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What if your boss is a woman? Evidence on gender discrimination at the workplace

Claudio Lucifora[1] · Daria Vigani[2]

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Abstract

In this paper, we exploit rich cross-country survey data covering 15 European countries over the period 2000–2015 to investigate the relationship between the gender of the immediate supervisor (i.e. having a male or a female "boss") and perceived gender discrimination at the workplace. We show that a female boss is associated with reduced gender discrimination, with positive spillovers mainly on female subordinates, in jobs where female presence is also higher and where work organization is more complex. The presence of more flexible work schedules and a better balance between work and life, further contributes to reinforce the mitigating effect of female leadership on discrimination. Results are shown to be consistent with available evidence on gender differentials in pay and career advancement, as well as being robust to a number of sensitivity checks.

1 Introduction

Despite the remarkable increase over the past decades of female participation in education, the labor market, and political life, women are still paid less than men and are largely under-represented in supervisory, managerial, and executive positions (Eurostat, 2019). As reported in recent studies by the European Commission, even if women in Europe account for around 45% of employment and over 55% of people in tertiary education, their proportion in high-level economic decision-making is still very low, as compared to men, with large differences across countries (between 5 and 37% in 2016 (European Commission 2012, 2016)). Empirical studies show that besides cultural

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✉ Daria Vigani
daria.vigani@unicatt.it

[1] Università Cattolica del Sacro Cuore, IZA and CNEL, Milan, Italy

[2] Università Cattolica del Sacro Cuore, Milan, Italy

factors, market imperfections, and gender norms, women's segregation in lower layers of the occupational hierarchy also depends on workplace characteristics, such as work–life balance and equal opportunity practices within firms (Bertrand et al., 2010; Goldin, 2014). In particular, when the standards for pay increases and promotions are centered on long working hours, rigid work schedule, and seniority, women are less likely to close the wage gap with men and move up the company hierarchy. Conversely, family-friendly work practices such as part-time work, flexible working time and parental leave arrangements make it easier for families with caring responsibilities (women in particular) to balance work and life (OECD, 2007).

While an extensive literature has documented the effect of gender in top management positions on firms' performance, on management styles (Bertrand & Schoar, 2003; Matsa & Miller, 2013), as well as on wage policies and equal opportunity practices within firms (Flabbi et al., 2019; Fortin, 2008), one aspect that has received less attention in the literature is the relationship between female leadership and gender discrimination. In particular, relatively little is known about whether having a female "boss" makes a difference in terms of gender equality and employees' perceived discrimination within firms, and whether that differs for men and women (Artz & Taengnoi, 2016; Booth & Leigh, 2010; Lazear et al., 2015).

In this paper, we exploit rich cross-country survey data covering 15 European countries over the period 2000–2015 to investigate the relationship between the gender of the immediate supervisor (i.e. having a male or a female "boss") and gender discrimination reported by employees at the workplace (Eurofound, 2010). In this respect, we complement the main findings from the above literature with novel evidence spanning several countries and over a longer time period. Notice that, while several papers have analyzed the effect of specific equal opportunity policies to promote female representation, such as gender quotas in managerial occupations, in company boardrooms, in parliament, etc., to the best of our knowledge, we are the first to document a wide range of stylized facts related to the gender of the immediate supervisor (a female or male "boss") and employees' perceived discrimination across different European countries, occupations, industries, and workplace characteristics (Eurofound, 2020). In particular, we provide evidence on the association between female leadership and gender discrimination by focusing on the role of direct supervisors, which has rarely been investigated in the economics literature. Only recently Lazear et al. (2015) and Artz and Taengnoi (2016) have focused the analysis on the role of supervisors finding evidence of a large positive effect of supervisors' quality (regardless of gender) on workers' productivity, and a negative association between female supervisors and job satisfaction, which they attribute to unobserved supervisor's characteristics. In this respect, we examine several hypotheses such as the role played by family-friendly work practices, the management style adopted by female supervisors, as well as the share of female employees in the job. Moreover, since female bosses are more likely to be concentrated in female-dominated jobs and more family-friendly work environments, we pay particular attention when interpreting the results as lower discriminatory attitudes toward women may result from unobservable factors that affect both female leadership and gender discrimination. We also further expand on the literature on discrimination, which has mainly used indirect measures—such as gender differentials in wages, call-back rates, and promotions—and exploit unique information available in our dataset which reports

perceived gender discrimination as reported by the individuals at the workplace. Finally, we complement existing evidence from laboratory or field experiments on the behavioral determinants of gender discrimination, using survey-based evidence on a large number of countries to uncover the heterogeneous patterns across institutional and cultural differences (Alesina & Giuliano, 2010; Cipollone et al., 2014; Van Mensvoort et al., 2020).

The paper is organized as follows. In Section 2 we review the evidence on the links between female leadership and gender discrimination at the workplace. Section 3 describes the data, the main variables of interest and reports some descriptive statistics. The main features and some of the limits of the empirical analysis are discussed in Section 4. In Section 5 we present our baseline results, along with an in-depth analysis of the heterogeneous patterns and potential mechanisms that are at work in shaping the relationship between female leadership and gender discrimination. In Section 6 we test the robustness of our findings against alternative model specifications and estimation methods. Concluding remarks are provided in Section 7.

2 Female leadership, work organization, and gender discrimination

The relationship between an employee and their supervisor has been shown to be central to the performance of the firm and the well-being of employees they oversee (Booth & Leigh, 2010). Female leadership may have an effect on gender differences at the workplace through a number of different channels. First, if wage determination and career advancements are affected by taste-discriminatory behavior of (mainly male) supervisors and managers, a larger representation of women at the top of the occupational hierarchy is expected to reduce the gender wage gap and provide more opportunities (for women) to be promoted (Albrecht et al., 2003; Becker, 1957). Second, it has been argued that under imperfect information female managers might be better at inferring other women's unobserved productivity, hence reducing statistical discrimination toward women (Aigner & Cain, 1977). In this respect, females are likely to receive higher wages when employed by a female manager rather than by a male, while lower wages are likely to be paid to males by female managers. Third, on top of the effect on wages, female leadership may be expected to adopt a management style that is less biased against women, introducing family-friendly policies and balanced work–life practices. However, while this is expected to be beneficial for women and their well-being, it is less obvious what the effects on men would be. Fourth, behavioral differences across gender—i.e., risk aversion, competitive attitude, and gender identity—may affect the way women behave in predominantly male work environments, as opposed to women who are in predominantly female jobs (Apesteguia et al., 2012; Hoogendoorn et al., 2013). Experimental and field studies have shown that women are more likely to enter competitive settings if surrounded by other women rather than men (Niederle & Vesterlund, 2007). Finally, quite independently from gender attributes, work practices and pay policies can influence both the share and the distribution of women in the occupational hierarchy as well as the gender wage gap (Kato & Kodama, 2018).

The above propositions have been extensively investigated in the literature, which has focused on specific segments of the labor market and on selected countries,

reporting mixed evidence. Cardoso and Winter-Ebmer (2007) find evidence for Portugal that female executives, compared to male executives, increase women's wages within firms, while they lower men's wages. Similar results are found in US firms, looking at the effect of female CEOs on the gender pay gap in executive positions (Bell, 2005). Flabbi et al. (2019) look at the effect of female leadership among Italian CEOs on the entire distribution of wages, showing that female CEOs are able to reverse statistical discrimination against women (with a similar distortion on men's wages as a side effect), reducing gender pay inequalities at the top of the distribution while increasing it at the bottom. Conversely, no statistically significant effect of female board members and top management on the overall gender wage gap is found in German and Norwegian firms (Gagliarducci & Paserman, 2015; Bertrand et al., 2018). From a broader perspective, descriptive evidence from a global survey of firms belonging to 91 countries suggests that the presence of women in corporate leadership positions might improve firms' performance, particularly so when female executive and board shares are considered (Noland et al., 2016).

The effect of female leadership has also been shown to be heterogeneous and likely to depend on a number of factors, such as the gender composition of lower layers within the organization, whether the occupation considered is predominantly male or female, and how pay incentives are designed. Greater female representation at higher ranks is found to generate positive spillovers on women's career advancements in Norway (Kunze & Miller, 2017) and higher female representation among directors and executives in the US, a pattern that has been called "women helping women" (Matsa & Miller, 2013)[1]. Spillover effects often work in opposite directions across genders, explaining why men may lose out when their boss is female or why it is more difficult to promote a woman when female employees are the majority in a given layer of the occupational hierarchy. Female leadership can also have negative spillovers on gender discrimination, when for example women in managerial or supervisory positions use their discretionary power to prevent other women from receiving pay bonuses or progressing in the occupational hierarchy: a pattern called the "queen bee syndrome" that has been found for women in male-dominated occupations (Bagues et al., 2014).

Female bosses are also expected to organize work in a way that is less gender biased and more family-friendly, improving time flexibility and work–life balance practices, with beneficial effects on gender discrimination. Most of the studies that have investigated the effects of female leadership on gender inequality have mainly focused on the patterns between occupations, as well as asking why females tend to be segregated in selected occupations (Barbulescu & Bidwell, 2013; Bertrand et al., 2018). However, since a large part of gender inequalities and discrimination take place within occupations, the above explanations miss an important part of the story[2]. In particular, much of the existing gender gap in firms appears to be due to how firms

[1] In an analysis of the propensity to hire and retain females among athletic directors, Bednar and Gicheva (2014), find instead no evidence that gender is strongly predictive of a supervisor's female-friendliness.

[2] Goldin (2014) shows that saturating a traditional Mincerian wage equation with 3-digit occupational dummies, or weighting equally male and females across occupations, the residual gender pay inequality is reduced by less than 1/3, meaning that the other 2/3 depends on other factors. A relevant part of the residual gender inequality is shown to be related to how the work is organized and rewarded in firms, and how the tasks and responsibilities are allocated across gender.

select, reward, and organize the work of their employees, who have different preferences in terms of time flexibility and work–life arrangements (Goldin & Katz, 2016). Goldin (2014) shows that in firms where work is organized around long working hours, inflexible time schedules, and where employees are not easily substitutable, pay and promotion probabilities exhibit non-linearities that disproportionately benefit those employees (mostly men) who are able (or prefer) to work under tight constraints, thus increasing gender inequalities. Conversely, in jobs where work is organized around flexible time schedules, where responsibilities are evenly shared among employees and part-time work is diffused, gender differences in pay and promotion are likely to be less pronounced (Bloom et al., 2009; Datta Gupta & Eriksson, 2012; Kato & Kodama, 2015).

3 Data and descriptive statistics

3.1 Sample selection and variables description

We use data from the European Working Conditions Survey (EWCS)[3], a unique survey combining a large coverage of countries (EU28 plus another eight European countries), with detailed information on employees' demographics, job attributes, working conditions, management, and work organization arrangements, as well as indicators of self-reported satisfaction, health, and discrimination at the workplace (Eurofound, 2012). In this paper we use data from four waves (2000, 2005, 2010, and 2015) for 15 countries[4] and further restrict our sample to employees aged 15 to 65 and working in the non-agricultural sector[5]. Overall, our final sample consists of 43,026 observations.

Gender discrimination in our dataset is assessed asking respondents to answer the following question: *Over the past 12 months, have you been subjected at work to discrimination on the basis of your sex?* Hence, we observe specific episodes of discrimination as perceived and reported by employees, that are likely to account for a missed promotion or a pay increase granted to a co-worker of the opposite sex, or alternatively the existence of a bias in the allocation of tasks across genders. Notice that both the wording of the question, as well as the 12 months reference period, may bias our measure of discrimination downward. Employees are more likely to report explicit discrimination episodes such as grievances with employee representative bodies or cases brought before the firm's equal opportunity commission, thus neglecting other forms of hidden discrimination and occupational segregation. In our

[3] European Working Conditions Survey Integrated Data File, 1991–2015 [computer file] 3rd Edition, February 2017. UK Data Service. Data are publicly available at http://www.eurofound.europa.eu - SN: 7363, https://doi.org/10.5255/UKDA-SN-7363-3.

[4] We restrict our analysis to EU15 (Austria, Belgium, Denmark, Germany, Greece, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the UK), since these are the only countries that have been surveyed in all waves. The whole empirical analysis is carried out using either country level post-stratification weight or cross-national weights (Eurofound, 2010).

[5] Retired individuals, students in full-time education, the self-employed and employees in the armed forces have been excluded. We also removed all observations in which the respondent replied "Don't know" or "Refusal".

sample, around 2% of respondents reported to have been subjected to gender discrimination; this share goes up among women (3.2%), while the share of men reporting gender discrimination is much lower (less than 1%).

Since measures of self-reported discrimination are not common in the literature and open to criticism for being sensitive to individual judgment, as well as to variations in the work environment, we replicate the analysis using more standard variables such as earnings and career advancements. The earnings variable we use is defined as net monthly earnings, while for career advancements we rely on a specific question about employees' expectations over career prospects in the current job[6]. Finally, given the very general nature of the survey question, we explore the possibility that perceived gender discrimination simply reflects episodes of overt harassment[7]. Since information on earnings, career advancements, and harassment are only available in the 2010 and 2015 surveys, this further round of analysis is restricted to these most recent waves of EWCS.

Female leadership is measured through the question: *Is your immediate boss a man or a woman?* Respondents whose immediate "boss" is a woman account for 26% of the sample, and over 75% of employees with a female boss are women. The share of female bosses has been growing over time; it was 22% in the 2000 wave and more than 35% in 2015. It is worth noting that the above definition of female leadership differs, in several ways, from the definition used in most studies in the literature. First, it is reported by the worker and not indirectly inferred from occupational classifications or other external information, which in our case should reduce measurement error and misclassifications. Second, the definition of a female boss encompasses any leadership position within the whole hierarchical structure and not just female CEO or executive positions. In this respect, while women who have reached the very top of the organizational hierarchy can certainly make a difference in combatting discrimination at the workplace and promoting a more family-friendly work environment, it is probably true that the immediate boss (whether manager or supervisor) is what matters most for gender imbalances and discriminatory behaviors at the workplace in terms of allocation of workloads, discretionary pay increases, and career advancements.

In the empirical analysis we include a large set of controls capturing individual, firm, and job characteristics. Moreover, information on work organization practices and social activities in which respondents are involved outside work are used to carry out additional analyses and robustness checks (the full list of variables used and their means are reported in Table 10 of the Appendix).

While the information available in EWCS data are ideal to exploit the wide differences in management, work organization, and other institutional arrangements across European workplaces, there are some obvious limitations. Two in particular are worth mentioning: first, data are not drawn from an employer–employee survey,

[6] The exact wording of the question is, *my job offers good prospects for career advancement* and respondents had to agree or disagree (on a 5-point scale, from strongly agree to strongly disagree) with the statement. We recoded the variable as a dummy taking value one if the respondent agreed or strongly agreed and zero otherwise.

[7] Harassment is measured through a dummy variable that takes value 1 if, "over the past 12 months, during the course of work" the individual has been subjected to bullying/harassment or sexual harassment.

which makes impossible to identify employees that work in the same firm and account for their common unobserved characteristics; second, data do not allow to follow the same individual over time and thus account for individual time-invariant unobserved heterogeneity. The trade-off, with respect to some existing studies which use employer–employee panel data, is that those studies (with few exceptions) have to rely on more limited or imprecise information on work practices and firms' attributes, and generally focus on a single country[8]. In our data, the availability of detailed information on employees' work tasks, firm's attributes, and work organization practices allows us to investigate the heterogeneity in the relationship among female leadership, family-friendly arrangements, and gender discrimination without relegating them to fixed effects. Moreover, the coverage of up to 15 European countries for nearly two decades constitutes a clear advantage in terms of generalizability and external validity of our results (Bloom et al., 2009).

3.2 Descriptive statistics

Summary statistics for our main variables of interest are reported in Table 1. Female bosses tend to be polarized by gender, with 44% of females reporting to have a woman as immediate supervisor, as compared with only 11% of men. Seen from another perspective, female bosses are more likely to be found where the share of females in the job is greater: the share of female bosses is more than 46% among women in female-dominated jobs, but only 18% among men, while it is less than 40 and 8%, in male-dominated jobs respectively, among women and men (see bottom two rows in Table 1). In general, public sector jobs and large firms are characterized by a larger fraction of female bosses with respect to smaller firms and the private sector, among both male and female employees.

While no remarkable differences are found in the distribution of female bosses across age groups or education in the female sample, female supervisors are more likely to be found among highly educated male employees, as compared with lower educated ones. As for tenure, female bosses account for 47 to 49% (12 to 16%) of women (men) with up to five years of experience in the firm, while the share is lower among highly tenured workers. Gender discrimination is more likely to be reported by young women, with tertiary education, and working in large firms. A similar distribution is observed among males, although with less pronounced differences and with an overall share of reported discrimination that is much lower (mainly below 1% in each group).

In Fig. 1 we show the distribution of female bosses and gender discrimination across occupations and industrial sectors, separately for female and male employees. Each dot represents average values of the variables for the selected group, while

[8] Cardoso and Winter-Ebmer (2007) used administrative data from the Ministry of Employment in Portugal; Flabbi et al. (2019) matched the Italian social security archive with two company surveys; Bertrand et al. (2018) used data from the Norwegian Registry Archives merged with the Register of Business Enterprises and the Register of Company Accounts. Datta Gupta and Eriksson (2012) and Gagliarducci and Paserman (2015) were able to match their employer–employee panel data (the first from Statistic Denmark, the second from IAB and social security data for Germany) with ad hoc workplace surveys with information on management and work organization practices similar to our own. Kato and Kodama (2015) used firm-level data from Japan.

Table 1 Summary statistics on female leadership and gender discrimination

	Female boss		Gender discrimination	
	(F)	(M)	(F)	(M)
Age				
<25	45.04	14.64	3.82	1.00
25–35	44.67	12.33	3.82	0.87
36–55	44.01	10.51	3.03	0.82
>55	47.82	12.11	2.04	0.46
Education				
Compulsory	45.43	6.955	2.53	0.65
Secondary	44.29	10.54	2.80	0.80
Tertiary	44.55	17.64	4.35	0.99
Private sector	39.93	9.03	3.20	0.67
Public sector	53.45	20.82	3.32	1.36
Small firm <100	43.76	11.00	2.79	0.64
Large firm ≥100	47.16	12.77	4.56	1.15
Tenure				
up to 1 year	46.68	15.93	3.06	1.04
2–3 years	46.63	11.51	3.69	0.97
4–5 years	48.78	12.80	3.32	0.90
6–9 years	43.69	10.26	3.69	0.62
10 or more yrs	41.57	10.08	2.94	0.72
Female-dominated job	46.75	18.86	2.79	1.44
Male-dominated or equal-share	39.49	8.21	4.34	0.53
Total	44.63	11.61	3.24	0.82

Figures reported are percentages for the share of female bosses and gender discrimination in each group

dotted lines represent sample averages. Panel A of Fig. 1 shows that women in managerial positions are more likely to report episodes of gender discrimination at the workplace, while those in service and elementary occupations are the least likely to report such episodes. Not surprisingly, occupations with a larger share of female bosses are also the ones where episodes of gender discrimination are less frequently reported by women (more by males), suggesting the presence of sorting by gender across jobs and workplaces on the basis of firms' attributes and a family-friendly work environment. The same patterns are detected across industries (Panel B).

We further inspect how gender discrimination relates to the presence of a female boss and the share of women in the job, by plotting (the share of) female bosses against perceived gender discrimination (separately for males and females) across stylized job types. In Fig. 2, job types are defined crossing occupation, industry and firm size (i.e., for a total of 160 job types), where the size of each marker also reflects the relative share of females in each cell. The fitted lines suggest that female employees tend to report lower gender discrimination as (the share of) female bosses

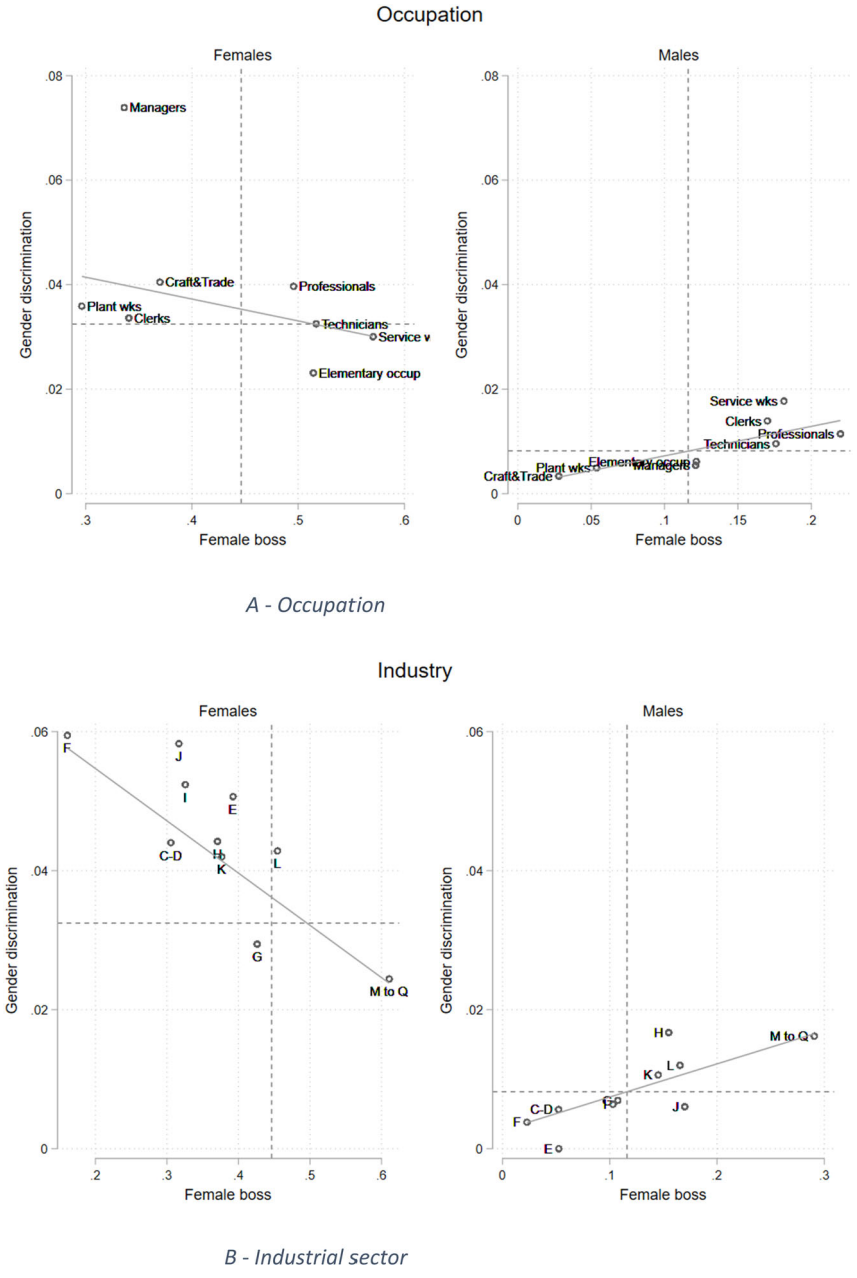

Fig. 1 Gender discrimination and female leadership across occupations and industrial sectors

in the job increase. The opposite occurs with male employees, while the larger size of the markers also suggest that female presence increases with female bosses within each job type.

When we explore the distribution of female bosses and gender discrimination across countries, we find a less clear-cut pattern between the share of female bosses

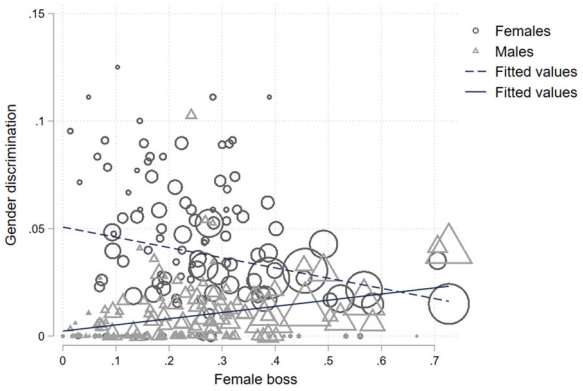

Fig. 2 Gender discrimination, share of female bosses and female representation in the job

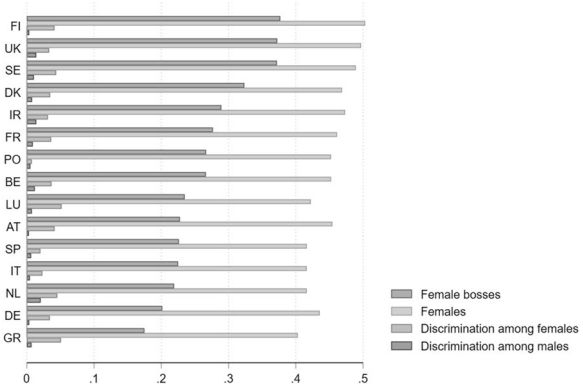

Fig. 3 Gender discrimination, share of females and female bosses across countries

and gender discrimination (Fig. 3). In particular, while Nordic and English-speaking countries report a larger share of female bosses, and Mediterranean countries a rather smaller share, the incidence of gender discrimination appears to be quite heterogeneous across countries and gender, ranging from 0.3% (male sample in Austria) to 5.3% (female sample in Greece).

4 Empirical analysis: does having a female boss make a difference?

To get an idea of whether having a female boss makes a difference in the probability of experiencing and reporting episodes of gender discrimination at the workplace, we estimate a probability model where discrimination is a binary outcome and having a woman as the immediate boss is our variable of interest[9]. Since, as shown in the

[9] Notice that, since we are modeling a "rare" event (i.e., with a large number of zeros), linear probability models can be problematic due to the large number of out-of-bounds predictions.

descriptive analysis, a female boss is more likely to be observed in specific job types and where women are over-represented, we always control for the share of female employees in the job, as well as a number of work attributes. In practice, our baseline model is specified as follows:

$$\Pr\left(Discr_{ijt}=1\right)=\Phi\left(\alpha+\gamma\, bosswoman_{ijt}+\delta\, femaleshare_{ijt}+X'_{ijt}\beta_1+c_j+t_t\right) \tag{1}$$

where $Discr_{ijt}$ is a latent dummy variable that takes value 1 if individual i, in country j at time t reported to be discriminated on the basis of gender. The variable $bosswoman_{ijt}$ is a binary indicator that takes value 1 when the employee immediate boss is a woman, while $femaleshare_{ijt}$ is the share of female employees in the job[10]. X'_{ijt} is a vector of covariates, which includes demographics (gender, age, marital status, presence of a child under 15 in the household, household size, educational attainment, and whether the respondent is the person who contributes most to household income), job-related attributes (occupational dummies from 1-digit ISCO-88 and tenure) and other firm characteristics (industry dummies at 2-digit NACE, log of firm size, and a public sector dummy). All specifications include country (c_j) and time fixed effects (t_t), while standard errors are clustered at the country–year level to account for possible country and time-specific heteroskedasticity. In alternative specifications, as a robustness test, we estimate Eq. (1) using smaller clusters as well as more general heteroskedasticity-robust standard errors.

Equation (1) is estimated as a simple probit on the pooled sample, as well as separately for female and male employees. We also explore potential mechanisms that contribute to shape the relationship between female leadership and gender differences, focusing on the role of work organization practices and female presence in the job, as well as the existence of heterogeneous patterns across countries, jobs, and workplace attributes. In the robustness analysis, we experiment using further specifications where we include additional controls for employees' overall satisfaction with working conditions, time spent in social activities outside of work and the degree of risk aversion. To compare our findings with existing literature, we replace our measure of gender discrimination with more traditional variables used in the discrimination literature, such as earnings and career advancements. Finally, to address the criticism that our dependent variable may capture subjective values of individuals rather than gender discrimination, we run several placebo tests with alternative measures of discrimination for which we have information.

Clearly a fundamental problem in estimating Eq. (1) is that the presence of women as bosses in the occupational hierarchy (i.e., supervisory and managerial positions) within firms is unlikely to be randomly distributed across jobs and workplaces. In other words, differences between jobs where the boss is female and those where the boss is male might depend, on top of the observed factors, on several characteristics that are unobserved. Moreover, the likelihood of observing more females in some jobs, as well as more female bosses, may depend on the lower propensity to

[10] Female share is the (weighted) average share of female employees computed by occupation, firm size, country, and year in the sample. We also experimented an alternative specification where *femaleshare* is computed by industrial sector, firm size, country, and year, and we obtained very similar results.

discriminate against women, such that reverse causation is an additional threat to our estimates. While we control for a large number of observable factors that, in the gender discrimination literature, have been shown to be relevant in explaining discrimination across gender at the workplace, our estimates of the association between the *bosswoman* dummy and gender discrimination in Eq. (1) cannot be interpreted as a causal relationship. Given the lack of a suitable instrument for the presence of a female boss, we take a number of steps to reduce the potential bias and explore unobservable heterogeneity. First, to account for time-invariant unobserved heterogeneity across workplaces in different countries, we estimate the model saturating our baseline specification with a large set of fixed effects, interacting country dummies with industry and firm-size dummies. Second, we allow for a more flexible specification including country-specific time trends. Third, following the procedure by Oster (2019), we test the robustness of our results to omitted variable bias associated with the existence of a selection process that drives females in leadership positions. Building on Altonji et al. (2005), this procedure evaluates the possible degree of omitted variable bias under the assumption that selection on observables is proportional to selection on unobservables. Moreover, exploiting information on coefficient movements after the inclusion of additional controls, as well as on movements in the R-squared when the controls are included, it provides consistent estimates of the biased-adjusted treatment effect. In order to implement Oster's full adjustment, we estimate Eq. (1) by means of a linear probability model[11].

5 Results

5.1 Baseline results

We begin estimating Eq. (1) on the pooled male–female sample. Table 2 reports the main results obtained under different specifications[12]. In column 1, we adopt the most parsimonious specification, which only includes our variable of interest (i.e., *bosswoman*), demographic controls, as well as country and year fixed effects, while in column 2 a number of job and firm attributes are added to the baseline specification. We always report the average marginal effects (AME) for the variables of interest[13].

The estimated coefficient on the *female* dummy indicates that female employees, compared to male employees, are more likely to experience and report gender discrimination; also, highly educated and younger employees are positively correlated with gender discrimination. Interestingly, household composition (i.e., presence of a partner, a child under 15, and household size) is not correlated with gender discrimination. The presence of a female boss is always statistically significant and

[11] Note that the Oster (2019) procedure can only be performed in linear models.

[12] Our baseline estimates were also replicated on an extended sample covering 33 countries using the last two waves (EWCS 2010–2015). The main set of results on the extended sample confirms most of our findings above (more detailed results are available upon request with the authors).

[13] Coefficients estimates for the full specification can be found in Table 11 in the Appendix.

Table 2 Gender discrimination and female leadership (AME)

	Pooled sample		Females		Males	
	(1)	(2)	(3)	(4)	(5)	(6)
Bosswoman	−0.756*** (0.145)	−0.736*** (0.150)	−1.930*** (0.330)	−1.621*** (0.380)	0.664** (0.323)	0.291 (0.280)
Female	2.740*** (0.249)	2.755*** (0.286)				
Demographics						
age 25–35	−0.165 (0.430)	−0.285 (0.454)	−0.412 (0.843)	−0.666 (0.945)	0.0658 (0.223)	0.136 (0.208)
Age 36–55	−0.495 (0.334)	−0.466 (0.415)	−1.258* (0.669)	−1.491* (0.824)	0.116 (0.283)	0.188 (0.317)
Age 56+	−1.274*** (0.451)	−1.180** (0.531)	−2.420*** (0.825)	−2.532** (0.989)	−0.311 (0.288)	−0.225 (0.302)
Partner	−0.299 (0.259)	−0.309 (0.252)	−0.0111 (0.669)	−0.119 (0.629)	−0.250 (0.302)	−0.203 (0.296)
Child	−0.131 (0.257)	−0.132 (0.261)	−0.687* (0.399)	−0.579 (0.357)	0.385 (0.474)	0.353 (0.456)
HH size = 2	0.303 (0.286)	0.318 (0.275)	0.654 (0.481)	0.619 (0.464)	0.161 (0.334)	0.242 (0.323)
HH size 3+	0.126 (0.361)	0.156 (0.361)	0.899* (0.496)	0.900* (0.492)	−0.381 (0.430)	−0.330 (0.425)
Secondary educ	0.118 (0.252)	−0.0676 (0.246)	−0.0694 (0.424)	0.0811 (0.390)	0.197 (0.264)	−0.215 (0.285)
Tertiary educ	0.808*** (0.293)	0.618** (0.306)	1.291** (0.547)	1.493*** (0.557)	0.188 (0.260)	−0.227 (0.356)
Breadwinner	0.335 (0.235)	0.316 (0.233)	1.333** (0.603)	1.220** (0.529)	−0.233 (0.211)	−0.0867 (0.181)
Female share		0.531 (1.243)		−0.690 (2.306)		1.106 (0.698)
Country and year dummies	✓	✓	✓	✓	✓	✓
Job and firm characteristics		✓		✓		✓
Pseudo-R^2	0.067	0.081	0.036	0.059	0.054	0.114
N	43,026	43,026	21,208	21,208	21,418	21,418

Marginal effects and standard errors are multiplied by 100

Job and firm characteristics (7 dummies for occupation, 9 dummies for industry, 4 dummies for tenure, log of firm size and a public sector dummy)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses, clustered at the country and year level

negatively associated with gender discrimination, while the magnitude of the coefficient is stable even after the inclusion of additional controls for job and firm characteristics[14]. The AME suggests that shifting from a male to a female boss, ceteris paribus, would imply a *per year* overall reduction of 0.74% in the likelihood of reporting gender discrimination. Other aspects of the work environment, such as working in specific occupations or industrial sectors are only weakly associated with gender discrimination or not statistically significant (see Table 11 in the Appendix).

Overall, these findings might be consistent with both taste and statistical theories of discrimination. In the first case, female bosses are found to have no (or at least lower) taste for gender discrimination, as opposed to male bosses, which could be rationalized in terms of prejudice, cultural factors, and social norms (Bertrand, 2011). In the second case, female bosses are deemed to be better at assessing the (unobserved) productivity of their female subordinates, thus improving the (gender) allocation of work as well as the (gender) gap in rewards, thereby reducing perceived discrimination (Aigner & Cain, 1977).

An underlying hypothesis of the empirical specification on the pooled sample is that, while gender discrimination is more likely to be reported by women, the association of having a female boss with gender discrimination is restricted to be the same across males and females. However, as found in the literature, the gender of the boss may be expected to play a different role across gender in shaping the relationship between discrimination, work environment, and leadership. To assess this, in columns 3 to 6 we estimate the different specifications of our model separately for male and female employees. Interestingly, the presence of a female supervisor is associated with opposite outcomes across gender: the coefficient of *bosswoman* is negative and strongly significant for female employees, while it is positive or not statistically different from zero among male employees. This finding is in line with existing evidence from laboratory and field experiments showing a different behavior of female bosses when dealing with female coworkers, as opposed to males, as well as in predominantly female jobs compared to male-dominated jobs. In the context of statistical discrimination this is also consistent with the hypothesis that female bosses may have a comparative advantage in assessing females' (unobserved) productivity.

Household composition, the presence of school-age children, and being the main contributor to household income are generally uncorrelated with gender discrimination or only weakly correlated in the female sample.

In terms of AMEs, a shift from male to female boss is associated with a reduction in the probability of experiencing and reporting discrimination among females of about 1.6%. While this effect may appear small in magnitude, it should be recalled that our indicator of gender discrimination measures a relatively "rare" event, that is, an episode of gender discrimination experienced and reported by the individual in the last 12 months. In order to compare the above estimate with more traditional measures of discrimination in pay or career advancement, it should be considered that the latter are likely to be cumulative processes over the working life of individuals, such

[14] Notice that the relatively small values of McFadden's pseudo-R-squared can also depend to the presence of (classical) measurement error.

that the expected long-term effect of female leadership is likely to be a multiple of our estimated marginal effects[15].

Hence, in line with a number of stylized facts traditionally found in the gender discrimination literature, we find that the presence of women in leadership positions is associated with lower overall gender discrimination, both because women are those who mainly experience discrimination within workplaces and because the estimated marginal effect of the *bosswoman* dummy is larger (and negative) for women as compared to men (where it is positive but not statistically different from zero).

While the above findings are indicative of the role on discriminatory behaviors by gender, they do not shed light on the channels through which female leadership and the incidence of females in the job interact within firms. The next section is devoted to the investigation of the mechanisms that shape gender differences and perceived discrimination in organizations.

5.2 Exploring potential mechanisms

There are several ways through which a female boss may influence gender differences and perceived discrimination at the workplace. As discussed above, bosses are expected to generate spillovers on subordinates in terms of firms' hiring, promotion, and compensation policies. Moreover, the gender composition of an organization, or the gender of the boss, may shape the way these policies are implemented. Another interesting mechanism through which female leadership is expected to affect gender inequalities within firms is via the management style, the organization of work, and the allocation of tasks within occupations. In what follows we exploit the rich set of information on job attributes and work organization practices that are available in our dataset, in order to inform and validate the empirical relevance of the above hypotheses.

5.2.1 Work organization practices

In order to explore the role of working arrangements, that is how work is organized at the workplace and the relationship between a female boss and gender discrimination, we augment our baseline specification with a vector of work organization characteristics describing employees' work intensity (pace of work, not having enough time to get the job done), working time flexibility (working long hours, taking a break when needed) and the work environment (work–life balance and receiving support from colleagues). Panel A in Table 3 reports the correlations of work organization variables with gender discrimination, for the pooled sample as well as separately by gender. While these estimates have to be interpreted with care, as work organization features could themselves be an outcome of having a female boss, we find that practices directed at improving employees' work–life balance are strongly and negatively associated with episodes of gender discrimination for both sexes, with

[15] A back-of-the envelope calculation suggests that a woman with average tenure and a female boss (i.e., approximately 8.5 years in our sample) over her working career has a lower probability of reporting gender discrimination of about 14 percent.

Table 3 Gender discrimination, female leadership and unfavorable work environment (AME)

	Pooled sample (1)	Females (2)	Males (3)
Panel A			
Bosswoman	−0.771*** (0.154)	−1.800*** (0.414)	0.301 (0.228)
Female	2.951*** (0.271)		
Female share	0.597 (1.269)	−0.379 (2.270)	1.006 (0.731)
Pace of work	0.865*** (0.200)	1.261*** (0.321)	0.659*** (0.221)
Enough time	−1.768*** (0.421)	−2.103*** (0.670)	−0.704*** (0.263)
Long hours	1.192*** (0.215)	2.061*** (0.366)	0.449** (0.177)
Breaks at work	−0.615*** (0.229)	−0.808* (0.446)	−0.347* (0.205)
Colleagues' support	0.0874 (0.396)	−0.0583 (0.800)	0.265 (0.291)
Work-life balance	−1.393*** (0.265)	−2.226*** (0.354)	−0.357* (0.192)
Pseudo-R^2	0.122	0.103	0.156
N	43,026	21,208	21,418
Panel B[a]			
Bosswoman	−0.973*** (0.198)	−2.004*** (0.409)	0.286 (0.220)
No WFFO	1.002*** (0.140)	1.674*** (0.237)	0.488*** (0.112)
Bosswoman × No WFFO	−0.089 (2.140)	−0.456* (0.424)	0.175 (3.552)
Female	2.868*** (0.260)		
Female share	0.518 (1.258)	−0.602 (2.275)	0.982 (0.724)
Pseudo-R^2	0.122	0.102	0.154
N	43,026	21,208	21,818

Marginal effects and standard errors are multiplied by 100

Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses, clustered at the country and year level

[a]AME for interaction terms are calculated with the method by Norton et al. (2004)

an estimated AME that is significantly larger for females. Conversely, high work intensity, measured by the pace of work and not having enough time, is positively associated with gender discrimination for both males and females, confirming previous evidence that the workload in the allocation of tasks contributes to gender imbalances within workplaces. Time flexibility, in terms of not working long hours, mainly affects perceived discrimination for female employees and has a very small effect on males. In line with the findings of Goldin (2014)—who argues that part of the gender pay gap found in most sectors and occupations can be explained by the presence of high rewards for (long) hours worked—we find that long and rigid working time schedules contribute to higher perceived gender discrimination among women. In other words, since women typically put more value on time flexibility than men (as they remain the dominant providers of child and elderly care), having to work long hours imposes a larger implicit cost on women thus resulting in higher perceived discrimination among female employees compared to male employees.

These findings provide support for the hypothesis that the presence of a female boss is associated with lower overall perceived gender discrimination at work, and that the presence of flexible work schedules and a better balance between work and life further contributes to reinforce a mitigating effect on discrimination. Also, the fact that the AME of the *bosswoman* dummy is not eroded by the inclusion of work organization variables (i.e., the magnitude slightly increases) indicates that the female boss effect is not entirely mediated by a more gender-balanced organization of work.

In panel B of Table 3, we further characterize the role of work organization attributes by investigating to what extent the relationship between work organization and gender discrimination is mediated by the presence of a female supervisor. One reason why women tend to be concentrated in specific occupations may be related to the presence of a better gender balance, or a lower perceived penalty associated to working time flexibility and work intensity, in jobs characterized by more family-friendly environments (Goldin, 2014). If female bosses are more likely to adopt a management style that is less biased toward women, we expect their mitigating role on perceived discrimination to be stronger where work is organized around high commitment and effort, and where time schedules are rather inflexible such that women are more likely to be disadvantaged in terms of work–life balance. To test this hypothesis, we construct an indicator of "work-family-(un)friendliness" in the organization of work—in terms of workloads, working time rigidity, and absence of work–life balance—and interact it with the *bosswoman* dummy. In practice, we use the principal component analysis (PCA) to derive a synthetic index of "no-work-family-friendly organization" (*No-WFFO*) drawn from the set of work organization variables included in our previous specifications. We retain the first component of the PCA[16] and standardize it to have zero mean and unit standard deviation, so that it is increasing in the no-family-friendliness of the work organization.

In panel B of Table 3, we report the AME of our variables of interest for the pooled sample and separately by gender. A negative sign on the interaction term can be interpreted as an indication of an additional mitigating effect of a female boss on gender discrimination through the way work is organized. Notice that, given the non-linearity of the probit model, care has to be used in computing the AME, as the full interaction effect consists of the cross-partial derivative of the expected value of the dependent variable. AME and standard errors of the interaction terms are computed using the method provided by Norton et al. (2004)[17]. Estimates for the pooled sample (column 1) confirm our previous findings that an unfavorable organization of work is likely to be associated with higher perceived gender discrimination. The estimated coefficient on the *No-WFFO* indicator is also associated with a higher probability of reporting discrimination among employees working for a male boss, while the coefficient on the *bosswoman* dummy is similar to previous results (see Table 2). The interaction term (i.e., *bosswoman* × *No-WFFO*), in the pooled sample shows the expected negative sign but it is not statistically significant.

[16] It accounts for more than 23% of the total variance and has positive loadings on all variables, larger for workloads and absence of work–life balance.

[17] The Stata command (inteff) developed by Norton et al. (2004) provides the correct marginal effect of interaction terms for logit and probit models, as well as the correct standard errors.

When the analysis is split by gender (columns 2 and 3), we still find that a poor-family-friendly work organization is associated with higher perceived gender discrimination for both female and male employees, though the AME is larger for women. A negative and statistically significant coefficient on the *bosswoman* × *No-WFFO* interaction is detected for women, while there is no statistically significant effect for men.

The above result indicates that part of the mitigating effect that female bosses have on gender discrimination might go through the management style or, to put it in another way, the gender penalty associated with a work environment that is not particularly family-friendly—in terms of work intensity, working time inflexibility, and lack of support from colleagues—is reduced for women when the immediate boss is also a woman. Conversely, for male employees the gender of the boss does not play any role in shaping the relationship between work organization and perceived gender discrimination. A way to explain these findings can be traced back in the way incentives and promotions are designed and implemented by female or male bosses. If male bosses are more likely to foster employees' competition and attach high pay and promotion opportunities to long hours, high work intensity, and a rigid work schedule, then women, who may value more part-time and working time flexibility, are more likely to be penalized by an incentive structure that disproportionately rewards a non-family-friendly work organization.

Given that most of the estimated coefficients on the female boss dummy and gender discrimination as reported by male employees are not statistically significant, to save space we focus rest of the analysis on the female sample, while we relegate results for the male sample to the Appendix.

5.2.2 Female representation in the job

In Table 4 we investigate whether the effect of having a woman as an immediate boss makes a difference when the subordinate employee occupies a predominantly male or female job. To do this, in column 1 we split the effect of the *bosswoman* dummy between female-dominated jobs and other jobs: the former takes a value of 1 when

Table 4 Gender discrimination, female leadership and female representation in the job (AME)

	Females	
	(1)	(2)
Bosswoman_mostlywomen	−1.504*** (0.348)	−2.367*** (0.536)
Bosswoman_mostlymen/even	−1.508*** (0.518)	−1.588** (0.384)
Female share	−0.791 (2.374)	−0.912 (2.814)
Pseudo-R^2	0.059	0.072
N	21,208	9,943

Marginal effects and standard errors are multiplied by 100

Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses (col. 2) and clustered at the country and year level (col. 1)

the share of females in the job (computed by occupation and firm size in each country and year) is (strictly) above 50% (*mostlywomen*), 0 otherwise; while the latter takes a value of 1 when the share of females in the job is equal or below 50% (*mostlymen/even*), 0 otherwise[18]. Next, in column 2 we rely on a more precise definition drawn from a specific question (available only in the 2010 and 2015 waves) asking the respondent about the predominantly female (or male) nature of similar jobs within the firm[19].

The estimated coefficients of the *bosswoman_mostlywomen* and the *bosswoman_mostlymen/even* dummies show the expected negative sign and are always statistically significant, indicating that female bosses are likely to be associated with lower perceived discrimination by female subordinate employees across all types of jobs. Conversely, in the male sample (see Table 12 in the Appendix), a positive coefficient is detected only on the *bosswoman_mostlywomen* dummy, suggesting that, if anything, male employees report they are discriminated by a female boss only when employed in female-dominated jobs (or where the share of females in the job is higher). This finding is consistent with the so-called women helping women hypothesis, suggesting that female bosses create positive spillovers mainly for their female subordinate employees (Neumark & Gardecki, 1998).

5.3 Exploring heterogeneous patterns

In consideration of the cross-country and time-series dimensions of our dataset, considerable heterogeneity might be expected in the estimated effects according to stylized job and workplace characteristics, as well as across countries. We thus replicate our estimation exercise reporting the coefficient of the *bosswoman* dummy by firm size, industry, public–private ownership and working time schedule (in Table 5), as well as by country of residence of the respondent (in Table 6), focusing only on female employees. Results, in Table 5, show different AME on the *bosswoman* dummy by sectors and firm size, suggesting a greater association in industries where female presence is also higher (public sector and service industries) and where work organization is more complex (very large firms), while no differences are detected between women employed with a full-time or part-time contract.

In Table 6, we investigate the heterogeneous role of the female boss across clusters of countries. Notice that, since estimation by single country is unfeasible due to the small sample sizes, we group countries in clusters using a standard classification of welfare and institutional features (Muffels & Luijkx, 2008). In practice we classify countries in four groups: Nordic (DK, SE, FI), Continental (AT, BE, DE, LU, NL, FR), Mediterranean (GR, IT, SP, PO), and Anglo-Saxon countries (IRL, UK). In terms of the AME, the association between female boss and gender discrimination is estimated to be around −2% in Nordic, Continental and Anglo-Saxon countries, while it is not statistically different from zero in Mediterranean countries. Interestingly, the presence of a female boss seems to be more beneficial in terms of (reduced) gender discrimination in countries where labor market flexibility is higher,

[18] Experimentation with slightly different thresholds produces similar results.

[19] The exact wording of the question is: "At your place of work are workers with the same job title as you … (Mostly women/Mostly men/More or less equal numbers of men and women)".

Table 5 Heterogeneous effects—firm size, industry and part-time (AME)

	Females							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Large firm (≥100)	Small firm (<100)	Manufacturing sectors	Services sectors	Private sector	Public sector	Full-time	Part-time
Bosswoman	−3.759***	−1.039***	−1.262	−1.575***	−1.059***	−2.626***	−1.594***	−1.527***
	(0.802)	(0.332)	(1.768)	(0.406)	(0.399)	(0.665)	(0.508)	(0.436)
Pseudo-R^2	0.097	0.057	0.207	0.055	0.058	0.118	0.064	0.099
N	5,222	15,986	2,637	18,571	13,164	8,044	15,307	5,712

Marginal effects and standard errors are multiplied by 100

Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses, clustered at the country and year level

Table 6 Heterogeneous effects—country clusters (AME)

	Females			
	(1) Nordic countries	(2) Continental countries	(3) Mediterranean countries	(4) Anglo Saxon countries
Bosswoman	−2.400*** (0.767)	−2.046*** (0.561)	−0.624 (0.545)	−1.703* (1.027)
Pseudo-R^2	0.082	0.075	0.115	0.098
N	4,783	9,050	4,452	2,911

Marginal effects and standard errors are multiplied by 100

Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses

jobs and wages are less regulated, and female participation is greater (Cipollone et al., 2014). Conversely, in Mediterranean countries strong familism and more traditional gender norms seem to reduce the potential of a female boss to mitigate gender discrimination. While we can only speculate on the underlying mechanisms that are driving the above results, in a later section we provide further evidence of the *bosswoman* effect in terms of pay and career opportunities.

5.4 Analysis of discrimination

The measure of perceived gender discrimination or gender bias used in this study is not standard in the literature, where variables such as pay or promotions have been used instead. As discrimination against women in the workplace could mean many different things, in this section we further contextualize our dependent variable in order to shed more light about what discriminatory behaviors we are considering.

First, to compare our main findings with existing studies, we replicate our analysis using more traditional variables. In particular, we estimate a different specification of Eq. (1)—on the male–female pooled sample—where the association of female leadership with gender discrimination is assessed with respect to earnings and career advancements. Second, we explore the possibility that self-reported gender discrimination, as measured by our dependent variable, simply reflects episodes of on-the-job harassment—hostile receptions that discourage individuals from entering and remaining in specific domains. In order to see whether having a female boss, as opposed to a male one, is associated with a lower wage penalty, better prospects for career advancement, or lower probability of experiencing any form of harassment for women (compared to men), we interact the *bosswoman* dummy with the *female* dummy.

The main findings, presented in Table 7, confirm the pay and career gender gap usually reported in the literature. Female employees, on average, earn less than men and are more likely to be in a leadership position in jobs where pay levels are lower, in line with available evidence on female occupational segregation. We find a further wage penalty associated with female-dominated jobs (−7.8%). Similar results are found concerning career advancements: female employees who work for male bosses

Table 7 Alternative measures of discrimination

	Earnings (1)	Career advancements (2)	Sexual harassment (3)
Bosswoman	−7.327*** (2.618)	−0.901 (2.103)	−0.143 (0.893)
Female	−15.49*** (2.133)	−3.698** (1.501)	1.866*** (0.593)
Bosswoman × female	5.883** (3.053)	4.487** (2.518)	−0.753 (1.150)
Mostlywomen	−7.761*** (2.043)	−8.047*** (1.333)	0.345 (0.536)

Coefficients, marginal effects and standard errors are multiplied by 100. Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

Estimates for the most recent waves (2010–2015). Columns 2 and 3 report average marginal effects calculated with the method by Norton et al. (2004)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses

show a lower probability of being promoted, both with respect to male employees who work for a male boss (−3.7%) and to women with a female supervisor. As above, we also find that in female-dominated jobs, compared to all other jobs, the likelihood of career advancement is lower (−8%).

Focusing on our parameter of interest and in line with our previous findings, we find a positive and statistically significant correlation on the *bosswoman* × *female* interaction term, suggesting a mitigating role on both the gender pay gap and the probability of career advancement when the immediate boss is a woman. The gender wage gap is estimated around −9.6% for women with a female boss, as opposed to −15.5% for women who work for a male boss, while the chances of being promoted for women even increase when the boss is female. On the other hand, while women (working for a male boss) are more likely than their male colleagues to report episodes of harassment, the presence of a female supervisor is not related to any change in the probability of experiencing on-the-job harassment, suggesting that our dependent variable is capturing discriminatory behaviors other than overt harassment.

Overall, we find support for the hypothesis that female leadership is associated with reduced gender imbalances of other (mostly female) employees in subordinate layers of the occupational hierarchy.

6 Robustness checks

In order to test the robustness of our main findings, in this section we perform a number of sensitivity checks. We experiment with several changes with respect to the model specification, different subsamples of the population, as well as alternative estimation methods.

All robustness checks are performed using our baseline specification (column 2 in Table 2), on the female sample. AMEs for the *bosswoman* dummy are reported in Table 8[20].

We first check the sensitivity of our results to the contribution of a specific country, by re-estimating the model excluding one country at a time (line 1). Results

[20] For each model we also report the Wald-χ^2 test for the joint significance of all predictors.

Table 8 Robustness checks (AME)

	Female		
	Bosswoman	Wald-χ^2 (p-value)	Obs.
Different samples by country			
1. Drop countries: range [min;max][a]	[−1.781***; −1.367***]		
Different specifications			
2. Control for satisfaction	−1.663*** (0.390)	72039.4 (0.000)	21,116
3. Control for social activities	−1.365*** (0.465)	36082.9 (0.000)	18,780
4. Control for risk aversion	−2.570** (1.184)	136.6 (0.000)	3,149
5. FE (country × industry × firmsize)	−1.799*** (0.414)	415.27 (0.000)	19,680
6. Country-specific time trends	−1.604*** (0.387)	233.19 (0.000)	21,208
Different estimation methods			
7. Complementary log-log model	−1.640*** (0.413)	32955.72 (0.000)	21,208
Alternative computation of std. errors			
8. Country × year × firm size clusters	−1.621*** (0.355)	1236.08 (0.000)	21,208
9. Robust std errors	−1.621*** (0.389)	201.50 (0.000)	21,208

Marginal effects and standard errors are multiplied by 100

Results are obtained using the full set of controls (demographics, job and firm characteristics, as well as country and year dummies—see Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors in parentheses (rows 1 and 4 to 6) and clustered at the country × year level (rows 2–3 and 7)

[a]The range of estimates is obtained excluding one country at a time from our preferred specification

show that the sign and statistical significance of our coefficient of interest are not altered by the change in the reference population, and that having a woman as an immediate boss is associated with a 1.4 to 1.8% lower probability of reporting gender discrimination in the female population.

Second, we check whether results are robust to the inclusion of additional controls that may be relevant in affecting gender discrimination at the workplace (lines 2 to 4). In particular, we augment the baseline specification including additional information on perceived job satisfaction with working conditions, individual preferences for social activities outside work (highly involved individuals might enjoy more leisure time and in turn report higher discrimination, if it reflects missed promotions or pay increases), and risk aversion[21]. In general, results are not modified by the inclusion of any of the above control variables.

Third, we investigate the sensitivity of our estimates to the limited incidence of non-zero outcomes in our dependent variable using an alternative estimation method that is robust to distributions with a large number of zeros, i.e., the complementary log-log model ("zero-inflated" model)[22]. When we correct for the "rare" nature of our

[21] Detailed information on variables' specification can be found in the Appendix.

[22] Recent literature in political and social sciences has raised the issue of explaining and predicting rare events (i.e., binary dependent variables with fewer ones than zeroes) with binary choice models. Besides the bias due to small samples, recent studies (King & Zeng, 2001) have argued that in rare events data, the biases in probabilities can be meaningful even with big sample sizes and that these biases result in an underestimation of event probabilities. To address these concerns, we also experimented with penalized likelihood methods. Results (not reported) are virtually unchanged.

outcome (line 7), our variable of interest remains strongly significant and bears the expected sign.

Fourth, we replicate our estimation exercise using alternative methods to compute standard errors. In particular, we rely on smaller clusters (at the country, year, and firm-size level) as well as on heteroskedasticity-consistent standard errors. Results, reported in lines 8 and 9, are virtually unchanged.

Fifth, since our measure of discrimination may be sensitive to individual judgment and reporting bias, we run a number of placebo tests investigating whether female employees systematically under-report gender discrimination when in a job with a female boss (see Table 15 in the Appendix). If this is the case, we should expect women to report lower or no discrimination in other domains of discrimination for which we have information, such as age, race, or nationality. We experimented with alternative measures of discrimination reported by employees, and found no evidence of any systematic subjective bias. In a similar exercise, we use measures of perceived health or work hazards[23], and found no evidence of systematic reporting bias.

Finally, we address the potential bias from unobserved heterogeneity between jobs where the boss is female and those where the boss is male. While conditioning on a large set of demographics, job and workplace characteristics, as well as work organization practices should reduce the likelihood of a spurious correlation, we cannot exclude that unobserved job and workplace characteristics (i.e., unobserved heterogeneity) or the lower propensity to discriminate against women (i.e., reverse causality) affect our estimates. In all the circumstances described above, the endogenous selection process is likely to provide biased estimates of the true effect of female bosses on gender discrimination. Lacking a valid instrument to address the above problems, we complement our empirical strategy in two different ways. First, we account for some time-invariant unobserved heterogeneity by saturating our preferred specification with a large set of fixed effects obtained interacting country, industry, and firm-size dummies (a total of 300 dummies). Also, we include country-specific time trends to control for time-varying unobservables that change over time, such as changes in social norms or cultural attitudes toward gender discrimination or women in leadership positions. The AMEs of the *bosswoman* dummy estimated on the female sample adding, respectively, fixed effects and country-specific time trends to the baseline specification are reported in lines 5 and 6 of Table 8. Results show that the negative sign, the magnitude of coefficients as well as the statistical significance of our variable of interest are not altered when an alternative specification is used, suggesting that time-invariant unobserved characteristics by country, industry, and firm size—or alternatively, country-specific unobserved trends—are not driving our results.

Second, following Oster (2019), we test the robustness of our results to omitted variable bias. The method developed by Oster (2019) to assess the bias arising from unobservable factors builds on the seminal work by Altonji et al. (2005), whose key

[23] We selected two questions available in each wave of the EWCS: "Do you think your health or safety is at risk because of your work?" and "dDoes your work affect your health?"

observation is that omitted variable bias is proportional to coefficient movements after the inclusion of observed controls, scaled by the change in R-squared when such controls are included[24]. This method delivers a consistent, closed-form estimator that relies on both coefficient and R-squared values, as well as on the variance of the outcome and the variable of interest (i.e., treatment). The implementation starts with the specification of a hypothetical regression of the outcome on treatment and both observed and unobserved controls. Rewriting Eq. (1) as a linear probability model in Oster form leads to the following equation (with subscripts suppressed for clarity):

$$\Pr(Discr = 1) = \alpha + \beta\, bosswoman + W_1 + W_2 + \epsilon \tag{2}$$

where W_1 (W_2) are linear combinations of observed (unobserved) control variables and their corresponding coefficients, and are orthogonal[25]. As β in Eq. (2) is not identified in the case of omitted variables, Oster's approach relies on the identification of a set of parameters on the treatment effect ($\widetilde{\beta}$, $\dot{\beta}$, $\widetilde{R}$, $\dot{R}$), that depend on two key inputs: δ, which is the coefficient of proportionality measuring the relative degree of selection on observables and unobservables, and R_{max}, which is the R-squared from the hypothetical regression in (2).

Results from the Oster (2019) procedure are reported in Table 9. Columns (1) and (2) report the coefficients and standard errors of the *bosswoman* dummy from the uncontrolled and controlled regressions respectively, along with the estimated R-squared values. The controlled regression is our preferred specification, that includes the full set of controls for demographics, job and firm characteristics, as well as country and year dummies. Columns (3) and (5) show the identified sets with different values of R_{max}, while in columns (4) and (6) we report the value of δ which produces $\beta = 0$, given the chosen value of R_{max}. The coefficient of the *bosswoman* dummy from the uncontrolled regression estimated by LPM is −0.018, with an R-squared of 0.003, while the corresponding estimate from the controlled regression is −0.0161 (virtually unchanged with respect to the AME we obtained from the baseline probit), with an R-squared of 0.017, suggesting a small movement in

[24] Altonji et al. (2005) provide a test statistic (valid under the null of a zero treatment effect) for the degree of selection on unobservables that fully confounds the estimate, but do not detail how to estimate a bias-adjusted treatment effect. Moreover, the baseline assumption that the inclusion of the unobservables would produce an R-squared of 1 is likely to understate the robustness of results, especially when there is measurement error in the outcome (Oster, 2019).

[25] As β in Eq. (2) is not identified in the case of omitted variables, the set of parameters ($\widetilde{\beta}$, $\dot{\beta}$, $\widetilde{R}$, $\dot{R}$), and additional inputs (δ, and R_{max}) are needed to implement the procedure. In particular, $\dot{\beta}$ and $\dot{R}$ come from an uncontrolled regression of the outcome on the treatment (*bosswoman* dummy) without additional explanatory variables, while $\widetilde{\beta}$ and $\widetilde{R}$ are obtained from a control regression, which includes the full set of observable controls. The bias-adjusted coefficient β^* is then defined as $\beta^* \approx \widetilde{\beta} - \delta\left[\dot{\beta} - \widetilde{\beta}\right]\frac{R_{max} - \widetilde{R}}{\widetilde{R} - \dot{R}}$, when $\delta = 1$. Oster (2019) suggests a heuristic approach with $R_{max} = 1.3\widetilde{R}$, based on a sample of randomized trials (90% of the trial results are robust to this value, while only 45% of results from a sample of non-randomized studies survive). In our empirical exercise we also consider a more restrictive value of $R_{max} = 2\widetilde{R}$, that allow 80% of randomized results to survive. We also evaluate whether the bounds of the identified set lie within the confidence interval of $\widetilde{\beta}$, especially if the estimated coefficient does not move towards zero when including additional explanatory variables. Further details on the method can be found in Oster (2019).

Table 9 Robustness to omitted variable bias

			$R_{max} = 1.3\widetilde{R}$		$R_{max} = 2\widetilde{R}$	
	(1) Baseline $\dot{\beta}, (SE), [\dot{R}]$	(2) Controlled $\widetilde{\beta}, (SE), [\widetilde{R}]$	(3) Identified set $\left[\widetilde{\beta}, \beta^{*\prime}\left(\min\{1.3\widetilde{R}, 1\}, 1\right)\right]$	(4) δ for $\beta = 0$	(5) Identified set $\left[\widetilde{\beta}, \beta^{*\prime}\left(\min\{2\widetilde{R}, 1\}, 1\right)\right]$	(6) δ for $\beta = 0$
Bosswoman	−0.018*** (0.0035) [0.003]	−0.0161*** (0.0043) [0.017]	[−0.0161, **−0.0152**]	8.052	[−0.0161, **−0.0128**]	2.921

The identified sets in columns 3 and 5 are calculated based on R_{max} given in the top rows and $\delta = 1$. Columns 4 and 6 show the value of δ which would produce $\beta = 0$, given the values of R_{max} reported in the top row. Estimates of the controlled regression are obtained using the full set of controls for demographics, job and firm characteristics, as well as country and year dummies (as in Table 2, col. 2)

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$; robust standard errors, clustered at the country × year level

coefficients and a relatively large movement in the R-squared. The bias-adjusted β is -0.0152 under $R_{max} = 1.3\widetilde{R}$, and -0.0128 under $R_{max} = 2\widetilde{R}$, and it survives both the confidence interval and the rejection of zero test. Finally, with coefficients of proportionality of 8 (for $1.3\widetilde{R}$) and 2.9 (for $2\widetilde{R}$), results can be considered robust to omitted variable bias.

7 Conclusions

Evidence from the analysis of a rich cross-country survey data covering 15 European countries over the period 2000–2015 suggests that having a female boss is associated with reduced gender discrimination and lower perceived gender bias in the workplace. In particular, we estimate that the presence of a female supervisor is associated with a lower probability for employees to experience and report discrimination on the basis of gender. This effect is shown to differ between female and male employees, with positive spillovers and lower discrimination mainly for female subordinates, while having a non-statistically significant effect for males. We also document a significant heterogeneity across occupations, industries, and workplace characteristics. The way work is organized, in terms of flexible working time and family-friendly practices, also matters for gender discrimination and can complement the effect of female bosses, particularly among women. We find support for the above findings even when we consider more traditional variables, such as pay and career advancement. Since female bosses are more likely to be concentrated in female-dominated jobs and a more family-friendly work environment, we interpret the above findings as suggestive evidence on the patterns of gender discrimination within workplaces. Results are shown to be consistent with more traditional measures of gender differentials and robust to a number of sensitivity checks. The above findings provide suggestive evidence consistent with most of the existing literature on gender discrimination, which predicts that women in leadership positions have less discriminatory taste, better information to assess the productivity of other women, and are less likely to introduce gender bias in the organization of work that is likely to penalize women. In this respect, we show that women who are in leadership positions are an important complement to firms' practices that are more friendly to employees with family obligations (mostly women), resulting in a lower gender discrimination. While the evidence presented in this study does not allow us to draw relevant policy implications, nevertheless the stylized facts we report are informative of the different gender discrimination patterns that are observed and reported by employees within European workplaces. Thus, an environment with a higher presence of women in leadership positions throughout the occupational structure, is a favorable environment to mitigate gender bias and discrimination toward women in workplaces. The way work is organized, along rigid working time schedules and poor work–life balance, seems to matter for employees' perception of gender discrimination and in particular for women who are more likely to be penalized, compared to men. Family-friendly work practices, part-time work, flexible working time, and parental leave arrangements are work environments that seem to better balance work and life, particularly for women (and men) with caring responsibilities. Whether this should

be done through a company's welfare provided schemes, through public subsidies for part-time work and child care facilities, or both, is yet to be assessed.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

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