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# A question of gender? How promotions affect earnings

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> Preliminary and incomplete. Please do not quote or cite.

#### Abstract

Occupational positions can explain an important part of the differences in pay between men and women. However, a considerable Gender Pay Gap exists even within the same occupational position. In this paper, we aim at understanding the reasons for the gap within occupational positions and, therefore, investigate whether promotions lead to the same effect on earnings growth for men and women. Using administrative data, we are the first to investigate potential gender gaps in earnings increase due to a promotion in Germany. Moreover, we are the first to analyze differences in the gender gap across promotions into different occupational positions. Our results emphasize that women's earnings growth are larger than men's after being promoted to the same position. We find that this effect is mainly due to selection since we compare a highly positively selected group of women to an average group of men. Once, we add firm fixed effects, however, gender differences disappear, which highlights the role of collective agreements.

JEL Classification: M51, J31, J24, J16 Keywords: Gender, Promotions, Wage Growth

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## 1 Introduction

Indicated by a Gender Pay Gap of 21 %, wage differences between men and women in Germany are the second largest within the EU (Boll and Lagemann, 2018). Among many other reasons, women earn less than men because they work in lower occupational positions than men on average. That is, the difference in the occupational position between men and women explain nearly 5 percentage points of the German Gender Pay Gap, since men are more likely to work in higher positions than women. However, parts of the unexplained Gender Pay Gap is also related to the occupational position, i.e. after controlling for differences in endowments, men still earn 2 percentage points more than their female colleagues within the same position (Finke, Dumpert, and Beck, 2017). The aim of this paper is to analyze whether or not different promotion effects on earnings for men and women can explain the Gender Pay Gap within occupational positions.

Using administrative data from Germany, we are not only able to identify promotions but also to link them with the entire employment biography. We contribute to the literature as being the first who can differentiate between different levels of promotion. In doing so, we can investigate whether the gender gap depends on the level of promotion. Moreover, we are – to the best of our knowledge – the first to analyze gender differences in earnings growth due to a promotion in Germany.

In the following, we refer to promotions as upward changes of the occupational position within the same occupation and the same firm. The identification of promotion relies on the new classification of occupation (KldB 2010) that is observable in our data since 2012, which – in contrast to the prior classification scheme (KldB 1988) – contains additional information on the occupational position. Following Matthes and Vicari (2017), we use a change in this variable to identify promotions. We base this study on unique data from the Institute of Employment Research (IAB), which is a subsample of the Integrated Employment Biographies (IEB) that encompasses every individual who has ever worked subject to social security. We restrict the sample to full-time employees to make daily earnings more comparable. In total, we observe more than 100,000 individuals, which allows us not only to estimate precise effects but also to compare gender gaps across different subsamples, e.g. women with and without children.

We base our theoretical framework on the considerations of Booth, Francesconi, and Frank (2003). In this setting, differences in earnings growth can occur for three reasons: a divergent number of job offers, different preferences to stay in the firm or dissimilar productivity. Since the literature indicates that promoted women receive fewer job offers on the one hand, and are more able than men on the other, we formulate two contradicting hypotheses suggesting either a lower or a higher earnings increase for women due to promotion. Moreover, we hypothesize that in particular mothers have a lower earnings growth due to promotion than men because previous studies show that women with children are less likely to change a firm for pecuniary reasons.

Next, we extend this model for different levels of promotions. Again, we argue that the size of the gender gap in earnings growth depends on job offers, the preference to stay in the firm and productivity. Using evidence from a study by Neumark, Bank, and Nort (1996) that suggests that women receive fewer job offers in more prestigious jobs, we expect that the gender gap widens at higher levels of

promotions (*Sticky Floor Hypothesis*). However, we anticipate the contrary from the *Glass Ceiling Hypothesis*. That is, since women are less likely to enter higher occupational positions than men, we suggest that those women who achieve these positions, have a higher level of productivity than their male colleagues. Therefore, we would conclude that the gender gap does not increase with the level of promotion. Finally, we derive from the model that the outside wage offer increases with the level of promotion and, therefore, the costs for a higher preference for the firm increases. Since women, in particular mothers, are more likely to stay in the current firm for family reasons (e.g. Webber, 2016), we expect that the gap in wage growth between mothers and men increases with the level of promotion.

To test these hypotheses, we use a pooled OLS regression, where we add the controls stepwise to the model. Thus, by including firm and occupation fixed effects, we can analyze to what extent different selection processes can explain gender gaps.

The descriptive results show that the share of women decreases with the level of promotion, in particular if we include part-time workers. While men and women are equally distributed in the lowest level of promotion, the share of men in the highest position is 70 %. For full-time workers, we observe similar results but with the highest share of women in the intermediate category. In addition, we compare mothers to non-mothers and find that mothers are underrepresented in our sample, in particular in the full-time sample. Moreover, we observe that the share of mothers decreases with the level of promotion. That is, only 30 % of the full-time working women who have been promoted to the highest occupational position have children.

Further, the data reveal that men's wage level is higher than women's. Moreover, we find that men's earnings increase is larger than women's in the year before the promotion took place, while women's earnings growth exceeds men's in the year of the promotion. Therefore, the findings suggest that women's earnings are more depending on promotions while men's earnings increase even in the absence of a promotion.

In our main specification, i.e. when we exclude part-time workers, we find that women have larger earnings growth than men. However, this gap decreases in size when we add occupations to the model. After controlling for firm effects, the gender gap turns insignificant. Hence, our results highlight the role of collective agreements within firms, which may prevent large difference in earnings growth after promotions between employees. The results are similar if we compare men to childless women.

We do not find that the gap increases with the level of promotion; instead, the results indicate that women are less likely to be promoted to higher occupational positions. Thus, our result indicate a "glass ceiling" rather than a "sticky floor." Moreover, we observe that the effects are less strong if we exclude mothers from the sample, which we interpret as the following: Only few mothers work in full-time and get promoted to higher occupational positions but those who do, represent a highly ambitious group of women. Hence, the results suggest that the higher earnings growth of women, in particular of mothers, compared to men in the highest occupational position may result from differences in productivity.

We further interpret the estimated gender gap as a lower bound, since we argue that we compare men to a more positive selected group of women, i.e. men and women in this sample do not have the

same selection processes. First, we restrict the sample to persons who have been promoted, which represents a positive selected group on the labor market for both genders. But given that men are more likely to be promoted, in particular in higher occupational positions, we argue that promoted women might be even more labor market attached (compared to all women) than promoted men (compared to all men). Second, the average wage level in female-dominated occupations is lower than in maledominated occupations (e.g. Hausmann, Kleinert, and Leuze, 2015). By controlling for occupations, we compare either a typical woman with an atypical, less career orientated man, in a female-dominated occupation or a typical man with an atypical, more ambitious woman in a male-dominated occupation. That is, comparing men and women within the same occupation might underestimate the effect of gender. Third, we analyze gender differences in earnings growth for persons working within the same firm. Card, Cardoso, and Kline (2016) show that men are more likely to select into high-paying firms, which suggests that women who work in high-paying firms might be a positive selected group of women, while men working in low-paying firms might be a negative selected group of men. Thus, comparing men and women working in the same firm might again underestimate the effect of gender. Lastly, we restrict the sample to persons who stay in the firm after the promotion. Since men are more likely to change firms for pecuniary reasons (Albrecht, Bronson, Thoursie, and Vroman, 2018; Fitzenberger and Kunze, 2005; Loprest, 1992; Manning, 2003), those men who stay in the firm might reflect a negatively selected group (out of the promoted men).

With this study, we contribute to the small body of literature examining the relationship between gender gaps and promotions. The first theoretical approach stems from Lazaer and Rosen (1990), who show that women have to be more able than men to be promoted. The authors argue that women have a higher risk of leaving the labor market and, therefore, women have to reach a higher level of skills to be promoted. However, once they have entered the (promoted) job, they do not face lower wages than men. Based on these theoretical considerations, Booth et al. (2003) extend the model by the "sticky floor" assumption. That is, men and women have the same likelihood of being promoted but men face more outside offers than women, thus, have a higher wage growth than women.

Besides these theoretical considerations, there exists empirical investigations that analyze whether the probability to be promoted differs between genders and whether promotions lead to the same effects on earnings for both men and women. While the literature agrees on the fact that men are more likely to hold leadership positions (Blau and Kahn, 2017; Busch and Holst, 2009b), there is mixed evidence on the relationship between gender and the probability to be promoted. Some studies find that men are more likely to be promoted than women (Blau and DeVaro, 2007; Bronson and Thoursie, 2019; Cobb-Clark, 2001; Cobb-Clark and Dunlop, 1999; Lazaer and Rosen, 1990)<sup>1</sup>, others do not find significant differences between men and women (Booth et al., 2003; Lewis, 1986), whereas still others find higher probabilities for women to be promoted (Gayle, Golan, and Miller, 2012; Gerhart and Milkovich, 1989; Hersch and Viscusi, 1996).<sup>2</sup>

<sup>&</sup>lt;sup>1</sup>These studies relate to promotions within the same firm. However, Neumark et al. (1996) shows that men are to likely to be promoted when they apply to another firm.

 $<sup>^{2}</sup>$ Addison, Ozturk, and Wang (2014) find that the differences of being promoted between men and women depends on the level of education and the career stage.

Previous studies have already examined the impact of promotion on earnings growth of men and women for the U.S. (Blau and DeVaro, 2007; Cobb-Clark, 2001; Olson and Becker, 1983) and the British labor markets (Booth et al., 2003). However, none of the studies has found significant differences in wage growth between men and women. Addison et al. (2014) confirm the result but show that the effects on earnings growth differ slightly between educational groups and career stages.

Thus, by finding no gender differences in earnings growth due to promotions within firms we confirm previous results. Moreover, we contribute to the literature by showing that this finding comes mostly from selection. Thus, women who end up being promoted depict a highly positive selected group of women in the labor market.

The paper is structured as follows. The next section describes the data. Section 3 deals with the model, while section 4 covers the empirical strategy. Section 5 presents the results and the last section concludes.

## 2 Data

We base the estimation on a unique administrative data set from the Institute of Employment Research (IAB). This data set is a 75 % subsample of the total population who had a change in their occupational position between 2012 and 2017 in the Integrated Employment Biographies (IEB), i.e. the population of all individuals subject to social security. The IEB is administrative data based on notifications of the employer, and, therefore, encompasses high-quality information on earnings and on the entire employment biography of all individuals subject to social security. Since employers have to report the employment status for each employee on a daily basis, the data are provided as spells. That is, each spell gives the beginning and the end of the employment and further information such as earnings and occupation. As soon as one of these information changes, e.g. an advancement in the occupational position, the current spell ends and a new spell begins. Because the notification have to be transmitted at least once a year, the maximal duration of a spell is 365 days (366 days in leap years).

A potential drawback of the data are that some occupational changes may not be recorded. Thus, it is possible that persons have been promoted but the employer did not report this change to the security records.<sup>3</sup> Although we might not be able to identify every promotion, we argue that every change that is observable in the data effectively has happened. We assume that employers do not have an incentive to misreport a promotion if it has not really occurred. In addition, we do not expect that the non-reporting of promotions is systematic with respect to gender or earnings. Instead, we think that some employers are more accurate than others (Fitzenberger, Osikominu, and Völter, 2005).

## Promotion

Due to a change in the classification of occupations, we are able to observe hierarchical mobility within occupations. Therefore, we define the fifth digit in the classification of occupation (KldB 2010) as

 $<sup>^{3}</sup>$ There is evidence that not every change in the data is recorded. As an example Frodermann, Müller, and Abraham (2013) show that employers do not always adjust the working time. Hence, persons who started to work in part-time are still coded as full-time workers.

occupational position. The data allow disentangling between four positions: 1) Unskilled work; 2) Skilled work; 3) Complex activities; and 4) Very difficult activities and supervisory power.

We define a promotion as an upward change by one category in the occupational position within the same occupation and establishment. We concentrate on promotions in the main employment. Moreover, we restrict the sample to those persons who still work in the same (promoted) occupational position in the spell after the promotion to reduce the impact of potential misreporting. In case, a person had more than one promotion, he or she enters multiple times in the estimation.<sup>4</sup>

#### Earnings and earnings growth

In an ideal world, we would like to estimate the effect of gender on hourly wage growth. However, the data give only information on daily earnings<sup>5</sup> and on whether the employee works in part- or full-time.<sup>6</sup> Consequently, differences in earnings could also come from divergent working time, which we cannot observe. For this reason, in our main specification, we restrict our sample to full-time employees.

The dependent variable in our model is earnings growth, which we define as the relative difference between the new and the old earnings. The *new* earnings refer to the spell where the person works for the first time in the (promoted) occupational position; the *old* earnings to the last spell before the promotion.

## Motherhood

In the data, we do not directly observe if someone has children. Therefore, we use the approach by Müller and Strauch (2017), which allows us to identify motherhood. This method exploits the information on earnings replacement paid by the health insurance. During paid maternity leave the health insurance pays previous earnings for twelve weeks – six weeks before and eight weeks after the estimated date of birth. Based on this information, it is possible to identify the (estimated) date of birth of children for women who have worked subject to social security before giving birth. However,

 $<sup>^{4}</sup>$ We use at maximum three promotions per person. However, we do not think that this affects our results as 97 % of the individuals in our sample have only one promotion. In order to consider that persons may have more than one promotion, we cluster standard errors on the personal level.

 $<sup>{}^{5}</sup>$ Since, there is a limit for social security contributions, earnings above this threshold are censored. To impute earnings above the censoring limit, we follow Reichelt (2015).

<sup>&</sup>lt;sup>6</sup>As these records might be wrong, especially for part-time worker, we adjust working time as follows: First, if the employee earns less than 90 % of the last spell and is coded as full-time employed, we classify her or him as part-time worker, and vice versa. Second, if the full-time daily earnings are less than 40 euro, we change the working time to part-time work. Third, due to the important change in the classification scheme, employers were very likely to validate the records in 2012. Therefore, we assume that the information in 2012 is more correct than the previously recorded. That is, if someone is listed as full-time worker in 2011 with the same earnings as in 2012, when he or she is recorded as part-time worker, we adjust the information in 2011. We apply the same approach for those who are (probably) wrongly coded as part-time worker. Lastly, we adjust the working time of mothers following Frodermann et al. (2013). In case a mother has given birth and, subsequently, interrupted employment, we compare her earnings in the first spell of employment with her earnings ten months prior to birth.

the number of children might be underestimated, as we cannot identify births that took place during employment interruptions, unemployment spells or before entering the labor force.

Moreover, this method can only be applied for women and not for men, since it relies on maternity leave. Hence, we cannot make a statement about fatherhood. Since research shows that parenthood affects mainly mother's careers and not father's (Kleven, Landais, Posch, Steinhauer, and Zweimüller, 2019), we do not think that ignoring fatherhood would affect our results.

### Sample

We restrict our sample to persons who had an upward change in their occupational position between 2012 and 2017 within the same firm and the same occupation. We exclude persons who had promotions that last only for one spell<sup>7</sup> and part-time employed persons before and after the promotion.

The summary statistics of our sample given in Table 1 reveal that men have, on average, higher earnings pre- and post-promotion. However, the promotion leads to a higher increase in earnings for women than for men, both in relative and absolute terms.

Further, men tend to work in larger firms and have more tenure than women. On average, women have less work experience than men, especially in full-time. In contrast, women tend to have more labor market experience in part-time. Women are, on average, slightly higher educated than men: While men are more likely to have vocational training without A-levels and women are more likely to have vocational training with A-levels.

The comparison of the summary statistics of full-time sample and the one including part-time workers (Table 7 in the Appendix) reveals that the full-time sample, especially for women, is positively selected. Thus, full-time workers have more (full-time) work experience, tenure, and are slightly higher educated. Furthermore, the restriction of working full-time pre- and post-promotion reduces the female sample by 75 % and the male by more than 40 %.

## 3 Theoretical Framework

In this section, we sketch a theoretical model from which we will derive our hypotheses. We base our model on the theoretical considerations of Booth et al. (2003) to investigate why women and men may not have the same increase in earnings due to the promotion. Further, we extend their model by introducing different levels of promotion and analyze in this theoretical setting how the gender gap develops across different levels of promotions.

In this one-period model, we focus on wage processes around promotions, since a large strand of literature has shown that promotions have an important effect on wage growth (e.g. Baker, Gibbs, and Holmstrom, 1994a,b; Frederiksen, Halliday, and Koch, 2016; Gibbons and Waldman, 1999). Further, Waldman (1984) shows that promotions serve as a signal to other firms about the ability of the employee. Given this signal, the other firms will make wage offers that may be higher than his or her current wage in firm A, the firm where the employee has worked before being promoted. In the

<sup>&</sup>lt;sup>7</sup>Since the duration of a spell does not exceed a year, we do not think that the spell duration affects our result.

	То	$\operatorname{tal}$	Wo	men	Μ	en	
	Mean	SD	Mean	SD	Mean	SD	
			Main V	ariables			
Earnings pre-promotion	107.08	46.81	93.90	40.45	112.66	48.19	
Earnings post-promotion	113.80	47.84	101.66	42.46	118.95	49.05	
Relative earnings growth	0.09	0.21	0.11	0.23	0.08	0.21	
Absolute earnings growth	6.73	22.61	7.76	19.82	6.29	23.68	
Level of promotion							
Skilled work	0.37	0.48	0.29	0.46	0.35	0.48	
Difficult activity	0.38	0.48	0.51	0.50	0.42	0.49	
Very difficult activity &	0.25	0.43	0.19	0.40	0.23	0.42	
Supervisory Power							
	Individual Characteristics						
Age	37.17	9.99	36.52	10.16	37.45	9.91	
Work experience (ft,	145.50	102.81	111.45	86.94	159.93	105.58	
months)							
Work experience (pt,	14.52	31.26	26.94	47.68	9.26	18.31	
months)							
Tenure (months)	86.01	90.78	71.07	77.41	92.34	95.18	
Share of unemployment ex-	0.03	0.07	0.03	0.07	0.03	0.07	
perience							
Education							
No A-level, No VT	0.06	0.24	0.04	0.20	0.06	0.23	
No A-Level, VT	0.28	0.45	0.13	0.33	0.23	0.42	
A-Level, No VT	0.03	0.16	0.03	0.18	0.03	0.17	
A-Level, VT	0.43	0.49	0.56	0.50	0.47	0.50	
Polytechnical degree	0.02	0.14	0.02	0.16	0.02	0.14	
University	0.19	0.39	0.22	0.41	0.19	0.40	
			Firm Cha	racteristics			
East vs. West Germany	0.20	0.40	0.19	0.40	0.21	0.41	
Size of the Establishment	3494.96	8499.93	2289.76	6837.52	4005.93	9065.47	
Observations	112,566		33,503		79,063		

Source: IEB, 1976-2017, own calculations.

Table 1: Summary Statistics

following, the current firm A decides whether or not it matches the outside offer, if not the employee leaves firm A (e.g. Bernhardt and Scoones, 1993; Bognanno and Melero, 2015).

In this framewok, we make some crucial assumptions. First, we assume a fixed skill level S, which is unaffected by the promotion (see Figure 1). In addition, we assume that the employer can observe the productivity due to the promotion P, i.e. the sum of the skill level S and the increase in the complexity of the task due to the promotion E, which is the same for every promoted employee. We also assume that the firm A guarantees a (higher) wage  $w_p$  due to the promotion. In addition, we introduce  $\omega$  which reflects both the individual-specific productivity and the preference to stay or leave the firm. While a higher productivity or a preference to leave the firm are indicated by a positive value of  $\omega$ ,  $\omega$  will take negative value if the employee has a high preference to stay in the firm or a low individual-specific productivity level. Moreover, we introduce outside offers as  $S + \omega$ . Lastly, we expect that the employer can act as perfectly discriminating monopsonist.



Source: Booth et al. (2003)

Figure 1: Bargaining model

Thus, due to the promotion, the employer guarantees the wage  $w_p$ , which is higher than the previous wage, which is why we formulate our first hypothesis:

Wage Gain Hypothesis: Wages increase due to the promotion.

Moreover, we infer the following negotiation process: Before the employee starts working in the promoted position, firm A learns whether the employee has outside offers. Since firm A knows the productivity of the employee due to the promotion, it will match outside offers as long as the wage does not exceed the productivity of the employee. In this model, wage differences arise for three reasons: a divergent number outside offers, other preferences to stay in the firm or different productivity.

Hence, in this model potential wage differences between men and women may come from these three sources. First, there is evidence that women receive fewer job offers than men. One prominent example is the so called *Orchestra Study*. In their study, Goldin and Rouse (2000) refer to the introduction of "blind" auditions in orchestras in the U.S. The authors find that these "blind" auditions increased the probability that a woman reaches the next round by 50 %. Moreover, the share of women has increased from 5 % in the 1970s to 25 % in the 2000s.<sup>8</sup> Further, Baert, Pauw, and Deschacht (2016) investigated the differences in job offers between men and women in a randomized control trial. To this end, the authors sent applications, where they vary between jobs, which imply a promotion and those who do not. They find that women receive 33 % fewer invitations to job interviews if a job implies a promotion. This study suggests that women receive fewer job offers because of their gender. Therefore, we conclude our next hypothesis:

Job Offer Hypothesis: Women's increase in earnings after a promotion is lower than men's because they receive fewer job offers.

A further reason why men and women may not have the same wage growth due to a promotion in this model are potential differences in their productivity. A number of studies has shown that women have to be more able than men to be promoted (Blau and DeVaro, 2007; Bronson and Thoursie, 2019; Cobb-Clark and Dunlop, 1999). Lazaer and Rosen (1990) argue in the sense of statistical discrimination, i.e. employers prefer to promote men and to invest in their careers', since women have a higher risk to leave the labor market.<sup>9</sup> Therefore, we argue that promoted women have a higher productivity than men.

*Productivity Hypothesis*: Women's increase in earnings after a promotion is higher than men's because they are more productive.

Finally, wage differences between women and men may occur because they differ in their preferences to stay or to leave the firm. For Germany, Hirsch, Schlank, and Schnabel (2010) find that men's labor supply to the firm is more elastic than women's. In a recent study, Webber (2016) shows that marital status and motherhood explain around 60 % of the difference in the labor supply elasticity, since it affects women's but not men's elasticity. The author argues that women prefer to work in a firm, which allows a good reconciliation of family and working life, over a high-paying firm. From these findings, we conclude that women are less likely to leave the firm for pecuniary reasons. Card et al. (2016), who find that women are more likely to work in lower paying firms, support this result. Although

<sup>&</sup>lt;sup>8</sup>However, previous research has established that the difference in the likelihood depends strongly on the share of women within an occupation. The higher the share of women, the more likely is a woman compared to a man to be invited for a next round (Booth and Leigh, 2010; Kübler, Schmid, and Stüber, 2018).

<sup>&</sup>lt;sup>9</sup>Thomas (2016) provides evidence for statistical discrimination in the context of promotion. She shows that the introduction of the Family and Medical Leave Act of 1993 has not only increased women's likelihood to return to the labor market but also decreased their likelihood to be promoted. Thus, due to this reform employer have less signals about the productivity of women, hence, the information asymmetry increases and, therefore, employer are less likely to promote women.

Webber (2016) finds that the labor supply elasticity for married childless women is slightly smaller than men's, the effect of children on the labor supply elasticity is much stronger. Thus, we conclude that women with children have a higher preference to stay at firm A for non-pecuniary reasons.

*Bargaining Hypothesis*: Mothers' increase in earnings after a promotion is lower than men's because they have a lower preference for a higher paying firm.

In the following, we will extend the model by making assumptions about different levels of promotion. Therefore, we introduce a second promotion, which demands more skills and more effort, i.e.  $S \leq S'$  and  $E \leq E'$ . Accordingly  $w_p \leq w'_p$  and  $P \leq P'$ . Further, we assume that  $\omega$  may change with the level of promotion. That is, having a high preference for a certain firm or the size of individualspecific productivity depends on the level of promotion such that  $\omega \leq \omega'$ . Since the skill level increases with the level of promotion, we also expect better outside offers (in terms of higher wage offers) in higher levels of promotion  $(S + \omega \leq S' + \omega')$  as depicted in Figure 2.



Figure 2: Bargaining model for different promotions

Since  $w_p \leq w'_p$ , we derive from the model that the wage gain due to the promotion increases with the level of promotion. This hypothesis is supported by Caines, Hoffmann, and Kambourov (2017), who find that there is a positive relationship between the complexity of a task and wage growth. Therefore, we formulate our next hypothesis:

Increasing Wage Growth Hypothesis: The wage growth due to the promotion increases with the level of promotion.

Again, gender differences in the number of outside offers, in preferences to stay in the firm or in productivity can explain different wage growth in the model. We start by hypothesizing that the higher the level of promotion the larger the number of outside offers of men compared to women. We build this hypothesis on an audit study by Neumark et al. (1996). In this study, male and female candidates applied for waiters and waitresses in different restaurants. The authors find that the level of discrimination against women is substantially higher in high-price restaurants than in low-price restaurants. These findings can be interpreted as decreasing job offers for women (compared to men) across the level of occupational positions. Thus, we formulate the following hypothesis:

Sticky Floor Hypothesis: Women's increase in earnings after a promotion (compared to men's) decreases with the level of promotion because they receive fewer job offers the higher the occupational position.

Next, the increase in earnings across different levels of promotion between men and women may differ because they have not the same productivity. The share of women decreases with the level of promotion (Holst and Wrohlich, 2019; Kohaut and Möller, 2019; OECD, 2016)<sup>10</sup> and productivity is equally distributed across gender, especially in the absence of children (**Gallen2018**). Since only the most productive individuals of each gender end up to be promoted (Landers, Rebitzer, and Taylor, 1996), the gap in productivity (in favor of women) increases with the level of promotion.<sup>11</sup> Once they have reached this position, however, they do not face lower increases in earnings (Lazaer and Rosen, 1990).

*Glass Ceiling Hypothesis*: Women's earnings growth after a promotion increases (relatively to men's) with the level of promotion because the gap in productivity between women and men increases.

Lastly, we want to discuss why the level of promotion affects the preference to work in a certain firm of women and men differently. Therefore, we refer to the well-established fact that women, in particular if they have children, are more likely to change the firm for non-pecuniary reasons (such as better reconciliation of family and working life), while men are more likely to have turnovers for monetary reasons (e.g. Fuller, 2008; Manning, 2003; Webber, 2016). Moreover, one assumption of the model is that the higher the level of promotion the higher the outside wage offers. Given that mothers feel more responsible for care work than men (Craig and Mullan, 2011; Samtleben, 2019), they have a higher preference to stay in firm A, which is more costly in higher occupational levels. In contrast, a low preference for the firm leads to higher bargaining power when it comes to negotiations. Therefore, we hypothesize:

<sup>&</sup>lt;sup>10</sup>Baxter and Wright (2000) argue that the share of women in top position can be very small although the likelihood of women to be promoted (compared to men) does not decrease. They argue that if women's probability to be promoted is smaller than men's but constant across different hierarchy levels, the share of women within each occupational position decreases by construction.

<sup>&</sup>lt;sup>11</sup>Arulampalam, Booth, and Bryan (2007) differ between a Gender Pay Gap that widens at the top of the distribution ("glass ceiling") and at the bottom of the distribution ("sticky floor").

Decreasing Bargaining Hypothesis: Mothers' increase in earnings after a promotion (compared to men) decreases with the level of promotion because costs for a high preference for the current firm increase with the level of promotion.

## 4 Empirical approach

In the following, we want to test these hypotheses by estimating the effect of gender on earnings growth due to promotion. However, this is not trivial, since being promoted might also depend on previous decisions, e.g. the hierarchy structure of the occupation and the firm. By controlling for occupation and firm fixed effects, we want to analyze potential sources of selection.

In the following, we define earnings growth as  $\Delta y = (y_t - y_{t-1})/y_{t-1}$ , where  $y_t$  is the daily earnings in the first spell after being promoted and  $y_{t-1}$  reflects the daily earnings in the last spell before the promotion. Gender differences in the wage growth are captured by  $\alpha$ . In addition, we differentiate between specific levels of promotion. We assume that unobserved characteristics, such as ambition, might be correlated with the occupational position. That is, persons that are more ambitious might work in a higher occupational position. Moreover, we include some individual-specific observables, such as work experience (in full-time and part-time), tenure, unemployment experience, and schooling. In addition, the model contains firm specific controls (e.g. firm size, region). These control variables are summed up in  $X_i$ .

$$\Delta y_i = \beta_0 + \alpha \text{ female}_i + \gamma \sum_{l=1}^{L} \text{occ. position}_l + \mu X_i + \epsilon_i \tag{1}$$

To test the sticky floor, glass ceiling and the decreasing bargaining power hypotheses, we include the interaction of the level of promotion and gender. Thus, in equation 2,  $\alpha$  gives the overall gender gap in earnings growth for persons working within the same level of promotion and  $\xi$  reflects differences in the gender gap between the occupational positions.

$$\Delta y_i = \beta_0 + \alpha \text{ female}_i + \gamma \sum_{l=1}^{L} \text{occ. position}_l + \xi \sum_{l=1}^{L} \text{occ. position}_l \times \text{female}_i + \mu X_i + \epsilon_i \qquad (2)$$

In addition, we control on a further source of selection: occupation.<sup>12</sup> We expect that persons who select into different occupations may differ in their unobservables. As an example, persons working as teachers may differ in their labor market attachment or fertility decisions from persons working as managers (Adda, Dustmann, and Stevens, 2017; Polachek, 1981). In addition, male-dominated occupations tend to be more hierarchical, which increases the likelihood of promotions in these occupations (Busch and Holst, 2009a). Moreover, we expect that occupations differ in their wage growth. Therefore, we include occupation fixed effects to reduce the heterogeneity in the model, since we assume that persons working within the same occupation may be more similar in their unobservables

<sup>&</sup>lt;sup>12</sup>We argue that neither occupation nor firm fixed effects are bad controls (Angrist and Pischke, 2009). Bad controls would be an issue if occupational or firm choices also affect the gender gap, i.e. the share of women within occupations or firms determine the gender gap. It is shown that women are less likely to select into high-paying occupations and firms but there is no evidence that the gender gap correlates with the share of women see chapter ??.

compared to persons working in other occupations. Including occupation fixed effects also allows us to analyze the role of occupations on the gender gap. In equation 3,  $\alpha$  indicates the gender gap in earnings growth within occupation j after being promoted in occupational position l.

$$\Delta y_i = \beta_0 + \alpha \text{ female}_i + \gamma \sum_{l=1}^{L} \text{occ. position}_l + \xi \sum_{l=1}^{L} \text{occ. position}_l \times \text{female}_i + \mu X_i + \nu \sum_{j=1}^{J} \text{occupation}_j + \epsilon_i$$
(3)

In addition, we expect that the selection within firms is also correlated with success on the labor market. More specifically, we assume that differences in earnings, in particular between men and women, come from selection into firms with higher or lower earnings (Card et al., 2016). We also suppose that persons who select into the same firm f are more similar in their unobservables, such as ambition or attitudes towards the future career. We also expect that firms differ in their wage growth because of different collective agreements. Therefore, we add firm fixed effects to our model. Hence, in this case  $\alpha$  gives the gender gap in earnings growth within occupation j and firm f after being promoted in the occupational position l.

$$\Delta y_i = \beta_0 + \alpha \text{ female}_i + \gamma \sum_{l=1}^{L} \text{occ. position}_l + \xi \sum_{l=1}^{L} \text{occ. position}_l \times \text{female}_i + \mu X_i + \nu \sum_{j=1}^{J} \text{occupation}_j + \eta \sum_{f=1}^{F} \text{firm}_f + \epsilon_i$$
(4)

To test differences in bargaining power between women with and without children, we repeat the estimation for childless women compared to men. In the final model, given in equation (4),  $\alpha$  gives the difference between men and women who made similar decisions in their life but we do not know the reasons for these decisions. Thus, even though both groups seem to be very similar in their observables, they might differ in their unobservables. For the interpretation of our results, we have, therefore, to keep in mind that we cannot disentangle whether our findings come from differences in productivity or from discrimination.

## 5 Results

The aim of this study is to investigate whether promotions have the same effects on earnings for women and men. The findings, however, also depend on the selection process into those promotions. Therefore, the first part of this section will descriptively examine whether men and women as well as childless women and mothers are equally distributed within each level of promotion and how men's and women's earnings increase before and after being promoted. The second part deals with the effects on earnings growth.

## 5.1 Descriptive results

In our setting, we focus on full-time employment. However, to describe how promotions are distributed on the labor market, we will first discuss the share of women within each occupational position for the entire labor market, i.e. including part-time workers. These shares are given in the first row of Table 2. It is apparent from the table that men and women are nearly equally distributed in our sample (48 % of the sample is female) but the share of women varies across the different levels of promotions. While slightly more women get promoted to "skilled work" (52 %), men are somewhat over-represented in "difficult activity" (share of women: 46 %). In the highest level "very difficult activity & supervisory power," the share of women is considerably smaller: only 29 % of persons who have been promoted to this occupational position are female. Thus, these descriptive findings suggest that men are more likely to get promoted to higher positions.

However, these descriptives may be biased by comparing two different groups: Full-time and parttime workers. Thus, the second row of the table gives the share of women for full-time employed workers. While interpreting the shares, note that the share of women in the total sample is smaller. Only 27 % of the persons who got promoted in full-time is female. Giving the total shares, the distribution in the lower two categories reverses. In the full-time sample, women are slightly underrepresented in "skilled work" and in "very difficult activity & supervisory power," where the share of women is 25 %. In contrast, women are over-represented in the level of "difficult activity," indicated by a share of women of 37 %.

In the third and fourth row of the table, we compare mothers to childless women. It is apparent from the table that mothers are underrepresented in the sample compared to the total population, where around 80 % of women have children (Statistisches Bundesamt, 2017). If we include parttime workers, almost half of the promoted women have children. Comparing the different levels of promotions, however, indicates that the share of mothers decreases with the level of promotion. Thus, the higher the occupational position the lower the probability of women with children (compared to childless women) to be promoted.

Restricting the sample to full-time employees decreases the share of mothers to 33 %. Again, we see that the higher the promoted position the lower the share of mothers. However, the differences between mothers and non-mothers is less pronounced than in the total sample (including part-time workers). The results indicate first that mothers are less likely to be promoted than women without children. Further, the results suggest that mothers are also less likely to be promoted to higher positions.

Besides the differences in probability to be promoted between men and women, it is worthwhile to look at differences in earnings growth between men and women before and after the promotion. Therefore, the left panel of Figure 3 plots how the earnings growth of men and women have evolved during a period of two years before and after the promotion. Two years before the promotion occurs, women's and men's relative wage growth are quite similar. However, one year before the promotion takes place, men's earnings growth is higher than the year before, while women's earnings growth is smaller in this year. In contrast, in the year of the promotion, women's earnings growth exceeds men's. In the years after the promotion, however, there are no observable differences in the average wage growth between men and women. These descriptive results suggest that promotions have a higher impact on women's earnings than on men's, since men's earnings increased strongly even before the promotion took place. Moreover, the decreasing earnings growth over time supports previous studies

	Share	of women in $\%$	Share of	of mothers in $\%$
Level	All	Full-time	All	Full-time
Skilled work	52.0	25.2	49.4	34.9
Difficult activity	45.6	36.5	44.8	32.5
Very difficult activity &	20.4	24.6	26.4	20. 0
Supervisory Power	29.4	24.0	30.4	29.8
Total	47.6	27.3	47.3	32.7

Source: IEB 1976-2017; own calculations. Share of mothers gives the share of women with children in relation to all women.

Table 2: Share of women within occupational positions including and excluding part-time worker

that find that the wage growth decreases with experience (e.g Lagakos, Moll, Porzio, and Qian, 2018; Mincer, 1974).

The right panel of the figure shows how this relative earnings growth translates into daily earnings. While women's (90 euro) and men's earnings (99 euro) are relatively equal two years before the promotion, men's earnings increase by 14 euro in the second year and women's only by 4 euro. Thus, in the year before the promotion takes place the gender gap in absolute terms is 19 euro. Since women's increase in earnings after the promotion is higher, than men's, the gap in daily earnings decreases to 17 euro. In the years after the promotion, men and women have a similar relative earnings growth but since men's earnings level is higher, the gap rises again to 19 euro in both years. Thus, we can conclude from these descriptive results that women's earnings are on average lower than men's. The promotion decreases the gender gap in absolute earnings in the year of the promotion. However, the gender gap increases again in the years after the promotion.



Source: IEB 1976-2017; own calculations.

Figure 3: Earnings growth and earnings before and after promotion

### 5.2 General gender gap in earnings growth

After observing differences in the likelihood to be promoted, the question arises whether this promotion has the same effect on earnings for men and for women. To answer this question, we add sequentially variables to the model.

In our main specification, we analyze the differences in earnings effects for men and women for full-time workers (see Table 3).<sup>13</sup> In the first row, we only include gender in the model and observe a positive effect. Thus, women's increase in earnings due to the promotion is 3 percentage points higher than men's. In the second row, we include the level of the promotion to the model. The results suggest that the differences in earnings growth between men and women is significantly lower in promotions into occupational positions with difficult activities. In contrast, women's earnings growth compared to men's in the level "very difficult activity & supervisory power" is even larger than in the reference group "skilled work."

While adding previous earnings growth does not affect the female coefficient, the gender gap decreases when we add individual controls to the model. Interestingly, controlling for individual characteristics decreases the female coefficient in "very difficult activity & supervisory power," i.e. women within the same occupational positions are more skilled than their male colleagues.

Next, we add occupations to the model, which has a considerable effect on the results, since it reduces the gender gap substantially. This result might be driven by the full-time restriction, which represents a positively selected group of women. Full-time working women might be more labor market attached and, therefore, might be less likely to select into occupations that offer a better reconciliation of family and working life but lower wages (Adda et al., 2017). The results for part- and full-time workers confirm this assumption (see Table 5 in the Appendix): We find that the positive female effect decreases when adding occupations to the model. Further, the negative female coefficient interacted with the occupational position "difficult activity" decreases slightly after including occupations in the model.

In row (VII), we further add firm fixed effects, which leads to an increase of the  $R^2$  from 7 to 54 percent, i.e. nearly 50 percent of the variance in earnings growth can be explained by intrafirm differences in earnings growth. From this, we conclude that differences in earnings growth due to promotion mostly depend on the sorting in firms with high or low earnings growth. Further, the gender gap is no longer significant. That is, once men and women have selected into the same occupation and the same firm, there are no differences in earnings growth e.g. due to collective agreements. Surprisingly, the interaction of the occupational position "difficult activity" and female is still negatively significant. Thus, women's earnings increasing due to a promotion into "difficult activity" compared to men is smaller than the earnings growth of women compared to men, who got promoted to "skilled work", even if they work in the same occupation and the same firm. Controlling on the year of promotion, does slightly change the results, in particular the interaction of the occupational position "difficult activity" and female is no longer significant. Thus, this result suggests that since the change in size of the coefficient is only marginal, the difference in the gender gap in difficult activities

 $<sup>^{13}</sup>$ The whole regressions of row (VIII) of Tables 3 and 4 is given in Table 8 in the Appendix.

within firms and occupations is not very robust. Further, we estimate the effects of promotions on the absolute increase in earnings and find very similar results (see Table 6 in the Appendix).

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Female	0.025***	0.034***	0.034***	0.028***	0.029***	0.009**	0.003	0.003
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)
Level of promotion (ref:	Skilled wor	k)						
Difficult activity		0.021***	0.021***	0.024***	0.023***	0.025***	-0.000	-0.002
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)
Very difficult activity $\&$		$0.006^{**}$	$0.006^{**}$	$0.018^{***}$	0.020***	$0.027^{***}$	0.000	-0.000
Supervisory Power		(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.006)	(0.006)
Female*Level of promotion (ref: Skilled work)								
Difficult activity		-0.031***	-0.031***	-0.037***	-0.037***	-0.022***	-0.012*	-0.010
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
Very difficult activity $\&$		$0.026^{***}$	$0.026^{***}$	0.011*	0.009	0.011	0.008	0.009
Supervisory Power		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)
Constant	0.070***	0.060***	0.060***	0.186***	0.191***	0.185***	0.022	0.164**
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)	(0.044)	(0.052)
N	84,308	84,308	84,308	84,308	84,308	84,308	84,308	84,308
$\mathbb{R}^2$	0.00	0.01	0.01	0.05	0.05	0.07	0.54	0.55
Earnings growth $t_{-1}$			√	√	√	√	$\checkmark$	√
Individual controls				$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Firm specific controls					$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Occupation fixed effects						$\checkmark$	$\checkmark$	$\checkmark$
Firm fixed effects							$\checkmark$	$\checkmark$
Year fixed effects								$\checkmark$

Source: IEB 1976-2017; own calculations. DV: Relative Earnings growth =  $(earnings_{after} - earnings_{before})/earnings_{before}$ ; Occupations: 3-digit level (KldB2010); Controls: Experience in part- and full-time (single and quadratic), Education (w/o A-levels and voc. training; Voc. Training w/o A-Levels; A-levels, w/o voc. training; A-levels + voc. training; University of appl. science; University), Month of tenure, Age, East/West Germany, Firm size. Sample: Persons who were promoted between 2012 and 2017 within the same occupation and the same firm before and after being promoted and who have worked in full-time before and after the promotion. Women without children and all men. Significance levels:\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001. Standard errors are clustered on the individual level.

Table 3: Effect of promotion on (relative) earnings growth, for full-time sample

From the Wage Gain Hypothesis we expect that earnings increase due to promotion. The average effect of promotions on earnings is indicated by the constant. As an example, we can see from the constant in row (I) that men's earnings increase by 7 % after a promotion. Since the female coefficient is significantly positive, women's wage growth after promotions is even larger (10 %). Thus, we cannot reject the hypothesis of increasing earnings.

Further, we formulated two contradicting hypotheses, which suggest higher increases in earnings for men (*Job Offer Hypothesis*) or for women (*Productivity Hypothesis*). Indicated by a positive female coefficient in the models without firm fixed effects, the results suggest that women have a higher wage growth due to promotion than men. This confirms the descriptive findings depicted in Figure 3. Moreover, the gender differences in the probability to be promoted indicate that women have to be more able than men to be promoted, which is in line with our *Productivity Hypothesis*. However, once we control for firm fixed effects, gender differences are no longer significant. One potential explanation for this finding is that collective agreements within firms do not allow differences in wage growth.

We argue that our result reflects the lower bound, since we compare full-time working women and men within the same occupation and the same firm, who did not change their employer after the promotion. The main reason for this assumption is that men and women in our setting differ substantially in the selection process. First, we exclude part-time workers from our model in our main specification to make earnings more comparable. Since this restriction affects women considerably more than men and Gallego Granados (2019) shows that women working full-time represent a positively selected group, we argue that full-time working women are more positively selected (compared to all women) than the full-time working men (compared to all men). Comparing the summary statistics of the main specification (Table 1) to the one including part-time workers (Table 7 in the appendix) confirms this assumption since the full-time sample is more experienced and higher educated. The differences between the full-time sample and the sample including part-time workers are more pronounced than for women, e.g. the share of individuals with university degree in the full-time sample is 22 % for women and 19 % for men and the sample with part-time workers 13 % for women and 14 % for men. Once we include part-time workers in the model, women's earnings growth due to the promotion is lower than men's (see Table 5 in the Appendix). However, these results should be interpreted with caution, since a large increase in earnings in the model with part-time workers may also result from a change from part-time before the promotion to full-time after the promotion.

Moreover, we compare men and women who work in the same occupation, i.e. we compare a typical man with an atypical woman, or vice versa. Assuming that female-dominated occupations compensate lower wages with a better reconciliation of family and working life (Adda et al., 2017; Polachek, 1981)<sup>14</sup>, we conclude that women who select into male-dominated are more labor market attached. In contrast, men who select into female-dominated occupations might be less career orientated. Thus, once we look at gender gaps within an occupation, we might compare a more positively selected group of women (compared to all women) to a less positively selected group of men (compared to all men).

In addition, we compare men's and women's earnings growth within the same firm. For Portugal, Card et al. (2016) show that men are more likely to select into higher paying firms. Thus, women who also work in the same (higher paying) firm might be more labor market attached than the average working woman. In contrast, men who sort into lower paying firms might reflect a negative selected group of men. Similar to occupations, estimating earnings effects within firms implies that we compare more labor market attached women (compared to all women) to less labor market attached men (compared to all men). That is, we argue again that we either compare a more career orientated woman to a typical man in a high-paying firm or a less labor market attached man to a typical woman in a low-paying firm.

Finally, we focus on persons who work in the same firm before and after being promoted. Previous research shows that women and men differ in their reasons to change the firm. Thus, men are more likely to change the firm for pecuniary reasons (e.g. Albrecht et al., 2018; Fitzenberger and Kunze,

<sup>&</sup>lt;sup>14</sup>This argument, however, is highly discussed in the literature (e.g. Budig and England, 2001; Glauber, 2011, 2012; Jacobs, 1990).

2005; Loprest, 1992; Manning, 2003). Therefore, we conclude that those men, who stay in the firm might reflect a negatively selected group.

From these different selection processes, we argue that our estimated effects reflect a lower bound. Thus, the effect may be underestimated because we compare an average labor market attached group of men to a strongly positively selected group of women.

Note that we cannot observe productivity in our model, which means that we are not able to identify whether gaps in promotion and in earnings growth come from differences in productivity or discrimination.<sup>15</sup> Moreover, we argue that men and women may differ in their selection but we do not control on unobservable differences. A way to control for this endogeneity would be to estimate a fixed effects model. Further, it is possible to identify the causal effect of promotion on earnings and its difference between men and women in an event study setting. In this framework, we would be able to analyze how women's and men's earnings develop pre- and post-promotion. However, using fixed effects we cannot investigate the role of sorting into firms or occupations.

Lastly, we want to mention that higher earnings growth for women (in the specifications without firm fixed effects) may be the result of general gender differences in the earnings level and the role of promotions on wage growth over time. Thus, as depicted in Figure 3 promotions have a higher impact on female earnings growth than on men's, since men have high earnings growth even before the promotion took place, which could also be analyzed in an event study setting.

### 5.3 The role of motherhood on the gender gap in earnings growth

Further, we hypothesize that mothers' earnings increase less due to promotions because they are less likely to change the firm for monetary reasons, i.e. may have a higher preference for the firm. To test whether effects differ between women with and without children, we restrict our female sample to childless women, which we compare to all men.

The results presented in Table 4 are very similar to our main specification. However, the female coefficients increases slightly when we exclude mothers from the sample. According to our model, mothers might, therefore, have a higher preference for the current firm. Another explanation may be that mothers may be less productive than women without children because having children may reduce their energy or motivation (Ejrnæs and Kunze, 2013).

Again, we argue that this result may be a lower bound because women with children, who work in full-time and who get promoted, may reflect a highly labor market attached group of mothers. The relatively small share of mothers, particular in the sample (see Table 2), confirms this assumption.

### 5.4 Glass ceiling vs. Sticky Floor

Before testing whether the gender gap changes across the levels of promotions, we will first examine whether the earnings growth increases with the level of promotion. Therefore, we refer to the coeffi-

<sup>&</sup>lt;sup>15</sup>In our model we argue that differences come from job offers or productivity, however, it might be possible that women receive more job offers than men but are less successful in negotiations (e.g. Babcock and Leschever, 2003; Niederle and Vesterlund, 2007).

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Female	0.032***	0.042***	0.042***	0.033***	0.033***	0.014***	0.006	0.006
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)
Level of promotion (ref:	Skilled wor	k)						
Difficult activity		0.021***	0.021***	0.024***	0.022***	0.025***	0.001	-0.000
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)	(0.006)
Very difficult activity $\&$		0.006***	0.006***	0.018***	0.020***	0.028***	0.002	0.002
Supervisory Power		(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.007)	(0.007)
Female*Level of promotion (ref: Skilled work)								
Difficult activity		-0.032***	-0.032***	-0.038***	-0.038***	-0.023***	-0.009	-0.008
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
Very difficult activity $\&$		$0.019^{**}$	$0.019^{**}$	0.008	0.006	0.006	-0.001	0.000
Supervisory Power		(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.009)	(0.009)
Constant	0.070***	0.060***	0.060***	0.188***	0.194***	0.187***	0.022	0.161**
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.006)	(0.044)	(0.053)
N	76,311	76,311	76,311	76,311	76,311	76,311	76,311	76,311
$\mathbb{R}^2$	0.01	0.01	0.01	0.05	0.05	0.07	0.55	0.55
Earnings growth $t_{-1}$			√	√	√	√	$\checkmark$	~
Individual controls				$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Firm specific controls					$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Occupation fixed effects						$\checkmark$	$\checkmark$	$\checkmark$
Firm fixed effects							$\checkmark$	$\checkmark$
Year fixed effects								$\checkmark$

Source: IEB 1976-2017; own calculations. DV: Relative Earnings growth =  $(earnings_{after} - earnings_{before})/earnings_{before}$ ; Occupations: 3-digit level (KldB2010); Controls: Experience in part- and full-time (single and quadratic), Education (w/o A-levels and voc. training; Voc. Training w/o A-Levels; A-levels, w/o voc. training; A-levels + voc. training; University of appl. science; University), Month of tenure, Age, East/West Germany, Firm size. Sample: Persons who were promoted between 2012 and 2017 within the same occupation and the same firm before and after being promoted and who have worked in full-time before and after the promotion. Women without children and all men. Significance levels:\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001. Standard errors are clustered on the individual level.

Table 4: Effect of promotion on (relative) earnings growth, for full-time sample, all men and childless women

cients for the different levels of promotions. Since in row (II) to (VI) the coefficients for both "difficult activity" and "very difficult activity & Supervisory Power" are positive and significant, we can infer that earnings growth after being promoted to "skilled work" is the lowest. However, before adding occupation fixed effects to the model, the wage gain of being promoted to "very difficult activity & Supervisory Power" is smaller than after promotions to "difficult activity". Once we add occupations to the model, we observe that individuals who are promoted to highest occupational position have the largest increase in earnings. Thus, we can confirm the hypothesis if we compare individuals within the same occupation. When we add firm fixed effects to the model, however, differences between the levels of promotions disappear, which may be the result of collective agreements within firms. Thus, we cannot find differences in (relative) earnings growth between the levels of promotion within firms.<sup>16</sup>

From our theoretical model, we derived two counteracting hypotheses: The *Sticky Floor Hypothesis* and the *Glass Ceiling Hypothesis*. The *Sticky Floor Hypothesis*, argues that the higher women get promoted, the fewer their number of job offers. However, in our model we do not find any support for this hypothesis, since the largest gender gap appears in occupational positions with "difficult activity". Women's earnings compared to men is even the largest in positions with "very difficult activity & supervisory power".

From the descriptive results, however, it is apparent that women are less likely to be promoted to the highest occupational position. Moreover, the findings suggest that in occupational positions, where the share of women is relatively high ("difficult activity"), men's earnings growth is larger than women's. In contrast, in those positions, where the share of women is relatively low ("skilled work" and "very difficult activity & supervisory power"), women's earnings growth is larger than men's. Therefore, these results are in favor of the *Glass Ceiling Hypothesis*. However, once we add firm and year fixed effects to the model, these effects are no longer statistically significant, which again supports the role of collective agreements.

Note that the data do not differ between "very difficult activity" and "supervisory power," which differ substantially in the share of women and also the gender gap in earnings (see chapter ??). Since previous research shows that the gender gap widens, especially at the top (Arulampalam et al., 2007; Blau and Kahn, 2017; Collischon, n.d.), it is probable that we would observe a gender gap in the occupational position "supervisory power." As women are considerably less likely to enter these positions (e.g. Holst and Friedrich, 2017), the gender gap in positions with "supervisory power" might be overlaid by the fact that women's earnings growth is higher than men's in positions with a "very difficult activity".

# 5.5 The role of motherhood on the gender gap in earnings growth across the levels of promotions

Finally, we want to test whether the "motherhood penalty" increases with the level of promotion. Therefore, we compare the interactions between the female coefficient and the level of promotion for the sample including (Table 3) and excluding (Table 4) mothers. Interestingly, after adding individual

<sup>&</sup>lt;sup>16</sup>In absolute terms, however, the earnings growth increases with the level of promotion (see Table 6 in the Appendix).

controls to the model, the gender gap for "very difficult activity & supervisory power" is no longer significant in the specification without mothers. This finding indicates that the large earnings growth for women in the highest occupational position is driven by mothers and, therefore, highlights the role of selection: Those few mothers, who work in full-time and are promoted into the highest occupational position (7 % out of our female sample), represent a highly labor market attached group, i.e. these women may be more productive than their male counterparts and will, therefore, have higher earnings growth. Thus, we cannot confirm the *Decreasing Bargaining Hypothesis*.

## 6 Conclusion

The Gender Pay Gap is a well-established fact that has different reasons, including part-time work, firm selection, occupations and occupational positions. With this paper, we contribute to the literature by providing evidence whether promotions affect women's and men's earnings differently. To this end, we use administrative data from Germany, which offers not only information on promotions but also on the entire employment biography. After adding firm and occupation fixed effects to the model, we do not find gender differences in earnings growth. Thus, our results confirm previous studies for the U.S. and the UK that also find no gender differences (Blau and DeVaro, 2007; Booth et al., 2003).

We argue that this result is a lower bound, since selection processes within full-time, promotions, firms and occupations differ substantially between women and men. Therefore, we compare a highly positively selected group of women to an average selected group of men.

Further, our results provide evidence for a "glass ceiling". That is, women are less likely to be promoted to the highest occupational position. However, we do not observe that women's earnings growth (compared to men's) is lower in the highest occupational position.

These results suggest that promoted women are not only more labor market attached than the average women in the labor market but also more ambitious than promoted men. However, with this model we are not able to control for individual specific effects. Thus, using a fixed effects model, or more specifically an event study framework, we could identify the causal effect of promotion. Arguing that – besides of gender, childless women do not differ in their unobservables from men – this framework also allows for estimating the causal effect of gender on earnings due to promotion.

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# Appendix

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Female	0.026	-0.018	-0.018	-0.127***	-0.126***	-0.019**	0.031	0.027
	(0.015)	(0.025)	(0.025)	(0.029)	(0.029)	(0.025)	(0.030)	(0.030)
Level of promotion (ref:	Skilled work	s)						
Difficult activity		-0.323***	-0.323***	-0.204***	-0.219***	-0.197***	-0.156***	$-0.156^{***}$
		(0.028)	(0.028)	(0.028)	(0.028)	(0.033)	(0.034)	(0.034)
Very difficult activity $\&$		$-0.648^{***}$	$-0.648^{***}$	$-0.424^{***}$	$-0.384^{***}$	$-0.241^{***}$	-0.122	-0.121
Supervisory Power		(0.031)	(0.031)	(0.037)	(0.038)	(0.044)	(0.066)	(0.066)
Female*Level of promotion (ref: Skilled work)								
Difficult activity		-0.148***	-0.148***	-0.049	-0.054	-0.035	-0.042	-0.038
		(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.035)	(0.035)
Very difficult activity &		0.099*	$0.099^{*}$	0.121*	$0.094^{*}$	0.006	-0.059	-0.055
Supervisory Power		(0.046)	(0.046)	(0.047)	(0.047)	(0.049)	(0.044)	(0.044)
Constant	0.548***	0.808***	0.808***	0.750***	0.788***	0.772***	1.539	1.983
	(0.012)	(0.023)	(0.023)	(0.054)	(0.055)	(0.056)	(1.137)	(1.126)
N	142,848	142,848	142,848	142,848	142,848	142,848	142,848	142,848
$\mathbb{R}^2$	0.00	0.01	0.01	0.02	0.02	0.04	0.87	0.87
Earnings growth $t_{-1}$			√	√	√	✓	√	✓
Individual controls				$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Firm specific controls					$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Occupation fixed effects						$\checkmark$	$\checkmark$	$\checkmark$
Firm fixed effects							$\checkmark$	$\checkmark$
Year fixed effects								$\checkmark$

Source: IEB 1976-2017; own calculations. DV: Relative Earnings growth =  $(earnings_{after} earnings_{before})/earnings_{before}$ ; Occupations: 3-digit level (KldB2010); Controls: Experience in part- and full-time (single and quadratic), Education (w/o A-levels and voc. training; Voc. Training w/o A-Levels; A-levels, w/o voc. training; A-levels + voc. training; University of appl. science; University), Month of tenure, Age, East/West Germany, Firm size, Share of women(male, mixed and female occupations). Sample: Persons who were promoted between 2012 and 2017 within the same occupation and the same firm before and after being promoted and who have worked in full-time before and after the promotion. Women without children and all men. Significance levels:\* p< 0.05, \*\* p<0.01, \*\*\* p< 0.001. Standard errors are clustered on the individual level.

Table 5: Effect of promotion on (relative) earnings growth, for the total sample (including part-time worker)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Female	1.291***	0.802***	0.802***	0.741***	0.748***	0.124	-0.062	-0.084
	(0.157)	(0.182)	(0.182)	(0.200)	(0.201)	(0.235)	(0.424)	(0.424)
Level of promotion (ref:	Skilled worl	k)						
Difficult activity		2.137***	2.137***	2.163***	2.122***	2.559***	1.962**	1.857**
		(0.150)	(0.150)	(0.157)	(0.160)	(0.201)	(0.611)	(0.611)
Very difficult activity &		2.253***	2.253***	2.649***	2.686***	3.371***	2.623***	2.638***
Supervisory Power		(0.286)	(0.286)	(0.305)	(0.305)	(0.397)	(0.795)	(0.797)
Female*Level of promoti	on (ref: Ski	lled work)						
Difficult activity		-1.175***	-1.175***	-1.806***	-1.820***	-1.300***	-0.945	-0.856
		(0.254)	(0.254)	(0.253)	(0.253)	(0.278)	(0.563)	(0.562)
Very difficult activity &		4.753***	4.753***	3.532***	$3.484^{***}$	2.562***	2.115*	$2.168^{*}$
Supervisory Power		(0.578)	(0.578)	(0.574)	(0.576)	(0.618)	(1.040)	(1.036)
Constant	6.202***	4.746***	4.746***	14.103***	14.247***	13.347***	0.944	13.204*
	(0.014)	(0.027)	(0.027)	(0.459)	(0.467)	(0.483)	(4.364)	(6.112)
N	84,308	84,308	84,308	84,308	84,308	84,308	84,308	84,308
$\mathbb{R}^2$	0.00	0.01	0.01	0.02	0.02	0.03	0.31	0.32
Earnings growth $t_{-1}$			√	√	1	√	√	√
Individual controls				$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Firm specific controls					$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Occupation fixed effects						$\checkmark$	$\checkmark$	$\checkmark$
Firm fixed effects							$\checkmark$	$\checkmark$
Year fixed effects								$\checkmark$

Source: IEB 1976-2017; own calculations. DV: Absolute Earnings growth =  $earnings_{after} - earnings_{before}$ ; Occupations: 3-digit level (KldB2010); Controls: Experience in part- and full-time (single and quadratic), Education (w/o A-levels and voc. training; Voc. Training w/o A-Levels; A-levels, w/o voc. training; A-levels + voc. training; University of appl. science; University), Month of tenure, Age, East/West Germany, Firm size, Share of women(male, mixed and female occupations). Sample: Persons who were promoted between 2012 and 2017 within the same occupation and the same firm before and after being promoted and who have worked in full-time before and after the promotion. Women without children and all men. Significance levels:\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001. Standard errors are clustered on the individual level.

Table 6: Effect of promotion on absolute earnings growth, for the full-time sample

	Total		Wo	men	Men	
	Mean	SD	Mean	SD	Mean	SD
			Main V	ariables		
Earnings pre-promotion	62.70	53.33	46.69	42.09	77.26	58.10
Earnings post-promotion	73.38	52.14	57.86	42.03	87.50	56.28
Relative earnings growth	1.04	10.86	0.97	6.67	1.11	13.58
Absolute earnings growth	10.86	25.31	11.17	20.83	10.24	28.78
Level of promotion						
Skilled work	0.61	0.49	0.67	0.47	0.56	0.50
Difficult activity	0.27	0.44	0.26	0.44	0.28	0.45
Very difficult activity & Supervisory Power	0.12	0.32	0.07	0.26	0.16	0.37
	Individual Characteristics					
Age	36.53	10.39	37.58	10.44	35.57	10.26
Work experience (ft)	89.45	94.29	61.60	70.83	114.77	105.21
Work experience (pt)	28.52	47.47	44.48	59.53	14.02	25.26
Tenure (months)	57.78	75.64	50.33	64.70	64.54	83.80
Share of unemployment experience	0.05	0.09	0.05	0.10	0.05	0.09
Education						
No A-level, No VT	0.09	0.28	0.07	0.26	0.10	0.30
No A-Level, VT	0.23	0.42	0.21	0.40	0.26	0.44
A-Level, No VT	0.05	0.23	0.05	0.22	0.06	0.23
A-Level, VT	0.47	0.50	0.53	0.50	0.43	0.49
Polytechnical degree	0.02	0.13	0.02	0.14	0.02	0.12
University	0.13	0.34	0.13	0.33	0.14	0.35
			Firm Cha	racteristics		
East vs. West Germany	0.20	0.40	0.20	0.40	0.19	0.39
Size of the Establishment	1775.26	6153.77	991.83	4382.69	2488.67	7334.47
Observations	$262,\!512$		125,020		137,492	

Source: IEB, 1976-2017, own calculations.

Table 7: Summary Statistics, including part-time worker

Earnings growth	$\beta$	se	$\beta$	se
Female	0.003	(0.005)	0.006	(0.006)
Level of promotion				
Difficult activity	-0.002	(0.005)	-0.001	(0.006)
Very difficult activity &	0.000	(0.006)	0.002	(0.007)
Supervisory Power				
Female*Level of promotion				
Difficult activity	-0.010	(0.006)	-0.008	(0.007)
Very difficult activity $\&$	0.009	(0.008)	0.000	(0.009)
Supervisory Power				
Previous earnings growth	0.000	(0.000)	0.000	(0.000)
Full-time experience	$-0.001^{***}$	(0.000)	$-0.001^{***}$	(0.000)
Full-time experience squared	0.000***	(0.000)	0.000***	(0.000)
Part-time experience	0.000	(0.000)	0.000*	(0.000)
Part-time experience squared	0.000*	(0.000)	0.000*	(0.000)
Unemployment work experience	0.009	(0.017)	0.005	(0.019)
Educational level (ref: No A-Lev	vels/ No VT)			
No A-Levels/ VT	0.002*	(0.004)	0.003	(0.004)
A-Levels/No VT	0.011	(0.008)	0.009	(0.008)
A-Levels/ VT	0.003	(0.004)	0.004	(0.004)
University of Applied Science	0.004	(0.007)	-0.002	(0.007)
University Degree	0.002	(0.005)	0.003	(0.005)
Tenure	0.000***	(0.000)	0.000***	(0.000)
Age at promotion	-0.001***	(0.000)	$-0.001^{***}$	(0.000)
East Germany	0.034**	(0.011)	0.036	(0.011)
Firm size	0.000	(0.000)	0.000	(0.000)
R-squared	0.548		0.553	
Ν	84,308		76,311	

Source: IEB 1976-2016; Note: Not shown: Constant, occupational fixed effects and firm fixed effects.; (I): Full-time workers, (II): Full-time working men and childless women; Significance levels: \* p< 0.05, \*\* p<0.01, \*\*\* p< 0.001. Standard errors are clustered at the individual level.

Table 8: Effect of promotion on (relative) earnings growth, for the full-time sample, full regression