm-fixed effects) across countries, we measure earnings in Euro and apply the average exchange rate in the respective year of the month of October available from the European Central Bank. Further, we also account for inflation and measure hourly wages in their 2014 values with inflation data from Eurostat. This also serves the comparability of the estimates, in particular of the wage equation, over time. Second, we incorporate annual bonuses in the earnings per hour as they constitute a rising fraction of remuneration, especially in high-paying jobs.

The SES also provides information on companies, specifically on firm size, the level of collective bargaining agreement and the form of economic control. With respect to firm size, we aggregate the information into three different categories in order to guarantee comparability across countries and years. The first category contains enterprises between 10 and 49 employees, the second category encompasses firms employing between 50 and 249 employees, and the third and last categories includes firms with more than 250 employees. The collective bargaining agreement is measured in seven categories, ranging from national level agreements to no agreement at all. Intermediate steps include industry-specific or firm-specific collective bargaining agreements. The form of economic control differentiates between private and public.

On the worker side, we explicitly use information on sex, age and education levels provided by the SES. One drawback of the SES is that both age and education are grouped into categories instead of providing detailed information, namely age into five and education into three categories.³ The five age bands span from 20-29, 30-39, 40-49, 50 to 59, and 60 to 64. With respect to education, we differentiate between primary, secondary and tertiary education. We use the education and age categories for the estimation of firm premia and differentiate between the groups of each variable in our decomposition. For the former, i.e. the estimation of firm premia, we also exploit information on tenure as this is the closest variable to experience in our data set.

³Technically, the SES includes more information on education for some countries in some survey years, but we group them into three groups for comparability across survey years.

2.2 Subsample Selection

From the overall sample, we restrict our sample for the subsequent analysis. First, we exclude non-market services such as health and education. This leaves us with eight sectors which cover the whole economy, ranging from manufacturing and construction to various service sectors. Second, we drop skilled agricultural workers as the SES also does not include information on the agricultural sector. These workers are likely employed by other firms for upkeeping firm premises. Third, we omit workers below the age of 20 as countries differ slightly on the age of the lower-bound of the age band. Further, we do not believe that this age band contains valuable information on firm premia and their impact on the gender wage gap, most employees are likely to still be in education or vocational training. Last, we exclude outliers in the hourly wage distribution, i.e. we drop the lowest and the highest percentile for each country and year. Now, we turn to the necessary data requirements for the estimation of the gender-specific firm premia. Their estimation then allows us to compute the firms' contribution to the gender wage gap and to conduct both the decomposition and subsequent analysis of the premia, the within-firm and between-firm gender wage gap. The main requirement to obtain the firm-fixed effect for each gender is to observe firms which employ at least one man and one woman. To be precise, we need to see at least one man and one woman working for the same employer in the data. We might observe only employees of one sex in a firm, especially if it is small, as the employees in the SES are randomly sampled in the second stage of the sampling design explained above. In other words, the presence of single-gender firms constitutes a problem for assessing the role of firm premia in the gender wage gap, since we cannot observe the wages that would be paid to the opposite gender in a single-gender firm.

In our baseline analysis, i.e. the estimation of firm-fixed effects, decomposition and analysis of the firm premia, we use firms where we observe at least one man and one woman. This choice maximizes the number of firms we include in our sample. However, the main threat to properly estimate the firm-fixed effects, which we use in the decomposition and the subsequent analysis, is that it may include worker-specific unobservables instead of the firm premium. In order to mitigate this threat to precisely estimating firm premia, we conduct the same analysis with a subsample, where we require to observe at least five men and five women per firm. Clearly, this choice comes at the expense of the number of firms, in particular small firms.

Tables A2 to A5 in Appendix A show how employer-related variables change for the years 2002 to 2014 with the different requirement to observing a minimum amount of employees of each sex. Column (1) always shows the sample statistics without the requirement to observe at least one employee of each gender, but includes the sample restrictions mentioned above, while columns (2) and (3) require to observe at least 1 and 5 employees of each gender, respectively. The composition of firm size exhibits the most pronounced change over the three samples and it holds in all years to a more or less strong degree. Specifically, small firms with 10 to 49 employees fall out of the baseline sample, i.e. when we require to observe at least one male

and one female employee. For example in 2002, small firms make up nearly 47% of total firms in the data set without any restrictions, it drops to close to 45% for the baseline sample, and to nearly 28% when requiring to observe at least five employees of each sex. This in turns implies that the share of medium-sized and large firms - i.e. enterprises employing between 50 and 249 workers, and more than 250 workers, respectively - increases with these samples. On average, the share of firms under public controls rises with data requirements.

Further changes in firm-related observables with data requirements affect the sector of economic activity and the level of collective bargaining. The largest three sectors in all years are manufacturing, wholesale and retail, and real estate and business activities. When comparing the shares over the years, manufacturing shows a continuous decline over the years as shown in previous research, whereas the real estate and business activities rises and even overtakes manufacturing in 2010.⁴ With the data restrictions, especially the share of manufacturing rises, whereas the shares of both construction and wholesale and retail fall. This is probably related strongly to the previously mentioned change in firm size, as firms in the sectors with falling shares are typically small. With respect to the level of collective bargaining, there is no clear-cut pattern over all years. In some years, the share of firms operating under national agreements rises, whereas it falls for firms without any collective bargaining agreements. A similar movement can be observed for industry and enterprise agreements. However, in some years the data requirements lead to changes in the opposite direction, hence there is no regular pattern with respect to collective bargaining dependent on sample selection.

The data requirements do not only lead to changing firm characteristics, but they also imply changes in employee-related observables. Tables A6 to A9 in Appendix A present these changes. In the tables, we differentiate between male and female employees, similar to Card et al. (2016) and Coudin et al. (2018). Specifically, the tables present changes in log hourly wage, share of each education and age group, the share of each occupation at the ISCO one-digit level, and the shares of both part-time workers and temporary contracts. The share of age groups, does not change significantly with the data requirements, neither for men nor for women in any survey year. Similarly, the share of occupations also exhibits hardly differences over the different samples in any given year. This is interesting given that the share of sectors of activity changes as described above. It indicates that workers of all broad occupations are necessary in broad sectors of activity. Further, part-time and temporary work do not change much due to data requirements.

The main adjustments of employee-specific observables relate to education and hourly wage. With respect to education, the more demanding the data requirements, the stronger the fall in workers with primary education. Simultaneously the share of workers with secondary and tertiary education the in every survey year, and this holds especially for the latter with stronger data requirements. This is in line with the observation, e.g. Oi and Idson (1999), that large firms

⁴Real estate and business activities is a very broad sector in NACE Rev.1, and actually constitutes the sector which is most split up with in the NACE Rev.2 classification with three sectors therein.

employ more educated workers. These changes in educational composition of the samples can also explain the rise of (log) hourly wage observed when making the data requirements.⁵ However, it is important for our analysis that these changes both genders equally, which is the case in all survey years.

Taking into consideration the changes described above, we use the data set with one employee of each sex in our baseline analysis. We do so because its differences to the full sample are typically smaller than for the sample with five employees of each sex. This choice comes at the expense of not estimating the true firm premia for small firms, and thus misreporting the gender wage gap in these firms. This holds true if the residuals in our wage equation also captures worker-specific unobservables. To encounter this threat, we also conduct the whole analysis with the subsample which only includes at least five male and female employees in a sensitivity analysis. The baseline sample includes 582,340 firms with more than 19.2 million employees across all four survey waves, whereas the subsample for the robustness analysis consists of 193,286 enterprises with more than 15.3 million workers.

3 Methodology

This section presents every step of the estimations in detail using the matched employer-employee data set described previously. Generally, we care about the firms' contribution to the gender wage gap. Overall, there is growing evidence of the firm's role in overall inequality as argued by Song et al. (2019). Further, two recent single-country studies suggest firm premia play a role for pay differentials between men and women. Card et al. (2016) are the first to compute the firm's contribution to the gender wage gap based on firm pay differentials and to decompose it using employer-employee matched data for Portugal. Coudin et al. (2018) conduct the same analysis for France, and relate observed gaps to firm-specific components over the life-cycle.

We first explain how we estimate the firm-fixed effects. We conduct the estimation of firm premia in two steps because we assume gender-neutral returns to observables such as education, age and tenure. The next step comprises the decomposition of the gender wage gap into a between- and within-firm component following Card et al. (2016). We will conduct this exercise for the baseline sample and for various subgroups based on education and age. After the decomposition, we present a regression framework, which allows us to link firm observables and workforce composition to both the average firm premium and the within-firm gender wage gap. Finally, we estimate correlations between various indicators relating to family policy and the between-firm gender pay gap.

⁵One exception is for the survey in 2006, where (log) hourly wages are nearly unchanged, and even drop slightly. The same holds for the share of workers with tertiary education.

3.1 Discussion

Adequately estimating the firm wage premia is still an unsolved problem of the field, with several competing approaches. The seminal paper is, of course, Abowd et al. (1999), which introduced the multi-way fixed effects estimation. The authors included worker and firm fixed effects in a regression framework, capturing both the firm wage premia and the unobserved earnings characteristics of workers. A frequent criticism of this approach is that the worker fixed effects are identified by job-to-job mobility of workers. Frequent movers are likely to be different inherently than workers with low job mobility, thus the estimates will suffer from “limited mobility bias” (a version of the incidental parameter problem). This may explain why unobserved worker characteristics and firm wage premia is correlated negatively with this approach, e.g. Andrews et al. (2008). Borovičková and Shimer (2017) explicitly addresses this problem by comparing the workers’ average residual wage (over the job spells in other firms) with the average wage of co-workers in the firm (leaving the worker herself out of the calculation).

Bonhomme et al. (2017) address the limited mobility bias by grouping firms together, thus generating “artificial” mobility to identify the model. Simulations have shown the advantages of this approach (Bonhomme et al., 2020). Barth et al. (2016) suggest another approach, the authors examine the role of establishments play in wage inequalities with a decomposition and for to this end they augment the human capital equation with an establishment fixed effects, effectively assuming that the workers variables capture all of the relevant worker characteristics. This approach demands less of the data, though it might overestimate the importance of firms, attributing some of the unobserved worker heterogeneity to firms. This approach has been effectively applied to the question of gender wage gap by Hara (2018). We will also rely on Barth et al. (2016), mainly because of data constraints. The SES is a pooled cross section, hence there is no possibility for us to control for worker unobservable characteristics.

We compare the estimated gender wage gap and its components for the decomposition method based on Card et al. (2016) with the estimation method using firm-fixed effects similar to Barth et al. (2016) and Hara (2018). Figure B1 in Appendix B shows that the residual gender wage gaps for all countries and years is essentially equivalent. The pattern is slightly more diluted than for the total gender wage gap, but both the within-firm components and the between-firm component take on very similar values and no obvious bias is visible from the data. Figure B2 compares the components of the gender wage gap across methods.

3.2 Estimating firm fixed effects

Our goal is to understand the role of firms for the gender wage gap, hence we abstract from employee-specific characters. Therefore, the first step is to estimate the firm fixed effects in a two-step procedure like Card et al. (2016) but for a different reason. The main reason is our assumption that returns to observables are equal across genders, whereas the authors as-

sume gender-specific returns to observables based on an Oaxaca-Blinder decomposition. However, we are not interested in differences in returns to observables, and as Weichselbaumer and Winter-Ebmer (2005) show, the results of both estimations are equivalent. Hence, in the first step we determine the residual wage for every worker, i.e. the wage component which cannot be explained by observable worker characteristics. As we assume gender-neutral returns to observables we include all observations of both men and women in our baseline sample with at least one worker per gender as presented in Tables A6 to A9.

We focus on differences in the “residual wage gap”, i.e. the component of wages, which cannot be explained by observable characteristics of employees. To do so, in a first step, we estimate a standard wage equation including worker-level characteristics. The vector of employee observables includes age (5 groups), education (3 groups), tenure and tenure squared. We estimate this wage equation separately by country and year as the returns to observable characteristic may differ across space and time. The wage equation takes on the following form:

$$\log w_{ict} = \alpha_0 + \mathbf{X}'\Theta_{ct} + \varepsilon_{ict}, \quad (1)$$

where w_{ict} represents the log hourly wage per worker i in country c in survey year t . It is explained by the vector \mathbf{X}' encompassing worker characteristics as described above. The residual ε_{ict} contains the unobservable wage component, which we are interested in to compute and decompose the gender pay gap. The equation also includes a constant α_0 . Observations are weighted by their sample weights provided by the SES.

In the second step, we explain the residual wage component with firm-fixed effects for each gender separately. At this point, the assumption of exploiting only firms with at least one woman and one man turns out to be crucial. Technically, we could estimate a firm-fixed effect for single-gender firms, but we cannot use them in the subsequent decomposition and analysis because we cannot observe the firm premium of the opposite gender in a single-gender firm. Hence, we estimate the following equation for men and women separately using the baseline sample, and by country and year as before:

$$\widehat{\varepsilon}_{ict}^G = \Psi_{0ct}^G + \Psi_{jct}^G + \mu_{ict}^G, \quad \text{where } G = \{M, F\} \quad (2)$$

where a firm-fixed effect (Ψ_{jct}^G) of firm j and a constant (Ψ_{0ct}^G) in country c at time t , both gender-specific due to the sample split, explain the residual wages of males (M) and females (F). The difference between the expected values of the gender-specific firm-fixed effects (plus the gender-specific constant) is equal to the unobservable gender wage gap observed in the data.

3.2.1 Normalization

Similar to Card et al. (2016) and Coudin et al. (2018) we also normalize our gender-specific firm-fixed effects because the wage premia are only identified relative to a reference firm. How-

ever, we do not possess data on firm characteristics outside the ones provided by the SES such as value added per worker or similar information regarding productivity and hence wage surpluses. For our baseline decomposition and estimations, we therefore use the hourly wages in the data for normalization. Implicitly, we assume that the lowest-paying firms also pay the lowest surpluses to their employees. To define a set of firms serving as a benchmark to normalize the firm-fixed effects, we exploit the definition of “low-pay” by the OECD. Low-pay indicates that a worker earns less than two-thirds of the median wage. We select a firm to pay no wage surpluses if the average payment to all employees is below two-thirds of the median wage in a given country in a given year. In a robustness analysis, we use all firms in the hotel and restaurant sector to serve as normalization. This decision is based on Card et al. (2016) and references therein.

3.3 Decomposition

Following Card et al. (2015), we decompose the firm-specific pay differentials into within- and between-firm components. We differ in the naming of the components, i.e. we call their bargaining and sorting effects the within-firm and between-firm component, respectively. Here, equation (2) provides the framework for a decomposition of the firm wage premiums based on Oaxaca (1973) and Fortin et al. (2011). This allows us to decompose the male and female firm-fixed effects into a combination of between- and within-firm component for every country in every survey year separately:

$$E[\psi_{jct}^M | male] - E[\psi_{jct}^F | female] = E[\psi_{jct}^M - \psi_{jct}^F | male] + E[\psi_{jct}^F | male] - E[\psi_{jct}^F | female] \quad (3)$$

$$= E[\psi_{jct}^M - \psi_{jct}^F | female] + E[\psi_{jct}^M | male] - E[\psi_{jct}^M | female], \quad (4)$$

where both equations (3) and (4) only differ in both their fixed effects and distribution by gender. In both equations, the first term equals the within-firm component, and the second term equals the between-component of the gender wage gap. In particular, the within-firm component reflects the average difference between men and women if they were working in equal proportions in the same firm. In equation (3) this effect is calculated across the distribution of jobs held by men, while it is the distribution of jobs held by women in equation (4). The between-firm component denotes differences in the average wage of women in equation (3) and of men in equation (4) attributable to differences in the distribution of men and women across firms, assuming they earn identical wages within firms.

It is important to note how normalization of firm premia affects both the within- and between-firm component. The former changes with normalization, while the latter is independent of any normalization. This is because - in order to calculate the latter - the decomposition method

uses the firm effects of only one gender, hence the normalization (with the same base) has no impact. On the other hand, to compute the within-firm component the method exploits the firm effects of both men and women, and hence normalization of each gender-specific firm effect matters. However, as Card et al. (2016) show, if the average of the firm-fixed effects for the female sample is smaller than for the male sample, then the within-firm component we obtain from our decomposition is an underestimate. Table C1 shows that this condition is met in all cases except two.⁶ Without normalization of the firm-fixed effects, our within-firm component of the gender wage gap would be “inflated”. In particular, they would be equal to the difference between the residual wage gap and the between-firm component.

The decomposition method of Card et al. (2016) has the great advantage that we can measure gender wage gaps conditional on worker characteristics within a firm. With other methodologies, such as a shift-share analysis or following Barth et al. (2016), we could measure the within-firm component only on the national level. The former also allows to exploit the female versus the male distribution and thus allowing a higher comparability compared to the baseline decomposition, while the latter exploits the joint distribution of men and women.

3.4 Estimation strategy

We explain how we work with our estimates of both the within- and between-firm components. For the former we possess information on the firm-level and can link these to firm observables similar to Coudin et al. (2018). To be precise, we exploit the estimated firm premia (after normalization) and investigate how firm observables influence both the level of firm premia and the within-firm gender pay gap. The latter, by definition, is not available on the firm-level, therefore we resort to simple cross-country regressions using family policy indicators. We want to emphasize that we do not claim any causality for any of these estimates, we are showing (conditional) correlations of each component with potential factors influencing them. Specifically, we focus on institutional settings.

3.4.1 *Within firms*

Investigating factors impacting the within-firm gender wage gap, we directly use the gender-specific firm-fixed effects we estimated for men and women in equation (2). Specifically, we construct the difference firm-fixed effects between the male and female sample. One might think that we possess two different types of within-firm gender wage gaps based on equations (3) and (4), but this is because we evaluate them at the national distribution of men and women separately. On the firm level, there is no scope for doing so.

In the first step of the estimation strategy, we investigate how the firm-level differences in gender-specific fixed effects are related to other observable firm characteristics available or

⁶Specifically, these two cases are Hungary in 2002 and Sweden in 2010. When exploiting firms in the hotel and restaurant sector, there are also two exceptions.

computable from data in the SES. We conduct the same analysis exercise as Coudin et al. (2018, Table 8) and regress the within firm gender gap in firm-fixed effects on a vector firm observables. In particular, the observables we consider are collective bargaining, firm size, type of control, share of men, share of workers below low-pay, share of part-time workers, shares of various occupations and the share of female in the same occupations. In a regression framework, we are controlling for country-, time- and sector-fixed effects because we are not estimating this equation by country and year as we did with the wage regression and the estimation of firm-fixed effects above. The regression equation for the within-firm gender wage gap takes on the following forms:

$$\Psi_{jct}^M - \Psi_{jct}^F = \mathbf{Y}'_{jct} \Phi + \gamma_c + \gamma_t + \gamma_s + \zeta_j^M \quad (5)$$

where the left-hand sides reflects the difference in normalized gender-specific fixed effects for firm j in country c at time t . As argued above, we obtain the gender-specific firm premia from equation (2). The vector \mathbf{Y}'_j contains observed and computed firm-level characteristics described previously in this subsection. We include a battery of fixed-effects in order to account for unobserved heterogeneity across time (γ_t), space (γ_c) and sector of activity (γ_s). Observations are weighted with the firm sample weights provided by the SES.

3.4.2 Between firms

The main concern with the between-firms component in a regression design is that we cannot measure it on the firm level. While an analysis on the sector or occupation level would be preferable, we would require information on job amenities in these sectors or occupations. Due to the lack of these information, we will estimate correlations exploiting variation across time and countries. The aggregation also implies that we can exploit both between-firm components based on equations (3) and (4). Due to the low number of observations on this level of aggregation, we will only include one indicator at a time. While we put no emphasis on the absolute size of the correlations, we will investigate the signs.

The regression of the between-firm component takes on the form:

$$Between_{ct}^G = \omega^G FamPolicy_{ct} + \gamma_t + \xi_{ct}^G \quad \text{where } G = \{M, F\} \quad (6)$$

where the left-hand side reflects the between-firm component using the difference of either male or female effects of the gender wage gap in country c and year t . We regress the between-firm component on various indicators of family policy from the OECD data base relating to social spending, length of parental leave and enrolment rates. We include a year-fixed effect, hence our identification relies on within-period variation. We do not include country-fixed effects because of the limited sample and the large degree of variation they eliminate.

We estimate equation (6) for the full sample and by age group because we assume that family

policy differs in their impact depending on family formation. As argued previously, the average woman in Europe gives birth to her first child at the age of 29, so we pay particular attention to the differences in the point estimates of ω^G between the age groups of 20 to 29 and 30 to 39. We also investigate all other categories of age in order to see whether the impact of family policy remains stable across age groups or potentially peters off. One issue with the estimates for older generations, in particular for the last two, i.e. from 50 to 59 and 60 to 65, is that the contemporaneous family policy probably differs from the family policy around the time of family formation of the older generation in the sample.

4 Results

We now discuss the findings based on the methodology outlined previously between 2002 and 2014 from the SES. We briefly outline the influence of observables on hourly wages and we document how firm observables such as collective bargaining regime, firm size, type of control and workforce composition variables with firm premia to lend credibility to our estimates. Then, we turn to our first main exercise, namely the decomposition of the firm-specific pay differential between men and women. We break down the firms' contribution to the gender wage gap into its within- and between-firm component and document changes over time for the full sample and various subgroups. Specifically, we differentiate by age to investigate change of both components over the life-cycle, and by education to see whether the overall decline in the wage gap is shared across all groups. Our second main exercise relate different institutional settings with each component. We link wage setting institutions on the firm level to the within-firm gender wage gap, and we explore the impact of family policies on the between-firm component on the country level. We put a special focus on differences across age groups for family policy.

4.1 Mincer equation

The first step is to determine residual wages by regressing log hourly wages on observable worker characteristics shown in equation (1). One drawback of the SES is the coarse and limited information on these characteristics, i.e. age and education are categorical variables and hence point estimates for both observables are relative to a baseline category. For the former, this is the age group from 20 to 29, and for the latter these are workers with primary education. We estimate the regression equation for every country and every year individually to account for variation in returns to all observables. We then compute the mean of the estimation parameters by year to show how they change (on average) over time.

Table 1 shows the mean coefficients for the four different waves. Relative to the baseline category for education, i.e. primary education, the average returns to secondary and tertiary education are falling over time. However, the decline in average returns to secondary education in percentage points is substantially stronger compared to tertiary education, namely 14% to

8.3%. This observation is likely due to the observed polarization of labor markets across Europe shown by Goos et al. (2014).⁷ The returns to age relative to the baseline category are moving in opposite directions. For example, returns to the age group 30-39 are largely unchanged across the four waves of the survey, while the returns to other age groups tend to fall. One notable exception is the significant rise in average returns to being 30 to 39 between 2010 and 2014. Overall, the life cycle pattern established in the literature, specifically an inverse U-shaped pattern, is visible across all four survey years in the returns to age groups.

Table 1: Returns to worker characteristics for subsample of firms with at least 1 employee of each gender

	(1)	(2)	(3)	(4)
	2002	2006	2010	2014
Secondary education	0.178	0.167	0.163	0.160
Tertiary education	0.612	0.590	0.604	0.574
Age 30-39	0.132	0.126	0.125	0.133
Age 40-49	0.154	0.137	0.135	0.159
Age 50-59	0.153	0.144	0.116	0.133
Age 60-65	0.131	0.125	0.112	0.109
Tenure	0.031	0.033	0.028	0.024
Tenure ²	-0.001	-0.001	-0.000	-0.000
Constant	1.779	1.820	2.000	1.630

Notes: The table shows the means obtained from the Mincer wage regression in equation 1 for all years. The average returns to each characteristics is based on the country-specific estimations as every country might exhibit different returns to worker characteristics. Primary education and age group 20 to 29 constitute the reference group for each. Tenure is a continuous variable. The sample on which we estimate the returns to worker characteristics includes one men and women per firm. A large majority of the country-specific estimates are statistically significant on conventional levels.

Equipped with the residual wages, i.e. the wages that cannot be explained by the observables included in Table 1, we determine gender-specific firm premia. To do so, we regress the residuals on firm-fixed effects for the samples including either only male or female workers. We then normalize the fixed effects by firms, where the average wage is below paying the definition of low-pay by the OECD, i.e. below two-thirds of the median pay, in a given country and year. As argued above, this normalization leads to a lower-bound estimate of the within-firm component, while the between-firm component is completely unaffected by normalization. The next step comprises of the decomposition of the normalized fixed effects into their within- and between-firm components. We obtain lower-bound estimates of the within-firm component because the fixed effects for women are lower in the firms paying below low-pay than those for men.

⁷While the authors focus on employment polarization, other studies, e.g. David and Dorn (2013) have shown that polarization also occurs in terms of wages in the United States.

4.2 Firm Premia and Firm Characteristics

The credibility of our estimated firm premia (after normalization) is crucial to our decomposition. Therefore, we now turn to the analysis of the estimated firm-fixed effects, and relate them to firm observables. The analysis is very similar to the one of the within-firm pay differential in premia as described above, and presented in equation (5). Instead of the within-firm wage gap on the left-hand side of the estimation equation, we have the weighted average firm premia. We weigh the firm premia by employment shares of men and women, i.e. we account for differences in workforce gender composition across firms. Due to the requirement to observe at least one employee of each gender, the weighted firm premia do not differ strongly from the unweighted firm premia. In fact, for the full sample including all years and countries, the correlation of weighted and unweighted firm premia exceeds .97.

Table 2 shows the results from the regressions, both for all years combined as well as for each year individually. Similar to the analysis for the within-firm wage gap below, we include the level of collective bargaining, firm size, type of control and workforce composition variables. Starting with the degree of centralization in the wage bargaining process, we remark that the national level serves as a benchmark for the other levels of pay agreement. The point estimates for most categories are positive and statistically significant and tend to rise for all over the waves of the SES. In fact, in 2002 the point estimates for all categories were negative and except for two cases statistically significant. This common trend seems to indicate a decrease of average firm premia over time for firms under a national collective bargaining regime. The question we cannot answer here how much is due to overall decrease in the centralization of collective bargaining and whether firms actively self-selected into less centralized bargaining regimes.

In line with findings established in the literature is that larger firms pay higher wages, our results indicate that larger firms pay higher premia relative to firms with less than 50 employees. However, these firm premia are declining over time, in particular for mid-sized firms with 50 to 249 employees, and to a lesser extent for very large firms with more than 250 employees. For the latter, there is rise in firm premia in the 2010 survey, which can be due to the Great Financial Recession. Overall, this decline in the large firm premium is consistent with the results by Bloom et al. (2018), who show a decline in the large-firm wage premium for the United States. Firm premia in privately controlled firms are larger relative to firms under public control. Balcik et al. (2010) argue that public companies also have non-monetary performance requirements, hence the finding of lower wage premia are not surprising and in line with previous literature. Last, we investigate the relationship between weighted firm wage premia with workforce composition variables based on Coudin et al. (2018). Most importantly, the share of managers is positively associated with firm premia, while the share of employees earning below low-pay is negatively associated. This in line with the authors' findings for France, albeit our coefficients are much smaller. Importantly, the coefficients are very stable across all five specifications. All

Table 2: Average Firm Premia

	(1)	(2)	(3)	(4)	(5)
	All years	2002	2006	2010	2014
<i>Pay Agreement</i>					
Industry Agreement	0.069*** (0.000)	-0.013*** (0.008)	0.003 (0.478)	0.018*** (0.000)	0.083*** (0.000)
Region-Industry Agreement	0.068*** (0.000)	-0.028*** (0.000)	-0.001 (0.845)	-0.048*** (0.000)	0.097*** (0.000)
Enterprise agreement	0.063*** (0.000)	0.023*** (0.000)	0.004 (0.397)	0.041*** (0.000)	0.055*** (0.000)
Local Unit Agreement	0.039*** (0.000)	-0.032** (0.021)	-0.021*** (0.000)	-0.015 (0.255)	0.013 (0.557)
Other agreement	0.017*** (0.001)	-0.015** (0.042)	-0.058*** (0.000)	0.005 (0.618)	0.062*** (0.001)
No agreement	0.102*** (0.000)	-0.003 (0.482)	0.033*** (0.000)	0.060*** (0.000)	0.064*** (0.000)
<i>Firm Size</i>					
50-249 Employees	0.020*** (0.000)	0.043*** (0.000)	0.039*** (0.000)	0.022*** (0.000)	0.030*** (0.000)
250+ Employees	0.026*** (0.000)	0.048*** (0.000)	0.037*** (0.000)	0.050*** (0.000)	0.033*** (0.000)
<i>Control</i>					
Private	0.083*** (0.000)	0.022*** (0.000)	0.031*** (0.000)	0.086*** (0.000)	0.087*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
White Collars (%)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Clerks (%)	0.000*** (0.000)	0.000*** (0.000)	-0.000 (0.213)	0.000*** (0.000)	0.000*** (0.000)
Female among Executives (%)	-0.000*** (0.000)	0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Female among White Collars (%)	-0.000*** (0.000)	-0.000*** (0.001)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Female among Clerks (%)	0.000*** (0.000)	-0.000 (0.554)	0.000*** (0.000)	0.000 (0.192)	0.000*** (0.000)
Female among Blue Collars (%)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Low Pay Earners (%)	-0.006*** (0.000)	-0.005*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)
Low Pay Earners (%F-%M)	-0.000*** (0.000)	-0.000*** (0.001)	0.000 (0.504)	-0.000*** (0.000)	-0.000*** (0.000)
Observations	413035	70918	118750	95955	127412
R ²	0.55	0.47	0.48	0.59	0.55

Notes: The dependent variable is the average firm premia (weighted by employment shares) based on estimated firm-fixed effects for each gender. The firm premia are normalized by low-pay firms. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

other workforce composition variables, including shares of occupational groups, are all essentially equal to zero.

4.3 Decomposition

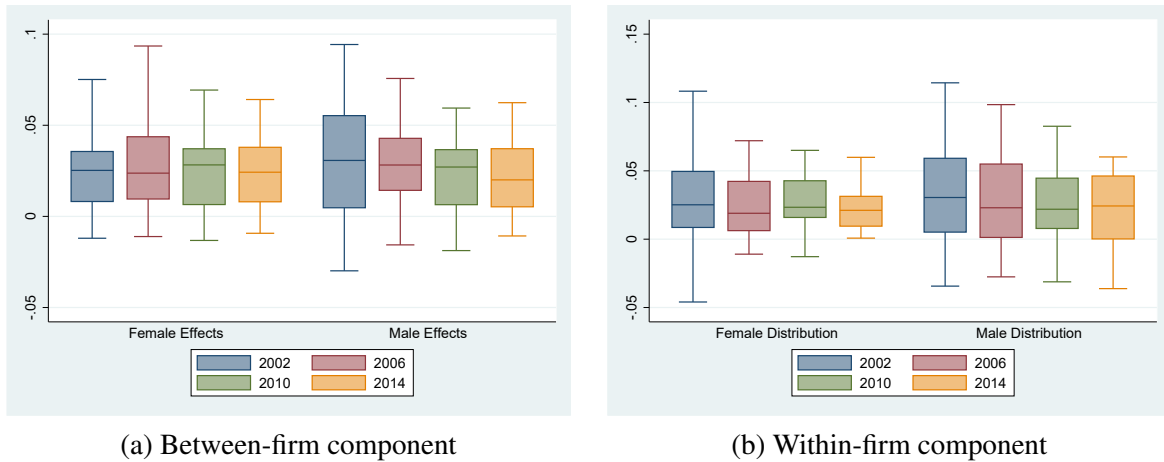
We decompose the gender pay differential based on the methodology by Card et al. (2016) using firm premia into a within- and between-firm component. The main focus of this section is to investigate how both the within- and between-firm components change over the four different waves of the SES, i.e. between 2002 and 2014. We pay attention to differences across subgroups, in particular with respect to age and education. The former is particularly important to assess which components matters for the life cycle pattern of the gender wage gap. We will make use of box plots to show how the components differ across the survey years, but for a clearer analysis of the components over the life-cycle, we make use of the latest survey to our availability in 2014 and examine how the components change across the life cycle.

4.3.1 Full sample

In Figure 1 we already outline that both the residual wage gap and the firms' contribution to it are falling. The naturally occurring question is now to determine which component is responsible for the decline, or whether both contributed to it between 2002 and 2014. Figure 2 shows the box plots of how the two components change over time. The left panel shows the between-firm component using either female or male effects, while the right panel shows the within-firm component using either the female or male distribution. Whenever discussing the components, it is important to keep in mind equations (3) and (4). The equations indicate that the sum of the between-firm component using female effects and the within-firm component using the male distribution is equal to the firms' contribution to the gender wage gap, which is also equivalent to the between-firm component using male effects and the within-firm component using the female distribution.

Figure 2 gives two important insights as to why the decomposition of the firms' contribution to the gender wage gap matters. First, it shows the importance of each component to the firms' contribution to the gender wage gap. Both components are nearly equally important over all years, independent of whether we consider male or female effects for the between-component, or female and male distributions for the within-component. Second, the between-firm component with female effects is largely unchanged, while there is a modest decline when computed with male effects. On the other hand, the within-firm component declines for both components, albeit it is stronger for the male distribution. As Card et al. (2016) argue, if the within-firm component using the female distribution is larger than when using the male distribution, this indicates that men are more concentrated where the gap in firm premia is smaller. Hence, our results indicate that men are increasingly concentrated in firms with low pay premium gaps. Our results resemble those of single-country studies, i.e. for Portugal and France, for which

Figure 2: Contribution of Components



The box plots show the absolute contribution of each component to the gender wage gap due to differential firm premia by gender for every year the SES was conducted. The left panel shows the between-firm component, estimated with either female or male effects. The right panel presents the within-firm component, estimated with either the female or male distribution. The results by country are shown in Columns (4) to (7) in Tables C2 to C5. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

Card et al. (2016) and Coudin et al. (2018), respectively. The former look at the period 2002 to 2009, while the latter consider the period 1995 to 2014. In both countries, the respective authors find that the between-firm component, i.e. in their words the sorting channel, is more important than the within-firm component. Our findings replicate the differential importance for the components in both countries. Further, taking the averages for Portugal from 2002, 2006 and 2010, our results equal those of Card et al. (2016) quite closely also in magnitude. Comparing our findings for France with those of Coudin et al. (2018), the within-firm component is negative in the single-country study, our results are only negative when using the female distribution. However, exploiting this distribution the within-component is larger in magnitude than with the male distribution.⁸

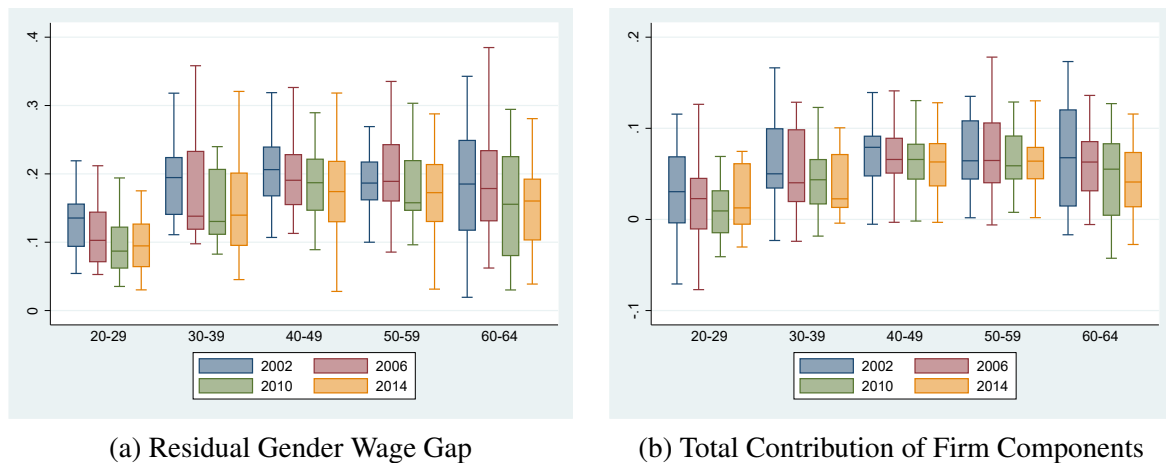
The box plots in the previous figure hide a lot of cross-country heterogeneity, especially with respect to changes over time. Tables C2 to C5 in Appendix D provide a better overview. Examples for opposite movements for the between-firm component are Italy, Slovak Republic, and the Netherlands and Norway. While the former two experience declines in both between-firm components, the latter two see a rise in the same component. Overall, as argued above, these country-specific changes seem to cancel each other out, especially when exploiting female effects. While the average within-firm component of the gender pay gap declines over time, the box plots also hide substantial heterogeneity here. For example, between 2002 and 2014 this component falls in Belgium, Spain and Sweden, but increases in Germany, France and Portugal.

⁸We use the results for 2005-2014 in Table 9 in Coudin et al. (2018) because this time horizon coincides more with ours.

4.3.2 Age

We now turn the analysis of subgroups, starting with age. It is established in the literature, e.g. Blundell et al. (2016), Kleven et al. (2019a) and Kleven et al. (2019b), that the overall wage gap is rising with age, which is particularly linked to the incidence of motherhood. While we do not have any information on family status or parenthood, the average age of women giving birth to their first child is around 30 in many European countries.⁹ Luckily, the SES contains a break between two age groups at the same age, which we will tentatively exploit as the start of parenthood in our sample. We are aware that we do not get specific results with respect to motherhood, but it allows us to look how the different components change over the life cycle and how motherhood likely affects each of them.

Figure 3: Evolution of Firm's Contribution to the Gender Wage Gap by Age



This figure shows the residual wage gap and the firms' contribution to the gender pay gap for five different age groups and across all waves of the SES. The results are based on the analysis explained in Section 3 for each age group. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

In line with the previous literature, the left panel of Figure 3 shows the well-known life-cycle dimension of the gender wage gap, namely an inverse U-shape. The sharpest increase, however, occurs between the age categories 20 to 29 and 30 to 39, which we associate with to motherhood. Further, the level of the residual wage gap has declined between 2002 and 2014 across all age groups, indicating that the progress in declining wage gaps has been shared across all age groups. One exception is the group of 40 to 49, where the gender wage gap has hardly changed over time. The right panel shows the contribution of firms to the gender wage gap by age group across the four waves of the SES. Both Card et al. (2016) and Coudin et al. (2018) find an increase in the contribution of firms over the life cycle in absolute terms, which we confirm on a European level. The jump between the first two age categories is also visible in this panel, and the subsequent age groups only recover weakly in terms of the firm's contribution.

⁹In 2016, the European average was 29.

In other words, the inverse U-shape as in the left panel is much weaker in the right panel, in particular the decline at later stage of the working life. This indicates a “scarring” effect of motherhood and that firms drive it overproportionally.

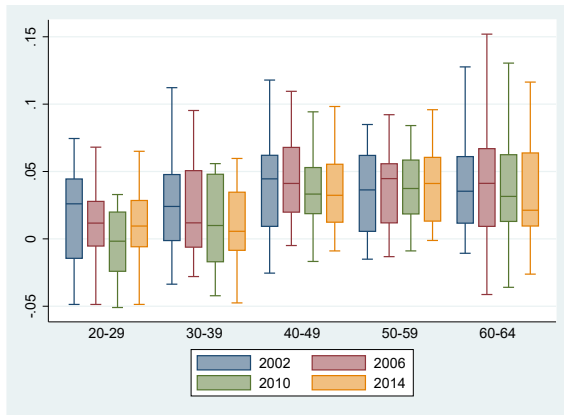
Figure 4 shows the evolution of both components with the analogous box plots as for the full sample. Based on equations (3) and (4), each panel depicts the components dependent on their way of computation. The upper two panels of the figure present the between-firm component, while the lower two panels depict the corresponding within-firm component. The upper two panels indicate a decline of the between-firm component between 2002 and 2014 for the youngest or youngest two age groups, depending on whether the component is calculated using female or male effects, respectively. This decline at the early stages of the working life can be explained with a reduction in discrimination of women when entering the labor market. Potentially, this can also be explained by changing initial preferences of women in terms of majors and occupational choice as Gelblum (2020) and Bertrand (2020) highlight.

The between-firm component does not change substantially in later stages of the life cycle. Instead, the jump between the age groups 30-39 and 40-49 for the between-firm component using male effects and between the age groups 20-29 and 30-39 when using female effects tends to increase over time. This jump in the gender wage gap and the between-firm component, regardless of its timing, aligns with our explanation of non-pecuniary remuneration. In other words, women’s preferences for job amenities change due to motherhood, and work in firms providing other advantages and accept wage cuts for these advantages. For example, Lowen and Sicilian (2009) provide evidence that women receive family-friendly fringe benefits. And Felfe (2012) shows that women in Germany adjust along various dimensions when having children, such as hours, work schedule and even level of stress.

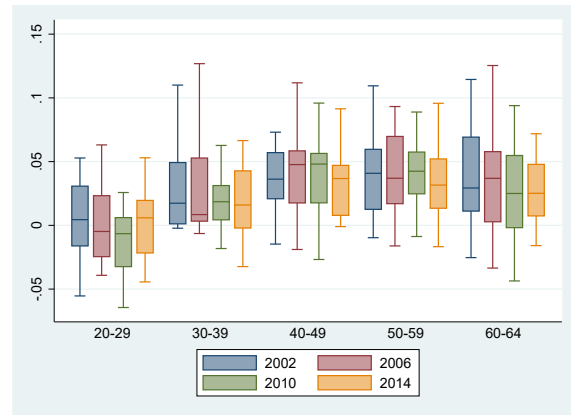
Depending on whether exploiting the male or female distribution, the within-firm component changes its form across the life-cycle slightly. With the female distribution shown in panel (c), it takes on the standard life-cycle form seen before and established in the literature, namely an inverse U-shape. However, the form is not very pronounced when taking into consideration only one survey wave at a time. On the other hand, when using the male distribution, the within-firm component is flat across all age groups in a given survey. In line with the previous finding that the within-firm component is falling between 2002 and 2014, this development can be also seen in both panels (c) and (d). In both panels, a substantial decline is visible for nearly all age groups, especially for younger cohorts. These changes over time tend to imply that discrimination towards women has decreased. Xiao (2020) argues that the gender wage gap in early career stages is due to discrimination, what we can also see in the levels of the within-firm component at the early stages of the career as it exceeds the levels of the between-firm component.

Figure 5 elaborates on the development of the gender wage gap, the contribution of firms and its two components across the life cycle using the latest wave of the SES. The left panel shows the gender wage gap and the firms’ contribution to it across the life cycle. It highlights the

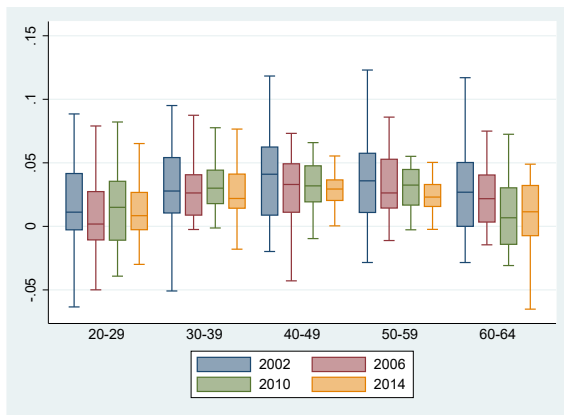
Figure 4: Components by Age Group



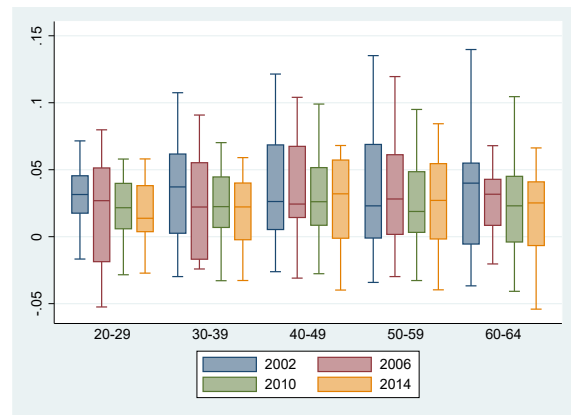
(a) Between-firm component (Male Effects)



(b) Between-firm component (Female Effects)



(c) Within-firm component (Female Distribution)



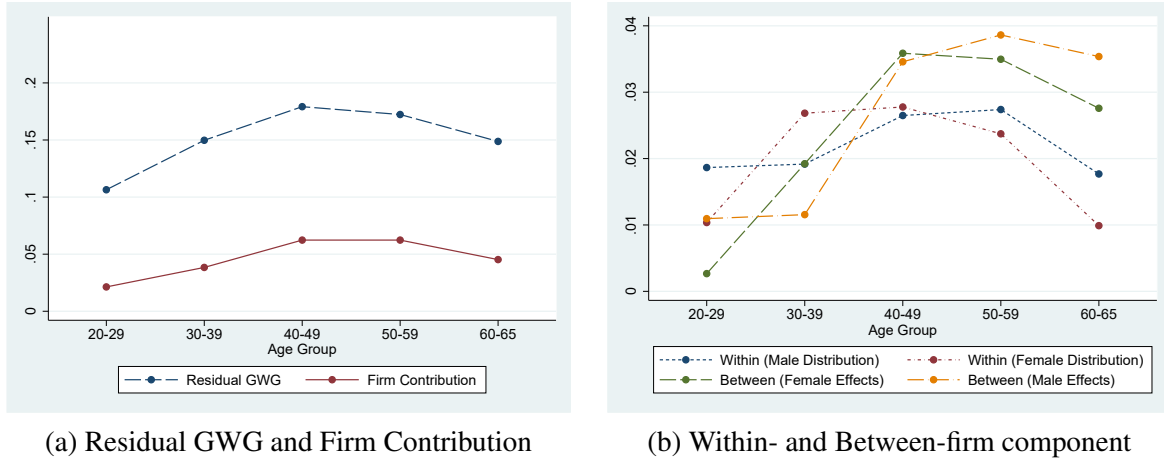
(d) Within-firm component (Male Distribution)

The box plots show the between- and within-firm component in the upper and lower panels, respectively. They differ in terms of whether we use male or female effects or distributions for the former and the latter. The results are based on equations (3) and (4), which are computed for each age group in the baseline sample with 1 man and 1 woman separately. The fixed effects were normalized using the definition of low-pay. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

importance of the firms' contribution on a European level. Specifically, the percentage of the wage gap that is explained by the firm-specific pay differentials is also taking on an inverse U-shape. For the lowest age category, the firms contribute close to 32 percent to the overall pay gap. It then rises by around 4.5 and 5.5 percentage points for the subsequent two age groups. It reaches its maximum at 44.6 percent for the age group from 50 to 59, and then declines weakly to 41 percent for the last age group. This pattern reinforces the picture of a “scarring” effect of motherhood, and that firms contribute significantly to this development over the life cycle.

The right panel presents the development of the within- and between-firm components of the firm contribution shown in the left panel over the life cycle. Interestingly, the within-firm component tends to be larger than the between-firm component for the youngest two age groups. This speaks to discrimination being the determining factor of the gender wage gap at early

Figure 5: Life-cycle analysis of the Gender Wage Gap and its Components



The left panel shows the residual gender wage gap and the firms' contribution to it across the five different age groups in 2014. The values depicted constitute the average across the 20 countries in the 2014 SES data. The firms' contribution is equal to the left-hand side of equation(3). The right panel shows the two different components differentiating between the way of computation, as shown in equations (3) and (4).

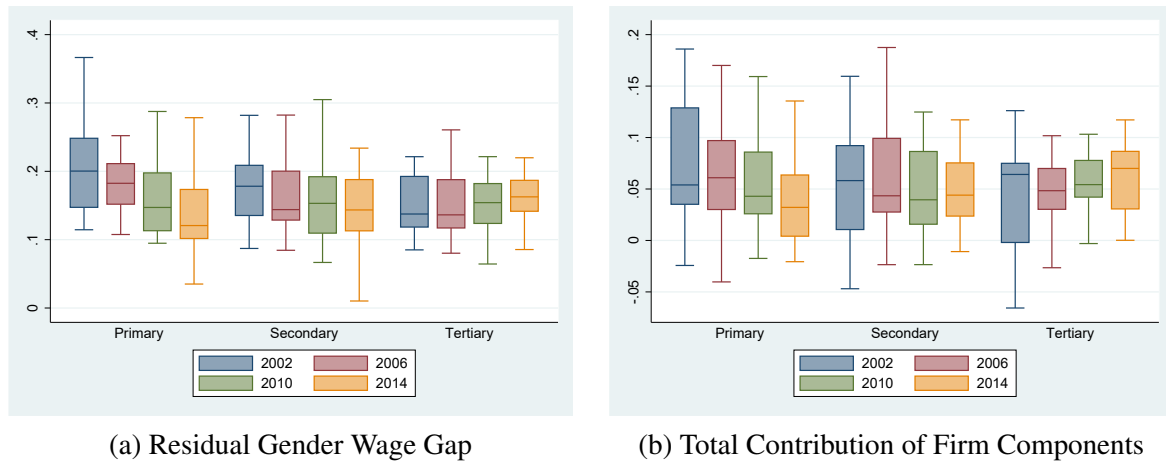
stages in the career as pointed out by Xiao (2020). However, for the age category from 40 to 49, the between-firm components overtake the within-firm components in their magnitude. This development indicates that non-pecuniary remuneration pays an important role as argued by Felfe (2012). Family-friendly firms potentially offer these benefits in exchange for wage cuts, and hence women tend to work in low-paying firms due to changing preferences over the life cycle. The importance of the between-firm component does tends to increase for the subsequent two age categories, while the within-firm component starts to fall for the same age groups. This indicates that non-pecuniary remuneration and human capital depreciation are closely interrelated, especially as Angelov et al. (2016) point out that the long-term depreciation rates are much higher than the short-term rates. Therefore, breaks or prolonged part-time work of mothers also implies worse long-term decline in wages and sorting into low-paying firms.

4.3.3 Education

We now explore how the gender wage gap, the firms' contribution and the individual components differ across educational levels. This distinction across education category relates to the discussion of sticky floors versus sticky floors, which was first investigated on a European level by Arulampalam et al. (2007) and later by Christofides et al. (2013). Strictly speaking, our analysis by education groups is not perfectly equivalent to the discussion because these studies examine the whole income distribution, but De la Rica et al. (2008) also relate larger gender wage gaps at higher levels educational attainment to glass ceilings for Spain. Our analysis relates insofar to the discussion as higher education typically implies higher incomes. As the SES provides information on education at three different levels, i.e. primary, secondary and tertiary,

we will consider primary education the lower part of the income distribution, and tertiary education to the upper part of the distribution. Hence, when relating to the discussion of sticky floors versus glass ceilings, we relate our findings for workers with primary education to the former, and for workers with tertiary education to the latter.

Figure 6: Evolution of Firm’s Contribution to the Gender Wage Gap by Education

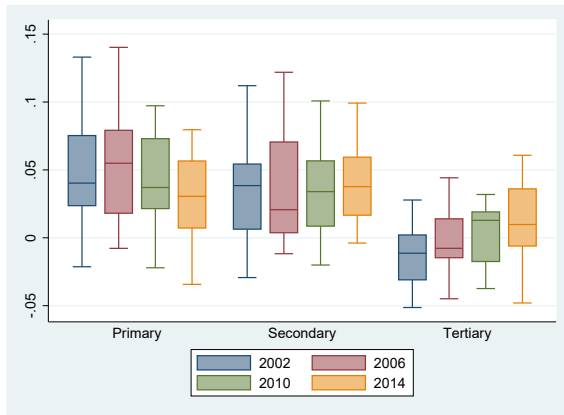


This figure shows the residual wage gap and the firms’ contribution to the gender pay gap for three different education groups and across all waves of the SES. The results are based on the analysis explained in Section 3 for each education group. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

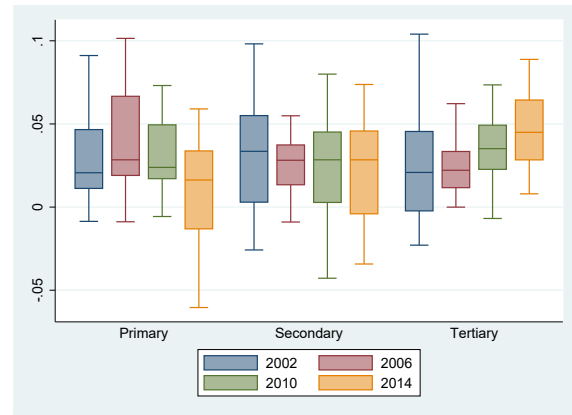
Figure 6 shows the residual wage gap and the firms’ contribution to this gap by educational level across all four waves of the SES. It is immediately visible that the unobserved gender wage gap fell most for workers with primary education, slightly for workers with secondary education and nearly no decrease over time for workers with tertiary education. Interestingly, the firms’ contribution to the gender pay gap reflects the declines, for the first two educational groups. On the other hand, the contribution of firms to the gender wage gap is increasing over time even though the overall unexplained wage gap between men and women stays constant. Relating these findings to the discussion of sticky floors versus glass ceilings, the glass ceiling seems to become stronger between 2002 and 2014, while the importance of sticky floors seems to decrease over time. Examining both panels in the figure in terms of levels, we see that in 2002 both the residual pay gap and the firms’ contribution are (on average) the lowest for secondary education, and slightly higher for both primary and tertiary education. Due to the aforementioned changes over time, this order has changed by 2014: the pay gap now increases with educational level.

We now explore how the within- and between-firm component differ by education category using an analogous structure as before. Figure 7 depicts both components with either male or female effects or distribution, with the between-component in the upper panels (a) and (b), and the corresponding within-firm component below. As argued above for the full sample, the between-firm component is not changing much over time. There is a modest decline for work-

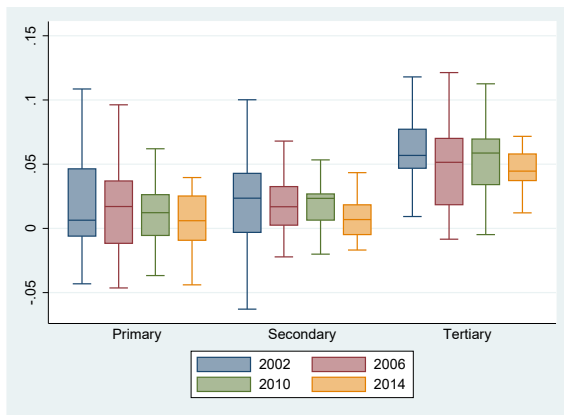
Figure 7: Components by Education Group



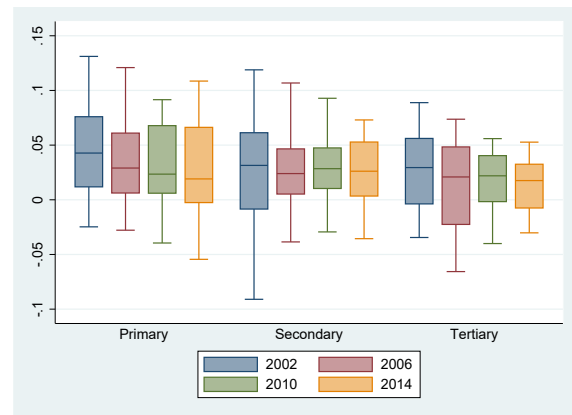
(a) Between-firm component (Male Effects)



(b) Between-firm component (Female Effects)



(c) Within-firm component (Female Distribution)



(d) Within-firm component (Male Distribution)

The box plots show the between- and within-firm component in the upper and lower panels, respectively. They differ in terms of whether we use male or female effects or distributions for the former and the latter. The results are based on equations (3) and (4), which are computed for each education group in the baseline sample with 1 man and 1 woman separately. The fixed effects were normalized using the definition of low-pay. Each box represents the interquartile range of the respective measure in a given year, and the whiskers indicate the minimum and the maximum, excluding outliers.

ers with primary education, but this effect is completely offset within the group of employees with tertiary education. Regardless of whether we compute the between-firm component with male or female effects, there is a substantial increase within the group of workers with tertiary education.

Given the previous findings about the firms' contribution to the gender pay gap and the between-firm component, the decline of the within-firm components over time across all education groups comes without surprise. The decrease for employees with primary education is somewhat stronger than for those with secondary or tertiary education. One striking difference between panels (c) and (d) is the level of the within-firm component across the different education groups. In particular, the level of this component is smaller for primary and secondary education when using the female distribution compared to the male distribution, and vice versa for tertiary education. This indicates that men with tertiary education are more concentrated in firms with

low gender wage gaps, whereas men with primary and secondary education are working primarily in firms with a higher gender premia differential. Thus, the finding for the full sample that men are concentrated in firms with pay gaps is mainly driven by men with primary and secondary education.

4.4 Within-firm Gender Wage Gap and Firm Characteristics

The decomposition into a within-firm and between-firm component using firm premia also allows us to compute the firm-specific gender wage gap due to these premia. In the analysis, we will use normalized wage premia based on the definition of low-pay as explained above. We relate these within-firm gaps between men and women to factors commonly referred to in the literature and in Coudin et al. (2018, Table 8). In particular, our specification is closest to Column (2) in their specification, as we include industry-fixed effects and the level of collective bargaining in our regressions. As we are investigating 21 countries, we also include country-fixed effects in all regressions. In the specification including all years, we also include year-fixed effects. This means that the conditional correlations we obtain between firm observables and the within-firm gender wage gap relies on variation within sector, within countries and within years. As explained above, we do not have information of firms on value added per worker, so we cannot include information like this in our estimations.

We relate workforce composition variables, the level of collective bargaining, firm size and the type of control with the within-firm gender wage gap. Table 3 shows the conditional correlations between the within-firm wage gaps and these observables, in Column (1) for all years, and from Columns (2) to (5) for each survey wave individually. The first category relates to pay agreements, i.e. the level of collective agreement under which more than 50% of the employees in the firm are working. A large literature associates a higher level of collective agreement with lower wage inequality because it compresses the wage distribution, e.g. DiNardo et al. (1996). Heinze and Wolf (2010) support this notion for Germany by showing that firms with collective bargaining agreements reduces the gender wage gap. Also for Germany, Antonczyk et al. (2010) highlight the differences of collective bargaining regimes across the income distribution. On the other hand, Felgueroso et al. (2008) argue that the gender wage gap rises along the wage distribution if the level of bargaining is centralized. The authors explain this with the difference in actual versus negotiated wages, where the former differs more from the latter towards the upper part of the wage distribution due to the rising importance of bonus payments.

Our results indicate that less centralized bargaining is associated with a decline in the gender wage gap. The coefficients are relative to the benchmark category “national coverage”. Given the results by Felgueroso et al. (2008), one crucial point is that we account for bonus payments in the computation of log hourly wages, and hence the gender wage gap. If they are more important in more centralized bargaining regimes, this can influence our results and lead to a downward bias in the conditional correlations. Examining the coefficients over time, we see

their magnitude falling with the exception of region-industry agreements, and sometimes losing significance altogether. Therefore, our results indicate that national wage bargaining acts conversely to international competition as argued by Black and Brainerd (2004). The authors find that product market competition reduces the gender wage gap, while it raises wage inequality. The next two firm characteristics refer to firm size and type of control, i.e. public or private. Considering the results including all four waves of the SES, larger firms are associated with larger within-firm gender wage gaps relative to firms with less than 50 employees. Oi and Idson (1999, Table 6) provides indirect evidence of this phenomenon. Comparing hourly wages for men and women across different sectors in the United States, the gender wage gap is larger across most industries in firms with more than 1000 workers compared to firms with less than 25 employees and the total wage gap within the sector. Comparing the evolution of our coefficients for firm size across the four survey years, they tend to fall in absolute magnitude and lose significance the latest in 2014. The coefficient for private control is always positive and significant at all conventional levels. Miller (2009) shows for the United States that the gender wage gap is smaller in the public sector at all points in the distribution, though the gap is widening stronger at the top.¹⁰ Frederickson (2010) argues that the values of representation and fairness in the public sector directly imply lower gender wage gaps.

Finally, we investigate how the within-firm gender wage gaps is related to workforce composition. The signs of the coefficients for the share of temporary and part-time workers changes throughout the specifications. However the share of executives is strongly associated with a rise in the within-firm gender wage gap. This can be due to the glass ceiling mentioned above due to a lack of access of women to management positions or even supervisory positions within firms as argued by Bishu and Alkadry (2017). A one percentage point increase in the share of executives is related to a .41 percentage point increase in the within-firm wage gap in the specification with all years, i.e. Column (1). However, a larger share of females among executives reduces the gender wage gap, which can have two explanations. First, the women in management positions also get a higher (hourly) wage and hence directly contribute to the decrease in firm wage gaps. Second, as Cardoso and Winter-Ebmer (2010) argue, female non-management workers also profit from female executives in terms of promotion and mentoring, and subsequently in terms of wages.

The share of workers earning below the definition of low-pay, which is equal to two-thirds of the median wage, is associated with a decrease in the gender wage gap. However, more women earn wages below this threshold. Therefore, as the coefficient for the difference of female share relative to the male share earning below this threshold, this has a strong negative impact on the gender wage gap. In fact, the magnitude of the coefficient is nearly identical with the share of executives in the specification including all waves of the SES. Other occupational shares, such as white collars and clerks, are related to a rise in the within-firm gender wage gap, similar to the analysis in Coudin et al. (2018).

¹⁰For a review also on differences between private and public sector, see Bishu and Alkadry (2017).

Table 3: Within-Firm Gender Wage Gap in Firm Premia

	(1)	(2)	(3)	(4)	(5)
	All years	2002	2006	2010	2014
<i>Pay Agreement</i>					
Industry Agreement	-1.053*** (0.000)	-1.061 (0.105)	-1.491** (0.020)	-0.427** (0.045)	-1.050*** (0.000)
Region-Industry Agreement	-1.284*** (0.000)	0.319 (0.662)	-1.703** (0.016)	-0.355 (0.399)	-1.979*** (0.000)
Enterprise agreement	-1.401*** (0.000)	-2.045*** (0.003)	-1.614** (0.018)	0.008 (0.976)	-2.153*** (0.000)
Local Unit Agreement	-0.952 (0.297)	-2.113 (0.250)	-1.766** (0.039)	1.298 (0.399)	-5.245* (0.083)
Other agreement	-4.393*** (0.000)	-4.612*** (0.000)	-5.181*** (0.000)	0.382 (0.765)	-1.990 (0.413)
No agreement	-1.549*** (0.000)	-2.186*** (0.000)	-4.074*** (0.000)	-0.078 (0.922)	-1.865 (0.196)
<i>Firm Size</i>					
50-249 Employees	1.070*** (0.000)	1.419*** (0.000)	1.217*** (0.000)	1.322*** (0.000)	0.725 (0.396)
250+ Employees	1.081*** (0.000)	0.106 (0.708)	-0.376 (0.138)	0.239 (0.247)	1.078 (0.206)
<i>Control</i>					
Private	2.605*** (0.000)	3.099*** (0.000)	0.891 (0.120)	1.658*** (0.000)	2.740*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	-0.006** (0.024)	-0.025*** (0.000)	-0.017*** (0.001)	-0.019*** (0.001)	-0.006 (0.190)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.311*** (0.000)	0.226*** (0.000)	0.284*** (0.000)	0.352*** (0.000)	0.322*** (0.000)
White Collars (%)	0.055*** (0.000)	0.047*** (0.000)	0.040*** (0.000)	0.065*** (0.000)	0.053*** (0.000)
Clerks (%)	0.031*** (0.000)	-0.018*** (0.001)	-0.014** (0.018)	0.087*** (0.000)	0.025*** (0.000)
Female among Executives (%)	-0.166*** (0.000)	-0.140*** (0.000)	-0.199*** (0.000)	-0.109*** (0.000)	-0.184*** (0.000)
Female among White Collars (%)	0.034*** (0.000)	0.041*** (0.000)	-0.004 (0.190)	-0.015*** (0.000)	0.046*** (0.000)
Female among Clerks (%)	0.026*** (0.000)	0.068*** (0.000)	0.089*** (0.000)	0.034*** (0.000)	0.018*** (0.000)
Female among Blue Collars (%)	0.056*** (0.000)	0.032*** (0.000)	0.038*** (0.000)	0.065*** (0.000)	0.056*** (0.000)
Low Pay Earners (%)	-0.011*** (0.000)	-0.092*** (0.000)	-0.083*** (0.000)	0.009*** (0.002)	-0.009*** (0.001)
Low Pay Earners (%F-%M)	0.353*** (0.000)	0.272*** (0.000)	0.366*** (0.000)	0.352*** (0.000)	0.354*** (0.000)
Observations	413035	70918	118750	95955	127412
R ²	0.21	0.16	0.23	0.24	0.22

Notes: The dependent variable is the difference in firm premia (male minus female) based on estimated firm-fixed effects for each gender. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

4.5 Between-firm analysis

After examining conditional correlations of the within-firm gender wage gap with and firm observables, we now investigate the between-firm component. By definition, this measure is not available on the firm-level. Due to the lack of information of job amenities on a more detailed level, such as occupation or sector of economic activity, our sample with country-year differences lacks variation for a more in-depth analysis. As is standard with cross-country panel regressions, independent of the number of explanatory variables, the potential for omitted variable bias is large. Therefore, we do not focus on the estimates per se, but rather put the emphasis on coefficients' signs and their relative magnitude across the different subgroups subject to scrutiny.

We compute unconditional correlations of the between-firm component with family policy indicators by the OECD. We focus on family policy for two reasons. First, our findings of the between-firm component indicates that it is rising across the life-cycle and related to motherhood. Second, the recent literature links an increase in the gender wage gap to motherhood. Olivetti and Petrongolo (2017) argue that family policy in developed economies has the idea to guarantee equity between men and women by allowing women to combine careers and motherhood. While we focus on the hourly wage gap as this has been subject to the analysis above, family policy can also influence other labor market outcomes of women, such as employment. Further, family policy is complex and can vary in many dimensions. Therefore, we pick eight different indicators to get a complete picture.

Our analysis is similar to Christofides et al. (2013, Fig. 3) in terms of its goal, i.e. we want to examine correlations of family policy on a component of the gender wage gap. However, there are a few important differences. First, the authors focus on the overall unexplained gender wage gap, we concentrate on the between-firm component. Second, instead of concentrating on an overall family-and work reconciliation index, we focus on single measures. Third, instead of comparing differences across the wage distribution, we rather compare age subgroups as explained previously. Finally, we possess more variation as we investigate four different waves, while the authors exploit cross-country variation.

Table 4 shows the correlations between various family policies ranging from expenditure, length of parental leave and child enrolment and the between-firm component. The upper panel uses the between-firm component computed with male effects, while the component in the lower panel is computed with female effects. Columns (1) to (4) focus on total public expenditure (in percent of GDP) on families and its subcomponents including cash, services and taxes. All signs of the components are negative except for the expenditure related to tax when computing the between-firm component using female effects. However, only the expenditure on services is statistically significant in both the upper and lower panel for the full sample. In particular, what holds for both specifications is that primarily women above the age of 30, i.e. shortly after the average European woman gets her first child, the coefficient turns significant and it rises in

Table 4: Between-Firm Gender Wage Gap in Firm Premia

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male Effects	Expenditure (Total)	Expenditure (Cash)	Expenditure (Services)	Expenditure (Tax)	Length Maternity Leave	Length Paternity Leave	Childcare Enrollment 0-2 (%)	Childcare Enrollment 3-5 (%)
Total	-1.747*** (0.000)	-1.990*** (0.001)	-2.716*** (0.000)	-2.100 (0.117)	0.005 (0.405)	-0.066 (0.140)	-0.077*** (0.000)	-0.111*** (0.002)
20-29	-2.071*** (0.000)	-2.933*** (0.000)	-1.621** (0.044)	-4.656*** (0.002)	-0.003 (0.661)	0.004 (0.939)	-0.009 (0.741)	-0.040 (0.388)
30-39	-1.701*** (0.001)	-1.504** (0.036)	-2.983*** (0.000)	-1.771 (0.281)	0.020*** (0.006)	-0.073 (0.169)	-0.108*** (0.000)	-0.163*** (0.000)
40-49	-1.774*** (0.000)	-1.613** (0.015)	-3.386*** (0.000)	-1.146 (0.462)	0.006 (0.440)	-0.096* (0.064)	-0.111*** (0.000)	-0.146*** (0.000)
50-59	-1.174** (0.026)	-1.545* (0.034)	-2.395*** (0.003)	-2.101 (0.193)	-0.007 (0.383)	-0.1122** (0.028)	-0.057** (0.040)	-0.071 (0.120)
60-64	-2.896*** (0.000)	-3.866*** (0.000)	-1.548 (0.217)	-4.754* (0.052)	-0.028** (0.019)	0.005 (0.958)	-0.005 (0.911)	0.042 (0.564)
Female Effects								
Total	-0.887*** (0.032)	-0.844 (0.136)	-1.975*** (0.001)	1.471 (0.246)	0.014** (0.015)	-0.065 (0.128)	-0.067*** (0.002)	-0.088** (0.019)
20-29	-0.317 (0.510)	-0.078 (0.915)	-0.718 (0.382)	-1.669 (0.246)	0.022*** (0.001)	-0.019 (0.723)	-0.037 (0.176)	-0.113*** (0.009)
30-39	-0.771 (0.191)	0.163 (0.831)	-2.476*** (0.003)	0.789 (0.659)	0.033*** (0.000)	-0.107* (0.062)	-0.102*** (0.000)	-0.156*** (0.001)
40-49	-1.130** (0.026)	-1.141 (0.128)	-2.286*** (0.006)	3.094** (0.044)	0.005 (0.549)	-0.074 (0.172)	-0.079*** (0.004)	-0.061 (0.215)
50-59	-1.149** (0.023)	-2.244*** (0.003)	-1.693* (0.053)	2.104 (0.174)	-0.014 (0.072)	-0.064 (0.272)	-0.025 (0.362)	0.009 (0.850)
60-64	-1.283** (0.033)	-2.676*** (0.003)	0.137 (0.896)	0.497 (0.789)	-0.015 (0.136)	0.074 (0.293)	0.026 (0.459)	0.019 (0.718)
Observations	47	64	64	47	55	55	52	46

Notes: The dependent variable is the between-firm component, the upper panel makes use of the male effects while the lower panel makes use of female effects. The table shows correlations between the two different between-firm components and various OECD indicators regarding public policies for families and children. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

absolute magnitude. The significance tapers off with rising age, but it is significant for both age groups 30 to 39 and 40 to 49.

The next area of family policy relates to parental leave regimes in columns (5) and (6). As Olivetti and Petrongolo (2017) argue, this issue within family policies is potentially the most complex as there are many dimensions, such as length, job protection, income support and eligibility to both partners. Therefore, it has been subject to many empirical studies, e.g. Ruhm (1998) and Nielsen et al. (2004). We focus on the length of parental leave for both mothers and fathers as they are found to have a stronger impact on earnings, whereas other factors rather relate to employment status. Maternity and paternity leave are both measured in weeks and vary strongly across countries in the sample, i.e. the former ranges between 16 and 166 weeks, and the latter between zero and 28 weeks. Maternity leave can lead to either changes in preferences for non-pecuniary remuneration as argued by Felfe (2012) or can be related to long-term depreciation in human capital. Both explanations lead to an increase of the gender pay gap across the cycle, though the former indicates a sudden rise after motherhood, whereas the latter implies a slowly rising gender wage gap across the life cycle.

In line with Ruhm (1998) and OECD (2012), a longer maternity leave is associated with higher gender pay gaps, though we find that the effect is most crucial for the group of 30-39 in both panels, whereas for the full sample and the age group 20-29 it has no impact. For higher age groups, this effect is diminishing and even changes signs.¹¹ On the other hand, paternity leave is hardly ever statistically significant on conventional levels, which can be due to the lower level of variation in paternity leave as mentioned above. However, the signs also indicate room for importance of paternity (besides maternity) leave. While the signs are positive for the full sample and the age group from 20 to 29, the sign turns negative and the coefficient is even statistically significant at 10% in the lower panel for the age group of 30 to 39. The sign does not change again until the age group of 60 to 64, hence paternity leave seems to be a potential policy for mitigating the “scarring” effect of motherhood. Patnaik (2019) examines the impact of paternity leave with very generous compensation on various labor market outcomes of women. Especially employment status and hours worked (conditional on employment) of mothers improve. She also finds long-term effects of paternity leave, for which we get suggestive evidence. Finally, we consider child enrolment (in percent) in pre-primary education or primary school for children both between zero and two, and three to five. Both indicators exhibit a strong positive correlation with expenditure in services, namely .70 and .51, respectively. Hence, the results are not very surprising, i.e. a higher enrolment in both age groups is associated with a lower between-firm component, and subsequently a lower gender pay gap. This holds particularly for the age group 30 to 39 in both panels. This effect seems to have an impact on the subsequent age group (40 to 49), though the estimates are smaller relative to the group 30 to 39, and the coefficients are estimated with more noise.

¹¹One issue with older age groups and family policy indicators is that they are likely to be less subject to the contemporaneous family policies, and were rather affected through the policy regime in place around their family formation.

4.6 Robustness Analyses

To test for the validity of the baseline results shown above, this paper applies two sensitivity analyses. The first accounts for possible bias by not fully identifying the firm-fixed effects in the baseline sample due to the requirement to observe only one man and one woman per firm. This minimum requirement for the decomposition can lead to a bias in firm-fixed effects, and hence pay premia, if they contain unobserved employee components which systemically differ between men and women. This bias can be stronger for small firms, where we do not observe many employees, and if one gender works primarily in small firms this can influence the differential pay premia after decomposition. The tables for the first sensitivity analysis are in Appendix D.

For our first robustness analysis we require to observe at least five male and female employees per firm. This tends to eliminate small firms, but this stronger requirement ensures that unobserved worker characteristics influence the firm-fixed effects except if these unobserved characteristics of the randomly employees do not cancel out in the mean. We repeat the whole analysis, starting with the estimation of the residual wage gap based on worker observables, the estimation of firm fixed effect and the test whether female fixed effects are smaller than male fixed effects for firms paying below the country-year specific threshold of low-pay according to the definition of the OECD. The results for the Mincer equation with this sample are shown in Table D1 and the results are qualitatively comparable to the baseline estimations. We also check the condition to obtain lower-bound estimates of the within-firm component of $\hat{\psi}^F < \hat{\psi}^M$ from equation (2) in Table D2. The first result is that the (non-normalized) estimated gender-specific firm premia tend to be larger in this sample, which does not come as a surprise given the stronger focus on larger firms due to the data requirement. Besides the previously mentioned two cases where the condition does not hold, two other cases emerge for this sample, namely Hungary in 2006 and Norway in 2002. So we still obtain lower-bound estimates of the within-firm component for the majority of observations.

Next, we decompose the new firm premia into their within- and between-firm components based on equations (3) and (4). Tables D3 to D6 show the residual gender wage gap, the gender-specific firm premia (after normalization), the resulting contribution of firms to the gender wage gap, and both the between- and within-firm components depending on computation. In none of the indicators there is a one-sided bias: some values are larger than in the baseline sample, whereas others are smaller. Importantly, there is no change in the relative importance of the components and their evolution across the four waves. In other words, this requirement does not change any of the findings for the full sample in the baseline estimations. This also holds largely with respect to the age and education subgroups with one exception.

Compared with the baseline results, we find one small exception, namely for educational subgroups, and it refers to the between-firm component and their different measurement. In the baseline results, we find different levels of the between-firm component for the group of work-

ers with tertiary education depending on whether we use male or female effects for its computation. In the robustness analysis, the levels are very similar regardless of the way of computation, just like for workers with primary and secondary education in the baseline analysis. in Figure 7. Hence, this sample (with larger firms) seems to clarify the issue found above and speaks to the concentration of men relative to the gender gap in firm premia.

The second robustness check refers to the type of normalization, and its results are shown in Appendix E. While Card et al. (2016) and Coudin et al. (2018) possess information on value added per worker on the firm level, and thus can infer match surpluses between employers and employees, we do not possess this information. Therefore in the baseline, we use actual wages containing surpluses and implicitly assume that wages from low-wage firms contain the smallest premiums. In the sensitivity analysis, we normalize by firms in the hotel and restaurant industry, which is considered a low-surplus sector, for the sample with at least one male and female worker per firm. This is motivated by Card et al. (2016) and references therein, e.g. Krueger and Summers (1988). As the crucial change to the analysis only occurs after the estimation of the firm-fixed effects, and hence after the estimation of residual wages, we start by comparing (non-normalized) gender-specific average fixed effects. Table E1 presents the estimated firm premia for men and women by country and year for the hotel and restaurant industry. Keeping in mind that in order to obtain lower-bound estimates for the within-firm component, the firm premia of women need to be smaller than four men. The results show that only in two cases this condition is not met, specifically in Latvia in 2002 and 2010.

Tables E2 to E5 present the decomposition results analogous to the baseline analysis and the first robustness analysis. The results for this normalization also do not indicate any specific bias on a country-year basis. This holds for all variables of interest in these tables, i.e. the gap in residual wages, the firms' contribution to this gap, as well as the within- and between-firm component. As before, both components are somewhat equally important and the within-firm component is falling over time, while the between-firm component stays constant. If at all, the within-firm component is declining stronger across the four waves of the SES compared to the baseline estimation. The tables support this for the full sample, but no part of the analysis of the subsamples by age and education is affected by the different normalization. The change in the between-component for tertiary education of the previous robustness analysis is not confirmed, hence this change is likely due to a slightly different sample composition with less smaller firms. Given that none of the previous messages changes substantially, it is not surprising that the subsequent analysis of firm observables with average premia or the individual components changes qualitatively. The tables are shown in appendices D and E for the subsample requiring 5 workers of each gender and for the alternative specialization using firms from the hotel and restaurant sector, respectively. Some estimates, which were close to zero in the baseline analysis in the analysis of average firm premia may change sign, but stay close to zero, e.g. the share of clerks. Overall, no covariates of higher interest change their sign in the analysis of the within- and between-firm components. Finally, we do not need to analyze the between-firm component for

the alternative normalization with the hotel and restaurant industry because, as argued above, this component is unaffected by the type of normalization.

5 Conclusion

We investigate the contribution of gender-specific firm premia to the gender wage gap for a large majority of European countries. We make use of the Structure of Earnings Survey provided by Eurostat, a harmonized matched employer-employee data set. We exploit the methodology of Card et al. (2016) to estimate the firms' contribution to the gender pay gap and decompose this contribution into a within- and between-firm component. We discuss three underlying explanations for why the gender wage gap changes across the life cycle, namely non-pecuniary remuneration, loss of human capital and discrimination. Importantly, we associate each component to either one or both of the explanations for the gender wage gap.

We find that firm-specific pay differentials between men and women contribute around 35 percent of the overall residual gender wage gap, with large heterogeneity across countries. The decomposition shows that in total, the within- and between-firm component contribute equally to the pay gap. Between 2002 and 2014, the former has declined, whereas the latter has stayed nearly unchanged over the time period. This finding shows that the overall decline in the gender pay gap is entirely driven by the within-firm component. Investigating the components across educational groups, we see that the decline in the within-firm component across the four survey waves is shared across all groups. However, in the group of workers with tertiary education, a rise in the between-firm component counteracts this decline of the within-component. We relate the lack of falling wage gaps within this group of workers to the glass ceiling as documented by Christofides et al. (2013) for Europe.

An established finding in the literature is that the gender wage gap is rising over the life cycle. We investigate how the two different components change over the life cycle, and in line with Coudin et al. (2018) for France, we find that the between-firm component is rising stronger across the life cycle. For the age 20 to 29, the average within-firm component is larger than the between-firm component. By the age group of 40 to 49, the between-firm components using either computation exceed the within-firm components, and this order does not change for the rest of the life cycle. Hence, the between-firm component plays a crucial role for the rise in the gender wage gap over the working life. This is likely due to explanations relating to motherhood, i.e. changing preferences with respect to non-pecuniary remuneration and human capital depreciation. The findings by Delfino (2019) suggest that men tend to sort negatively into female-dominated occupations due to a lack of expected returns to ability. To reduce the between-firm component, policies to break gender barriers should go in both directions: Support women to take on high-paying occupations, and to encourage men to go into female-dominated occupations.

In the last step of our analysis, we relate the within- and the between-firm component to institu-

tional settings, the former to collective bargaining and the latter to family policy. Even though a higher level of centralization in the wage bargaining process is typically associated with less wage inequality, we find that it does not reduce the within-firm gender wage gap. Instead, lower levels of centralization are associated with lower levels of the gender wage gap. This indicates that our results for collective bargaining are converse to the findings for product market competition by Black and Brainerd (2004), who show that competition raises wage inequality and reduces the gender wage gap. Finally, we link various indicators of family policy to the between-firm component. Importantly, we distinguish between age groups as the between-firm component increases over the life cycle. We find that higher social spending on families and children enrolment reduce the gender wage gap in particular in the age group of 30 to 39, and then tend to peter off over the life cycle. For maternity leave, we confirm previous findings that longer periods increase the gender wage gap, and the effect also starts for the same age group. While the correlation between paternity leave and the gender wage gap are not statistically significant, our results suggest a potential for reducing gender wage gaps. Miyajima and Yamaguchi (2017) suggest that men would like to take paternity leave, but do not dare doing so. Policies should be designed in a way to encourage men to take paternity leave to overcome gender role norms in order to achieve greater wage parity between men and women.

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Appendices

A Data Availability and Comparisons of Descriptive Statistics

Table A1: Data Availability

Country	Code	2002	2006	2010	2014	Reason of Exclusion
Belgium	BE	Y	Y	Y	Y	
Bulgaria	BG	Y	Y	Y	Y	
Cyprus	CY	Y	Y	Y	Y	
Czech Republic	CZ	Y	Y	Y	Y	
Germany	DE	X	Y	Y	Y	
Estonia	EE	Y	Y	Y	Y	
Greece	EL	Y	Y	Y	Y	
Spain	ES	Y	Y	Y	Y	
Finland	FI	(Y)	(Y)	(Y)	(Y)	No firm identifier
France	FR	Y	Y	Y	Y	
Croatia	HR	X	X	X	Y	Lack of consecutive years
Hungary	HU	Y	Y	Y	Y	
Italy	IT	Y	Y	Y	Y	
Lithuania	LT	Y	Y	Y	Y	
Luxembourg	LU	(Y)	(Y)	(Y)	(Y)	No firm identifier
Latvia	LV	Y	Y	Y	Y	
Malta	MT	(Y)	(Y)	(Y)	Y	Pre-2014 data only in Safe Center
Netherlands	NL	Y	Y	Y	Y	
Norway	NO	Y	Y	Y	Y	
Poland	PL	Y	Y	Y	Y	
Portugal	PT	Y	Y	Y	Y	
Romania	RO	Y	Y	Y	Y	
Sweden	SE	(Y)	Y	Y	Y	No information on tenure in 2002
Slovenia	SI	X	X	X	(Y)	Lack of consecutive years
Slovakia	SK	Y	Y	Y	Y	
United Kingdom	UK	(Y)	Y	Y	Y	Only one worker per firm in 2002

The table does not show Austria (AT), Denmark (DK) or Ireland (IE) because the SES was not conducted in these countries in any given year. The SES for Sweden in 2002 does not possess information on tenure, so it is not included either as it does not allow for the estimation of the wage residual. “X” indicates that the data is not available, and “(Y)” indicates that the data is available, but lacks information for estimating the gender wage gap. Finally, “Y” indicates that we use the sample in our analysis.

Table A2: Descriptive Statistics for various samples of Employers in SES (2002)

	(1)	(2)	(3)
	Original Data	Cleaned Data (1)	Cleaned Data (5)
10-49 Employees (%)	0.460	0.427	0.252
50-249 Employees (%)	0.262	0.275	0.334
> 249 Employees (%)	0.278	0.298	0.414
Public Control	0.089	0.099	0.167
Private Control	0.909	0.899	0.830
MQEWS	0.037	0.035	0.045
Manufacturing	0.331	0.351	0.392
Construction	0.082	0.064	0.043
Wholesale and Retail	0.236	0.221	0.179
Hotels and Restaurants	0.045	0.047	0.040
Transport, Storage, Communication	0.084	0.079	0.092
Financial Intermediation	0.057	0.065	0.071
Real Estate and Business Activities	0.129	0.137	0.138
National Agreement (%)	0.203	0.207	0.083
Industry Agreement (%)	0.120	0.120	0.092
Region-Industry Agreement (%)	0.076	0.063	0.022
Enterprise Agreement (%)	0.128	0.149	0.238
Local Unit Agreement (%)	0.003	0.003	0.002
Agreement (Other) (%)	0.053	0.026	0.010
No Agreement (%)	0.190	0.206	0.233
Average Wage below Low Pay (%)	0.131	0.140	0.175
Number of Employers	133473	91934	27518

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various firm characteristics, including level of collective pay agreement, sector of activity, public control and the share of firms paying below. It also includes the total number of firms observed in each sample.

Table A3: Descriptive Statistics for various samples of Employers in SES (2006)

	(1)	(2)	(3)
	Original Data	Cleaned Data (1)	Cleaned Data (5)
10-49 Employees (%)	0.421	0.347	0.172
50-249 Employees (%)	0.211	0.226	0.251
> 249 Employees (%)	0.367	0.426	0.577
Public Control	0.055	0.065	0.101
Private Control	0.860	0.840	0.779
MQEWS	0.032	0.035	0.039
Manufacturing	0.292	0.337	0.397
Construction	0.082	0.063	0.035
Wholesale and Retail	0.246	0.219	0.174
Hotels and Restaurants	0.045	0.046	0.041
Transport, Storage, Communication	0.082	0.075	0.067
Financial Intermediation	0.068	0.068	0.071
Real Estate and Business Activities	0.152	0.156	0.175
National Agreement (%)	0.093	0.127	0.184
Industry Agreement (%)	0.225	0.232	0.209
Region-Industry Agreement (%)	0.060	0.057	0.028
Enterprise Agreement (%)	0.156	0.205	0.292
Local Unit Agreement (%)	0.011	0.008	0.002
Agreement (Other) (%)	0.120	0.032	0.010
No Agreement (%)	0.264	0.270	0.216
Average Wage below Low Pay (%)	0.109	0.119	0.111
Number of Employers	234199	134715	44887

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various firm characteristics, including level of collective pay agreement, sector of activity, public control and the share of firms paying below. It also includes the total number of firms observed in each sample.

Table A4: Descriptive Statistics for various samples of Employers in SES (2010)

	(1)	(2)	(3)
	Original Data	Cleaned Data (1)	Cleaned Data (5)
10-49 Employees (%)	0.430	0.387	0.242
50-249 Employees (%)	0.230	0.273	0.349
> 249 Employees (%)	0.321	0.317	0.395
Public Control	0.057	0.065	0.089
Private Control	0.724	0.658	0.664
MQEWS	0.038	0.042	0.040
Manufacturing	0.218	0.269	0.328
Construction	0.078	0.059	0.032
Wholesale and Retail	0.233	0.186	0.142
Hotels and Restaurants	0.049	0.044	0.041
Transport, Storage, Communication	0.129	0.132	0.141
Financial Intermediation	0.069	0.074	0.079
Real Estate and Business Activities	0.187	0.194	0.198
National Agreement (%)	0.191	0.232	0.246
Industry Agreement (%)	0.163	0.186	0.180
Region-Industry Agreement (%)	0.011	0.016	0.020
Enterprise Agreement (%)	0.092	0.123	0.188
Local Unit Agreement (%)	0.015	0.003	0
Agreement (Other) (%)	0.095	0.024	0.007
No Agreement (%)	0.221	0.151	0.144
Average Wage below Low Pay (%)	0.055	0.060	0.054
Number of Employers	280937	138872	47543

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various firm characteristics, including level of collective pay agreement, sector of activity, public control and the share of firms paying below. It also includes the total number of firms observed in each sample.

Table A5: Descriptive Statistics for various samples of Employers in SES (2014)

	(1)	(2)	(3)
	Original Data	Cleaned Data (1)	Cleaned Data (5)
10-49 Employees (%)	0.400	0.321	0.198
50-249 Employees (%)	0.291	0.336	0.375
> 249 Employees (%)	0.291	0.321	0.413
Public Control	0.061	0.084	0.126
Private Control	0.908	0.873	0.826
MQEWS	0.042	0.050	0.055
Manufacturing	0.198	0.238	0.310
Construction	0.081	0.058	0.030
Wholesale and Retail	0.236	0.202	0.152
Hotels and Restaurants	0.059	0.056	0.048
Transport, Storage, Communication	0.126	0.128	0.132
Financial Intermediation	0.053	0.064	0.076
Real Estate and Business Activities	0.204	0.205	0.199
National Agreement (%)	0.263	0.246	0.176
Industry Agreement (%)	0.205	0.264	0.231
Region-Industry Agreement (%)	0.040	0.047	0.023
Enterprise Agreement (%)	0.109	0.153	0.253
Local Unit Agreement (%)	0.016	0.005	0.002
Agreement (Other) (%)	0.013	0.014	0.008
No Agreement (%)	0.341	0.251	0.279
Average Wage below Low Pay (%)	0.079	0.088	0.094
Number of Employers	294640	139204	40629

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various firm characteristics, including level of collective pay agreement, sector of activity, public control and the share of firms paying below. It also includes the total number of firms observed in each sample.

Table A6: Descriptive Statistics for various samples of Employers in SES (2002)

	(1) Original Data		(2) Cleaned Data (1 man & woman)		(3) Cleaned Data (5 men & women)		(4) Cleaned Data (5 men & women)		(5) Cleaned Data (5 men & women)		(6) Cleaned Data (5 men & women)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Log Hourly Wage	2.709	2.639	2.807	2.687	2.807	2.687	2.964	2.812	2.964	2.812	2.964	2.812
Primary education (%)	0.364	0.283	0.325	0.272	0.325	0.272	0.265	0.231	0.265	0.231	0.265	0.231
Secondary education (%)	0.463	0.515	0.484	0.523	0.484	0.523	0.544	0.569	0.544	0.569	0.544	0.569
Tertiary education (%)	0.173	0.202	0.191	0.206	0.191	0.206	0.192	0.199	0.192	0.199	0.192	0.199
Age 20-29 (%)	0.209	0.258	0.207	0.250	0.207	0.250	0.200	0.224	0.200	0.224	0.200	0.224
Age 30-39 (%)	0.308	0.308	0.302	0.308	0.302	0.308	0.285	0.294	0.285	0.294	0.285	0.294
Age 40-49 (%)	0.278	0.281	0.283	0.286	0.283	0.286	0.292	0.313	0.292	0.313	0.292	0.313
Age 50-59 (%)	0.187	0.144	0.189	0.148	0.189	0.148	0.201	0.162	0.201	0.162	0.201	0.162
Age 60-65 (%)	0.018	0.008	0.019	0.008	0.019	0.008	0.022	0.008	0.022	0.008	0.022	0.008
Managers (%)	0.064	0.050	0.066	0.048	0.066	0.048	0.062	0.045	0.062	0.045	0.062	0.045
Professionals (%)	0.071	0.070	0.079	0.073	0.079	0.073	0.085	0.091	0.085	0.091	0.085	0.091
Technicians (%)	0.130	0.164	0.138	0.166	0.138	0.166	0.140	0.170	0.140	0.170	0.140	0.170
Clerks (%)	0.103	0.258	0.109	0.265	0.109	0.265	0.111	0.236	0.111	0.236	0.111	0.236
Service workers (%)	0.071	0.128	0.077	0.116	0.077	0.116	0.069	0.099	0.069	0.099	0.069	0.099
Craft (%)	0.268	0.112	0.246	0.110	0.246	0.110	0.254	0.122	0.254	0.122	0.254	0.122
Operators (%)	0.194	0.118	0.195	0.123	0.195	0.123	0.199	0.138	0.199	0.138	0.199	0.138
Elementary (%)	0.100	0.101	0.091	0.099	0.091	0.099	0.080	0.099	0.080	0.099	0.080	0.099
Part Time (%)	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Contract (%)	0.077	0.076	0.059	0.072	0.059	0.072	0.048	0.061	0.048	0.061	0.048	0.061
Number of employees	2042882	1129244	1875816	1090910	1875816	1090910	1426994	874205	1426994	874205	1426994	874205

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various employer characteristics, including the log hourly wages and the shares of groups by education, age, occupation, part-time and temporary contracts. It also includes the total number of employees observed in each sample.

Table A7: Descriptive Statistics for various samples of Employers in SES (2006)

	(1) Original Data		(2)		(3)		(4)		(5)		(6)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Log Hourly Wage	2.550	2.231	2.514	2.233	2.456	2.124	2.456	2.124	2.456	2.124	2.456	2.124
Primary education (%)	0.274	0.223	0.246	0.219	0.211	0.219	0.211	0.219	0.211	0.219	0.211	0.219
Secondary education (%)	0.511	0.532	0.531	0.537	0.579	0.571	0.579	0.571	0.579	0.571	0.579	0.571
Tertiary education (%)	0.215	0.246	0.223	0.244	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Age 20-29 (%)	0.192	0.247	0.188	0.238	0.183	0.220	0.183	0.220	0.183	0.220	0.183	0.220
Age 30-39 (%)	0.297	0.305	0.297	0.305	0.293	0.298	0.293	0.298	0.293	0.298	0.293	0.298
Age 40-49 (%)	0.286	0.269	0.288	0.274	0.290	0.285	0.290	0.285	0.290	0.285	0.290	0.285
Age 50-59 (%)	0.194	0.165	0.197	0.169	0.206	0.184	0.206	0.184	0.206	0.184	0.206	0.184
Age 60-65 (%)	0.031	0.015	0.029	0.014	0.029	0.013	0.029	0.013	0.029	0.013	0.029	0.013
Managers (%)	0.082	0.074	0.078	0.070	0.056	0.045	0.056	0.045	0.056	0.045	0.056	0.045
Professionals (%)	0.088	0.081	0.097	0.084	0.110	0.092	0.110	0.092	0.110	0.092	0.110	0.092
Technicians (%)	0.136	0.168	0.149	0.170	0.164	0.174	0.164	0.174	0.164	0.174	0.164	0.174
Clerks (%)	0.090	0.269	0.100	0.273	0.113	0.253	0.113	0.253	0.113	0.253	0.113	0.253
Service workers (%)	0.059	0.139	0.060	0.122	0.054	0.102	0.054	0.102	0.054	0.102	0.054	0.102
Craft (%)	0.254	0.076	0.237	0.079	0.228	0.097	0.228	0.097	0.228	0.097	0.228	0.097
Operators (%)	0.187	0.092	0.181	0.098	0.180	0.119	0.180	0.119	0.180	0.119	0.180	0.119
Elementary (%)	0.102	0.099	0.097	0.102	0.093	0.116	0.093	0.116	0.093	0.116	0.093	0.116
Part Time (%)	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Contract (%)	0.097	0.104	0.088	0.104	0.096	0.121	0.096	0.121	0.096	0.121	0.096	0.121
Number of employees	3313570	1716316	3035814	1649609	2324151	1372367	2324151	1372367	2324151	1372367	2324151	1372367

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various employer characteristics, including the log hourly wages and the shares of groups by education, age, occupation, part-time and temporary contracts. It also includes the total number of employees observed in each sample.

Table A8: Descriptive Statistics for various samples of Employers in SES (2010)

	(1) Original Data		(2)		(3)		(4)		(5)		(6)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Log Hourly Wage	3.042	2.843	3.063	2.853	3.128	2.891	3.128	2.891	3.128	2.891	3.128	2.891
Primary education (%)	0.125	0.140	0.123	0.140	0.118	0.145	0.118	0.145	0.118	0.145	0.118	0.145
Secondary education (%)	0.743	0.744	0.741	0.747	0.722	0.740	0.722	0.740	0.722	0.740	0.722	0.740
Tertiary education (%)	0.131	0.116	0.136	0.113	0.160	0.116	0.160	0.116	0.160	0.116	0.160	0.116
Age 20-29 (%)	0.175	0.263	0.174	0.261	0.172	0.257	0.172	0.257	0.172	0.257	0.172	0.257
Age 30-39 (%)	0.235	0.226	0.235	0.225	0.240	0.227	0.240	0.227	0.240	0.227	0.240	0.227
Age 40-49 (%)	0.330	0.283	0.331	0.285	0.334	0.287	0.334	0.287	0.334	0.287	0.334	0.287
Age 50-59 (%)	0.223	0.200	0.222	0.202	0.221	0.204	0.221	0.204	0.221	0.204	0.221	0.204
Age 60-65 (%)	0.037	0.027	0.037	0.027	0.034	0.025	0.034	0.025	0.034	0.025	0.034	0.025
Managers (%)	0.038	0.025	0.039	0.024	0.042	0.022	0.042	0.022	0.042	0.022	0.042	0.022
Professionals (%)	0.085	0.070	0.089	0.069	0.105	0.071	0.105	0.071	0.105	0.071	0.105	0.071
Technicians (%)	0.199	0.213	0.207	0.214	0.227	0.215	0.227	0.215	0.227	0.215	0.227	0.215
Clerks (%)	0.092	0.334	0.096	0.339	0.110	0.341	0.110	0.341	0.110	0.341	0.110	0.341
Service workers (%)	0.050	0.143	0.051	0.134	0.050	0.116	0.050	0.116	0.050	0.116	0.050	0.116
Craft (%)	0.285	0.052	0.274	0.053	0.227	0.053	0.227	0.053	0.227	0.053	0.227	0.053
Operators (%)	0.151	0.071	0.146	0.073	0.136	0.083	0.136	0.083	0.136	0.083	0.136	0.083
Elementary (%)	0.099	0.092	0.099	0.094	0.101	0.099	0.101	0.099	0.101	0.099	0.101	0.099
Part Time (%)	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Contract (%)	0.055	0.078	0.057	0.078	0.062	0.083	0.062	0.083	0.062	0.083	0.062	0.083
Number of employees	3378010	1776841	3075048	1690551	2366455	1408533	2366455	1408533	2366455	1408533	2366455	1408533

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various employer characteristics, including the log hourly wages and the shares of groups by education, age, occupation, part-time and temporary contracts. It also includes the total number of employees observed in each sample.

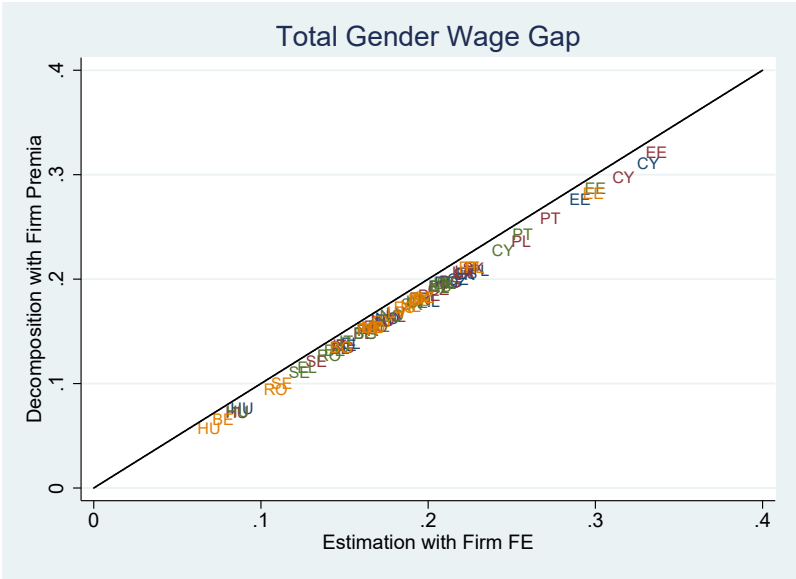
Table A9: Descriptive Statistics for various samples of Employers in SES (2014)

	(1) Original Data		(2)		(3)		(4)		(5)		(6)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Log Hourly Wage	2.927	2.733	2.993	2.766	2.993	2.766	3.119	2.858	3.119	2.858	3.119	2.858
Primary education (%)	0.094	0.097	0.090	0.099	0.090	0.099	0.082	0.105	0.082	0.105	0.082	0.105
Secondary education (%)	0.687	0.708	0.668	0.701	0.668	0.701	0.629	0.672	0.629	0.672	0.629	0.672
Tertiary education (%)	0.218	0.195	0.243	0.201	0.243	0.201	0.289	0.223	0.289	0.223	0.289	0.223
Age 20-29 (%)	0.168	0.244	0.167	0.242	0.167	0.242	0.163	0.239	0.163	0.239	0.163	0.239
Age 30-39 (%)	0.235	0.224	0.236	0.223	0.236	0.223	0.244	0.230	0.244	0.230	0.244	0.230
Age 40-49 (%)	0.280	0.244	0.281	0.245	0.281	0.245	0.285	0.245	0.285	0.245	0.285	0.245
Age 50-59 (%)	0.257	0.238	0.258	0.240	0.258	0.240	0.256	0.241	0.256	0.241	0.256	0.241
Age 60-65 (%)	0.061	0.050	0.059	0.050	0.059	0.050	0.052	0.046	0.052	0.046	0.052	0.046
Managers (%)	0.040	0.024	0.039	0.023	0.039	0.023	0.040	0.020	0.040	0.020	0.040	0.020
Professionals (%)	0.122	0.108	0.143	0.112	0.143	0.112	0.183	0.130	0.183	0.130	0.183	0.130
Technicians (%)	0.177	0.205	0.195	0.201	0.195	0.201	0.216	0.203	0.216	0.203	0.216	0.203
Clerks (%)	0.130	0.334	0.149	0.350	0.149	0.350	0.183	0.354	0.183	0.354	0.183	0.354
Service workers (%)	0.054	0.152	0.054	0.126	0.054	0.126	0.041	0.078	0.041	0.078	0.041	0.078
Craft (%)	0.272	0.048	0.225	0.049	0.225	0.049	0.166	0.054	0.166	0.054	0.166	0.054
Operators (%)	0.144	0.059	0.135	0.064	0.135	0.064	0.118	0.080	0.118	0.080	0.118	0.080
Elementary (%)	0.062	0.071	0.060	0.074	0.060	0.074	0.054	0.081	0.054	0.081	0.054	0.081
Part Time (%)	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Contract (%)	0.083	0.113	0.089	0.118	0.089	0.118	0.095	0.131	0.095	0.131	0.095	0.131
Number of employees	3068910	1717847	2757532	1628547	2757532	1628547	2117269	1345774	2117269	1345774	2117269	1345774

Notes: The table compares the data before and after cleaning with respect to requirements mentioned in the text, once with requiring 1 man and 1 woman per firm, and once with observing 5 men and 5 women per firm. The table compares various employer characteristics, including the log hourly wages and the shares of groups by education, age, occupation, part-time and temporary contracts. It also includes the total number of employees observed in each sample.

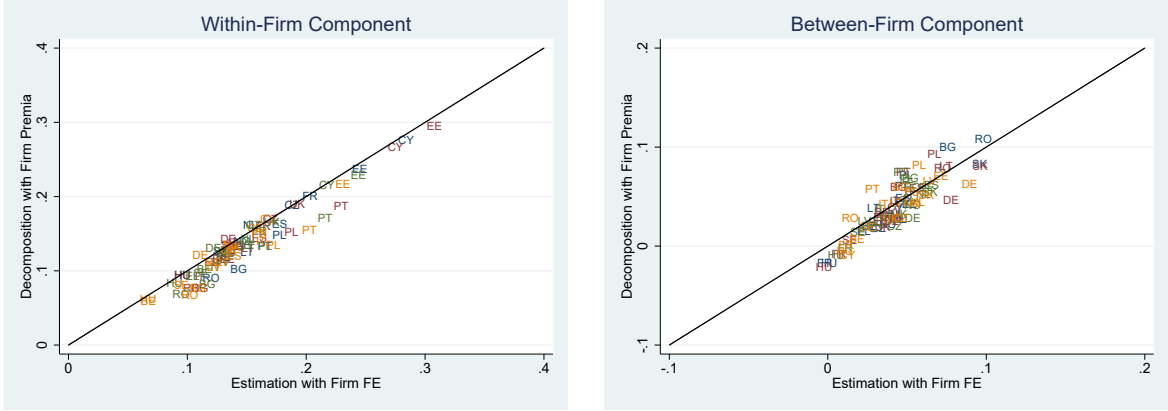
B Comparison across Methods

Figure B1: Comparison Gender Wage Gap across Methods



This plot compares the total gender wage gap using the decomposition method by Card et al. (2016) and with firm-fixed effects similar to Barth et al. (2016) and Hara (2018). It shows that the estimated gender wage gaps are equivalent across both estimation methods.

Figure B2: Comparison of Gender Wage Gap Components across Methods



(a) Within-Firm Component

(b) Between-Firm Components

This figure compares the within-firm and between-firm component of the gender wage gap using the decomposition method by Card et al. (2016) and with firm-fixed effects similar to Barth et al. (2016) and Hara (2018). For a comparison of the within-firm component, we aggregate the individual firm-fixed effects. It shows that the estimated components of the gender wage gaps are equivalent across both estimation methods.

C Benchmark Decomposition Tables

Table C1: Comparison Firm-Fixed Effects by Gender (Normalization Low-Pay)

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2002		2006		2010		2014	
	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F
BE	-.405	-.449	-.417	-.476	-.251	-.278	-.229	-.219
BG	-.492	-.541	-.389	-.422	-.468	-.516	-.418	-.469
CY	-.179	-.453	-.132	-.375	-.125	-.312	-.301	-.366
CZ	-.274	-.399	-.323	-.404	-.302	-.39	-.297	-.4
DE			-.41	-.509	-.392	-.46	-.415	-.486
EE	-.574	-.701	-.596	-.75	-.48	-.59	-.463	-.587
EL	-.266	-.326	-.335	-.374	-.36	-.398		
ES	-.349	-.44	-.339	-.425	-.305	-.395	-.334	-.42
FR	-.272	-.362	-.258	-.351	-.272	-.342	-.287	-.358
HU	-.519	-.524	-.532	-.556	-.473	-.502	-.428	-.457
IT	-.342	-.388	-.34	-.385	-.355	-.414	-.241	-.329
LT	-.57	-.611	-.551	-.624	-.394	-.509	-.378	-.471
LV	-.645	-.67	-.641	-.683	-.519	-.583	-.433	-.513
NL	-.302	-.31	-.285	-.366	-.299	-.363	-.273	-.325
NO	-.374	-.358	-.321	-.348	-.334	-.341	-.297	-.337
PL	-.423	-.536	-.422	-.524	-.427	-.507	-.431	-.507
PT	-.266	-.439	-.263	-.448	-.222	-.376	-.238	-.344
RO	-.619	-.647	-.598	-.641	-.547	-.569	-.507	-.564
SE			-.365	-.401	-.328	-.354	-.371	-.339
SK	-.347	-.432	-.288	-.421	-.285	-.403	-.341	-.418
UK			-.421	-.484	-.506	-.563	-.513	-.564

Notes: The table compares the gender-specific firm-fixed effects obtained from equation (2). In order to obtain a lower-bound estimate of the within-firm component, the female premium has to be smaller than the male premium within the group it is normalized by. The average fixed effects are shown for firms which are paying average wages below τ , which is equal to 2/3 of the median pay.

Table C2: Firm Premia and Contribution of each Component to the Gender Wage Gap (2002)

Country	(1)	(2) Means of Firm Effects		(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium	GWG in firm premiums	Using Male Effects	Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.118	.269	.229	.039	-.002	.009	.031	.041	
BG	.201	.474	.352	.122	.082	.054	.069	.04	
CY	.312	.076	.054	.023	.055	.018	.005	-.033	
CZ	.19	.166	.155	.011	.002	.028	-.018	.009	
EE	.284	.415	.325	.09	.035	.036	.054	.055	
EL	.138	.182	.158	.024	.019	.003	.021	.004	
ES	.202	.297	.239	.059	.035	.028	.03	.024	
FR	.181	.116	.137	-.021	-.03	.004	-.025	.009	
HU	.096	.449	.377	.072	-.012	-.012	.084	.084	
IT	.153	.249	.194	.054	.039	.037	.018	.015	
LT	.18	.444	.347	.097	.027	.02	.077	.07	
LV	.164	.575	.453	.123	.014	.008	.114	.108	
NL	.142	.179	.134	.045	.019	.023	.022	.026	
NO	.142	.157	.113	.045	.005	.007	.037	.04	
PL	.208	.342	.272	.071	.055	.027	.043	.015	
PT	.215	.227	.226	.001	.046	.035	-.034	-.046	
RO	.198	.541	.397	.144	.094	.085	.059	.05	
SK	.192	.235	.169	.066	.075	.075	-.009	-.009	

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table C3: Firm Premia and Contribution of each Component to the Gender Wage Gap (2006)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium	GWG in firm premiums	Using Male Effects	Using Female Effects	Using Male Distribution	Using Female Distribution		
BE	.131	.228	.195	.033	.022	.01	.023	.011		
BG	.136	.393	.303	.09	.048	.023	.067	.042		
CY	.3	.105	.072	.033	.035	.024	.009	-.002		
CZ	.183	.192	.169	.023	.014	.041	-.018	.009		
DE	.149	.309	.274	.035	.028	.055	-.02	.006		
EE	.321	.435	.346	.089	.018	.028	.061	.071		
EL	.136	.236	.201	.035	.029	.016	.019	.006		
ES	.192	.268	.214	.053	.036	.029	.024	.017		
FR	.142	.101	.117	-.017	-.016	.004	-.021	-.001		
HU	.098	.456	.398	.058	-.014	-.011	.069	.072		
IT	.128	.246	.206	.04	.021	.023	.017	.019		
LT	.232	.483	.337	.146	.076	.054	.092	.07		
LV	.169	.537	.441	.096	.043	-.003	.098	.053		
NL	.149	.204	.156	.048	.026	.031	.017	.022		
NO	.138	.16	.111	.048	.003	.014	.034	.045		
PL	.243	.337	.239	.099	.074	.044	.055	.024		
PT	.266	.22	.196	.025	.036	.045	-.021	-.011		
RO	.156	.518	.412	.106	.067	.062	.044	.04		
SE	.111	.197	.165	.032	-.005	-.002	.034	.037		
SK	.206	.239	.173	.066	.069	.093	-.028	-.003		
UK	.158	.249	.245	.004	0	.003	.001	.004		

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table C4: Firm Premia and Contribution of each Component to the Gender Wage Gap (2010)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium		GWG in firm premiums	Using Male Effects	Using Female Effects		Using Male Distribution	Using Female Distribution
BE	.1	.144	.113		.031	.014	.016		.015	.017
BG	.156	.421	.323		.098	.054	.032		.065	.044
CY	.235	.108	.091		.017	.03	.009		.008	-.013
CZ	.172	.163	.148		.015	.014	.046		-.031	0
DE	.119	.287	.258		.029	.006	.042		-.013	.023
EE	.297	.341	.235		.106	.046	.053		.052	.06
EL	.114	.242	.222		.02	.028	.006		.014	-.008
ES	.183	.245	.193		.053	.037	.039		.014	.016
FR	.137	.112	.123		-.011	-.019	0		-.011	.008
HU	.113	.389	.338		.051	-.014	.006		.045	.065
IT	.111	.226	.213		.013	-.007	.006		.007	.02
LT	.221	.286	.216		.069	.032	.036		.033	.037
LV	.162	.42	.351		.069	.026	-.013		.083	.043
NL	.142	.201	.151		.05	.028	.028		.022	.022
NO	.143	.186	.125		.061	.011	.025		.036	.049
PL	.203	.343	.262		.082	.05	.037		.045	.032
PT	.247	.219	.169		.05	.027	.032		.019	.023
RO	.131	.485	.388		.097	.059	.033		.064	.038
SE	.101	.177	.142		.034	0	.005		.03	.034
SK	.175	.218	.164		.054	.041	.069		-.015	.013
UK	.156	.39	.351		.039	-.003	.01		.029	.043

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table C5: Firm Premia and Contribution of each Component to the Gender Wage Gap (2014)

Country	(1)	(2) (3)		(4)	(5) (6)		(7)	(8)
	Residual GWG	Means of Firm Effects		GWG in firm premiums	Between		Within	
Male premium		Female premium	Using Male Effects		Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.044	.117	.117	0	-.004	.001	-.001	.004
BG	.141	.394	.314	.081	.045	.03	.051	.036
CY	.174	.16	.135	.024	.005	-.003	.027	.019
CZ	.182	.162	.144	.018	.018	.055	-.036	.001
DE	.144	.32	.269	.051	.038	.064	-.013	.013
EE	.294	.31	.226	.084	.058	.053	.031	.027
ES	.165	.25	.218	.032	.027	.024	.008	.005
FR	.142	.141	.129	.012	-.011	.011	.001	.023
HU	.12	.359	.294	.065	.005	.012	.053	.06
IT	.17	.171	.133	.038	.03	.024	.013	.007
LT	.196	.273	.207	.066	.035	.024	.042	.031
LV	.209	.354	.262	.092	.086	.032	.06	.006
NL	.123	.177	.147	.03	.018	.034	-.004	.012
NO	.134	.205	.147	.059	.013	.027	.032	.046
PL	.219	.34	.246	.094	.062	.042	.053	.032
PT	.21	.219	.188	.031	.012	.01	.021	.019
RO	.101	.463	.414	.049	.022	-.009	.058	.027
SE	.089	.203	.178	.026	-.001	.006	.02	.026
SK	.178	.234	.179	.055	.036	.06	-.005	.018
UK	.117	.42	.38	.04	-.003	.004	.036	.043

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

D Robustness Analysis: Subsample with 5 Men and 5 Women per Firm

Table D1: Returns to worker characteristics for subsample of firms with at least 5 employees of each gender

	(1)	(2)	(3)	(4)
	2002	2006	2010	2014
Secondary education	0.200	0.194	0.188	0.179
Tertiary education	0.637	0.621	0.642	0.611
Age 30-39	0.122	0.135	0.145	0.152
Age 40-49	0.140	0.164	0.155	0.178
Age 50-59	0.179	0.151	0.130	0.146
Age 60-65	0.145	0.140	0.127	0.126
Tenure	0.036	0.038	0.030	0.026
Tenure ²	-0.001	-0.002	-0.001	-0.000
Constant	1.966	1.845	2.020	1.655

Notes: The table shows the means obtained from the Mincer wage regression in equation 1 for all years. The average returns to each characteristics is based on the country-specific estimations as every country might exhibit different returns to worker characteristics. Primary education and age group 20 to 29 constitute the reference group for each. Tenure is a continuous variable. The sample on which we estimate the returns to worker characteristics includes five men and women per firm. A large majority of the country-specific estimates are statistically significant on conventional levels.

Table D2: Comparison Firm-Fixed Effects by Gender (Normalization Low-Pay)

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2002		2006		2010		2014	
	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F
BE	-.422	-.476	-.341	-.392	-.157	-.213	-.256	-.316
BG	-.509	-.574	-.418	-.464	-.486	-.526	-.438	-.478
CY	-.135	-.444	-.144	-.378	-.105	-.308	-.208	-.3
CZ	-.278	-.403	-.332	-.426	-.319	-.432	-.316	-.426
DE			-.419	-.526	-.396	-.481	-.41	-.497
EE	-.559	-.713	-.531	-.719	-.484	-.561	-.425	-.564
EL	-.197	-.3	-.292	-.368	-.27	-.389		
ES	-.273	-.381	-.286	-.399	-.237	-.351	-.308	-.414
FR	-.291	-.433	-.253	-.358	-.299	-.378	-.404	-.458
HU	-.57	-.557	-.582	-.606	-.496	-.545	-.444	-.488
IT	-.326	-.331	-.318	-.339	-.343	-.388	-.248	-.369
LT	-.595	-.66	-.537	-.596	-.355	-.535	-.351	-.388
LV	-.722	-.762	-.685	-.745	-.592	-.653	-.452	-.558
NL	-.306	-.297	-.28	-.317	-.266	-.326	-.193	-.231
NO	-.334	-.323	-.283	-.334	-.325	-.359	-.309	-.35
PL	-.409	-.534	-.408	-.514	-.43	-.51	-.445	-.522
PT	-.348	-.532	-.297	-.529	-.237	-.383	-.228	-.361
RO	-.666	-.719	-.601	-.643	-.558	-.583	-.543	-.583
SE					-.342	-.34	-.363	-.295
SK	-.351	-.439	-.303	-.44	-.294	-.414	-.346	-.444
UK					-.487	-.554	-.527	-.589

Notes: The table compares the gender-specific firm-fixed effects obtained from equation (2). In order to obtain a lower-bound estimate of the within-firm component, the female premium has to be smaller than the male premium within the group it is normalized by. The average fixed effects are shown for firms which are paying average wages below , which is equal to 2/3 of the median pay.

Table D3: Firm Premia and Contribution of each Component to the Gender Wage Gap (2002)

Country	(1)	(2) (3)		(4)	(5) (6)		(7)	(8)
	Residual GWG	Means of Firm Effects		GWG in firm premiums	Between		Within	
Male premium		Female premium	Using Male Effects		Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.12	.257	.226	.032	.006	.021	.011	.025
BG	.216	.474	.355	.12	.09	.059	.06	.029
CY	.253	.075	.097	-.022	.007	-.008	-.014	-.028
CZ	.198	.173	.155	.018	.007	.031	-.012	.011
EE	.29	.397	.332	.065	.018	.023	.042	.047
EL	.141	.123	.117	.006	.011	.014	-.009	-.005
ES	.183	.243	.215	.028	.033	.036	-.008	-.005
FR	.163	.13	.151	-.021	-.005	.002	-.022	-.015
HU	.13	.483	.383	.1	.012	.005	.096	.088
IT	.148	.209	.166	.043	.031	.051	-.008	.011
LT	.242	.434	.315	.119	.066	.045	.074	.053
LV	.206	.642	.503	.139	.025	.017	.122	.114
NL	.126	.137	.104	.032	0	.029	.003	.032
NO	.144	.16	.112	.048	.009	.011	.037	.039
PL	.214	.33	.263	.067	.057	.03	.037	.01
PT	.196	.241	.27	-.03	.023	.033	-.063	-.053
RO	.222	.593	.445	.148	.116	.09	.058	.032
SK	.217	.254	.162	.091	.094	.095	-.004	-.003

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table D4: Firm Premia and Contribution of each Component to the Gender Wage Gap (2006)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium	GWG in firm premiums	Using Male Effects	Using Female Effects	Using Male Distribution	Using Female Distribution		
BE	.134	.236	.19	.046	.032	.031	.014	.014		
BG	.15	.427	.337	.09	.048	.018	.072	.042		
CY	.262	.115	.106	.009	.038	.019	-.01	-.028		
CZ	.199	.208	.173	.035	.027	.049	-.014	.008		
DE	.16	.324	.283	.041	.042	.068	-.027	-.002		
EE	.295	.342	.302	.04	-.001	0	.04	.041		
EL	.13	.213	.182	.031	.028	.047	-.015	.003		
ES	.158	.229	.209	.02	.024	.029	-.009	-.004		
FR	.142	.132	.131	.001	-.001	.013	-.012	.002		
HU	.122	.464	.401	.064	.001	-.005	.069	.063		
IT	.152	.234	.165	.069	.038	.04	.029	.03		
LT	.263	.411	.28	.131	.069	.053	.077	.062		
LV	.195	.583	.487	.097	.027	-.005	.101	.069		
NL	.157	.199	.137	.062	.033	.023	.04	.029		
NO	.141	.173	.121	.052	.009	.017	.035	.043		
PL	.253	.318	.216	.102	.081	.053	.05	.022		
PT	.269	.266	.255	.011	.034	.055	-.044	-.023		
RO	.166	.518	.416	.102	.076	.055	.047	.026		
SE	.114	.212	.168	.044	.003	.011	.032	.04		
SK	.229	.27	.182	.088	.087	.105	-.018	.001		
UK	.108	.146	.043	.104	0	0	.104	.104		

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table D5: Firm Premia and Contribution of each Component to the Gender Wage Gap (2010)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium	GWG in firm premiums	Using Male Effects	Using Female Effects	Using Male Distribution	Using Female Distribution		
BE	.099	.125	.1	.026	.015	.015	.011	.011		
BG	.16	.454	.358	.096	.052	.026	.07	.044		
CY	.235	.119	.107	.012	.026	.018	-.006	-.014		
CZ	.184	.19	.172	.018	.014	.049	-.031	.004		
DE	.133	.297	.267	.03	.021	.049	-.018	.009		
EE	.29	.31	.226	.084	.032	.039	.045	.052		
EL	.12	.226	.214	.011	.02	.019	-.008	-.009		
ES	.158	.211	.196	.015	.02	.032	-.017	-.004		
FR	.125	.123	.136	-.012	-.016	-.005	-.008	.004		
HU	.151	.393	.334	.059	-.002	.015	.044	.06		
IT	.132	.227	.204	.024	.005	.016	.007	.019		
LT	.256	.239	.248	-.01	.01	.008	-.017	-.02		
LV	.2	.467	.373	.094	.036	.004	.09	.058		
NL	.135	.193	.141	.051	.03	.021	.031	.021		
NO	.152	.206	.142	.064	.02	.028	.036	.045		
PL	.216	.334	.248	.086	.06	.05	.036	.026		
PT	.261	.238	.181	.058	.042	.056	.001	.015		
RO	.129	.479	.395	.083	.053	.031	.052	.031		
SE	.101	.184	.142	.042	.008	.012	.031	.034		
SK	.194	.236	.165	.071	.051	.079	-.008	.021		
UK	.127	.346	.324	.022	-.029	-.023	.045	.051		

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table D6: Firm Premia and Contribution of each Component to the Gender Wage Gap (2014)

Country	(1)	(2) (3)		(4)	(5) (6)		(7)	(8)
	Residual GWG	Means of Firm Effects		GWG in firm premiums	Between		Within	
Male premium		Female premium	Using Male Effects		Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.048	.094	.09	.004	.003	.007	-.003	.001
BG	.154	.388	.303	.085	.047	.038	.047	.038
CY	.182	.179	.151	.028	.009	.001	.027	.019
CZ	.197	.199	.169	.03	.015	.053	-.024	.015
DE	.156	.337	.284	.053	.051	.07	-.017	.002
EE	.31	.289	.208	.081	.061	.059	.022	.02
ES	.152	.241	.227	.014	.015	.024	-.01	-.001
FR	.104	.181	.193	-.012	-.009	0	-.012	-.003
HU	.156	.37	.288	.082	.012	.017	.065	.069
IT	.17	.131	.115	.015	.032	.029	-.013	-.016
LT	.235	.249	.177	.072	.025	.033	.039	.046
LV	.221	.362	.273	.09	.068	.021	.069	.022
NL	.105	.148	.103	.046	.032	.037	.009	.014
NO	.144	.221	.157	.064	.022	.031	.032	.041
PL	.232	.33	.233	.097	.068	.057	.04	.029
PT	.213	.232	.193	.039	.033	.034	.005	.006
RO	.113	.482	.418	.064	.031	.016	.048	.033
SE	.097	.209	.175	.034	.004	.011	.023	.03
SK	.207	.258	.186	.072	.054	.071	0	.018
UK	.059	.401	.398	.003	-.023	-.041	.045	.027

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table D7: Robustness Analysis - Average Firm Premia (Subsample 5 Men and 5 Women)

	(1)	(2)	(3)	(4)	(5)
	All years	2002	2006	2010	2014
<i>Pay Agreement</i>					
Industry Agreement	0.110*** (0.000)	-0.045*** (0.000)	0.034*** (0.000)	0.068*** (0.000)	0.119*** (0.000)
Region-Industry Agreement	0.135*** (0.000)	-0.012 (0.322)	0.012** (0.047)	0.030*** (0.000)	0.174*** (0.000)
Enterprise agreement	0.115*** (0.000)	-0.040*** (0.000)	0.058*** (0.000)	0.069*** (0.000)	0.110*** (0.000)
Local Unit Agreement	0.169*** (0.000)	-0.052* (0.080)	0.025 (0.244)	0.040 (0.710)	0.183** (0.017)
Other agreement	0.013 (0.404)	0.028 (0.126)	-0.063*** (0.000)	0.174*** (0.000)	0.132*** (0.006)
No agreement	0.210*** (0.000)	0.029*** (0.002)	0.082*** (0.000)	0.109*** (0.000)	0.126*** (0.000)
<i>Firm Size</i>					
50-249 Employees	0.036*** (0.000)	0.111*** (0.000)	0.037*** (0.000)	0.020*** (0.000)	0.071*** (0.001)
250+ Employees	0.016*** (0.000)	0.219*** (0.000)	0.078*** (0.000)	0.076*** (0.000)	0.029 (0.165)
<i>Control</i>					
Private	0.084*** (0.000)	-0.011* (0.087)	0.079*** (0.000)	0.098*** (0.000)	0.087*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	-0.001*** (0.000)	0.000 (0.123)	0.000*** (0.000)	-0.000*** (0.006)	-0.001*** (0.000)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.006*** (0.000)	0.004*** (0.000)	0.003*** (0.000)	0.007*** (0.000)	0.006*** (0.000)
White Collars (%)	0.004*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.004*** (0.000)	0.004*** (0.000)
Clerks (%)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Female among Executives (%)	0.000* (0.058)	0.000 (0.709)	0.000 (0.688)	-0.000 (0.285)	0.000 (0.183)
Female among White Collars (%)	-0.001*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Female among Clerks (%)	0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000* (0.064)	0.000*** (0.000)
Female among Blue Collars (%)	-0.000*** (0.000)	-0.000* (0.055)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Low Pay Earners (%)	-0.008*** (0.000)	-0.008*** (0.000)	-0.008*** (0.000)	-0.009*** (0.000)	-0.008*** (0.000)
Low Pay Earners (%F-%M)	-0.001*** (0.000)	0.000 (0.151)	-0.000 (0.549)	-0.000* (0.055)	-0.001*** (0.000)
Observations	128189	18626	38394	34198	36971
R ²	0.43	0.43	0.57	0.46	0.44

Notes: The dependent variable is the average firm premia (weighted by employment shares) based on estimated firm-fixed effects for each gender. The firm premia are normalized by low-pay firms from the sample including 5 men and 5 women per firm. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

Table D8: Within-Firm Gender Wage Gap in Firm Premia

	(1)	(2)	(3)	(4)	(5)
	All years	2002	2006	2010	2014
<i>Pay Agreement</i>					
Industry Agreement	-1.741*** (0.000)	-1.360** (0.020)	-0.290 (0.377)	-0.308 (0.141)	-1.882*** (0.000)
Region-Industry Agreement	-2.213*** (0.000)	0.592 (0.422)	-1.107** (0.014)	0.079 (0.839)	-2.742*** (0.000)
Enterprise agreement	-2.022*** (0.000)	-3.066*** (0.000)	-1.132*** (0.001)	-0.202 (0.410)	-3.078*** (0.000)
Local Unit Agreement	-0.431 (0.871)	-4.933*** (0.007)	0.410 (0.797)	-5.570 (0.442)	0.344 (0.952)
Other agreement	-3.816*** (0.000)	-4.731*** (0.000)	0.834 (0.173)	2.569 (0.350)	-0.790 (0.825)
No agreement	-1.213** (0.027)	-3.843*** (0.000)	-0.514 (0.263)	-1.148 (0.381)	-3.861** (0.019)
<i>Firm Size</i>					
50-249 Employees	-0.682*** (0.000)	2.230*** (0.000)	1.485*** (0.000)	-0.732*** (0.000)	2.410 (0.118)
250+ Employees	0.408** (0.017)	3.140*** (0.000)	1.130*** (0.000)	-1.200*** (0.000)	3.910** (0.011)
<i>Control</i>					
Private	3.362*** (0.000)	0.891** (0.023)	2.821*** (0.000)	2.464*** (0.000)	3.736*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	-0.026*** (0.000)	-0.009 (0.188)	-0.002 (0.647)	-0.001 (0.854)	-0.035*** (0.000)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.257*** (0.000)	0.163*** (0.000)	0.067*** (0.000)	0.231*** (0.000)	0.333*** (0.000)
White Collars (%)	0.049*** (0.000)	0.040*** (0.000)	0.002 (0.570)	0.017*** (0.000)	0.067*** (0.000)
Clerks (%)	0.037*** (0.000)	-0.003 (0.682)	0.014*** (0.003)	0.062*** (0.000)	0.038*** (0.000)
Female among Executives (%)	-0.046*** (0.000)	-0.069*** (0.000)	-0.050*** (0.000)	-0.053*** (0.000)	-0.045*** (0.000)
Female among White Collars (%)	-0.015*** (0.000)	0.017*** (0.000)	0.020*** (0.000)	-0.035*** (0.000)	-0.012*** (0.000)
Female among Clerks (%)	0.017*** (0.000)	0.029*** (0.000)	0.038*** (0.000)	0.027*** (0.000)	0.009*** (0.000)
Female among Blue Collars (%)	0.047*** (0.000)	0.018*** (0.001)	-0.006* (0.085)	0.057*** (0.000)	0.044*** (0.000)
Low Pay Earners (%)	-0.019*** (0.000)	-0.096*** (0.000)	-0.085*** (0.000)	-0.031*** (0.000)	-0.012*** (0.001)
Low Pay Earners (%F-%M)	0.372*** (0.000)	0.378*** (0.000)	0.376*** (0.000)	0.365*** (0.000)	0.374*** (0.000)
Observations	128189	18626	38394	34198	36971
R ²	0.22	0.25	0.22	0.24	0.22

Notes: The dependent variable is the difference in firm premia (male minus female) based on estimated firm-fixed effects for each gender. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

Table D9: Between-Firm Gender Wage Gap in Firm Premia

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male Effects	Expenditure (Total)	Expenditure (Cash)	Expenditure (Services)	Expenditure (Tax)	Length Maternity Leave	Length Paternity Leave	Childcare Enrollment 0-2 (%)	Childcare Enrollment 3-5 (%)
Total	-1.526*** (0.000)	-1.835*** (0.002)	-2.232*** (0.001)	-0.591 (0.673)	0.015** (0.017)	-0.023 (0.608)	-0.076*** (0.000)	-0.106*** (0.004)
20-29	-0.801** (0.035)	-1.049* (0.071)	-0.441 (0.506)	-2.656** (0.020)	0.005 (0.370)	0.042 (0.289)	0.023 (0.279)	0.031 (0.394)
30-39	-1.139* (0.053)	-0.701 (0.356)	-2.418*** (0.004)	-0.381 (0.833)	0.034*** (0.000)	-0.041 (0.472)	-0.103*** (0.000)	-0.162*** (0.000)
40-49	-1.863*** (0.000)	-1.946*** (0.003)	-2.898*** (0.000)	-0.195 (0.906)	0.014* (0.054)	-0.052 (0.329)	-0.121*** (0.000)	-0.173*** (0.000)
50-59	-1.737*** (0.000)	-2.540*** (0.000)	-2.560*** (0.001)	-0.580 (0.703)	0.000 (0.970)	-0.054 (0.303)	-0.061** (0.027)	-0.088** (0.044)
60-64	-4.028*** (0.000)	-6.043*** (0.000)	-1.991 (0.204)	-5.311* (0.084)	-0.012 (0.447)	-0.028 (0.798)	-0.059 (0.216)	-0.101 (0.143)
Female Effects								
Total	-1.361*** (0.006)	-1.686*** (0.010)	-2.467*** (0.001)	1.461 (0.344)	0.018*** (0.009)	-0.042 (0.418)	-0.081*** (0.001)	-0.099** (0.026)
20-29	-0.236 (0.530)	-0.171 (0.777)	-0.508 (0.456)	-1.127 (0.317)	0.011* (0.062)	0.011 (0.792)	0.013 (0.572)	0.015 (0.714)
30-39	-0.968 (0.139)	-0.231 (0.780)	-2.529*** (0.005)	1.453 (0.465)	0.038*** (0.000)	-0.070 (0.278)	-0.109*** (0.000)	-0.168*** (0.001)
40-49	-1.826*** (0.005)	-2.327*** (0.007)	-3.178*** (0.001)	2.735 (0.176)	0.017* (0.062)	-0.060 (0.377)	-0.132*** (0.000)	-0.158*** (0.006)
50-59	-2.047*** (0.000)	-3.385*** (0.000)	-3.011*** (0.001)	1.420 (0.397)	-0.003 (0.716)	-0.045 (0.459)	-0.064** (0.035)	-0.053 (0.314)
60-64	-3.322*** (0.000)	-6.353*** (0.000)	-1.404 (0.353)	-1.467 (0.629)	-0.012 (0.415)	-0.020 (0.851)	-0.039 (0.404)	-0.063 (0.377)
Observations	46	63	63	46	54	54	51	45

Notes: The dependent variable is the between-firm component, the upper panel makes use of the male effects while the lower panel makes use of female effects. The table shows correlations between the two different between-firm components and various OECD indicators regarding public policies for families and children. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

E Robustness Analysis: Normalization with Hotel & Restaurant Industry

Table E1: Comparison Firm-Fixed Effects by Gender (Normalization Hotel & Restaurants)

Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2002		2006		2010		2014	
	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F	Ψ^M	Ψ^F
BE	-.22	-.315	-.204	-.271	-.112	-.163	-.094	-.143
BG	-.187	-.207	-.168	-.217	-.158	-.219	-.097	-.149
CY	.146	-.033	.007	-.167	.033	-.146	-.024	-.169
CZ	-.003	-.164	-.083	-.248	-.071	-.226	-.088	-.251
DE			-.245	-.346	-.236	-.356	-.266	-.353
EE	-.204	-.326	-.192	-.397	-.13	-.27	-.103	-.278
EL	-.011	-.102	-.063	-.142	-.07	-.118		
ES	-.082	-.193	-.057	-.163	-.049	-.149	-.011	-.121
FR	-.059	-.189	.022	-.092	-.071	-.161	-.078	-.182
HU	-.256	-.294	-.169	-.21	-.213	-.278	-.186	-.279
IT	-.125	-.197	-.119	-.168	-.095	-.171	-.073	-.198
LT	-.317	-.321	-.29	-.371	-.194	-.218	-.181	-.242
LV	-.215	-.247	-.236	-.292	-.045	-.133	.014	-.078
NL	-.092	-.235	-.128	-.28	-.134	-.262	-.1	-.224
NO	-.091	-.177	-.114	-.191	-.129	-.215	-.159	-.229
PL	-.097	-.213	-.078	-.192	-.109	-.241	-.099	-.234
PT	-.01	-.169	.031	-.173	-.025	-.215	-.045	-.208
RO	-.194	-.28	-.168	-.225	-.233	-.283	-.243	-.267
SE			-.123	-.192	-.086	-.162	-.102	-.149
SK	-.107	-.161	-.1	-.227	-.072	-.213	-.076	-.218
UK			-.204	-.318	-.266	-.36	-.267	-.361

Notes: The table compares the gender-specific firm-fixed effects obtained from equation (2). In order to obtain a lower-bound estimate of the within-firm component, the female premium has to be smaller than the male premium within the group it is normalized by. The average fixed effects are shown for firms in the sector as it is considered a low-wage industry.

Table E2: Firm Premia and Contribution of each Component to the Gender Wage Gap (2002)

Country	(1)	(2) (3)		(4)	(5) (6)		(7)	(8)
	Residual GWG	Means of Firm Effects		GWG in firm premiums	Between		Within	
Male premium		Female premium	Using Male Effects		Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.118	.249	.226	.023	-.002	.009	.014	.024
BG	.201	.272	.092	.181	.082	.054	.127	.099
CY	.312	-.015	-.149	.133	.055	.018	.116	.078
CZ	.19	.074	.046	.029	.002	.028	0	.027
EE	.284	.326	.164	.162	.035	.036	.127	.127
EL	.138	.064	.018	.047	.019	.003	.044	.027
ES	.202	.152	.062	.091	.035	.028	.063	.056
FR	.181	.121	.07	.051	-.03	.004	.047	.081
HU	.096	.296	.238	.058	-.012	-.012	.07	.07
IT	.153	.176	.096	.08	.039	.037	.044	.041
LT	.18	.393	.217	.176	.027	.02	.156	.149
LV	.164	.288	.156	.132	.014	.008	.124	.117
NL	.142	.128	.129	-.001	.019	.023	-.025	-.02
NO	.142	.13	.074	.056	.005	.007	.049	.051
PL	.208	.174	.082	.093	.055	.027	.065	.037
PT	.215	.102	.046	.056	.046	.035	.021	.01
RO	.198	.274	.162	.112	.094	.085	.027	.018
SK	.192	.189	.052	.138	.075	.075	.062	.063

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table E3: Firm Premia and Contribution of each Component to the Gender Wage Gap (2006)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium	Female premium	GWG in firm premiums	Using Male Effects	Using Female Effects	Using Male Distribution	Using Female Distribution	Using Female Distribution
BE	.131	.236	.173	.173	.063	.022	.01	.053	.041	
BG	.136	.227	.14	.14	.087	.048	.023	.064	.039	
CY	.3	.124	-.002	-.002	.125	.035	.024	.102	.09	
CZ	.183	.149	.132	.132	.018	.014	.041	-.023	.003	
DE	.149	.284	.237	.237	.047	.028	.055	-.008	.019	
EE	.321	.347	.231	.231	.116	.018	.028	.088	.098	
EL	.136	.115	.059	.059	.057	.029	.016	.041	.028	
ES	.192	.129	.042	.042	.086	.036	.029	.057	.051	
FR	.142	.028	.001	.001	.028	-.016	.004	.023	.043	
HU	.098	.21	.152	.152	.058	-.014	-.011	.069	.073	
IT	.128	.161	.081	.081	.08	.021	.023	.057	.059	
LT	.232	.387	.236	.236	.151	.076	.054	.097	.075	
LV	.169	.312	.199	.199	.113	.043	-.003	.116	.07	
NL	.149	.169	.172	.172	-.003	.026	.031	-.034	-.03	
NO	.138	.151	.09	.09	.061	.003	.014	.047	.058	
PL	.243	.167	.038	.038	.129	.074	.044	.085	.054	
PT	.266	.078	.016	.016	.062	.036	.045	.017	.026	
RO	.156	.232	.133	.133	.099	.067	.062	.038	.033	
SE	.111	.155	.114	.114	.041	-.005	-.002	.043	.047	
SK	.206	.182	.103	.103	.078	.069	.093	-.015	.01	
UK	.158	.266	.222	.222	.044	0	.003	.042	.045	

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table E4: Firm Premia and Contribution of each Component to the Gender Wage Gap (2010)

Country	(1)	(2) Means of Firm Effects		(3)	(4)	(5) Between		(6)	(7)	(8)
	Residual GWG	Male premium	Female premium		GWG in firm premiums	Using Male Effects	Using Female Effects		Using Male Distribution	Using Female Distribution
BE	.1	.14	.091		.049	.014	.016		.034	.035
BG	.156	.227	.131		.096	.054	.032		.063	.042
CY	.235	.07	.014		.056	.03	.009		.047	.027
CZ	.172	.136	.118		.018	.014	.046		-.028	.004
DE	.119	.266	.267		-.002	.006	.042		-.044	-.008
EE	.297	.263	.105		.157	.046	.053		.104	.112
EL	.114	.119	.052		.066	.028	.006		.06	.038
ES	.183	.119	.036		.083	.037	.039		.044	.046
FR	.137	.123	.076		.047	-.019	0		.047	.066
HU	.113	.262	.214		.048	-.014	.006		.042	.062
IT	.111	.13	.096		.034	-.007	.006		.028	.041
LT	.221	.291	.094		.197	.032	.036		.161	.165
LV	.162	.116	.042		.074	.026	-.013		.088	.048
NL	.142	.169	.155		.014	.028	.028		-.014	-.014
NO	.143	.168	.112		.057	.011	.025		.032	.045
PL	.203	.184	.113		.071	.05	.037		.034	.022
PT	.247	.125	.067		.057	.027	.032		.025	.03
RO	.131	.286	.205		.081	.059	.033		.048	.022
SE	.101	.116	.092		.025	0	.005		.02	.024
SK	.175	.144	.109		.034	.041	.069		-.035	-.007
UK	.156	.327	.264		.063	-.003	.01		.053	.066

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table E5: Firm Premia and Contribution of each Component to the Gender Wage Gap (2014)

Country	(1)	(2) (3)		(4)	(5) (6)		(7)	(8)
	Residual GWG	Means of Firm Effects		GWG in firm premiums	Between		Within	
Male premium		Female premium	Using Male Effects		Using Female Effects	Using Male Distribution	Using Female Distribution	
BE	.044	.106	.111	-.005	-.004	.001	-.006	-.001
BG	.141	.159	.07	.089	.045	.03	.059	.044
CY	.174	.106	.077	.029	.005	-.003	.032	.024
CZ	.182	.157	.139	.018	.018	.055	-.036	.001
DE	.144	.307	.25	.057	.038	.064	-.007	.019
EE	.294	.236	.116	.12	.058	.053	.066	.062
ES	.165	.074	.019	.055	.027	.024	.031	.028
FR	.142	.131	.092	.039	-.011	.011	.028	.05
HU	.12	.233	.206	.027	.005	.012	.016	.022
IT	.17	.138	.093	.045	.03	.024	.021	.015
LT	.196	.266	.131	.135	.035	.024	.111	.1
LV	.209	.077	-.04	.117	.086	.032	.085	.031
NL	.123	.132	.133	-.001	.018	.034	-.035	-.019
NO	.134	.197	.133	.064	.013	.027	.037	.052
PL	.219	.18	.097	.083	.062	.042	.041	.021
PT	.21	.136	.089	.047	.012	.01	.036	.035
RO	.101	.284	.208	.076	.022	-.009	.085	.054
SE	.089	.129	.086	.042	-.001	.006	.036	.043
SK	.178	.147	.111	.036	.036	.06	-.024	0
UK	.117	.314	.291	.023	-.003	.004	.019	.026

Notes: The table provides information by country on the firm premia by gender, the wage gap and the size of the between- and within-firm component. Column (1) presents the residual gender wage gap, and columns (2) and (3) show the average of the male and female firm premium, respectively. Column (4) is the difference between the first two columns, and constitutes the firms' contribution to the gender wage gap. This wage gap is then decomposed into a between- and within-firm component, shown in Columns (5) and (6), and (7) and (8), respectively. The decomposition is based on equations (3) and (4) and uses male or female effects for the between-firm component and the male or female distribution for the within-component. The sum of columns (5) and (8), and columns (6) and (7) is equal to Column (4).

Table E6: Robustness Analysis - Average Firm Premia (Normalization Hotel & Restaurant Sector)

	(1) All years	(2) 2002	(3) 2006	(4) 2010	(5) 2014
<i>Pay Agreement</i>					
Industry Agreement	0.142*** (0.000)	-0.034*** (0.000)	0.032*** (0.000)	0.074*** (0.000)	0.162*** (0.000)
Region-Industry Agreement	0.177*** (0.000)	-0.034*** (0.000)	0.047*** (0.000)	0.025*** (0.000)	0.229*** (0.000)
Enterprise agreement	0.155*** (0.000)	-0.007 (0.253)	0.045*** (0.000)	0.074*** (0.000)	0.172*** (0.000)
Local Unit Agreement	0.134*** (0.000)	-0.048*** (0.002)	0.024*** (0.000)	0.033** (0.032)	0.139*** (0.000)
Other agreement	0.073*** (0.000)	-0.001 (0.948)	-0.033*** (0.000)	0.091*** (0.000)	0.160*** (0.000)
No agreement	0.196*** (0.000)	-0.005 (0.258)	0.081*** (0.000)	0.115*** (0.000)	0.163*** (0.000)
<i>Firm Size</i>					
50-249 Employees	0.038*** (0.000)	0.081*** (0.000)	0.059*** (0.000)	0.048*** (0.000)	0.068*** (0.000)
250+ Employees	0.066*** (0.000)	0.117*** (0.000)	0.062*** (0.000)	0.104*** (0.000)	0.092*** (0.000)
<i>Control</i>					
Private	0.043*** (0.000)	-0.006 (0.148)	0.031*** (0.000)	0.047*** (0.000)	0.050*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.266)	-0.000** (0.034)	0.001*** (0.000)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.005*** (0.000)	0.004*** (0.000)	0.004*** (0.000)	0.006*** (0.000)	0.006*** (0.000)
White Collars (%)	0.004*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.004*** (0.000)	0.003*** (0.000)
Clerks (%)	0.002*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Female among Executives (%)	-0.000* (0.071)	0.000*** (0.000)	-0.000*** (0.001)	-0.000*** (0.000)	-0.000 (0.965)
Female among White Collars (%)	-0.000*** (0.000)	-0.000*** (0.003)	-0.000*** (0.002)	-0.001*** (0.000)	-0.000*** (0.000)
Female among Clerks (%)	0.000*** (0.000)	-0.000** (0.047)	0.000*** (0.000)	0.000** (0.037)	0.000*** (0.000)
Female among Blue Collars (%)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Low Pay Earners (%)	-0.006*** (0.000)	-0.007*** (0.000)	-0.008*** (0.000)	-0.008*** (0.000)	-0.006*** (0.000)
Low Pay Earners (%F-%M)	-0.000*** (0.000)	0.000** (0.033)	0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
Observations	413035	70918	118750	95955	127412
R ²	0.34	0.30	0.40	0.42	0.33

Notes: The dependent variable is the average firm premia (weighted by employment shares) based on estimated firm-fixed effects for each gender. The firm premia are normalized by firms in the hotel & restaurant industry. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.

Table E7: Within-Firm Gender Wage Gap in Firm Premia

	(1)	(2)	(3)	(4)	(5)
	All years	2002	2006	2010	2014
<i>Pay Agreement</i>					
Industry Agreement	-1.085*** (0.000)	-1.061 (0.105)	-1.491** (0.020)	-0.427** (0.045)	-1.050*** (0.000)
Region-Industry Agreement	-1.363*** (0.000)	0.319 (0.662)	-1.703** (0.016)	-0.355 (0.399)	-1.979*** (0.000)
Enterprise agreement	-1.608*** (0.000)	-2.045*** (0.003)	-1.614** (0.018)	0.008 (0.976)	-2.153*** (0.000)
Local Unit Agreement	-1.661* (0.069)	-2.113 (0.250)	-1.766** (0.039)	1.298 (0.399)	-5.245* (0.083)
Other agreement	-5.399*** (0.000)	-4.612*** (0.000)	-5.181*** (0.000)	0.382 (0.765)	-1.990 (0.413)
No agreement	-2.365*** (0.000)	-2.186*** (0.000)	-4.074*** (0.000)	-0.078 (0.922)	-1.865 (0.196)
<i>Firm Size</i>					
50-249 Employees	1.383*** (0.000)	1.419*** (0.000)	1.217*** (0.000)	1.322*** (0.000)	0.725 (0.396)
250+ Employees	1.358*** (0.000)	0.106 (0.708)	-0.376 (0.138)	0.239 (0.247)	1.078 (0.206)
<i>Control</i>					
Private	2.611*** (0.000)	3.099*** (0.000)	0.891 (0.120)	1.658*** (0.000)	2.740*** (0.000)
<i>Workforce Composition</i>					
Temporary Contract (%)	-0.005** (0.040)	-0.025*** (0.000)	-0.017*** (0.001)	-0.019*** (0.001)	-0.006 (0.190)
Part-time (%)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Executives (%)	0.311*** (0.000)	0.226*** (0.000)	0.284*** (0.000)	0.352*** (0.000)	0.322*** (0.000)
White Collars (%)	0.055*** (0.000)	0.047*** (0.000)	0.040*** (0.000)	0.065*** (0.000)	0.053*** (0.000)
Clerks (%)	0.032*** (0.000)	-0.018*** (0.001)	-0.014** (0.018)	0.087*** (0.000)	0.025*** (0.000)
Female among Executives (%)	-0.166*** (0.000)	-0.140*** (0.000)	-0.199*** (0.000)	-0.109*** (0.000)	-0.184*** (0.000)
Female among White Collars (%)	0.034*** (0.000)	0.041*** (0.000)	-0.004 (0.190)	-0.015*** (0.000)	0.046*** (0.000)
Female among Clerks (%)	0.026*** (0.000)	0.068*** (0.000)	0.089*** (0.000)	0.034*** (0.000)	0.018*** (0.000)
Female among Blue Collars (%)	0.055*** (0.000)	0.032*** (0.000)	0.038*** (0.000)	0.065*** (0.000)	0.056*** (0.000)
Low Pay Earners (%)	-0.011*** (0.000)	-0.092*** (0.000)	-0.083*** (0.000)	0.009*** (0.002)	-0.009*** (0.001)
Low Pay Earners (%F-%M)	0.353*** (0.000)	0.272*** (0.000)	0.366*** (0.000)	0.352*** (0.000)	0.354*** (0.000)
Observations	413035	70918	118750	95955	127412
R ²	0.22	0.16	0.23	0.24	0.22

Notes: The dependent variable is the difference in firm premia (male minus female) based on estimated firm-fixed effects for each gender. The sample includes firms with at least one man and one woman per firm. Sector, country and year-fixed effects are not shown. Firm observations are weighted. Robust standard errors are used. p-values are shown in brackets. * denotes 10% significance, ** denotes 5% significance, *** denotes 1% significance.