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Who perceives lower wages for women to be fair? How perceptions of the fairness of men's and women's wages vary by firm and workplace characteristics

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Previous research has shown that gender pay gaps are perceived as fair or justified, not only by men but also by women. In this paper we contribute to the discussion of a biased evaluation of fair wages and assess whether the organizational context has an impact on fairness perceptions. We use unique data from a vignette study that was part of a representative online survey of 5,556 employees in 532 larger firms (> 100 employees) in Germany which are merged to administrative data. This allows us to consider different contextual factors at both the workgroup level and the firm level. In contrast to older studies we find that women tend to evaluate wages of female workers as unfairly too low. Moreover, the perception of (un)fair wages depends on the organizational context. Female supervisors and collective bargaining agreements in firms increase the likelihood that female employees evaluate other women's wages as unfairly low. When employees talk about their wages with their colleagues, they are more likely to judge the wages of co-workers as unfairly low.

Introduction

Despite women's increasing success in the educational system they continue to earn less than men—a phenomenon that has been termed the gender pay gap (Blau and Kahn, 2017; Schmitt and Auspurg, 2022). At the same time, previous research has shown, strikingly, that this gap is perceived by some to be fair or justified (Auspurg, Hinz and Sauer, 2017; Adriaans, Sauer and Wrohlich, 2020; Sauer, 2020)—not only by men but also by women. These findings are based on vignette studies that try to elicit unconscious biases by presenting fictitious employees whose wages the respondents have to rate. By varying the vignette person's gender, the researchers try to assess in how far gender plays a role in assessing the fairness of wages. The finding that lower wages are justified by some is important, not least when one thinks about the behavioural consequences that such a perception might have: in the case of systematic gender differences in perceptions regarding fair wages, it might contribute to explaining persistent gender pay differentials, since women might be less likely to ask for higher pay or to leave jobs for which the pay is unjustly low, as compared to men (Adriaans and Targa, 2022). It has been shown that individuals who perceive their wages to be unfair experience larger wage growth in subsequent years (Pfeifer and Stephan, 2019). Researchers should therefore look into perceptions regarding gender wage inequalities in order to understand and alleviate gender inequality in the workplace.

Previous studies based on vignette designs have shown that the gender bias of women and men perceiving lower female wages to be fair is not universal but differs by the characteristics of the given context, such as region (Lang and Groß, 2020), occupation (Auspurg, Hinz and Sauer, 2017) and federal state (Sauer, 2020). What remains less clear, however, is what the relevant factors in the contextual surroundings are

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that shape the gender bias. Several studies have shown that other workers in the same occupation as well as colleagues from the same firm seem to be relevant referents for wage comparisons (Brown, 2001; Schneider and Schupp, 2010; Godechot and Senik, 2015; Hauret and Williams, 2019). Drawing on psychological theories of social comparison processes, Sauer and May (2017: 46) argue that individuals compare themselves with those who work in the same organization and who have similar skills, educational backgrounds, and professional responsibilities. Due to the privileged access to information about co-workers as compared to workers from other firms, within organization comparisons are most likely (Sauer and May 2017: 46). This should not only be the case when employees evaluate the fairness of their own wages but also when they evaluate the fairness of fictitious co-workers that they imagine to work in the same firm as themselves. This is because employees assume that the rates of return to specific skills and work-related tasks should be similar for all employees of an organization, as they are part of the same award allocation system (Berger et al. 1972: 121). As Sauer and May (2017) show, the type of organizational context plays a role in shaping fairness evaluations. We investigate the relevance of three institutional characteristics for fairness evaluations that are believed to impact on the perception of women's situation in a firm and the degree of information advantage regarding co-workers' pay. More specifically, we look at (1) the share of female managers at the firm level, as well as the gender of the direct supervisor (Kurtulus and Tomaskovic-Devey, 2012; Srivastava and Sherman, 2015); (2) whether employees talk with their colleagues about their wages (OECD, 2021); and (3) whether the firm is subject to a collective bargaining agreement (Bruno, Greenan and Tanguy, 2021). We assume that these organizational characteristics are related on the one hand to the transparency of wage setting processes and thus influence the information advantage regarding co-workers' pay (collective agreements, talk about wages) and on the other hand to the perception of gender inequalities in the organization (female supervisors). As to the latter, there is a discussion as to whether female supervisors might increase their team's awareness of gender inequalities or, to the opposite, reduce attention to unfairness in gendered wage setting processes because the success of the female leaders reduced the attention to gender inequalities. For the other two contextual factors under study, we assume that they are both prone to increase employees' information about their colleagues' wages which might in turn increase the chances that gender inequalities are perceived. All three characteristics of the organizational context thus can be expected to be related to information or awareness about gender inequalities in wages in the respective organization. This is expected to influence in turn the employees' fairness evaluation of fictitious co-workers' wages since it sets the reference frame for respondents' expectations about transparent wage setting procedures (collective bargaining agreements, talk about wages) and women's chances for advancement in the firm (female supervisors).

Our study consists of two steps. First, we assess whether there is a gender bias in the evaluation of similar others' wages (women and men perceiving similar women's lower wages to be fair). Although we do not directly aim at replicating previous studies that either focussed on the evaluation of fictitious vignette persons' earnings and found a gender bias (e.g. Auspurg, Hinz and Sauer, 2017) or focussed on evaluations of the respondent's own earnings and—based on recent data—did not find gender differences (Adriaans and Targa, 2022; Brüggemann and Hinz, 2023), we contribute to the discussion of the gendered fairness assessment of wages. Second, our main contribution is to investigate the impact of several contextual factors related to the transparency of wages in an organization and to the role of women in leading positions on employees' perceptions regarding the fairness of wages.

We address these two steps using a vignette study that was part of a representative online survey of employees in German firms. Vignette designs are a powerful tool for this type of research as their internal validity is high and several relevant factors for the fairness evaluation of wages can be causally disentangled at the same time (without informing respondents about the main research interest). Compared to previous work, we came up with the innovation to link the vignette scenarios to the respondents' actual organizational environment. This means that the vignette person was described as a co-worker and the wages were constructed based on the actual respondent's wages. This approach should provide scenarios that are closer to their own which should allow respondents to make evaluations of fictitious employees as if they were their co-workers. To explore the contextual factors at the firm level we focus on firms with at least 100 employees which ensures a sufficient number of observations to construct the contextual measures of interest. We run hierarchical linear models (evaluations nested in respondents) with occupation- and federal state-fixed effects on employee's fairness perceptions of their fictitious co-workers' wages, analysing 27,742 vignette evaluations made by 5,556 employees working in 531 firms.

What do we know about gendered fairness evaluations and how can we explain them?

While research on gender differences in perceptions of wages is abundant, studies differ substantially as to a)

the exact phenomenon that they study, as well as b) the methodological approach that they take. Regarding the phenomenon under study, previous research differs as to whether it is interested in men's and women's *satisfaction* with their wages or their *evaluation of the fairness* of wages. For the latter, it is, moreover, important to note that some studies focus on the evaluation of an individual's own wages, while others investigate evaluations of (fictitious) other people's wages. Related to these substantial differences in research questions are the different methodological approaches that studies take. *Evaluations of the fairness* of wages are either based on direct survey questions, especially regarding an individual's own wages, or based on vignette studies where respondents evaluate the wages of fictitious individuals who differ by characteristics, such as productivity or gender.

These different empirical approaches are also important when conceptualizing fairness evaluations theoretically. Evaluations of the fairness of pay involve a subjective sense of (un)fairness that is triggered when one's own or another person's pay is compared to the level of pay that an individual would consider as fair. If the actual pay and the level of pay that would be considered fair match, then pay is evaluated as being fair. If the actual pay is higher than what the individual would consider fair, a state of unfair over-reward is perceived; if the inverse is the case, a state of unfair under-reward is identified (Jasso, 1978; Jasso, Törnblom and Sabbagh, 2016). Hence, whether a reward situation is perceived as fair or not lies in the eye of the beholder and depends on the underlying reference frame. For reflexive evaluations of the own wage, comparable colleagues in the same firm and/or occupation serve as pay referents with whom I compare myself when assessing the fairness of my wages. Similarly, when assessing the fairness of a fictious co-worker's wage, similar colleagues' wages are used as underlying reference frame. It is important to note however that these two empirical approaches to measure fairness assessments of (own or of others') wages grasp somewhat different aspects of the phenomenon: While the reflexive approach, measuring fairness assessments of own wages, can be expected to be informed by self-interest of the person, the non-reflexive approach, measuring the fairness evaluation of (fictitious) other people's pay, is more suited to capture unconscious gender biases in fairness evaluations of wages. This should be kept in mind when assessing the results of studies of these two different kinds of approaches. In both cases, however, it can be assumed that similar co-workers' wages serve as a reference point when assessing the fairness of wages.

Several survey studies (Valet, 2018; Pfeifer and Stephan, 2019) assessing the respondents' evaluation of their own pay find that women evaluate their own pay as fairer than do their male counterparts. However, in their country-comparative study, Adriaans and Targa (2022) do not find evidence that women evaluate their own earnings more favourably than men: in 15 out of 28 analysed countries, women reported more intensive levels of perceived unfairness than did men. Similarly, the results of Brüggemann and Hinz (2023) also challenge the idea that female workers evaluate their lower wages as fair.

Vignette studies that assess respondents' evaluation of fictitious workers' wages find that gender earnings gaps are perceived to be fair or justified not only by men but also by women (Auspurg, Hinz and Sauer, 2017; Adriaans, Sauer and Wrohlich, 2020; Sauer, 2020). The size of the gap that is considered fair varies between about a three per cent gap (Adriaans, Sauer and Wrohlich, 2020) and about an eight per cent gap (Auspurg, Hinz and Sauer, 2017).

When trying to understand the phenomenon of gender biased perceptions of the fairness of wages, two main theoretical arguments have been put forward. The first theoretical argument is related to the concept of gender status beliefs that assume that men are more competent and worthy, and thus more deserving of higher pay (Ridgeway, 2011). According to this perspective, also called the expectation states theory (Correll and Ridgeway, 2003), both men and women are expected to evaluate lower wages for women as being fair (H1a).

The second theoretical approach is based on the idea that individuals compare themselves or a person that is to be evaluated with similar pay referents (Jasso, Törnblom and Sabbagh, 2016). Thus, women have been shown to be more likely to select female referents who are, on average, lower paid (Davison, 2014). Hence, men might have different comparison standards when comparing their own wage levels to those of other men than women who compare themselves to other women (Schneck, 2014). Similarly, it has been argued that men might be overconfident when engaging in self-evaluations and might therefore overestimate their own performance (Pelham and Hetts, 2001; Niederle and Vesterlund, 2008). From this theoretical perspective, one would expect only women to consider lower wages for women to be fair or justified (H1b).

It has been shown that this gender bias in evaluations of the fairness of wages is not universal but differs between social groups and contextual surroundings. Thus, it could not be found for social science students, which is explained by the high salience of equality norms among this group (Sauer, 2020). The more liberal the respondents are in terms of gender roles, the less they perceive females to be inferior in their performance, and the more they consider fair pay to be important (Buchanan, 2014). Moreover, Lang

and Groß (2020), in their study on the German case, only find a gender bias for men with children in West Germany, suggesting that a male breadwinner norm is the basis for such beliefs. This is supported by Jann, Zimmermann and Diekmann (2021), who find that higher wages for married men (as compared to married women) are considered to be fair. Auspurg, Hinz and Sauer (2017) show that respondents who work in occupations with lower gender pay gaps are less likely to perceive gender pay gaps as justified. Likewise, respondents living in federal states of Germany that have high actual gender pay gaps report a larger bias favouring men (Sauer, 2020).

While these studies suggest that a gender bias in perceptions of the fairness (or unfairness) of wages is not universal, it remains less clear what the relevant factors in the contextual surroundings are that shape this gender bias. Due to issues relating to data availability, earlier studies focussed on factors such as different parts of countries (east/west Germany (Lang and Groß, 2020)), federal states (Sauer, 2020), or the share of women in occupations (Auspurg, Hinz and Sauer, 2017). Although these differentiations yield interesting results, they are generally rather broad as regards influencing people's evaluations of the fairness of wages directly. A more important frame of reference that should be addressed is the organizational context, that is the working group and—as a wider context—the firm in which an employee works. Several studies have shown that other workers in the same occupation as well as colleagues from the same firm seem to be the most relevant referents for wage comparisons (Brown, 2001, Godechot and Senik, 2015, Hauret and Williams, 2019, Schneider and Schupp, 2010). Thus, it can be assumed that, depending on this direct day-to-day environment, employees have different experiences that should impact on their evaluations of the fairness of wages (Sauer and May, 2017). This should include not only the evaluation of own wages in comparison to colleagues' wages but also the fairness evaluation of fictious co-workers' wages. We therefore expect that employees' evaluations of other women's wages as (un) fair should depend on the daily context in which they work, especially insofar as it impacts on the likelihood that gender pay inequalities are evaluated as unfair.

We therefore address the relevance of three institutional characteristics for fairness evaluations that are believed to impact on the perception of women's situation in a firm and the degree of information advantage regarding co-workers' pay. The first factor under study that can influence employees' evaluation of gender inequalities in pay is the gender of managers in the company where a person works. There are two opposing assumptions as to how a supervisor's gender should shape evaluations of the fairness of pay. The first argument, based on social psychological theories of in-group preference based on ascriptive similarity (Tajfel and Turner, 1986; Reskin, 2000), coined 'agents of change' by Cohen and Huffman (2007), suggests that increased representation of women in the management will attenuate the gender wage gap as female managers will redress the past inequalities experienced by female employees. By contrast, it could also be that greater representation of women in management positions decreases employees' concern about the gender pay gap because women are no longer perceived to be disadvantaged, due to an overgeneralization of women's access to equal opportunities (for empirical evidence, see Georgeac and Rattan, 2019). Cohen and Huffman (2007) refer to this phenomenon as 'cogs in the machine', meaning that women, as they assume managerial roles, will exert a negligible, or even negative, effect on the earnings of female employees. The results of studies in this area are rather mixed. Balcar and Hedija (2019) conclude that the gender of the manager has an effect on the level of wages, but not on the gender wage gap. Srivastava and Sherman (2015) cannot find support for the proposition that female managers reduce the gender wage gap among their subordinates. Similarly, Van Hek and Van Der Lippe (2019) do not find an effect of female supervisors or their share in the organization on women's and men's earnings. Dezsö, Li and Ross (2022) even find that female top managers are paid less where the CEO is female than they would have earned if the CEO was male. By contrast, Zimmermann (2021), based on German-linked employer-employee data, finds that female first-level managers slightly narrow the gender wage gap among workers, while female second-level managers considerably narrow the gender wage gap. We thus derive two opposing hypotheses: Following the 'agents of change' perspective, we expect employees who have either a direct female supervisor or who work in a firm where a high share of women hold management positions to be more likely to assess wages for women as unfair (H2a).

Following the 'cogs in the machine' perspective, we expect that employees with a direct female supervisor or working in a firm with a high share of women in management positions are less likely to evaluate women's wages as unfair (H2b).

Regarding the second contextual characteristic—that is, whether a firm or working group allows (or even encourages) employees to talk about their wages—there has also been some previous research on this matter. Thus, an evaluation of the Austrian Pay Transparency Law, introduced in 2011, which requires firms above a certain size threshold to publish internal reports on the gender pay gap, did not find any discernible effects on male and female wages (Gulyas, Seitz

and Sinha, 2021). In Germany, the Pay Transparency Act came into force in 2017. This entitles workers in companies with more than 200 employees to an individual right to wage comparison information (which affects about one-third of the workforce) (Ahrens and Scheele, 2022). Policy evaluations are, however, rather sceptical, since only very few employees use their new right to information, and an even smaller share of employees see a change in wages when they make use of that right (Peichl and Schricker, 2019). On the positive side, the introduction of the law has initiated a broader public and political debate on the gender pay gap (Ahrens and Scheele, 2022), and might also have contributed to firms (especially those with more than 200 employees) increasing the attention they give to the issue. In organizations with a high degree of wage transparency, employees can thus be expected to have more information about their co-workers' wages and therefore have more reference points for making wage comparisons. Due to women's, on average, lower wages, greater wage transparency resulting from an exchange between employees on wages should therefore lead to a higher likelihood for both, men and women, to evaluate women's wages as unfair (H3).

As to the third organizational characteristic, there is evidence that collective bargaining agreements lead to higher wages in general (Addison *et al.*, 2014). Moreover it has also been shown that the union wage benefit is most pronounced among women (Elvira and Saporta, 2001). For the period between 2000 and 2010, Grimm, Lang and Stephan (2016) can show that in firms with collective bargaining agreements, the gender wage gap decreased over time, while it remained constant (on a higher level) in firms without such an agreement. The authors conclude that this difference is mostly due to unmeasured factors, and could thus be related to discrimination.

Our theoretical argument on how collective bargaining agreements should impact on fairness assessment is that they will lead to higher wage transparency. Moreover, the standardization of wages through collective bargaining agreements reduces opportunities for wage discrimination (Freeman and Medoff, 1984), as well as intrafirm wage dispersion (Freeman, 1982), and hence potentially also reduces the gender pay gap. This is achieved by establishing wage-setting, bureaucratic procedures that reduce wage dispersion, and bureaucratic wage rules that lower the degree of arbitrariness in wage rates, thus minimizing the potential for discrimination (Elvira and Saporta, 2001). Employees in firms with collective bargaining agreements can thus be expected to be used to lower wage dispersion and a high standardization of wages, and should therefore be less tolerant of wages that deviate from these standards. We therefore expect that (male and female) employees in firms with collective bargaining agreements are more likely to evaluate women's wages as unfair (H4).

Data

To address our research questions, we were faced with extensive data requirements as we not only need representative data, including a vignette study, to replicate previous findings, but also detailed information on the organizational environment to test whether institutional surroundings constrain individuals' perceptions of the fairness of wages. Hence, we conducted a factorial survey experiment as part of an online survey (see Strauß *et al.* (2022), for survey data and detailed documentation on field work), for which we recruited employees from German firms that allowed the linkage of survey and administrative data from social security records.

For the recruitment of participants, we relied on a combination of two administrative data sources—the Establishment History Panel (BHP) and Employee History (Beschäftigtenhistorik—BeH) of the Institute for Employment Research (IAB), which cover all firms with at least one employee, and the complete working population in Germany being subject to social security contributions—and we applied the following stratified sampling approach. First, a random sample of 20,000 firms with at least 100 employees each (14,000 based in west and 6,000 in east Germany) was drawn, to make the data small enough for computational work. Second, we created a $3 \times 3 \times 3$ matrix based on all combinations of terciles of three institutional factors that we deemed to be relevant for wage fairness (gender pay gap, share of women in management positions, Gini coefficient). This step guarantees enough observations in those specific contexts which provide variance for the later analysis of firm-level explanatory variables. Finally, we randomly selected 20 firms from each of the 27 sampling cells and then 100 employees from each of the selected firms, resulting in a total sample of 54,000 employees from 540 firms.

Between May and August 2021 the online survey was fielded using postal invitation letters and up to three postal reminders.[1] In total, 7,867 employees took part in our survey, which corresponds to a response rate of 15 per cent if we take into account that around 1,500 letters were returned as undeliverable. A large majority (87.3 per cent) of participants gave their informed consent to link their survey answers with administrative data. We exclude from our sample of analysis respondents that were not employed anymore (or only marginally employed) at the time of the survey (N = 268), changed their firm between sampling and survey participation (N = 396), or reported contractual

working hours of less than 10 or more than 60 hours per week (N = 102). After excluding respondents who did not evaluate all five vignettes and listwise deletion, our analytic sample consists of 5,556 respondents from 531 firms evaluating 27,742 vignettes.

Factorial survey design

As mentioned before, it is important to understand how different methodological approaches can influence the results of studies. Of the previous studies on perceptions of the fairness of wages, some are based on survey questions and consider the respondents' own wages (e.g. Pfeifer and Stephan, 2019), while others implement vignette studies, asking the respondents to evaluate other (fictitious) people's wages (e.g. Auspurg, Hinz and Sauer, 2017). In our own study, we combine both approaches in the sense that we implement vignettes, asking respondents to evaluate others' wages. However, we ask them to imagine a person in their own firm, with a similar position to that which they themselves hold (see Table 1).

Moreover, we do not predefine a range of income categories for the fictitious co-workers as this could lead to a lot of unrealistic scenarios: for example, when participants working in jobs at the bottom/top of the income distribution are presented with potential co-workers earning wages similar to bottom/top positions. Hence, our survey experiment was programmed in such a way that participants' gross income and their working hours, stated at the beginning of the survey, were used to dynamically calculate a range of income values distributed around respondents' employment situation while other survey questions were answered.[2] This whole calculation process was designed to provide our respondents with fictitious co-workers that would be as realistic as possible with regard to their wages.

Besides the vignette's firm and position, which were depending on the working environment of the respondents, we also assigned the same family status to all vignettes (stable partnership). We manipulated eight additional dimensions that are underlined in Table 1. We list these, with their specific levels, in Table 2. To make our vignettes comparable with previous research, we focus on a vignette structure and conditions that are similar to previous vignette studies from the field (e.g. Auspurg, Hinz and Sauer, 2017).

We use a $6 \times 2 \times 9 \times 2 \times 3 \times 3 \times 4 \times 4$ design (see Table 2), leading to a vignette universe of 31,104 vignettes. To reach a lower number of vignettes while maintaining a maximum of orthogonality (minimum of correlation between dimensions) and level balance (equal frequency of each level) we rely on a d-efficient (d = 91.4) design, with 360 vignettes that were blocked to 72 decks, each containing five vignettes. Each respondent was randomly assigned to one of these 72 questionnaire versions. Supplementary Table A1 contains a correlation matrix of all variables, showing no substantial associations between vignette variables ($r < 0.03$). Hence, randomization, as well as the fractional design search, worked as intended. By further randomizing the order of vignettes per respondent, making it possible to move back and forth in the online survey to re-evaluate vignettes, and by assigning only five vignettes to each respondent, we reduce order, learning and fatigue effects (Auspurg and Hinz, 2015).

Measures

Dependent variable

The outcome variable is the evaluation of the fairness of co-workers' gross wages, as formulated in Table 1. We use a nine-point scale ranging from 'unfairly low (–4)' to 'unfairly high (+4)', with a midpoint (0) defining

Table 1 Sample vignette

Please imagine a person, that works in your firm in a position that is similar to your position.

A 40-year-old woman works full-time, i.e. 40 hours per week, and is overqualified for her job. She entered the firm and started in the position a long time ago and performs above-average. She is living in a stable partnership, with two children in her household.

Her monthly pay amounts to €3,000 (gross).

How fair do you consider the gross pay of the described person?

Unfairly low				Fair				Unfairly high
–4	–3	–2	–1	0	+1	+2	+3	+4
☐	☐	☐	☐	☐	☐	☐	☐	☐

Note: For screenshots of the vignettes, as presented in the online survey, see Strauß *et al.* (2022). Vignette text was translated from German into English.

Table 2 Vignette dimensions and levels

#	Dimensions	Levels
1	Age	25/30/35/40/45/50 years
2	Gender	Male/female
3	Gross earnings/months	Nine values, ranging from –40 to + 40 per cent of a respondent's wage (about which respondents were asked earlier in the survey)
4	Working hours/week	Full-time, i.e. 40 hours per week/part-time, i.e. 20 hours per week
5	Qualifications	Under-qualified/qualified/overqualified
6	Tenure	Entered the firm and started in the position just recently/ entered the firm a long time ago but started in the position just recently/ entered the firm and started in the position a long time ago
7	Job performance	Below-average/average/above-average/no information
8	Children	Four values, ranging from 'no children' to 'three children'

perfect fairness of wages. Similar versions of this scale have been used in other surveys (e.g. European Social Survey (Round 9)) and in several other studies (see, e.g. Liebig, Sauer and Friedhoff (2015) for an overview). Participants' average evaluation of the fairness of wages was –0.416, with women's evaluations being –0.618, and thus 0.351 scale points lower than men's average evaluation of –0.267. Hence, on average, employees evaluated their fictitious co-workers' wages as being unfairly low, and this was more pronounced for women.

Explanatory variables

The first hypothesis (a, b) is concerned with the evaluation of male and female co-workers' wages, as well as differences between respondents' gender. Hence, we use a dummy variable for both variables indicating the gender of vignettes and respondents (1=female, 0=male). Following our second hypothesis (a, b), we expect that having a female supervisor or working in firms with a higher share of women in management positions should shape evaluations of the fairness of co-workers' wages, either toward the 'agents of change' or the 'cogs in the machine' argument. The first institutional variable was measured based on the individual responses to the question of whether respondents have an immediate supervisor, differentiating between respondents with a male or female supervisor or with no supervisor.

For the share of women in management positions at the level of firms we rely on administrative data (BeH). Women in management positions are identified using the fourth digit of the five-digit German Classification of Occupations 2010 (KldB 2010), which indicates supervisors and managers. This operationalization has been applied in other studies using the same or different data, including information on occupations from the KldB 2010 (e.g. Zimmermann, 2021). As a substantial share of firms (more than 20 per cent) in our sample did not employ women in management positions at all, we constructed the following three categories: 0 per cent, 0.1–30.0 per cent, and more that 30 per cent of women in managing positions.

The third and fourth hypotheses state that greater wage transparency in a firm leads to a higher likelihood of unfairly low wages of women, both for men and women. This was first measured directly by asking employees 'Have you ever had an exchange about your wages with your colleagues? (Yes/No)'. 45 per cent of our respondents stated that they had never discussed their wages with colleagues, which illustrates that wages in Germany are still a sensitive topic—even among co-workers.

Additionally, we expect that collective bargaining agreements in firms lead to higher wage transparency and can create contexts with greater probability of perceiving unfairly low wages. Hence, we asked 'Does your establishment/office have a regional collective bargaining agreement or a collective bargaining agreement concluded between your establishment/office and trade unions? (Yes/No/Don't know)'. In some of the firms, the respondents provided different responses on the collective bargaining coverage. We define a firm as being covered by a collective bargaining agreement if the majority of respondents from the firm stated that there is a collective bargaining agreement.[3] We find that more than 65 per cent of our participants work in firms that are subject to a collective bargaining agreement.

Table 3 gives an overview of the variables used in the analysis.

Further control variables

For the regression analyses we additionally include information about the fictitious co-workers, employees

Table 3 Descriptive statistics

	mean	sd	min	max
Vignette level (co-workers):				
Evaluated wage fairness (–4 unfairly low, 0 fair, 4 unfairly high)	–0.41	2.24	–4	4
Age				
25	0.16		0	1
30	0.17		0	1
35	0.17		0	1
40	0.16		0	1
45	0.17		0	1
50	0.17		0	1
Female (ref. male)	0.51		0	1
Part-time (ref. full-time)	0.49		0	1
Qualification (ref. qualified)				
Under-qualified	0.33		0	1
Qualified	0.33		0	1
Overqualified	0.34		0	1
Tenure				
Entered firm and position recently	0.33		0	1
Entered firm long time ago but started position recently	0.32		0	1
Entered firm long time ago and started position long time ago	0.34		0	1
Job performance				
Below average	0.25		0	1
Average	0.25		0	1
Above average	0.25		0	1
No information on performance included	0.25		0	1
Children				
No children	0.25		0	1
One child	0.25		0	1
Two children	0.26		0	1
Three children	0.24		0	1
Gross earnings (relative to respondent's earnings)				
–40 per cent	0.12		0	1
–30 per cent	0.11		0	1
–20 per cent	0.10		0	1
–10 per cent	0.11		0	1
Respondent's earnings	0.11		0	1
+ 10 per cent	0.11		0	1
+ 20 per cent	0.11		0	1
+ 30 per cent	0.11		0	1
+ 40 per cent	0.11		0	1
Number of vignette (1–5)				
1	0.20		0	1
2	0.20		0	1
3	0.20		0	1
4	0.20		0	1
5	0.20		0	1

Table 3. Continued

	mean	sd	min	max
Respondent level (employees):				
Gender (ref. male)	0.42		0	1
Monthly gross pay (logged)	8.22	0.45	7	10
Working hours (weekly, contracted)	36.65	5.66	12	56
Tenure (days in firm)	8.29	0.85	7	10
Fixed contract (ref. permanent)	0.04		0	1
Education (highest school degree)				
No degree	0.00		0	1
Lower secondary	0.08		0	1
Intermediate secondary	0.32		0	1
University of applied sciences entrance qualification	0.15		0	1
A-level (Abitur)	0.43		0	1
Another level	0.01		0	1
continued	mean	sd	min	max
Age	47.40	10.94	20	68
Nationality German (ref. other)	0.96		0	1
Partner living in household (ref. no)	0.82		0	1
Workgroup level:				
Gender of direct supervisor				
Male	0.69		0	1
Female	0.28		0	1
No supervisor	0.02		0	1
Exchange about wages (ref. no)	0.55		0	1
Gender composition in team				
No team	0.12		0	1
More men	0.39		0	1
More women	0.34		0	1
Similar shares of men and women	0.15		0	1
Firm level:				
Share of women in management				
0 per cent	0.21		0	1
0.1–30.0 per cent	0.36		0	1
> 30.1 per cent	0.43		0	1
Collective bargaining agreement (ref. no)	0.66		0	1
Firm size	382.69		101	7682
Gender composition				
< 30 per cent	0.38		0	1
30.1–70 per cent	0.39		0	1
> 70.1 per cent	0.23		0	1
Gender pay gaps (unadjusted)				
< 0 per cent	0.08		0	1
0.1–20.0 per cent	0.48		0	1
> 20.1 per cent	0.44		0	1
Gini coefficient				
low	0.31			
middle	0.35			
high	0.34			

Table 3. Continued

	mean	sd	min	max
Federal state				
Schleswig-Holstein	0.03		0	1
Hamburg	0.02		0	1
Niedersachsen	0.08		0	1
Bremen	0.02		0	1
Nordrhein-Westfalen	0.20		0	1
Hessen	0.07		0	1
Rheinland-Pfalz	0.03		0	1
Baden-Württemberg	0.12		0	1
Bayern	0.13		0	1
Saarland	0.01		0	1
Berlin	0.07		0	1
Brandenburg	0.05		0	1
Mecklenburg-Vorpommern	0.01		0	1
Sachsen	0.09		0	1
Sachsen-Anhalt	0.03		0	1
Thüringen	0.04		0	1
N (evaluations); N (individuals); N (firms)	27,742; 5,556; 531			

Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

and their firm. At the vignette level, we include all vignette dimensions (see Table 2) as we are mainly interested in whether vignettes with similar characteristics are evaluated differently depending on the assigned gender.

At the individual level, we control for inputs and outcomes following equity theory. In our experimental design where the vignettes reflect a scenario close to respondents' own, they might take into account their own ratio of inputs and outputs as a reference to evaluate the fictitious co-workers. As outcome, we control for the monthly gross pay (natural logarithm). For inputs, we account for weekly contracted working hours and logged seniority (days in the same firm), as well as education (highest school degree), as past inputs. Moreover, we control for occupations (we use dummies for 37 occupational fields) as another main frame of reference and for the gender composition in the working group (0=no team, 1=more men, 2=more women, 3=similar shares of men and women). As the gender composition in the working group is moderately correlated with the gender of the direct supervisor (r=0.41 for more women in working group and female supervisor, see Supplementary Table A1), controlling for the former is required to net out the latter's effect of interest. Further control variables on the individual level are type of contract (1 = fixed, 0 = permanent), age (in years), a nationality dummy (1 = German, 0 = foreign) and a dummy for living with a partner in a household.

Finally, at the level of firms, we rely on matched information from administrative data to control for firm size (number of employees), gender composition, gender pay gaps and wage dispersion as these are factors correlated with our main explanatory variables at the firm level (the share of women in management and the collective bargaining agreements). Gender composition is measured as the share of women employed in a given firm and recoded in the following categories: 0–30, 30–70 and 70–100 per cent. Gender pay gaps (GPG) are calculated as the difference between male and female median daily gross pay divided by male median daily gross pay, and are transformed into a categorical variable with three values (negative GPG, GPGs between 0 and 20 per cent, and GPGs greater than 20 per cent). Finally, we control for the overall wage dispersion in a firm by including a categorical variable for the Gini coefficient with three values (the distribution of the coefficient is divided into three equally sized groups). Lastly, we add federal state dummies of firm location to eliminate unobserved regional heterogeneity.

Estimation strategy

In our survey, the respondents were asked to evaluate five different vignettes. To account for the nested structure, we estimate three-level hierarchical linear models, with the vignettes at the lower level, the individuals at the medium level, and the firms at the upper level. Following Heisig and Schaeffer (2019), in addition to random intercepts, we include a random slope for respondents' gender and one for vignette gender because in our multilevel models we are also interested in cross-level interactions between contextual factors on the upper level and gender on the vignette and respondent level. We start with our model evaluating the employee's perception of male and female co-workers' wages, as well as the differences between respondents' gender, by including respondents' and vignette persons' gender as well as their interaction.

In the next step, in order to analyse whether the firm and work group context plays a role in evaluations of the fairness of wages, and whether this differs by respondents' gender, we estimate four different models, one for each context variable we are interested in. In these models, we include a three-way interaction between the contextual variable, respondents' gender, and vignette gender. In addition, we also present the results from a model where we jointly estimate the gender-specific effects of all context factors by including all four three-way interactions. Besides the control variables mentioned above, all contextual variables are included as additional control variables in the different models.

The first institutional variable regarding the gender of the direct supervisor actually has three categories (male, female, no supervisor). However, as the number of observations for workers without a supervisor is very small (~2 per cent) we only report the results for the other two categories. We estimate predictive margins for all four combinations of vignette and respondent gender, as well as average marginal effects for the interaction of respondent and vignette gender, to see whether male and female respondents evaluate male and female vignette wages differently, in general and in different organizational environments.

Results

Gendered evaluations of the fairness of wages

First, we discuss the results of our analyses regarding the gender bias in evaluations of the fairness of wages. Figure 1 shows the predictive margins for vignette and respondent gender, as well as the conditional effects of vignette gender on the fairness evaluation for the baseline model with the interaction between vignette and respondent gender (see Supplementary Table A2 for all covariates). The predictive marginal effects (Figure 1a) show that men assess the fairness of women's wages and men's wages very similarly. The fairness evaluation of female respondents with regard to women's wages is at a similar level. However, female respondents are less likely to rate men's wages as unfairly low. Figure 1b shows that the assessment of the fairness of wages differs significantly by vignette gender for female respondents. Female respondents are more likely to evaluate the wages of female vignette persons compared to male vignette persons as unfairly low (the conditional effect

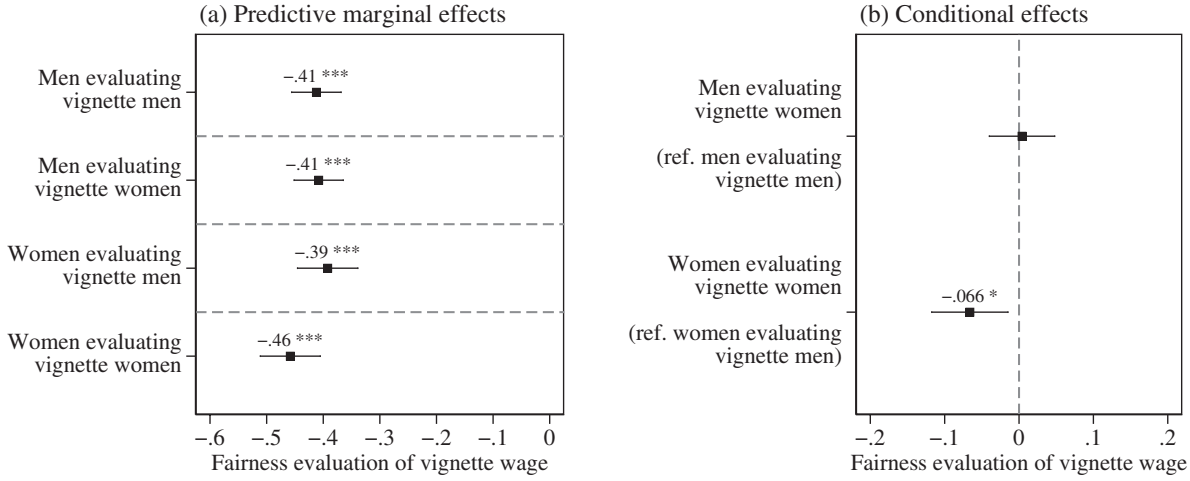

Figure 1 Gendered fairness evaluations—predictive marginal effects and conditional effects of interaction between vignette and respondent's gender on evaluation of the fairness of wages*Note:* N evaluations = 27,742; N respondents = 5,556; N firms = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.*Data:* Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

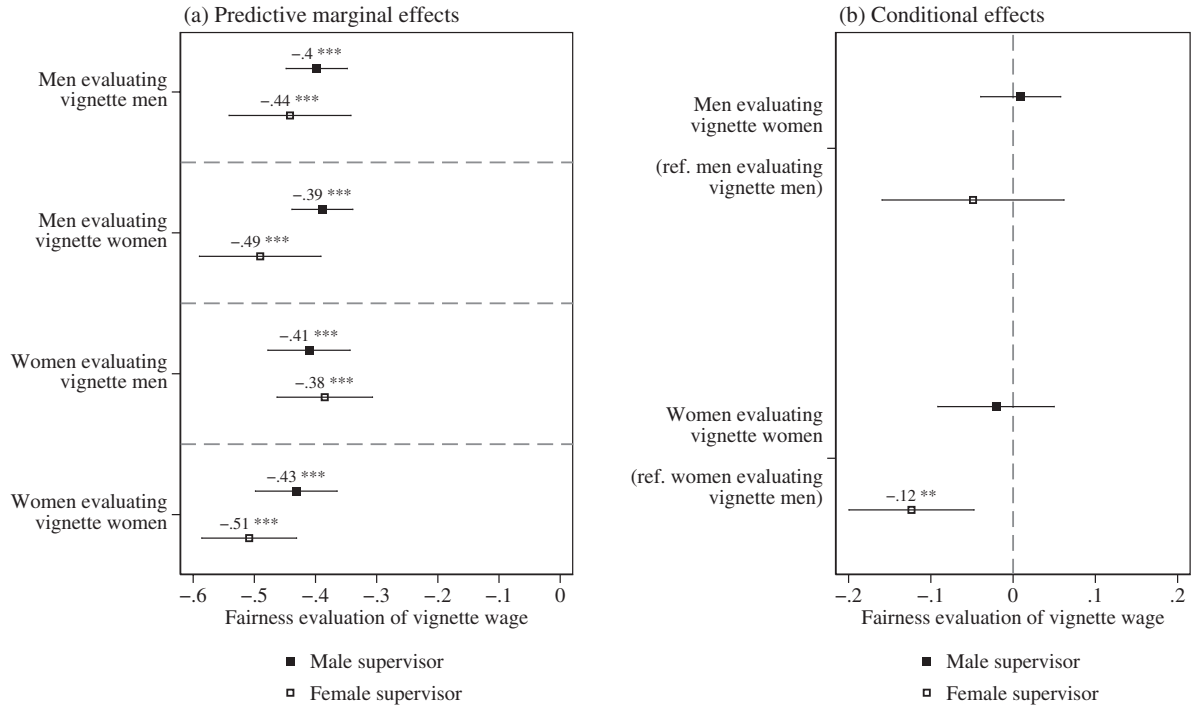

Figure 2 Gendered fairness evaluations, by gender of supervisor

Note: N evaluations = 27,742; N respondents = 5,556; N firms = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.

Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

is significant at the 5 per cent level). Men, on the contrary, do not have a gender bias in their fairness evaluations. Thus, our results do not support either H1a or H1b. In contrast to previous vignette studies, we do not find that women and men find higher wages for (other fictitious) men to be justified. Instead, female respondents are more likely to perceive the wages of their female vignette co-workers to be unfair.

The role of the organizational environment

We now turn to our second research question about the role of the organizational context in perceptions of the fairness of wages. The first institutional factor we consider relates to the *gender of managers*. To test our hypotheses H2a and H2b we estimate two different models with a three-way interaction of respondents' gender, vignette gender and gender of the direct supervisor (on the work group level), as well as the share of female managers (on the firm level). First, Figure 2a shows that both male and female respondents with a female supervisor tend to assess wages as unfairly low more often than those with a male supervisor. However, the interaction effect between respondents' and vignette persons' gender shows that only women who have a female supervisor are significantly more likely to rate women's wages as unfairly low as compared to men's wages (Figure 2b). The result partly supports hypothesis H2a in the sense that female (but not male) employees with a female supervisor are more likely to consider wages of female co-workers as too low. Hypothesis H2a is not supported by the results regarding the proportion of women in management positions at the firm level, presented in Figure 3. Where higher proportions of women are present in the management, respondents are somewhat more likely to rate women's wages as unfairly low as compared to men's wages, but the estimated effects do not reach conventional levels of statistical significance. If, instead of estimating a separate model for each context variable, all contextual factors and their three-way interactions with the gender variables are included in one joint model (see Supplementary Tables A3 and A4), the effect of a high share of female managers on the gender-specific evaluation of the fairness of wages by female respondents and the effect for a medium share of female managers stay insignificant. H2a is therefore only confirmed for female (not male) employees and the context effect is confirmed only for direct female supervisors, not the proportion of female managers.

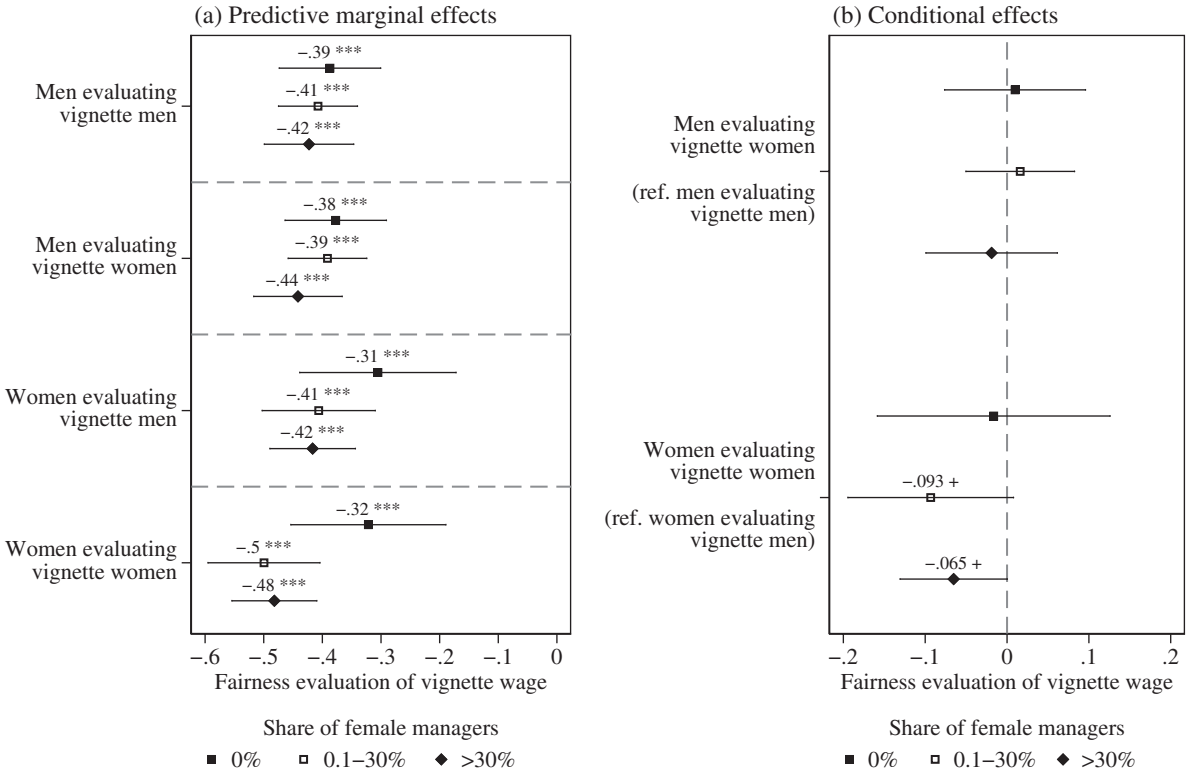

Figure 3 Gendered fairness evaluations, by share of female managers in firm

Note: N evaluations = 27,742; N respondents = 5,556; N firms = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.

Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

Next, we analyse the role of *wage transparency* in perceptions of the fairness of wages. We consider whether employees discuss their wages with their colleagues (individual level), as well as whether the firm is subject to a collective bargaining agreement. However, collective bargaining coverage not only increases wage transparency, it also reduces the wage dispersion in firms, thus potentially shaping the reference for wage comparisons of employees.

Figure 4a shows that employees who report to discuss their wages with their colleagues tend to more often evaluate the wages of (fictitious) co-workers as unfairly low, regardless of gender. With respect to gender differences, women are more likely to rate women's wages as unfairly low compared to men's wages, but this is true both for women who discuss their wages with co-workers and for those who do not talk about their wages with other colleagues (Figure 4b). Thus, discussing wages with colleagues seems to increase the probability of assessing wages as unfair in general, but does not have a significant gender-specific effect. Of course, it is also possible that employees who are highly aware of inequalities in pay are more likely to talk to colleagues about their wages, i.e. that the causality of the relation is reversed. In addition, these effects that are conditional on a respondent's gender are no longer significant when we estimate a single model including three-way interactions for all context variables at once (see Supplementary Tables A3 and A4).

Finally, Figure 5 shows the results of evaluations of the fairness of wages for firms with and without collective bargaining agreements. On the whole, employees in firms with a collective bargaining agreement are more likely to assess wages as unfairly low than people in firms without a collective bargaining agreement (Figure 5a). In terms of gender differences, we find that women in firms covered by collective bargaining agreements especially perceive the wages of other women to be unfairly low (Figure 5b). This effect also holds when estimating a joint model for all contextual variables (see Supplementary Tables A3 and A4 in the Appendix).

Effect heterogeneity

In order to better understand our (unexpected) finding of a reverse gender bias, that is women who are more

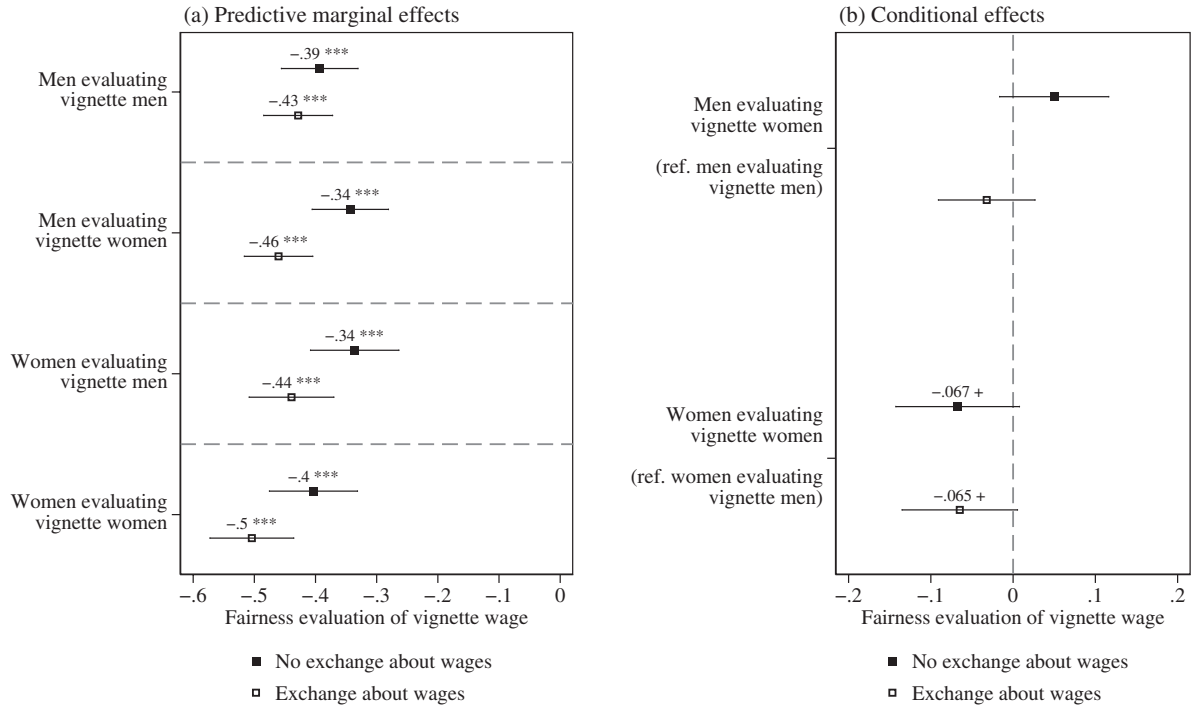

Figure 4 Gendered fairness evaluations, by exchanges about wages

Note: N evaluations = 27,742; N respondents = 5,556; N firms = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.

Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

likely to perceive other women's wages as unfairly low, we finally examine whether this pattern is universal in our sample or driven by certain sub-groups of female workers. The results for the heterogeneity analyses are reported in Table 4.

In terms of individual characteristics, we first find that the reverse gender bias is particularly pronounced among higher educated and higher earning women. Moreover, our finding that women judge women's wages to be unfairly low appears to be driven primarily by the 36- to 45-year-olds.

We also find effect heterogeneity by firm characteristics. If we differentiate between smaller and larger firms, we see that only women in large firms (number of employees > median = 217 employees) rate the wages of female colleagues as unfairly too low. For the results by industry, we focus on the most common industries in our sample (more than 1000 observations each) and find clear differences. For the selected industries, the reverse gender bias is particularly pronounced in Education and in Human Health and Social Work Activities.

Discussion and conclusion: what have we learned and where should we go next?

Previous research has repeatedly shown that people's perceptions of the fairness of wages are biased in such a way that they see the gender pay gap as fair or justified (Auspurg, Hinz and Sauer, 2017; Adriaans, Sauer and Wrohlich, 2020; Sauer, 2020). Moreover, there is empirical evidence that perceptions regarding fair (or unfair) wages are not a universal phenomenon but can depend on the contextual surroundings. In this paper we use unique data to analyse whether we also find the gender bias found in earlier vignette studies in evaluations of the fairness of wages, and—most importantly—whether the organizational context has an impact on perceptions of the fairness of wages.

While previous studies have been based on generic third-person evaluations, and in some cases on direct questions about the earnings of the evaluators, we explicitly set a point of reference for comparison at the firm level by asking participants to evaluate hypothetical peers working in the same firm and in the same position as the respondents. Beyond data from a factorial survey experiment, we are able to exploit information on the broader social context of the participants in the firm and in their working group.

Other than expected and in contrast to other vignette studies, we find a reverse gender bias for women. Female employees more frequently evaluate the wages of female co-workers as unfairly low compared to the wages of male co-workers. There could be different reasons why our results differ from those of previous

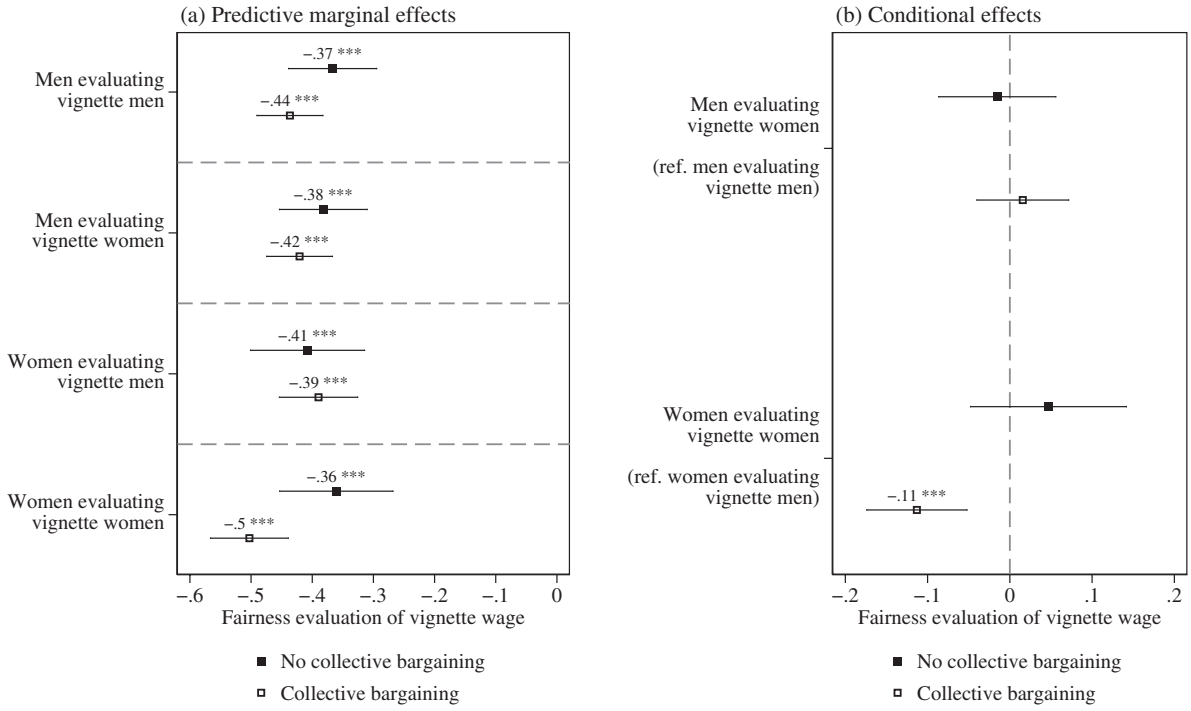

Figure 5 Gendered fairness evaluations, by collective bargaining coverage

Note: N evaluations = 27,742; N respondents = 5,556; N firms = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.

Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

studies, and especially from the study of Auspurg, Hinz and Sauer (2017): First, there could be differences in the construction of the sample. Our sample differs from those authors' 2017 study in that it is not a general population sample but only includes employees. However, Auspurg, Hinz and Sauer (2017) report that they find similar effects when replicating their analyses for a subsample of employees only (although this analysis is not limited to large firms, as in our study). Second, the diverging results could be related to our vignette design that differs from earlier studies in the sense that the fictitious wages of the vignette persons are related to the wages of the respondents. This comes with the advantage that respondents can evaluate a scenario closer to their own but with the difficulty that the vignette persons evaluated by female respondents have on average lower wages than the ones evaluated by male respondents which contributes to their higher likelihood of perceiving wages as unfair. It does however not explain why female respondents are more likely to evaluate female as opposed to male vignette persons' wages as unfairly low. Third, our data is from 2021, while the data used by Auspurg, Hinz and Sauer (2017) was collected in 2009. During this time there may well have been a societal shift associated with an increased perception that women's pay is unfairly low. Fourth, our analyses are limited to larger firms with at least 100 employees and firm size could be correlated with wage inequality. Indeed, further heterogeneity analyses show that the unexpected reverse gender bias we find in our sample is not universal, but driven by women from larger firms (above median firm size), with higher education, with higher wages and who are in the age bracket of 36 to 45. Notably, we also find no indication for a gender bias similar to previous studies in any of the studied subgroups. Generally, however, our study differs from the seminal work by Auspurg, Hinz and Sauer (2017) and similar vignette studies due to our specific design that links the vignette person's wage to the respondent's wage which makes it impossible to compare the results directly.

Our most important contribution is thus that we find that perceptions of (un)fair wages depend on the organizational context. Discussing wages with co-workers increases the likelihood of assessing wages as too low, but does not have a gender-specific impact. Moreover, collective bargaining agreements in firms also increase the likelihood of women considering other women's wages as unfairly low. Finally, we also confirm that direct female supervisors increase female employees' likelihood of evaluating other women's wages as unfairly low. This does not apply to male employees. We

Table 4 Heterogeneity analysis: differences in fairness evaluations by individual and firm characteristics

	Respondent: education		Respondent: wage			Respondent: age		
	Other qualification	University entrance	Below median	Above median	<36	36–45	46–55	>55
Men evaluating vignette women (ref. men evaluating vignette men)	0.013	−0.003	0.010	−0.000	−0.025	−0.044	0.033	0.031
Women evaluating vignette women (ref. women evaluating vignette men)	0.039	−0.139***	−0.022	−0.156***	−0.087	−0.212***	0.022	−0.049

	Industry			
	Manufacturing	Wholesale and Retail Trade	Information and Communication	Professional, Scientific and Technical Activities
Men evaluating vignette women (ref. men evaluating vignette men)	0.025	−0.023	−0.045	−0.035
Women evaluating vignette women (ref. women evaluating vignette men)	−0.001	0.035	0.071	−0.064

	Industry			Firm size	
	Public Administration	Education	Human Health and Social Work Activities	Below median	Above median
Men evaluating vignette women (ref. men evaluating vignette men)	−0.066	0.009	0.027	−0.003	0.011
Women evaluating vignette women (ref. women evaluating vignette men)	−0.078	−0.132	−0.104*	0.007	−0.134***

Note: N (evaluations) = 27,742; N (individuals) = 5,556; N (firms) = 531. + P < 0.1 *P < 0.05, **P < 0.01, ***P < 0.001.
Data: Strauß *et al.* (2022), linked with administrative data (IAB Beschäftigtenhistorik (BeH) V10.05.01, Nuremberg 2020), own calculations.

cannot, however confirm our expectation that the share of female supervisors in a firm increases the likelihood that employees perceive wages of female co-workers as unfairly low. These results on the contextual influences suggest that especially the information advantage regarding co-workers' wages seems to contribute to female employees' perception of other women's wages as unfairly low. Moreover, female supervisors seem to enact as agents of change for female employees.

Generally speaking, we are convinced that our research provides an important contribution to the previous literature in different respects. First, it aligns with recent findings based on survey research that cannot replicate the paradox of the contented female worker (Adriaans and Targa, 2022; Brüggemann and Hinz, 2023). Instead, women seem to be even more likely to perceive unfairly low wages among other women. In addition, we demonstrate the importance of the firm surroundings as a contextual factor that seems theoretically more prone to moulding individuals' fairness perceptions directly: for example, through social comparisons with colleagues or experiences with wage negotiations. While previous studies had already shown how larger social entities, such as country parts, are related to individuals' fairness perceptions, this finding is an important contribution as understanding the influence of firm characteristics brings us much closer to understanding how the social context matters in shaping perceptions of the fairness of wages than does the comparison of large entities. In the light of a stagnation or decrease in collective bargaining agreements this might thus have adverse effects when it comes to perceptions of gender inequalities in wages. Moreover, the implementation of policies that encourage the discussion of wages among co-workers seems to contribute to a higher likelihood of women to perceive the injustice involved in gendered wage setting processes.

Notes

1 We randomly varied the number of reminders (one to three) and the weeks between reminders (one to three).
2 For more details on the exact calculations of the fictitious vignette wages, linked to the actual respondent wages, see Strauß *et al.* (2022).
3 Approximately 10 per cent of respondents reported a different collective bargaining agreement status than the majority in their company. If we instead directly use respondents' own information on collective bargaining coverage, our results do not change (results available on request).

Supplementary data

Supplementary data are available at *ESR* online.

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Data availability

Survey data and documentation can be found at https://doi.org/10.7802/2486. The administrative data we additionally use is an excerpt from the Employee History (Beschäftigtenhistorik - BeH) of the IAB. This data is not publicly available due to data restrictions. To access this social data on site at the IAB, external researchers need to enter into a contract with the IAB, which needs to be authorized by the Federal Ministry of Labour and Social Affairs. Linked datasets are only available after approval of data access and upon request to conduct data analysis locally at the IAB, in cooperation with project members.

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