Managing the Gender Wage Gap—How Female Managers Influence the Gender Wage Gap among Workers

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Abstract

Previous research shows that female managers narrow the gender wage gap (GWG) among workers but does not disentangle two general underlying mechanisms. First, female managers might use their organizational power to change organizational practices and make organizations more gender-equal. Second, female workers might benefit from interacting with a female manager, e.g. through homophily and mentoring. To disentangle these two mechanisms, I distinguish between female managers at the first management level, which is responsible mainly for organizational practices, and at the second management level, which mainly interacts with workers. Additionally, I consider practices enhancing gender equality, such as work-life balance practices. Using German linked employer–employee panel data and a firm fixed-effects regression, I find that female first-level managers slightly narrow the GWG. This influence is not affected by the consideration of organizational practices. Hence, female first-level managers do not affect workers’ by changing organizational practices. In contrast, female second-level managers considerably narrow the GWG among workers. In summary, female managers substantially reduce the GWG among workers, and this effect works via the manager–worker interaction mechanism. Hence, increasing the share of female second-level managers might close the GWG.

Introduction

Despite the great progress towards gender equality in recent decades, gender labour market inequalities—notably, the gender wage gap (GWG)—remain in many Western countries (Eurostat, 2019), even within organizations (Blau, 2016). Researchers have emphasized the necessity of ‘bringing the firm back in’ (Baron and Bielby, 1980: p. 738) to analyze how organizational structures determine inequality in organizations (Kanter, 1977; Baron and Bielby, 1980). Within organizations, differences in the group power of demographic groups can result in different flows of resources to these groups, resulting in between-group inequalities (Nelson and Bridges, 1999).

At the intersection of organizational demography and gender inequality, women’s limited access to positions of power, such as management positions, might contribute to persisting gender inequalities in organizations (Huffman, 2016) because managers make decisions regarding hiring, promoting, and organizational practices (Huffman, 2013). To test this hypothesis, researchers have explored whether increasing the share of female managers could further gender equality in the...
labour market. While some studies have found no influence of female managers on the GWG among workers\(^2\) (Srivastava and Sherman, 2015; Van Hek and Van der Lippe, 2019), most previous research suggests that female managers narrow the GWG among workers in many Western countries (Hultin and Szulkin, 2003; Cardoso and Winter-Ebmer, 2010; Hirsch, 2013; Abraham, 2017).

Two mechanisms can explain the impact of female managers on the GWG in an organization. First, female workers might benefit from female managers' homophily and mentoring when interacting with their managers (Hultin and Szulkin, 2003). Second, female managers might use their organizational power to change organizational practices, resulting in a more gender-equal organization (Cohen and Huffman, 2007). Although these two distinct mechanisms are widely used as theoretical arguments for a connection between female managers and the GWG (Hultin and Szulkin, 2003; Cohen and Huffman, 2007; Van Hek and Van der Lippe, 2019), the channels underlying this connection have not been thoroughly investigated. Thus, my research question is as follows: How can female managers narrow the GWG among workers? More specifically, do female managers narrow the GWG among workers by changing organizational policies or interacting with the workforce?

As the first mechanism, women in managerial positions might prefer to promote female workers and mentor them more often. Hence, female workers might benefit from interacting with their same-sex managers (Hultin and Szulkin, 2003). Using worker–supervisor dyads, previous studies have found mixed evidence regarding the mechanism of manager–worker interaction. The different findings are related to the data the authors have used. These studies have high data requirements and are limited to either small sample sizes (Abendroth et al., 2017), cross-sectional evidence (Van Hek and Van der Lippe, 2019), or a single firm in the United States (Srivastava and Sherman, 2015; Abraham, 2017). To overcome these limitations, I propose an alternative approach for extracting the manager–worker interaction mechanism. Building on previous research (Hultin and Szulkin, 2003; Hirsch, 2013), I consider the different management tasks of supervisors and top managers. While supervisors often interact with their workers, top managers are responsible for the strategic decisions inside a firm. However, due to flat hierarchies, managers' tasks are not strictly separated in smaller firms. While previous literature mostly analyses the influence of female managers split by management levels (Hultin and Szulkin, 2003; Cohen and Huffman, 2007; Hirsch, 2013), my first contribution to the literature is in expanding this identification strategy by exploiting the differences in managers' tasks depending on firm size.

As the second mechanism, female managers might use their organizational power over strategic decisions to change organizational practices. Organizations with women in managerial positions more often adopt practices promoting gender equality (Dobbin, Kim and Kalev, 2011), i.e. work-life balance practices or practices explicitly promoting female employees. Since these practices make an organization more gender-equal (Cohen and Huffman, 2007), policies promoting gender equality might mediate the positive effect of female managers on the GWG. Stojmenovska (2019) finds that the influence of female managers on workers' GWG is smaller when controlling for organizational practices. Thus, these practices might serve as a mediator. My second contribution is to perform a formal mediator test following Sobel (1982), which allows me to test the statistical significance of the mediator (Mustillo, Lizardo and McVeigh, 2018). Furthermore, while previous study investigates organizational practices and female managers in general (Stojmenovska, 2019), my dataset allows me to distinguish between top managers in charge of changing organizational policies and supervisors. Thus, my third contribution to the literature is to further isolate the organizational power mechanism by focussing on top managers in my mediator analysis.

Previous research mostly uses cross-sectional survey data (Abendroth et al., 2017; Van Hek and Van der Lippe, 2019) or large-scale longitudinal administrative data (Hultin and Szulkin, 2003; Cardoso and Winter-Ebmer, 2010). I combine the advantages of both by using a large-scale panel survey dataset linked to administrative employee data. Thus, I can observe changes over time and rule out alternative explanations, such as power restrictions in larger firms. Additionally, I provide the first-panel data evidence for Germany. The German setting reflects the former ideal type of conservative male breadwinner/female homemaker model. In recent decades, private sector firms have started to promote women's careers. In 2001, central associations of the German private industry sector agreed to voluntarily implement practices to further women's labour market opportunities. These practices at the firm level are either aimed at reconciling family and work or directly promoting women. Despite this voluntary agreement, the implementation of such practices remains at a low level (Kohaut and Möller, 2009), and large gender inequalities are still prevalent in Germany. I assume that the impact of organizational characteristics on earnings may be larger in Germany than in other Western countries.
because Germany had the third-highest unexplained GWG in Europe in 2017 (Eurostat, 2019).

**Theoretical Framework**

Authority positions in organizations, such as management, influence the reward distribution process (Nelson and Bridges, 1999). The management of a firm can be broadly divided into two levels: second- and first-level managers. Second-level managers, such as supervisors, are responsible for the day-to-day business. These managers supervise workers and make decisions regarding promoting or hiring (Hultin and Szulkin, 2003). Second-level managers regularly interact with workers (Hirsch, 2013) but lack the power to change organizational practices. In contrast, first-level managers, such as CEOs, are in charge of the organization’s strategic alignment. These top managers are responsible for establishing organizational goals, practices, and procedures but rarely interact with workers directly (Hultin and Szulkin, 2003). I can distinguish between the mechanisms of manager–worker interaction and organizational power by considering these main tasks of different management levels, i.e. second-level managers interacting with workers and first-level managers changing organizational practices.

Female managers might affect the GWG by interacting with workers. Gender is an essential attribute on which people socially distinguish (England, 2010). Hence, this characteristic may generate a common interest between managers and same-sex workers based on homophily (Cohen and Huffman, 2007). Supervisors can ensure homosocial reproduction by preferring workers of the same sex in several ways (Kanter, 1977; Elliott and Smith, 2004).

First, supervisors evaluate the performance of same-sex workers higher on average (Castilla, 2011). As these evaluations correlate positively with earnings (Lyness and Heilman, 2006), female supervisors might decrease the GWG. Second, supervisors generally mentor workers of the same sex better or more often (Athey, Avery and Zemsky, 2000). Third, supervisors on average prefer same-sex workers for promotions (Kurtulus and Tomaskovic-Devey, 2012). Fourth, potential female applicants might benefit in general from networks of female managers (Kurtulus and Tomaskovic-Devey, 2012). As these theoretical arguments require managers to interact with workers, female workers might benefit from female managers at the second management level. Overall, this leads to Hypothesis 1a:

H1a: Female second-level managers narrow the GWG among workers.

Since first-level managers usually do not interact with workers, these managers should not affect their workers’ wages through this mechanism. However, the tasks of the two management levels might also overlap. While small firms usually have flat hierarchies and a limited division of responsibilities, large firms are characterized by steep hierarchies and a strict division of labour (Van der Meer and Wielers, 1998). Thus, first-level managers interact with workers only in small firms and cannot directly affect the GWG in large firms by interacting with workers. For medium firms, I expect first-level managers’ division of tasks to fall between small and large firms. When compared with small firms, first-level managers in medium firms interact less with workers because these managers need more time to manage the organization’s strategic outlook in general. Thus, I assume that female first-level managers narrow the GWG in medium firms but that this narrowing influence is not as strong as it is in small firms due to fewer interactions with workers. In summary, I propose three follow up hypotheses from Hypothesis 1a:

H1b: Female first-level managers narrow the GWG among workers in small firms.
H1c: Female first-level managers slightly narrow the GWG among workers in medium firms.
H1d: Female first-level managers do not affect the GWG among workers in large firms.

Organizational rules and practices play an important role in generating and sustaining inequalities between women and men in organizations (Nelson and Bridges, 1999; Van der Lippe, Van Breeschoten and Van Hek, 2019). Female managers might use their organizational power to change organizational practices and make an organization more gender-equal, e.g. by introducing work-life balance practices or explicitly promoting women. Since female managers support policies promoting gender equality more often than male managers (Cohen and Huffman, 2007), organizations with female managers adopt these practices more often (Dobbin, Kim and Kalev, 2011). Both work-life balance policies (Huffman, King and Reichelt, 2017; Van der Lippe, Van Breeschoten and Van Hek, 2019) and the direct promotion of women (Huffman, King and Reichelt, 2017) positively influence women’s wages. Hence, female first-level managers might use their organizational power to
narrow the GWG in an organization by adopting practices promoting gender equality. Since second-level managers do not possess the organizational power to change the organization’s policies, these managers cannot affect the GWG via this mechanism. Overall, this leads to Hypotheses 2a and 2b:

H2a: Female first-level managers narrow the GWG among workers.
H2b: The influence of female first-level managers on narrowing the GWG among workers vanishes when practices promoting gender equality are considered (mediation).

Data and Measurements

Data

I test my hypotheses using longitudinal linked employer–employee data (LIAB_LM_9314_v1) (Heining et al., 2016; Umkehrer, 2017) of the Institute for Employment Research (IAB). On the firm side, this dataset comprises annual firm-level survey data on employment-related topics such as the composition of the workforce and organizational policies in Germany. The survey is a stratified random sample of 16,000 firms in Germany. The sample is drawn from all firms in Germany with at least one employee liable to social security as of 30 June in the previous year. Professional interviewers conducted mainly face-to-face interviews. Since most interview respondents had a managerial job position, high data quality can be ensured.

As information about the composition of the management levels is limited to the years 2004, 2008, and 2012, I use these years from the LIAB to analyze the influence of female managers on the GWG. After I link the longitudinal individual employment histories of every employee liable to social security to these data, 9,155 unique firms remain. Civil servants, family workers, students, and self-employed individuals are not part of this dataset because they do not contribute to social security in Germany. Next, I restrict the data to firms in the private sector (leaving 8,726 firms) with at least 10 employees (leaving 4,318 firms). As the administrative data lack information about working hours, I focus on 20- to 60-year-old full-time workers working at least 35 h per week (leaving 4,258 firms). According to Blossfeld’s (1987) occupation classification, I exclude managers to ensure that managers’ wages do not bias my results. Furthermore, I remove firms with missing values in the firm-level survey variables, which can be found in the control variables section (leaving 4,214 firms). Finally, I restrict the dataset to firms with at least one full-time female worker and one full-time male worker (leaving 3,723) and remove firms with only one management level (leaving 2,947). After completing these steps, I have an unbalanced panel dataset with 2,947 firms and 940,951 workers.

Limitations of the Data

Although the LIAB offers a unique opportunity to examine how female managers and organizational practices shape the GWG within firms, I must address two limitations. First, I exclude part-time workers due to a lack of information on working hours. Part-time employment is especially important for researching gender inequalities. In firms of my sample, approximately 32 per cent of women work part-time. In comparison, less than 3 per cent of men work part-time. Since females in part-time earn more than males (Boll and Lagemann, 2018a) the effect of female managers on the GWG might be lower when considering part-time employees. However, Abendroth et al. (2017), who also researched the influence of female managers on the GWG among workers in Germany and included part-time workers, could not find different results when using hourly or monthly earnings as their dependent variable. Thus, I expect similar results when including part-time workers and that this limitation of the data does not limit the validity of the results.

Second, I cannot analyze the public sector because my data lacks information on civil servants. The public sector accounts for 11.5 per cent of total employment in Germany and is an important employer of women. In 2013, the female share of employees was approximately 55 per cent in the public sector (Bundesministerium des Innern, 2014) and approximately 43 per cent in the private sector (Kohaut and Möller, 2019). In contrast to the private sector, the public sector introduced 1994 binding laws to promote female employment opportunities, such as by preferring female to male recruits with equal capabilities and qualifications (Bundesministerium des Innern, 2014). Additionally, wages in the public sector are strongly determined by collective bargaining agreements and the public sector has a much lower unadjusted GWG of approximately 7 per cent (Boll and Lagemann, 2018a). Due to these binding laws, collective bargaining agreements, and minimal GWG, I assume that the influence of female managers on the GWG in the public sector is likely somewhat smaller than in the private sector. Hence, I might overestimate the actual effect compared with a setting that includes the public sector.
**Measurements**

**Dependent variable**

My dependent variable is workers’ daily gross wage in euros drawn from social security contributions and deflated to 2010 euros. The wage information is right-censored at the upper earnings limit for statutory pension insurance. Therefore, I impute the deflated wage separately by gender, East and West Germany, and year using the individual-level control variables (Dauth and Eppelsheimer, 2020). The imputed wage is censored at ten times the 99th percentile to eliminate randomly generated outliers. Finally, I take the logarithm of the imputed wage.

**Independent variables**

*Share of females at the two management levels.* For the years 2004, 2008, and 2012, the survey addresses the composition of the two management levels. While previous longitudinal research regarding female managers and the GWG has relied on occupational codes (Hultin and Szulkin, 2003) or wages (Cardoso and Winter-Ebmer, 2010), I have hierarchical information about the share of female managers. Thus, I know that the first management level controls and supervises the second management level. The question for the first management level is: ‘How many persons in your establishment/office have a supervisory position at the top management level (management, proprietor, director, branch manager, or works manager)? How many of these are women?’ The question for the second management level explicitly states that this level is below the first management level and consists of supervisors: ‘Is there a second management level below the top management level in your establishment/office? How many persons hold a supervisory position at this second management level? And how many of these are women?’

I calculate the shares of female first-level managers by dividing the number of female first-level managers by the total number of first-level managers. Thus, this variable ranges from zero for a 0 per cent share of females to one for a 100 per cent share of females. The same procedure is performed for the second management level. Hence, I measure the presence of female second-level managers in a firm to approximate direct interactions between managers and workers. Table 1 shows the descriptive statistics for this variable. Since there are some outliers regarding the number of managers, I perform robustness checks without the firm-year observations above the 95th percentile of either the number of first-level managers or the number of second-level managers separately for the different samples. The main results are robust.

**Organizational practices.** The survey contains information about four organizational practices promoting gender equality in the years 2004, 2008, and 2012: ‘Support with childcare or financial contributions towards childcare’ (0 = no; 1 = yes), ‘Services for employees taking periods of parental leave’ (0 = no; 1 = yes), ‘Targeted promotion of women’ (0 = no; 1 = yes), and ‘Other measures’ (0 = no; 1 = yes). These practices either directly support women in the workplace, such as through targeted promotion of women, or facilitate work-life balance, such as through financial contributions towards childcare.

For the number of practices promoting gender equality, I sum the availability of these four policies (Van der Lippe, Van Breeschoten and Van Hek, 2019). The resulting index ranges from 0 to 4. This index represents how many practices promoting gender equality are formalized at this firm. However, I cannot consider informal help or how strongly formal practices are enforced. Since the influence of work-life policies on the GWG remains robust under the control of family-friendliness (Van der Lippe, Van Breeschoten and Van Hek, 2019), my results should also be robust to the consideration of informal policies.

**Table 1. Two management levels in firms, 2004, 2008, and 2012 pooled**

|                                    | Mean | SD  | Min | p50 | Max |
|------------------------------------|------|-----|-----|-----|-----|
| Number of first-level managers     | 2.2  | 2.8 | 1   | 2   | 97  |
| Share of female first-level managers | 0.15 | 0.30 | 0   | 0   | 1   |
| Number of second-level managers    | 6.6  | 16.6| 1   | 4   | 711 |
| Share of female second-level managers | 0.28 | 0.33 | 0   | 0.14| 1   |

Observations

Firm-year observations 5,638
Firms 2,947

Notes: See Supplementary Table S1 for summary statistics by firm size. For a kernel density plot of the share of female first-level and second-level managers, see Supplementary Figure S1.

Source: Own calculations using LIAB_LM_9314_v1.
practice shows by far the highest number of changes. To ensure that my results are not affected by the distribution of the variance in the index of practices promoting gender equality, I additionally calculate regressions with a dummy for each practice instead of an index in the Results section.

Control variables. I include control variables following the literature review presented in the first part of the article. At the individual level, I control for labour market experience and its square, tenure and its square, three education dummies,7 a dummy for non-German nationality as a proxy for migration background, and dummies for the one-digit occupation code. The controls at the firm level include full-time equivalent shares of female, qualified, and fixed-term-contract workers in the firm’s workforce and the share of part-time workers in the firm’s workforce. Additionally, I include dummies for the existence of a works council, a collective agreement at the sector level, and a collective agreement at the firm level; a good profit situation; log firm size; a dummy for East Germany; and dummies for the one-digit industry code.8 Table 2 shows the descriptive statistics for these variables.

Analytical strategy
The aim of my empirical analysis is 2-fold. First, I measure whether changes in the share of female managers decrease the GWG (Hypotheses 1a and 2a). Second, to take different levels of division of labour and strictness of hierarchies into account, I assess whether female first-level managers’ influence varies across firm sizes (Hypotheses 1b and 1c). Third, to investigate the organizational power mechanism, I test whether practices promoting gender equality mediate the influence of female first-level managers (Hypothesis 2b).

I use this fully interacted linear regression with firm fixed-effects to estimate the influence of the share of female managers on female workers’ wages:

\[
\ln(w_{it}) = F_i \times \beta_1 + F_{\text{first}it} \times \beta_2 + F_{\text{sec}it} \times \beta_3 + (F_i \times F_{\text{first}it}) \times \theta_1 + (F_i \times F_{\text{sec}it}) \times \theta_2 + x_{\text{fit}} \times \delta + F_i \times x_{\text{fit}} \times \rho + \mu_i + \epsilon_{it}
\]

where \(\ln(w)\) is the log daily gross wage of individual \(i\) in year \(t\), \(F_i\) is a female dummy, \(F_{\text{first}it}\) \((F_{\text{sec}it})\) is the share of females among first- (second-)level managers of firm \(f\) in year \(t\), and \(F_i \times F_{\text{first}it}\) \((F_i \times F_{\text{sec}it})\) is the interaction of the female dummy and the share of female first- (second-)level managers. This interaction effect aims to identify the impact of female managers on the firm’s GWG. The coefficient of the interaction effects is identified by between-firm variation, i.e. women working in firms with different shares of female managers, and within-firm variation, i.e. the share of female managers in a firm changing over time (Supplementary Table S4).

The model also includes control variables \(x_{\text{fit}}\) at firm-level \(f\) and individual-level \(i\) in year \(t\). Following Hirsch (2013), I estimate a fully interacted model to take variation in the GWG among industry sectors and occupation codes into account (Hinz and Gartner, 2005). I demean the variables before interacting them with the undemeaned female dummy so that I can interpret the female coefficient as the GWG at the sample mean (Imbens and Wooldridge, 2009). Finally, I control for firm fixed-effects \(\mu_i\) to take unobserved time-constant differences between organizations into account (Rabe-Hesketh and Skrondal, 2012). The standard errors are clustered at the firm level.

To test whether the effect of the share of female first-level managers on the GWG depends on the firm size, I split the sample into small (10–50 employees), medium (51–250 employees), and large firms (more than 250 employees). To ensure that the firms do not change their size category, I use a firm’s average size to determine the subsample of that firm (Cardoso and Winter-Ebmer, 2010). Thus, the subsamples are independent of each other. This restriction affects a minimal number of firms, and the results remain robust when I categorize firms by their size each year.

Finally, I explore whether organizational practices promoting gender equality mediate the influence of female first-level managers on the GWG. Three steps are necessary for a rigorous mediator test (Mustillo, Lizardo and McVeigh, 2018). First, I regress the share of female first-level managers on the number of organizational practices at the firm level. Second, I estimate the baseline fixed-effects regressions with the organizational practices as additional control variables. Third, I determine the mediator’s statistical significance following Sobel (1982).

Results
Table 3 shows the results. First, column (1) shows the estimated raw GWG. In this sample, women earn on average 20.9 per cent \((\exp(-0.235) - 1)\) less than men do, which is slightly higher than the raw German GWG for 2014 (Boll and Lagemann, 2018b). I can explain this difference by the data restrictions. The raw German GWG is higher in the private sector than in the public sector and more pronounced for full-time employees (Eurostat, 2019). After I consider the control variables
|                          | Total        |          |          |          |
|--------------------------|--------------|----------|----------|----------|
|                          | Mean | SD    | Mean | SD    | Mean | SD    |
| **Worker characteristics** |     |       |      |       |      |       |
| Number of years in the sample | 2.05 | 0.80  | 2.09 | 0.80  | 1.91 | 0.80  |
| Gross daily wage          | 117.91 | 48.55  | 124.07 | 49.26  | 99.07 | 40.92  |
| Female                    | 0.25  | 0.43  | 0.00  | 0.00  | 1.00  | 0.00  |
| Experience                | 16.05 | 8.93  | 16.76 | 9.00  | 13.88 | 8.35  |
| Tenure                    | 11.00 | 8.50  | 11.41 | 8.66  | 9.63  | 7.83  |
| **Highest completed education** |     |       |      |       |      |       |
| No vocational degree      | 0.08  | 0.27  | 0.08  | 0.27  | 0.09  | 0.28  |
| Vocational degree         | 0.75  | 0.43  | 0.75  | 0.43  | 0.74  | 0.44  |
| University degree         | 0.17  | 0.37  | 0.17  | 0.37  | 0.17  | 0.37  |
| **Year**                  |      |       |      |       |      |       |
| 2004                      | 0.35  | 0.48  | 0.34  | 0.48  | 0.37  | 0.48  |
| 2008                      | 0.36  | 0.48  | 0.36  | 0.48  | 0.35  | 0.48  |
| 2012                      | 0.29  | 0.45  | 0.30  | 0.46  | 0.28  | 0.45  |
| **Employer characteristics** |     |       |      |       |      |       |
| Number of years in the sample | 2.39 | 0.72  | 2.40 | 0.72  | 2.39 | 0.73  |
| Number of employees       | 6,451 | 14,296 | 7,265 | 15,014 | 3,962 | 11,480 |
| Good profit situation      | 0.49  | 0.50  | 0.51  | 0.50  | 0.41  | 0.49  |
| Existence of a works council | 0.88  | 0.33  | 0.89  | 0.32  | 0.84  | 0.36  |
| No collective agreement   | 0.14  | 0.35  | 0.13  | 0.34  | 0.19  | 0.39  |
| Collective agreement at the firm level | 0.22  | 0.41  | 0.23  | 0.42  | 0.18  | 0.39  |
| Collective agreement at the sector level | 0.64  | 0.48  | 0.64  | 0.48  | 0.63  | 0.48  |
| Firm is located in East Germany | 0.26  | 0.44  | 0.22  | 0.42  | 0.35  | 0.48  |
| Share part-time workers   | 0.12  | 0.14  | 0.10  | 0.11  | 0.19  | 0.17  |
| **Full-time equivalent shares (workers)** |     |       |      |       |      |       |
| Share females             | 0.27  | 0.22  | 0.21  | 0.17  | 0.45  | 0.25  |
| Share high-skilled        | 0.15  | 0.14  | 0.15  | 0.13  | 0.17  | 0.15  |
| Share fixed-term contract | 0.03  | 0.08  | 0.03  | 0.07  | 0.04  | 0.10  |
| **Promotion of gender equality** |     |       |      |       |      |       |
| Workplace childcare facilities | 0.33  | 0.47  | 0.33  | 0.47  | 0.31  | 0.46  |
| Parental leave            | 0.53  | 0.50  | 0.53  | 0.50  | 0.50  | 0.50  |
| Specific promotion of women | 0.27  | 0.44  | 0.28  | 0.45  | 0.21  | 0.41  |
| Other measures            | 0.19  | 0.39  | 0.20  | 0.40  | 0.16  | 0.37  |
| **One-digit industry code** |     |       |      |       |      |       |
| Agriculture, mining, gas and water supply | 0.05  | 0.21  | 0.05  | 0.22  | 0.03  | 0.18  |
| Manufacture of food products and beverages | 0.02  | 0.15  | 0.02  | 0.14  | 0.03  | 0.18  |
| Manufacture of consumer products | 0.02  | 0.13  | 0.02  | 0.12  | 0.03  | 0.16  |
| Manufacture of industrial products | 0.22  | 0.41  | 0.25  | 0.43  | 0.13  | 0.34  |
| Manufacture of capital and consumer goods | 0.35  | 0.48  | 0.39  | 0.49  | 0.21  | 0.41  |
| Construction, hotels, and other services | 0.02  | 0.15  | 0.03  | 0.17  | 0.01  | 0.09  |
| Trade, maintenance and repair of motor vehicles, and other services | 0.06  | 0.23  | 0.05  | 0.21  | 0.09  | 0.28  |
| Storage, IT, real estate, renting, and liberal professions | 0.16  | 0.37  | 0.15  | 0.36  | 0.20  | 0.40  |
| Education, health and social work, and non-industrial organizations | 0.11  | 0.31  | 0.05  | 0.22  | 0.27  | 0.45  |

**Observations**

|                          | Total Year Observations | Men Year Observations | Women Year Observations |
|--------------------------|-------------------------|-----------------------|-------------------------|
|                          | 940,951                 | 709,237               | 231,714                 |
| Workers                  | 556,211                 | 408,304               | 147,907                 |
| Firms                    | 2,947                   | 2,947                 | 2,947                   |

**Notes:** See Supplementary Table S3 for summary statistics of the occupation codes.

**Source:** Own calculations using LIAB_LM_9314_v1.
Table 3. Females at two management levels and the GWG

|                      | (1) Raw | (2) Controls | (3) Controls | (4) Firm fixed-effects |
|----------------------|---------|--------------|--------------|------------------------|
| Female               | −0.235 (0.013)** | −0.143 (0.007)** | −0.142 (0.007)** | −0.135 (0.004)** |
| Share female first-level managers | −0.021 (0.022) | −0.014 (0.017) |           |                       |
| Share female second-level managers | −0.165 (0.032)** | −0.059 (0.016)** |           |                       |
| Female × share female first-level managers | 0.059 (0.024) | 0.022 (0.010)** |           |                       |
| Female × share female second-level managers | 0.111 (0.027)** | 0.108 (0.011)** |           |                       |
| Controls             | No      | Yes          | Yes          | Yes                    |
| Firm fixed-effects   | No      | No           | No           | Yes                    |

Observations 940,951 940,951 940,951 940,951
Adjusted $R^2$ 0.060 0.637 0.640 0.451
Firms 2,947 2,947 2,947 2,947

Notes: The dependent variable is the log daily wage. Columns (1), (2), and (3) show OLS estimations, and column (4) reports the results of the firm-fixed-effects regression. The controls include labour market experience and its square, tenure, and its square, three education dummies, a dummy for non-German nationality, dummies for the one-digit occupation code, and 2-year dummies at the individual level. For the firm level, I consider the full-time equivalent shares of women, qualified, and fixed-term-contract workers in the firm’s workforce as well as the share of part-time workers in the firm’s workforce; dummies for the existence of a works council, a collective agreement at the sector level, and a collective agreement at the firm level; a good profit situation; log firm size; a dummy for East Germany; and dummies for the one-digit industry code. Finally, I control for all of these variables’ interactions with the female dummy. The standard errors are clustered at the firm level and shown in parentheses.

Source: Own calculations using LIAB_LM_9314_v1.
Significance levels: *5 and **0.1 per cent.

at the individual and firm levels, this gap narrows to 13.3 per cent (exp (−0.143) − 1) in column (2). Including the variables of interest (column 3) and firm fixed-effects (column 4) reduces the GWG slightly to 12.6 per cent (exp (−0.135) − 1).

In columns (3) and (4) of Table 3, I investigate whether the share of female managers affects the GWG among workers in the labour market (column 3) and within firms (column 4). In these models, the main effect of the share of female managers represents the effect for men, and its interaction with female represents the difference in the coefficient between men and women, i.e. the effect on the GWG among workers (Table 3). The average marginal effect (AME), which is the sum of the main and interaction effects, represents the total effect of the share of female managers on women (Table 4).

Column (3) of Table 3 shows that increasing the share of female second-level managers is associated with a narrower GWG among workers. This change is associated with lower wages for male workers. The increase in female wages and decrease in male wages might indicate a redistribution of wages among workers. These findings are the same for the labour market overall (Table 3, column 3) and within firms (Table 3, column 4). While the AME for female workers is negative across the labour market (Table 4, column 1), it is positive within firms (Table 4, column 2). The difference between the AME in columns (1) and (2) of Table 4 suggests that the share of female second-level managers is higher in firms that pay less in general. The effect of female second-level managers on narrowing the GWG among workers serves as first evidence for Hypothesis 1a, stating that female managers who interact with workers narrow the GWG among workers.

Increasing the share of female first-level managers is correlated with a narrower GWG among workers (Table 3, column 3). However, neither the positive AME for female wages nor the negative coefficient for male wages is statistically significant (Table 4, column 1). The statistical significance or direction of these results does not change within a firm (Table 4, column 2). Notably, the correlation between female first-level managers and the GWG is approximately three times as large for the German labour market in total (0.059, Table 3, column 3) than within firms (0.022, Table 3, column 4). The difference between these coefficients indicates that well-paid females more often work in firms with a high share of female first-level managers. The association between female first-level managers and a narrower GWG among workers serves as first evidence for Hypothesis 2a, stating that female managers with organizational power narrow the GWG.

Manager–Worker Interaction Mechanism

Table 5 reports the results of the firm fixed-effects regression by firm size. Column (1) shows the results for
small firms with 10–50 employees, column (2) for medium firms with 51–250 employees, and column (3) for large firms with more than 250 employees. The share of female second-level managers’ negative association with male wages remains significant for medium and large firms and is marginally not significant for small firms.

While the interaction effect of female and the share of female second-level managers varies little with firm size, the interaction effect of female and the share of female first-level managers depends on firm size. Since the 95% CIs of the female coefficient and the share of female first-level managers coefficient do not overlap for small and large firms, the difference is significant. As a robustness check, I use the fixed-effects specification from Table 3 with three-way interaction effects of two company size dummies, female, and the share of female first-level managers. The three-way interaction effects for medium and large firms are statistically significant at the 5 per cent level (Supplementary Table S5). These results are in line with Hypotheses 1b to 1d and show that the narrowing association between the share of female first-level managers and the GWG among workers is limited to first-level managers in small and medium firms, whose tasks include interacting with workers. In large firms, where first-level managers barely interact with workers, the share of female first-level managers does not correlate with the GWG among workers. This variation by firm size serves as strong evidence for the manager–worker interaction mechanism, stating that female managers narrow the GWG by interacting with workers.

Table 4. Average marginal effects by gender

|                  | Controls                          | Firm fixed-effects                  |
|------------------|-----------------------------------|-------------------------------------|
| Males            |                                   |                                     |
| Share male first-level managers | $-0.021 (0.022)$                | $-0.014 (0.017)$                   |
| Share male second-level managers  | $-0.165 (0.032)$***              | $-0.059 (0.016)$***                |
| Females          |                                   |                                     |
| Share female first-level managers  | $0.038 (0.024)$                  | $0.008 (0.017)$                    |
| Share female second-level managers  | $-0.050 (0.022)*                 | $0.049 (0.014)**                   |

Notes: The average marginal effects have been calculated using results from columns (3) and (4) of Table 3. The standard errors are calculated using the delta-method.

Source: Own calculations using LIAB_LM_9314_v1.
Significance levels: ‘5’, ‘1’, and ‘‘0.1 per cent.

Table 5. Sample split by firm size

|                  | Small                  | Medium                 | Large                  |
|------------------|------------------------|------------------------|------------------------|
| Female           | $-0.201 (0.008)$***    | $-0.157 (0.004)$***    | $-0.123 (0.005)$***    |
| Share female first-level managers  | $-0.027 (0.017)$    | $-0.015 (0.014)$    | $-0.010 (0.024)$    |
| Share female second-level managers  | $-0.022 (0.011)$  | $-0.032 (0.014)$  | $-0.081 (0.029)$  |
| Female × share female first-level managers | $0.067 (0.016)**   | $0.027 (0.010)$  | $0.008 (0.015)$  |
| Female × share female second-level managers  | $0.070 (0.015)**  | $0.086 (0.012)** | $0.106 (0.020)** |
| Controls         | Yes                    | Yes                    | Yes                    |
| Firm fixed-effects | Yes                    | Yes                    | Yes                    |
| Observations     | 37,937                 | 185,482                 | 717,532                 |
| Adjusted $R^2$   | 0.319                  | 0.388                   | 0.478                   |
| Firms            | 1,306                  | 1,174                   | 467                     |

Notes: The dependent variable is the log daily wage. Columns (1), (2), and (3) show the fixed-effects regression from column (4) of Table 3 split by firm size. Small firms have 10–50 employees, medium firms 51–250 employees, and large firms more than 250 employees. See Table 3 for a list of the control variables. The standard errors are clustered at the firm level and shown in parentheses.

Source: Own calculations using LIAB_LM_9314_v1.
Significance levels: ‘5’, ‘1’, and ‘‘0.1 per cent.
Organizational Power Mechanism

For the first step of the mediator test, I regress the share of female managers on the number of practices promoting gender equality at the firm level. Column (1) of Table 6 shows that the share of female first-level managers positively correlates with the number of practices promoting gender equality. For the second step, I estimate the fixed-effects regression and control for the number of organizational practices and its interaction effect with female. The results are reported in column (2) of Table 6. The interaction effect of the number of organizational practices and female is not statistically significant. Because the number of organizational practices does not affect female workers’ wages, the Sobel test (Sobel, 1982) for mediation is not statistically significant for any firm size.9 Additionally, the association between female first-level managers and women’s wages (Table 3, Column 4) does not change after including these variables (Table 6, Column 2). The mediator is also not statistically significant for any firm size (Supplementary Table S6).

As an alternative specification, I use dummies for each gender equality-promoting practice instead of an index. These variables are not associated with workers’ GWG (Supplementary Table S7). Since other policies, such as formalized hiring policies, might also close the GWG (Huffman, King and Reichelt, 2017), I include these practices as an alternative mediator in a robustness check (Supplementary Table S8). Formalization practices are not a mediator, either. These results serve as evidence against Hypothesis 2b, stating that gender equality-promoting practices mediate the influence of female first-level managers on women’s wages.

Channels: Changing the Composition of the Workforce or the Wages of Current Workers

Increasing the share of female managers could influence the GWG within firms in at least three ways. First, female managers might change the composition of the workforce by preferring to hire female workers. This compositional change might decrease the GWG. Second, higher wages for females and lower wages for males might lead to sorting or selection processes among job seekers or promotion seekers. Third, female managers might increase current workers’ wages, e.g. by specifically promoting female workers.

To test the first channel, I regress the gender of a new hire on the control variables at the individual and firm levels. I cannot find an association between the share of females at either the first or second management levels and the gender of new hires. These results are evidence against a substantial compositional change in a firm’s workforce (Table 7). Second, I use the Abowd, Kramarz and Margolis (AKM) effect (Abowd, Kramarz and Margolis, 1999) for Germany (Bellmann et al., 2020), which approximates productivity,10 as a dependent

| Table 6. Organizational power as a mediator |
|---------------------------------------------|
| (1) Firm-level: number of practices promoting gender equality | (2) Individual-level: wages |
| Female | –0.135 (0.004)*** |
| Share female first-level managers | 0.151 (0.070)* |
| Share female second-level managers | –0.015 (0.016) |
| Number of practices promoting gender equality | 0.023 (0.054) |
| Female × share female first-level managers | –0.059 (0.016)** |
| Female × share female second-level managers | 0.005 (0.003) |
| Female × number of practices promoting gender equality | 0.022 (0.009)** |
| Female × number of practices promoting gender equality | 0.109 (0.011)** |
| Female × number of practices promoting gender equality | 0.001 (0.003) |
| Controls | Yes |
| Firm fixed-effects | Yes |
| Observations | 5,638 |
| Adjusted $R^2$ | 0.051 |
| Firms | 2,947 |

Notes: The dependent variable for the column (1) is the number of practices promoting gender equality. The regression includes the firm-level controls from Table 3 and firm fixed-effects. The dependent variable for the column (5) is the log daily wage. Column (2) shows the second stage of the mediator test. The specification is the fixed-effects regression as in column (4) of Table 3. See Table 3 for a list of the control variables. The standard errors are clustered at the firm level and shown in parentheses.

Source: Own calculations using LIAB_LM_9314_v1.

Significance levels: *5, **1, and ***0.1 per cent.

10 European Sociological Review, 2021, Vol. 00, No. 0
variable for new hires. The productivity differences between males and females are not associated with shares of female managers (Supplementary Table S9). These results serve as evidence against selection among new hires. For the third channel, I restrict the regressions from Table 5 to workers with more than 365 days of tenure (Table 8). The findings echo the main results. In summary, female managers are associated with narrowing the GWG among workers who already work at a firm.

Ruling Out Alternative Explanations

Thus far, the results imply that a higher share of female managers partially correlates with a lower GWG and varies by firm size. However, the different results by firm size might be confounded. For example, managers’ power in large firms might be more restricted. Works councils limit managers’ power and correlate with firm size. Hence, I split the sample into firms that always had a works council and firms that never had a works council in the observed period. Since the results show for both samples that female first-level managers are associated with narrowing the GWG among workers significantly for small firms and insignificantly for large firms, power restriction probably does not bias the results (Supplementary Table S10). However, the evidence is tentative due to the small sample size for small firms.
with a works council and large firms without one. Furthermore, management at headquarters might restrict the power of managers in branches by determining practices companywide. My results are robust to restricting the sample to independent firms and headquarters (Supplementary Table S11).

Reverse causality might bias my findings. In my mediator test, I assume that female first-level managers more often introduce gender equality enhancing practices which might decrease the GWG among workers. However, gender equality enhancing practices could also lead to more female first-level managers. Furthermore, female first-level managers might prefer to promote females within a firm to the first management level (Kurtulus and Tomaskovic-Devey, 2012) or recruit more female managers externally (Bossler, Mosthaf and Schank, 2020). Thus, there might be endogeneity between the share of females at the first and second management levels. To test these endogeneities, I use lagged versions of these variables. The results of regressions using one of these lagged variables (Supplementary Table S12, columns (5–8) and Supplementary Table S13 columns (1–8)) barely differ from those of the non-lagged regression (Supplementary Table S12, columns (1–4)). These results serve as evidence against reverse causality affecting my findings.

Due to glass ceilings and sticky floors, females at the top or bottom of the wage distribution might benefit differently from organizational policies. Following Huffman, King and Reichelt (2017), I estimate an unconditional quantile regression and additionally include fixed-effects. Like previous evidence in Germany (Huffman, King and Reichelt, 2017), the positive and statistically significant coefficient of practices promoting gender equality is limited to females with low to medium incomes (Supplementary Figure S2). The coefficients of females at the first management level do not change with (Supplementary Figure S3) or without organizational practices (Supplementary Figure S4). Hence, organizational practices are probably not a mediator in this alternative specification.

While my identification strategy is limited to firms with multiple management levels, smaller German firms have only a single management level. These firms have limited hierarchies and management cannot delegate tasks requiring manager–worker interactions to a lower management level. Hence, first-level managers interact with workers irrespective of firm size and the effect of female first-level managers should not decrease with firm size. The results suggest that the coefficients do not differ (Supplementary Table S14). However, this evidence is tentative due to the small sample size for large firms with a single management level.

Conclusions

Using panel survey data linked to administrative data, I analyze how female managers affect the GWG among workers in Germany. This study contributes to the existing research on the GWG and women in management in three ways. First, I explicitly take the different tasks of different management levels into account and exploit their tasks' peculiarities by firm size to extract the manager–worker interaction mechanism. Second, I estimate a formal mediator test to analyze the organizational power mechanism. Third, I focus on top managers who can change organizational practices to isolate the organizational power mechanism. Thereby, I disentangle these two potential mechanisms.

My results demonstrate that female managers, particularly female second-level managers such as supervisors, narrow the GWG among workers. These findings are evidence for the manager–worker interaction mechanism because these managers regularly interact with workers. Assuming gender parity in the second management level, the share of female second-level managers would rise in the German median firm from 14 to 50 per cent. This increase of 36 percentage points (pp.) would lead to a decrease of the GWG in the median firm by 3.8 pp. Since estimations for the unexplained GWG in Germany are valued at approximately 5.8 pp. (Boll and Lagemann, 2018b), this process could reduce the unexplained GWG by 65 per cent for the median firm, decreasing the unexplained GWG substantially. I also find evidence that female second-level managers narrow the GWG by redistributing the wages of males to females. However, the redistribution of wages is not robust to all alternative specifications.

The effect of female first-level managers on the GWG among workers is limited to small and medium firms. Since first-level managers also interact with workers in smaller firms, the results also support the manager–worker interaction mechanism. In contrast, organizational practices do not mediate the influence of female first-level managers on the GWG among workers. This evidence contradicts the organizational power mechanism. Alternative specifications show that my results are not affected by stronger regulations for larger firms or reverse causality. Despite the robustness of my main results to many alternative specifications, I cannot guarantee causality. Future research could analyze reforms, such as mandating a minimum representation.
of each gender on boards (Bertrand et al., 2019), to ensure causality.

My overall finding that female managers are associated with a lower GWG among workers is in line with previous longitudinal research from Great-Britain (Stojmenovska, 2019) and with cross-sectional results from Portugal (Cardoso and Winter-Ebmer, 2010), Sweden (Hultin and Szulkin, 2003), and Germany (Hirsch, 2013). While the results from Great-Britain and Portugal investigate managers in general, Hultin and Szulkin (2003) also find that female lower-level managers narrow the GWG in firms with multiple management levels. Hirsch (2013) finds that female second-level managers narrow the GWG substantially in Germany and that female first-level managers narrow the GWG slightly. I assume that my contributions to the literature are generalizable because my overall results are in line with previous research from countries with four different welfare states.

In contrast to previous cross-sectional research on supervisor–worker dyads in Europe, I find that female second-level managers narrow the GWG in general. Van Hek and Van der Lippe (2019) find no influence of female department managers on the GWG in nine European countries. Differing definitions of managers might explain the different results. A department manager might be a first- or second-level manager. Thus, department managers’ tasks might vary substantially. Although Van Hek and Van der Lippe (2019) try to estimate managers’ status by variables such as their education, this approximation might lead to measurement error and downward bias. For Germany, their results show that the share of female managers in a firm narrows the GWG by a magnitude like the one I find. The small sample size for Germany might explain the missing statistical significance.

Abendroth et al. (2017) find that the share of female managers narrows the GWG and that female supervisors do not close the GWG of their subordinates. Their study is limited to a small sample of 94 German firms with more than 500 employees. Due to missing information, they cannot distinguish between different management levels of supervisors or managers in general. Since previous research on supervisor–worker dyads lacks information on managers’ tasks and my study lacks direct supervisor–worker dyads, further studies could include direct questions about the status and tasks of the supervisors to combine both identification strategies.

A remaining question concerns why female first-level managers do not affect the GWG across all company sizes. Theoretically, these managers use their organizational power to introduce practices promoting gender equality, which decrease the GWG. Although female first-level managers might use their organizational power to adopt practices promoting gender equality (Cohen and Huffman, 2007), the influence of work–life balance practices on the GWG is ambiguous. On the one hand, mothers can return to work quicker after childbirth (Bächmann, Frodermann and Müller, 2020). On the other hand, employers might penalize the use of these practices (Glass, 2004). While work-life balance practices narrow the GWG in European countries in general, they do not affect the GWG in Northern, Western, or Southern Europe (Van der Lippe, Van Breeschoten and Van Hek, 2019). Since these practices decrease the GWG in Eastern Europe (Van der Lippe, Van Breeschoten and Van Hek, 2019), the organizational power mechanism might affect the GWG in this region. When analyzing different wage levels separately, I find a narrowing association between these practices and the GWG for low and medium wage levels like previous research (Huffman, King and Reichelt, 2017). However, I still find no evidence of mediation, i.e. that female first-level managers lower the GWG by introducing practices promoting gender equality.

Although many countries try to close the GWG, this gap remains in most countries (Blau, 2016). Previous political interventions regarding management have focussed on board quotas for publicly listed firms to enhance gender equality. However, results in Norway from Bertrand et al. (2019) suggest that the positive effects of board quotas are limited to females who make it onto the board. Similarly, my findings indicate that the impact of female first-level managers on the GWG among workers is limited, especially in large firms. However, female workers’ wages benefit greatly from female second-level managers. Hence, increasing the share of female second-level managers might close the GWG faster than board quotas.

**Supplementary Data**

Supplementary data are available at ESR online.

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Notes

1. The terms firms and organizations refer to firms. For multi-site firms, firms and organizations refer to local establishments.
2. Workers in this context refer to non-managerial employees.
3. The Research Data Centre of the Federal Employment Agency at the IAB (https://fdz.iab.de/en.aspx) provides the LIAB_LM_9314_v1.
4. Civil servants comprise 19.2 per cent of the employees in public sector firms with at least 10 employees liable to social security and two management levels.
5. The Blossfeld occupation classification classifies occupations into twelve categories, such as ‘managers’, based on tasks from German Micro Census data from the 1980s to the early 2000s. This classification might be outdated because occupations’ tasks have changed in recent decades. Since 2010, the classification of occupations has been updated in German administrative data and includes ‘manager’ as an occupation. Using the updated classification for my sample restricted to 2012 leads to similar results as using the Blossfeld (1987) classification for my full sample.
6. The survey includes additional practices that vary yearly. I consider measurements surveyed in 2004, 2008, and 2012 to use the panel data structure.
7. As the education variable is not necessary for the administrative process, its degree of completeness is less than 85 per cent (Heining et al., 2016). I impute the education variable (Dauth and Eppelsheimer, 2020), increasing the degree of completeness from less than 85 to 99.9 per cent.
8. The shares are calculated by aggregating workers’ administrative data. Due to missing information on actual working time, I weigh part-time workers at 0.5 the weight of full-time workers. The firm size, the location in East Germany, and the industry sector are drawn from administrative establishment history panel data (BHP). See Schmucker et al. (2018) for more information regarding this dataset. The remaining employer-level variables are survey data from the LIAB.
9. For the first stage of a Sobel test, the dependent variable should be the mediated variable in the second step, the interaction effect of female and the number of practices promoting gender equality. Since this variable is always 0 for males, I use the number of organizational practices promoting gender equality as the dependent variable. This change does not affect the results of the Sobel test because this test can only be statistically significant if both the first and second stages are statistically significant.
10. In the AKM framework, the individual wage is regressed on human capital variables, a person fixed-effect, and firm fixed-effect. Thus, the individual fixed-effect might be seen as a combination of individual skills and other factors that are awarded regardless of the employer. Hence, the individual AKM effects approximate the productivity of employees. See Bellmann et al. (2020) for more details regarding the AKM effect.
11. I use the HReFreg ado to calculate the quantile regressions.

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