Gender Earnings Gap in German Firms: The Effect of Firm Characteristics and Institutions

Anja Heinze and Elke Wolf
Centre for European Economic Research (ZEW Mannheim)

Very preliminary results – please do not quote

Abstract

The gender earnings differential is an intensely studied issue in labor economics. Most studies analyze gender pay differentials by focusing primarily on the differences in the wage-determining characteristics of men and women and how these characteristics are rewarded. However, most existing analyses have neglected the establishment as a place where the inequality between male and female arise and is maintained. The availability of linked employee-employer data permits us to move beyond the individual and consider the importance of the workplace to explain gender pay differentials. That is, we first provide a comprehensive study on the effect of various firm characteristics and the institutional framework on the gender wage gap in Germany. The innovation of our research is that we do not just compare average male and female wages (of specific groups of employees), but look at within-firm gender wage differentials. To do so, we use measures to describe the firm specific gender wage gap. First we use the observed gender wage gap and second a wage gap, which is adjusted for the differences in human capital characteristics between men and women within establishments.

Our results indicate that the mean gender wage gap within firms is smaller than the mean overall gender wage gap. Furthermore we can show that firms with formalized co-determination (works councils) and those covered by collective wage agreements are more likely to have smaller gender earnings gaps. It is also interesting to note that the wage differential between men and women increases with the firms size and the wage level.

1. Introduction

The gender earnings differential is an intensely studied issue in labor economics and other social sciences. Most studies analyze gender pay differentials by focusing primarily on the differences in the wage-determining characteristics of men and women and how these characteristics are rewarded. Differences in the return to specific human capital measures are generally denoted as discrimination and not analyzed further more. The idea that firms play an important role in creating and maintaining gender inequality by the way they define and reward jobs as well as by their recruiting practices, became more and more popular during the last decade (see e.g. Baron, 1984; Acker, 1990, 1992). According to their approach, firms are no sex-neutral organizations. Looking closely at the design of work processes, pay systems, internal qualification activities and firm philosophy often reveals the firm's image of male and female employees and it's attitude towards equality. While it is well accepted that firm characteristics affect the wage level as well as the wage distribution (see e.g. Davis and Haltiwanger, 1991; Bronars and Famulari, 1997; Abowd, Kramarz and Margolis, 1999), most empirical studies do not examine how wage policies and the institutional environment affect the gender earnings differentials within firms.

The goal of our research is to move beyond the individual and consider the importance of the workplace to explain gender pay differentials. The empirical analysis is based on the German LIAB data, a representative linked employee-employer panel including information on all employees of firms covered by the establishment survey. The LIAB merges annual survey data (the IAB-establishment panel) and process generated individual data (the Employment Statistical Register of the IAB, which is based on administrative social security records).

There already exists some studies analyzing the effects of firm-specific characteristics on the gender wage gap based on linked employee-employer data for other countries. Reilly and Wirjanto (1999) as well as Datta Gupta and Rothstein (2001) include both person- and establishment-level information to point out the effect of segregation on the gender wage gap in Canada and Denmark. Drolet (2002) investigates how much of the Canadian pay gap can be attributed to specific workplace characteristics, such as high-performance workplace practices or training expenditures. Datta Gupta and Eriksson (2004) analyze the relationship between new workplace practices and the gender wage gap. Meng (2004) and Meng and Meurs (2004) extend the traditional decomposition of the observed gap in an endowment and a remuneration effect to an additional firm effect. In this setting, the firm effect represents the difference between the firm's premium paid to male and female employees and can be

interpreted as discrimination. In a second step, the impact of firm characteristics on the gender wage differential denoted as discrimination is determined.

The innovation of our research approach is that we do not just compare average male and female wages (of specific groups of employees), but look at within-firm gender wage differentials. The aim of our study is to analyze explicitly the impact of human resource policies and the institutional framework on the gender wage gap *within* establishments. Given the rich information on the establishments in our survey, we can control for many other firm characteristics. To investigate the theoretical hypotheses regarding the effect of human resource practices and institutional characteristics on wage inequality, we define two alternative measures describing the firm-specific gender wage gap. First, we use the observed wage gap as the difference between the mean wages of males and females within a firm. One important factor explaining this observed wage are difference in human capital and other labor market relevant characteristics of the employees. As a second measure, we therefore calculate a wage gap under the assumption that male and female employees would have the same characteristics within each firm. Using these two measures for the gender wage gap as dependent variable in the second step, we can determine the impact of firm characteristics, wage policies and the institutional framework on the wage inequality within firms. Based on our results, we provide new insights into the nature and the sources of gender wage inequality in Germany.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical background of our empirical analysis. The econometric methodology is expounded in Section 3. Section 4 describes our data source and in the following section the preliminary results are presented. We close our paper with a short conclusion and a list of planned extensions.

2. Theoretical Background

So far, there exists no theory which explicitly deals with gender wage difference within firms. However, hypotheses about the impact of selected firm characteristics or institutional settings on wage inequality within firms can be derived from deliberations in other theories like collective bargaining models or the model of employer discrimination (Becker 1957).

According to the discrimination model gender earnings differentials may be attributed to two sources. First, differences in labor productivity between men and women and second, direct

discrimination by employers, employees and customers against women. As Gary Becker himself puts it:

If an individual has a "taste for discrimination", he must act as if he were willing to pay something, either directly or in the form of a reduced income, to be associated with some persons instead of others. When actual discrimination occurs, he must, in fact, either pay or forfeit income for this privilege. This simple way of looking at the matter gets at the essence of prejudice and discrimination.(p. 14)

Employers with "taste of discrimination" against women will hire fewer than the profit-maximizing number of women and consequently employ more men who are equally skilled yet more highly paid. However, in a competitive market discrimination it is costly to employers and restricts their scale and profitability. Hence, Arrow (1973) and Cain (1986), among others, argue that under strong product market competition firms may not be able to afford discrimination and will therefore behave more egalitarian. This hypothesis can be tested by variables describing the competition in the market, such as the affiliation of the firm to the public or private sector. According to Becker's model we would expect that the gender wage is larger for organizations in the public sector. Note however that the establishments in the public sector tend to sensitive to public relations and to their image. Due to public pressure, the gender wage gap in the public sector might be smaller than Becker's model would suggest (Cain 1986). Alternatively, we want to test Becker's model by a variable describing the export quota of the firm. The idea is that firms operating on the world market are more subject to competition than the firms operating only on the local or national market. Hence, exporting firms are more likely to pay male and female workers the value of their marginal products.

Another hypothesis derived from Becker's model is that employers who hire more women are be expected to have less prejudice against women and hence are more likely to pay equal wages to men and women. In order to examine this point we include the percentage female employees in total employment. (ENDOGEN????)

Perhaps one of the most important factors influencing wage determinants within firms is whether wages are subject to collective bargaining or not (Elvira and Saporta 2001). While the overall impact of unions on the gender wage gap is not obvious, collective bargaining models provide several reasons for arguing that collective agreements tend to reduce the gender wage gap within organizations. First of all, it is argued that unions generally reduce the wage dispersion among employees covered by the same collective bargaining agreement,

especially those working in the same occupation (Freeman and Medoff 1984). As a consequence, unionization should reduce the gender wage gap for women performing the same activity as male colleagues in the same firm. Furthermore Freeman (1980) exposes that unions tend to reduce the wage differentials within and across establishments regardless of occupation by setting fixed wage levels for specific jobs[1]. Therefore, the gap between segregated female and male jobs also narrows.

Cornfield (1987) points out that in the case of layoffs bureaucratic rules consequently reduce the potential of discrimination. Elvira and Saporta (2001) apply the same logic to the wage setting process. They argue that the management of unionized firms are more likely to adhere to such bureaucratic wage setting rules, reducing the arbitrariness in wage rates and generating more predicable wages for male and female employees. That way the potential of discrimination and the gender wage gap are reduced.

Finally it is conceivable that unions actively aim at reducing the gender wage gap, because more and more women become unionists and get involved in the policy of unions. Despite the increasing importance of women, they still represent a minority among the members in Germany[2] (Koch-Baumgarten 2002). As a consequence some unions have adopted pay equity as a strategic policy goal. Regardless of the motivation, such pay equity policies would raise the wage in mostly female jobs relative to predominantly male, thereby narrowing the gender gap jobs (Acker 1989).

In order to examine the effect of unionization on the gender wage gap we include variables describing whether a firm applies collective agreements or not. More precisely, we distinguish between industry-wide collective wage agreements, firm-specific collective wage agreements as well wage determination without collective bargaining coverage. Industry-wide collective wage agreements are negotiated between and industry-specific union and employers' association. The wage rates set by collective agreements are legally binding for all firms being members of respective employers' association. Note in Germany the employers do not differentiate between unionists and non-unionists because non-unionized employees who would receive a lower wage may expected to join the union anyway in order to benefit from higher union wage. The firm-specific collective wage agreements are negotiated between an individual firm and the sector-specific trade union. Those agreements

---

[1] That means, „uniform piece or time rates among comparable workers across establishments and impersonal rates or ranges of rates in a given occupational class within establishments". (Freeman, 1980, p.4)
[2] Among the members of the Federation of German Trade Unions (umbrella organization of all unions), the DGB, in 1999 30.4% are female.

should offer more flexibility to adjusting the wage structure to firm's requirements than industry-wide collective wage agreements[3].

Furthermore, not only collective wage contracts, but also works councils affect wage distribution within firms (Hübler and Jirjahn 2003). By the rights of co-determination works councils can negotiate about the placing of workers in higher wage groups. Therefore, we control also for existence of works councils in firms. In general employees' representations follow up the aim of reducing inequality among employees within firms. As a result, the existence of works council should counteract wage inequality within firms. More differentiated hypotheses can be derived from the Insider-Outsider theory (Lindbeck and Snower 1988). According to this approach, works councils act in favor of the majority of the workforce while interests of the fringe group are neglected. This implies that works councils foster equal treatment of male and female employees in firms with high female quota rather than in male dominated firms. Therefore the effect of employees' representation on the gender wage gap is not unambiguous.

To control for firm heterogeneity with respect to industry and region, we also include a set of dummy variables.

3. Methodology

In the study we examine the interaction between firm characteristics, wage policy, institutions, market effects and gender specific earnings inequality on the firm level. This empirical analysis of the gender wage differential within firms is only feasible with linked employee-employer data.

To investigate the theoretical hypothesis we define two measures reflecting the degree of wage inequality within a firm. First we use the observed wage gap:

(1) $Gap1_j = \overline{\ln w_{ij}^m} - \overline{\ln w_{ij}^f}$

where w_{ij} denotes the earnings for individual i at firm j; superscripts m and f refer to male and female observations. The source of observed wage gaps can be manifold. On the one hand male and female employees differ in regard to their human capital endowment and other labor market relevant characteristics. On the other hand the endowments of men and women are remunerated differently. As a second measure, we therefore calculate a wage

---

[3] In recent years, contractual opting-out clauses or hardship clauses have become a widespread element of central agreements. In general the adoption of such clauses requires the approval of collective bargaining parties (Hassel 1999)

gap under the assumption that men and women would have the same characteristics within a firm:

$$(2) \quad Gap2_j = \left(\overline{\ln w_{ij}^m} - \overline{\ln w_{ij}^f} \right) - \left(\hat{\beta}_j^m \overline{X_{ij}^m} - \hat{\beta}_j^m \overline{X_{ij}^f} \right)$$

where X_{ij} includes characteristics of the individual i at firm j and β_j^m is a vector of wage coefficients of the individual characteristics X_{ij} in firm j. Hence, Gap2 reflects the difference in the valuation of individual characteristics and unobserved effects between male and female employees within each firm j. The calculation requires the estimation of wage equations for male employees only. In order to allow for heterogeneity and complexity of the wage setting process we estimate separate wage equations for each firm:

$$(3) \quad \ln w_{ij}^m = \beta_j^m X_{ij}^m + \varepsilon_{ij}^m$$

The dependent variable describes the daily log wage rate. X_{ij}^m include potential experience (squares), dummy variables for different education levels, dummy variables for the occupational status and dummies for different groups of occupations. In order to make sure that our wage estimations are reliable we only take into account firms with more then hundred male employees.[4] Unobserved heterogeneity among individuals is supposed to be captured by the individual effect resulting from panel estimation (subscript t is ignored in all equations for reasons of simplicity). We assume the individual effect to be constant over time and model it as a random effect. The random effect estimation technique provides consistent results as long as the unobserved effect is not correlated with the explaining variables in X_{ij}.

Given the results of equation 3 , we can calculate Gap2 which describes the gender wage gap within firms assuming that men and women had the same individual labor market characteristics. Note however that there might be a discriminating element in the selection of employees such that observed characteristics of employees as well as estimated coefficients are not distributed randomly across firms.[5]

Using these two measures for the firm-specific wage differential as dependent variable allows us to analyze the effect of firm characteristics and institutional framework on the wage inequality within firms. The observed (Gap1) and the gender wage gap, that is adjusted for the difference in human capital characteristics between male and female employers (Gap2) is assumed to depend on the vector

---

[4] To check the sensitivity of our results, we will also run wage equations for different groups firms (by sector, firms size or bargaining regime)

(4) $\quad GapK_j = \gamma Z_j + \varepsilon_j, \qquad K = 1,2$

Z_j including firm characteristics and information to the institutional framework of firm j. γ captures the impact if the corresponding explanatory variables. As mentioned in Section 2, the set of explaining variables is derived from several theories. To investigate the hypotheses derived from Becker's discrimination model, we use the export quota, affiliation to the public or private sector and the proportion of female employees. Implications from the collective bargaining model might be checked by variables like application of collective wage agreements and existence of a works council. Other than the mentioned variables we use also some control variables such as industry and firm size. Again we apply a random effect model to control for firm specific heterogeneity.

4. Data

The present analysis of the effect of firm characteristics and institutional framework on the wage inequality within firms requires individual and firm information. For that reason we use a representative German employer-employee linked panel data set. This data set is constructed by merging the IAB-establishment panel and the employment statistic of the German Federal Services based on a unique firm identification number. The IAB establishment panel is an annual survey of Germany establishments, which started in West-Germany in 1993 and was extended to East Germany in 1996.[6] The data is collected by personal interviews with the owners or senior managers of smaller establishments and personnel managers in larger establishments. It is performed by specially trained professional interviewers from a well-known market research institute. As far as possible, the survey is carried out by the same interviewer and interviewee each year. This procedure helps to reduce panel attrition to less than 20% per year.[7] In order to keep the panel representative and correct for panel mortality, exits, and newly-founded units, additional establishments are drawn each year, yielding an unbalanced panel. These additional establishments are stratified with respect to ten categories of establishment size and 34 economic sectors. This procedure ensures a response rate above 70 % which is high compared with other non-official German establishment panel studies (Kölling, 2000). The

---

[5] In order to correct for this selection we have to estimate employment probabilities (Datta Gupta, 1993). Due to the lack of information on the household context and the individual background, it is difficult to implement this procedure which requires convincing exclusion restrictions.

[6] Detailed information on the IAB-establishment panel is given by Kölling (2000).

[7] The establishments are first approached by a letter indicating the goals of the survey. This letter is accompanied by separate letters of recommendation by the president of the Federal Employment Services and the leader of the

sample unit is the establishment as the local business unit. The establishments asked in the enquête are selected from the parent sample of all German establishments that employ at least one employee covered by social security. Thus, self-employed and establishments that employ only people not covered by social security (mineworkers, farmers, artists, journalists, etc.) as well as public employers with solely civil servants do not belong to the original sample. The data set is a representative sample of German establishments employing at least one employee who pays social security contributions.[8] The establishments covered by the survey have been questioned every year about turnover, number of employees, personnel problems, industrial relations, wage policies, apprenticeship training, investments, innovations, and business strategies. From time to time, additional topics, such as training and personnel measures, were added to the questionnaire. .

The employment statistic of the German Federal Services, so-called Employment Statistics Register, is a administrative panel data set of all employees in Germany paying social security contributions.[9] The Employment Statistics are collected by the social insurance institutions for their purposes according to a procedure introduced in 1973. These data cover the period between 1975 and 2002, that is, every person who was employed for at least one day from 1975 to 2002 and/or with claims to pension benefits is included.[10] During this time, social security contributions were mandatory for all employees who earned more than a lower earnings limit. Civil servants, self employed and people with so-called marginal jobs, that is, jobs with less than 15 hours per week or temporary jobs which last 6 weeks at most, are not covered by this sample. Altogether, the Employment Statistics Register represents about 80 percent of all West German employees. According to the statutory provisions, employer have to report information for all employed contributor at the beginning and end of their employment spells. In addition an annual report for each employee is compulsory at the end of a year. This report contains information on an employee's occupation, the occupational status, qualification, sex, age, nationality, industry and the size of the employer. Also the available information on daily gross earnings refers to employment spells that

German employer's association. Some weeks after this announcement letter, the establishment is contacted by telephone in order to arrange an individual appointment for the interview.

[8] Note, about 80% of all employed persons in Germany are covered by the social security system.

[9] Information on the Employment Statistics Register is given by Bender, Haas and Klose (2000)

[10] These are people who, as employees, have paid contributions to the pension system or who have been covered by the pension system through contributions by the unemployment insurance or by being a parent (depending on the birth year of the child, a fixed number of years is counted as child caring time during which the non-working parent becomes entitled to receive pension benefits).

employers report to the Federal Employment Service.[11] If the wage rate exceeds the upper earnings limit ("Beitragsbemessungsgrenze"), the daily social security threshold is reported instead.[12] Note that the daily wage rate is therefore censored from above – mostly relevant for men – and truncated from below, which concerns women's wages in particular.

Both data sets contain a unique firm identifier which is used to match information on all employees paying social security contributions with the establishment in the IAB-establishment panel. We restrict our sample to West German establishments who participated in the IAB-establishment panel in at least two years from 1997 to 2001. East German firms are not considered in the analysis, because both the wage level as well as the wage setting process is still very different and therefore a common investigation of both regions would not be very meaningful.[13] We exclude firms which employed only women or only men because the gender wage gap is not observable in these organizations. To guarantee the reliability of our estimation results, we consider only establishment with at least 100 full-time employed German males subject to social insurance contributions with an age between 20 and 60 years.

The following table shows the number of firms as well as their male and female employees in each year which enter the wage estimations. The number of different firms entering our estimation is 1600. The table also includes information about the average gender wage gap within firms and the gender wage gap over all employees in the sample. Apart from 2001, the overall wage gap amounts to more than 20% whereas the wage differential within firms is about 2 percentage points lower. The difference between these two measures of gender wage differentials indicates that women tend to select into lower paying firms. This segregation process does not seem to be very important, though.

Table 1: Description of the sample and the gender wage gap

year	Number of firms	Number of male employees	Number of female employees	Within-firm gender wage gap (in logarithm)	Overall gender wage gap (in logarithm)
1997	893	639,402	208,733	0.18699	0.21357
1998	1032	672,771	215,610	0.19355	0.21004

---

[11] To deal with the problem of overlapping spells, we apply a hierarchical order of activities where employment trumps all other activities.

[12] Fitzenberger and Wunderlich (2000) show that this affects particularly the wage rate of high-skilled employees. According to their results, about 50 percent of high-skilled men earn wages above the upper earnings limit. Among high-skilled full-time females, this share amounts to at least 20 percent.

[13] A separate analysis for East Germany is not possible due to the small number of firms with enough male employees.

1999	1024	614,844	202,190	0.18807	0.20524
2000	1265	658,724	206,300	0.18572	0.20004
2001	1143	604,638	192,684	0.18218	0.18809

Note: The results refer to firms with at least 100 male employees.

Source: own calculation; LIAB-Data 1997-2001

As mentioned above, the wages are reported up to the social security contribution limit. In order to avoid biased estimation results we impute censored wages with estimated wages. The wages are estimated with a Tobit-model, where individual characteristics from the Employment Statistics Register, such as qualification, region, industry, etc. are used as variables explaining the censoring (for more details see Gartner 2004).

Table 2 shows some descriptive statistics on the relationship of same firm characteristics and the gender wage gap within firms. The results indicate that establishments covered by industry-wide wage or firm-specific wage agreements pay more equal wages to men and women than establishments without any collective wage agreements. Accordingly, the existence of a works council tends to reduce the within gender wage gap. It is interesting to note that the share of female employees is differently correlated with Gap1 and Gap2. Since Gap1 includes the wage gap caused by differences in the human capital endowment of men and women, it is rather obvious that the correlation in positive in this case. The result reverses once differences in observed characteristics are taken into account. That is, establishments employing comparatively many women seem to provide more equality among men and women than those with a small share of female workers.

Table 2: Correlation between Gap1 respectively Gap2 and selected firm characteristics

Variables	Raw Gender Wage Gap (Gap1)	Adjusted Gender Wage Gap (Gap2)
Number of employees	-0.061	-0.175
Export quota (in % of all sales)	-0.013	0.186
Female quota (in % of all employees)	0.275	-0.397
Industry-wide wage agreement	-0.048	-0.059
Firm-specific wage agreement	-0.056	-0.037
Works council	-0.067	-0.186
Wage bill per employee	0.031	0.061
Public sector	-0.009	-0.328

Note: The results refer to firms with at least 100 male employees.

Source: own calculation; LIAB-Data 1997-2001

In the appendix, we present the summary statistics of all variables entering the wage estimation and the gender wage gap estimation.

5. Results

To calculate the within-firm gender wage gap under the assumption that male and female employees had the same characteristics within each firm (Gap2), we first have to determine wage estimates for all establishments in our sample. That is, we estimate 1600 random effects wage equations and use the firm-specific wage coefficients to determine Gap2. We suppose that the individual wage rate is determined by potential experience, the education level, the occupation as well as the occupational status. Table 3 provides a summary of the estimation results. Column 1 describes the number of the observations for each characteristic. Note, that some characteristics are missing, such that specific coefficients can not be determined in some firms. The second column presents the mean of the estimated coefficients of the firm-specific wage estimations and column 3 shows that corresponding mean of the estimated t-values. Furthermore the table includes the standard deviation of the estimated coefficients to illustrate the range of the estimated coefficients across firms (see column 4). The last column includes a quotient between the standard deviation of the coefficients and corresponding mean as absolute value. The results show the relative variation of coefficients across the firms. High values of this quotient indicate that the variation of specific coefficients is small. Small values are signaling moderate heterogeneity of wage returns to the corresponding characteristic across firms.

Table 3: Coefficients of the Random effects wage estimations

Coefficients	Number of Obs. (1)	Mean of the coefficients (2)	Mean of the t-value (3)	Standard deviation of coefficients (4)	Quotient (4)/(2)
Potential experience	1600	0.026	9.398	0.014	0.524
(Potential experience)^2/100	1600	-0.046	-7.954	0.025	0.553
Job tenure	1600	0.000	5.192	0.000	1.5
Low education without vocational training	1059	-0.179	-3.324	0.189	1.056
Vocational training	1570	-0.047	-1.294	0.180	3.807
Second. school (with and without vocational training)	826	0.021	-0.071	0.239	11.473

Collage of higher education or university	1119	0.251	-1.294	0.195	0.779

.... Table 3 continued

Unskilled blue-collar worker	908	-0.146	-4.033	0.147	1.011
Skilled blue-collar worker /master craftsman	1001	-0.012	0.045	0168	14.551
White-collar worker	1060	0.153	0.060	0138	0.907
Simple manual occupations	1240	-0.129	-1.466	0.271	2.108
Skilled manual occupations	1411	-0.088	-1.041	0.273	3.088
Technicians	1370	0.005	0.141	0.257	47.718
Engineers	1123	0.096	1.030	0.276	2.889
Service occupations	1329	-0.138	-1.593	0.283	2.045
Semiprofessions and professions	659	0.094	0.848	0.290	3.004
Office and administrative occupations	1530	-0.016	-0.177	0.260	16.40
Managers	1043	0.203	2.074	0.278	1.368
Other occupations	398	-0.230	-1.908	0.355	15.441

Note: The first column contains the number of different estimated coefficients. The next two columns show the means of the estimated coefficients and the t-values over all wage equations. The last column presents the standard deviation of the estimated coefficients from the mean coefficient of all firms. The last column includes a quotient between the mean of the coefficients and the corresponding standard deviation as absolute values.

Source: own calculation; LIAB-Data 1997-2001

The means of the estimated coefficients show that the variables have the expected effect on the wage. For instance the wage rates increase with the education level and experience on average as well a white collar worker earns more than a blue collar worker. The second column expose that the coefficients of the some occupation dummies are not significant on average. This could be due to few observations of some occupations within firms or due to small wage differentials between occupational groups within a firm. The last column in table 3 points out that estimated coefficients for the dummy variables of occupations vary highly while the coefficients for experience do. In consideration of the high varying coefficients, the wage estimation in each firm seems to be necessary to determine the correct remuneration of the characteristics.

As mentioned in Section 2, the estimated coefficients are used to calculate the adjusted gender wage gap, Gap2. In order to derive conclusions on the impact of firm characteristics

and the institutional framework on the gender wage gap, we regress firm characteristics on the raw wage gaps (Gap1) and on the adjusted wage gaps (Gap2). We use the export quota, sector affiliation and the firm size to test whether firms with market power discriminate more and have so a higher gender wage gap or not. In order to check the hypothesis that collective wage agreements entail smaller gender wage gaps we distinguish between industry-wide, firm-specific and no wage agreement. Furthermore we use the wage bill per employee to control for difference between high and low wage firms. Table 4 shows the results of two very preliminary estimations where the control variables region, industry and year dummies are not presented here.

Table 4: Determinates of the firm-specific gender wage gap

Variables	GAP1		GAP2	
	Coefficients	Standard Errors	Coefficients	Standard Errors
Number of employees	-3.44E-06	1.94E-06	-7.90E-06	1.59E-06
(Number of employees)^2/10000	7.99E-07	6.67E-07	1.42E-06	5.50E-07
Wage bill per employee/10000	0.0259	0.0082	0.0132	0.0069
Export quota (in % of sales)	0.0001	0.0001	0.00002	0.0001
Female quota (in % of all employees)	0.1155	0.0119	-0.0703	0.0098
Female part-timer (in % of all female employees)	0.0389	0.0081	0.0217	0.0068
Works council	-0.0172	0.0096	-0.0283	0.0080
Industry-wide wage agreement	-0.0126	0.0050	-0.0108	0.0042
Firm-specific wage agreement	-0.0106	0.0055	-0.0128	0.0046
Public sector	-0.0405	0.0067	-0.0300	0.0055
Observations	4332		4332	
R^2	0.2087		0.2918	

Note: The dummy variables for the years, regions and industry are also included in the estimation. The results are available on inquiry.

Source: own calculation; LIAB-Data 1997-2001

The results show a negative relation between the number of employees and the gender wage gap, which is contrast to Becker's hypothesis that large firms can afford more discrimination due to their superior market power. However, the assumption about the market power of large firms could be too simple. Considering, that large firms are more in the focus of public and suppose that the public pressure tends to lower the gender wage gap then the negative coefficients become plausible. The larger effect of firm size on the adjusted gender wage could support this explanation. This indicates the smaller potential to remunerate equal

characteristics differently in large firms due to public pressure. Another reason for the reused gender wage gap in large firms may be the fact, that male and female employees in large firms are more likely to work in comparable job positions (unless jobs are not fully segregated). In this case it is more difficult to enforce different wage rates for equal jobs because employees can easily compare their wage rates and tasks.

In contrast to the hypotheses of Becker's model, the public sector tends to have smaller wage gender wage gaps than the private sector. As mentioned in Section 2, the reason for this result could be related to the employment relationship which is more stamped by the trend of equal treatment of all employees in the public sector. The export quota, which may also be interpreted as the degree of market competition has no significant impact on Gap1 or Gap2.

It is interesting to note that the controversial results of the share of female employees found in Table 2 still holds after controlling for other firm characteristics. The positive impact on the raw wage gap is coherent because Gap1 includes the wage gap caused by differences in the human capital endowment of men and women. Gap2 is adjusted by the differences in observed characteristics. The regression on this measure shows that establishments employing comparatively many women seem to provide more equality among men and women than those with a small share of female workers. This result is in line with the hypothesis derived from Becker's theory. [However a causal interpretation should not be formulated on the basis of this variable because the share of female workers within a firm could be endogenous.]

The significant positive coefficients of the wage bill per employee in both regressions expose that the gender wage gap is higher in high wage firms. Possibly a kind of glass ceiling effect could be an explanation. In particular in a high wage firms male employees have the highest paid jobs while females work in low paid positions. In the regression of Gap2 which control for different jobs the effect is smaller but is still significant

The regression results also indicate that the industrial relations as well as the wage bargaining regime are linked to the gender wage gap. As the collective bargaining model suggests, firms under collective agreements tend to have lower pay gaps between males and females than those without wage agreements. The results on the effect of alternative wage bargaining regimes are somewhat puzzling, though. Industry-wide wage agreements have larger effects on the raw wage gap than firm-specific wage agreements. Using Gap2 as dependent variable reverses this result. However, a Wald test indicates in both estimations

that the null hypothesis $\gamma_{industry} = \gamma_{firm-specific}$ cannot be rejected at conventional levels[14]. As firm-specific contracts are generally concluded by sector-specific unions, one possible explanation might be that a considerable fraction of firm-specific contracts simple adopts wage bargains negotiated in the corresponding industry agreement to lower transaction costs.

Furthermore, works councils also have a significant negative impact on Gap1 and Gap2. It seems that employees' representations foster equal treatment of male and female employees within firms.

6. Conclusions and future work

By this analysis we provide the first comprehensive study on the effect of various firm characteristics and the institutional framework on the gender wage gap in Germany. The goal of our research is to move beyond the individual and consider the importance of the workplace to explain gender pay differentials. The empirical analysis is based on the German LIAB data, a representative linked employee-employer panel including information on all employees of firms covered by the establishment survey. The data allows for not just comparing average male and female wages (of specific groups of employees), but also for looking at within-firm gender wage differentials. To do so, we use measures to describe the firm specific gender wage gap. First we use the observed gender wage gap and second a wage gap, which is adjusted for the differences in human capital characteristics between men and women within establishments. In order to calculate the second measure we estimate wage equations for male employees in each firm separately.

Our results indicate that the mean gender wage gap within firms is smaller than the mean overall gender wage gap. Furthermore the findings indicate that the hypotheses derived from different theories explain in parts gender wage gaps within firms. The "personal taste" hypothesis of Becker's model predicts that stronger market competition will tend to reduce gender earnings differentials. The "collective bargaining" hypothesis predicts that firms under collective agreements should exhibit a narrower gender pay gap. In this study we cannot really support the hypothesis of Becker's model but the "collective bargaining" hypothesis. The results indicate that firms with formalized co-determination (works councils) and those covered by collective wage agreements are more likely to have smaller gender earnings gaps.

---

[14] The p-values are 0.6364 for the raw wage gap and 0.5739 for the adjusted wage gap.

However the existing results are still very preliminary. In the next step we will test other wage estimation designs. To improve the robustness of our wage estimates, we will pool certain firms to different groups by industry and/ or size assuming that these firms will have similar wage equations. Thereby we may be improving robustness of our wage estimation results which could affect our wage gap estimation. Furthermore we want to test the effect of additional explanatory variables in the gap estimation, such as like organizational changes or other personal policies.

References

Abowd, J. M., Kramarz, D. und D. N. Margolis (1999): High Wage Workers and High Wage Firms, *Econometrica*, Vol. 67(2), 251-333.

Acker, J. (1989): *Doing comparable worth: Gender, class, and pay equity*, Temple University Press, Philadelphia.

Acker, J. (1990): Hierarchies, Jobs, Bodies: A Theory of Gendered Organizations, *Gender & Society 4*, 139 – 158.

Acker, J. (1992): Gendering Organizational Theory, in Mills, A. J. und Tancred, P. (Hrsg.): *Gendering Organizational Analysis*, Newbury Park, London, 248 – 260.

Arrow, K.J. (1973): The theory of discrimination, In O. Ashenfelter (ed.), *Discrimination in labor markets*, 3-33, NJ: Princeton University Press, Princeton.

Baron, J. N. (1984): Organizational Perspectives on Stratification, *Annual review of sociology*, Vol. 10, 37 – 69.

Becker, G.S. (1957): *The economics of discrimination*, University of Chicago Press, Chicago.

Bender, S.; A. Haas and C. Klose (2000): IAB Employment-Subsample 1975-1995. Opportunities analysis provided by the anonymised subsample, *IZA Discussion Paper*, No.117, IZA, Bonn.

Bronars, S. G. und M. Famulari (1997): Wage, Tenure, and Wage Growth Variation Within and Across Establishments, *Journal of Labor Economics* , Vol. 15(2), 285 – 317.

Cain, G.G. (1986): The economic analysis of labor market discrimination: A survey, In O. Ashenfelter and R. Layard (ed.), *Handbook of labor economics*, 693-785, Amsterdam: North- Holland.

Cornfield, D.B. (1987): Ethnic inequality in layoff chances: The impact of unionization on layoff procedures, In R.S. Lee (ed.), *Redundancy, layoffs, and plant closures: Their character, causes and consequences*, 116-140, Croom Helm, London.

Datta Gupta, N. (1993): Probabilities of job choice and employer selection and male-female occupational differences, *American Economic Review* 83(2), 57-61.

Datta Gupta, N. and D.S. Rothstein (2001): The impact of worker and establishment-level characteristics on male-female wage differentials: Evidence from Danish matched employee-employer data, *CLS Working Paper*, 01-09, Aarhus.

Datta Gupta, N. and T. Eriksson (2004): New workplace practices and the gender wage gap, *Working Paper*, 04-18, Aarhus.

Davis, S. J. und J. Haltiwanger (1991*): Wage Dispersion Between and Within US Manufacturing Plants, 1963 – 1986, *Brookings papers on economic activity*, 115 – 180.

Drolet, M.(2002): Can the workplace explain Canadian gender pay differentials? *Canadian Public Policy*, Supplement May 2002, Vol. 28, S41-S63.

Elvira, M.M and I. Saporta (2001): How does collective bargaining affect the gender pay gap? *Work and Occupation*, Vol. 28, No. 4, 469-490.

Fitzenberger, B. and G. Wunderlich (2000): Gender Wage Differences in West Germany: A Cohort Analysis, *ZEW Discussion Paper No. 00-48*.

Freeman, R.B. (1980): Unionism and the dispersion of wages, *Industrial Labor Relations Review*, Vol. 34, No.1, 3-23.

Freeman, R.B. and J.L. Medoff (1984): *What do unions do?* Basic Books, New York.

Gartner, H. (2004): The imputation of wages above the contribution limit with the German IAB employment sample, *Technical Working Paper*, IAB, Nuremberg

Hassel, A. (1999): The erosion of the German system of Industrial Relations, *British Journal of Industrial Relations,* Vol.37, 483-506.

Hübler, O. and u. Jirjahn (2003): Works councils and collective bargaining in Germany: the impact on productivity and wages, *Scottish Journal of Political Economy*, Vol. 50, 471-491.

Koch-Baumgarten, S. (2002): Changing Gender Relations in German Trade Unions: From the Worker Patriarchy to Gender Democracy in the Network Union? In: Colgan, Fiona and Ledwith, Sue (Eds.): *Gender, Diversity and Trade Unions*, International Perspectives, London, p.132-153.

Kölling, A. (2000): The IAB establishment panel, *Applied Social Science Studies*, Vol. 120, Nr. 2, 291-300.

Lindbeck, A. und D. Snower (1988): *Cooperation, Harassment and Involuntary Unemployment: A Insider-Outsider Approach*, American Economic Review, 78(1), 167-188

Meng, X. (2004): Gender earnings gap: the role of firm specific effects, *Labour Economics,* Vol. 11, 555-573.

Meng, X. and D. Meurs (2004): The gender earnings gap: effects of institutions and firms – a comparative study of French and Australian private firms, *Oxford Economic Papers*, Vol. 56, 189-208.

Reilly, K.T. and T.S. Wirjanto (1999): Does more less? The male/female wage gap and proportion of females at the establishment level, *Canadian Journal of Economics*, Vol.32, No.4, 906-929.

Appendix

Table A1: Summary statistic of individual characteristics (pooled over 1997-2001)

Variables	Males		Females	
	Mean	Std. Dev.	Mean	Std. Dev.
log wage	4.629	0.306	4.425	0.302
low education without vocational training	0.121	0 .326	0.171	0.377
vocational training	0.690	0.462	0.636	0.481
second. school (with and without vocational training)	0.048	0.213	0.109	0.312
collage of higher education or university	0.141	0.348	0.0837	0.277
potential experience	22.153	9.680	19.996	10.738
(potential experience)^2/100	5.845	4.477	5.151	4.687
job tenure	4251.866	2862.121	3552.448	2688.475
unskilled blue collar worker	0.254	0.435	0.191	0.393
skilled blue-collar worker /master craftsman	0.325	0.468	0.027	0.163
white-collar worker	0.421	0.494	0.781	0.413
simple manual occupations	0.246	0.431	0.134	0.340
skilled manual occupations	0.209	0.407	0.039	0.194
technicians	0.102	0.303	0.046	0.209
engineers	0.078	0.268	0.015	0.122
service occupations	0.118	0.322	0.087	0.281
semi professions and professions	0.033	0.179	0.127	0.333
office and administrative occupations	0.183	0.386	0.539	0.498
managers	0.025	0.156	0.0113	0.106
other occupation	0.006	0.078	0.002	0.050
Observations	3190379		1025517	

Source: own calculation; LIAB-Data

Table A2: Summary statistic of firm characteristics (pooled over 1997-2001)

Variables	Mean	Std. Dev.
raw gender wage gap (Gap1)	0.187	0.116
adjusted gender wage gap (Gap2)	0.173	0.099
agriculture and forestry; electricity, gas and water supply, mining	0.038	0.190
manufacturing I	0.174	0.379
manufacturing II	0.356	0.479
construction	0.027	0.163
wholesale and retail trade	0.048	0.214
transport and communication	0.038	0.192
financial intermediation	0.074	0.262
real state, renting and business activities	0.030	0.170
education	0.019	0.137
other service activities	0.102	0.302
public sector	0.202	0.401
number of employees	1321.849	2379.078
wage bill per employee/10000	0.513	0.147
female quota (in % of all employees)	0.307	0.2120
female part-timer (in % of all female employees)	0.228	0.165
industry-wide wage agreement	0.816	0.387
firm-specific wage agreement	0.108	0.310
no wage agreement	0.076	0.264
works council	0.965	0.185
Berlin-West	0.059	0.236
Schleswig Holstein	0.018	0.134
Hamburg	0.049	0.217
Niedersachsen	0.113	0.317
Bremen	0.021	0.145
North Rhine-Westphalia	0.287	0.452
Hesse	0.073	0.260
Rhineland-Palatinate	0.065	0.246
Baden-Wuerttemberg	0.150	0.358
Bavaria	0.156	0.363
Observations	5337	

Source: own calculation; LIAB-Data