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DISCUSSION PAPER SERIES

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Boris Hirsch
Leuphana University Lüneburg,
Halle Institute for Economic Research and IZA

Philipp Lentge
Leuphana University Lüneburg

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Non-Base Compensation and the Gender Pay Gap*

This paper investigates whether non-base compensation contributes to the gender pay gap. In wage decompositions, we find that lower bonus payments to women explain about 10% of the gap at the mean and at different quantiles of the unconditional wage distribution whereas the lower prevalence of shift premia and overtime pay among women is unimportant. Among managers, the contribution of bonuses to the mean gap more than doubles and is steadily rising as one moves up the wage distribution. Our findings suggest that gender differences in bonuses are an important contributor to the gender pay gap, particularly in top jobs.

JEL Classification: J31, J71

Keywords: gender pay gap, bonus payments, shift premia, overtime pay, glass ceilings

Corresponding author:
Boris Hirsch
Leuphana Universität Lüneburg
Universitätsallee 1
21335 Lüneburg
Germany
E-mail: hirsch@leuphana.de

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1 Introduction

Studies investigating the gender pay gap (GPG) are legion and continue to document substantial pay differences between men and women (recent surveys include Blau and Kahn, 2017, and Kunze, 2018). Although gender differences in employment rates and working hours have been continuously falling, marked pay differences persist. As equal pay and equal treatment of women figure prominently in public debates and high on many policymakers' agenda, this current state of affairs has left commentators and scientists alike asking 'Have women gone as far as they can?' (Blau and Kahn, 2007) and wondering what factors continue to contribute to the GPG. This paper adds to this literature in investigating how non-base compensation contributes to the GPG both at the mean and at different quantiles of the wage distribution.

In line with so-called glass ceilings, recent contributions based on quantile regressions document that the GPG is more pronounced at the top of the wage distribution than at the bottom (e.g. Arulampalam *et al.*, 2007; Antonczyk *et al.*, 2010; Christofides *et al.*, 2013; Xiu and Gunderson, 2014; Collischon, 2019). Moreover, Kassenboehmer and Sinning (2014) find that the narrowing of the GPG is mostly driven by falling wage differences at the bottom of the wage distribution or less so-called sticky floors. In contrast and women's educational catch-up in educational attainment notwithstanding, glass ceilings at the top did not change much. Furthermore, Goldin (2014) observes that gender pay differences attributable to productivity differences have almost vanished and that persisting differences largely stem from occupational differences. She further argues that flexibility and working hours arrangements, and thus arguably non-base compensation related to flexible working hours, are among the foremost contributors to the GPG, particularly among top earners.

That said, vertical segregation is still a widespread phenomenon with women being underrepresented in the higher echelons. It is well documented that women are less likely to climb job ladders and receive promotions (e.g. Lazear and Rosen, 1990; Ransom and Oaxaca, 2005; Blau and Devaro, 2007; Kunze and Miller, 2017), and Fortin *et al.* (2017) further show that the underrepresentation of women in top jobs exacerbates the GPG at

the top. But even within top jobs, women receive lower wages than men and a significant GPG remains (e.g. Bertrand and Hallock, 2001; Christofides *et al.*, 2013; Pfeifer, 2014). In top jobs, in turn, base salaries play a lesser role and non-base compensation is both more widespread and more sizeable than in average jobs. Hence, persistent gender differences in non-base compensation may be behind the finding of largely intact glass ceilings.

This explanation would square up with the observation that women in top jobs receive lower bonuses (e.g. Kulich *et al.*, 2011; Grund, 2015). What is more, base salaries are arguably to a much larger extent set by administrative rules and company regulations than non-base compensation. Hence, we suspect employers to possess more discretion over non-base compensation than base salaries, which is likely to lead to additional gender pay differences in top jobs because women negotiate less aggressively than men (e.g. Babcock and Laschever, 2003; Gneezy *et al.*, 2003; Ors *et al.*, 2013) and/or because of employers' additional scope for discrimination.

Evidence on the importance of non-base compensation on the GPG is rare. Usually, studies investigating the GPG analyse gross hourly wages and either omit non-base compensation entirely or do not disentangle base salaries and non-base compensation, for example because survey data just ask for overall labour income and thus do not contain the relevant information for doing so. That said, the sparse existing evidence suggests that non-base compensation may be one important contributor to the GPG.

Investigating highly educated workers from the chemical industry in Germany, Grund (2015) finds that gender differences in bonus payments are more pronounced than gender differences in base salaries and that bonus payments are more widespread and larger for higher echelons. Furthermore, Grund and Hofmann (2018) document that bonus–base salary ratios differ substantially across employers, pointing at employers' discretion in setting bonus payments. For the U.S., McGee *et al.* (2015) find that women are less likely to work in jobs with performance pay and that different recipience of performance pay accounts for part of the GPG. Finally, Collischon (2019) documents a larger GPG at the top of the German wage distribution that widens further once bonus payments are included in workers' earnings. Yet, to the best of our knowledge no study has investigated

in detail how non-base compensation affects the GPG, particularly among top earners.

Against this backdrop, we contribute to the existing literature along three dimensions. In contrast to most existing studies, our high-quality, representative linked employer–employee data for Germany includes detailed information on non-base compensation that we will use, firstly, to document gender differences in non-base compensation stemming from bonus payments, shift premia, and overtime pay. Our core finding will be that all these forms of non-base compensation are less prevalent and also less sizeable among women than among men.

We will, secondly, use this information to investigate in wage decompositions how non-base compensation contributes to the GPG both at the mean and beyond. The main result will be that a substantial part of the GPG is due to gender differences in bonus payments, both at the mean and along the wage distribution, whereas shift premia and overtime pay are unimportant.

Finally, our data also includes information on hierarchy levels, and we will use this information to examine the GPG among higher echelons. Our key result will be that bonus payments, which are particularly widespread and sizeable among workers holding top jobs, are particularly important for the GPG of managers and rise in importance as one moves up the wage distribution. We will further see that gender differences in bonus payments are by far the most important source of glass ceilings at the top of the top, that is of managers' GPG at the ninth decile of the wage distribution.

The remainder of this paper is organised as follows. Section 2 describes our data and provides descriptive findings on the prevalence and size of non-base compensation. Section 3 explains our econometric approach based on wage decompositions. Section 4 presents and discusses our decomposition results, and Section 5 concludes.

2 Data and descriptive findings

Our data come from the Structure of Earnings Survey (*Verdienststrukturerhebung*) for the year 2014 (VSE 2014 henceforth), which is provided as a scientific use file by the Federal Statistical Agency (*Statistisches Bundesamt*) of Germany (for details, see

Federal Statistical Agency, 2016). The VSE 2014 is a representative survey of all German firms with at least one worker and contains information on about 71,000 firms and one million workers. The data quality of these rich linked employer–employee data is high because most observations stem from firms' personnel records and firms are obliged by law to answer the survey correctly. The VSE 2014 thus differs from other survey data for Germany, such as the Socio-Economic Panel, in terms of sample size and its mandatory nature. It further differs from administrative data, in particular social security data provided by the Institute for Employment Research (*Institut für Arbeitsmarkt- und Berufsforschung*, IAB), in that it contains detailed information on working hours and the included wage information is not subject to censoring, thereby allowing detailed analyses of top earners' wages.[1]

The VSE 2014 data include detailed characteristics of both workers and firms. Worker characteristics comprise, *inter alia*, workers' earnings, base salaries, and non-base compensation components; their age, job tenure, and working hours; information on educational attainment, hierarchy levels, temporary (as opposed to permanent) contracts, and occupation. Firm characteristics include information on firm size, workplace size, sector, and coverage by collective wage agreements. We use these data to build up a sample of workers aged 18 to 65 years employed in the private sector excluding apprentices, marginally employed, partial retirees, and temporary agency workers. Our final sample comprises 461,404 workers, with descriptive statistics given in Table 1.

In our analysis of the contribution of non-base compensation to the GPG, we exploit the rich information on remuneration components in the VSE data. Our outcome variable of interest are gross hourly wages comprising both base salaries and non-base compensation and are based on actual working hours excluding overtime hours. Non-base compensation includes shift premia, overtime pay, and bonus payments, where the latter comprise all irregular, non-monthly payments such as incentive bonuses, profit sharing, stock options, vacation pay, Christmas bonuses, bonuses for improvement suggestions, and bonuses for inventions. Specifically, our wage variable adds up gross hourly wages

[1] The exception is a negligible number of workers with exceptionally high wages, i.e. yearly remuneration exceeding €750,000, that are censored and that we exclude from our sample.

Table 1: Descriptive statistics

Variable	**All**		**Men**		**Women**	
	Mean	SD	Mean	SD	Mean	SD
Gross hourly wage (€)	18.10	11.27	20.36	12.96	15.41	8.04
Wage incl. bonus payments (€)	19.75	14.11	22.43	16.49	16.56	9.69
Bonus payments (0/1)	0.71	0.45	0.73	0.44	0.68	0.46
Bonus payments (€)	3,143.75	8,890.40	4,127.6	11,053.56	1,971.91	5,012.79
Bonus-to-income ratio	0.06	0.07	0.07	0.07	0.05	0.06
Shift premium (0/1)	0.22	0.41	0.24	0.43	0.19	0.39
Shift premium (€/month)	43.04	148.45	59.07	184.43	23.94	84.25
Overtime pay (0/1)	0.09	0.29	0.13	0.33	0.06	0.24
Overtime pay (€/month)	31.20	151.31	45.4	186.81	14.29	89.86
Paid hours (monthly)	153.00	34.78	164.81	24.88	138.93	39.36
Paid overtime hours (monthly)	1.71	7.58	2.33	8.93	0.97	5.46
Age (years)	43.00	11.30	42.99	11.19	43.02	11.43
Tenure (years)	9.63	9.49	10.13	9.9	9.03	8.94
Skill level						
Low skilled (0/1)	0.11	0.31	0.1	0.3	0.12	0.33
Medium skilled (0/1)	0.69	0.46	0.66	0.47	0.71	0.45
High skilled (0/1)	0.20	0.40	0.23	0.42	0.17	0.37
Full-time employment (0/1)	0.72	0.45	0.9	0.3	0.51	0.5
Temporary contract (0/1)	0.13	0.34	0.12	0.32	0.15	0.36
Firm size						
$<$ 50 workers (0/1)	0.30	0.46	0.29	0.46	0.31	0.46
50–249 workers (0/1)	0.30	0.46	0.31	0.46	0.29	0.46
250 and more workers (0/1)	0.39	0.49	0.39	0.49	0.39	0.49
Workplace size	666.61	2,669.96	811.36	3,209.13	494.21	1,816.17
East Germany (0/1)	0.19	0.39	0.18	0.38	0.19	0.39
Hierarchy level						
Manager (0/1)	0.08	0.27	0.11	0.31	0.05	0.22
Specialist (0/1)	0.17	0.38	0.2	0.4	0.14	0.35
Experienced worker (0/1)	0.51	0.50	0.49	0.5	0.54	0.5
No decision-making (0/1)	0.16	0.36	0.15	0.35	0.17	0.38
Simple tasks (0/1)	0.07	0.26	0.06	0.23	0.1	0.3
Collective agreement						
Sector-level agreement (0/1)	0.32	0.47	0.32	0.47	0.33	0.47
Firm-level agreement (0/1)	0.07	0.26	0.07	0.25	0.08	0.28
Observations	461,404		250,821		210,583	

Notes: VSE 2014.

including overtime pay and shift premia and bonus payments per hour worked.

As is visible from Table 1, there is a substantial raw average GPG in gross hourly wages of €4.95 or 24% (relative to men's wages) that rises to about €5.87 or 26% when wages include bonus payments which will be the outcome of interest in our wage decompositions. Figure 1 displaying kernel density plots of log gross hourly wages including bonuses by gender (weighted using the VSE's sample weights as all following descriptives) suggests a more pronounced GPG in the upper part of the wage distribution. This impression is also borne out in Figure 2 that shows the GPG over the wage distribution. No matter whether wages include or exclude bonuses, the GPG is monotonously increasing as one moves up the wage distribution, which is consistent with substantial glass ceilings.

Turning to workers' non-base compensation, we see from Table 1 that 71% of workers in our sample receive some bonus payments and that women are not only less likely than men (68% vs. 73%) to receive any bonus payments but also obtain less sizeable bonus payments on average (€1,972 vs. €4,127 per year).[2] Figure 3 displaying quantile plots by gender further reveals that bonus payments are lower for women than for men over

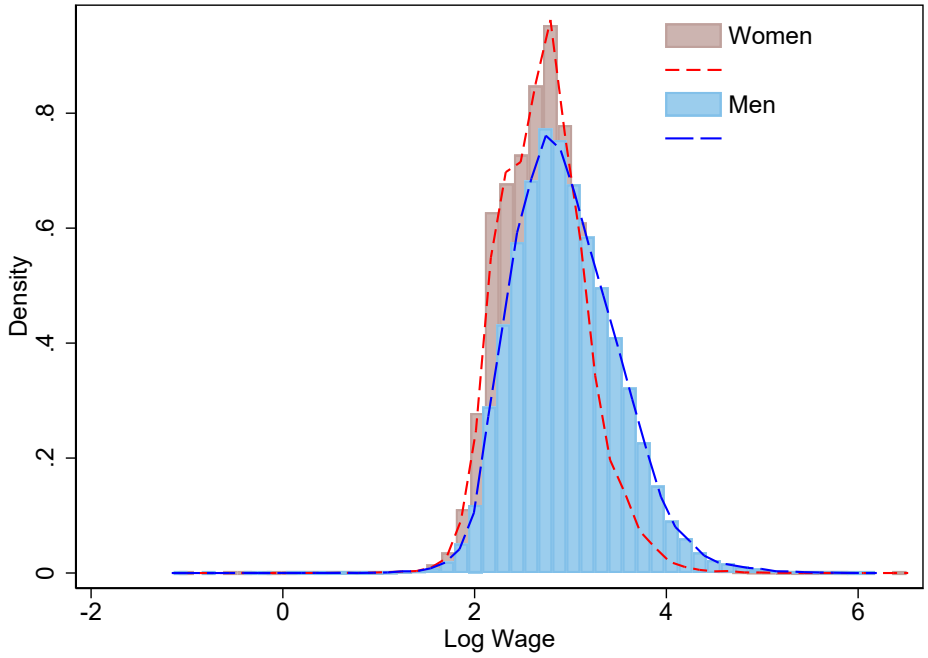

Figure 1: Kernel density plots of log gross hourly wages (including bonus payments) by gender (VSE 2014, weighted using sample weights)

[2] For more details on the prevalence of bonus payments, see Appendix A.2.

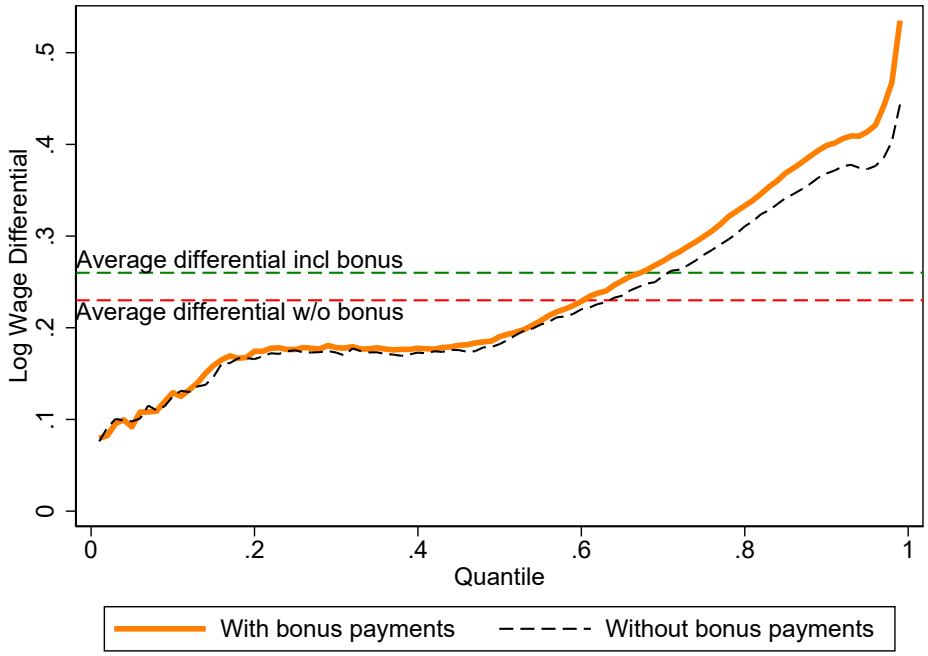

Figure 2: Gender pay gap in log gross hourly wages (including bonus payments) by quantile (VSE 2014, weighted using sample weights)

the entire distribution with women's bonus payments being roughly half of men's at each population share.

However, as women receive lower base salaries as well, we should expect some discrepancies in bonuses. In a next step, we thus normalise bonus payments by workers' full remuneration and consider the bonus-to-income ratio instead.[3] As is visible from Figure 4, bonus-to-income ratios are markedly lower for women than for men over the entire distribution as well, but less so than absolute bonus payments. Gender differences in bonuses may thus be a contributor to the GPG, particularly among top earners with large bonuses. This suggestion is borne out in Figure 2 showing that in the upper part of the wage distribution the GPG is larger when wages include bonus payments, and bonuses contribute more and more to the GPG when moving up the wage distribution (see also Table 3 that compares the GPG along the wage distribution when wages either exclude or include bonus payments).

But couldn't gender differences in bonus payments merely reflect that women are

[3] Specifically, the bonus-to-income ratio is the ratio of worker's yearly bonus payments and his or her total yearly earnings including bonus payments and other non-base compensation.

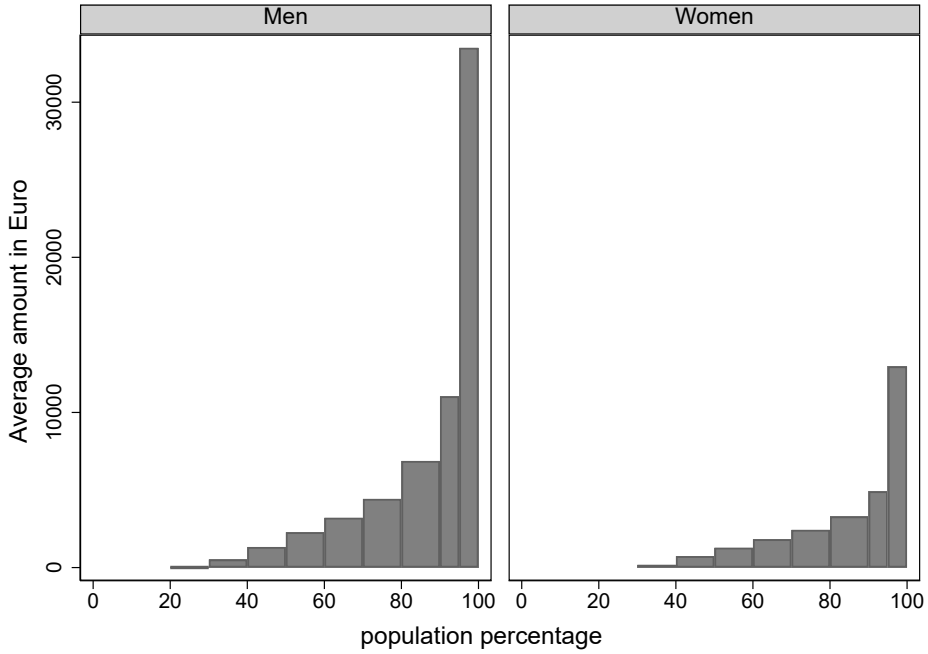

Figure 3: Quantile plots of bonus payments by gender (VSE 2014, weighted using sample weights)

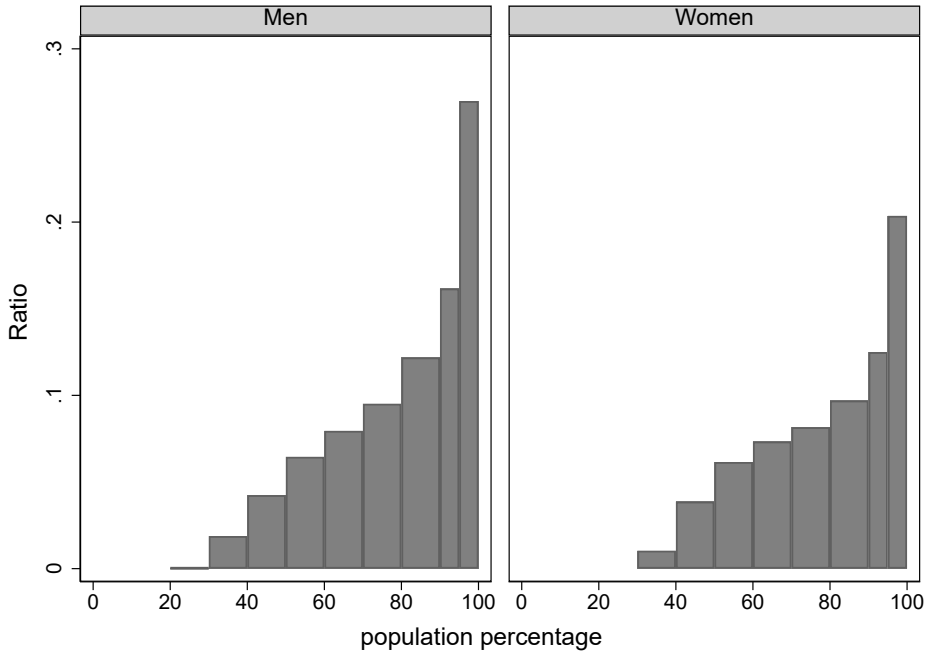

Figure 4: Quantile plots of bonus-to-income ratios by gender (VSE 2014, weighted using sample weights)

underrepresented in higher hierarchy levels where bonus payments are disproportionately important? In a next step, we thus focus on the distribution of bonus payments within hierarchy levels. The VSE 2014 distinguishes five different hierarchy levels (details are in Appendix A.1): workers with simple tasks, workers without decision-making, experienced workers, specialists, and workers with managerial duties (called managers henceforth). And indeed Table 2 shows that women are underrepresented among the higher echelons, that is specialists and managers, but overrepresented in the lower ranks, that is the three lower hierarchy levels.

That said, quantile plots by gender and hierarchy level in Figures 5 and 6 show that marked gender differences in bonus payments persist within hierarchy levels and that they are most pronounced among managers and specialists, that is in top jobs where bonus payments are widespread and make up a substantial part of most workers' overall remuneration. These findings strongly suggest that gender differences in bonus payments may be one important contributor to the GPG among top earners. This suggestion is further substantiated in Table 3 that shows that the GPG is not only larger in the upper part of the wage distribution, in higher hierarchy levels, and in the upper part of the wage distribution within hierarchy levels, but even more so when wages include bonus payments. In short, gender differences in bonuses are likely to be an important contributor to glass ceilings.

Related to these findings, Goldin (2014) concludes that the GPG would to be low when wages are linear with respect to workings hours, but large when they are strictly

Table 2: Share of workers at different hierarchy levels

	Men	**Women**	**Total**
Hierarchy level		%	
Manager	11.4	5.1	8.4
Specialist	19.5	13.8	16.7
Experienced worker	49.8	57.9	53.7
No decision-making	14.1	15.2	14.6
Simple tasks	5.3	8.1	6.6

Notes: VSE 2014, weighted using sample weights.

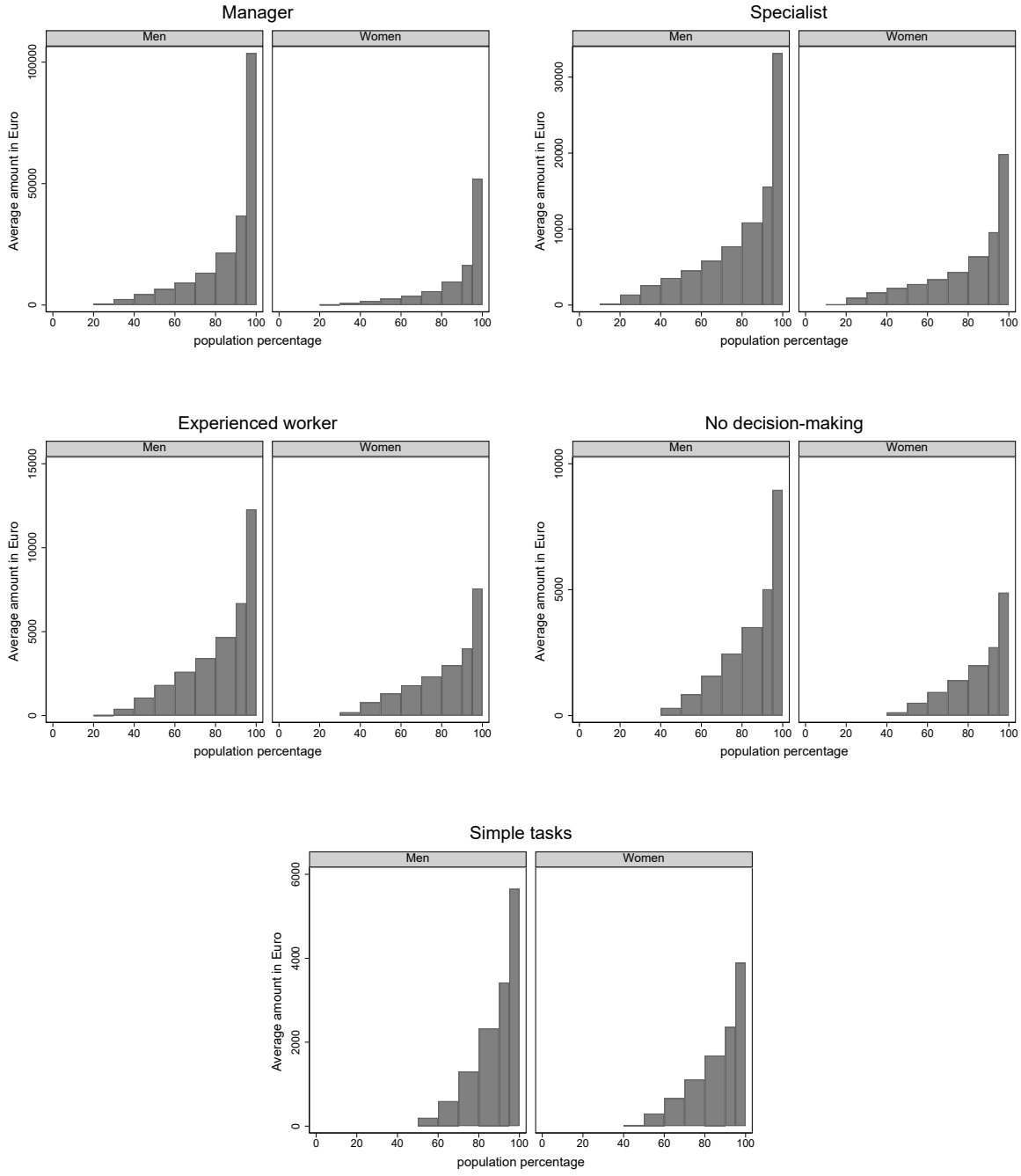

Figure 5: Quantile plots of bonus payments by gender and hierarchy level (VSE 2014, weighted using sample weights)

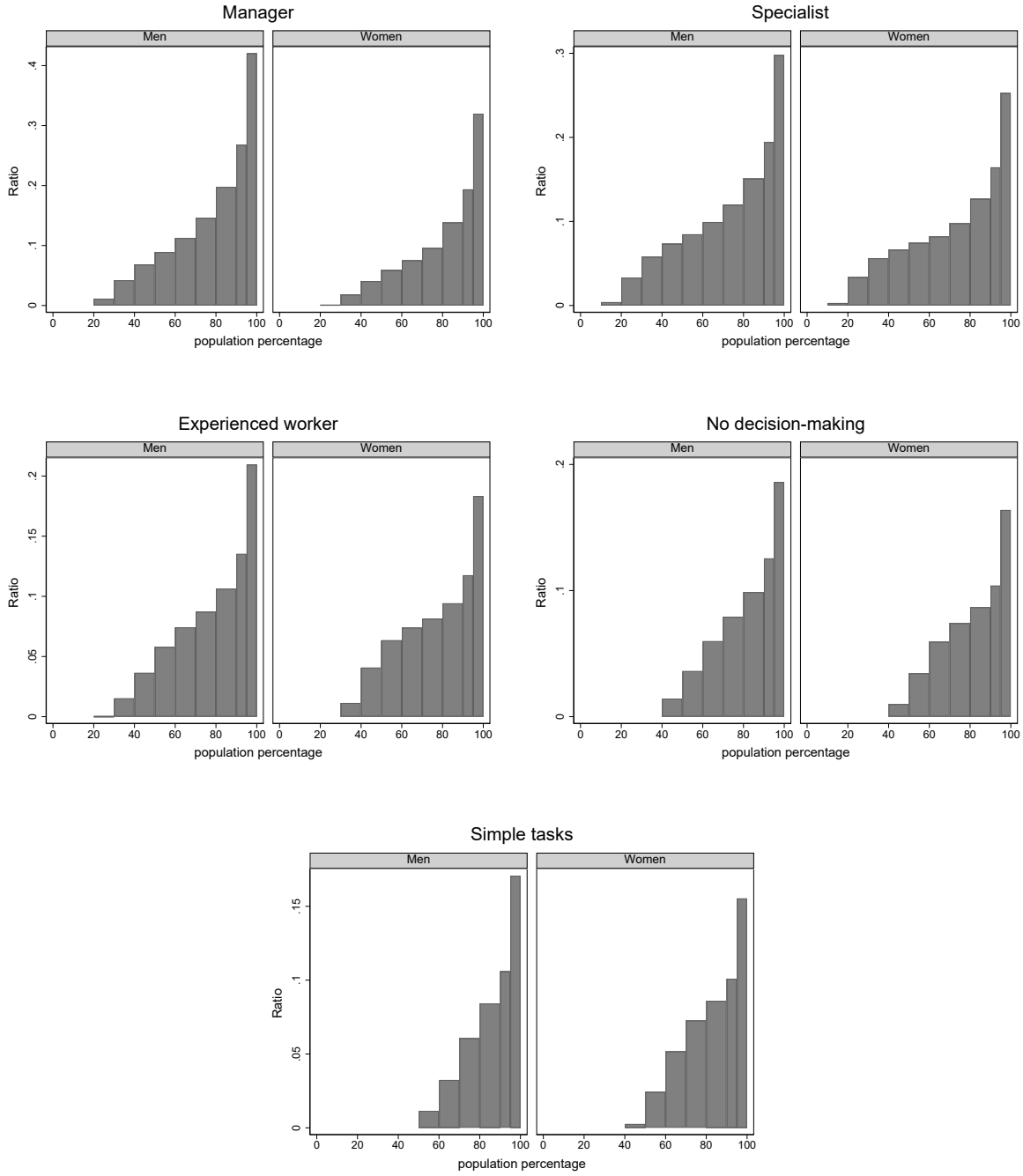

Figure 6: Quantile plots of bonus-to-income ratios by gender and hierarchy level (VSE 2014, weighted using sample weights)

Table 3: Gender pay gaps in gross hourly wages along the wage distribution

Excluding bonus payments						
	Mean	p10	p25	p50	p75	p90
Overall	23%	12%	16%	17%	24%	31%
Manager	23%	19%	22%	20%	22%	25%
Specialist	17%	12%	13%	17%	21%	19%
Experienced worker	12%	11%	10%	8%	12%	16%
No decision-making	14%	4%	8%	14%	15%	20%
Simple tasks	8%	-4%	1%	10%	10%	14%
Including bonus payments						
	Mean	p10	p25	p50	p75	p90
Overall	26%	12%	16%	17%	26%	33%
Manager	26%	19%	23%	23%	26%	29%
Specialist	19%	13%	15%	18%	22%	20%
Experienced worker	12%	12%	10%	8%	12%	17%
No decision-making	15%	4%	8%	14%	15%	22%
Simple tasks	7%	-4%	1%	9%	9%	13%

Notes: VSE 2014, weighted using sample weights.

convex. Our findings seem to indicate a similar convexity in the relationship between job positions and wages which is further strengthened when bonus payments are included. As for instance standard tournament theory predicts and empirical evidence documents, moving up the career ladder raises workers' wages and bonuses disproportionately (e.g. Lazear and Rosen, 1990; Eriksson, 1999; DeVaro, 2006; Lazear and Shaw, 2007). Given women's lower promotion probability, the GPG is thus expected to rise as workers' careers progress and men disproportionately more often move into higher hierarchy levels and higher quantiles of the wage distribution, and particularly so when workers' remuneration includes bonus payments, which are more prevalent and sizeable in top jobs.

Turning to shift premia and overtime pay, we see from Table 1 that only a minority of workers receive these forms of non-base compensation and further that they are typically modest in size. 22% of workers in our sample obtain shift premia (24% of men vs. 19%

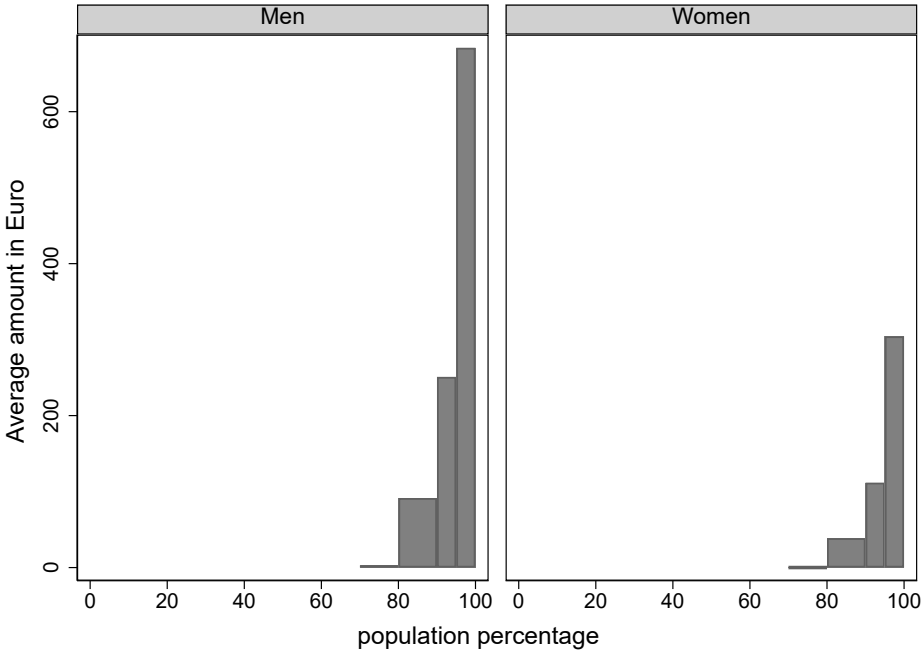

Figure 7: Quantile plots of shift premia by gender (VSE 2014, weighted using sample weights)

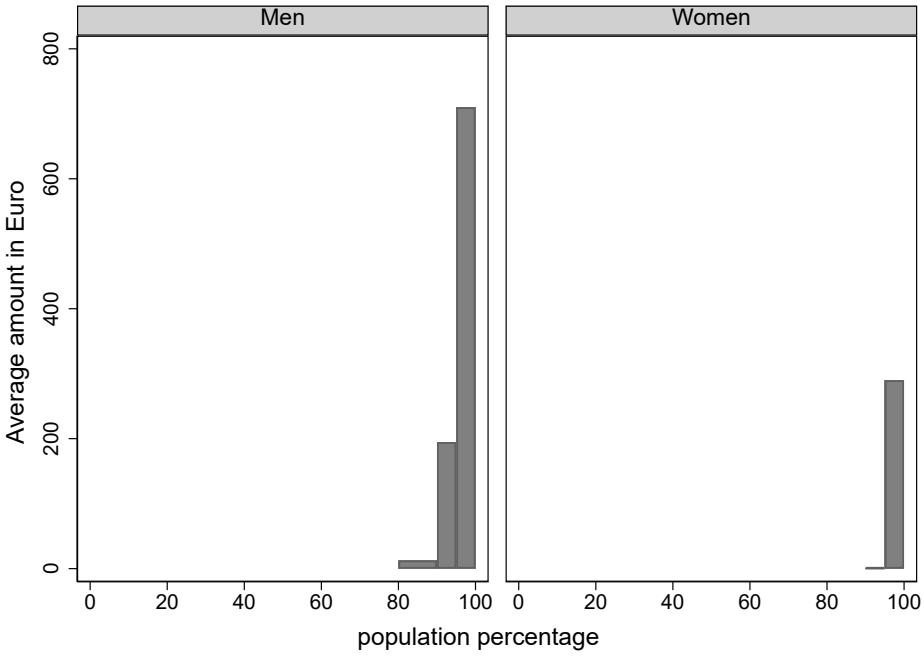

Figure 8: Quantile plots of overtime pay by gender (VSE 2014, weighted using sample weights)

of women) with an average premium of just €43 per month (€59 for men vs. €24 for women). Moreover, 9% of workers get overtime pay (13% of men vs. 6% of women) with an average amount of €31 per month (€45 for men vs. €14 for women). In quantile plots in Figures 7 and 8, we see that only a very small fraction of workers receive sizeable shift premia and overtime pay and that this is more often the case for men than for women. Hence, the scope of these forms of non-base remuneration to contribute significantly to the GPG appears to be very limited.

In summary, our descriptive findings strongly suggest that gender differences in bonus payments are an important contributor to the GPG, particularly at the top of the wage distribution and in higher hierarchy levels, whereas other forms of non-base compensation are unlikely to play an important role. In a next step, we will run several wage decompositions to quantify the contribution of bonus payments and other forms of non-base compensation to the GPG along the wage distribution.

3 Econometric approach

Our econometric approach rests on several Oaxaca–Blinder (OB) decompositions (Oaxaca, 1973; Blinder, 1973) that we perform at the mean and at several quantiles of the unconditional wage distribution treating men as reference category. These OB decompositions of workers' log gross hourly wages including non-base compensation split up the overall GPG into an 'explained' part due to gender differences in covariates and an 'unexplained' part due to gender differences in the remuneration of these covariates, that is in gender differences in these covariates' coefficients (for a detailed discussion, see Fortin *et al.*, 2011).

Following Firpo *et al.* (2009), the OB decompositions for the unconditional quantiles are based on two separate recentred influence function (RIF) regressions for the respective quantile for men and women. Yet, we do not perform the OB decomposition directly on the two RIFs because the linear approximation involved in using the RIFs is only locally valid and may thus result in a poor approximation and a large specification error for large gender differences in covariates. Instead, we follow Firpo *et al.*'s (2018) suggestion and

perform all OB decompositions after reweighting the distribution of women's covariates to that of men. To arrive at this counterfactual sample, we apply the reweighting approach by DiNardo *et al.* (1996), which involves estimating the propensity score that we obtain from a logit model with the same covariates as in the RIF regressions (detailed in the next paragraph) and additional powers and interaction terms.[4]

To check whether non-base compensation contributes to the GPG, we include the bonus-to-income ratio as well as dummies for shift premia and overtime pay in the OB decompositions. The latter forms of non-base compensation enter as dummies because they are not that widespread and also rather modest in size for the vast majority of workers. As further covariates we add the following groups of variables: (i) human capital variables capturing workers' educational attainment (distinguishing high-skilled workers with an academic education, medium-skilled workers with a vocational training, and low-skilled workers with neither), age (linearly and squared), and tenure (linearly and squared); (ii) job characteristics including groups of dummies for two-digit sectors, two-digit occupations, firm size, and workplace size, as well as dummies for working full-time hours, a temporary contract, and job location in East Germany; (iii) dummies for hierarchy levels (distinguishing the five hierarchy levels already mentioned and detailed in Appendix A.1); and (iv) a dummy for the existence of a collective agreement (either at sector or firm level).[5]

4 Decomposition results

Table 4 presents the key findings of our OB decompositions of workers' log gross hourly wages (including non-base compensation), where we note in passing that these do not deviate in general terms from the results based on the VSE 2010 reported in Collischon (2019). At the mean of the unconditional wage distribution, 57% of the GPG of 25.5 log points can be attributed to the included covariates. Among the different forms of non-base compensation, gender differences in the bonus-to-income rate are an important

[4] Calculations are done in `Stata 16.1` using the ado-files by Rios-Avila (2020).

[5] Note that we employ the normalisation procedure by Yun (2005) for those dummies reflecting categorial variables with more than two values.

contributor to the mean GPG in that they explain 2.7 log points or 10% of the mean GPG.[6] In contrast, gender differences in the prevalence of shift premia or overtime pay contribute little.

Like shift premia and overtime pay, human capital variables and collective bargaining coverage play only a minor role, which is in line with many recent studies (e.g. Goldin, 2014; Oberfichtner *et al.*, 2020). Also in line with previous evidence, gender differences in job characteristics and in hierarchy levels contribute markedly to the mean GPG in that they explain 6.8 log points (27%) or 4.4 log points (17%), respectively.

Turning to the GPG at other points of the unconditional wage distribution, we observe that the contribution of gender differences in the bonus-to-income ratio to the GPG rises from 1.1 log points at the first decile to 3.4 log points at the ninth decile. As the GPG more than doubles from 15.4 log points to 37.7 log points when moving from the first decile to the ninth decile, gender differences in bonuses contribute significantly to the GPG along the whole wage distribution with a pretty stable relative contribution in between 7% and 12% of the GPG at the respective quantile.

This finding contrasts with other forms of non-base compensation that explain only little of the GPG. Although 0.6 (0.5) log points or 4% (2%) of the GPG is attributable to gender differences in the prevalence of shift premia at the first decile (quartile) of the wage distribution, which thus contribute somewhat to sticky floors, we see no contribution in the middle and the upper part of the wage distribution. And the contribution of less frequent overtime pay among women than men is nil over the entire wage distribution.

Turning to the other covariates in our RIF decompositions, we observe that gender differences in job characteristics explain 3 log points of the GPG at the first decile but 14 log points at the ninth decile and thus a rising fraction of the GPG of 19% at the first and 37% at the ninth decile. This rising contribution along the wage distribution is even more pronounced for hierarchy levels that explain only 0.5 log points or 3% of the GPG at the first decile, but 11 log points or 29% at the ninth decile. This latter finding means that the underrepresentation of women in higher hierarchy levels with higher wages

[6] Given our large sample size, we will in the following abstain from commenting on statistical significance and focus on effect sizes instead.

Table 4: Oaxaca–Blinder decompositions of log gross hourly wages along the unconditional wage distribution

	Mean	%	p10	%	p25	%	p50	%	p75	%	p90	%
Raw differential	0.255	*100*	0.154	*100*	0.226	*100*	0.213	*100*	0.306	*100*	0.377	*100*
	(0.00441)		(0.00379)		(0.00486)		(0.00556)		(0.00800)		(0.00643)	
Explained part	0.145	*57*	0.0508	*33*	0.0975	*43*	0.105	*49*	0.184	*60*	0.293	*78*
	(0.00581)		(0.00518)		(0.00600)		(0.00733)		(0.00908)		(0.0149)	
thereof...												
Bonus-to-income ratio	0.0261	*10*	0.0109	*7*	0.0221	*10*	0.0253	*12*	0.0231	*8*	0.0338	*9*
	(0.00201)		(0.000977)		(0.00181)		(0.00204)		(0.00204)		(0.00318)	
Shift premium (0/1)	0.00339	*1*	0.00551	*4*	0.00527	*2*	0.00312	*1*	0.00222	*1*	-0.000315	*0*
	(0.000391)		(0.000667)		(0.000661)		(0.000440)		(0.000383)		(0.000323)	
Overtime pay (0/1)	0.000229	*0*	-0.000796	*-1*	-0.000505	*0*	0.000974	*0*	0.0000901	*0*	0.000871	*0*
	(0.000223)		(0.000413)		(0.000398)		(0.000324)		(0.000332)		(0.000485)	
Human capital	0.00431	*2*	0.00206	*1*	0.00330	*1*	0.00484	*2*	0.00551	*2*	0.00662	*2*
	(0.000859)		(0.000575)		(0.000777)		(0.00111)		(0.00118)		(0.00129)	
Job characteristics	0.0679	*27*	0.0297	*19*	0.0559	*25*	0.0465	*22*	0.0941	*31*	0.141	*37*
	(0.00347)		(0.00475)		(0.00478)		(0.00470)		(0.00644)		(0.0113)	
Hierarchy levels	0.0443	*17*	0.00498	*3*	0.0141	*6*	0.0283	*13*	0.0603	*20*	0.110	*29*
	(0.00153)		(0.000685)		(0.00113)		(0.00153)		(0.00225)		(0.00431)	
Collective agreement	-0.00172	*-1*	-0.00154	*-1*	-0.00266	*-1*	-0.00406	*-2*	-0.00155	*-1*	0.00101	*0*
	(0.000529)		(0.000505)		(0.000848)		(0.00125)		(0.000484)		(0.000393)	
Unexplained part	0.102	*40*	0.0892	*58*	0.0992	*44*	0.0971	*46*	0.105	*34*	0.120	*32*
	(0.00274)		(0.00542)		(0.00555)		(0.00497)		(0.00549)		(0.00635)	
Reweighting error	0.00334	*1*	0.00981	*6*	0.0136	*6*	0.00710	*3*	-0.00377	*-1*	-0.00676	*-2*
	(0.00353)		(0.00365)		(0.00449)		(0.00467)		(0.00495)		(0.00435)	
Specification error	0.00517	*2*	0.00381	*2*	0.0159	*7*	0.00390	*2*	0.0207	*7*	-0.0285	*-8*
	(0.00162)		(0.00474)		(0.00531)		(0.00438)		(0.00602)		(0.0125)	

Notes: VSE 2014. OB decompositions based on OLS and RIF regressions with men as reference category. Bootstrapped (500 replications) standard errors clustered at the firm level in parentheses. RIF decompositions follow Firpo *et al.*'s (2018) two-step approach that performs the RIF decomposition after reweighting the distribution of covariates of women to that of men. The reweighting involves estimating the propensity score in a logit model including all covariates from the RIF regressions and additional powers and interaction terms. Included covariates in the OLS and RIF regressions are (i) human capital variables capturing workers' educational attainments, age (linearly and squared), and tenure (linearly and squared); (ii) job characteristics including groups of dummies for two-digit sectors, two-digit occupations, firm size, and workplace size as well as dummies for working full-time hours, a temporary contract, and job location in East Germany; (iii) dummies for hierarchy levels; and (iv) a dummy for the existence of a collective agreement.

disproportionately contributes to the GPG in the upper part of the wage distribution, in line with glass ceilings stemming from discriminatory promotion practices against women, but also in line with women being less career-oriented than men.

Given the high and rising contribution of bonus payments, job characteristics, and hierarchy levels to the GPG in the upper quantiles, we find that the unexplained part of the GPG shrinks as we move upward the wage distribution. We further see that reweighting errors are small in size in all decompositions (and even statistically insignificant most of the time) and that they are also accompanied by modest specification errors, which points at a good quality of the reweighting procedure and little deviations from the local linearity assumption inherent to the RIF regressions.

We also note in passing that our findings remain robust when restricting to different subsamples (results available upon request): They show up when considering separate samples for East Germany and West Germany, for workers covered by collective wage agreements and uncovered workers, and for workers employed in manufacturing and services. Finally, our results change little when performing the OB decomposition on the OLS and RIF regressions directly, that is when omitting the first-step reweighting procedure suggested by Firpo *et al.* (2018).

So far, we found clear evidence that bonus payments are an important source of the GPG whose absolute contribution to the GPG is rising as we move up the wage distribution and whose relative contribution is more or less constant around 10%. In our descriptive analysis, we also saw that bonus payments are more prevalent and more sizeable in top hierarchy levels and differ more between men and women there than in the lower ranks which suggests that gender differences in bonus payments are likely to explain an even bigger part of the GPG among the higher echelons. To check this suggestion, we now present OB decompositions akin to those of Table 4 separately for the subgroups of managers and specialists, that is the two highest hierarchy levels in our data that comprise roughly a quarter of the workers in our sample.

Table 5 reports the OB decomposition for managers, that is for workers at the top hierarchy level comprising 8% of workers in our sample. As we saw earlier in the descriptive

findings, the GPG is much larger for the subgroup of managers compared to all workers and amounts to 28.6 log points at the mean. It also rises when moving up the wage distribution from 26.1 log points at the first decile to 35.1 log points at the ninth decile. The included covariates explain roughly half of the mean GPG, and gender differences in the bonus-to-income ratio stand out as the single most important contributor of 6.5 log points or 23% to the mean GPG. Second come gender differences in job characteristics that explain 6.4 log points or 22% of the mean GPG, and third gender differences in human capital that contribute 2.5 log points or 9%. As was the case for all workers, non-base compensation in form of shift premia and overtime pay are unimportant.

What is more, for managers bonus payments disproportionately contribute to the GPG in the upper part of the unconditional wage distribution. Both their absolute and their relative contribution to the GPG steadily rises as we move to higher quantiles. Whereas gender differences in the bonus-to-income ratio explain 3.3 log points or 13% of the GPG at the first decile, they explain even 11.8 log points or about a third of the GPG at the ninth decile. Notably, gender differences in bonuses are the most important contributor to the GPG once we move to the third quartile of the wage distribution and amount to almost two thirds of the explained part of the GPG at the ninth decile. In other words, at this top of the top gender differences in base salaries attributable to worker and job characteristics make up just one third of the explained GPG. This finding is clearly in line with glass ceilings in bonuses that translate into glass ceilings in total pay. And it is also in line with the notion that employers use their larger discretion over bonus payments compared to base salaries to discriminate against women as well as with the notion of men negotiating harder than women over bonuses.

Turning to the second highest hierarchy level, that is specialists who make up 17% of workers in our sample, Table 6 shows that the patterns found for managers are mostly group-specific. For specialists, gender differences in the bonus-to-income ratio explain 2.1 log points or 12% of the mean GPG of 18.4 log points. This is roughly half of the relative contribution of bonuses to the mean GPG found for managers in Table 5 and about a third of the contribution of job characteristics to the mean GPG of specialists, which

Table 5: Oaxaca–Blinder decomposition of log gross hourly wages of managers along the unconditional wage distribution

	Mean	%	p10	%	p25	%	p50	%	p75	%	p90	%
Raw differential	0.286	*100*	0.261	*100*	0.279	*100*	0.263	*100*	0.290	*100*	0.351	*100*
	(0.00763)		(0.0140)		(0.0125)		(0.00893)		(0.00988)		(0.0151)	
Explained part	0.152	*53*	0.115	*44*	0.130	*47*	0.146	*56*	0.151	*52*	0.194	*55*
	(0.0102)		(0.0110)		(0.0127)		(0.0116)		(0.0124)		(0.0211)	
thereof...												
Bonus-to-income-ratio	0.0645	*23*	0.0333	*13*	0.0384	*14*	0.0412	*16*	0.0589	*20*	0.118	*34*
	(0.00817)		(0.00501)		(0.00522)		(0.00619)		(0.00777)		(0.0150)	
Shift premium (0/1)	-0.000611	*0*	0.00159	*1*	0.000754	*0*	-0.00314	*-1*	-0.000798	*0*	0.000199	*0*
	(0.000452)		(0.00114)		(0.000770)		(0.000825)		(0.000655)		(0.00103)	
Overtime pay (0/1)	-0.000144	*0*	-0.000208	*0*	-0.000201	*0*	-0.000102	*0*	-0.000204	*0*	-0.000212	*0*
	(0.000185)		(0.000282)		(0.000259)		(0.000194)		(0.000275)		(0.000330)	
Human capital	0.0252	*9*	0.0181	*7*	0.0262	*9*	0.0312	*12*	0.0269	*9*	0.0265	*8*
	(0.00220)		(0.00325)		(0.00308)		(0.00278)		(0.00249)		(0.00360)	
Job characteristics	0.0636	*22*	0.0723	*28*	0.0784	*28*	0.0807	*31*	0.0571	*20*	0.0324	*9*
	(0.00629)		(0.0103)		(0.0100)		(0.00870)		(0.00813)		(0.0111)	
Collective agreement	-0.000733	*0*	-0.0102	*-4*	-0.0137	*-5*	-0.00346	*-1*	0.00921	*3*	0.0165	*5*
	(0.000772)		(0.00214)		(0.00237)		(0.00111)		(0.00186)		(0.00371)	
Unexplained part	0.119	*42*	0.118	*45*	0.132	*47*	0.112	*43*	0.130	*45*	0.135	*38*
	(0.00728)		(0.0169)		(0.00966)		(0.00726)		(0.0110)		(0.0152)	
Reweighting error	0.00355	*1*	0.00922	*4*	0.0108	*4*	0.0102	*4*	-0.00120	*0*	-0.0138	*-4*
	(0.0107)		(0.00943)		(0.00648)		(0.00645)		(0.0107)		(0.0171)	
Specification error	0.0118	*4*	0.0191	*7*	0.00686	*2*	-0.00619	*-2*	0.0102	*4*	0.0364	*10*
	(0.00567)		(0.0129)		(0.00834)		(0.00682)		(0.00897)		(0.0191)	

Notes: VSE 2014. OB decompositions based on OLS and RIF regressions with men as reference category. Bootstrapped (500 replications) standard errors clustered at the firm level in parentheses. RIF decompositions follow Firpo *et al.*'s (2018) two-step approach that performs the RIF decomposition after reweighting the distribution of covariates of women to that of men. The reweighting involves estimating the propensity score in a logit model including all covariates from the RIF regressions and additional powers and interaction terms. Included covariates in the OLS and RIF regressions are (i) human capital variables capturing workers' educational attainments, age (linearly and squared), and tenure (linearly and squared); (ii) job characteristics including groups of dummies for two-digit sectors, two-digit occupations, firm size, and workplace size as well as dummies for working full-time hours, a temporary contract, and job location in East Germany; and (iii) a dummy for the existence of a collective agreement.

Table 6: Oaxaca–Blinder decompositions of log gross hourly wages of specialists along unconditional wage distribution

	Mean	%	p10	%	p25	%	p50	%	p75	%	p90	%
Raw differential	0.184	*100*	0.151	*100*	0.153	*100*	0.185	*100*	0.225	*100*	0.202	*100*
	(0.00500)		(0.00666)		(0.00592)		(0.00553)		(0.00762)		(0.00840)	
Explained part	0.0915	*50*	0.0499	*33*	0.0561	*37*	0.0924	*50*	0.136	*60*	0.138	*68*
	(0.00670)		(0.0118)		(0.00811)		(0.00760)		(0.0112)		(0.0164)	
thereof...												
Bonus-to-income ratio	0.0213	*12*	0.0169	*11*	0.0148	*10*	0.0152	*8*	0.0226	*10*	0.0329	*16*
	(0.00278)		(0.00241)		(0.00213)		(0.00202)		(0.00321)		(0.00463)	
Shift premium (0/1)	0.000591	*0*	0.00144	*1*	0.000583	*0*	0.0000775	*0*	0.000423	*0*	0.000239	*0*
	(0.000286)		(0.000678)		(0.000419)		(0.000267)		(0.000341)		(0.000394)	
Overtime pay (0/1)	-0.00000575	*0*	0.000278	*0*	-0.000250	*0*	0.000255	*0*	0.000300	*0*	0.000699	*0*
	(0.000322)		(0.000615)		(0.000430)		(0.000374)		(0.000491)		(0.000853)	
Human capital	0.00836	*5*	0.00920	*6*	0.00769	*5*	0.00715	*4*	0.00929	*4*	0.00946	*5*
	(0.00155)		(0.00179)		(0.00167)		(0.00171)		(0.00170)		(0.00177)	
Job characteristics	0.0606	*33*	0.0357	*24*	0.0428	*28*	0.0716	*39*	0.0955	*42*	0.0751	*37*
	(0.00555)		(0.0111)		(0.00682)		(0.00646)		(0.0102)		(0.0156)	
Collective agreement	0.000637	*0*	-0.0136	*-9*	-0.00958	*-6*	-0.00192	*-1*	0.00812	*4*	0.0199	*10*
	(0.000628)		(0.00223)		(0.00155)		(0.000687)		(0.00158)		(0.00309)	
Unexplained part	0.0863	*47*	0.0930	*62*	0.0800	*52*	0.0884	*48*	0.0838	*37*	0.0946	*47*
	(0.00546)		(0.0126)		(0.0104)		(0.00666)		(0.0117)		(0.0109)	
Reweighting error	-0.000136	*0*	0.00442	*3*	0.00667	*4*	-0.00279	*-2*	-0.00144	*-1*	-0.00513	*-3*
	(0.00441)		(0.00876)		(0.00748)		(0.00564)		(0.00544)		(0.00551)	
Specification error	0.00625	*3*	0.00343	*2*	0.0108	*7*	0.00680	*4*	0.00608	*3*	-0.0257	*-13*
	(0.00286)		(0.00882)		(0.00719)		(0.00517)		(0.00891)		(0.0116)	

Notes: VSE 2014. OB decompositions based on OLS and RIF regressions with men as reference category. Bootstrapped (500 replications) standard errors clustered at the firm level in parentheses. RIF decompositions follow Firpo *et al.*'s (2018) two-step approach that performs the RIF decomposition after reweighting the distribution of covariates of women to that of men. The reweighting involves estimating the propensity score in a logit model including all covariates from the RIF regressions and additional powers and interaction terms. Included covariates in the OLS and RIF regressions are (i) human capital variables capturing workers' educational attainments, age (linearly and squared), and tenure (linearly and squared); (ii) job characteristics including groups of dummies for two-digit sectors, two-digit occupations, firm size, and workplace size as well as dummies for working full-time hours, a temporary contract, and job location in East Germany; and (iii) a dummy for the existence of a collective agreement.

explain 6.1 log points or 33%. Furthermore, when moving along the wage distribution gender differences in bonus payments explain roughly 10% of the GPG at all the quantiles considered. The only exception is the ninth decile where their contribution of 3.3 log points or 16% to the GPG is more pronounced but still substantially lower than their contribution to the GPG of managers at the ninth decile (11.8 log points or 34%).

5 Conclusions

Using German linked employer–employee data from the mandatory Structure of Earnings Survey for the year 2014, this paper has investigated how gender differences in non-base compensation influence to the GPG. To that end, we analysed the contribution of bonus payments, shift premia, and overtime pay to the mean GPG and to the GPGs along the unconditional wage distribution.

Descriptively, we saw that women are less prevalent to receive bonus payments and also receive less sizeable bonuses. The same pattern also showed up for shift premia and overtime pay, but these forms of non-base compensation are much more limited in size as is, in consequence, their scope to contribute substantially to the GPG. We further observed that the GPG is more pronounced when wages include bonus payments and that the difference in the GPG from the inclusion of bonuses is larger in higher hierarchy levels and at higher quantiles of the wage distribution.

In wage decompositions, we found that gender differences in bonus payments are an important contributor to the GPG both at the mean and along the unconditional wage distribution. They explain about 10% of the mean GPG and the GPG at several quantiles of the wage distribution. That said, their absolute contribution rises over the wage distribution as does the GPG, where the latter finding is strongly suggestive of glass ceilings. Further in line with glass ceilings, gender differences in bonuses are much more important for managers at the top of the hierarchy, and their absolute and their relative contribution to managers' GPG also steadily rises as one moves up the wage distribution. What is more, they stand out as the most important contributor to the GPG at the top of the top in that they explain almost two thirds of managers' GPG at the ninth decile

of the wage distribution.

In short, our results show that gender differences in bonus payments contribute substantially to the GPG and are strongly suggestive of glass ceilings in the form of much more pronounced gender differences in bonuses in top jobs. These may reflect employers' larger discretion over bonus payments compared to base salaries that leaves women in top jobs particularly vulnerable to discrimination, but may also mirror that 'women don't ask' (Babcock and Laschever, 2003) and realise inferior outcomes in negotiations, which are more likely to take place in top jobs.

As Goldin (2014) notes, women's job decisions continue to shift toward more remunerative and career-oriented fields. We expect this ongoing trend to further increase the important role of bonus payments for the GPG documented in this paper. Unfortunately, our data did not permit us to analyse specific components of bonus payments, such as stock options, incentive bonuses, and profit sharing. Such a detailed analysis promises additional insights why bonus payments are lower for women than for men and on the specific channels how they contribute to the GPG, and glass ceilings in particular.

A Appendix

A.1 Hierarchy levels

The hierarchy level information in the VSE 2014 takes on five values ranges from working 'simple tasks' to 'managerial duties'. Workers are assigned into these groups based on the operational grouping in the collective agreement or if there is no coverage based on the definitions given in the VSE as follows.

Hierarchy level 1 'managerial duties' comprise: 'Workers in leading positions with supervisory and disposition powers. These also comprise, for example, salaried managing directors, provided that their earnings at least partially include payments that are independent of success. Also included are all workers who perform disposition or management tasks in larger management areas (e.g. heads of department) and workers

with activities that require extensive commercial or technical expertise.'

Hierarchy level 2 'specialists' comprise: 'Workers with very difficult to complex or multifaceted activities that usually require a completed vocational training and several years of work experience as well as special expertise. These activities are predominantly carried out independently. In addition also workers who hold responsibility in small areas or for other coworkers.'

Hierarchy level 3 'experienced workers' comprise: 'Workers with difficult specialist activities that usually require a completed vocational training, sometimes combined with work experience.'

Hierarchy level 4 'no decision-making responsibilities' comprise: 'Semi-skilled workers with predominantly simple activities that do not require a vocational training but special knowledge and skills for special, industry-related tasks. The necessary knowledge and skills are usually acquired through a training period of up to two years.'

Hierarchy level 5 'simple tasks' comprise: 'Unskilled workers with simple, schematic activities or isolated work processes that do not require a vocational training. The necessary knowledge and skills can be acquired by a training of up to three months.'

A.2 Further descriptive findings on bonus payments

Since only few papers investigate bonus payments in detail, this appendix provides some additional descriptive findings on the prevalence of this non-base remuneration component. As is seen from Appendix Table A, bonus payments are more widespread in West Germany than in East Germany, with 71% of West German but just 60% of East German workers receiving at least one yearly bonus payment. They are further more prevalent in the manufacturing than in the services industries (83% vs. 66% of workers) and in large companies than in small firms. Moreover, 88% of workers covered by collective bargaining receive bonus payments compared to just 58% of uncovered workers. Finally, they are more widespread among high-wage than among low-wage workers, with 86% of workers with above-median wages receiving bonus payments but only 52% of workers with below-median wages.

Table A: Prevalence of bonus payments

West Germany	71%
East Germany	60%
Manufacturing	83%
Services	66%
Full-time employment	74%
Part-time employment	60%
Firm size	
$<$ 50 workers	47%
50–249 workers	74%
250 and more workers	89%
Worker covered by collective bargaining	88%
Worker uncovered by collective bargaining	58%
Worker with above-median wage	86%
Worker with below-median wage	52%

Notes: VSE 2014, weighted using sample weights.

References

Antonczyk, D., Fitzenberger, B., and Sommerfeld, K. (2010), 'Rising Wage Inequality, the Decline of Collective Bargaining, and the Gender Wage Gap', *Labour Economics*, 17(5): 835–847.

Arulampalam, W., Booth, A. L., and Bryan, M. L. (2007), 'Is There a Glass Ceiling over Europe? Exploring the Gender Pay Gap across the Wage Distribution', *ILR Review*, 60(2): 163–186.

Babcock, L. and Laschever, S. (2003), *Women Don't Ask: Negotiation and the Gender Divide*, Princeton University Press.

Bertrand, M. and Hallock, K. F. (2001), 'The Gender Gap in Top Corporate Jobs', *ILR Review*, 55(1): 3–21.

Blau, F. D. and Devaro, J. (2007), 'New Evidence on Gender Differences in Promotion Rates: An Empirical Analysis of a Sample of New Hires', *Industrial Relations*, 46(3): 511–550.

Blau, F. D. and Kahn, L. M. (2007), 'The Gender Pay Gap: Have Women Gone as Far as They Can?', *Academy of Management Perspectives*, 21(1): 7–23.

Blau, F. D. and Kahn, L. M. (2017), 'The Gender Wage Gap: Extent, Trends, and Explanations', *Journal of Economic Literature*, 55(3): 789–865.

Blinder, A. S. (1973), 'Wage Discrimination: Reduced Form and Structural Estimates', *Journal of Human Resources*, 8(4): 436–455.

Christofides, L. N., Polycarpou, A., and Vrachimis, K. (2013), 'Gender Wage Gaps, ' 'Sticky Floors" and ' 'Glass Ceilings" in Europe', *Labour Economics*, 21: 86–102.

Collischon, M. (2019), 'Is There a Glass Ceiling over Germany?', *German Economic Review*, 20(4): 329–359.

DeVaro, J. (2006), 'Internal Promotion Competitions in Firms', *RAND Journal of Economics*, 37(3): 521–542.

DiNardo, J., Fortin, N. M., and Lemieux, T. (1996), 'Labor Market Institutions and the Distribution of Wages, 1973–1992: A Semiparametric Approach', *Econometrica*, 64(5): 1001–1044.

Eriksson, T. (1999), 'Executive Compensation and Tournament Theory: Empirical Tests on Danish Data', *Journal of Labor Economics*, 17(2): 262–280.

Federal Statistical Agency (2016), Verdienststrukturerhebung 2014: Erhebung der Struktur der Arbeitsverdienste nach §4 Verdienststatistikgesetz, Qualitätsbericht, Federal Statistical Agency, Wiesbaden.

Firpo, S., Fortin, N., and Lemieux, T. (2009), 'Unconditional Quantile Regressions', *Econometrica*, 77(3): 953–973.

Firpo, S., Fortin, N., and Lemieux, T. (2018), 'Decomposing Wage Distributions Using Recentered Influence Function Regressions', *Econometrics*, 6(2): 28.

Fortin, N., Lemieux, T., and Firpo, S. (2011), 'Decomposition Methods in Economics', in D. Card and O. C. Ashenfelter, eds., *Handbook of Labor Economics,* vol. 4A, pp. 1–102, Amsterdam: Elsevier.

Fortin, N. M., Bell, B., and Böhm, M. (2017), 'Top Earnings Inequality and the Gender Pay Gap: Canada, Sweden, and the United Kingdom', *Labour Economics*, 47: 107–123.

Gneezy, U., Niederle, M., and Rustichini, A. (2003), 'Performance in Competitive Environments: Gender Differences', *Quarterly Journal of Economics*, 118(3): 1049–1074.

Goldin, C. (2014), 'A Grand Gender Convergence: Its Last Chapter', *American Economic Review*, 104(4): 1091–1119.

Grund, C. (2015), 'Gender Pay Gaps among Highly Educated Professionals — Compensation Components Do Matter', *Labour Economics*, 34: 118–126.

Grund, C. and Hofmann, T. (2018), 'The Dispersion of Bonus Payments within and between Firms', *Journal of Business Economics*, 89(4): 417–445.

Kassenboehmer, S. C. and Sinning, M. G. (2014), 'Distributional Changes in the Gender Wage Gap', *ILR Review*, 67(2): 335–361.

Kulich, C., Trojanowski, G., Ryan, M. K., Haslam, S. A., and Renneboog, L. D. R. (2011), 'Who Gets the Carrot and Who Gets the Stick? Evidence of Gender Disparities in Executive Remuneration', *Strategic Management Journal*, 32(3): 301–321.

Kunze, A. (2018), 'The Gender Wage Gap in Developed Countries', in S. L. Averett, L. M. Argys, and S. D. Hoffman, eds., *The Oxford Handbook of Women and the Economy,* pp. 369–394, Oxford: Oxford University Press.

Kunze, A. and Miller, A. R. (2017), 'Women Helping Women? Evidence from Private Sector Data on Workplace Hierarchies', *Review of Economics and Statistics*, 99(5): 769–775.

Lazear, E. P. and Rosen, S. (1990), 'Male-Female Wage Differentials in Job Ladders', *Journal of Labor Economics*, 8(1, Part 2): 106–123.

Lazear, E. P. and Shaw, K. L. (2007), 'Personnel Economics: The Economist's View of Human Resources', *Journal of Economic Perspectives*, 21(4): 91–114.

McGee, A., McGee, P., and Pan, J. (2015), 'Performance Pay, Competitiveness, and the Gender Wage Gap: Evidence from the United States', *Economics Letters*, 128: 35–38.

Oaxaca, R. (1973), 'Male-Female Wage Differentials in Urban Labor Markets', *International Economic Review*, 14(3): 693–709.

Oberfichtner, M., Schnabel, C., and Töpfer, M. (2020), 'Do Unions and Works Councils Really Dampen the Gender Pay Gap? Discordant Evidence from Germany', *Economics Letters*, 196: 109509.

Ors, E., Palomino, F., and Peyrache, E. (2013), 'Performance Gender Gap: Does Competition Matter?', *Journal of Labor Economics*, 31(3): 443–499.

Pfeifer, C. (2014), 'The Gender Composition of Establishments' Workforces and Gender Gaps in Wages and Leadership Positions', *Manchester School*, 82: 69–81.

Ransom, M. and Oaxaca, R. L. (2005), 'Intrafirm Mobility and Sex Differences in Pay', *ILR Review*, 58(2): 219–237.

Rios-Avila, F. (2020), 'Recentered Influence Functions (RIFs) in Stata: RIF Regression and RIF Decomposition', *Stata Journal*, 20(1): 51–94.

Xiu, L. and Gunderson, M. (2014), 'Glass Ceiling or Sticky Floor? Quantile Regression Decomposition of the Gender Pay Gap in China', *International Journal of Manpower*, 35(3): 306–326.

Yun, M.-S. (2005), 'A Simple Solution to the Identification Problem in Detailed Wage Decompositions', *Economic Inquiry*, 43(4): 766–772.