Determinants of Gender-Specific Wages in Germany: New Evidence from Linked Employer-Employee Data

DISSERTATION

zur Erlangung des akademischen Grades
doctor rerum politicarum
(Doktor der Wirtschaftswissenschaft)

eingereicht an der
Wirtschaftswissenschaftlichen Fakultät
der Humboldt-Universität zu Berlin

von

Diplom-Volkswirtin Anja Heinze
geboren am 08.08.1978 in Neubrandenburg

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Tag des Kolloquiums: 20.11.2008

Abstract

This thesis consists of empirical and methodological contributions to the literature on the wage differences between men and women, with a particular focus on Germany. Due to a lack of appropriate data, previous studies have been unable to document the potential impact of employers and establishments respectively on the wage differences between men and women. Based on a newly available data set – the Linked Employer-Employee Data Set (LIAB) – which is provided by the IAB (Institute for Employment Research) the role of employers and establishments are investigated in three empirical studies.

The first chapter gives an overview of various theoretical approaches to the gender wage gap and previous empirical findings for Germany.

The second chapter pays attention to the gender wage gap within establishments. It provides a comprehensive study of the effects of the institutional framework and competitive pressure on the gender wage gap within establishments. For this purpose, two alternative measures describing the gender wage gap within establishments are defined. The first finding is that the gap within establishments varies tremendously across establishments. The empirical analysis shows that establishments with works council and those covered by collective wage agreements have a significantly smaller wage gap. Furthermore, the study provides some empirical evidence for the hypothesis that establishments operating under strong product market competition behave in a more egalitarian way.

While the investigation in the second chapter treated the segregation of women and men in different establishments as given, in the third chapter the selection into firms is explicitly taken into account as an explanation for the overall wage gap. The key issue is to disentangle differences in the human capital endowment of men and women and the segregation of men and women in different types of establishment as sources for the gender wage inequality. Therefore, the traditional decomposition method by Oaxaca (1973) and Blinder (1973) is extended to four terms and is undertaken across the entire wage distribution. Drawing on a flexible parametric decomposition approach by Machado and Mata (2005), the four decomposition terms are implemented directly at each percentile of the wage distribution. The empirical analysis shows that the gender wage gap is highest in the lower part of the wage distribution. The segregation of women into less successful and productive firms explains a sizeable part of the gap, especially in the lower part of the wage distribution. Gender differences in the human

capital endowment as well as differences in returns to human capital have a lesser impact upon the wage differential.

Finally, the forth chapter also uses the LIAB data in order to examine the relationship between the share of women in establishments and the wages of men and women. The study addresses the possible reasons for such a correlation. For this, hypotheses are formulated as to what a high proportion of women in an establishment can indicate: attractive working conditions for women, lower qualification requirements or less discrimination against women. The empirical results show that an increasing proportion of women in an establishment reduce wages for males and females. By successively including worker and establishment characteristics, the proportion of females in an establishment still has a negative effect upon the wages of both sexes but it becomes smaller. In particular, the regression results reveal that attractive working conditions lead to lower wages in female dominated establishments.

Keywords:
gender-specific wage differentials, gender segregation, Linked Employer-Employee data

Zusammenfassung

Diese Arbeit besteht aus empirischen und methodischen Beiträgen zur Literatur über Lohnunterschiede zwischen Männern und Frauen, wobei der Schwerpunkt auf Deutschland liegt. Bisher war es aus Mangel an geeigneten Daten nicht möglich, den potentiellen Einfluss von Arbeitgebern bzw. Firmen auf Lohnunterschiede zwischen Männern und Frauen zu untersuchen. Auf der Basis eines neues Datensatzes – dem Linked Employer-Employee Datensatz (LIAB, Integrierte Betriebs- und Personendaten) – der vom IAB (Institut für Arbeitsmarkt- und Berufsforschung) zur Verfügung gestellt wird, wird in drei empirischen Studien die Rolle von Arbeitgebern und Firmen untersucht.

Das erste Kapitel gibt zunächst einen Überblick zu verschiedenen theoretischen Erklärungsansätzen für den geschlechtsspezifischen Lohnunterschied und zu bisherigen empirischen Befunden für Deutschland.

Das zweite Kapitel wendet sich dem innerbetrieblichen Lohnunterschied zwischen Männern und Frauen zu. Es enthält eine umfassende Untersuchung darüber, wie sich das institutionelle Umfeld und der Wettbewerbsdruck auf den Lohnunterschied innerhalb von Firmen auswirken. Für die Untersuchung werden zwei verschiedene Maßzahlen für den innerbetriebliche Lohnunterschied definiert. Wie die Untersuchung aufzeigt, schwankt der innerbetriebliche Lohnunterschied stark über die Firmen. Die empirische Analyse zeigt weiterhin, dass Unternehmen mit einem Betriebsrat und solche, die Tarifverträge anwenden, signifikant geringere Lohnunterschiede aufweisen. Darüber hinaus liefert die Studie teilweise empirische Evidenz für die Hypothese, dass Firmen, die einem starken Wettbewerbsdruck ausgesetzt sind, weniger Unterschiede hinsichtlich der Entlohnung zwischen ihren weiblichen und männlichen Mitarbeiter vornehmen.

Während im zweiten Kapital die Verteilung von Frauen und Männer in unterschiedlichen Firmen als gegeben betrachtet wird, wird dies im dritten Kapital explizit als mögliche Ursache für den gesamten Lohnunterschied untersucht. Im Mittelpunkt steht dabei die Frage, wie viel des beobachteten Lohnunterschieds durch verschiedene individuelle Merkmale wie Bildung und Berufserfahrung erklärt werden kann und wie viel auf die Selektion in unterschiedliche Betriebe zurückzuführen ist. Dafür wird die traditionale Zerlegungsmethode, die auf Oaxaca (1973) and Blinder (1973) zurückgeht, auf vier Zerlegungsterme erweitert und die Zerlegung über die gesamte Lohnverteilung vorgenommen. Unter Verwendung einer flexiblen

parametrischen Zerlegungsmethode, die auf Machado und Mata (2005) zurückgeht, werden die vier Erklärungskomponenten direkt in jedes Perzentil der Lohnverteilung implementiert. Die empirische Analyse zeigt, dass der Lohnunterschied am unteren Rand der Lohnverteilung am höchsten ist. Auf die Segregation von Frauen in weniger erfolgreiche und produktive Firmen ist ein Teil des beobachteten Lohnunterschieds zurückzuführen, insbesondere am unteren Rand der Lohnverteilung. Unterschiede in der Humankapitalausstattung zwischen Männern und Frauen sowie unterschiedliche Ertragsraten haben nur einen geringen Einfluss auf den Lohnunterschied.
Im vierten Kapitel werden wiederum die LIAB Daten verwendet, um die Beziehung zwischen dem Frauenanteil in Unternehmen und dem Lohn von Männern und Frauen zu untersuchen. Dabei befasst sich die Studie insbesondere mit den Gründen für eine solche Korrelation. Es werden Hypothesen aufgestellt, dass ein hoher Frauenanteil innerhalb von Unternehmen eine für Frauen attraktive Arbeitsumgebung, geringe Qualifikationsanforderungen von Seiten der Arbeitgeber oder weniger Diskriminierung gegenüber Frauen widerspiegelt. Die empirische Analyse zeigt, dass ein steigender Frauenanteil innerhalb von Firmen zu einem geringeren Lohn von Frauen und Männern führt. Wenn jedoch sukzessive individuelle und Firmenmerkmale berücksichtigt werden, dann sinkt der Einfluss erheblich. Es zeigt sich, dass insbesondere eine attraktive Arbeitsumgebung zu einem geringen Lohn in frauendominierten Firmen führt.

Schlagworte:
geschlechtspezifischer Lohnunterschied, Geschlechtersegregation, Linked Employer-Employee Datensatz;

Acknowledgements

This collection of studies represents my doctoral thesis submitted to the School of Economics and Business at the Humboldt-Universität zu Berlin, Germany. The work described in this thesis was carried out at the Centre for European Economic Research (ZEW) in Mannheim.

I am very grateful to my supervisor Prof. Michael C. Burda, Ph.D. for all his support, critical remarks, and encouragement. In particular, I would like to thank him for his reassurance in the final phase of my thesis. I am also indebted to Prof. Bernd Fitzenberger, Ph.D., who kindly accepted to be my second supervisor. During all the time I worked on this thesis he was always available for my questions and gave me many very helpful hints.

This work has been made possible through the financial support of the Deutsche Forschungsgemeinschaft (DFG) within the framework of the projects "Gender Inequality within Organizations" and "Gender Segregation within Organizations", which I gratefully acknowledge. These projects are part of the DFG-Research Network "Flexibility in Heterogenous Labour Markets" and I thank all members of the research network for productive discussions at several workshops. Many thanks are also due to my project leader and co-author Elke Wolf and my project leader Miriam Beblo. This research would not have been possible without their support.

Furthermore, I have gained great personal and scientific benefit during my time spent at the ZEW. I would like to thank my colleagues from the Department of Labour Markets, Human Resources and Social Policy for numerous discussions, critical and constructive comments as well as for the inspiring academic environment. This applies in particular to Melanie Arntz, Alfred Garloff, Nicole Gürtzgen, Anja Kuckulenz and Susanne Steffes. I am also grateful to Eva Arnold for her research assistance.

Special thanks go to the staff of the Research Data Centre (FDZ) of the Institute of Employment Research (IAB) in Nuremberg. I am particularly grateful to Holger Alda, Stefan Bender, Peter Jacobebbinghaus and Dirk Oberschachtsiek for help with the data and hosting in Nuremberg.

Last but not least, I would like to thank my family and friends, whose help and support was more indirect but not less valuable. I could not have done this work without the help of my cousin Birgit Reinhard, who always motivated me. I am especially grateful to my boyfriend Gerhard Mantke for his patience and understanding. Finally, I owe many thanks to my parents and my brother for their ever-present support.

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Chapter 1
Introduction and overview

1.1 Introduction

"Equal pay for equal work"

The principle of equal remuneration for equal work as between male and female employees has been firmly embedded in European and German law for many years now.[1] However, despite the clear legislative framework, the reality is quite different. On average women earn less than men. Figure 1.1, which is based on the earnings survey (Verdiensterhebung) conducted by the German Federal Statistical Office (Statisches Bundesamt), reveals that although the pay gap has narrowed in western Germany since the 1960s, pay equality is still a long way off.

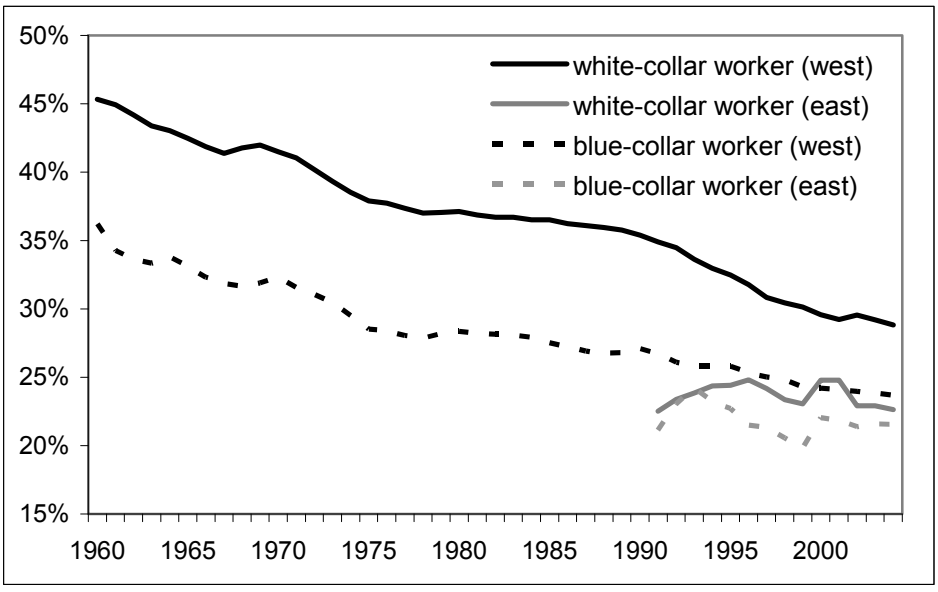

Figure 1.1: Gender wage gap as difference between male and female earnings in relation to male earnings, western Germany 1960-2004, eastern Germany 1991-2004
Note: The earnings of blue-collar workers are measured as gross hourly earnings and the earnings of white-collar worker are gross monthly earnings.
Source: WSI FrauenDatenReport 2005

[1] The principle of gender wage equity is written down in § 612 (3) BGB (German Civil Code) and Article 14 of the EC Treaty, for example.

The relevant literature offers widely differing views on the reasons for the existence of - and changes in - pay differentials between men and women. Only a few years ago, empirical studies of the gender wage gap in Germany drew almost exclusively on individual data sets. While individual data sets provide information about individuals' income, gender, age, occupation, training, etc., they provide very little information about employers. However, a new data set, the Linked Employer-Employee Data Set of the IAB (LIAB)[2], has become available in Germany since 2004 (Alda et al. 2005). This data set combines data derived from the IAB Establishment Panel and the Employment Statistics Register. The IAB Establishment Panel is based on annual surveys of a representative sample of firms and contains detailed information about aspects such as the workforce structure, the institutional setting, investments, total wages and salaries, the technology, etc. This information is then combined with data on employees paying social security contributions in the same establishments. The employee data are derived from the Employment Statistics Register. As a result, it is now possible to study the gender wage gap taking greater account of the establishment level.

This is the starting point for this thesis which draws on this newly available representative data to examine the influence of corporate policies and other establishment and institutional features on the gender wage gap within establishments. Furthermore, this thesis examines the extent to which observed wage differentials between men and women may be explained by individual productivity differences or by segregation of men and women into different types of establishments. In order to arrive at a more profound understanding of the causes of the gender wage gap, the study takes account of differences across the entire wage distribution and not merely the mean differential. The final part of this thesis focuses on whether and why female dominated firms pay lower wages to their employees than male dominated firms.

The studies are preceded by an overview of the previous research on the gender wage gap. This review begins with a presentation of various theoretical approaches and is followed by an overview of the empirical findings for Germany. Finally, international studies based on linked employer-employee data are used to shed new light on research into the gender wage gap before summarizing the authors' own studies.

[2] This data set is described in detail in chapter 2, chapter 3 and chapter 4.

1.2 Theoretical approaches to the gender wage gap

In neo-classical labor economics, wage differentials are primarily due to differences in productivity as, in perfectly competitive labor markets, wages reflect labor productivity. According to human capital theory (Becker 1964), productivity is a function of general and specific human capital. If men and women are endowed with different levels of human capital, different wage rates are regarded as legitimate. Different endowments of human capital are in turn derived from pre-labor market processes, including determinants such as family roles (Becker 1981, 1985). Due to family responsibilities and related career interruptions women may anticipate a shorter total working life and consequently, could invest less in their own human capital. Furthermore, acquired knowledge and skills can be lost during employment breaks (Mincer and Polachek 1974, Polachek and Siebert 1993).[3] Human capital theory suggests that women would be well advised to choose occupations which promise a relatively high entry wage and lower wage losses during discontinuous labor force participation (Polachek 1981).

Occupational choices are closely related to the human capital theory and can also explain wage differentials between men and women. There are certain typically female occupations which are seldom chosen by men and which are also less well paid. Preferences such as these may be historically determined, may be the outcome of gender-specific differences in labor productivity, or reflect the need to reconcile the demands of work and family (Becker 1981). Often mentioned in this context is the "overcrowding" model which proposes that women tend to concentrate on a narrower spectrum of occupations than do men (Bergmann 1974). A surplus supply of women in typical female occupations enables employers to pay wage rates below the wage at which men are employed. From this perspective the gender wage gap may also be ascribed to segregation in different occupations.

However, even in instances in which labor market relevant characteristics are identical (i.e. education and occupation in particular) women generally earn less well than their male colleagues. This is often ascribed to wage discrimination.

The literature basically distinguishes between three discrimination concepts. "Taste-based" discrimination against women, monopsonistic discrimination based on

[3] Polachek (1981) introduces an atrophy rate which describes the depreciation of human capital during employment breaks.

differences in the elasticity of labor supply between men and women, and statistical discrimination arising from incomplete information about individual productivity. These discrimination models are discussed in detail by Altonji and Blank (1999).

The *"taste-based" discrimination model* proposed by Becker (1971) assumes that employers have discriminatory preferences against women[4] and regard the employment of female employees as utility reduction. As a result, these employers hire fewer women and more men than non-discriminating employers. This in turn depresses the wages earned by women relative to those paid to men on the labor market. In the long term this is only possible under conditions of imperfect competition as otherwise discriminating employers are forced out of the market.

The concept of *monopsonistic discrimination* is based on differences in the elasticity of labor supply between men and women (Robinson 1933). In this framework women are assumed to have a relatively lower elasticity of labor supply. One reason for this might be that domestic responsibilities reduce their mobility and commitment to finding paid work. Employers' profit maximization aims consequently result in women earning less because they are less responsive to changing wages than men.

The concept of *statistical discrimination* ascribes wage differentials between men and women to incomplete information about individual productivity (e.g. Phelps 1972, Arrow 1973, Aigner and Cain 1977). It is very difficult for employers to determine whether or not a particular potential employee has certain productivity-relevant features, such as motivation or resilience to stress. According to this model employers tend to use gender as a productivity signal, thereby ascribing lower productivity to women. This is also a reason why women are less often employed and why they receive lower pay when they are taken on.

Discriminatory behavior on the labor demand side can have an impact on labor supply side if women expect to be confronted with discrimination and therefore invest less in their skills which, in turn, results in real differences in productivity (e.g. Coate and Loury 1993).

In summary, the theoretical approaches described so far offer a mix of complementary and conflicting explanations for earnings inequality between men and women. In the

[4] This is only one of several other models which are based on the discriminatory tendencies. Customers and work colleagues can also have prejudice against women (see e.g. Altonji and Blank 1999). These models have attracted less discussion in the literature as the implications of both variants are in fact rarely observed in reality.

next section, some empirical results are discussed for the gender wage gap in Germany, which partly pick up these theoretical approaches.

1.3 Empirical studies on the gender wage gap in Germany

A large number of studies have focused on the gender wage gap in Germany over the last 30 years (refer to Hübler 2003 for an overview).

These studies have mostly concentrated on the extent to which the wage gap is the outcome of sex discrimination. While almost all studies find evidence for such discrimination, they diverge substantially in when it comes to quantifying the extent of discrimination. In many cases this is due to the use of different methods and variables (Hübler 2003, Beblo et al. 2003, Kunze 2007 for a detailed discussion). However, most studies adopt very similar underlying procedures. Wage discrimination is determined indirectly by decomposing the observed wage differentials into two components. One component encompasses a wage differential based on observable characteristics (e.g. human capital or occupation). The other component represents gender-related discrimination. Discrimination is therefore determined as a residual term. Generally the more effectively the differentiation can be explained, the smaller the discrimination components are. This means that the inclusion of previously neglected variables or factors reduces the level of discrimination even further. While the limited availability of data forced earlier studies to focus primarily on different endowments of human capital (e.g. Bellmann and Gerlach 1984, Gerlach 1987) as the cause of wage differentials, later studies have also taken into account individual determinants such as marital status, number of children and occupation (e.g. Hübler 1990, 1991). As more and broader data becomes available researchers are able to switch their attention to developments over time and the wage differentials which arise after job changes and career interruptions. Other studies examine special groups of employees, such as university graduates and new entrants to the labor market, or segregation in specific occupations. Yet other studies deal with the wage gap on the labor market in eastern Germany or with differences across the wage distribution. These branches of research are presented in more detail in the following. They are primarily based on the

employment statistics of the Federal Employment Agency, the IAB Employment Subsample (IABS)[5] and the German Socio-Economic Panel (SOEP)[6].

The development of the wage gap over time is discussed in particular by Fitzenberger and Wunderlich (2002), Lauer (2000) as well as Prey and Wolf (2004). The former present graphical evidence based on the IABS from 1975 – 1995 which shows that women's pay rose faster during this period than that of men with the same qualifications. In contrast, Lauer (2000) draws on the SOEP to investigate the effect of the expansion of education on the development of the gender wage gap in the 1980s and 1990s. The narrowing of this gap, from 45 percent to 36 percent, is ascribed in part to the improved human capital acquired by women. At the same time, returns to human capital over the same period dropped – in fact, they fell more for men than for women. Prey and Wolf (2004) also draw on the SOEP and conclude that, in terms of their observed qualifications, women made progress catching up with men in the period between 1984 and 2001. At the same time, there was a loss of unobserved skills or qualifications and/or women were confronted with increasing discrimination. However, this is overcompensated for by changes in the valuation of women's unobserved skills.[7]

Other studies (Mavromaras and Rudolph 1995 and 1997 as well as Mavromaras 2003) concentrate on the wage gap following resumption of employment with a new employer after a job to job change or after a career interruption. They find substantial pay discrimination[8], particularly at the beginning of such employment, while differences in qualification are found to have little explanatory power for the pay differential. Nonetheless, the extent of wage discrimination falls if the differing probabilities of women and men finding new employment are taken into account.[9]

As far as the influence of career interruptions on the gender wage gap is concerned, the study by Beblo and Wolf (2003) emphasizes that employment breaks have a different

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[5] Information about the IABS and the employment statistics is available at http://fdz.iab.de/de.aspx or in Bender et al. (2000)

[6] Information about the SOEP can be found at www.diw.de/soep or in Haisken De-New and Frick (2005).

[7] These findings are based on a Juhn-Murphy-Pierce decomposition (Juhn et al. 1993) which decomposes the change of the gender wage gap over time into 4 components: (1) The change in observable characteristics – "endowment effect" (2) The change in the remuneration of observable characteristics – "remuneration effect" (3) The change in unobservable characteristics at unchanged remuneration – "gap effect" (4) The change in the relative remuneration of unobservable characteristics at unchanged unobservable characteristics – "unobserved remuneration effect"

[8] The unexplained decomposition term is interpreted as pay discrimination.

[9] In the authors' view, the differing probabilities of women and men finding new employment are based on gender-specific preferences and unobserved segregation which may have an influence on labor force participation.

impact on both sexes. The negative wage effects of career interruptions are significantly larger for female employees. Furthermore, they show that women's wage return to work experience is lower than for men. If women had the same work experience as men and received equal pay, the gender wage gap would be 15 percent narrower.

Other studies concentrate on the wage differentials for special groups of employees. Machin and Puhani (2003), for example, study the impact of subject of degree on the wage earned by university graduates. The observation that women appear to prefer subjects of degree with which they will later earn lower pay on the labor market than men may ultimately explain around 2-4 percent points of the pay premium enjoyed by men compared with women.

The income discrepancy between men and women already arises as soon as both have completed their vocational training (e.g. Engelbrech and Nagel 2002[10], Kunze 2003 and 2005). On the basis of the IABS, Kunze (2003) observes a difference in entry wages paid to men and women of 22 percent. Yet, this gap widens during the first years of employment and narrows again after the fourth year of work. The differences in entry wages are largely determined by the choice of training occupation however, and not by "pre-labor market" characteristics, such as school qualifications and length of training (see also Kunze 2005). Women prefer occupations in the comparatively less well-paid service sector, while men choose jobs in the manufacturing sector (Kunze 2005). Bearing in mind the relatively low occupational mobility in Germany, the choice of training occupation has a tremendously important impact on the later wage development. Fitzenberger and Kunze (2005)[11] confirm this in a further study. The initial pay disadvantage experienced by women on completing their vocational training is sustained even as women gain further work experience. This is the case since they change their occupation less frequently and because they do not benefit as much from occupational changes as do their male colleagues.

Another group of studies discusses the relationship between the distribution of men and women in different occupations and its impact on wage differentials (e.g. Mavromaras and Rudolph 2002, Jurajda and Harmgart 2007). A key finding of these

[10] In 1997, women working full time in western Germany earned 84 percent of men's wages after completing their training. In eastern Germany this difference is somewhat lower at 89 percent.

[11] This study complements the studies carried out by Kunze (2003 and 2005) by also taking account of occupational mobility. The observation period is also extended and the effects across the wage distribution also considered.

studies is that a reduction in occupational segregation does not necessarily also result in a narrowing in the gender wage gap. The study by Mavromaras and Rudolph (2002) shows that reduced segregation[12] in male dominated occupation can in fact result in a widening of the wage gap, while such a reduction has no effect in female dominated occupations.[13] Jurajda and Harmgart (2007) also come to similar conclusions. In western Germany they find no significant impact of the proportion of women within certain occupations on male and female wage. In eastern Germany the authors find a positive effect on male wages. By controlling for unobserved heterogeneity this effect disappears. Apparently men are positively selected in female dominated occupations in eastern Germany. This is not observed in other countries such as the UK (e.g. Macpherson and Hirsch 1995).

Against the background of the rapid transformation of the labor market in eastern Germany following German reunification, several studies focus on pay differentials in eastern Germany. Drawing on the SOEP, Hunt (2002) observed a fall in the gender wage gap of around 10 percent points in the 1990 - 1994 period. However, as studies by Hunt (2002) as well as Gang and Yun (2001) have shown, this supposedly good news is not due to reduced wage discrimination but basically to selection. Rather than encouraging gender equality, the restructuring of the eastern German labor market has tended to crowd out low qualified women from employment altogether.

Research on wage differentials is deepened by consideration of the wage distribution between men and women. It is apparent that the wage gap at the bottom of the distribution is wider than it is at the top (e.g. Fitzenberger and Kunze 2005 as well as Hübler 2005).[14] Observed earnings inequality in the lower tail in the period 1975 to 1995, for example, fell much more substantially than in the upper tail (Fitzenberger and Wunderlich 2002). This is due to the fact that wage inequality increased among men in this period while it decreased among women. Hübler (2005) ascribes the wage gap in the lower part of the wage distribution mainly to the less advantageous individual characteristics of women.

[12] Segregation is measured with the help of the Duncan and Duncan (1955) index.
[13] The study also controls for changes in the qualification and age structure within occupations, for example.
[14] Hübler (2005) draws on the SOEP to show that in 1998 pay differentials were around 39 percent in the 10^{th} percentile and approximately 28 percent in the 90^{th} percentile.

1.4 Including the firms' perspective

The studies referred to above show that the gender wage gap can be explained in part by different individual characteristics. These are based on individual data sets and are therefore only capable of shedding light on labor supply side effects. However, also the labor demand side is likely to have an impact on the gender wage gap through wage differentials between firms. The literature offers a number of different reasons for inter-firm wage differentials. Groshen (1991b), for example, discusses compensating wage differentials, efficiency wages and rent-sharing processes as explanations. Institutional settings also have a significant impact on wage differentials. In this context collective agreements play a particularly important role in German industrial relations. The distribution of men and women across different establishments means that the related wage differentials can also have implications for the gender wage gap. For this reason, it also makes sense to include the establishment level in the discussion of the gender wage gap.

The incorporation of the establishment level in empirical research is facilitated by the availability of new data which includes both individual and employer information. Linked employer-employee (LEE) data sets[15], in particular, which have recently become available in Germany in the form of the Linked Employer-Employee Data Set of the IAB (LIAB), have stimulated new research on wage differentials. The LIAB is a linked data set which comprises data from a representative annual establishment survey as well as individual data generated in labor administration and social security data processing. This thesis is among the first studies that use these data in general and in particular to explore the gender wage gap. As most of the empirical literature on this topic is international, the key findings of both German and international studies are presented in the following.

The majority of the studies which are based on LEE data consider the segregation of men and women into different occupations and establishments (e.g. Groshen 1991a, Carrington and Troske 1998, Reilly and Wirjanto 1999a, Bayard et al. 2003, Datta Gupta and Rothstein 2005, or Vieira et al. 2005, Amuedo-Dorantes and De la Rica 2006). Basically these studies arrive at two key findings. On the one hand they confirm that women and men not only choose different occupations, but are also employed in

[15] The data sets differ strongly in terms of employer information and the employees they cover. An overview can be found in Abowd and Kramarz (1999).

different types of establishments. This segregation explains a major part of observed wage differentials. On the other hand, it is shown that within establishments as well as within particular occupations in establishments (job cells) women and men are paid differently. The studies disagree on the extent to which this wage gap can be explained by segregation. In a pioneering approach to this topic, Groshen (1991a) assigned the wage gap in the U.S. almost exclusively to segregation. In contrast, Bayard et al. (2003) find that after controlling for segregation of women into lower-paying occupations, industries, establishments and job cells one half of the wage gap remains unexplained. Datta Gupta and Rothstein (2005) and Amuendo-Dorantes and De la Rica (2006) come to similar conclusions for Denmark and Spain respectively as Bayard et al. (2003). Accordingly, Hinz and Gartner (2005) conclude that in Germany only a small part of the wage gap is explained by segregation in industry, establishment, occupation and job cell. Controlling in addition for human capital endowment, the residual wage gap amounts to about 15 percent, which is high in international terms.

Several studies consider and attempt to quantify the within-firm wage gap (Meng 2004, Meng and Meurs 2004, Jirjahn and Stephan 2006). Separate individual wage regressions with firm-specific fixed effects are estimated.[16] The difference in these firm-specific fixed effects between men and women is interpreted as the within-firm wage gap. Meng (2004) shows that the gender wage gap in Australia is smaller in firms which are better able to measure the individual productivity of their employees. In contrast, wage bargaining at the establishment level leads to greater gender inequality than does collective bargaining at a more centralized level. Comparing France and Australia, a similar result is obtained by Meng and Meurs (2004).

Other studies focus on the gender wage gap between firms and consider to which extent the establishment characteristics contribute to the explanation of the wage gap (e.g. Drolet 2002, Achatz et al. 2005). Drolet (2002), for example, attributes around 42 percent of observed pay gap in Canada to differences in firm-specific characteristics such as training expenditures and flexible working hours. In contrast, only around 19 percent of the wage gap results from differences in individual characteristics. In Germany, the binding nature of collective bargaining agreements plays a particularly significant role in narrowing the wage gap (Achatz et al. 2005). The negative impact of

[16] The estimation approach is based on panel estimates with individual fixed effects. Instead of observing several individuals at a particular point in time, this approach entails using several different employees from a single establishment to identify the firm-specific fixed effect. The estimation approach can be compared with an approach in which dummies are used for the firms.

collective agreements on the gender wage gap is also confirmed by Gartner and Stephan (2004).

1.5 Summary of the thesis

This thesis contains three independent empirical studies dealing with wage differences between men and women, with a particular focus on Germany. The studies are summarized in the following.

The intra-firm gender wage gap: A new view of wage differentials based on linked employer-employee data (jointly with Elke Wolf)

Several international studies (e.g. Bayard et al. 2003, Datta Gupta and Rothstein 2005 as well as Amuedo-Dorantes and De la Rica 2006) and Hinz and Gartner (2005) for Germany show that the selection of women and men into different establishments explains only part of the observed wage gap. The unexplained portion suggests that women and men are also treated unequally with regard to pay within firms. This within-firm wage gap is in the focus of the first study. This study considers the influence, among other things, of collective agreements, works councils and competitive pressures on the within-firm wage gap.

In Germany collective bargaining exercises a huge influence on the wage setting process in firms.[17] It is not entirely clear, however, to what extent collective agreements lead to an increase and/or decrease in the within-firm wage gap. Drawing on the literature, the hypothesis is proposed that collective agreements tend to reduce the within-firm wage gap. Arguments in favor of this hypothesis include wage compression from which women benefit more (Blau and Kahn 1999, 2003) and the restrictions on arbitrary unequal treatment of men and women (Cornfield 1987). On the other hand, it is also assumed that collective agreements lead to a widening in the within-firm wage gap as unions, acting as the representatives of employees, tend to emphasize the interests of the majority of their male members (Sap 1993). Additional information on the proportion of female union members is matched to the LIAB in order to verify this aspect in particular.

[17] According to the WSI Tarifarchiv (2001) collective bargaining applies to 48 percent of all establishments and covers at least 70 percent of all employees in the year 2000.

Works councils are expected to affect the within-firm gender wage gap as well. While they do not directly engage in wage bargaining, they participate in the implementation of collective agreements and the assignment of wage groups. As an "equalizing agent" (Baron 1984) they may be expected to contribute to a reduction of the within-firm wage gap.

The impact of competitive pressure on the within-firm wage gap is also examined based on the argument that discrimination can only take place in firms which are able to afford such discrimination. Firms underlying a competitive pressure do not earn enough profits to afford discrimination. (Becker 1971)

These hypotheses are examined drawing on the rich information available in the LIAB. The empirical analysis draws on two measures of the within-firm wage gap: the observed mean gender wage gap in an establishment and a wage gap adjusted for within-firm human capital differences between men and women. The second measure is calculated on the basis of establishment-specific wage regressions which control for human capital. In this way the heterogeneity of the wage setting process across firms is taken into account.

The outcome is that establishments subject to collective agreements show a narrower wage gap than other establishments. The existence of works councils has a similar impact. Furthermore, the hypothesis that firms which are subject to strong international competitive pressures pay women and men more equally is confirmed. Finally, it is apparent that, on the basis of collective agreements, unions with a large female membership do not foster a reduction of the within-firm wage gap.

Beyond the mean gender wage gap: Decomposition of differences in wage distributions using quantile regression

While the investigation of the within-firm wage gap in the first study considered the segregation of women and men in different establishments as given, this study takes explicit account of selection into firms as an explanation for the wage gap. The key issue here is the extent to which the observed wage gap can be explained by different individual characteristics such as education and work experience and how much is due to selection into different establishments. Based on the Oaxaca-Blinder

decomposition[18], the observed wage gap is assigned to four explanatory components: (1) Difference in the individual characteristics, (2) Difference in the remuneration of these individual characteristics, (3) Difference in establishment characteristics, (4) Difference in the remuneration of these establishment characteristics. Beyond the decomposition of the mean wage gap, the decomposition is undertaken across the entire wage distribution. This study consequently links two aspects of current empirical research on the gender wage gap. On the one hand, the establishment level is included in the study and, on the other hand, the analysis is extented to include the entire wage distribution. Drawing on a flexible parametric decomposition approach by Machado and Mata (2005), the four decomposition terms are implemented directly at each percentile of the wage distribution. The idea behind this method is to simulate counterfactual wages on the basis of estimated quantile regression coefficients and randomly drawn individual and establishment characteristics. This method is used for the first time to decompose the gender wage gap in Germany.

Based on the LIAB the finding is that, on average, women earn 23.5 percent less than men. The gender wage gap is larger in the lower tail of the wage distribution than on the upper tail. For instance, the gap is 32.6 percent at the 10^{th} percentile and 21.6 percent at the 80^{th} percentile. The decomposition of the observed wage gap shows that the four defined decomposition components vary only mildly across the wage distribution. Only a small part of the wage gap is due to differences in the individual characteristics between men and women. In the middle of the wage distribution women are even endowed with better individual characteristics. The segregation of men and women in different firms also explains part of the wage gap, particularly in the lower part of the wage distribution. The largest part of the wage gap is attributable to differences in the remuneration of establishment characteristics. It is apparent that even if men and women have the same individual characteristics, receive the same remuneration of these individual characteristics and work in the same firm, women still earn 16 percent less than men on average. This within-firm wage gap is more pronounced in the lower part of the wage distribution than at the upper part.

In summary, the sources of the gender wage gap do not differ much between individuals in the lower and the upper part of the wage distribution. Compared with the

[18] The decomposition method is derived from Oaxaca (1973) and Blinder (1973). The observed wage gap is decomposed into two explanatory components: Difference in the observed characteristics and the difference in the evaluation of these characteristics

selection of men and women into different establishments, differences in qualification between men and women explain only a small part of the observed wage differential. The findings consequently suggest that establishments are the key fields of action and the site at which measures to narrow the gender wage gap should be taken.

Earnings of men and women in firms with a female dominated workforce: What drives the impact of sex segregation on wages?

International studies based on the LEE data (e.g. Carrington and Troske 1998 Reilly and Wirjanto 1999a, Amuedo-Dorantes and De la Rica 2006) find that both men and women receive lower wage rates in firms with a high proportion of female employees. The third study considers this topic for Germany. The study also addresses the possible reasons for a correlation between the proportion of women in establishments and the wage earned by women and men.

The first hypothesis is that establishments with a high share of female employees offer attractive working conditions by, for example, reconciling the demands of work and family. On the basis of compensating wage differentials (Rosen 1986) the employees in such establishments tend to be paid lower wages.

The second hypothesis is based on two assumptions: Women are less qualified than men and establishments are heterogeneous in terms of the qualification requirements of their employees. It is therefore assumed that establishments seeking low qualified individuals show a high proportion of female employees in their workforce and pay lower wages.

Another possible explanation discussed for the correlation between the proportion of female employees in establishments and the individual wage is the discrimination preference of the employer. In the framework of this third hypothesis, discriminatory employers are assumed to hire fewer women and to pay them lower wages, while men receive a preferential treatment and higher pay in such firms.

These hypotheses are systematically examined in the empirical analysis. In addition to the proportion of female employees in the establishment, various individual and establishment characteristics are included successively in the regression analysis as determinants of wages. Individual qualifications and workplace characteristics can be controlled for by drawing on the extensive information provided by the LIAB data.

The wage regressions – which, apart from the proportion of female employees in establishment workforces, only include human capital characteristics and occupation

as explanatory variables – show different relationships for eastern and western Germany. In western Germany, the proportion of female employees has a negative impact on the individual wages paid to men and women. In eastern Germany, in contrast, there appears to be no significant relationship between individual wages and the proportion of female employees. If the industry sector and the size of the establishment are included in the regressions as additional explanatory variables, the expected negative relationships between the proportion of female employees and individual wages applies to men and women. This suggests that women in eastern Germany are employed in larger, better paying firms, while women in western Germany tend in contrast to work in smaller, lower paying firms. If variables describing workplace characteristics which appear to be particularly attractive for women are included, the impact of the proportion of female employees becomes less significant. Thus, there is empirical evidence that women themselves select firms which offer them an attractive working environment for which they are prepared to accept a reduction in pay. However, this effect is much weaker in eastern than in western Germany.

The second hypothesis is confirmed in part. The proportion of females in an establishment would appear to reflect the lower qualifications of female employees. Less qualified men do not select employment into female dominated firms. Nonetheless, men in female dominated firms are less well paid than men working elsewhere.

The discrimination preferences of employers cannot directly be observed. This means that the third hypothesis can only be tested indirectly. After controlling for individual qualifications and establishment characteristics, the proportion of female employees in an establishment is shown to have a negative impact on the wages of men and women, thus partly contradicting the discrimination hypothesis.

Chapter 2

The intra-firm gender wage gap: A new view on wage differentials based on linked employer-employee data

(Joint work with Elke Wolf)

2.1 Introduction

Most studies analyze gender pay differentials by focusing primarily on differences in the wage-determining characteristics of men and women and how these characteristics are rewarded. The latter ones, called the "unexplained" wage gap, may either result from unobserved productivity differences between men and women or simply illustrates the degree of discrimination. The idea that organizations play an important role in creating and maintaining gender inequality by the way they define and reward jobs as well as by their recruiting and training practices, has become more and more popular during the last decade (see e.g. Baron 1984, Acker 1990, 1992). In most countries, however, the wage setting process is not just the result of free negotiations between employee and employer, but is substantially affected by various restrictions and legislation. Most importantly, wage bargaining is affected by unions as well as the degree of employee co-determination. In Germany, collective bargaining over wages and work conditions is generally conducted outside the establishment between trade unions and employers' associations. It applies to 48 percent of all West German establishments and covers at least 70 percent of all employees in the year 2000. This commitment is even more marked among larger establishments (WSI Tarifarchiv 2001). Works councils are charged with implementing collective agreements at the plant level and are actively involved in setting wages outside the agreed scale rates and arranging the provision of special allowances. A comprehensive system of co-determination is meant to involve works councils in many decisions concerning the wage structure within establishments. Apart from this institutional framework, the intra-firm distribution of wages is presumably also shaped by economic restrictions arising from competitive pressures on the product market.

Wages of German men and women are therefore likely to depend on the way co-determination rights are implemented and put into practice, on whether establishments are subject to collective wage agreements or not, and the degree to which establishments are exposed to (international) competition. While it is well accepted that these firm characteristics affect wage levels as well as overall wage distributions (see e.g. Davis and Haltiwanger 1991, Bronars and Famulari 1997, Abowd et al. 1999, Addison et al. 2006), most empirical studies do not consider whether these firm characteristics and the institutional environment limit the discretion of establishments and hence constrain discrimination against women and reduce GWGs. Exceptions are Blau und Kahn (1995, 1999 and 2003), who analyze the impact of institutions on the gender wage gap in a cross-country comparison. Meng and Meurs (2004) extend the traditional decomposition of the observed gap in an endowment and a remuneration effect by an additional firm effect and herewith determine the different effects of the institutional setting in France and Australia. They find that wage bargaining at the establishment level, like in Australia, leads to greater gender inequality than does collective bargaining at a more centralized level as in France. Duguet and Petit (2006) find that union representatives have no impact on the GWG at the establishment level in France. The Anglo-Saxon literature, in contrast, points out that union action seems to reduce the GWG attributable to discrimination by increasing the wages of females more than the wages of males (Main and Reilly 1992, Doiron and Riddell 1994, or Elvira and Saporta 2001). Addison et al. (2006) as well as Gartner and Stephan (2004) look at the impact of unions and works councils on the wage structure of men and women in Germany. To our knowledge, none of the studies analyzing the effect of competitive pressure on the remuneration of male and female labor market characteristics refer to Germany (see e.g. Black and Strahan 2001, Black and Brainerd 2004, Oostendorp 2004).

Since most theoretical explanations of discrimination are based on the matching of employers and employees (see e.g. Becker 1971), it seems very promising to link wage differences between men and women to the characteristics of employees *and* employers (see also Hamermesh 1999). The goal of our research is therefore to move beyond the individual and consider the importance of the wage setting process and the degree of competition to explain gender pay differentials. The fundamentally innovative nature of our approach is that we do not just analyze average male and female wage differences, but consider gender wage differentials at establishment level.

Provided that the distribution of women among establishments is not random, the results and interpretation of our approach may differ substantially from traditional analyses which only consider overall wage differentials. Our descriptive figures illustrate that the mean cross-section GWG within establishments is smaller than the mean overall GWG by about one to two percent points, which hints at a certain selection of women into low-paying establishments. Using the *within-firm* GWG as a dependent variable, our analysis describes the effect of firm characteristics and the institutional setting on the GWG, taken the selection into establishments – a decision which is very difficult to explain without special survey data on job seeking – as given. In the following study, we will focus on the impact of works councils and the collective bargaining process. In contrast with the existing literature, we use a broader set of variables to describe industrial relations by merging additional information on unions. An attempt to explain the wage differences between men and women would not be comprehensive and convincing without a consideration of Becker's theory of discrimination. We therefore propose alternative concepts to measure the degree of competition in order to test the hypotheses that discrimination decreases with competitive pressure.

To investigate the theoretical hypotheses regarding the effect of firm and institutional characteristics on wage inequality, we define two alternative measures describing the firm-specific GWG. First, we use the observed wage gap as the difference between the mean wages of men and women within an establishment. One important factor explaining this observed wage gap is the difference in the human capital endowment and other labor market relevant characteristics of 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 establishment. Taking these two measures for the GWG as dependent variables in the second step, we can determine the impact of selected firm characteristics and the institutional framework on average wage inequality within establishments using regression analyses. Given the rich information on the establishments in our survey, we can control for many firm-specific attributes and features, such as establishment size, average wage level, female share or employee qualification level. Based on our results, we provide new insights into the nature and the sources of gender wage inequality in Germany.

The empirical analysis is based on the German LIAB data, a representative linked employer-employee panel which includes information on all employees of

establishments covered by the IAB establishment survey. The LIAB merges annual survey data (the IAB Establishment Panel) and process generated individual data (the Employment Statistical Register of the Institute for Employment Research (IAB), which is based on administrative social security records).

The remainder of the study is organized as follows: Section 2.2 discusses the theoretical background of our empirical analysis. The econometric methodology is expounded in Section 2.3. Section 2.4 describes our data sources and in the subsequent section the results are presented. Section 2.6 concludes.

2.2 Theoretical background and empirical implementation

No theories are currently available which explicitly deal with gender wage differences at the establishment level. However, hypotheses about the impact of selected firm characteristics or institutional settings on wage inequality within establishments can be derived from deliberations in other theories like collective bargaining models or the model of employer discrimination (Becker 1971).

According to the discrimination model, gender earnings differentials may be attributed to direct discrimination by employers, employees and customers against women. Employers with a "taste for discrimination" against women will hire fewer than the profit-maximizing number of women. Furthermore, the model predicts that men are paid above and women below their marginal product. This implies that discriminating employers earn lower profits than non-discriminators. However, in a competitive market discrimination is costly and restricts the employer's scale and profitability. Hence, Becker (1971), Arrow (1973) and Cain (1986), among others, argue that under strong product market competition establishments may not be able to afford discrimination and will therefore behave in a more egalitarian fashion. Assuming that larger establishments are more likely to have market power than smaller establishments, this hypothesis can be tested by establishment size, measured according to the number of employees. Alternatively, we use the relative establishment size to test the hypothesis that establishments acting in more concentrated markets may be able to afford more discrimination.[19] Finally, we include a variable which describes

[19] The relative establishment size is measured by the number of employees within the establishment relative to the number of employees within the whole industry sector in western Germany. Thanks to the IAB Establishment Panel, we can distinguish between 41 industries. Note, however, that the industry employment relies only on establishments covered by the panel. Since the industry structure of the panel

the export quota of the establishment as an indicator of the level of competition. The underlying idea is that establishments operating on the world market are more subject to competition than establishments which only operate on the local or national market. Given Becker's theory, exporting establishments are less likely to have a persistent taste for discrimination and are hence are more likely to pay the value of worker's marginal products, which is assumed not to differ by sex.[20]

Perhaps one of the most important factors influencing wage determination within establishments is whether wages are subject to collective bargaining or not (Elvira and Saporta 2001). This insight is particularly true for Germany, where unions still play an important role in the wage setting process. While the overall impact of unions on the GWG is not obvious, collective bargaining models provide several reasons for arguing that collective agreements tend to reduce the GWG within establishments. 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, Fitzenberger and Kohn 2005). International evidence also suggests that there is limited wage dispersion in countries with centralized collective bargaining, which is – to a large extent – caused by more compressed inter-firm wage dispersion (Blau and Kahn 1999, 2003). Even if the wage compressing effect seems to be more pronounced among male employees (see e.g. Card et al. 2003a), it automatically reduces the GWG for women performing the same activity as male colleagues in the same establishment, since workers at the bottom of the wage distribution are more likely to be female. Freeman (1980) also shows that unions tend to reduce wage differentials within and across establishments regardless of occupation by setting fixed wage levels for specific jobs. As a result, the gap between segregated female and male jobs should also narrow.

Second, collective bargaining agreements regulating wage rates and general working conditions may limit the extent of arbitrary remuneration. In Germany, each sector-specific bargaining agreement assigns typical jobs to a set of wage groups which are associated with a certain level of required skills and responsibility. This should reduce discrimination potential and the resulting GWG. Cornfield (1987) points out, for example, that in the case of layoffs, bureaucratic rules consequently reduce

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sample is supposed to be representative, this figure should serve as a good proxy of the concentration in the market.

discrimination potential. Accordingly, Elvira and Saporta (2001) argue that unionized establishments are more likely to adhere to such bureaucratic wage setting rules, reducing the arbitrariness in wage rates and generating more predictable wages for male and female employees.

But these arguments may be somewhat naive as regards the shares of male and female union membership. Based on the median voter approach we would expect union leaders up for re-election to speak out in favor of a majority group's interests and not to support the interests of minority groups. According to Koch-Baumgarten (2002), despite their growing importance women still represent a minority among union members in Germany. 30.4 percent of DGB members (the umbrella organization of all unions, the Federation of German Trade Unions) were female in 1999. Even if some unions have adopted pay equity as a strategic policy goal – possibly in order to attract new members at a time when unions are losing members fast (see e.g. Fitzenberger et al. 1999, Card 2001) – it is nonetheless by no means obvious that unions are actively trying to reduce the GWG in general. Based on a theoretical model of intra-union bargaining and the assumption that negotiated boosts in wages are divided between male and female unionists, Sap (1993) even comes to the conclusion that unions lead to greater discrimination.

In order to examine the effect of unionization on the GWG we include variables which indicate whether an establishment is subject to collective agreements or not. More precisely, we distinguish between industry-wide collective wage agreements (covering 63 percent of all employees in western Germany in the year 2000), firm-specific collective wage agreements as well as wage determination (covering 7 percent), and without collective bargaining coverage (30 percent, while 15 percent nonetheless follow the wage agreements) (WSI Tarifarchiv 2001). In order to test the hypothesis that unions aim to represent the preferences of their median member, we also exploit information about the female share among the members of different German unions. We would expect collective agreements with unions that register a high proportion of female members (e.g. unions bargaining in the retail sector) to be more likely to reduce the firm-specific GWG than a collective agreement with a union that is still dominated by men, such as the IG BAU (union for the construction, agriculture and forestry sector). Based on this background information, which is merged with our

[20] Alternatively, Black and Brainerd (2004) use the import quota and the four-firm concentration ratio to measure the competitive pressure within an industry.

establishment-level data, we can first test whether unions tend to reduce the GWG in general, or whether this effect only occurs in unions with a high proportion of female members.

Furthermore, wage distribution within establishments is not only affected by collective wage agreements but also by the existence of works councils (Hübler and Jirjahn 2003, Stephan and Gerlach 2005). Works councils establish a comprehensive system of establishment-level participation that is formally independent of the collective bargaining process. They also have the task of implementing the collective agreement within the establishment. This means that works councils cannot directly intervene in the wage bargaining process but may influence the establishment's wage structure thanks to their right of co-determination in negotiations on the assignment of workers to different wage groups. They are also involved in decision-making on the introduction of pay systems, such as performance-related pay schemes, and the setting of wages above agreed tariff and bonus rates. Their implementation is formally designated by law but depends upon the activity of the employees. According to Baron (1984), works councils often act as equalizing agents by monitoring compliance with corporate or legal principals aimed at achieving equal opportunities and avoiding discrimination. As a result, the existence of a works council should counteract wage inequality within establishments.

More differentiated hypotheses about the objectives of works councils can again be derived from the median-voter theory or the insider-outsider theory (Lindbeck and Snower 1988). According to the former approach, works councils act in favor of the majority of the workforce while the interests of fringe groups are neglected. In this setting, works councils foster equal treatment of male and female employees only in establishments with a high proportion of female employees. A male dominated workforce is presumably associated with a male dominated works council which is unlikely to promote wage equality. Therefore, the effect of employees' representation on the GWG is not unambiguous, either. To examine whether the effect of works councils depends upon the proportion of female employees in an establishment we also include an interaction term between the works council-dummy and the firm-specific share of women.[21]

[21] Since we have no information on the female share among the works council members, we cannot directly test the implications derived from the insider-outsider theory.

2.3 Methodology

To investigate the theoretical hypothesis we define two measures which reflect the degree of wage inequality within an establishment. First, we use the observed wage gap:

$$Gap1_j = \overline{w}_j^m - \overline{w}_j^f, \quad \overline{w}_j^g = \frac{1}{N_j^g}\sum_{j=1}^{N_j^g} w_{ij}^g, \quad \text{g=m,f} \tag{2.1}$$

where w_{ij} denotes the log earnings for individual *i* at establishment *j* superscripts *m* and *f* refer to male and female observations. N_j^g indicated the number of male and female employees, respectively, in establishment j. Since the wage information in our data set is right-censored (see Section 2.4 for more details), the observed wage gap defined in equation underestimates the actual raw wage differential. In order to determine the actual observed wage gap we apply a simple Tobit model. By estimating the following equation for each establishment, we can directly derive the wage differential between male and female employees:

$$w_{ij} = \alpha_j + \gamma_j fem_{ij} + \mu_{ij}, \tag{2.2}$$

where α is an absolute term measuring the average wage rate in establishment *j*, *fem* is a dummy variable reflecting the gender of individual *i* and μ_{ij} denotes the error term. The estimated coefficient $\hat{\gamma}_j$ then represents the raw GWG in establishment *j* ($Gap1_j$) taking into account that w_{ij} is censored from above.

From an economic viewpoint the wage gap which is due to differences in occupational skills shall be deemed to be justified and comprehensible. Therefore, we calculate a second measure of the gender pay differential which is adjusted by the difference in human capital of employees:

$$Gap2_j = Gap1_j - \left(\hat{\beta}_j^m \overline{X}_{ij}^m - \hat{\beta}_j^m \overline{X}_{ij}^f\right) \tag{2.3}$$

$\overline{X}_{ij}$ includes mean characteristics of the individuals *i* at establishment *j* and $\hat{\beta}_j^m$ is a vector of estimated coefficients – derived from wage regressions – of the individual characteristics X_{ij} of male employees in establishment *j*. Hence, Gap2 reflects the difference in the rewards for individual human capital characteristics and unobserved wage effects between male and female employees within each establishment *j*. The calculation of this measure requires the estimation of wage equations for male

employees only.[22] In order to allow for the heterogeneity and complexity of the wage setting process we estimate – as far as possible – separate wage equations for each establishment:

$$w_{ij}^{m} = \beta_{j}^{m} X_{ij}^{m} + \varepsilon_{ij}^{m} \quad \textit{for establishments with at least } 100 \textit{ male employees}. \quad (2.4)$$

The dependent variable describes the daily log wage rate. We restrict the wage equation to a standard Mincer equation aiming to adjust the observed wage rate by differences in human capital endowments between men and women. Since other possible wage determinants, such as the occupational status and the occupational group are determined by human capital and presumably also by other firm characteristics, we exclude them from our wage equation. Hence, X_{ij}^{m} includes potential experience (squares), dummy variables for different education levels and job tenure.[23] The right-censoring of the dependent variable again requires the estimation of a Tobit model. In order to make sure that our firm-specific wage estimations yield statistically meaningful results, we only take into account establishments with at least 100 male employees. This procedure is most suitable to take into account the heterogeneity among establishments. The benefit of this approach is only feasible, however, at the expense of the number of considered establishments. To exploit information from establishments with less than 100 male employees, we run pooled regressions for all establishments with between twenty and ninety-nine male employees:

$$w_{ij}^{m} = \beta^{m} X_{ij}^{m} + \varepsilon_{ij}^{m} \quad \textit{for establishments with less than } 100 \textit{ employees}. \quad (2.5)$$

Given the results of equation (2.4) and (2.5) respectively, we can calculate Gap2 which describes the GWG within establishments assuming that men had the same human capital endowment as women within an establishment. Note, however, that part of the differences in characteristics may be explained by inequality in access to and encouragement of education. Furthermore, 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 establishments.[24]

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[22] Alternatively, one may use female wages and characteristics to determine the remuneration of human capital. Given that the regression of male wages are unlikely to be biased due to selection problems and that men are less concerned with discrimination, we argue that male wage coefficients better represent the market value of selected qualification characteristics.

[23] Note that the inclusion of firm effects or industry-level variables is not required in this specification because we run firm-specific wage regressions and hence identification would not be feasible.

[24] In order to correct for this selection we would 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.

Using these two measures for the firm-specific wage differential as dependent variables allows us to analyze the effect of firm characteristics and institutional framework on wage inequality within establishments. To ensure the significance of our results, both indicators are only calculated for establishments with at least 20 male and 20 female employees.

$$GapK_j = \delta Z_j + \varepsilon_j, \qquad K = 1,2. \tag{2.6}$$

The observed wage gap (Gap1) as well as the GWG which is adjusted for the difference in human capital characteristics (Gap2) is assumed to depend on the vector Z_j including firm characteristics and information on the institutional framework of establishment j. δ captures the impact of the corresponding explanatory variables, derived from the theories expounded in Section 2.2. To investigate the hypotheses based on Becker's discrimination model, we use the establishment size, the relative establishment size within the sector and the export quota. Implications from the bargaining model are tested by variables such as "application of collective wage agreements" and "existence of a works council". To determine whether the naive notion of collective bargaining holds, i.e. that unions aim to increase wages at the lower tail of the wage distribution irrespective of sex, we add the female share of union members in the relevant union to vector Z_j in equation (2.6). In order to test whether the works council acts in favor of the majority of the workforce, we interact the existence of a works council with the female share in the establishment. As well as the variables attributable to we also use specific control variables such as region and industry.

In this second estimation step we can exploit the panel structure of the data by applying a random effects model. In the first estimation step, that is the wage estimation, it is not possible to apply fixed-effects panel estimation in a Tobit model, because most of our human capital variables are time invariant. Even if it would be straightforward to apply a random effects Tobit model, we currently refrain from this approach because of computer time restrictions. Since the variance of the calculated gender wage gap varies by establishment size per definition, we calculate robust standard errors accommodating heteroscedasty in the dependent variable.

A general issue in assessing the effect of firm characteristics is the firm self-selection into works council status or the adoption of collective agreements. In our setting, this problem becomes relevant if employees of establishments with high gender wage gaps were more or less likely to implement works council or follow collective agreements.

According to Addison et al. (2006), however, endogeneity of works councils does not seem to be important for Germany.

2.4 Data and some descriptive figures

The present analysis of the effects of firm characteristics and institutional framework on wage inequality within establishments is only feasible with linked information on employer and employees. For this 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 Statistics* of the Federal Employment Agency based on a unique establishment identification number. To test the hypothesis concerning the effect of the proportion of female union members, we further merge union membership data at the sector level. Information about the share of women among union members is published on the homepage of the Federation of German Trade Unions.[25]

The IAB Establishment Panel is an annual survey of German establishments, which was launched in western Germany in 1993 and was extended to eastern Germany in 1996.[26] The sample of selected establishments is random and stratified by industries, establishment size classes and regions. 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 ensures response rates between 63 and 73 percent - depending on the shares of first and follow-up interviews (Fischer et al. 2008). Given that the response rate of follow-up interviews is higher, panel attrition amounts to less than 20 percent. In order to keep the panel representative and correct for panel mortality, exits, and newly-founded units, additional establishments are drawn in each year, yielding an unbalanced panel. These additional establishments are stratified with respect to ten categories of establishment size and 34 economic sectors.

The sample unit is the establishment as the local business unit. Note, however, that firm and establishment are used as synonyms in this study. The surveyed

[25] http://www.dgb.de/dgb/mitgliederzahlen/mitglieder.htm.
[26] Detailed information on the IAB Establishment Panel is given by Kölling (2000).

establishments are selected from the parent sample of all German establishments that employ at least one employee covered by social security. Thus, self-employed people and establishments that employ only people not covered by social security (mineworkers, farmers, artists, journalists, etc.) as well as public employers engaging solely civil servants are excluded from the original sample. 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. Casually, other topics, such as training and human resource policies, were added to the questionnaire.

The employment statistic of the Federal Employment Agency, so-called *Employment Statistics Register*, is an administrative panel data set of all employees in Germany paying social security contributions.[27] 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.[28] 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 marginal jobs, that is, employees whose earnings are below a lower earnings limit or temporary jobs which last 50 working days at most, are not covered by this sample. Altogether, the Employment Statistics Register represents about 80 percent of all employees in western Germany. Employers are required by law to report information on all employed contributors 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, occupational status, qualifications, sex, age, nationality, industry and the size of the employing company. The available information on daily gross earnings (including all overtime premiums and other allowances) refers to employment spells that employers report to the Federal Employment Agency.[29] If the wage rate exceeds the upper earnings limit ("Beitragsbemessungsgrenze"), the daily social security threshold is

[27] Information on the Employment Statistics Register is given by Bender, Haas and Klose (2000).
[28] These are people who, as employees, have paid contributions to the pension system or who have been covered by the pension system through contributions to the unemployment insurance scheme or by being a parent (depending on the birth year of the child, a set number of years is counted as child caring time during which the non-working parent is entitled to receive pension benefits).
[29] To deal with the problem of overlapping spells, we apply a hierarchical order of activities where employment trumps all other activities.

reported instead.[30] 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. The male wage regressions presented in Section 2.3, therefore, ignore potential sample selection issues.

Both data sets contain a unique establishment identifier which is used to match information on all employees paying social security contributions with the establishment in the IAB Establishment Panel. To create a data set appropriate to assess the effect of labor relations on the GWG, we first exclude all part-time employees and homeworkers, because the limited information on working hours does not allow calculating hourly wage rates in that case. Second, apprentices as well as employees under the age of 20 or over the age of 60 are dropped in order to eliminate the particularities of early retirement and the transition from school to work. Furthermore, we restrict our sample to German employees, because the wage setting process of immigrants presumably further depends on other factors, such as the years since migration, the origin of their schooling and other qualification degrees, as well as the penchant for discrimination within the establishment, which are not available in our data. Regarding establishments, we further restrict our sample to the private sector in western Germany. We use information on all establishments participating in the IAB Establishment Panel in at least one year from 1997 to 2001.[31] Finally we exclude establishments which employ less than 20 women or 20 men because the calculation of the firm-specific GWGs as well as their regression on the firm characteristics derived in Section 2.2 is not statistically meaningful in these organizations. Table A1 in the appendix illustrates the effect of our sample selection criterions on the distribution of establishment size and industry sectors. Not surprisingly, our sample underrepresents establishments with less than 100 employees compared to the original LIAB sample.

[30] Fitzenberger and Wunderlich (2002) show that this particularly affects 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.

[31] Eastern German establishments are not considered in the analysis because both the wage level as well as the wage setting process is still very different. Given the small number of union members in eastern Germany and the limited application of co-determination, the importance of the institutional framework is supposed to be less relevant. A common investigation of both regions would therefore not be very meaningful. Furthermore, the GWG is much smaller in eastern Germany. A separate analysis for eastern Germany would not be comparable either, because the wage setting process and the resulting GWG in eastern German establishments is likely to be driven by internal processes, which cannot be captured by our data, such as the devaluation of female labor as well as the crowding out of women in the labor market and particularly women in occupations which were dominated by females in eastern Germany before unification.

The relatively high share of establishments referring to manufacturing presumably also results from the large number of bigger establishments. In contrast, establishments belonging to trade and repair, construction and services are somewhat underrepresented in our sample.

One innovation of our study is the firm-specific estimation of the wage equations. Based on these results, we can calculate an adjusted wage gap (Gap2) accommodating the firm-specific wage setting process. To guarantee the reliability of our estimation results, we restrict this procedure to larger establishments. These are establishments employing at least 100 full-time employed German men who are subject to social security contributions. Since this condition does not hold for many smaller establishments, we would have to leave out many establishments and information on the determinants of the firm-specific GWG. To maximize the number of establishments in the second estimation step, we apply an alternative estimation strategy for smaller establishments. The employees of establishments employing twenty to ninety-nine full-time employed German men are considered in a pooled wage estimation (see equation (2.5)).

Table 2.1 shows the number of firms as well as the number of their male and female employees in each observation year which enters the wage estimations. The rather small share of female employees results from our sample definition, which excludes the public sector and all part-time employees. The number of yearly observations varies between 1148 and 1852 establishments. The 4th column of Table 2.1 contains the average of the observed log gender wage gaps within firms as defined in equation (2.1).

Table 2. 1: Description of the sample and the gender wage gap

Year	Number of firms	Number of male employees	Number of female employees	Within-firm GWG based on reported value (in logarithm)	Adjusted within-firm GWG (in logarithm) for right censoring	Adjusted overall GWG (in logarithm)
	(1)	(2)	(3)	(4)	(5)	(6)
1997	1,148	655,002	189,807	0.183	0.198	0.207
1998	1,195	604,140	181,452	0.184	0.199	0.211
1999	1,179	543,955	164,154	0.181	0.196	0.215
2000	1,640	605,410	184,514	0.185	0.202	0.215
2001	1,852	669,695	207,085	0.180	0.197	0.219

Note: The results refer to firms with at least 20 male and 20 female employees. Further explanations are given in the text.
Source: own calculation; LIAB cross-sectional model 1997-2001

A look at Table A2 in the appendix reveals that the observed wage gap is larger in establishments with fewer male employees. Note, however, that this figure is based on reported wage rates and ignores the fact that actual earnings could be higher. In our sample, 15 percent of male employees earn wage rates above the upper earnings limit while this is true for only 4 percent of female employees. As a result, the measure based on equation (2.1) underestimates the true GWG within firms. In order to correct for the right-censoring of the wage information, we estimate equation (2.2) with a Tobit model. The average of the estimated raw wage gaps within firms is presented in the 5th column. As expected, the actual raw wage gap is higher then the calculated values in column 4. The last column show the average adjusted overall gender wage gap without taking into account the establishment level.

The wage gap in the last column is corrected for the censoring, but compares the wage rates of males and females across all establishments. That is, equation (2.2) is estimated by a pooled Tobit model across all employees. In every year, the overall wage gap is a higher than the wage differential within establishments. The difference between these two measures of gender wage differential indicates that women tend to select into lower paying establishments. The average difference in the GWG amounts to at least one percent points. Our results should hence be interpreted bearing in mind that selection into establishments is considerable and taken as given.

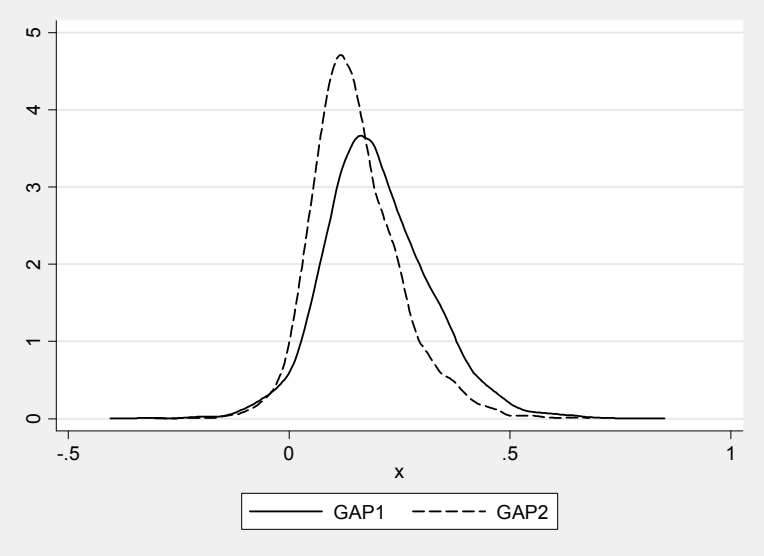

Figure 2.1: Kernel estimation of Gap1 and Gap2

Note: Gap1 denotes the observed wage differential between men and women within the same establishment. Gap2 describes the gender wage gap under the assumption that male employees would have the same characteristics as female employees. Both measures accommodate the censoring of our wage variable by applying Tobit estimates. The Epanechnikov kernel function is used in the kernel density estimations of Gap1 and Gap2.

Source: own calculation; LIAB cross-sectional model 1997-2001.

Figure 2.1 shows the distribution of Gap1 and Gap2 in across establishments. Gap1 has a mean of about 0.2 and a standard deviation of 0.12. Gap2 is smaller on average with a mean of 0.14. The corresponding standard deviation amounts to 0.10. Since Gap2 controls for the differences in human capital and hence much of the heterogeneity between establishments, the distribution of Gap2 is steeper and the mode appears to be at a lower level than the one of Gap1.

2.5 Estimation results

2.5.1 First estimation step: Wage regression

To calculate the within-firm GWG under the assumption that male employees have the same characteristics as female employees within each establishment (Gap2), we first have to determine wage estimates for all establishments in our sample. For establishments with at least 100 male employees, we estimate 1,704 wage equations with a Tobit model in order to account for censoring. The estimated firm-specific wage coefficients are used to determine Gap2 according to equation (2.3). This estimation strategy is not applicable for establishments with fewer employees because the within-firm estimation would yield no statistically meaningful results. For this reason, we estimate a pooled wage equation across all male employees in establishments with less than 100 male employees. The summary statistics of the dependent and explanatory variables are presented in Table A3 and A4 in the appendix.

Table 2. 2: Coefficients of the wage estimations in a Tobit model (establishments ≥ 100 male employees)

Variable	No. of Obs.	Mean of the coeff.	Mean of the t-value	Share of significant coeff.	Share of same sign	Std. deviation of coeff.	Quotient
	(1)	(2)	(3)	(4)	(5)	(6)	(2)/(6)
Potential experience	1,704	0.024	7.624	0.887	0.978	0.015	0.625
(Potential experience)^2/100	1,704	-0.040	-6.011	0.799	0.952	0.029	-0.725
Job tenure (in days)/1000	1,704	0.412	7.072	0.808	0.892	0.787	1.910
Low education without vocational training	1,192	-0.424	-11.077	0.898	0.972	0.219	-0.517
Vocational training	1,669	-0.130	-4.433	0.796	0.693	0.265	-2.038
Secondary school	904	0.054	0.823	0.746	0.516	0.323	5.981
College of higher education or university	1,118	0.336	9.066	0.814	0.953	0.239	0.711

Note: Coefficients result from wage regressions in establishments with at least 100 male and 20 female employees. Further explanations are given in the text.
Source: own calculation; LIAB cross-sectional model 1997-2001

As the coefficients from the 1,704 large establishments cannot be displayed in detail, we present a summary of the firm-specific estimation results in larger establishments in Table 2.2.

Column 1 in Table 2.2 describes the number of estimated coefficients for each characteristic. Note that some characteristics are missing in some establishments, such that specific coefficients cannot be determined in every establishment. The second column presents the mean of the coefficients of the firm-specific wage estimations and column 3 shows the corresponding mean of the t-values. Table 2.2 contains coefficients for all possible education levels because the left-out category differs from establishment to establishment. The means of the estimated coefficients show that the variables have the expected effect on the wage rate. That is, the wage rate increases with the education level and potential experience on average. As predicted by Mincer (1974), the squared term of potential experience is negative, hinting at diminishing returns to experience. Longer spells within the same establishment also cause small but positive effects on the wage rate. In order to obtain a more exact impression of the significance of the estimated coefficient, column 4 shows the shares of the estimated coefficients which are significant at the 5 percent level. We can see that about 75 to 90 percent of the estimated coefficients are statistically different from zero. Note, however, that not all coefficients show in the same direction. Column 5 describes the share of coefficients with the same sign as the mean of the coefficient in column 2. The firm-specific coefficients of vocational training and secondary schooling exhibit the smallest share of consistent signs. Furthermore, Table 2.2 includes the standard deviation of the estimated coefficients to illustrate the heterogeneity of the wage regressions across establishments (see column 6). The last column presents a sort of variation coefficient, which is a quotient of the standard deviation of the coefficient and the absolute value of the corresponding mean. Hence, this figure illustrates the standardized variation of coefficients across establishments. High values of this quotient indicate that the variation of firm-specific coefficients is high, supporting our supposition that the wage setting process differs tremendously across establishments. Small values signal moderate heterogeneity of wage returns to the corresponding characteristics. The results in Table 2.2 point out, for example, that the remuneration of job tenure varies much more across establishments than the coefficients for experience. In consideration of the varying coefficients, the wage estimation in each establishment

seems to be advantageous in determining the correct remuneration of the characteristics.

In addition to these summary statistics, we also present the 25th, 50th and 75th percentiles of the estimated coefficients in Table A6 in the appendix. The results show that the rather "extreme" values of the estimated coefficients also indicate the well known fact that education, establishment tenure and experience have a positive effect on individual wage levels.

Table 2. 3: Coefficients of the pooled wage estimations in a Tobit model (establishments with 20 to 99 male employees)

Variables	Coefficients	Standard deviation of coefficients	t-value
Potential experience	0.036	0.000	98.19
(Potential experience)^2/100	-0.063	0.001	-80.62
Job tenure (in days)/1000	0.263	0.003	75.87
Low education without vocational training	-0.299	0.002	-124.87
Vocational training (reference group)	-	-	-
Secondary school	0.204	0.003	62.79
College of higher education or university	0.432	0.003	135.89
No. of observations	120,091		
Log likelihood	-26,970		

Note: The regression includes male employees from establishments with 20 to 99 male and at least 20 female employees. Instead of a constant variable we include all year dummies.
Source: own calculation; LIAB cross-sectional model 1997-2001.

Table 2.3 presents the estimation results of the pooled Tobit regression for smaller establishments. Note that the education level *vocational training* serves as the only reference group in this setting. The estimated coefficients are highly significant and also exhibit the expected sizes and signs.

2.5.2 Second estimation step: Explaining the firm-specific gender wage gap

As mentioned in Section 2.2, the estimated coefficients are used to calculate the adjusted GWG, Gap2. In order to derive conclusions about the impact of firm characteristics and the institutional framework on the GWG, we regress selected establishment-level and industry-level variables on the raw firm-specific wage gaps (Gap1) and on the adjusted firm-specific wage gaps (Gap2). We use the export quota, the establishment size as well as the relative establishment size to test whether establishments with market power discriminate more and therefore reveal a higher

GWG or not. The impact of the institutional framework on the GWG is investigated by including a dummy variable for the existence of a works council. Furthermore, we use an interaction term between this dummy and the share of female employees within an establishment to test whether the effect of employees' representations depend upon the female share among the staff. In order to check the hypothesis that collective wage agreements entail smaller GWGs, we distinguish between industry-wide, firm-specific and no wage agreements. In one model specification, we also include the female share among union members in the relevant union, to see whether the naive notion of collective bargaining holds. A positive coefficient of the female share in the corresponding union would suggest that unions with a high female share are more successful in reducing the wage gap between men and women. Unfortunately, our data do not provide any information about which collective bargaining agreement is relevant for establishment *j*. We therefore assign each establishment to an industry-specific union according to the industry affiliation of the establishment. This implies, for example, that an establishment in the construction sector is supposed to be subject to the collective agreement of the union called "IG-Bau".[32] As a consequence, we assign the same female share to all establishments in the construction sector. For this reason, the error terms of establishments negotiating with the same union are not independent. To adjust for the correlation within each union-cluster, we calculate clustered standard errors. Due to the decreasing number of unions in Germany[33], we can only distinguish between seven unions and one cluster of establishments without collective wage agreements. Since the estimation approach requires that establishments remain in the same cluster during the whole observation period, we lose 493 observations of establishments which changed their union status or the industry sector.[34] A switch between industry-wide or firm-specific wage agreements has no effect on the number of observations. In order to make sure that we use as much information as possible and to avoid our estimation results being affected by the restriction of the sample, we include this variable only in an additional model

[32] In the case of a firm-specific wage agreement, the establishment negotiates directly with the corresponding union. The female share of the union members is hence merged in the same way as in the case of industry-wide wage agreements.

[33] For instance, five separate unions covering the service sector merged to form the large union "ver.di" in 2001 and other small unions joined more powerful unions like "IG Metall".

[34] These 493 observations refer to 198 different establishments. Most switches across clusters were due to changes in the union status, that is, establishments quit the employer association and did not negotiate with unions anymore (189 establishments). Only 9 establishments actually changed their industry sector.

specification. Summary statistics of the selected variables in both samples are presented in Table A5 in the appendix.

In all regressions, differences between regions, industries and years are captured by several control variables. Apart from that, we include the wage bill per employee to control for differences between high and low wage establishments. Table 2.4 shows the effects of the selected variables on our two measures of the gender earnings gap. The results rely on the whole sample as the female share among union members does not enter this baseline specification. The number of different establishments entering our estimation is 2,758, of which 1,054 establishments belong to the group of smaller establishments (with pooled wage regressions) and 1,704 are large establishments (with firm-specific wage regressions). The estimated coefficients of the control variables region, industry and year dummies are not presented here but are available on request.

Table 2. 4: Determinants of the firm-specific gender wage gap

	GAP1		GAP2	
Variables	Coefficients	Standard Errors	Coefficients	Standard Errors
Constant	0.2528**	0.0173	0.2145**	0.0145
Number of employees/1000	-0.0099**	0.0023	-0.0094**	0.0022
(Number of employees/1000)^2	0.0003**	0.0001	0.0003**	0.0001
Relative firm size	0.0631*	0.0337	0.0826**	0.0309
Export quota (of sales)/10	-0.0265	0.0683	-0.1272**	0.0575
Wage bill per employee/100000	0.1430*	0.0773	0.0075	0.0666
Female share (of all employees)	0.0603**	0.0299	0.0120	0.0261
Works council	-0.0341**	0.0150	-0.0461**	0.0132
Works council * Female share	0.0306	0.0300	0.0385	0.0264
Industry-wide wage agreement	-0.0149**	0.0046	-0.0100**	0.0037
Firm-specific wage agreement	-0.0128**	0.0055	-0.0103**	0.0045
Observations	5,802		5,802	
R^2	0.1871		0.1456	

Note: The dummy variables for the years, regions and industry are also included in the estimation. The results are available on request. Significance levels: **: 5 percent, *: 10 percent.
Source: own calculation; LIAB cross-sectional model 1997-2001

Before discussing the effect of the institutional setting and the degree of competition, we now take a short look at the list of control variables which are meant to capture observed heterogeneity among establishments. Unobserved firm-specific heterogeneity is captured by the random effects determined by the estimation model. The positive impact of the female share on Gap1 and Gap2 may be interpreted as a segregation effect. The regressions show that establishments employing comparatively many

women seem to provide less equality among men and women than those with a small share of female workers. If the devaluation of jobs due to a high share of female employees is more pronounced for women (see e.g. Carrington and Troske 1998), segregation not only reduces the wage level but also reinforces the pay differential between men and women. Another explanation could be that the few men working in female dominated establishments mostly hold managerial positions and the mass of women perform simple tasks in lower paid positions (see e.g. Dolado et al. 2004). A typical example of this type of work sharing is the retail industry, where most women are employed as shop assistants or cashiers while most men work as shop managers. This interpretation corresponds to the result that the effect is smaller and not even significant in the estimation of Gap2, implying that part of the female effect is driven by the gender differences in human capital endowment.

The positive coefficient of the wage bill per employee in the regression of Gap1 shows that the GWG is larger in high wage establishments.[35] This may be due to the so-called glass ceiling effect. According to this phenomenon, the wage rate of women is capped at a certain threshold, partly because women do not reach the top positions in most establishments. As a result, the GWG at the right tail of the earnings distribution is higher than at the mean. In the regression of Gap2, which controls for differences in human capital endowment, the effect of the firm-specific wage level is insignificant. We therefore conclude that controlling for human capital partly explains the larger gender pay differences in high wage establishments.

Note, however, that due to our sample selection criterions, establishments with less than 100 employees are underrepresented in our sample (see Table A1 in the appendix). Hence, applying all these conclusions to small businesses may be bold.

We now turn to the alternative indicators of competition. The results reveal a negative relation between the number of employees and the two measures of the GWG. However, the positive coefficient of the quadratic term points out that the negative impact of the number of employees decreases at a certain establishment size. The GWG starts to rise with the number of employees once the establishment employs more than 15,050 workers in the case of Gap1 (respectively 14,700 in the case of

[35] The average wage level is not correlated with the GWG per definition, because the first figure relies on the establishment panel and corresponds to all employees while the GWG only refers to the selected employees as described in Section 2.4.

Gap2).[36] This implies that the hypothesis that very large establishments can afford more discrimination due to their market power only holds for establishments with more than about 15,000 employees, which only applies to 0.03 percent of observations in the sample. This result suggests that it may be too simplistic just to assume that large establishments have more market power. The negative coefficient appears plausible bearing in mind that large establishments are more in the public eye and that public pressure tends to lower the GWG. Another reason for the smaller GWG in large establishments may be the fact that male and female employees are more likely to work in comparable job positions (unless jobs are not fully segregated) in large establishments. Hinz and Schübel (2001) show, for instance, that occupational gender segregation decreases with the establishment size. In this case, it is more difficult to enforce different wage rates for equal jobs because employees can easily compare their tasks and wage rates.

The relative establishment size in terms of establishment employment relative to the number of employees in the industry sector increases the GWG within the establishment and hence supports the hypothesis of a discrimination-reducing effect of competition.[37] The fact that this effect is somewhat stronger for Gap2 implies that relatively large establishments tend to employ a higher share of high-skilled women. The export quota – suggesting additional competition on the global markets – has a significant negative impact on Gap2, which is also in line with Becker's model of discrimination. The coefficient of the export quota is smaller and has no significant effect on Gap1, however. An interpretation which is perfectly in line with the results of Black and Brainerd (2004) would be that international trade increases inequality by reducing the relative wages of less skilled workers who are predominantly female. As a consequence, the observed GWG is not reduced. At the same time, trade appears to benefit women by reducing the ability of establishments to discriminate, as revealed by a diminishing Gap2.

As far as the effect of institutional setting is concerned, we find pretty clear and convincing results which concur with those of earlier studies. The estimates indicate that industrial relations are strongly linked to the GWG. The existence of a works council has a significant negative impact on Gap1 and Gap2, denoting that employees'

[36] By calculating this number of employees we assume that the total number of employees in the industry sector is constant and for simplification we use the average of the total number of employees in the industry sector.

representatives foster equal treatment of male and female employees within establishments. The consistent effect on both measures implies that the existence of works councils also limits the potential of discrimination within qualification levels. The interaction between works councils and the female share within an establishment is positive but has no significant impact in any regression. We therefore conclude that works councils tend to reduce inequality between men and women irrespective of the gender relations within the establishment. In other words, the median voter approach does not seem to apply in this setting. Note, however, that even if a high share of female employees does not seem to foster the effectiveness of co-determination in terms of wage equality, it may be likely that the female share among the works council's members influences the goals of the staff association. Given that we have no individual information on the membership in works councils, we cannot test this hypothesis.

As the collective bargaining model suggests, establishments under collective agreements tend to have smaller pay gaps between males and females than those without wage agreements. The results on the effect of alternative wage bargaining regimes show that the impact of the industry-wide and firm-specific wage agreements are very similar. A Wald test indicates that the null hypothesis $\delta_{industry} = \delta_{firm-specific}$ cannot be rejected at conventional levels in both estimations.[38] Since firm-specific contracts are generally bargained by sector-specific unions, one possible explanation might be that a considerable fraction of the firm-specific contracts simply adopt most of the terms negotiated in the corresponding industry agreement in order to lower transaction costs (see e.g. Gürtzgen 2005). This argument becomes even more plausible if we think of firm-specific contracts that are primarily aimed at saving jobs. In these cases firm-specific contracts include individual agreements on working hours, periods of notice and possibly reduce overall wage increases.[39]

Even if these results seem to support the naive notion of unions' goals, there might be differences in the effect on the GWG with respect to the gender composition among the union members. We therefore investigate the hypothesis that unions with a higher

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[37] Alternatively, we calculated the relative establishment size in terms of turnover. However, the results do not provide empirical evidence for the hypotheses derived in Section 2.2.

[38] The p-values are 0.6052 for the raw wage gap and 0.9209 for the adjusted wage gap.

[39] This result partly contrasts with the conclusion of Amuedo-Dorantes and De la Rica (2006) for Spain, who find evidence for different effects of firm-level agreements and more centralized collective bargaining agreements on the GWG in 2002, but not in 1995. Blau and Kahn (2003) also reason that the decentralization of bargaining processes raises the overall wage gap.

share of female members act more in favor of female interests and hence have a greater effect on the firm-specific wage gap. Union membership data are merged on an aggregated sector level (7 categories according to the sector classification of the unions) and interacted with a dummy variable indicating whether the establishment is subject to an industry- or firm-specific collective agreement or not.

Table 2. 5: Determinants of the firm-specific gender wage gap (restricted sample)

	GAP1		GAP2	
Variables	Coefficients	Standard Errors	Coefficients	Standard Errors
Constant	0.2834**	0.0176	0.2275**	0.0198
Number of employees/1000	-0.0098**	0.0027	-0.0091**	0.0027
(Number of employees/1000)^2	0.0003	0.0002	0.0003	0.0002
Relative firm size	0.0918**	0.0189	0.1101**	0.0286
Export quota (of sales)/10	0.1613*	0.0878	0.0092	0.0418
Wage bill per employee/100000	-0.0331	0.0444	-0.1252**	0.0267
Female share (of all employees)	0.0434	0.0514	0.0150	0.0505
Works council	-0.0359**	0.0129	-0.0387**	0.0113
Works council * Female share	0.0483	0.0441	0.0319	0.0296
Industry-wide wage agreement	-0.0498**	0.0108	-0.0385**	0.0092
Firm-specific wage agreement	-0.0521**	0.0116	-0.0433**	0.0092
Collective agreement * Female share of involved union	0.0285	0.0178	0.0356**	0.0149
Observations	5,374		5,374	
R^2	0.1929		0.1533	

Note: The dummy variables for the years, regions and industry are also included in the estimation. The results are available on request. The female share of involved union is assigned to the establishment on the basis of the industry. Significance levels: **: 5 percent, *: 10 percent.
Source: own calculation; LIAB cross-sectional model 1997, 1999, 2001. The female share of unions is given on the homepage of the DGB: http://www.dgb.de/dgb/mitgliederzahlen/mitglieder.htm.

Table 2.5 presents the results of the clustered regression. Note that the number of observations is somewhat smaller due to establishments switching their union status. Our regressions cannot prove the hypothesis. Instead, the results show a positive relationship between the number of women involved in the union and the wage differential within establishments. The coefficient of the interaction term is, however, not significant in the regression of Gap1. One explanation for this result may be that negotiating about wages is not the most important aim of female union members, but that they are more interested in improving the compatibility of family and job by means of family-friendly work practices, such as childcare facilities, human resource measures easing the integration of mothers after employment breaks, promotion of part-time employees or flexible work schedules.

Note that the results of the restricted sample also differ in some respect compared to our baseline models presented in Table 2.4. For example, the female share has no significant impact on Gap1 anymore. This result hints at a positive correlation between the female share within establishments and the corresponding union. In contrast, the importance of relative establishment size is more evident in the clustered regression based on the reduced sample. Apart from that, the results are very similar and hence support the conclusion derived above.

2.6 Conclusions

This study provides a first comprehensive analysis of the GWG *within* German establishments. Being aware that other firm-specific factors, such as segregation (see e.g. Reilly and Wirjanto 1999, Bayard et al. 2003 or Datta Gupta and Rothstein 2005), training (see e.g. Wolf and Heinze 2007) or organizational structure (see e.g. Drolet 2002, Datta Gupta and Eriksson 2006 or Wolf and Heinze 2007) may also frame the wage differences between men and women at establishment level, we focus here on the impact of industrial relations and the stress of competition. The specific benefit of our research is that we exploit the linked information on employer and employees by looking at gender pay differentials at establishment level. Since our descriptive figures illustrate that the mean cross-section GWG at establishment level is smaller than the mean overall GWG by about one to two percent points, our results should be interpreted as the impact of firm characteristics and the institutional setting on the GWG, taking the selection into establishments – depending on many factors we cannot control for with our data – as given. The empirical analysis is based on the German LIAB data, a representative linked employer-employee panel including information on all employees of establishments covered by the IAB establishment survey.

To assess the impact of industrial relations and competitive pressure on the GWG, we define two measures describing the firm-specific GWG. First, we use the observed GWG and second a wage gap, which is adjusted for the differences in human capital characteristics between men and women at establishment level. In order to calculate the second measure, we estimate separate wage equations – as far as possible – for male employees in each establishment.

Our findings suggest that establishments bargaining their wages within the framework of collective agreements have a smaller gender pay gap. Given that most unions are still dominated by men, this result is not self-evident. It is, however, not possible to

empirically detect any additional effects of unions in which a higher proportion of members are female. In contrast, it is noticeable that a high proportion of female union members correlates with larger pay differentials. One plausible explanation may be that female union members rather focus on improving working conditions and the compatibility of work and family than simply negotiating on wages. Our results also point to a gender equalizing effect of formalized co-determination. This suggests that works councils systematically influence the establishment's wage structure and actively use their right to decide on new pay schemes and the setting of wages above agreed tariff and bonus rates. Again, the hypothesis that works councils only realize the interests of women if they represent a larger part of the staff is not supported by the data. Considering that not only German establishments increasingly loosen from institutional restriction on the part of unions and works councils, the trend of stagnating GWGs observed in many countries (see e.g. European Commission 2007) may be aggravated by the reduced importance of formalized labor relations.

Finally, we tested the hypothesis that the degree of Becker's discrimination preferences depends upon the market structure and the returns to scale using various alternative proxies for the degree of competition. While establishment size (up to 15,000 employees) tends to decrease discrimination, the relative establishment size, which is supposed to correlate with market power, seems to increase the pay differences between men and women within establishments. The negative coefficient of the export quota also yields support for the hypothesis derived from the discrimination model.

An alternative interpretation of the effect of relative establishment size may be that the market dominating establishments may have monopsonistic power. Robinson (1933) first introduced the idea of monopsonistic discrimination in the labor market. According to this approach, a single employer may set wages below the marginal revenue product if there is little or no competition on the factor market. The more inelastic the labor supply, the larger the gap will be between the achievable wage rate and the marginal revenue product. By differentiating wages between groups with variously elastic labor supply curves, the monopsonist may maximize his profit. For instance, gender can be one dimension along which the employer may differentiate. Given the limited job mobility – for instance due to family responsibilities of women[40]

[40] The reasons for the lower job mobility of women are manifold. First, the availability of family-friendly jobs is still limited. In this setting, wages become a less important job criterion compared with flexible

- there exists theoretical and also some empirical evidence that female labor supply at the establishment level is less elastic than male labor supply (see for instance Barth and Dale-Olsen 1999, Ransom and Oaxaca 2005, Hirsch et al. 2006 and Hirsch 2008). In the case of monopsonistic power, women will hence have to accept lower wages than men relative to their productivity. Unfortunately, we must refrain from an exact empirical implementation of this hypothesis because we have no direct information capturing the monopsonistic power of the establishment.[41]

work schedules, commuting or career perspectives for part-time employees. Second, since husbands earn higher wages in general, local mobility is mostly driven by men.

[41] To test a model of monopsonistic discrimination according to Burdett and Mortensen (1998), one would need gender-specific labor turnover rates, strictly speaking the resignation rate of men and women and the potential to recruit new male and female employees for each establishment. These indicators may be constructed by imposing relatively strong assumptions, though.

Chapter 3
Beyond the mean gender wage gap: Decomposition of differences in wage distributions using quantile regression

3.1 Motivation

The gender wage gap has been extensively studied in the labor economics and sociological literature. Even though the pay differential tends to shrink over time, a sizeable gender wage gap persists (see for example, the international evidence in Blau and Kahn, 1996, 2003 and the OECD 2002). Identifying the different source of wage differentials is crucial for explaining and understanding this persistence. In addition, policy options are different depending on the underlying reasons for the wage differentials.

Traditionally, the gap has been explained by gender differences in the human capital endowment and its reward in the labor market. A widely-used way to explore gender wage differentials empirically is to decompose the observed mean gap into a component attributable to differences in human capital characteristics (endowment part) and a component referring to differences in returns to these characteristics (remuneration part). This decomposition into two parts was introduced by Oaxaca (1973) and Blinder (1973).

More recently, gender segregation as a further source of wage differentials has moved more and more into the focus of scholarly interest. The empirical finding is that the segregation of women into low-paying labor market structures is a major source of wage differentials between men and women (e.g. Groshen 1991a, Dolado et al. 2004, Bayard et al. 2003). Although the seminal studies in this field emphasize the importance of female segregation into low-paying occupations (see for an overview Sorensen 1990), more recent studies have extended the analysis to firm segregation and conclude that this segregation is also an important source of gender wage differentials (e.g. Groshen 1991a, Carrington and Troske 1998, Reilly and Wirjanto 1999a, Bayard et al. 2003). The importance of firm segregation of men and women is related to empirical findings which point to the influence of labor demand-side factors in wage

determinations. This empirical literature shows that wage differentials can also be the result of inter-firm wage differentials (overview in Abowd and Kramarz 1999). Thereby the inter-firm wage differentials can be attributed to different reasons, such as compensating wage differentials, efficiency wage payments, institutional settings or rent-sharing processes (see for a theoretical overview Groshen 1991b). Since men and women work in different firms, these inter-firm wage differentials can also have an impact on the gender wage gap.

One purpose of this study is to disentangle the effect of differences in personal characteristics and the effect of selection into different firms of women and men on the gender wage gap. For this aim, the wage equations include establishment characteristics in addition to individual characteristics and the traditional Oaxaca-Blinder (OB) decomposition is extended.

Another relevant finding in the recent gender wage gap literature is that the gap is very complex and varies across the wage distribution. Albrecht et al. (2003), for instance, detect that while the average gender wage gap is indeed relatively small in Sweden, the gap increases throughout the wage distribution and rises even more in the upper tail. They conclude that the earnings potential of women in the upper part of the wage distribution is limited (glass ceiling effect). Hence, assuming a constant wage gap throughout the wage distribution is misleading because this could wrongly lead us to conclude the gender wage gap to be of minor importance. Furthermore, the traditional approach is based on the assumption that the importance of explanatory factors does not vary with the wage rate. This assumption is not very realistic. Among others, Albrecht et al. (2003) show an increasing impact of education on the wage differential across the wage distribution. In fact, there are many good reasons to believe that male and female wages are also not equally affected by innovative human resource practices and institutional settings across the wage distribution. In particular, firm characteristics describing the collective bargaining and co-determination are supposed to be more important in the wage determination process of employees with low earnings because these workers belong to the main target group of unions. Furthermore, it is conceivable that firm's profits have a stronger impact on the wage rate of highly-paid employees because they are more likely to get corresponding bonus payments.

As an additional contribution, therefore, this study decomposes the gender wage gap across the wage distribution and thus combines two important strands of the recent empirical literature. On the one hand differences in the workplaces of male and female

employees are taken into account and on the other hand the analysis is extended to the entire wage distribution. More precisely, I include a detailed set of firm characteristics in addition to individual characteristics as wage determinants. Then in order to decompose the observed wage gap, I apply an extension of the traditional OB decomposition to disentangle the effect of personnel characteristics (including human capital and occupations) and the effect of firm characteristics in explaining the gender wage gap. The extended decomposition results in four terms: one attributable to differences in individual characteristics, one referring to differences in returns to individual characteristics, another that captures differences in firm-specific characteristics and finally one resulting from differences in returns to these characteristics. In order to accommodate differences across the wage distribution, the four decompositions terms are implemented at each percentile of the wage distribution. To this end a flexible parametric method introduced by Machado and Mata (2005) is applied.

The empirical analysis is based on a large German linked employer-employee data set. The comparison of the wage information for male and female employees in the sample shows that the raw gender wage gap is sharply decreasing within the first quartile, the decrease then decelerates up to the 60^{th} percentile, and after that the gap is slightly increasing again.

The decomposition shows that the selection of women into less successful and productive firms explains a sizeable part of the gap. This selection is more pronounced in the lower part of the wage distribution than in the upper part. In addition, women benefit from the success of firms to a lesser extent than their male colleagues. This is the source of the largest part of the pay gap. Gender differences in individual characteristics as well as differences in returns to these characteristics play a smaller role in explaining the wage differential.

The remainder of the study is organized as follows. Section 3.2 briefly discusses the literature on decomposing gender wage gaps throughout the wage distribution. The econometric methodology is presented in Section 3.3. Section 3.4 describes the data source and the specification of the wage equations. Section 3.5 presents and discusses the results. Finally Section 3.6 gives some concluding remarks.

3.2 Decomposing the gender wage gap: Some background

A decomposition analysis is a standard approach to explore the wage differential between male and female employees. It is often used to examine the sources of the gap and to answer the question, how much of the gap is attributable to discrimination. In this approach the mean wage differential is decomposed into one part capturing differences in characteristics and another part referring to different returns using the estimates of male and female wage equations (Oaxaca 1973 and Blinder 1973). The latter part is called the unexplained part of the wage differential or the remuneration effect. This fraction of the gap is often used as a measure of wage discrimination.[42]

However, one drawback of this standard approach by Oaxaca (1973) and Blinder (1973) is the focus on the average gender wage differential. Thus, potentially important variations of the wage differences across the wage distribution are not taken into account. Hence, the attention in empirical gender studies has shifted towards investigating the degree to which the gender wage gap varies across the wage distribution. For instance, Fortin and Lemieux (1998) decompose changes in the US gender wage gap at various wage percentiles. They apply rank regressions to estimate the probability of an individual being in a certain wage segment given this individual's characteristics. Bonjour and Gerfin (2001) apply a methodology proposed by Donald et al. (2000) to decompose the gender wage gap across the earnings distributions in Switzerland. The basic idea of the applied method is to recover estimates of the density and distribution functions from the estimated parameters of a hazard function.

Most recently, studies use quantile regressions in order to decompose the gender wage gap at different points of the wage distribution. García et al. (2001) propose to use quantile regressions in order to compare quantiles of the male and the female wage distribution conditional on the same set of characteristics as an approximation of the unexplained part of the gap. However, their decomposition of the Spanish gender wage gap evaluates the vector of characteristics of men and women at only one point, the unconditional mean, regardless of which quantile is considered. Gardeazabel and Ugidos (2005) consider it more suited to weight the difference in returns to a certain

[42] However, Altonji and Blank (1999) argue in their survey article "Race and Gender in the Labor Market" that this is a misleading terminology, because if any control variables are omitted that are correlated with the included characteristics, then the coefficients will be affected. The unexplained part therefore captures both the effects of discrimination and unobserved gender differences in productivity and tastes. Furthermore, discriminatory barriers in the labor market can also affect the characteristics (such as education) of individuals.

characteristic (for example primary education) at a given quantile according to the proportion of individuals with this characteristic at that quantile. Based on this methodological approach, their findings for the Spanish wage gap contradict the results of García et al. (2001). While in the analysis of García et al. (2001) the part of the gender wage gap due to different returns to characteristics increases throughout the wage distribution, Gardeazabel and Ugidos (2005) find the opposite to be the case.

Considering only the mean of the regressors like García et al. (2001) neglects some important factors explaining the difference between the two distributions. Assume, for instance, that the sample means of the characteritics are the same for males and females, but the variance is much higher for males. In this setting, the distribution of the dependent variable will also have a higher variance for males. This feature can not be analyzed with the method suggested by García et al. (2001) or the one used by Gardeazabel and Ugidos (2005). Machado and Mata (2005) (MM) hence propose an alternative decomposition procedure which combines a quantile regression and a bootstrap approach in order to estimate counterfactual density functions. Albrecht et al. (2003) applied this method for the first time to decompose the gender wage gap in Sweden. They show that the gender wage gap in Sweden increases throughout the wage distribution and rises in the upper tail. The authors interpret this as a strong glass ceiling effect. The wage gap also increases throughout the wage distribution after controlling for gender differences in individual characteristics. Using the same estimation strategy, De la Rica et al. (2005) show that the gender wage gap in Spain is much flatter than in Sweden. However, if the sample is split according to education, the authors also find a glass ceiling effect for the group of high skilled employees, while the gender wage gap decreases throughout the wage distribution for workers with low education. Albrecht et al. (2004) investigate the gender wage gap in the Netherlands using the MM decomposition method and take into account a selection of women into full time employment. Thus, the authors' purpose is to make statements for all employed women regardless of their hours of work. Also applying the MM decomposition method, Arulampalam et al. (2007) explore the wage differential for eleven European countries. Their results show a u-shaped raw wage gap for the private sector in Germany. However, in the public sector the gender wage gap is smaller and wider at the left hand side. While the unexplained part of wage differential is nearly constant across the wage distribution in the private sector, this part decrease throughout the distribution in the public sector. Beblo et al. (2003) also take into

account the whole distribution in their analysis of the gender wage gap in Germany by using the Juhn-Murphy-Pierce (Juhn et al. 1993) decomposition. They pool employees of the public and private sector and find a u-shaped raw wage gap. Furthermore their results show that the part explained by differences in individual characteristics increases throughout the distribution. The part attributable to difference in returns to these characteristics has the reverse pattern. The results of Hübler (2005) differ from Beblo et al. (2003). He considers the gender wage differential over a time period from 1984 to 2002. In his study the raw wage gap decreases with increasing quantiles of the wage distribution. Based on a combination of linear local matching and quantile regressions he shows that the unexplained wage differences between males and females are larger in the higher percentiles of the wage distribution. Furthermore, the difference in the unexplained wage gap between the 10^{th} and 90^{th} percentile narrows over time. Fitzenberger and Kunze (2005) like Hübler (2005) find that the German gender wage gap is highest in the lower part and lowest in the upper part of the distribution. Their study highlights that occupational segregation and lower occupational mobility among females may explain the gender wage gap, a result that differs across the wage distribution. Using the MM decomposition method they show that in the lower part of wage distribution, females benefit less from occupational mobility than males. In the upper tail the gains are similar for both sexes.

My study differs from existing studies in three respects. First, I include a set of detailed establishment characteristics in addition to individual characteristics as explanatory variables. Second, I extend the traditional OB decomposition to disentangle the effect of individual characteristics and the effect of establishment characteristics in explaining the mean gender wage gap. Finally, I implement the decomposition across the entire wage distribution with the MM method. Based on this most flexible parametric decomposition, I provide new insights into the nature and the sources of gender wage inequality in Germany.

3.3 Methodology

3.3.1 Wage regression

OLS and most other estimation approaches are used to investigate mean effects. In this framework the effect of covariates operates only as a shift factor. Koenker and Bassett (1978) introduced a more flexible approach, the quantile regression model. This model allows for studying marginal effects of covariates on the dependent variable at various

points in the distribution, not just at the mean. There is a comprehensive literature concerning the application of quantile regressions, see Fitzenberger et al. (2001) and Koenker and Hallock (2001) for surveys.

Let w_i denote the log wage of worker *i*. X_i is a vector of covariates representing his individual characteristics, whereas Z_i represents establishment characteristics. The statistical model specifies the θth quantile of the conditional distribution of w_i given X_i and Z_i as a linear function of the covariates,

$$Q_\theta\left(w_i \middle| X_i, Z_i\right) = X_i\beta_\theta + Z_i\delta_\theta, \quad \theta \in (0,1). \tag{3.1}$$

As shown by Koenker and Bassett (1978), the quantile regression coefficients β_θ and δ_θ are estimated as the solution to the following minimization problem:[43]

$$\begin{bmatrix}\hat{\beta}_\theta \\ \hat{\delta}_\theta\end{bmatrix} = \arg\min_{\beta,\delta}\left[\sum_{i:w_i \geq X_i\beta + Z_i\delta} \theta\left|w_i - X_i\beta - Z_i\delta\right| + \sum_{i:w_i < X_i\beta + Z_i\delta} (1-\theta)\left|w_i - X_i\beta - Z_i\delta\right|\right]. \tag{3.2}$$

The estimated quantile regression coefficients, $\hat{\beta}_\theta$ and $\hat{\delta}_\theta$, are interpreted as the estimated returns to individual and establishment characteristics at the θth quantile of the log wage distribution.

Since wages observed in the data are censored from above at the social security taxation threshold c_s, one observes only $\tilde{w}_i = \min\{w_i, c\}$. Powell (1984, 1986) developed censored quantile regressions as a robust extension to the censored regression problem. There are different algorithms to solve this non-convex optimization problem in the literature (see e.g. Buchinsky 1994, Koenker and Park 1996 or Fitzenberger 1997a, 1997b). However, as the access to the data[44] is limited and the sample size is large it is not possible to implement censored quantile regressions. As an alternative, I apply quantile regressions after imputing estimated uncensored wages (see Gartner 2005). As described in the next section, right-censored observations are replaced by wages randomly drawn from a truncated normal distribution. The predicted wages from a Tobit wage regression are used to construct the moments of this truncated normal distribution. The lower truncation point of the

[43] Consistency and asymptotic normality of the estimators can be proved if the minimization problem (3.2) is transferred into a GMM framework (see e.g. Buchinsky 1998). The asymptotic covariance matrix of the estimator can also be derived from this model framework.

[44] The data are only available at the Research Data Centre (FDZ) of the Federal Employment Agency (BA) in Nuremberg. The FDZ offers the possibility to work with the data on site and to send programs to a remote data access. However, the computation time is limited.

truncated normal distribution is given by the contribution limit of the social security system. In the Tobit regression model, the same exogenous variables are used as in the quantile regression model.

Heteroscedasticity consistent standard errors for the quantile regression estimates can be obtained by means of the design matrix bootstraps (see e.g. Kohn 2006). Again, because of the limited access to the data, I cannot estimate standard errors. Nevertheless the decomposition method applied in this study, still yields valuable insights.

3.3.2 Decomposition

The quantile regression analysis provides detailed insights into the remuneration of observed worker and establishment characteristics for men and women across the whole wage distribution. A decomposition analysis can complement the regression evidence by showing whether differences in observed distributions follow from differences in estimated coefficients or from differences in the composition of the workforce. In an OB decomposition, the gender wage gap is evaluated at the average characteristics of male (m) and female (f) employees:[45]

$$\overline{w}^m - \overline{w}^f = \left(\overline{X}^m - \overline{X}^f\right)\hat{\beta}^m + \overline{X}^f\left(\hat{\beta}^m - \hat{\beta}^f\right), \tag{3.3}$$

where $\overline{w}^g$ is the mean of the log wage for $g = m, f$, $\overline{X}^g$ the vector of average characteristics of male and female employees and $\hat{\beta}^g$ the estimated vector of returns to characteristics. The first term on the right hand side of equation (3.3) represents the part of the wage gap due to different characteristics of males and females, whereas the second term is the part attributable to differences in the returns to these characteristics. In order to distinguish between individual characteristics (X) and establishment characteristics (Z) I extend the OB decomposition in the following way:

$$\overline{w}^m - \overline{w}^f = \underbrace{\left(\overline{X}^m - \overline{X}^f\right)\hat{\beta}^m}_{(i)} + \underbrace{\overline{X}^f\left(\hat{\beta}^m - \hat{\beta}^f\right)}_{(ii)} + \underbrace{\left(\overline{Z}^m - \overline{Z}^f\right)\hat{\delta}^m}_{(iii)} + \underbrace{\overline{Z}^f\left(\hat{\delta}^m - \hat{\delta}^f\right)}_{(iv)}. \tag{3.4}$$

The first term on the right hand side of equation (3.4) captures the part of the wage differential that is attributable to differences in individual characteristics (i). The third term shows the component of the wage gap due to differences in the establishment

[45] The mean gender wage gap in equation (3.3) is decomposed by adding and simultaneous subtracting a counterfactual wage $\overline{w}^c = \overline{X}^f\hat{\beta}^m$ from the difference between the average male and average female wage.

characteristics (iii). The second and the forth term represent the components attributable to differences in the returns to individual characteristics (ii) and to establishment characteristics (iv), respectively. In order to decompose the gender wage gap as in equation (3.4), I use as counterfactual wage[46]

$$\overline{w}^c = \overline{X}^f \hat{\beta}^m + \overline{Z}^f \hat{\delta}^m \tag{3.5}$$

that reflects what the log wage would have been had females receive the same returns to characteristics as their male counterparts. The approach assumes that male returns are the relevant benchmark for the distribution in the absence of any "discrimination".[47]

The approach in equation (3.4) considers only differences in the average earnings. As stated above, the average wage gap is not representative of the gap at different quantiles of the wage distribution. Garcia et al. (2001) combine the OB decomposition technique with quantile regressions to determine the decomposition terms at various points of the wage distribution. They consider the mean of the covariates and quantile regression estimates. Thus differences in higher moments of the distribution of the independent variables are not controlled for. The method proposed by Machado and Mata (2005) can account for such differences. It combines a quantile regression model with a bootstrap approach to simulate counterfactual wage densities.[48]

In order to save computation time, I apply a simplification of the MM techniques as suggested in Albrecht et al. (2003). Formally, the estimation procedure involves four steps:

1. Estimate quantile regression coefficients at each single percentile for male and female employees: $\begin{pmatrix} \hat{\beta}_\theta^m \\ \hat{\delta}_\theta^m \end{pmatrix}, \begin{pmatrix} \hat{\beta}_\theta^f \\ \hat{\delta}_\theta^f \end{pmatrix}$; $\theta = 0.01...0.99$. This results in 99 coefficient vectors for males and 99 coefficient vectors for females.

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[46] It is well known that the partition depends on the ordering of the effects and that the decomposition results may not be invariant with respect to the choice of the involved counterfactual. See the surveys of Oaxaca and Ransom (1994) and Silber and Weber (1999). Therefore, the choice of a counterfactual should be guided by the questions of economic interest.

[47] Most other studies to the gender wage gap use male returns as benchmark and thus comparisons are possible.

[48] The MM method relies on the following ideas. First, the conditional quantiles of w given by equation (3.1) can be estimated by quantile regressions. Second, the probability integral transformation theorem is used: If U is uniformly distributed on $[0,1]$, then $F^{-1}(U)$ has distribution F. Thus, for given $[X_i : Z_i]$ and a random $\theta \sim U[0,1]$, $X_i\beta_\theta + Z_i\delta_\theta$ has the same distribution as $w_i | X_i, Z_i$. If $[X : Z]$ are randomly drawn from the population, instead of keeping $[X_i : Z_i]$ fixed, $X\beta_\theta + Z\delta_\theta$ has the same distribution as w (see also Melly 2005).

2. Randomly draw samples of size M=10000 with replacement from the set of covariates $[X : Z]$ for each estimated coefficient vector:

   $\left\{\tilde{X}_i^m : \tilde{Z}_i^m\right\}_{i=1}^M$; $\left\{\tilde{X}_i^f : \tilde{Z}_i^f\right\}_{i=1}^M$; $\left\{\tilde{X}_i^f : \tilde{Z}_i^m\right\}_{i=1}^M$.

3. Calculate $\left\{\tilde{w}_i^m = \tilde{X}_i^m \hat{\beta}_\theta^m + \tilde{Z}_i^m \hat{\delta}_\theta^m\right\}_{i=1}^M$ and $\left\{\tilde{w}_i^f = \tilde{X}_i^f \hat{\beta}_\theta^f + \tilde{Z}_i^f \hat{\delta}_\theta^f\right\}_{i=1}^M$ for each estimated coefficient vector. These two data sets are random samples of $M \times 99$ observations from the marginal wage distributions of w which is consistent with the linear model in equation (3.1).

4. Generate the following random samples of the counterfactual distributions with the estimated coefficients of each percentile:

   $\left\{\tilde{w}_i^1 = \tilde{X}_i^f \hat{\beta}_\theta^m + \tilde{Z}_i^m \hat{\delta}_\theta^m\right\}_{i=1}^M$, $\left\{\tilde{w}_i^2 = \tilde{X}_i^f \hat{\beta}_\theta^f + \tilde{Z}_i^m \hat{\delta}_\theta^m\right\}_{i=1}^M$ and $\left\{\tilde{w}_i^3 = \tilde{X}_i^f \hat{\beta}_\theta^f + \tilde{Z}_i^f \hat{\delta}_\theta^m\right\}_{i=1}^M$

   $\tilde{w}^1$ is the hypothetical log wage for female employees if they had the establishment characteristics of male employees and had been paid as male employees. $\tilde{w}^2$ is the hypothetical log wage for female employees if they had the establishment characteristics of male employees and only those characteristics had the same returns as for male employees. Finally, $\tilde{w}^3$ denotes the hypothetical log wage for female employees as it their establishment characteristics had been rewarded as they are for men.

The empirical implementation of this procedure is, however, not straightforward. In the second step of the estimation procedure above, I have to draw a random sample that contains random draws of women's individual characteristics and men's establishment characteristics. If the characteristics were independent it would be possible to assign the randomly drawn female to any drawn male employee. However, it is not very realistic to assume independence between individual and establishment covariates. In contrast, a self selection of individuals into certain firms is much more likely. Alternatively, employers demand employees with certain skills. In order to incorporate the correlation between individual and establishment covariates, I decide for the following assignment strategy guided by the economic meaning behind the counterfactual wage distributions in step 4: First I construct a random sample of M female employees. After this I implement a matching on the Mahalanobis distance in order to assign each woman to a similar male worker with respect to individual characteristics. From the matched pairs I consider the individual characteristics from

the female employees and the establishment characteristics from the matched male employees.

Based on the estimation results generated by the procedure described above, I can decompose the gender wage gap into the contribution of the individual characteristics and the establishment characteristics as well as the contribution of the returns to individual characteristics and establishment characteristics. In order to simplify the comparison to the OB decomposition, I decompose the quantiles of the wage distribution as follows:

$$\begin{aligned} Q_\theta\left(w^m\right)-Q_\theta\left(w^f\right) = & \underbrace{\left[Q_\theta\left(\tilde{w}^m\right)-Q_\theta\left(\tilde{w}^1\right)\right]}_{(i)}+\underbrace{\left[Q_\theta\left(\tilde{w}^1\right)-Q_\theta\left(\tilde{w}^2\right)\right]}_{(ii)} \\ & +\underbrace{\left[Q_\theta\left(\tilde{w}^2\right)-Q_\theta\left(\tilde{w}^3\right)\right]}_{(iii)}+\underbrace{\left[Q_\theta\left(\tilde{w}^3\right)-Q_\theta\left(\tilde{w}^f\right)\right]}_{(iv)}+R. \end{aligned} \tag{3.6}$$

In analogy to equation (3.4) there are four terms and an additional residual term. The first term (i) represents the contribution of individual characteristics and the second term (ii) denotes the contribution of the corresponding coefficients to the difference between the θth quantile of the male wage distribution and the θth quantile of the female wage distribution. The third term (iii) refers to the contribution of the establishment characteristics and the fourth term (iv) is the contribution of the corresponding coefficients to the difference between θth quantile of the male wage distribution and θth quantile of the female wage distribution. The last term is a residual term in equation (3.6). It includes sampling errors which disappear with more observations, simulation errors which disappear with more simulations and specification errors by estimating a linear quantile regression. Assuming that my specification is correct, the residual term asymptotically tends to zero and equation (3.6) describes the true decomposition of the gender wage gap in quantiles.

Note that the first and third terms do not have exactly the same meaning as in the case of an OB decomposition due to the previously described assignment strategy. As an example, the counterfactual log wage $\tilde{w}^1$ for women is only based on the establishment characteristics of men with comparable individual characteristics. Thus, if there is no overlap between certain parts of the male and the female sample with respect to individual characteristics, the establishment characteristics of the corresponding male sub-sample is not used for the counterfactual female wage distribution $\tilde{w}^1$. As a consequence, the contribution of establishment characteristics to the decomposition part (i) is not necessarily cancelled out, but leaves some unknown residual. Similarly,

decomposition part (iii) does not necessarily hold because the counterfactual establishment characteristics for women only refer to men who are comparable with regard to their individual characteristics. In other words, decomposition parts (i) and (iii) do not show the pure contribution of differences in individual characteristics and differences in establishment characteristics of male and female employees, but only hold in approximation. However, if male and female employees are not systematically different, i.e. there is a common support along the whole range of individual characteristics, than this residual effect is zero and term (i) and (iii) hold exactly.[49]

3.4 Data and specification

3.4.1 General construction of the data

The empirical analysis is based on the IAB Linked Employer-Employee panel (LIAB) which combines data from the *IAB Establishment Panel* and the *Employment Statistics Register*.

The first data set, the *IAB Establishment Panel*, is an annual survey of German establishments administered since 1993.[50] The database is a representative sample of German establishments employing at least one employee who pays social security contributions. During the time of analysis around 84 percent of all employed persons in Germany are covered by the social security system. The survey was administered through personal interviews and provides general information on the establishment, such as investments, revenues, size, composition of the workforce, salaries and wages.

The second data set, the so-called *Employment Statistics Register*, is an administrative register data set of all employees in Germany paying social security contributions.[51] In order to comply with legal requirements, employers have to provide information to the social security agencies for all employees who pay social security contributions. Due to its administrative nature, this database provides reliable information on the daily earnings that are subject to social security contributions. Furthermore, the data include information on age, gender, occupation, employment status and education. The date of entry into the establishment and the ending date of the employer's notification are also

[49] For my analysis, these residuals turn out to be small when using a random assignment of female individual covariates and male firm characteristics.
[50] Eastern German establishments are surveyed since 1996. Detailed information on the IAB Establishment Panel is given by Kölling (2000).
[51] Information on the Employment Statistics Register is given by Bender et al. (2000).

available in the individual data and are used to calculate job tenure. Note, however, that this tenure variable cannot be corrected for employment breaks as this information is not available. Hence this variable is only a proxy for tenure.

The sample for the subsequent analysis of the linked employer-employee data is constructed in two steps: First, I select establishments from the establishment panel data set for the year 2002.[52] I exclude firms from eastern Germany and non-profit firms because both the wage level as well as the wage setting process is still different in those firms and would require a separate analysis. Furthermore, I only consider firms with at least 10 employees.

In the second step, the establishment data are merged with the notifications for all employees employed by the selected establishments in 2002. From the worker data, I eliminate foreigners, apprentices, part-time workers and home workers in order to ensure that the dependent and the independent variables are comparable for my sample. I restrict the analysis to employees who are between 25 and 55 years old to avoid inference with ongoing education and early retirement. Since I consider only full-time workers, I also drop those whose wage is less than twice the lower social security contribution limit or have more than one employment. I am aware that by dropping part-time workers I exclude a lot of women from the analysis. However, the data set includes only information on the daily wage rate and no information of working hours. Thus, it is not possible to calculate wage rates per hour. Controlling for the working status by a dummy variable would also lead to improper results because part-time working can comprise a range of three to six hours. For this reason, I decide to limit my analysis to full-time workers. The final sample contains 384,908 male and 98,368 female employees in 3,994 establishments.

The dependent variable in the subsequent analysis is the log real gross daily wage. The wage also contains all fringe benefits that are subject to social security contributions. The reported wage rates are top-coded at the upper contribution limit to the social security system. In the sample, top-coding affects 18.1 percent of all observations. Male employees are more affected by top-coding than female employees.[53] While in the subsample of male employees the wage is censored above the 81st quantile of the

[52] From the available waves 1993 to 2003, I use one wave, the year 2002, since the estimation procedure does not allow for more observations.

[53] Top-coding affects 20.6 percent of all men and 8.5 percent of all women.

male wage distribution, the censoring of the female wage distribution appears above the 93rd quantile.

To address this problem, a Tobit regression is estimated by gender with log daily wage as the dependent variable. The independent variables are the same individual and establishment covariates as in the decomposition analysis later on. Then, as described in Gartner (2005), right-censored observations are replaced by wages randomly drawn from a truncated normal distribution. Predicted values from Tobit wage regressions are used to construct the moments of the truncated normal distribution. The lower truncation point of the distribution is the contribution limit to the social security system.

3.4.2 Individual and establishment covariates

In order to estimate log wage equations, I use a set of individual characteristics and a set of establishment characteristics. Thus both labor supply and labor demand aspects of the wage setting process are taken into account.

The set of individual characteristics should capture the productivity of individuals. These variables include six formal skill dummies, age, age squared, job tenure and six dummies for occupational categories.[54] Table B1 (in the appendix) presents summary statistics of the individual characteristics used in the subsequent analysis. The summary statistic shows that, on average, male employees are older and have longer job tenures than female employees. Most male and female employees have a vocational training degree, yet the share of men is higher than the share of women. Furthermore, many females do not have any vocational training and the share of women without a degree is higher than the proportion of men. The summary statistic also indicates that most male employees in the sample are blue collar workers, while most female employees work in administrative occupations.

While there are numerous theoretical and empirical studies discussing the effect of human capital variables (see e.g. Mincer 1974, Card 1999), there is no "universally accepted" set of establishment variables that should be included when investigating determinants of wages. However, as there is widespread empirical evidence that different establishments may pay different wages to employees of equal ability (see

[54] Unfortunately, I cannot control for employment interruptions and the actual labor market experience. This could lead to a bias in the estimation, especially for female employees. However, the data set does not include such information.

e.g. Groshen 1991b, Abowd and Kramarz 1999, Cardoso 2000)[55], I attempt to account for these differences by including establishment characteristics. Motivated by studies which investigate single aspects of establishment wage differentials (for instance employer size or bargaining regime wage differentials), I gather various establishment characteristics as wage determinants. First, I include variables describing the workforce within establishments. These are the number of employees and its square as well as the gender and qualification composition. The positive impact of the establishment size has been widely discussed in the literature (see for an overview Oi and Idson 1999) which considers the size typically as a proxy for various unobserved determinants such as job satisfaction, monitoring costs, more complex technologies and worker participation in monopoly profits.[56] Other studies (see e.g. Carrington and Troske 1998, Reilly and Wirjianto 1999a, Datta Gupta and Rothstein 2005) stress the negative relationship between the female proportion within establishments and wages.[57] The effect of the qualification level of the workforce can be explained by sorting theories. According to these, the quality of a worker has an impact on the productivity of his or her co-workers (see, for example, the model of Kremer 1993).

In addition, I take into account establishment characteristics capturing the current profit-situation and the long run profitability. The theory of rent sharing in the labor market predicts that firms generating rents on the product market may share them with their workforce (e.g. Abowd and Lemieux 1993, Blanchflowers et al. 1996). The extent of rent sharing depends on the relative bargaining power of employers and employees. The theory therefore predicts that employees in more profitable firms may earn higher wages than workers in less successful firms. Therefore, I include sales per employee and two dummy variables indicating whether the revenues of the establishment increased or decreased during the last year. Furthermore, the share of exports in total sales is used as a wage determinant. This variable reflects the extent of product market competition under which firms operate. In the literature, there is the hypothesis that exporting renders firms more productive and leads to higher wages (see e.g. Bernard and Wagner 1997, Bernard and Jensen 1999). The reason is that exporting firms are forced to improve faster than firms only operating on the national market due

[55] There is also earlier research on wage differentials that highlighted the relevance of wage policies at the firm level (see the overview by Kerr 1994).

[56] Schmidt and Zimmermann (1991) find that when using all possible controls, wages increase with firm size. They conclude that there have to exist other reasons why large firms are able to pay higher wages and nevertheless survive. A possible explanation might be non-production economics of scale.

[57] In the next chapter I investigate the relationship for Germany.

to higher stress of competition. However, the recent theoretical literature (e.g. Melitz 2003) argues that the positive relationship between productivity and exporting is due to a self-selection of more productive firms into foreign markets. The empirical findings of Schank et al. (2008) support this latter argument for Germany. Overall, one would expect a positive relationship between wages and the share of exports in total sales. In order to further control for firm productivity, estimations include a discrete choice variable indicating the state-of-the-art of the production technology used in the establishment.

Furthermore, labor market institutions are taken into account. In Germany the most important institution is collective wage bargaining. A large theoretical and empirical literature shows that collective bargaining raises wages and reduces wage inequality (e.g. Blau and Kahn 1996, Card et al. 2003b, Fitzenberger and Kohn 2005, Gürtzgen 2006). Some studies also examine the effect of collective bargaining on the entire wage distribution (e.g. Fitzenberger and Kohn 2005, Burda et al. 2008, Fitzenberger et al. 2008). In the analysis, I consider collective bargaining by including dummy variables indicating whether the establishment is covered by an industry-wide or firm-specific wage agreement.[58] In addition to collective wage contracts, works councils have an impact on wage distributions within establishments (Hübler and Jirjahn 2003). Although works councils' co-determination rights do not formally include negotiating over wages, they may negotiate about placing workers in higher wage groups. Among other things they can also co-decide on the introduction of new payment schene, overtime work and working conditions. Freeman and Lazear (1995) point out that co-determination confirms the bargaining power of employees. Hübler and Jirjahn (2003) argue that on the one hand works councils strengthen trust and cooperation between the management and the workforce. Thus, the works councils can support the management in implementing new productivity-enhancing work practices. On the other hand, works councils can also prevent the implementation of work practices which are not desired by the workforce. Thus, co-determination may considerably weaken the management's bargaining position. Overall, one can conclude that the

[58] In Germany, industry-specific unions and employers' associations negotiate industry-wide agreements. Then the agreement is applied to all member firms of the employers' association who signed the contract. A firm can also directly negotiate with a labor union if the firm is not member of an employers' association. Empirical studies (e.g. Stephan and Gerlach 2005, Gürtzgen 2006, Fitzenberger et al. 2008) provide evidence of a positive and significant wage premium of industry-wide and firm-specific wage agreements for western Germany.

presence of works councils may have an impact on both the creation and redistribution of economic rents. Thus, I also control for the presence of a works council.
Further establishment controls in the wage equation are the wage bill per employee, the number of the average agreed working hours, a dummy variable indicating whether the establishment has been found after 1989 and 10 industry dummies.
The descriptive statistics of the establishment characteristics are given in Table B2. The summary statistics indicate that male employees, on average, work in larger, more export-orientated firms than female employees. Further men are rather employed in establishments applying wage agreements and with higher sales per employee than women. There are only small differences between an average man's and an average woman's workplace regarding the state of the technology, the presence of a works council in the establishment and profits of the last year.

3.5 Empirical results

3.5.1 Distribution of the gender wage gap

Before I present and discuss my estimation and decomposition results I address the actual raw gender wage gap. Thus, all following statements refer to wage rates after the imputation (as described in Section 3.4.1). The usual procedure to measure the male-female wage gap is to consider the differences between the average male wage and its female counterpart. In my sample, the average male daily wage is 105.47 Euro, whereas the average daily wage for women is 83.40 Euro. Therefore, the male-female average wage differential is 22.07 Euro. When I undertake the same calculation but consider log daily wages, the male-female average wage gap turns out to be 0.2347 log points. Thus, in my sample women earn, on average, about 23.5 percent less than men.
Figure 3.1 shows nonparametric estimates of the density functions of male and female (log) daily wages.[59] The male wage density is placed rightward with respect to the female wage distribution, indicating a non negligible raw gender wage gap.

[59] Densities are estimated using an adaptive Epanechnikov kernel. The peak (in particular in the function for male employees) reflects a cluster of wages below the threshold above which wages are top-coded.

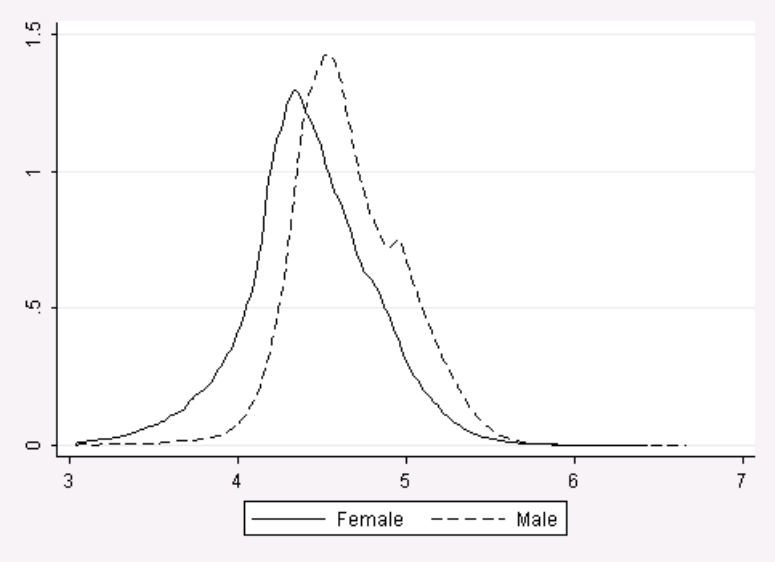

Figure 3.1: Density functions of male and female (log) daily wages
Note: Kernel density wage estimation of man and women use Epanechnikov kernel function. The daily log wage rate after imputation is used.
Source: own calculation; LIAB cross-sectional model 1997-2001.

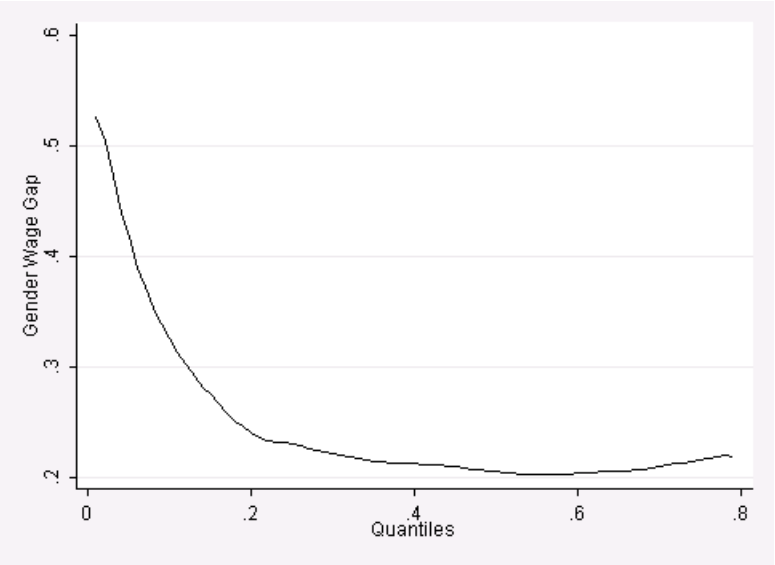

Figure 3.2: Gender wage gap at quantiles
Note: The gender wage gap is the difference between the log wage rate of male and female employees at the quantiles of the wage distribution.
Source: own calculation; LIAB cross-sectional model 1997-2001.

Figure 3.2 plots the raw gender wage gap as a function at quantiles of the wage distributions.[60] The gap is distributed unequally across the wage distribution. The wage

[60] I present the gap only up to the 80th percentile, because the latter percentiles are too unreliable implicated by the imputation.

gap lies above its mean at low wages, drops below the mean around the 30th percentile and keeps on falling up to the 60th percentile.

In contrast to other countries like Sweden (Albrecht et al. 2003), Spain (Gardeazabal and Ugidos 2005), Finnland or Denmark (see Arulampalam et al. 2007), the wage gap across the wage distribution has no increasing trend in Germany. Based on other sample definitions and data sets, Fitzenberger and Kunze (2005) and Hübler (2005) also find that the German gender wage gap is large in the lower part of the wage distribution and decreases as the quantiles increase. This falling tendency is not completely confirmed by Arulampalam et al. (2007). They reveal a u-shaped form of the wage gap. Figure 3.2 resembles the falling tendency of the wage gap with increasing quantiles. Whether it is increasing again in the upper tail of the wage distributions cannot be examined due to top-coding of wages. Still, the gender wage gap is far from being stable across the wage distribution.

3.5.2 Regression results

The first step in the empirical analysis of the gender wage differential is to estimate the log wage equations for male and female employees. As discussed in Section 3.4.2, in addition to individual characteristics, establishment characteristics serve as covariates.

As mentioned in Section 3.3.2, for the gap decomposition across the wage distribution, it is necessary to estimate the wage by quantile regressions at each percentile of the wage distribution. In sum, this decomposition requires to run 99 quantile regressions for male and 99 quantile regressions for female employees. For comparison, I also present the decomposition of the average pay gap, for example OB decomposition. For this, I estimate separate wage equations by OLS for men and women.

Table B3 and Table B4 in the appendix show the OLS coefficients with their standard errors and the coefficient estimated by quantile regressions for a subset of quantiles of the distributions[61]. All estimated effects in the OLS regressions are significantly different from zero. The variables describing the human capital have the expected effects for both male and female employees: wages increase with the education level, age indicating potential experience and job tenure. The findings also show that, on average, unqualified and qualified blue collar workers as well as individuals in service occupations earn much less than employees in an administrative occupation. That

[61] The results for the other percentiles are available upon request from the author.

holds for male and female employees. The estimated quantile regression coefficients for the individual characteristics show the same pattern as in the OLS regressions, but vary across the wage distribution. The effect of tertiary education levels, such as a university or a technical university degree, decreases with increasing quantiles of the wage distribution for male employees, while the impact of this covariate increases with increasing quantiles for women. The same holds for the variable age. Without having standard errors, these findings should only be interpreted as some indication.

Turning to the establishment variables, I find that wage rates increase with the number of employees and with the share of highly qualified employees for both men and women. The OLS regressions indicate that the share of female employees affects the wage rate of women and men negatively. This negative impact might reflect a sorting of women into firms with a preferred work environment for which lower compensating wages are paid. This hypothesis as well as alternative explanations are intensely investigated in the next chapter. The quantile regression results show that the impact of variables describing the workforce decreases with increasing quantiles of the wage distribution for male and female employees.

The OLS findings further indicate that establishments with higher sales per employee, good results in the last year and a state-of-the-art production technology tend to pay higher wage rates both for male and female employees. Apparently, the workforce benefits from the success of the establishement in terms of higher wage rates. The export quota has a positive impact on the wage rate in the OLS regression. This indicates that exporting establishments are more productive and able to pay higher wages rates than establishments operating only on the national market. Whether this result is due to self-selection of more productive establishments in entering the foreign market or due to an increase of the productivity driven by international competition can not be concluded from this kind of analysis (see Schank et al. 2008).

Furthermore, the OLS findings indicate that establishments covered by an industry-wide or firm-specific wage agreement tend to pay higher wage rates than establishments which do not apply such wage agreements. Note that the impact of these institutional variables decreases with increasing quantiles of the wage distribution for both male and female employees. This finding can be explained by the compression of the wage distributions due to collective bargaining and is in line with Burda et al. (2008). Furthermore, the OLS results reveal a strong positive effect of works councils on the wage rate. Note, that the estimated coefficient for this covariate

is much higher for women than for men. As the quantile regression estimates show, the impact also increases with increasing quantiles of the wage distribution. The findings regarding the impact of works councils on wages and the wage distribution are in line with Addison et al. (2006) who study this issue for Germany.

3.5.3 Decomposition results

As mentioned in Section 3.3.2, the estimated quantile regression coefficients and randomly drawn samples of male and female covariates are used to simulate counterfactual wage distributions. The decomposition of the gender wage gap across the wage distributions is implemented, as shown in equation (3.6). Table 3.1 presents the gender wage gap and the four decomposition parts at eight deciles. Unfortunately, due to computational constraints at the research data center, I cannot provide standard errors.

Table 3. 1: MM decomposition at selected quantiles and OB decomposition

Quantiles	Gender wage gap	Wage differential due to difference in …			
		individual characteristics	returns to individual characteristics	establishment characteristics	returns to establishment characteristics
0.1	0.3256	0.0207	0.0066	0.0493	0.2255
0.2	0.2405	0.0089	-0.0095	0.0391	0.2153
0.3	0.2218	-0.0024	-0.0126	0.0350	0.2107
0.4	0.2122	-0.0131	-0.0077	0.0326	0.2044
0.5	0.2054	-0.0250	0.0027	0.0281	0.1996
0.6	0.2035	-0.0330	0.0139	0.0236	0.1955
0.7	0.2098	-0.0297	0.0257	0.0197	0.1875
0.8	0.2159	-0.0114	0.0410	0.0168	0.1643
OB	0.2347	-0.0224	0.0470	0.0509	0.1592

Note: The results are based on the log of the imputed daily wage. The gender wage gaps are calculated as the difference between log male wages and log female wages.
Source: own calculation; LIAB cross-sectional model 2002

For comparison, the last row in Table 3.1 includes the mean gender wage gap and four decomposition parts based on an OB decomposition (see equation (3.4)). As mentioned before, the mean gender wage gap is 23.5 percent. The largest proportion of the observed raw wage gap is explained by differences in returns to establishment characteristics. Thus, if male and female employees were comparable regarding their individual and establishment characteristics and they had the same returns to their individual characteristics, then nevertheless women would earn 16 percent less on average than men. This could be interpreted as a pay gap within firms and is in line

with a result of Hinz and Gartner (2005). By contrast, the contribution of the differences in individual characteristics to the mean pay gap is small and negative. This implies that on average, women would receive lower wages if they had the same endowment of productivity-related individual characteristics as male employees. This result suggests that full-time employed women are well educated.

Furthermore, the OB decomposition shows that the gap attributable to differences in establishment characteristics and the gap referring to differences in the returns to individual characteristics are equally high.

The OB decomposition is limited to decomposing the mean gender wage gap. The MM decomposition based on quantile regression considers the entire wage distribution. The four decomposition parts at each percentile of the wage distributions are also presented in Figure 3.3. The extreme quantiles are not presented because of unrobust estimates.

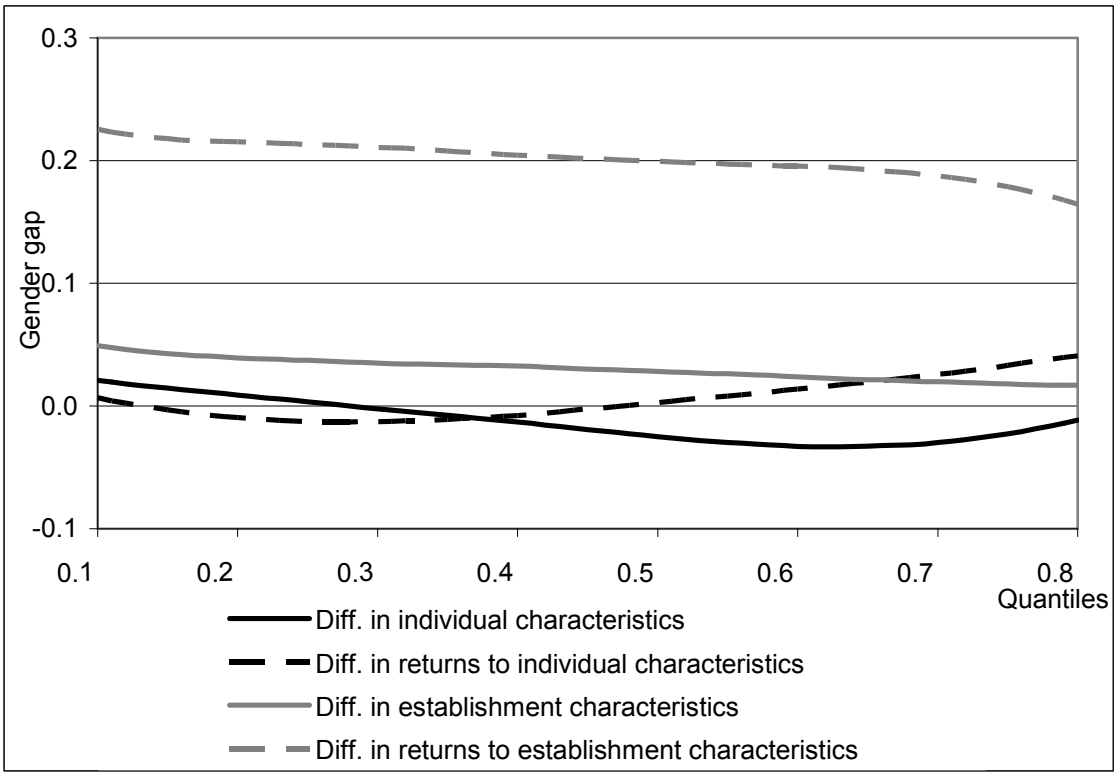

Figure 3.3: MM decomposition of the gender wage gap
Source: own calculation; LIAB cross-sectional model 2002

The decomposition terms vary across the quantiles of the wage distribution. However, the variation is not as strong as other international studies indicate that only take into account individual characteristics (e.g. Albrecht et al. 2003 for Sweden, De la Rica et al. 2005 for Spain, Arulampalam et al. 2007 among other countries also for Germany).

The estimated quantile regression coefficients already provide first hints on these relatively small variations across the quantiles of the wage distribution.

Similar to the OB decomposition, the largest fraction of the gender wage gap is attributable to differences in establishment-specific coefficients across the whole wage distribution. This finding is readily identifiable in Figure 3.3. This part of the pay gap slightly decreases with increasing quantiles of the wage distributions. Apparently, women benefit less from rents which might be shared between employer and employees than male colleagues. Or in other words, women tend to participate less in the success of the establishment, especially in the lower wage groups. Maybe, they are more diffident in wage negotiations with their superior or they have less bargaining power in comparison to male employees.

Furthermore, Figure 3.3 shows that there is a male wage premium for the establishment characteristics across the whole distribution. This part also slightly decreases as the quantiles increase. In the lower part of the wage distribution women tend to work in firms which are less productive and profitable in comparison to firms where men are typically employed. This also contributes considerably to the gender wage gap. The differences in establishment characteristics are less important for the gap in the upper tail of the wage distribution. It seems that male and female employees in the upper tail of the wage distribution work in similar firms. Unfortunately, I cannot say anything about the statistical significance because the calculation of significance bonds with a bootstrap method is not possible given the computation time.

The fraction of the gender wage gap that is attributable to differences in individual characteristics and the part due to differences in the returns to those characteristics vary around zero along the wage distribution. In the lower part of the wage distribution the fraction due to differences in individual characteristics is positive. Below the 30^{th} percentile, men are endowed with the better paid productivity-related characteristics. By contrast, the reverse holds from above the 30^{th} percentile. This suggests that women in the middle and the upper tail of the wage distribution receive a higher wage rate given their better human capital endowment and their occupations, ceteris paribus.

The decomposition part due to differences in returns to individual characteristics is at first negative and then becomes positive. Between the 15^{th} and the 45^{th} percentile of the wage distribution women get higher returns for their human capital endowment than male employees.

The findings of the OB decomposition of the mean gender wage gap and the MM decomposition of the gap across the whole distribution both suggest the selection of women into less successful and productive firms. In addition, women participate in the success of firms by rent-sharing to a lesser extent than their male colleagues. This is the source of the largest part of the pay gap. The firm and respectively the workplace seem to be very important in explaining wage differentials between male and female employees. This finding is line with results of Drolet (2002), Datta Gupta and Rothstein (2005) as well as Simón and Russell (2005). Gender differences in human capital and occupations as well as differences in returns to these characteristics are less responsible for the wage differential.

3.6 Conclusions

This study investigates the role of individual characteristics and the establishments in determining the gender wage gap across the whole wage distribution in Germany. It thus differs from existing analysis examining the decomposition of the gender wage gap in three respects. First, instead of limiting the explanatory variables to individual characteristics, I include a set of detailed establishment characteristics. Second, I extend the traditional OB decomposition to disentangle the effect of human capital characteristics and the effect of establishment characteristics in explaining the gender wage gap. This approach yields new insights into what causes the gender wage gap. Are women less educated or do they work in worse firms compared to men? Third, I implement the decomposition across the entire wage distribution with the Machado Mata method.

The unconditional gender gap is sharply decreasing within the first quartile of the wage distribution and then the decrease decelerates up to the 60^{th} percentile, and from then on the gap slightly increases. The gender wage gap is not constant across the wage distribution, but the decomposition terms only vary slightly across the wage distribution. This result suggests that the sources of the wage differential are similar for high- and low-paid employees. One methodological reason for this may be that the top-coding of the data prevents an analysis of the gender wage gap above the 80^{th} percentile. Strong changes in the decomposition of the wage gap might only occur in the upper quantiles though. As a robustness check, a similar analysis with the *German*

Structure of Earnings Survey (GSES), another large German linked employer-employee data set might be helpful.[62]

The present analysis shows that the selection of women into less successful and productive firms explains a sizeable part of the gap. This selection is more pronounced in the lower part of the wage distribution than in the upper tail. In addition, women also benefit from the success of firms by rent-sharing to a lesser extent than their male colleagues. This suggests the largest part of the gap is a wage gap within firms. The establishment seems to be very important in explaining wage differentials between male and female employees. Gender differences in human capital endowment as well as differences in returns to human capital are less responsible for the wage differential. In the middle and upper part of the wage distribution women even have better paid individual characteristics compared to their male colleagues.

These are important findings from a public policy viewpoint. In particular, the findings pose the question why women participate less in the success of firms and what can be done about it. An explanation for married or cohabitating women could be that they have less bargaining power within firms than their male colleagues if they face a limited number of alternative job opportunities due to being tied to the regional labor market of the male breadwinner. The weak bargaining position of women may thus partially reflect the weak bargaining position within their relationship. A separate analysis for single and married/cohabitating women might shed light on the relevance of this argument. If women's weaker bargaining position proves relevant, policies aiming at a reduction of the gender wage gap should strengthen women's bargaining position in the private sphere by for example improving the public child care infrastructure or abolishing the employment disincentive inherent in the German tax system. In addition, women – irrespective of their marital status – might be too hesitant compared to their male colleagues to demand the merits of their work as a share of the firm's rents. If this was the case, women should be encouraged to seek wage negotiations with the aim of enjoying greater financial rewards.

[62] The German Structure of Earnings Survey is a linked employer-employee data set. It is conducted by the Federal Statistical Office. However, the establishment information is not so rich as in the LIAB.

Chapter 4

Earnings of men and women in firms with a female dominated workforce: What drives the impact of sex segregation on wages?

4.1 Introduction

The fact that women earn lower wages than men has been documented in many studies for several countries and periods of time. One important result of this research is that there is a relationship between the wages of men and women and the gender composition of occupations, industries and firms[63]. Such evidence helps to understand the source of gender differences and could potentially increase the effectiveness of policies that aim to reduce the gender wage gap.

Most segregation research has focused on the impact of *occupational* segregation of men and women on the gender wage gap (e.g. Macpherson and Hirsch 1995) and the effect of *industry* segregation (e.g. Fields and Wolff 1995). The empirical studies show that individual wages vary systematically according to the gender composition of occupations and industries. More precisely, an increasing proportion of women has a detrimental effect upon the wages of men and women.

The relationship between wages and sex segregation at establishment level has been studied less in empirical analysis.[64] The first studies (McNulty 1967, Buckley 1971, Blau 1977) found that women were more likely to work in lower paying firms than men. More recent investigations (e.g. Carrington and Troske 1998, Reilly and Wirjanto 1999a, Bayard et al. 2003, Vieira et al. 2005, Amuedo-Dorantes and De la Rica 2006) support this result and demonstrate that the individual wages of men and women decrease as the proportion of women within an establishment increases.

However, most empirical studies do not sufficiently scrutinize the measured impact of the proportion of females within establishments on individual wages. For this reason, I

[63] In the study the terms firm and establishment are used synonymously.

[64] One reason is the lack of micro-data with information on both the employers and employees. Indeed, the availability of linked employer-employee data in the last decade has generated many studies which highlights firm aspects. For a survey of linked employer-employee data see e.g. Abowd and Kramarz (1999)

shall attempt to go one step *further* in my analysis. Why should sex segregation at establishment level impact upon individual earnings? I examine three hypotheses. Firstly, by assuming gender differences in the preferences for specific establishment and workplace characteristics, the proportion of females in an establishment may reflect the attractiveness of a specific workplace environment for women, creating an environment in return for which they are willing to accept lower wages. Secondly, I examine the so-called quality sorting hypothesis, which considers the proportion of females within an establishment as a proxy for the skill requirements of the employer. The main assumptions are that skill requirements vary from establishment to establishment and that men and women have different skill endowments, with the latter being less well-qualified. Finally, another possible explanation for a connection between the proportion of females within establishments and individual wages could be discriminatory preferences among employers against women. In this study, I investigate the direction of the relationship between the proportion of females within establishments and the wages of male and female employees by specifying various wage equations for both western and eastern Germany. For this purpose, I use a rich linked employer-employee data set maintained by the Research Data Centre of the Federal Employment Agency at the Institute for Employment Research in Germany. This data set is rich in terms of information on important productivity-related characteristics (e.g. education and tenure) and very detailed information on establishment characteristics (e.g. employment number, collective bargaining and industry). A further strength of this data is that the available number of observations is very large[65], making it possible to obtain reliable estimates for the parameters of interest.

By means of this analysis, I attempt to investigate why sex segregation affects individual earnings. Such an improved understanding is important for designing adequate policies. If the reason for a negative relationship between the proportion of females and individual wage rates arises from the choice of women to work for firms that provide an attractive working environment for them, such policies will differ from policies aiming at reducing discrimination against women. In the latter case, one can initiate the discussion about affirmative action or employment equity programs to

[65] The data set contains a representative sample of German establishments with at least one employee covered by the German social security system and all employees in these establishments who pay social security contributions.

address issues of imbalance in the sex composition of establishments. If the impact of the proportion of females within establishments on individual wages is due to self-selection of women in certain firms, then there is no need for direct political intervention at firm level. If the relationship between the proportion of females within an establishment and the level of wages paid can be attributed to lower qualifications among women, then policies should aim to improve qualifications among women.

In this study, I will not address occupational segregation even though occupation is a very interesting dimension. Occupational segregation is more stable over time than segregation at firm level because occupational changes occur less often. Nonetheless, I refrain from including occupational segregation as many empirical studies measuring the impact of occupational segregation on wages have already been conducted. For instance, Achatz et al. (2005) as well as Jurajda and Harmgart (2007) have investigated this issue as it affects Germany.

The study will then develop as follows. In the following section, I present a brief review of the empirical literature that investigates the relationship between the gender composition in establishments and individual wages. In Section 4.3, I formulate hypotheses that seek to explain the relationship between sex segregation and the wages of women and men. In Section 4.4, I describe the empirical methodology that I employ to gauge this relationship. In the subsequent section, I introduce the data set and provide descriptive statistics of the characteristics. The results of the estimations are presented in Section 4.6. The Section 4.7 provides a conclusion.

4.2 Previous empirical literature

In this section I will summarize the results of previous empirical studies that analyze the association between the proportion of females in establishments and wages. I will focus on studies that use establishment level data.[66]

The first empirical studies investigating earnings and gender segregation at establishment level emerged in the seventies. McNulty (1967) and Buckley (1971) indicate that inter-firm gender segregation is an important factor for determining different earnings of male and female employees. Both studies point out that men tend to work in high-wage establishments and women in low-paying establishments. Using the same data set for the US they compare average wages of male and female

[66] c. f. Foguel (2004)

employees between integrated and single-sex establishments by occupations. The comparison reveals that men's earnings exceed those of women in the same occupations but these differences are smaller in establishments employing both sexes. However, the descriptive results are derived from selected occupational earnings and establishments. Blau (1977) also considers selected occupational groups in three metropolitan statistical area but she exploit the information to the accurate proportion of female employees within firms. She computes the correlation between the ranking of firms with respect to both wages and the proportion of female employees. This ranking is based on coefficients associated with firm dummies in two separate regressions on wages and the proportion of female employees, respectively. The negative estimated correlation coefficient suggests that females are highly represented in the workforce in firms which pay lower wages to both sexes, while males comprise a higher proportion of employees in those firms which pay higher wages.

Groshen (1991a) extends the work of Blau (1977) by jointly estimating the effects of segregation by occupation, establishment and job-cells[67] on the wages of workers within five industries in the US. Her results show a negative relationship between gender segregation at establishment level and individual wages in all five industries. Furthermore, it seems that in some industries gender segregation at establishment level explained the gender wage gap for the most part, while in other industries occupational segregation is more important in determining the gap. The used data set, however, does not include further information on employees and establishments. Hence, typical wage determinants such as education and experience are not taken into account, which are presumably important controls in gender wage regressions.

Carrington and Troske (1995) study the establishment gender segregation in small U.S. firms. In an establishment level regression they estimate the impact of the proportion of women on the average wage within an establishment (wage bill per employee). The estimates reveal that firms with a predominantly male workforce tend to pay higher average wages than firms where women account for the majority of the workforce. In a follow-up study Carrington and Troske (1998) improve their previous work by using individual worker information from a small sample of linked employer-employee data. In a pooled wage equation for male and female employees they control for various worker and establishment characteristics and use an interaction term between the

[67] Job-cells mean the interaction between occupations and establishments.

female dummy and the proportion of women within an establishment variable to ascertain the impact of gender segregation on female and male wages. The basic findings are that both men and women earn less in firms that are predominantly staffed by women, but that the negative effects experienced by women are greater.

Bayard et al. (2003) attempt to review the results of Groshen (1991a) by a using comprehensive matched employer-employee data set which covers all industries and occupations across all regions in the US. They also find negative effects arising from the proportion of females within an establishment on wages for both sexes. This negative impact is again greater for women. Their results also indicate that, even though a sizeable part of the gender wage gap can be explained by the segregation of females into lower-paying occupations, industries, establishments and job cells, a considerable part of the gap remains unexplained. These findings differ from other research, most notably that of Groshen (1991a). The authors attribute the deviations to the larger data set and to the inclusion of some controls for individual characteristics and industry dummies in separate regressions for men and women.

The European studies conducted by Datta Gupta and Rothstein (2005) as well as Amuedo-Dorantes and De la Rica (2006) are similar to those of Groshen (1991a) and Bayard et al. (2003). Datta Gupta and Rothstein (2005) use matched employer-employee data from Denmark to investigate how gender segregation affects the gender wage gap, while Amuedo-Dorantes and De la Rica (2006) focus on Spain. Both analyses estimate pooled (by gender) wage equations that include the proportion of females in industry, occupation, establishment and job-cell. The relationship between the proportion of females within firms and individual wages is negative. In addition, in separate wage regressions by gender, Amuedo-Dorantes and De la Rica (2006) find that being employed in a predominantly female establishment has a negligible impact on men's wages, whereas it significantly reduces female wages. In both studies the authors focus on the effect of segregation on the wage gap (rather than on individual earnings) and find that there is a significant within-job-cell gender wage differential.

Reilly and Wirjanto (1999a) investigate the relationship between wages and gender segregation for Canada with a small sample of matched employer-employee data. In a Generalised Least Squares (GLS) regression framework they find that the proportion of women in an establishment has a negative impact on individual wages for both men and women. Again the negative effect on the female wages is more pronounced than on male wages.

Vieira et al. (2005) study gender segregation at the establishment level over fifteen years in Portugal, and its impact on wages and the gender wage gap by using a large matched employer-employee data set. This is the only study that finds a negative effect arising from the proportion of women within firms on women's wages and, *to the contrary*, a positive effect on men's wages.

In an empirical analysis, Achatz et al. (2005) use one wave (from the year 2000) of a German linked employer-employee data set (the LIAB data) to investigate the impact of the proportion of females within job-cells on individual wages in western Germany. Like most other studies, they find that the negative relationship is more pronounced for women. They conclude that discrimination occurs particularly through a gender-based assignment of jobs.

In summary, previous empirical studies lead one to conclude that working in establishments with a predominantly female workforce reduces wages for both sexes, with this effect being more pronounced for women. Despite a consensus regarding these stylized facts, the magnitude and interpretation of the relationship between wages and gender composition remain unclear.[68] In this study, I attempt to investigate the relationship between the proportion of females within establishments and individual wages by including individual characteristics such as experience, education and occupation as well as standard firm-specific variables such as establishment size and type of industry. In an extension to previous studies, I attempt to control for further establishment characteristics by exploiting the rich firm-side of my data set. If firm characteristics are important, including them should reduce the impact of the proportion of females within establishments on individual wages. In this way, I seek to understand what is measured by the impact of the proportion of females on individual wages.

4.3 Theoretical framework

In this section I present three hypotheses which deal with the gender wage gap and sex segregation at establishment level. I begin by reviewing the hypothesis that gender differences in wages and employment patterns are the consequence of preferences. I then go on to formulate a second hypothesis that is based on skill differences between men and women. I then present a third hypothesis that explains the relationship

[68] Some studies hastily explain the negative impact by discrimination.

between the proportion of females within firms and wages by assuming that discriminatory attitudes are adopted by employers against women.

4.3.1 Preference hypothesis

The role of differences in preferences is often emphasized in the discussion of gendered labor market outcomes. Men and women are assumed to differ in their preferences for market versus non-market work or leisure as well as for particular types of work, such as manual labor versus office work.[69] The distribution of preferences for particular job attributes among men and women and the costs to employers of offering jobs with particular characteristics will affect the wage distribution. For instance, the theory of compensating differentials (Rosen 1986) predicts that if differences in job characteristics, such as inflexible work schedules or shift work, are associated with a disutility, then such jobs will offer a wage premium. The theory further predicts that those workers with a relatively high tolerance for such disamenities will naturally gravitate towards these jobs. If workers with these preferences are also predominantly males, then such jobs will be largely filled by men.
The argumentation of the theory of compensating differentials can be used to explain the negative correlation between the proportion of females within firms and the wages of both males and females. Firms differ regarding the technologies used in production, the institutional background, the profit situation and so on. Hence, they offer jobs with different characteristics. On the other hand, there are certain job characteristics which are typically favored by women and which are connected to lower wage rates. These are mainly job characteristics which improve the work-life balance as the major burden of family work is still borne by women. These attributes are, for instance, flexible working time, less overtime, a firm kindergarten or crèche, or special mentoring programs for female employees. The workplace attributes are connected with costs for the employers and thus lead to a wage reduction, which is likely to be accepted by those individuals with a greater preference for these workplace amenities[70]. Based on

[69] Related to the topic is the question concerning the source of gender differences in preferences (see Altonji and Blank 1999). There is only little direct evidence concerning the question how and why preferences might develop over time. For instance, the differential treatment of boys versus girls in the family or in the educational system may be one source of differences in preferences. However, regardless of the source, in a competitive labor market gender differences in preferences can imply gender differences in labor force participation, in workplaces and in wages.
[70] The costs are partly transferred from employers to employees and the resulting wage reduction depends on the bargaining power of employees and employers.

the assumption that women have a greater preference for these characteristics, firms offering these attributes will be particularly attractive for women. This results in a larger proportion of female employees than in establishments not offering such benefits. These considerations show that if one does not control for an attractive working environment in a wage regression analysis, the impact of the proportion of females in establishments on wages is likely to reflect part of the negative correlation between certain job characteristics and individual wages. This also holds true for men: Men choosing to work for firms with a predominately female workforce also seems to be willing to accept lower wages for job characteristics such as flexible working hours. Reilly and Wirjanto (1999b) argue in a similar manner. In their study they employ the expression "coincidence of needs". They argue that firms with a high proportion of females offer employment contracts to employees that fit the employment pattern preferred by women. Worker and employers have preferences, technological choices, and constraints that have to correspond. A successful job match is thus a coincidence of needs. That implies the sorting of women into specific establishments. The resulting (compensating) wage differential reflects the mutually advantageous trade between employers and employees.

4.3.2 Qualification hypothesis

The second hypothesis dealing with the relationship between individual wages and sex segregation at establishment level is related to the so-called quality sorting hypothesis, which finds frequent mention in the literature (see e.g. Macpherson and Hirsch 1995, Carrington and Troske 1998, Reilly and Wirjanto 1999a). The idea is simple and based on two premises. The first is that firms are heterogeneous in terms of the skill demands on employees. Some establishments need many highly qualified workers for their production. These would include such establishments as research establishments. Other firms, for example cleaning companies, demand low skilled workers. The second premise is that women and men have different skill levels, with the former group being less qualified. The lower qualification of women is often explained by the human capital model (e.g. Mincer and Polachek 1974). This model departs from the traditional gender division of labor within families under which women are expected to have a shorter and more intermittent attachment to the labor market than men. This implies, ceteris paribus, that the net return on pre-labor market investments in human capital for

women will be lower than that for men. Similarly, the shorter and more discontinuous labor force participation of women reduces the long-run pay-off on investments in general and firm-specific training. Thus, given their shorter expected working life, women's optimal response is to acquire a lower amount of human capital in terms of training and labor market experience. Polachek (1981) also argued that women invest rather in human capital and favor occupations with lower rates of depreciations for periods of absence from the labor force.

The result of the two premises is that firms requiring relatively more unskilled (skilled) labor will have a higher (lower) concentration of females and pay lower (higher) wages. According to the quality sorting hypothesis, male employees in firms with a predominantly female workforce are also less well-qualified than men in other firms. Thus, in the quality sorting hypothesis the gender composition of a firm serves as an index of labor quality. This hypothesis therefore predicts that wages of men and women are negatively correlated with the proportion of females in the establishment if one does not control for productivity.

Note that in the quality sorting hypothesis mentioned in literature (see e.g. Hirsch and Schumacher 1992, Macpherson and Hirsch 1995, Hirsch and Macpherson 2004)[71], the proportion of female employees is assumed to be correlated to both measured and unmeasured labor productivity differences. Here, I can only control for observed characteristics. To the extent that measurable and immeasurable labor quality factors are positively correlated, this may partly cover unobserved differences.

4.3.3 Discrimination hypothesis

The third hypothesis is framed by the Becker (1971) model of employer discrimination. I shall explain this model in more detail since it is less straightforward than the two hypotheses already dealt with. Following this model, a wage-taking firm with a production function f uses two inputs: the labor of men, M, and labor of women, F, which are perfect substitutes and have the same marginal products[72]. Employers have a dislike of hiring female workers, and do not maximize profits but rather maximize utility, defined as

[71] However, the first two mentioned studies investigate wages and racial composition.
[72] Perfect substitutes imply that male and female employees have infinite substitution elasticity.

$$U(\pi, M, F) = Y(M + F) - w_M M - w_F F - d \cdot (F/M) \tag{4.1}$$

where d is the discrimination coefficient representing this dislike, w_M and w_F are the market wages of men and women respectively.[73] Short-run utility maximization then implies

$$MP_M + d\left(F/M^2\right) = w_M, \quad MP_F - d/M = w_F. \tag{4.2}$$

The marginal product of male labor MP_M is below its input price w_M, because male labor increases the employer's utility, ceteris paribus, the marginal product of female labor MP_F is discounted by the non-pecuniary cost of discrimination to the employer and hence is above the input price of female labor w_F. The discrimination coefficient d will lead the firm in the short run to hire fewer women and more men than profit maximization would dictate.[74] The degree of aversion to hiring female employees is assumed to vary across employers. Firms with weaker discriminatory preferences (smaller d) will tend to hire relatively more women and relatively fewer men, and vice versa. Thus, preferences provide the exogenous source of variation in the proportion of females across otherwise identical firms. However, in the Becker model the firms are price-takers, so the wages for male and female employees do not vary across firms. Another drawback of the model is that employer discrimination cannot persist under perfect competition without productivity differences between male and female employees. Firms which have no aversion to hiring women pay wages according to their marginal productivity and force the discriminatory firms out of the market. Thus the assumption of perfect competition is relaxed towards that firms have monopsony power.

The new monopsony literature emphasizes that monopsony power may even occur if there are many employers competing for employees, and not only in the case of one single employer (see for a systematic presentation of this literature Manning 2003). Models of new monopsony literature ascribe upward-sloping firm level labor supply curves[75] to mobility costs, search frictions and heterogeneous preferences among

[73] The output price is standardized to 1. See also Hellerstein and Neumark (2005)

[74] Arrow (1973) formulated it in this way. In the original model *d* simply multiplies *F* in the employer's utility function, which generates complete sex segregation across the board with the exception of the marginal employer. The utility function based on the relative number of female employees leads to an equilibrium less at odds with observed employment patterns.

[75] The analyses of job-to-job flows within a search framework by Burdett and Mortensen (1998) and Manning (1994) have established the idea that each single firm or establishment faces its own individual

employees.[76] Discrimination against women in a situation of such imperfect competition results in lower wages and a reduced level of employment for women. In order to demonstrate this, it is supposed that the firm level labor supply curve of men and women is equal to $L^s(w_g)$ use $g = M, F$.[77] The male and female employees are perfect substitutes in production. If the employer dislikes employing women, the utility function[78] has the following form:

$$U = Y\left(L^s\left(w_M\right) + L^s\left(w_F\right)\right) - w_M L^s\left(w_M\right) - w_F L^s\left(w_F\right) - dL^s\left(w_F\right). \tag{4.3}$$

By differentiating equation (4.3) with respect to w_M and w_F, the optimal wage rates for men and woman can be obtained. They are as follows:

$$w_g^* = \frac{\varepsilon\left(w_g^*\right)}{1+\varepsilon\left(w_g^*\right)}\left(MP_g - d_g\right) \tag{4.4}$$

$$\text{with } \varepsilon\left(w_g\right) = \frac{w_g L^s{}'\left(w_g\right)}{L^s\left(w_g\right)} \quad \text{and} \quad d_g = \begin{cases} d > 0 & \text{if } g = F \\ 0 & \text{if } g = M \end{cases}$$

where $\varepsilon(w)$ denotes the elasticity of the labor supply and lies between 0 and 1, w_g^* is the wage for male and female employees, $g = M, F$, given the labor supply curve. If the second-order condition is satisfied, $L^s{}'' - 2\left(L^s{}'\right)^2 < 0$, and one can see that women obtain a lower wage than male employees. Wages and employment therefore are both lower for women. This result would be even stronger if one assumes that the female labor supply is more inelastic than its male counterpart.[79]

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labor supply curve. The point is that workers quit endogenously, and have to be replaced by new hires. The higher the wage, the lower the number quitting and thus the easier it is to attract replacement hires.

[76] Bergmann (1974) argued in a related way in her "overcrowding" model. She acts on the assumption that men and women are segregated into two occupations. Furthermore, it is assumed that there is no mobility of labor between occupations. Hence, if the job opportunities for women are small relative to their labor supply, women will "crowd" to work in one occupation. This depresses the wage there. This results in a gender wage differential. The argumentation is often mentioned in studies dealing with occupational segregation. However, the segregation is exogenously given in that model framework.

[77] I suppress the firm subscript.

[78] Note, for simplification I return to the original formulation of the Becker model assuming that the utility negatively depends on the number of the hired women instead of the relative number. Using the relative number of female employees would unnecessarily complicate the analysis. Then the derivations of the utility regarding the male and female wages would also depend on the labor supply of the other gender. Thus I cannot formulate a clear relationship as an equation (4.4).

[79] This is the idea of monopsonistic discrimination in the labor market developed by Robinson (1933). In this model it is assumed that the female labor supply is more inelastic than the male labor supply. Thus women will earn less than men relative to their productivity, and thus face a higher level of exploitation in the labor market. In this model framework the existence of gender pay gap can be explained by difference in labor supply between men and women even if employers have no discrimination preferences. Ransom and Oaxaca (2005) and Hirsch et al. (2006) empirically support the idea that female labor supply to the firm is less elastic than male labor supply.

Thus the preference-based discrimination model predicts that the proportion of female employees varies across firm depending on the degree of discriminatory behavior: the less (more) discriminatory the employer is, the higher (lower) the proportion of women in the firm. In addition, the monopsony model framework allows employers a wage setting policy according to the firm-specific elasticity of labor supply and to the extent of aversion to employing women. Ceteris paribus, the wage rate of female employees decreases with the degree of discrimination. Thus, supposing the same wage elasticities for male and female employees, the formulated discrimination hypothesis predicts a positive relationship between wage rates of female employees and the proportion of women within an establishment when the latter is a proxy for the disinclination to employ women. In contrast to this, the hypothesis predicts a negative relationship for male employees. This directly results from the upward-sloping labor supply, predicting a lower employment level for the group that receives a lower wage.

Note, in this hypothesis I use the preference-based discrimination model according to Becker (1971) and Arrow (1973) respectively. This model is embedded in a monopsony framework to derive a relationship between individual wages and the proportion of females which varies across establishments.

To sum up, the first two hypotheses, the preference and qualification hypotheses, both predict a negative relationship between the proportion of females within establishments and individual wages for both male and female employees. The discrimination hypothesis predicts a positive relationship between the proportion of females and wages for women and a negative relationship for men.

In the empirical analysis I want to investigate what drives the impact of the proportion of females within establishments on individual wages. By successively including productivity-related characteristics and variables describing the workplace I extract the impact of those variables from the effect of the proportion of females. Thus I can directly test my first two hypotheses.

Unfortunately I cannot directly test the discrimination hypothesis because I cannot observe the discriminatory behavior of employers. However, if I can rule out that the proportion of females reflects preferences and productivity differences, the explanation is likely to be discrimination. Thus I can indirectly test the discrimination hypothesis by controlling for productivity-related characteristics and variables describing the workplace. I check whether the remaining effect of the proportion of females on wages is in accordance with the predicted relationship in the discrimination hypothesis.

4.4 Empirical methodology

In order to analyze the effect of the proportion of females within an establishment on the wages of individuals I consider a standard Tobit model since the dependent variable is censored from above in the data set employed (see next section):

$$
\begin{aligned}
& w_{ij}^{g*} = \beta^g X_{ij}^g + \gamma^g \phi_j^g + \varepsilon_{ij}^g \quad i = 1,...N_j, j = 1,...J \\
& w_{ij}^g = c \text{ if } w_{ij}^{g*} \geq c \\
& w_{ij}^g = w_{ij}^{g*} = \beta^g X_{ij}^g + \gamma^g \phi_j^g + \varepsilon_{ij}^g \text{ if } w_{ij}^{g*} < c \\
& \varepsilon_{ij}^g \sim N\left(0, \sigma_j^g\right)
\end{aligned}
\tag{4.5}
$$

where superscript $g = (m, f)$ indicates the gender, w_{ij}^g describes the log wage of worker i in establishment j, w_{ij}^{g*} refers to the true log wage, X_{ij}^g denotes a various set of individual and job related characteristics dependent of the specification, ϕ_j^g presents the proportion of females in the establishment. Furthermore β^g and γ^g are the corresponding regression coefficients, ε_{ij}^g is an error term and σ_j^g is the establishment-specific variance of these. The right-censoring of the dependent variable can be dealt with by estimating a Tobit model, where the distribution of the log wage rate is censored from above at the point *c* (the daily social security threshold).

n order to deal with this issue we adjust the standard errors using robust variance estimator based on clusters at establishment level

I estimate the Tobit model (4.5) and adjust standard errors using robust variance estimator based on clusters at the establishment level. As I mentioned above, I use matched employer-employee data. For each establishment I observe wage rates of almost all employees.[80] The standard regression assumption is that what is not known about the determination of wages is distributed independently across all observations. This is an extremely strong assumption for this type of data. It is not reasonable to assume that establishments will set an individual's wage independently relative to other individuals in the firm. For instance, establishments might use internal labor markets to determine wages. This and other possible arguments suggest a non-independence of wage equation error terms for individuals who work in the same establishment.

[80] I do not observe all workers because the data set includes only employees which are covered by the social security system (see next section). I also do not use all observable wage rates because of my sample selection. In the next section I describe these details.

This is the reason for using robust standard errors based on clusters at establishment level. I assume the following structure for the covariance of the errors:

$$\sigma_{ikjl} = \begin{cases} \sigma_{ikj} & \text{for } i \neq k,\ j = l;\ \ i,k = 1,...,N_j,\ \ j,l = 1,...,J \\ \sigma_{jl}^2 & \text{for } i = k,\ j = l;\ \ i,k = 1,...,N_j,\ \ j,l = 1,...,J \\ 0 & \text{for } j \neq l;\ \ i,k = 1,...,N_j,\ \ j,l = 1,...,J \end{cases} \tag{4.6}$$

4.5 Data

In the empirical analysis I use data from the IAB Linked Employer-Employee panel (LIAB) which combines data from the *IAB Establishment Panel* and the *Employment Statistics Register*.

The *IAB Establishment Panel* is an annual survey of German establishments, which started in western Germany in 1993 and was extended to eastern Germany in 1996.[81] The sample of selected establishments is random and stratified by industries, establishment size classifications and regions. The sample unit is the establishment as the local business unit. The establishments asked in the survey are selected from the parent sample of all German establishments that employ at least one employee covered by social security. Thus, the self-employed and establishments employing only people not covered by social security (mineworkers, farmers, artists, journalists, etc.) as well as the public sector employing exclusively 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. The establishments covered by the survey have been questioned every year about turnover, number of employees, composition of the workforce, personnel problems, industrial relations, wage policies, investments, innovations and business strategies.

The worker information comes from the *Employment Statistics Register.* This is an administrative panel data set of all employees in Germany paying social security contributions.[82] The data is based on notifications which employers are obliged to provide for each employee covered by the German social security system. According to the statutory provisions, employers have to report information for all employed contributors at the beginning and end of their employment spell. In addition an annual report for each employee is compulsory at the end of the year. This report contains

[81] Detailed information on the IAB Establishment Panel is given by Kölling (2000).
[82] Information on the Employment Statistics Register is given by Bender et al. (2000).

information on an employee's occupation, the occupational status, qualification, sex, age, nationality and industry. Also the available information on daily gross earnings refers to employment spell that employers report to the Federal Employment Service.[83] If the wage rate exceeds the social security threshold ("Beitragsbemessungsgrenze"), the daily social security threshold is reported instead. Note that the daily wage rate is therefore censored from above – mostly relevant for men.

Both data sets contain a unique establishment identifier which is used to match information on all employees paying social security contributions with the establishment in the IAB Establishment Panel.

I construct my sample in two steps. First I select establishments from the IAB Establishment Panel data set. I use the wave 2002 because it includes very interesting information describing the workplace. As mentioned in Section 4.3, the theoretical approaches are based on the profit-maximizing behavior of establishments. For this reason, I exclude observations corresponding to non-profit establishments, including the public sector. Since I implement separate analyses for eastern and western Germany I also construct separate data sets, whereby the location of the establishment determines the assignment.

In the second step, I merge the establishment data with notifications for all employees employed by selected establishments in the year 2002. From the worker data I drop observations for apprentices, part-time workers and home workers. I consider only full-time workers because the Employment Statistics Register lacks explicit information on hours worked.[84] To avoid modeling human capital formation and retirement decisions, I focus on individuals aged between 25 and 55 years. Some individuals in the data set have more than one job at the same time. Furthermore I select the observations that correspond to the main job of the individual to avoid that estimation with information on secondary labor market activities and notification errors are contaminated.

The final western German sample comprises 757,914 individuals in 6,123 establishments. The sample for eastern Germany contains 196,325 employees in 3,386 establishments.

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

[84] However, I have in mind that the meaning of my results is limited to full-time employed males and females although a lot of women work part-time.

The individual data contain information on the gross daily wage, age, gender, nationality, employment status, educational status[85] and on the date of entry into the establishment. The latter is used to calculate tenure by subtracting the entry date from the ending date of the employer's notification which is also included in the data. Note, however, that this tenure variable cannot be corrected for employment interruptions as this information is not available. Hence this variable is only a proxy for tenure.

The dependent variable in my empirical analysis is the real gross daily wage. The wage also includes such fringe benefits which are subject to social security contributions. The reported wage rates are top-coded at the upper contribution limit to the social security system. In my two samples, top-coding affects 17.66 percent of the observations from western Germany and 8.69 percent of those from eastern Germany. As can be seen in Tables C1 and C2 in the appendix, both in western and eastern Germany, male employees are more affected by top-coding than female employees.

Tables C1 and C2 provide descriptive statistics for the individual characteristics I use in the estimation. Row 1 reports the observed average log wage for male and female employees. A simple estimation of a wage equation for male and female employees by a Tobit model including a constant and a female dummy shows a substantial wage gap between sexes in western Germany[86]: The average log wage of female employees is 20.57 percent lower than for male employees. At only 7.79 percent the average gender wage gap is significantly lower in eastern Germany.[87] It is also interesting to see in Table C2 that in eastern Germany there are little differences between the human capital of male and female employees. That means, there are only small differences between average job tenures and educational attainments between the sexes (with women actually enjoying a slight advantage). In western Germany the differences are more pronounced (see Table C1 in the appendix).

I would now like to address the establishment variables described in Tables C3 and C4 in the appendix. The main variable used in the subsequent empirical analysis is the proportion of female employees in an establishment. Since I have information on all employed individuals in the establishment, I can calculate this variable directly. For

[85] The six categories (no degree, vocational training degree, high-school degree, high-school degree and vocational training, university of applied science degree and university degree) are summarized to three categories. Missing and inconsistent data on education are corrected according to the imputation procedure described in Fitzenberger et al. (2006). The basic idea of this procedure is that individuals cannot lose their educational degrees.

[86] The estimated coefficient for the female dummy gives the mean actual wage gap.

[87] Hunt (2002) points out that the lower gender wage gap is due to a selection of better qualified women in employment, while the unskilled women are rather unemployed or out of labor force.

comparison, I have also used the self-reported information from the IAB Establishment Panel. There are only small deviations between both measures. In the subsequent empirical analysis I have used the calculated proportion of female employees.[88]

Row 1 in Tables C3 and C4 (in the appendix) presents the average proportion of females across establishments. An average man works in an establishment where women represent around one fourth of the workforce. Regarding this point the figures in western and eastern Germany are very similar. In contrast to this, women typically work in establishments where the proportion of females is around 50 percent of the establishment's workforce in western Germany and around 60 percent of the labor force of an establishment in eastern Germany. Thus women tend to work in predominately female establishments, with the opposite being true for men.

I use a detailed set of establishment variables to control for firm heterogeneity that may have been unobserved in previous studies. The set includes the size of establishments, the application of collective wage agreements (firm-specific and industry-wide), presence of a works council in the establishment, sales and wage bill per employee, state of the technology, the type of industry and the region where the establishment is located. I use additionally information on workplace attributes which might be related to gender specific preferences. I include a number of variables describing the extent of working hours in an establishment. Furthermore, I exploit information regarding an establishment's practices for reconciling family and working life as well as practices for health promotion. Arrangements to improve the work-life balance comprise, for instance, a firm kindergarten or other child care facilities, mentoring programs for female members of staff, equal opportunity commissioners and so on. Tables C3 and C4 in the appendix show that both practices for reconciling family and working life as well as practices for health promotion are more common in establishments in western Germany than in eastern Germany. In both regions male employees rather work in establishments with programs promoting health than women do, while the opposite is true for programs to improve the work-life balance. In addition, the establishments provide information on which worker characteristics are important for the workplaces. I use information as to whether employees have to be especially flexible and need to be able to work under physical and mental pressure.

[88] I also test the other variable and detect no qualitative differences and only quantitative differences between the estimation results.

4.6 Empirical results

In the empirical analysis, I investigate the impact of the proportion of females within establishments on wages of male and female employees. In Section 4.3, I introduced three hypotheses through which I established a relationship between gender segregation across establishments and individual wages. In the empirical analysis, I attempt to test these hypotheses. The first is based on gender differences in preferences, suggesting that the proportion of females captures the impact of workplace characteristics favored by women. In this framework the impact of sex segregation on wages is negative for both male and female employees according to the theory of compensating wage differentials. In the second hypothesis, it is assumed that women are less well-qualified, thus involving lower wage rates. In such cases the proportion of women reflects the low qualification needs of the establishment and is connected with lower wage rates. The third hypothesis is based on discriminatory behavior against women by the employer. The impact of the proportion of females is negative on male wages and positive on female wages because the proportion of females is inversely related to the degree of discrimination.

The empirical strategy is as follows: I successively include individual and establishment-specific variables describing a) the qualification and b) workplace characteristics in the wage regression of male and female employees. By observing the impact of the proportion of females on individual wages of male and female employees for each of the various specifications, I can test the previously discussed hypotheses concerning what lies behind the impact of the proportion of females within firms. That means I interpret the changes in the estimated coefficient of the interesting variable caused by the inclusion of information.

For readability, Table 4.1 only presents coefficient estimates and corresponding standard errors for the main indicator of interest, the proportion of females within establishments. The complete regression results of the all specifications are in Tables C5, C6, C7 and C8 in the appendix.

Table 4. 1: Coefficients for the establishment proportion of females in various specification of a log wage equation

Specification		Western Germany		Eastern Germany	
		Males	Females	Males	Females
(1)	proportion of females	0.1071***	-0.2316***	0.1717***	-0.0099
		(0.0368)	(0.0298)	(0.0567)	(0.0567)
(2)	(1) + human capital + occupation + regions	-0.2082***	-0.2669***	-0.0889*	-0.0819
		(0.0241)	(0.0254)	(0.0458)	(0.0556)
(3)	(2) + establishment size + industry	-0.1687***	-0.2194***	-0.1413***	-0.2452***
		(0.0215)	(0.0277)	(0.0331)	(0.0399)
(4)	(3) + institutional setting	-0.1645***	-0.1770***	-0.1293***	-0.1993***
		(0.0204)	(0.0263)	(0.0325)	(0.0338)
(5)	(4) + achievement potential	-0.0870***	-0.0520**	-0.0684**	-0.1202***
		(0.0195)	(0.0232)	(0.0351)	(0.0330)
(6)	(5) + workplace characteristics	-0.0793***	-0.0462**	-0.0728**	-0.1203***
		(0.0188)	(0.0225)	(0.0345)	(0.0321)
(7)	(6) + interaction terms	-0.0728***	-0.0458**	-0.0703**	-0.1209***
		(0.0179)	(0.0224)	(0.0329)	(0.0309)
Number of observations		565,100	192,814	120,985	75,340

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Standard errors are in parentheses and are adjusted for clustering at the establishment level. The complete estimation results are in Tables C5 – C8. Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: own calculation, LIAB cross-sectional model 2002.

I start with wage regressions for male and female employees using only the proportion of females and a constant as explanatory variables. There appears to be a positive relationship between the wage rate and the variable of interest for male employees in western and eastern Germany. By contrast, it seems that women earn less in establishments with a high proportion of females. However, the estimated parameter is not significant for eastern German women. The explanatory power of that specification is not very large. I compare here, for instance, a man employed in senior positions in a typical female dominated establishment such as a supermarket with an unqualified worker in a construction firm.

In the next specification, I control for human capital endowment and occupations. The estimated coefficients for the proportion of females turn out to be negative for men both in western and eastern Germany. For women the estimated coefficients in this specification are more negative than in the first specification. So far, the results show that men and women respectively earn less in a female dominated firm than men and women respectively with the same observed human capital and occupation in an establishment with a lower proportion of women. These results contradict the second hypothesis that establishments with a high proportion of females rather employ unqualified workers. If this hypothesis were true the estimated coefficients for the

proportion of females would have to be larger in the specification controlling for qualification than in the specification without such controls.[89]

In the third specification, I further include the establishment size (in terms of the number of employees) and the industry as explanatory variables in the wage regressions. The results show significant negative coefficients for the impact of the proportion of females on individual wages for both gender groups in western and eastern Germany. Furthermore, the estimated effect of the interesting variable is larger for female employees than for male employees. This pattern also appears in most international studies that control for the same firm-specific variables (see e.g. Bayard et al. 2003).

In comparison to the second specification, the relationship between the proportion of females and individual wages is weaker in western Germany if I control for the establishment size and type of industry. This change is due to the selection of women in smaller firms paying at average lower wage rates (see results in Tables C5 and C6 in the appendix). A different pattern can be found in eastern Germany. The estimated coefficients for the effect of the proportion of females are smaller (more negative) for both gender groups in the third specification than in the second. Unlike in western Germany, women in eastern Germany tend to work in larger establishments.

By controlling for the presence of a works council and the application of a collective bargaining agreement in the establishment, the estimated coefficient for the impact of the proportion of women becomes larger (less negative) for both gender groups in eastern as well as in western Germany in comparison to the last specification. This result suggests that female employees benefit more in terms of wages from the presence of a works council and the application of a wage agreement than male employees do.

In the fifth specification, I further include variables reflecting achievement potential. I additionally take into account the sales and the wage bill per employee as well as a dummy for a state of the technology. Again the estimated coefficients for the interesting variable dramatically increase (become less negative) in all four sub-samples compared to the last specification. This is particularly pronounced for women in western Germany. The impact of the proportion of females is now only significant at the 5 percent level. Furthermore in western Germany, the effect of that variable is now

[89] Note, I only control for observed qualification. A sorting based on unobserved skills is also possible and is not accounted for in that estimation approach.

larger for male than for female employees, a finding which differs to most other studies. The opposite pattern appears in eastern Germany. Here, the estimated effect of the proportion of females on individual wages is still larger (more negative) for women while the coefficient is only significant at the 5 percent level for men.

In the sixth specification, I include a large set of variables reflecting workplace attributes which could describe a selection of male and female employees in firms. In detail these variables comprise the weekly working hours, a dummy for overtime and dummy for no compensations for overtime working in terms of leisure or payments. Furthermore I include information on whether the firms explicitly implement measures to promote health and arrangements to improve the work-life balance. I also control as to whether the employers demand a high degree of flexibility and a high degree of mental and physical fitness from their employees.

For western Germany, the results show a further weakening of the relationship between the proportion of females within establishments and the individual wages for male and female employees. However, the reduction of the partial correlation is marginal compared to my expectations. In eastern Germany, the estimated coefficients for the proportion of females even decrease in comparison to the last specification. Thus the coefficients are more negative than they would be without controlling for the defining workplace attributes. This result is puzzling as it contradicts the descriptive findings which show that the proportion of women is higher in firms with these workplace characteristics. An explanation could be that the effects of these variables are captured by other characteristics for which I have controlled in previous specifications. For instance, the data shows that firms with works councils and collective bargaining also offer arrangements to improve the work-life balance and less weekly working hours. In order to test this, I have changed the sequence of including firm-specific characteristics. The results are presented in Table C9 in the appendix. After controlling for individual characteristics, I start by taking into account the large set of workplace attributes. In the third specification, the estimated coefficient for the impact of the proportion of females becomes larger (less negative) for both gender groups in eastern as well as in western Germany in comparison to the last specification, controlling for individual characteristics. The weakening of the relationship between wages and the proportion of women within firms is now more pronounced than the observed change from specification five to six in Table 4.1. After controlling for workplace characteristics, I continue to include the other firm

characteristics (see Table C9 in the appendix). In western Germany, the impact of the interesting variable changes only slightly until I take into account variables reflecting the achievement potential of the firm. Then the estimated coefficient for the proportion of females again increases dramatically (less negative) for male and female employees. In eastern Germany, controlling for establishment size and type of industry again leads to an decrease of the estimated coefficient for the interesting variable. As mentioned above, this is because women in eastern Germany tend to work in larger establishments.

This robustness check confirms the first hypothesis that the proportion of females reflects the attractiveness of the workplace for female employees for both western and eastern Germany. This is often captured by other firm characteristics such as work councils or collective bargaining agreements.

I also check whether the workplace characteristics have different effects for different types of employees by including interaction terms between individual characteristics (human capital and occupation). However, as specification seven shows, the impact of the proportion of females within establishments on individual wages does not change compared to the specification without the interaction term.

Regarding the second hypothesis my previous estimates show that the proportion of females within establishments does not reflect the demand for unqualified workers. I check the robustness of this result by running all specifications of the wage equations without controlling for productivity-related characteristics. I present the estimated coefficients for the proportion of females in Table C10 in the appendix. For male employees, I find that the estimated coefficient for the impact of the proportion of females is always positive in the wage equations without controlling for human capital and occupation. Thus the estimated coefficient for the interesting variable is smaller in the wage equation with controls for individual productivity. This result supports the conclusion that the second hypothesis does not hold. Otherwise, the effect would have to increase when controlling for productivity because these controls would absorb the negative effect of the lower productivity from the effect of proportion of females.

However, for female employees such a clear pattern does not appear. For women, the estimated coefficient for the impact of the proportion of females within establishments is larger (less negative) in specifications with controls for individual productivity than in the specifications without these controls. This supports the hypothesis that

establishments with a high proportion of females demand less qualified and thus primarily female workers who are paid less.

The last specification shows that a negative relationship between the proportion of females within establishments and wages for male and female employees still exists. In eastern Germany the relationship is more negative for women than for men. This result is in accordance with most other empirical studies. In contrast, in western Germany the negative connection between both variables is stronger for male employees. I cannot directly test the third hypothesis since I cannot capture the monopsony power and discriminatory preferences in observable firm characteristics. However, in the last specification I control for productivity-related and firm-specific characteristics. Thus the remaining effect of the proportion of females on wages should be an indicator of employer discrimination. The residual effect is still negative and significant for male and female employees, but is reduced in magnitude. In eastern Germany the effect is larger for women than for men, while in western Germany the reverse holds true. So far, the estimation results do not support the discrimination hypothesis. In this hypothesis, the proportion of females within establishments reflects the degree of prejudice against women among employers: the higher the aversion against women is, the lower the proportion of females. Furthermore, more discriminatory employers pay women less than employers who are more favorably disposed towards women. Thus this hypothesis predicts a positive relationship between individual wages and the proportion of females. The estimation results do not show this.[90] Perhaps there is an alternative explanation as to what drives the impact of the proportion of females on individual wages.

4.7 Conclusions

In this study I examine why the segregation of women across establishments affects the wages of male and female employees. To investigate this issue, I use matched employer-employee data from eastern and western Germany. The IAB Linked Employer-Employee panel (LIAB) combines data from the *IAB Establishment Panel* and the *Employment Statistics Register*. The data set is rich in both worker as well as

[90] However, I can speculate that controlling for more workplace attributes would lead to a further decrease in the estimated coefficients, at least for Western Germany. Maybe the estimated coefficients turn to a positive sign. However, this is a speculation.

establishment characteristics and includes particularly relevant information concerning the workforce composition of firms.

My empirical results confirm the results of previous international studies (e.g. Reilly and Wirjanto 1999a, Bayard et al. 2003, Amuedo-Dorantes and De la Rica 2006) which show a negative relationship between the proportion of females within establishments and individual wages of men and women. However, it is not always clear what is actually measured by the impact of the proportion of females on wage rates as potentially important information is omitted. For this reason I attempt to go one step *further*. Why should there be an effect of the sex segregation on individual earnings? I present three hypotheses. Firstly, assuming gender differences in preferences for specific firm and workplace characteristics, the proportion of women in an establishment reflects the attractiveness of a given workplace for women for which they are willing to accept lower wage rates in return. Secondly, I present a qualification hypothesis in relation to the so-called quality sorting hypothesis. According to this hypothesis, the proportion of females is a proxy for the skill requirements of the firm. This model framework predicts that women (men) will be over-represented in firms that demand comparatively less (more) skilled labor, so that the gender composition effect is negative on both male and female wages. As a third hypothesis, I suppose that discriminatory behavior against women by the employer can be a reason for a connection between the proportion of females within firms and individual wages. I use for this a Becker/Arrow model of employer discrimination embedded in a monopsonisitic framework in order to allow for heterogeneous wages across firms. Firms are assumed to be heterogeneous in terms of discriminatory preferences. Since the degree of discrimination against females is negatively correlated with the proportion of females within establishments and with female wages, the model framework predicts a positive relationship between the proportion of females and the wage rate for women. Furthermore, the model framework would predict for male employees a negative relationship with the proportion of females.

The empirical analysis does not support the last hypothesis because both men and women continue to be paid less in female dominated firms after controlling for productivity-related individual and firm characteristics. Moreover, this remaining negative impact for women is larger in eastern than in western Germany. As one of the omitted firm characteristic in the wage regression is the market structure, one explanation for this difference between eastern and western Germany may be that

firms in eastern German can particularly exploit women due to their monopsonistic power.

The second hypothesis is partly confirmed. It seems that the proportion of females partly reflects the low qualification of female employees, but low-qualified men are not selected in firms with a predominantly female workforce. As discussed before, these results only refer to the observed individual qualification. It is still possible that men and women with low unobserved labor productivity are selected by firms with a high proportion of females. In order to investigate this issue, a panel analysis is necessary. Macpherson and Hirsch (1995) investigate the quality sorting hypothesis for occupational segregation. Using a longitudinal analysis, they find that female dominated occupations reduce wages. They conclude that unobserved person-specific labor quality or preferences account for much of the negative relationship. However, a panel analysis is unable to ascertain whether the weakening of the relationship is due to preferences or labor quality. For this reason, this study chose a different methodological approach based on cross-section data.[91]

As the strongest finding, my empirical analysis shows that the impact of the proportion of females across establishments on wages mainly captures a selection of male and female employees in different types of firms. It seems that women tend to prefer firms that offer better chances of reconciling family and work responsibilities and also accept lower wages in return. This outcome might reflect that a general lack of child care facilities in Germany creates a pressure on women to seek remedy for this lack of public infrastructure in the sphere of the work environment. As only some firms provide attractive workplaces, this constrains the number of employment opportunities for women and therefore creates a downward pressure on their wages. If this was true, such selection processes should be weaker in countries with a better public infrastructure for reconciling family and work responsibilities. This points to the need for an empirical cross-country comparison of the gender-specific workplace selection. Moreover, from a policy perspective, creating equal employment opportunities between men and women might be an important instrument for reducing the gender wage gap. For this purpose, policies should either aim at improving the public

[91] I also use longitudinal data for the years 2000 to 2005. The estimations results show no significant effect of the proportion of females on individual wages. The comparison of longitudinal results and cross-section estimates suggests, that unmeasured, time-invariant worker- and establishment specific effects are correlated with establishment proportion of females. However, I cannot disentangle whether this effect is due to preferences, individual productivity or the behaviour of the employer.

infrastructure and/or create incentives for men to take up an equal burden of child care responsibilities.

Chapter 5

Conclusion and outlook

Even though the gender wage gap tends to shrink over time in most countries, a sizeable pay differential between men and women persists that cannot be fully explained by differences in individual characteristics which are considered as important determinants within the wage setting process. As it has been shown in the literature review of chapter 1, previous empirical studies have been unable to document the potential impact of employers and establishments respectively on the wage differences between men and women due to a lack of appropriate data. The presented thesis has incorporated the establishment level in three empirical studies on gender wage differentials by exploiting a newly available German data set - the Linked Employer-Employee Data Set of the IAB (LIAB). In the following, I briefly discuss the main findings of each of the last three chapters and conclude with an outlook on topics of future research.

The second chapter, which is a joint work with Elke Wolf, is concerned with an empirical investigation of the gender wage gap within establishments. It provides a comprehensive study of the effects of the institutional framework and competitive pressure on the gender wage gap within establishments. For this purpose, two alternative measures describing the gender wage gap within establishments are defined: the observed mean gender wage gap in an establishment and a wage gap adjusted for the within-firm human capital differences between men and women. The second measure is estimated on the basis of establishment-specific wage regressions which control for human capital. In this way, the heterogeneity of the wage setting process across firms is taken into account. The first finding is that the intra-firm gender wage gap varies tremendously across establishments. The empirical study provides some evidence for the hypothesis that establishments operating under strong product market competition behave in a more egalitarian way. Furthermore, the analysis shows that establishments covered by collective wage agreements also have smaller gender wage gaps. Given that most unions are still dominated by men, this result is not self-evident. Unions with a higher proportion of female members, however, seem to have no further decreasing effect on the intra-firm gender wage gap according to the findings. To the contrary, it is shown that a high proportion of female union members correlates with larger intra-firm wage differentials. One plausible explanation may be

that female union members focus on improving working conditions and the reconciling the demand of work and family rather than negotiating on wages only. The results also reveal a gender equalizing effect of formalized co-determination. This suggests that works councils systematically affect the establishment's wage structure and actively use their co-decide rights on new pay schemes as well as the setting of wages above agreed tariff and bonus rates. Considering that establishments suffer less and less from institutional restrictions on the part of unions and works councils, the observed trend of stagnating gender wage gaps in Germany, and in most other countries (see e.g. European Commission 2007), may be caused by the reduced importance of formalized labor relations.

While the investigation in the second chapter treats the segregation of women and men in different establishments as given, in the third chapter the selection into firms is explicitly taken into account as an explanation for the overall wage gap. The key issue is to disentangle differences in the individual characteristics (e.g. human capital endowment) of men and women and the segregation of men and women in different types of establishments as sources for the gender wage inequality. Therefore, the familiar decomposition method by Oaxaca (1973) and Blinder (1973) is extended to four terms and is undertaken across the entire wage distribution. Drawing on a flexible parametric decomposition approach by Machado and Mata (2005), the four decomposition terms are implemented directly at each percentile of the wage distribution.

The empirical analysis shows that the gender wage gap is highest in the lower part of the wage distribution. The decomposition of the observed wage gap reveals that only a small part of the wage gap is due to differences in individual characteristics of men and women. In the middle of the wage distribution women are even endowed with better individual characteristics. The selection of men and women into different firms also explains part of the wage gap, particularly at the lower part of the wage distribution. The largest part of the wage gap is attributable to differences in the remuneration of establishment characteristics. The findings reveal that even if men and women have the same endowment of individual characteristics, receive the same remuneration of these individual characteristics and work in the same firm, women still earn 16 percent less than men on average. This component of the wage gap is more pronounced in the lower part of the wage distribution than in the upper part. One possible explanation could be that women benefit less from rents which might be shared between employer

and employees than male colleagues. Or in other words, women tend to participate less in the success of the establishment, especially in the lower wage groups. Maybe they are more diffident in wage negotiations with their superior or they could have less bargaining power in comparison to male employees. Altogether, the four described decomposition components vary only mildly across the wage distribution i.e. the sources of the gender wage gap do not differ much between individuals in the lower and the upper part of the wage distribution. However, the decomposition was only considered up to 80th percentile due to right-censored wage rates.

Finally, the fourth chapter also uses the LIAB data in order to examine the relationship between the share of female employees in establishments and the wages of men and women. The study addresses the possible reasons for such a correlation. To this purpose, hypotheses are formulated as to what a higher proportion of female employees in an establishment can indicate: attractive working conditions for women, lower qualifications requirements or less discrimination against women. These hypotheses are systematically examined in the empirical analysis. In addition to the proportion of female employees in the establishment, various individual and establishment characteristics are included successively in the regression analysis as determinants of wages.

The empirical results show that an increasing proportion of women in an establishment reduces wages for both males and females. If variables describing workplace characteristics which appear to be particularly attractive for women are included, the impact of the proportion of female employees in the firm becomes less significant. Thus, there is empirical evidence that women themselves select employers which offer an attractive working environment and for which they are prepared to accept a reduction in pay. This also applies to male employees in female dominated firms. However, this effect is much weaker in eastern than in western Germany.

The partly negative effect of the proportion of female employees in the wage regression for women when including variables capturing individual qualifications reveals that the proportion of women in an establishment appears to reflect the lower qualifications of female employees. There is no evidence that less qualified men select into female dominated firms.

The discrimination preferences of employers cannot directly be observed. According to the discrimination hypothesis, it can be expected that there is a positive correlation between the proportion of female employees and the wages of female employees.

However, after controlling for individual qualifications and establishment characteristics, the proportion of women in an establishment is shown to have a negative impact on the wage of women, thus contradicting the discrimination hypothesis.

While giving some answers this thesis has also opened up possibilities for future research. The unequal treatment of men and women within establishments deserves further attention – both in theoretical and empirical terms. Further research based on LIAB data could focus on the evolution of the wage differential within establishments as a function of tenure. One idea is to compare the gender wage gap within firms at the time of hiring with that for employees with longer tenure. This would allow finding out how much of the wage inequality between men and women within firms exists from the start of the employment contract and how it changes over time. Related to this, it would be interesting to study whether the career paths within establishments of men and women differ. Indeed, besides wages, it could be the case that the hierarchical position within firms also evolves differently for men and women.

The present thesis neglects part-time employees due to the lack of information on the working hours in LIAB. However, part-time working is widespread among women, and deserves to be considered in further analysis. In order to include part-time employees in the analysis, data on the number of working hours of part-time employees is necessary. It is unfortunately not possible to receive information related to working hours in the Employment Statistics Register which is an administrative data set. An alternative would be to use the *German Structure of Earnings Survey* (GSES), another German linked employer-employee data set, which contains hourly wage rates. This data set is not so comprehensive with regard to the included establishment characteristics and basically omits the public sector and smaller firms. However, the latter data set presents the further advantage that the wages are not censored from above. Thus, the gender wage gap can also be investigated in the highest percentiles of the wage distribution, possible identifying a glass ceiling.

In order to further improve the analysis of the gender wage gap using the LIAB data, it would be worthwhile to extend the amount of available worker information with regard to the employment history. Through the incorporation of the employment history the human capital endowment could be better captured. Information on the number, length and timing of the career interruptions of the workers, drawn from the employee and benefit recipient history (BLH), could be matched to the LIAB data.

Recent literature from the US has shown that gender role attitudes can have a significant impact on the gender wage gap as well as on the employment status of women. For instance, Fortin (2005) finds that there are significant gender differences in the importance of 'making a lot of money' and 'having a job useful to society'. These preferences will affect the types of jobs chosen by women and contribute to a larger gender wage gap. In further research, it would be of great interest to examine the importance of such social attitudes regarding gender roles for the occupational choice as well for the choice of a workplace in Germany.

From the policy perspective, this thesis is interesting because it shows that gender differences in wages depends on the selection of men and women into different types of firms but within the same firm men and women are treated unequally as well. One reason for both key findings could be the lesser mobility of women due to anticipated or actual family responsibilities. This may limit women's choice of potential employers on the one hand and weaken women's bargaining position in firms on the other hand. In order to create equal employment opportunities between men and women and to improve women's bargaining position in firms, policies could aim at improving the public childcare supply and/or create incentives for men to take up an equal burden of child care responsibilities. Indirectly, employment disincentives inherent to the German tax system may also weaken women's bargaining position in firms.

In sum, I hope this thesis does not only provide new insides into the nature and the source of gender inequality in Germany but also motivates new and exiting research.

Appendices

A Appendix for Chapter 2

Table A 1**:** Distribution of establishment size and industry sector in our sample and the original LIAB sample (2001)

	Shares . . .	
	in the LIAB (%)	in our sample(%)
Establishment size		
20 – 49 employees	28.18	<1.00
50 – 99 empl.	19.41	5.35
100 – 199 empl.	16.05	17.01
200 – 499 empl.	18.62	32.78
500 – 999 empl.	9.74	23.60
1000 – 4999 empl.	7.33	19.01
5000 – 9999 empl.	0.41	1.13
> 10000 empl.	0.26	<1.00
Industry sector		
Farming, forestry and mining	2.34	2.38
Manufacturing	30.9	47.08
Construction	5.96	1.19
Trade and repair	12.1	9.77
Communication and information transmission	4.67	4.05
Credit and insurance industry	4.2	10.53
Firm-related services	9.84	7.56
Other services	17.76	14.74
Lobbies	12.23	2.70

Source: own calculation; LIAB cross-sectional model 2001.

Table A 2: Description of the sample and the gender wage gap in establishments

Year	Number of establishments	Number of male employees	Number of female employees	Within-firm GWG based on reported value (in logarithm)	Within-firm GWG (in logarithm)	Overall GWG (in logarithm)
	(1)	(2)	(3)	(4)	(5)	(6)
Establishments with at least 100 male employees						
1997	810	637,784	167,095	0.173	0.191	0.207
1998	818	584,979	157,701	0.173	0.191	0.211
1999	810	525,978	141,747	0.168	0.186	0.215
2000	1,020	576,187	151,954	0.168	0.187	0.215
2001	1,113	633,183	166,934	0.165	0.185	0.219
Establishments with 20 to 99 male employees						
1997	338	17,218	22,712	0.207	0.217	0.207
1998	377	19,161	23,751	0.207	0.218	0.211
1999	369	17,977	22,407	0.208	0.220	0.215
2000	620	29,223	32,560	0.213	0.227	0.215
2001	739	36,512	40,151	0.202	0.216	0.219

Note: The results refer to establishments with at least 20 female employees. Further explanations are given in chapter 2.
Source: own calculation; LIAB cross-sectional model 1997-2001

Table A 3: Summary statistic of individual characteristics for the firm-specific wage regressions (pooled over 1997-2001)

	Males		Females	
Variables	Mean	Std. Dev.	Mean	Std. Dev.
Log wage	4.597	0.244	4.427	0.291
Low education without vocational training	0.122	0.327	0.202	0.401
Vocational training	0.706	0.455	0.603	0.489
Secondary school (with and without vocational training)	0.049	0.215	0.127	0.333
College of higher education or university	0.123	0.328	0.068	0.252
Potential experience	21.900	9.657	19.758	10.682
(Potential experience)^2/100	5.729	4.436	5.045	4.626
Job tenure (in days)/1000	4,269.920	2,865.767	3,563.518	2,715.643
Share of censored wage rates	0.152	0.359	0.045	0.207
Observations	2,958,111		785,431	

Note: The results refer to establishments with at least 100 male and 20 female employees.
Source: own calculation; LIAB Data 1997-2001

Table A 4: Summary statistic of individual characteristics for the pooled wage regression (pooled over 1997-2001)

	Males		Females	
Variables	Mean	Std. Dev.	Mean	Std. Dev.
Log wage	4.435	0.323	4.226	0.302
Low education without vocational training	0.137	0.344	0.218	0.413
Vocational training	0.707	0.455	0.671	0.470
Secondary school (with and without vocational training)	0.074	0.261	0.080	0.271
College of higher education or university	0.083	0.276	0.031	0.174
Potential experience	22.292	10.050	21.545	10.908
(Potential experience)^2/100	5.979	4.678	5.832	4.902
Job tenure (in days)/1000	3,183.280	2,744.020	3,030.600	2,565.310
Share of censored wage rates	0.092	0.290	0.013	0.111
Observations	120,091		141,581	

Note: The results refer to establishments with 20-99 male and at least 20 female employees.
Source: own calculation; LIAB cross-sectional model 1997-2001

Table A 5: Summary statistic of establishment characteristics (pooled over 1997-2001)

	Total Sample		Restricted Sample	
Variables	Mean	Std. Dev.	Mean	Std. Dev.
Raw gender wage gap (Gap1)	0.199	0.123	0.196	0.121
Adjusted gender wage gap (Gap2)	0.135	0.098	0.132	0.096
Number of employees	1,051.500	2,167.720	1,077.430	2,231.340
Relative establishment size (employees relative to total employment in the industry sector)	0.019	0.037	0.019	0.037
Wage bill per employee	4,906.380	1,624.340	4,928.250	1,628.270
Female share (all employees)	0.386	0.230	0.381	0.230
Industry-wide wage agreement	0.784	0.412	0.814	0.389
Firm-specific wage agreement	0.104	0.306	0.101	0.301
Export quota (sales)	0.179	0.252	0.181	0.252
Works council	0.914	0.281	0.921	0.270
Works council * female share (of all employees)	0.350	0.247	0.348	0.245
Wage agreement * female share in involved union	0.323	0.219	0.332	0.215
Agriculture and forestry; electricity, gas and water supply, mining	0.030	0.170	0.029	0.169
Manufacturing I	0.147	0.354	0.145	0.352
Manufacturing II	0.350	0.477	0.352	0.478
Construction	0.012	0.107	0.012	0.111
Wholesale and retail trade	0.087	0.281	0.087	0.281
Transport and communication	0.043	0.203	0.045	0.207
Financial intermediation	0.102	0.302	0.109	0.311
Real estate, renting and business activities	0.049	0.215	0.050	0.218
Education	0.026	0.160	0.026	0.160
Other service activities	0.155	0.362	0.145	0.352
Berlin-West	0.061	0.239	0.061	0.240
Schleswig Holstein	0.020	0.139	0.020	0.140
Hamburg	0.056	0.230	0.059	0.235
Lower Saxony	0.100	0.300	0.099	0.299
Bremen	0.024	0.152	0.024	0.154
North Rhine-Westphalia	0.250	0.433	0.252	0.434
Hesse	0.092	0.289	0.093	0.290
Rhineland-Palatinate	0.066	0.248	0.062	0.242
Baden-Wuerttemberg	0.155	0.362	0.154	0.361
Bavaria	0.163	0.369	0.161	0.368
Observations	7,014		6,491	

Note: The results refer to establishments with at least 20 male and 20 female employees. The restricted sample does not contain establishments switching their union status.
Source: own calculation. The total sample is based on LIAB cross-sectional model 1997-2001. The restricted sample is based on the LIAB cross-sectional model 1997, 1999, 2001. The female share of unions is given on the homepage of the DGB: http://www.dgb.de/dgb/mitgliederzahlen/mitglieder.htm.

Table A 6: Coefficients of the firm-specific wage estimations in Tobit models (establishments ≥ 100 male employees), percentiles

Variables	Number of Obs.	Percentile 25^{th}	Percentile 50^{th}	Percentile 75^{th}
Potential experience	1,704	0.013	0.022	0.033
(Potential experience)^2/100	1,704	-0.056	-0.035	-0.020
Job tenure (in days)/1000	1,704	0.106	0.246	0.427
Low education without vocational training	1,192	-0.58	-0.439	-0.281
Vocational training	1,669	-0.335	-0.145	0.089
Secondary school (with and without vocational training)	904	-0.194	0.024	0.307
College of higher education or university	1,118	0.159	0.304	0.509

Note: Coefficients result from wage regressions in establishments with at least 100 male and 20 female employees. Further explanations are given in chapter 2.
Source: own calculation; LIAB cross-sectional model 1997-2001

B Appendix for Chapter 3

Table B 1: Summary statistics of individual characteristics for male and female employees

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Log wage (imputated)	4.6584	0.3225	4.4237	0.3776
Log wage (censored)	4.6205	0.2610	4.4089	0.3492
Age	40.7127	7.8045	39.5960	8.3721
Job tenure (in month)	138.0195	98.6705	119.0050	93.6713
Low education without vocational training degree	0.1161	0.3204	0.2033	0.4024
Vocational training degree	0.7030	0.4569	0.6229	0.4847
High school without vocational training degree	0.0065	0.0802	0.0122	0.1096
High school with vocational training degree	0.0319	0.1758	0.0704	0.2559
Technical university degree	0.0728	0.2598	0.0340	0.1812
University degree	0.0697	0.2546	0.0572	0.2323
Simple blue-collar occupation	0.2549	0.4358	0.2211	0.4150
Qualified blue-collar occupation	0.2346	0.4237	0.0445	0.2062
Engineer	0.1965	0.3973	0.0812	0.2732
Service occupation	0.1177	0.3222	0.0886	0.2841
Clerical and administrative occupation	0.1480	0.3551	0.4771	0.4995
Profession, manager and others	0.0483	0.2145	0.0876	0.2827
Number of employees	384,908		98,368	

Source: own calculation; LIAB cross-sectional model 2002

Table B 2: Summary statistics of establishment characteristics for male and female employess

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Employment size ($1/10^3$)	2.3976	3.9996	1.7425	3.0503
Proportion of female employees	0.2089	0.1604	0.3976	0.2354
Proportion of highly qualified employees	0.6855	0.2527	0.6500	0.2625
Business start-up after 1989	0.1484	0.3555	0.1473	0.3544
Export quota (sales)	0.3077	0.2956	0.2512	0.2821
Wage bill per employee ($1/10^3$)	5.8003	2.0433	5.3250	2.3203
Sales per employee ($1/10^5$)	5.0887	13.6998	5.3275	19.7887
Good results last year	0.3595	0.4799	0.3527	0.4778
Bad results last year	0.2826	0.4503	0.2895	0.4535
Average results last year	0.3579	0.4794	0.3578	0.4793
State of the technology	2.9817	0.7145	2.9974	0.7160
Industry-wide wage agreement	0.7778	0.4157	0.7286	0.4447
Firm-specific wage agreement	0.1128	0.3163	0.1048	0.3063
No wage agreement	0.1094	0.3122	0.1667	0.3727
Works council	0.9156	0.2780	0.8733	0.3326
Average weekly working hours	36.7957	1.8723	37.2115	1.7615
Agriculture and forestry, electricity, gas and water supply, mining	0.0384	0.1922	0.0251	0.1564
Manufacturing I	0.2190	0.4136	0.1785	0.3830
Manufacturing II	0.4981	0.5000	0.4113	0.4921
Construction	0.0344	0.1822	0.0148	0.1206
Wholesale and retail trade	0.0541	0.2262	0.1341	0.3407
Transport and communication	0.0687	0.2530	0.0462	0.2100
Financial intermediation	0.0013	0.0360	0.0010	0.0320
Real estate, renting and business activities	0.0527	0.2235	0.0695	0.2543
Education	0.0028	0.0524	0.0056	0.0746
Other service activities	0.0306	0.1721	0.1138	0.3176
Berlin-West	0.0432	0.2034	0.0583	0.2343
Schleswig Holstein	0.0503	0.2185	0.0602	0.2379
Hamburg	0.0588	0.2352	0.0522	0.2225
Lower Saxony	0.0841	0.2775	0.0745	0.2625
Bremen	0.0298	0.1700	0.0352	0.1843
North Rhine-Westphalia	0.1982	0.3986	0.1681	0.3739
Hesse	0.1332	0.3398	0.1330	0.3395
Rhineland-Palatinate	0.0472	0.2120	0.0559	0.2298
Baden-Wuerttemberg	0.1290	0.3352	0.1572	0.3640
Bavaria	0.1668	0.3728	0.1664	0.3724
Saarland	0.0595	0.2365	0.0391	0.1937
Number of employees	384,908		98,368	

Source: own calculation; LIAB cross-sectional model 2002

Table B 3: Estimates of OLS and Quantile wage regressions for male employees

	OLS regression		Quantile regression			
			θ=0.10	θ=0.25	θ=0.50	θ=0.75
Variables	Coeff.	Std. err.	Coeff.	Coeff.	Coeff.	Coeff.
Age	0.0374***	0.0004	0.0341	0.0335	0.0305	0.0299
Age squared ($1/10^2$)	-0.0398***	0.0005	-0.0376	-0.0363	-0.0325	-0.0313
Low education without vocational training degree	-0.0936***	0.0011	-0.0844	-0.0798	-0.0775	-0.0845
Vocational training degree (reference)	-	-	-	-	-	-
High school without vocational training degree	0.0442***	0.0041	-0.0138	0.0323	0.0631	0.0603
High school with vocational training degree	0.0858***	0.0019	0.0563	0.0688	0.0872	0.0916
Technical university degree	0.2146***	0.0014	0.2432	0.2218	0.2054	0.1978
University degree	0.2937***	0.0015	0.3164	0.3046	0.2838	0.2692
Simple blue-collar occupation	-0.2594***	0.0012	-0.1507	-0.2034	-0.2695	-0.3272
Qualified blue-collar occupation	-0.2087***	0.0012	-0.1137	-0.1610	-0.2228	-0.2735
Engineer	0.0259***	0.0012	0.0599	0.0448	0.0230	0.0072
Service occupation	-0.2566***	0.0014	-0.1846	-0.2195	-0.2739	-0.3099
Clerical and administrative occupation (reference)	-	-	-	-	-	-
Profession, manager and others	0.0540***	0.0018	0.0536	0.0707	0.0696	0.0599
Job tenure (in month) ($1/10^2$)	0.0334***	0.0004	0.0417	0.0359	0.0315	0.0299
Employment size ($1/10^3$)	0.0179***	0.0003	0.0224	0.0212	0.0200	0.0151
Employment size squared ($1/10^6$)	-0.0007***	0.0000	-0.0009	-0.0008	-0.0008	-0.0005
Proportion of female employees	-0.0970***	0.0024	-0.1362	-0.1289	-0.1035	-0.0719
Proportion of highly qualified employees	0.0803***	0.0015	0.0767	0.0569	0.0589	0.0648
Business start-up after 1989	0.0389***	0.0010	0.0305	0.0426	0.0479	0.0433
Export quota (sales)	0.0099***	0.0015	0.0107	0.0090	0.0019	0.0012
Wage bill per employee ($1/10^3$)	0.0230***	0.0002	0.0231	0.0271	0.0289	0.0279
Sales per employee ($1/10^5$)	0.0005***	0.0000	0.0006	0.0007	0.0007	0.0007
Good results last year	0.0159***	0.0008	0.0140	0.0147	0.0168	0.0156
Bad results last year	-0.0072***	0.0009	-0.0110	-0.0068	-0.0038	-0.0055
Average results last year (reference)	-	-	-	-	-	-
State of the technology	0.0136***	0.0005	0.0122	0.0146	0.0133	0.0127
Industry-wide wage agreement	0.0366***	0.0013	0.0634	0.0472	0.0368	0.0207
Firm-specific wage agreement	0.0214***	0.0016	0.0240	0.0231	0.0224	0.0130
No wage agreement (reference)	-	-	-	-	-	-
Works council	0.0870***	0.0014	0.1177	0.0940	0.0762	0.0619
Average weekly working hours	-0.0097***	0.0002	-0.0113	-0.0103	-0.0090	-0.0084
Constant	3.8928***	0.0125	3.6841	3.8116	4.0144	4.1908
R^2	0.6077					
Number of observations	384,908		384,908			

Note: The dependent variable is the log of the imputed daily wage. Controls for regions and industries are also included in estimations. Significance levels: *: 10 percent **:5 percent ***: 1 percent, Quantile regressions are without standard errors.
Source: own calculation; LIAB cross-sectional model 2002

Table B 4: Estimates OLS and Quantile wage regressions for female employees

	OLS regression		Quantile regression			
			θ=0.10	θ=0.25	θ=0.50	θ=0.75
Variables	Coeff.	Std. err.	Coeff.	Coeff.	Coeff.	Coeff.
Age	0.0241***	0.0010	-0.0014	0.0194	0.0305	0.0351
Age squared ($1/10^2$)	-0.0263***	0.0013	0.0020	-0.0227	-0.0350	-0.0395
Low education without vocational training degree	-0.0843***	0.0025	-0.0602	-0.0639	-0.0715	-0.0816
Vocational training degree (reference)	-	-	-	-	-	-
High school without vocational training degree	0.0712***	0.0078	-0.0220	0.0249	0.0780	0.1225
High school with vocational training degree	0.1142***	0.0035	0.0792	0.0834	0.0968	0.1245
Technical university degree	0.2569***	0.0049	0.2160	0.2255	0.2519	0.2697
University degree	0.3563***	0.0040	0.3008	0.3204	0.3565	0.3890
Simple blue-collar occupation	-0.1913***	0.0028	-0.0675	-0.1395	-0.1963	-0.2478
Qualified blue-collar occupation	-0.1844***	0.0044	-0.1033	-0.1533	-0.1975	-0.2212
Engineer	0.0154***	0.0034	0.0554	0.0330	0.0101	-0.0115
Service occupation	-0.1560***	0.0034	-0.1357	-0.1554	-0.1487	-0.1443
Clerical and administrative occupation (reference)	-	-	-	-	-	-
Profession, manager and others	0.0860***	0.0037	0.1170	0.1113	0.0960	0.0765
Job tenure (in month) ($1/10^2$)	0.0428***	0.0011	0.0524	0.0457	0.0401	0.0343
Employment size ($1/10^3$)	0.0270***	0.0009	0.0381	0.0300	0.0247	0.0188
Employment size squared ($1/10^6$)	-0.0010***	0.0001	-0.0015	-0.0012	-0.0010	-0.0006
Proportion of female employees	-0.0762***	0.0049	-0.0939	-0.0862	-0.0902	-0.0794
Proportion of highly qualified employees	0.1406***	0.0039	0.1896	0.1094	0.0825	0.0883
Business start-up after 1989	0.0431***	0.0026	0.0181	0.0271	0.0427	0.0488
Export quota (sales)	0.0476***	0.0042	0.0222	0.0422	0.0480	0.0364
Wage bill per employee ($1/10^3$)	0.0304***	0.0004	0.0249	0.0355	0.0395	0.0421
Sales per employee ($1/10^5$)	0.0001***	0.0000	0.0001	0.0000	0.0000	0.0002
Good results last year	0.0222***	0.0021	0.0215	0.0276	0.0257	0.0255
Bad results last year	0.0073***	0.0022	-0.0054	0.0095	0.0116	0.0140
Average results last year (reference)	-	-	-	-	-	-
State of the technology	0.0130***	0.0013	0.0123	0.0103	0.0086	0.0066
Industry-wide wage agreement	0.0470***	0.0028	0.0923	0.0572	0.0483	0.0357
Firm-specific wage agreement	0.0270***	0.0038	0.0742	0.0377	0.0255	0.0160
No wage agreement (reference)	-	-	-	-	-	-
Works council	0.1555***	0.0031	0.2766	0.1934	0.1315	0.1054
Average weekly working hours	-0.0193***	0.0007	-0.0257	-0.0205	-0.0206	-0.0172
Constant	4.1050***	0.0322	4.4006	4.0757	4.0733	4.0419
R^2	0.4992					
Number of observations	98,368			98,368		

Note: The dependent variable is the log of the imputed daily wage. Controls for regions and industries are also included in estimations. Significance levels: *: 10 percent **:5 percent ***: 1 percent, Quantile regressions are without standard errors.
Source: own calculation; LIAB cross-sectional model 2002

C Appendix for Chapter 4

Table C 1: Summary statistics of individual characteristics for male and female employees, western Germany

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Log wage	4.6214	0.2683	4.4358	0.3440
Age	40.5572	7.9364	39.4871	8.5406
Job tenure (in months)	127.3092	96.8090	109.2366	91.0117
Foreigner	0.1029	0.3038	0.0823	0.2748
Without vocational training degree	0.1431	0.3502	0.1882	0.3909
With vocational training degree	0.7048	0.4561	0.7101	0.4537
Graduate degree	0.1520	0.3591	0.1016	0.3022
Simple blue-collar occupation	0.2509	0.4335	0.1519	0.3589
Qualified blue-collar occupation	0.1995	0.3996	0.0415	0.1995
Engineers	0.1682	0.3740	0.0574	0.2325
Service occupation	0.1282	0.3343	0.1173	0.3218
Clerical and administrative occupation	0.1814	0.3854	0.4540	0.4979
Profession, manager and others	0.0719	0.2583	0.1780	0.3825
Censored wage rates	0.2091	0.4067	0.0814	0.2734
Number of employees	565,100		192,814	

Source: own calculation, LIAB cross-sectional model 2002.

Table C 2: Summary statistics of individual characteristics for male and female employees, eastern Germany

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Log wage	4.2680	0.3239	4.1916	0.3743
Age	41.5545	7.9294	41.7276	7.8038
Job tenure (in months)	77.4810	43.7862	79.6125	43.4014
Foreigner	0.0099	0.0989	0.0065	0.0801
Without vocational training degree	0.0368	0.1882	0.0355	0.1851
With vocational training degree	0.7929	0.4052	0.8068	0.3948
Graduate degree	0.1703	0.3759	0.1577	0.3644
Simple blue-collar occupation	0.2686	0.4432	0.1455	0.3526
Qualified blue-collar occupations	0.2501	0.4331	0.0444	0.2061
Engineers	0.1287	0.3349	0.0708	0.2565
Service occupation	0.1632	0.3695	0.1229	0.3283
Clerical and administrative occupations	0.0800	0.2712	0.3361	0.4724
Profession, manager and others	0.1094	0.3122	0.2802	0.4491
Censored wage rate	0.1054	0.3071	0.0571	0.2320
Number of employees	120,985		75,340	

Source: own calculation, LIAB cross-sectional model 2002.

Table C 3: Summary statistics of establishment characteristics for male and female employees, western Germany

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Establishment proportion of females	0.2419	0.1935	0.4870	0.2411
Employment size ($1/10^3$)	3.4952	6.5812	2.4588	5.1064
Industry-wide wage agreement	0.7784	0.4153	0.7727	0.4191
Firm-specific wage agreement	0.1209	0.3260	0.0969	0.2958
No wage agreement	0.1008	0.3010	0.1304	0.3367
Works council	0.9158	0.2777	0.8888	0.3144
Sales per employee ($1/10^5$)	10.7694	63.6161	17.3609	79.1176
Wage bill per employee ($1/10^4$)	0.2975	0.0945	0.2656	0.1027
Very high or high state of the technology	0.7624	0.4256	0.7622	0.4258
Average weekly working hours	36.9283	2.1720	37.6515	1.7136
Overtime	0.9525	0.2128	0.9264	0.2612
No overtime compensation	0.0023	0.0478	0.0047	0.0687
Measures for improving work-child compatibility	0.4625	0.4986	0.4749	0.4994
Workplace health promotion	0.8725	0.3335	0.8418	0.3649
Workplace with physical or mental stress	0.3860	0.4868	0.3964	0.4892
Workplace with high flexibility needs	0.6463	0.4781	0.6315	0.4824
West Berlin	0.0464	0.2104	0.0596	0.2368
Schleswig Holstein	0.0474	0.2126	0.0593	0.2362
Hamburg	0.0563	0.2305	0.0599	0.2374
Lower Saxony	0.0959	0.2944	0.0863	0.2808
Bremen	0.0288	0.1673	0.0349	0.1835
North Rhine-Westphalia	0.2146	0.4105	0.2023	0.4017
Hesse	0.1301	0.3364	0.1280	0.3341
Rhineland-Palatinate	0.0448	0.2070	0.0539	0.2258
Baden-Wuerttemberg	0.1322	0.3387	0.1399	0.3469
Bavaria	0.1428	0.3499	0.1433	0.3504
Saarland	0.0606	0.2386	0.0327	0.1778
Agriculture and forestry	0.0024	0.0486	0.0016	0.0400
Electricity, gas and water supply, mining	0.0278	0.1645	0.0130	0.1132
Manufacturing	0.6241	0.4844	0.3825	0.4860
Construction	0.0282	0.1656	0.0076	0.0868
Wholesale and retail trade	0.0429	0.2026	0.0710	0.2568
Transport and communication	0.0575	0.2328	0.0274	0.1631
Financial intermediation	0.0646	0.2459	0.1411	0.3481
Real estate, renting and business activities	0.0601	0.2377	0.0678	0.2514
Other service activities	0.0923	0.2895	0.2881	0.4529
Number of establishments	5,533		5,133	
Number of employees	565,100		192,814	

Source: own calculation, LIAB cross-sectional model 2002.

Table C 4: Summary statistics of establishment characteristics for male and female employees, eastern Germany

	Males		Females	
Variables	Mean	Std. dev.	Mean	Std. dev.
Establishment proportion of females	0.2791	0.2186	0.5915	0.2504
Employment size ($1/10^3$)	0.8036	1.3813	0.8253	1.1746
Industry-wide wage agreement	0.5417	0.4983	0.5893	0.4920
Firm-specific wage agreement	0.1970	0.3977	0.1607	0.3673
No wage agreement	0.2613	0.4393	0.2499	0.4330
Works council	0.7740	0.4183	0.7984	0.4012
Sales per employee ($1/10^5$)	2.3112	8.7614	3.3196	13.6779
Wage bill per employee ($1/10^4$)	0.2189	0.0887	0.2065	0.0809
Very high or high state of the technology	0.7553	0.4299	0.7254	0.4463
Average weekly working hours	39.2733	1.4678	39.4793	1.2643
Overtime	0.8606	0.3463	0.7746	0.4178
No overtime compensation	0.0056	0.0746	0.0040	0.0631
Measures for improving work-child compatibility	0.2442	0.4296	0.3002	0.4583
Workplace health promotion	0.8300	0.3756	0.8200	0.3842
Workplace with physical or mental stress	0.4621	0.4986	0.5028	0.5000
Workplace with high flexibility needs	0.6207	0.4852	0.6042	0.4890
Berlin-East	0.0547	0.2274	0.0734	0.2608
Mecklenburg-Western Pomerania	0.1530	0.3600	0.1614	0.3679
Brandenburg	0.1240	0.3296	0.1069	0.3089
Saxony-Anhalt	0.2818	0.4499	0.2428	0.4288
Thuringia	0.1889	0.3914	0.2184	0.4132
Saxony	0.1976	0.3982	0.1971	0.3978
Agriculture and forestry	0.0212	0.1440	0.0159	0.1250
Electricity, gas and water supply, mining	0.0668	0.2497	0.0402	0.1963
Manufacturing	0.4809	0.4996	0.2819	0.4499
Construction	0.0923	0.2894	0.0159	0.1249
Wholesale and retail trade	0.0374	0.1897	0.0383	0.1920
Transport and communication	0.0770	0.2666	0.0285	0.1664
Financial intermediation	0.0152	0.1222	0.0580	0.2338
Real estate, renting and business activities	0.0524	0.2228	0.0616	0.2404
Other service activities	0.1569	0.3637	0.4598	0.4984
Number of establishments	3.035		2.746	
Number of employees	120,985		75,340	

Source: own calculation, LIAB cross-sectional model 2002.

Table C 5: Estimates of Tobit wage regressions for male employees, western Germany

	Specification (1)		Specification (2)		Specification (3)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	0.1071***	0.0368	-0.2082***	0.0241	-0.1687***	0.0215
Age			0.0320***	0.0020	0.0343***	0.0017
Age squared ($1/10^2$)			-0.0336***	0.0021	-0.0353***	0.0019
Job tenure (in month)			0.0014***	0.0001	0.0011***	0.0001
Job tenure squared ($1/10^2$)			-0.0003***	0.0000	- 0.0002***	0.0000
Foreigner			-0.0053	0.0070	-0.0182***	0.0047
Without vocational training			-0.1099***	0.0066	-0.1003***	0.0059
Graduate degree			0.2855***	0.0084	0.2632***	0.0079
Simple blue-collar occupation			0.0318**	0.0123	-0.0135	0.0114
Qualified blue-collar occupation			0.0742***	0.0121	0.0423***	0.0105
Engineers			0.3283***	0.0153	0.2924***	0.0143
Clerical and administrative occupation			0.3283***	0.0157	0.2688***	0.0136
Profession, manager and others			0.3224***	0.0153	0.3442***	0.0128
Employment size ($1/10^3$)					0.0219***	0.0023
Employment size squared ($1/10^6$)					-0.0005***	0.0001
Industry-wide wage agreement						
Firm-specific wage agreement						
Works council						
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours						
Overtime						
No overtime compensation						
Improving work-child compatibility						
Workplace health promotion						
Workplace with physical or mental stress						
Workplace with high flexibility needs						
Region / Industry controls / Interaction terms	no / no /no		yes /no /no		yes / yes /no	
Log pseudolikelihood	-243,255.22		-55,910.22		-24,232.26	
Observations	565,100		565,100		565,100	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 5, continued: Estimates of Tobit wage regressions for male employees, western Germany

	Specification (4)		Specification (5)		Specification (6)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1645***	0.0204	-0.0870***	0.0195	-0.0793***	0.0188
Age	0.0347***	0.0017	0.0346***	0.0016	0.0348***	0.0016
Age squared ($1/10^2$)	-0.0359***	0.0019	-0.0358***	0.0018	-0.0360***	0.0017
Job tenure (in month)	0.0010***	0.0001	0.0010***	0.0001	0.0010***	0.0001
Job tenure squared ($1/10^2$)	-0.0002***	0.0000	-0.0002***	0.0000	-0.0002***	0.0000
Foreigner	-0.0168***	0.0046	-0.0188***	0.0043	-0.0184***	0.0042
Without vocational training	-0.0981***	0.0056	-0.0921***	0.0052	-0.0935***	0.0050
Graduate degree	0.2572***	0.0077	0.2380***	0.0070	0.2367***	0.0067
Simple blue-collar occupation	-0.0151	0.0113	-0.0140	0.0096	-0.0170*	0.0092
Qualified blue-collar occupation	0.0470***	0.0104	0.0437***	0.0092	0.0375***	0.0087
Engineers	0.2924***	0.0139	0.2734***	0.0123	0.2683***	0.0116
Clerical and administrative occupation	0.2691***	0.0134	0.2520***	0.0114	0.2501***	0.0108
Profession, manager and others	0.3424***	0.0125	0.3315***	0.0116	0.3256***	0.0111
Employment size ($1/10^3$)	0.0188***	0.0022	0.0140***	0.0024	0.0084***	0.0021
Employment size squared ($1/10^6$)	-0.0004***	0.0001	-0.0004***	0.0001	-0.0002***	0.0001
Industry-wide wage agreement	0.0404***	0.0107	0.0420***	0.0095	0.0321***	0.0092
Firm-specific wage agreement	0.0470***	0.0146	0.0553***	0.0137	0.0396***	0.0123
Works council	0.1210***	0.0109	0.0878***	0.0104	0.0679***	0.0103
Sales per employee ($1/10^5$)			-0.0002**	0.0001	-0.0001*	0.0001
Wage bill per employee ($1/10^4$)			0.7247***	0.0546	0.6975***	0.0518
Very high or high state of the technology			0.0343***	0.0074	0.0362***	0.0064
Average weekly working hours					-0.0114***	0.0017
Overtime					0.0434***	0.0099
No overtime compensation					0.0228	0.0228
Improving work-child compatibility					0.0232***	0.0071
Workplace health promotion					0.0075	0.0075
Workplace with physical or mental stress					0.0156**	0.0072
Workplace with high flexibility needs					0.0053	0.0068
Region / Industry controls / Interaction terms	yes / yes /no		yes / yes /no		yes / yes / no	
Log pseudolikelihood	-16,433.64		715.51		4,492.13	
Observations	565,100		565,100		565,100	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 5, continued: Estimates of Tobit wage regressions for males employees, western Germany

	Specification (7)		Specification (8)		Specification (9)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.0728***	0.0179	-0.1553***	0.0169	-0.1549***	0.0199
Age	0.0347***	0.0015	0.0341***	0.0017	0.0348***	0.0016
Age squared ($1/10^2$)	-0.0359***	0.0017	-0.0355***	0.0018	-0.0359***	0.0018
Job tenure (in month)	0.0010***	0.0001	0.0012***	0.0001	0.0011***	0.0001
Job tenure squared ($1/10^2$)	-0.0002***	0.0000	-0.0002***	0.0000	-0.0002***	0.0000
Foreigner	-0.0185***	0.0039	-0.0129***	0.0046	-0.0171***	0.0045
Without vocational training	0.0317	0.0855	-0.1081***	0.0059	-0.1014***	0.0056
Graduate degree	0.0264	0.1163	0.2672***	0.0074	0.2588***	0.0073
Simple blue-collar occupation	0.1292	0.1769	0.0067	0.0104	-0.0191*	0.0107
Qualified blue-collar occupation	0.2440	0.1561	0.0513***	0.0096	0.0338***	0.0097
Engineers	0.9130***	0.1799	0.3006***	0.0125	0.2828***	0.0132
Clerical and administrative occupation	0.5887***	0.1797	0.3132***	0.0138	0.2649***	0.0125
Profession, manager and others	1.0588***	0.2428	0.3082***	0.0127	0.3350***	0.0120
Employment size ($1/10^3$)	0.0079***	0.0021			0.0126***	0.0023
Employment size squared ($1/10^6$)	-0.0002***	0.0001			-0.0002***	0.0001
Industry-wide wage agreement	0.0306***	0.0089				
Firm-specific wage agreement	0.0379***	0.0118				
Works council	0.0669***	0.0101				
Sales per employee ($1/10^5$)	-0.0001*	0.0001				
Wage bill per employee ($1/10^4$)	0.6983***	0.0511				
Very high or high state of the technology	0.0355***	0.0062				
Average weekly working hours	-0.0058	0.0037	-0.0226***	0.0017	-0.0165***	0.0023
Overtime	0.0645***	0.0377	0.0680***	0.0121	0.0528***	0.0112
No overtime compensation	0.0193	0.0233	-0.0364	0.0324	-0.0133	0.0279
Improving work-child compatibility	0.0557***	0.0153	0.0676***	0.0090	0.0361***	0.0080
Workplace health promotion	-0.0145	0.0235	0.0394***	0.0105	0.0252***	0.0094
Workplace with physical or mental stress	0.0380***	0.0135	0.0080	0.0091	0.0124	0.0083
Workplace with high flexibility needs	0.0023	0.0144	0.0164*	0.0086	0.0080	0.0076
Region / Industry controls / Interaction terms	yes / yes / yes		yes / yes /no		yes / yes /no	
Log pseudolikelihood	7,409.61		-31,464.76		-16,299.04	
Observations	565,100		565,100		565,100	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 5, continued: Estimates of Tobit wage regressions for males employees, western Germany

	Specification (10)		Specification (11)		Specification (12)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1555***	0.0195	0.0717**	0.0301	0.0671**	0.0302
Age	0.0350***	0.0016				
Age squared ($1/10^2$)	-0.0362***	0.0018				
Job tenure (in month)	0.0010***	0.0001				
Job tenure squared ($1/10^2$)	-0.0002***	0.0000				
Foreigner	-0.0165***	0.0044				
Without vocational training	-0.0993***	0.0053				
Graduate degree	0.2549***	0.0073				
Simple blue-collar occupation	-0.0190**	0.0106				
Qualified blue-collar occupation	0.0394***	0.0097				
Engineers	0.2850***	0.0129				
Clerical and administrative occupation	0.2658***	0.0125				
Profession, manager and others	0.3351***	0.0118				
Employment size ($1/10^3$)	0.0123***	0.0022	0.0265***	0.0029	0.0236***	0.0026
Employment size squared ($1/10^6$)	-0.0002***	0.0001	-0.0005***	0.0001	-0.0005***	0.0001
Industry-wide wage agreement	0.0287***	0.0102			0.0167	0.0194
Firm-specific wage agreement	0.0286**	0.0131			-0.0106	0.0238
Works council	0.0973***	0.0110			0.1857***	0.0160
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours	-0.0126***	0.0021				
Overtime	0.0437***	0.0110				
No overtime compensation	0.0136	0.0267				
Improving work-child compatibility	0.0294***	0.0079				
Workplace health promotion	0.0083	0.0088				
Workplace with physical or mental stress	0.0145*	0.0080				
Workplace with high flexibility needs	0.0088	0.0075				
Region / Industry controls / Interaction terms	yes / yes /no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	-11,981.09		-206,517.71		-198,969.22	
Observations	565,100		565,100		565,100	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 5, continued: Estimates of Tobit wage regressions for males employees, western Germany

	Specification (13)		Specification (14)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	0.1829***	0.0241	0.1767***	0.0236
Age				
Age squared ($1/10^2$)				
Job tenure (in month)				
Job tenure squared ($1/10^2$)				
Foreigner				
Without vocational training				
Graduate degree				
Simple blue-collar occupation				
Qualified blue-collar occupation				
Engineers				
Clerical and administrative occupation				
Profession, manager and others				
Employment size ($1/10^3$)	0.0147***	0.0030	0.0088***	0.0029
Employment size squared ($1/10^6$)	-0.0004***	0.0001	0.0002***	0.0001
Industry-wide wage agreement	0.0235*	0.0142	0.0094	0.0140
Firm-specific wage agreement	0.0103	0.0176	-0.0119	0.0172
Works council	0.1227***	0.0139	0.1013***	0.0136
Sales per employee ($1/10^5$)	-0.0003*	0.0002	0.0002*	0.0001
Wage bill per employee ($1/10^4$)	1.2600***	0.0819	1.2143***	0.0766
Very high or high state of the technology	0.0465***	0.0083	0.0476***	0.0079
Average weekly working hours			0.0128***	0.0027
Overtime			0.0590***	0.0136
No overtime compensation			0.0727**	0.0319
Improving work-child compatibility			0.0346***	0.0088
Workplace health promotion			0.0019	0.0091
Workplace with physical or mental stress			-0.0051	0.0086
Workplace with high flexibility needs			0.0310***	0.0080
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no	
Log pseudolikelihood	-169,955.29		-166,251.24	
Observations	565,100		565,100	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 6: Estimates of Tobit wage regressions for female employees, western Germany

	Specification (1)		Specification (2)		Specification (3)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.2316***	0.0298	-0.2669***	0.0254	-0.2194***	0.0277
Age			0.0260***	0.0017	0.0285***	0.0016
Age squared ($1/10^2$)			-0.0302***	0.0020	-0.0317***	0.0019
Job tenure (in month)			0.0012***	0.0001	0.0010***	0.0001
Job tenure squared ($1/10^2$)			-0.0001***	0.0000	-0.0001***	0.0000
Foreigner			-0.0165***	0.0059	-0.0141**	0.0055
Without vocational training			-0.1051***	0.0065	-0.1037***	0.0057
Graduate degree			0.3465***	0.0089	0.3186***	0.0086
Simple blue-collar occupation			-0.0503***	0.0151	-0.1030***	0.0145
Qualified blue-collar occupation			-0.0519***	0.0139	-0.0880***	0.0123
Engineers			0.1914***	0.0232	0.1472***	0.0179
Clerical and administrative occupation			0.1882***	0.0161	0.1266***	0.0114
Profession, manager and others			0.2459***	0.0109	0.2472***	0.0104
Employment size ($1/10^3$)					0.0333***	0.0036
Employment size squared ($1/10^6$)					-0.0008***	0.0001
Industry-wide wage agreement						
Firm-specific wage agreement						
Works council						
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours						
Overtime						
No overtime compensation						
Improving work-child compatibility						
Workplace health promotion						
Workplace with physical or mental stress						
Workplace with high flexibility needs						
Region / Industry controls / Interaction terms	no / no / no		yes /no / no		yes / yes / no	
Log pseudolikelihood	-843,89.52		-46,300.90		-34,812.51	
Observations	192,814		192,814		192,814	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 6, continued: Estimates of Tobit wage regressions for female employees, western Germany

	Specification (4)		Specification (5)		Specification (6)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1770***	0.0263	-0.0520**	0.0232	-0.0462**	0.0225
Age	0.0293***	0.0016	0.0283***	0.0015	0.0284***	0.0015
Age squared ($1/10^2$)	-0.0326***	0.0018	-0.0314***	0.0017	-0.0314***	0.0017
Job tenure (in month)	0.0008***	0.0001	0.0009***	0.0001	0.0009***	0.0001
Job tenure squared ($1/10^2$)	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000
Foreigner	-0.0147***	0.0052	-0.0182***	0.0048	-0.0174***	0.0045
Without vocational training	-0.1017***	0.0056	-0.0975***	0.0051	-0.0976***	0.0049
Graduate degree	0.3098***	0.0083	0.2917***	0.0073	0.2917***	0.0072
Simple blue-collar occupation	-0.1053***	0.0141	-0.0910***	0.0124	-0.0953***	0.0115
Qualified blue-collar occupation	-0.0825***	0.0120	-0.0884***	0.0105	-0.0892***	0.0100
Engineers	0.1459***	0.0169	0.1280***	0.0151	0.1294***	0.0141
Clerical and administrative occupation	0.1295***	0.0113	0.1151***	0.0099	0.1160***	0.0094
Profession, manager and others	0.2374***	0.0102	0.2283***	0.0088	0.2276***	0.0085
Employment size ($1/10^3$)	0.0270***	0.0032	0.0224***	0.0027	0.0172***	0.0026
Employment size squared ($1/10^6$)	-0.0006***	0.0001	-0.0006***	0.0001	-0.0004***	0.0001
Industry-wide wage agreement	0.0544***	0.0120	0.0586***	0.0113	0.0481***	0.0107
Firm-specific wage agreement	0.0427**	0.0177	0.0475***	0.0165	0.0300**	0.0145
Works council	0.1978***	0.0168	0.1603***	0.0164	0.1319***	0.0145
Sales per employee ($1/10^5$)			-0.0002**	0.0001	-0.0002*	0.0001
Wage bill per employee ($1/10^4$)			0.8957***	0.0865	0.8553***	0.0824
Very high or high state of the technology			0.0172***	0.0080	0.0168**	0.0079
Average weekly working hours					-0.0172***	0.0026
Overtime					0.0439***	0.0110
No overtime compensation					0.0233	0.0302
Improving work-child compatibility					0.0167**	0.0072
Workplace health promotion					0.0335***	0.0085
Workplace with physical or mental stress					-0.0051	0.0071
Workplace with high flexibility needs					0.0198***	0.0066
Region / Industry controls / Interaction terms	yes / yes /no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	-29,500.68		-23,211.94		-21,815.03	
Observations	192,814		192,814		192,814	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 6, continued: Estimates of Tobit wage regressions for female employees, western Germany

	Specification (7)		Specification (8)		Specification (9)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.0458**	0.0224	-0.1810***	0.0215	-0.1896***	0.0257
Age	0.0282***	0.0014	0.0269***	0.0016	0.0288***	0.0016
Age squared ($1/10^2$)	-0.0312***	0.0017	-0.0306***	0.0019	-0.0318***	0.0019
Job tenure (in month)	0.0009***	0.0001	0.0010***	0.0001	0.0009***	0.0001
Job tenure squared ($1/10^2$)	-0.0001***	0.0000	-0.0001***	0.0000	-0.0001***	0.0000
Foreigner	-0.0175***	0.0043	-0.0148**	0.0053	-0.0128**	0.0051
Without vocational training	0.3361**	0.1206	-0.1052***	0.0057	-0.1035***	0.0054
Graduate degree	-0.3013*	0.1561	0.3297***	0.0085	0.3142***	0.0083
Simple blue-collar occupation	0.3829	0.2880	-0.0876***	0.0130	-0.1102***	0.0132
Qualified blue-collar occupation	0.4586*	0.2734	-0.0687***	0.0119	-0.0880***	0.0111
Engineers	1.2414***	0.3134	0.1659***	0.0177	0.1455***	0.0162
Clerical and administrative occupation	0.8425***	0.2878	0.1722***	0.0129	0.1272***	0.0107
Profession, manager and others	1.7600***	0.3364	0.2413***	0.0100	0.2438***	0.0099
Employment size ($1/10^3$)	0.0179***	0.0024			0.0225***	0.0034
Employment size squared ($1/10^6$)	-0.0005***	0.0001			-0.0005***	0.0001
Industry-wide wage agreement	0.0478***	0.0107				
Firm-specific wage agreement	0.0311**	0.0142				
Works council	0.1288***	0.0147				
Sales per employee ($1/10^5$)	-0.0002*	0.0001				
Wage bill per employee ($1/10^4$)	0.8542***	0.0816				
Very high or high state of the technology	0.0164**	0.0074				
Average weekly working hours	0.0000	0.0076	-0.0249***	0.0031	-0.0261***	0.0037
Overtime	0.0709***	0.0209	0.0861***	0.0131	0.0624***	0.0118
No overtime compensation	0.0219	0.0307	-0.0389	0.0417	-0.0296	0.0312
Improving work-child compatibility	0.0528***	0.0143	0.0853***	0.0110	0.0374***	0.0084
Workplace health promotion	0.0308	0.0190	0.0993***	0.0122	0.0696***	0.0106
Workplace with physical or mental stress	0.0342**	0.0155	-0.0273**	0.0101	-0.0182**	0.0083
Workplace with high flexibility needs	0.0171	0.0149	0.0354***	0.0114	0.0272***	0.0081
Region / Industry controls / Interaction terms	yes / yes / yes		yes / yes /no		yes / yes /no	
Log pseudolikelihood	-21,054.55		-37,818.12		-30,847.80	
Observations	192,814		192,814		192,814	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 6, continued: Estimates of Tobit wage regressions for female employees, western Germany

	Specification (10)		Specification (11)		Specification (12)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1669***	0.0252	-0.3069***	0.0333	-0.2656***	0.0314
Age	0.0294***	0.0016				
Age squared ($1/10^2$)	-0.0325***	0.0018				
Job tenure (in month)	0.0008***	0.0001				
Job tenure squared ($1/10^2$)	-0.0001***	0.0000				
Foreigner	-0.0139***	0.0049				
Without vocational training	-0.1017***	0.0054				
Graduate degree	0.3085***	0.0081				
Simple blue-collar occupation	-0.1100***	0.0129				
Qualified blue-collar occupation	-0.0842***	0.0110				
Engineers	0.1444***	0.0156				
Clerical and administrative occupation	0.1289***	0.0105				
Profession, manager and others	0.2359***	0.0096				
Employment size ($1/10^3$)	0.0210***	0.0031	0.0389***	0.0045	0.0317***	0.0042
Employment size squared ($1/10^6$)	-0.0004***	0.0001	-0.0008***	0.0001	-0.0006***	0.0001
Industry-wide wage agreement	0.0415***	0.0112			0.0626***	0.0150
Firm-specific wage agreement	0.0208	0.0154			0.0284	0.0234
Works council	0.1619***	0.0147			0.2270***	0.0204
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours	-0.0192***	0.0032				
Overtime	0.0419***	0.0113				
No overtime compensation	-0.0104	0.0285				
Improving work-child compatibility	0.0250***	0.0082				
Workplace health promotion	0.0408***	0.0097				
Workplace with physical or mental stress	-0.0095	0.0078				
Workplace with high flexibility needs	0.0271***	0.0079				
Region / Industry controls / Interaction terms	yes / yes /no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	-27,656.16		-67,723.87		-62,615.47	
Observations	192,814		192,814		192,814	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 6, continued: Estimates of Tobit wage regressions for female employees, western Germany

	Specification (13)		Specification (14)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.0825***	0.0290	-0.0816***	0.0286
Age				
Age squared ($1/10^2$)				
Job tenure (in month)				
Job tenure squared ($1/10^2$)				
Foreigner				
Without vocational training				
Graduate degree				
Simple blue-collar occupation				
Qualified blue-collar occupation				
Engineers				
Clerical and administrative occupation				
Profession, manager and others				
Employment size ($1/10^3$)	0.0255***	0.0035	0.0204***	0.0034
Employment size squared ($1/10^6$)	-0.0006***	0.0001	-0.0005***	0.0001
Industry-wide wage agreement	0.0678***	0.0138	0.0578***	0.0137
Firm-specific wage agreement	0.0348*	0.0194	0.0195	0.0182
Works council	0.1771***	0.0197	0.1531***	0.0185
Sales per employee ($1/10^5$)	-0.0004**	0.0002	-0.0003**	0.0001
Wage bill per employee ($1/10^4$)	1.1962***	0.1131	1.1590***	0.1099
Very high or high state of the technology	0.0197**	0.0096	0.0183*	0.0100
Average weekly working hours			-0.0120***	0.0040
Overtime			0.0496***	0.0143
No overtime compensation			0.0518	0.0347
Improving work-child compatibility			0.0264***	0.0096
Workplace health promotion			0.0222**	0.0101
Workplace with physical or mental stress			-0.0037	0.0096
Workplace with high flexibility needs			0.0283***	0.0082
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no	
Log pseudolikelihood	-54,275.75		-53,369.50	
Observations	192,814		192,814	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 7: Estimates of Tobit wage regressions for male employees, eastern Germany

	Specification (1)		Specification (2)		Specification (3)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	0.1717***	0.0567	-0.0889*	0.0458	-0.1413***	0.0331
Age			0.0307***	0.0025	0.0324***	0.0025
Age squared ($1/10^2$)			-0.0376***	0.0027	-0.0385***	0.0029
Job tenure (in month)			0.0048***	0.0009	0.0035***	0.0004
Job tenure squared ($1/10^2$)			-0.0018***	0.0007	-0.0011***	0.0002
Foreigner			0.0269	0.0170	0.0321**	0.0147
Without vocational training			-0.0748***	0.0126	-0.0521***	0.0112
Graduate degree			0.4060***	0.0148	0.3480***	0.0140
Simple blue-collar occupation			0.0352	0.0227	-0.0066	0.0148
Qualified blue-collar occupation			0.0308**	0.0139	0.0229*	0.0127
Engineers			0.2406***	0.0176	0.2331***	0.0184
Clerical and administrative occupation			0.2459***	0.0214	0.2193***	0.0168
Profession, manager and others			0.1884***	0.0212	0.2575***	0.0218
Employment size ($1/10^3$)					0.1587***	0.0211
Employment size squared ($1/10^6$)					-0.0150***	0.0030
Industry-wide wage agreement						
Firm-specific wage agreement						
Works council						
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours						
Overtime						
No overtime compensation						
Improving work-child compatibility						
Workplace health promotion						
Workplace with physical or mental stress						
Workplace with high flexibility needs						
Region / Industry controls / Interaction terms	no / no / no		yes / no /no		yes / yes / no	
Log pseudolikelihood	-54,723.55		-22,515.08		-7,955.87	
Observations	120,985		120,985		120,985	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 7, continued: Estimates of Tobit wage regressions for male employees, eastern Germany

	Specification (4)		Specification (5)		Specification (6)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1293***	0.0325	-0.0684*	0.0351	-0.0728**	0.0345
Age	0.0311***	0.0023	0.0303***	0.0023	0.0301***	0.0022
Age squared ($1/10^2$)	-0.0369***	0.0027	-0.0355***	0.0027	-0.0351***	0.0026
Job tenure (in month)	0.0033***	0.0003	0.0030***	0.0003	0.0031***	0.0003
Job tenure squared ($1/10^2$)	-0.0013***	0.0002	-0.0011***	0.0002	-0.0012***	0.0002
Foreigner	0.0121	0.0131	0.0057	0.0129	0.0078	0.0126
Without vocational training	-0.0485***	0.0100	-0.0456***	0.0092	-0.0482***	0.0093
Graduate degree	0.3233***	0.0129	0.2968***	0.0147	0.2969***	0.0140
Simple blue-collar occupation	-0.0010	0.0137	-0.0076	0.0115	-0.0098	0.0115
Qualified blue-collar occupation	0.0369***	0.0117	0.0275***	0.0099	0.0222**	0.0097
Engineers	0.2445***	0.0178	0.2348***	0.0158	0.2311***	0.0159
Clerical and administrative occupation	0.2356***	0.0167	0.2242***	0.0158	0.2204***	0.0167
Profession, manager and others	0.2697***	0.0197	0.2618***	0.0181	0.2581***	0.0179
Employment size ($1/10^3$)	0.0857***	0.0202	0.0639***	0.0195	0.0582***	0.0187
Employment size squared ($1/10^6$)	-0.0067**	0.0028	-0.0057**	0.0025	-0.0044*	0.0024
Industry-wide wage agreement	0.1047***	0.0152	0.0824***	0.0143	0.0743***	0.0132
Firm-specific wage agreement	0.0263	0.0204	0.0185	0.0174	0.0080	0.0167
Works council	0.1525***	0.0153	0.1142***	0.0164	0.1010***	0.0152
Sales per employee ($1/10^5$)			0.0039*	0.0022	0.0038*	0.0021
Wage bill per employee ($1/10^4$)			0.8292**	0.3557	0.7830**	0.3429
Very high or high state of the technology			0.0307***	0.0107	0.0312***	0.0105
Average weekly working hours					-0.0174***	0.0040
Overtime					0.0499***	0.0150
No overtime compensation					0.1085**	0.0550
Improving work-child compatibility					-0.0024	0.0130
Workplace health promotion					0.0111	0.0109
Workplace with physical or mental stress					-0.0139	0.0106
Workplace with high flexibility needs					0.0100	0.0091
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	-1,089.98		4,533.63		5,752.97	
Observations	120,985		120,985		120,985	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 7, continued: Estimates of Tobit wage regressions for male employees, eastern Germany

	Specification (7)		Specification (8)		Specification (9)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.0703**	0.0329	-0.0675*	0.0414	-0.1354***	0.0324
Age	0.0293***	0.0022	0.0294***	0.0023	0.0311***	0.0024
Age squared ($1/10^2$)	-0.0342***	0.0026	-0.0356***	0.0025	-0.0368***	0.0027
Job tenure (in month)	0.0030***	0.0003	0.0048***	0.0008	0.0035***	0.0003
Job tenure squared ($1/10^2$)	-0.0011***	0.0002	-0.0020***	0.0006	-0.0012***	0.0002
Foreigner	0.0093	0.0118	0.0176	0.0148	0.0296**	0.0136
Without vocational training	-0.3468	0.2717	-0.0780***	0.0126	-0.0569***	0.0117
Graduate degree	-0.2246	0.2698	0.3792***	0.0134	0.3399***	0.0133
Simple blue-collar occupation	1.0842***	0.2869	0.0170	0.0196	-0.0135	0.0143
Qualified blue-collar occupation	0.9474***	0.2365	0.0168	0.0123	0.0129	0.0120
Engineers	1.4793***	0.4113	0.2262***	0.0167	0.2250***	0.0180
Clerical and administrative occupation	0.8075***	0.2870	0.2352***	0.0220	0.2122***	0.0178
Profession, manager and others	0.9394**	0.3883	0.2040***	0.0203	0.2510***	0.0208
Employment size ($1/10^3$)	0.0547***	0.0175			0.1134***	0.0187
Employment size squared ($1/10^6$)	-0.0035	0.0023			-0.0082***	0.0027
Industry-wide wage agreement	0.0708***	0.0126				
Firm-specific wage agreement	0.0077	0.0157				
Works council	0.0964***	0.0147				
Sales per employee ($1/10^5$)	0.0038*	0.0021				
Wage bill per employee ($1/10^4$)	0.7730**	0.3379				
Very high or high state of the technology	0.0343***	0.0099				
Average weekly working hours	-0.0071**	0.0034	-0.0372***	0.0066	-0.0326***	0.0053
Overtime	0.1120***	0.0324	0.1088***	0.0238	0.0754***	0.0180
No overtime compensation	0.1073**	0.0509	0.0250	0.0785	0.1107	0.0849
Improving work-child compatibility	0.0381*	0.0201	0.0686***	0.0201	0.0284**	0.0159
Workplace health promotion	-0.0272	0.0214	0.1038***	0.0209	0.0572***	0.0131
Workplace with physical or mental stress	-0.0235	0.0179	-0.0379**	0.0199	-0.0152	0.0120
Workplace with high flexibility needs	0.0001	0.0157	-0.0175	0.0281	0.0062	0.0111
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	6,757.33		-15,668.79		-4,276.65	
Observations	120,985		120,985		120,985	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 7, continued: Estimates of Tobit wage regressions for male employees, eastern Germany

	Specification (10)		Specification (11)		Specification (12)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1296***	0.0318	-0.0054	0.0424	0.0109	0.0418
Age	0.0307***	0.0023				
Age squared ($1/10^2$)	-0.0362***	0.0027				
Job tenure (in month)	0.0034***	0.0003				
Job tenure squared ($1/10^2$)	-0.0013***	0.0002				
Foreigner	0.0127	0.0125				
Without vocational training	-0.0515***	0.0104				
Graduate degree	0.3197***	0.0123				
Simple blue-collar occupation	-0.0047	0.0134				
Qualified blue-collar occupation	0.0289**	0.0113				
Engineers	0.2390***	0.0176				
Clerical and administrative occupation	0.2296***	0.0179				
Profession, manager and others	0.2649***	0.0192				
Employment size ($1/10^3$)	0.0707***	0.0194	0.2432***	0.0254	0.1445***	0.0249
Employment size squared ($1/10^6$)	-0.0041	0.0028	-0.0283***	0.0037	-0.0165***	0.0035
Industry-wide wage agreement	0.0925***	0.0138			0.1172***	0.0186
Firm-specific wage agreement	0.0133	0.0193			0.0340	0.0261
Works council	0.1332***	0.0141			0.2025***	0.0183
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours	-0.0198***	0.0044				
Overtime	0.0667***	0.0165				
No overtime compensation	0.1422***	0.0694				
Improving work-child compatibility	0.0148	0.0150				
Workplace health promotion	0.0190	0.0117				
Workplace with physical or mental stress	-0.0209**	0.0112				
Workplace with high flexibility needs	0.0130	0.0103				
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	695.00		-42,504.92		-36,065.71	
Observations	120,985		120,985		120,985	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 7, continued: Estimates of Tobit wage regressions for male employees, eastern Germany

	Specification (13)		Specification (14)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	0.0889**	0.0434	0.0804*	0.0427
Age				
Age squared ($1/10^2$)				
Job tenure (in month)				
Job tenure squared ($1/10^2$)				
Foreigner				
Without vocational training				
Graduate degree				
Simple blue-collar occupation				
Qualified blue-collar occupation				
Engineers				
Clerical and administrative occupation				
Profession, manager and others				
Employment size ($1/10^3$)	0.1106***	0.0233	0.1004***	0.0227
Employment size squared ($1/10^6$)	-0.0144***	0.0029	-0.0125***	0.0029
Industry-wide wage agreement	0.0834***	0.0183	0.0749***	0.0169
Firm-specific wage agreement	0.0214	0.0219	0.0100	0.0207
Works council	0.1454***	0.0213	0.1372***	0.0196
Sales per employee ($1/10^5$)	0.0043*	0.0023	0.0040*	0.0021
Wage bill per employee ($1/10^4$)	1.1717**	0.4995	1.1071**	0.4841
Very high or high state of the technology	0.0341***	0.0130	0.0344***	0.0128
Average weekly working hours			-0.0147***	0.0044
Overtime			0.0551***	0.0182
No overtime compensation			0.1641**	0.0771
Improving work-child compatibility			0.0107	0.0167
Workplace health promotion			0.0070	0.0127
Workplace with physical or mental stress			-0.0323**	0.0136
Workplace with high flexibility needs			0.0191*	0.0106
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no	
Log pseudolikelihood	-29,625.48		-28,717.36	
Observations	120,985		120,985	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 8: Estimates of Tobit wage regressions for female employees, eastern Germany

	Specification (1)		Specification (2)		Specification (3)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.0099	0.0567	-0.0819	0.0556	-0.2452***	0.0399
Age			0.0383***	0.0039	0.0412***	0.0032
Age squared ($1/10^2$)			-0.0453***	0.0038	-0.0483***	0.0036
Job tenure (in month)			0.0051***	0.0009	0.0040***	0.0005
Job tenure squared ($1/10^2$)			-0.0018**	0.0007	-0.0012***	0.0004
Foreigner			0.0623	0.0425	0.0546	0.0374
Without vocational training			-0.0621***	0.0210	-0.0504***	0.0185
Graduate degree			0.3296***	0.0145	0.2941***	0.0125
Simple blue-collar occupation			-0.0757**	0.0323	-0.0384	0.0249
Qualified blue-collar occupation			-0.0544*	0.0290	-0.0348	0.0223
Engineers			0.1827***	0.0289	0.1670***	0.0247
Clerical and administrative occupation			0.1964***	0.0386	0.1575***	0.0238
Profession, manager and others			0.2735***	0.0238	0.2727***	0.0240
Employment size ($1/10^3$)					0.1702***	0.0307
Employment size squared ($1/10^6$)					-0.0187**	0.0075
Industry-wide wage agreement						
Firm-specific wage agreement						
Works council						
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours						
Overtime						
No overtime compensation						
Improving work-child compatibility						
Workplace health promotion						
Workplace with physical or mental stress						
Workplace with high flexibility needs						
Region / Industry controls / Interaction terms	no / no / no		yes / no / no		yes / yes / no	
Log pseudolikelihood	-37,926.55		-20,080.85		-11,633.91	
Observations	75,340		75,340		75,340	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 8, continued: Estimates of Tobit wage regressions for female employees, eastern Germany

	Specification (4)		Specification (5)		Specification (6)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1993***	0.0338	-0.1202***	0.0330	-0.1203***	0.0321
Age	0.0388***	0.0029	0.0384***	0.0026	0.0384***	0.0026
Age squared ($1/10^2$)	-0.0448***	0.0032	-0.0438***	0.0029	-0.0438***	0.0029
Job tenure (in month)	0.0036***	0.0004	0.0033***	0.0004	0.0033***	0.0004
Job tenure squared ($1/10^2$)	-0.0013***	0.0003	-0.0013***	0.0002	-0.0013***	0.0003
Foreigner	0.0287	0.0273	0.0232	0.0280	0.0231	0.0247
Without vocational training	-0.0414**	0.0169	-0.0327**	0.0160	-0.0392***	0.0149
Graduate degree	0.2823***	0.0110	0.2672***	0.0111	0.2679***	0.0106
Simple blue-collar occupation	-0.0386*	0.0212	-0.0366*	0.0187	-0.0277	0.0183
Qualified blue-collar occupation	-0.0379**	0.0191	-0.0430**	0.0170	-0.0372**	0.0170
Engineers	0.1747***	0.0231	0.1674***	0.0207	0.1782***	0.0209
Clerical and administrative occupation	0.1623***	0.0202	0.1460***	0.0179	0.1519***	0.0183
Profession, manager and others	0.2509***	0.0200	0.2386***	0.0190	0.2402***	0.0191
Employment size ($1/10^3$)	0.0805***	0.0246	0.0589***	0.0209	0.0580***	0.0214
Employment size squared ($1/10^6$)	-0.0069	0.0053	-0.0054	0.0042	-0.0049	0.0042
Industry-wide wage agreement	0.1228***	0.0241	0.1003***	0.0232	0.0976***	0.0220
Firm-specific wage agreement	0.0144	0.0282	0.0161	0.0239	0.0130	0.0227
Works council	0.2395***	0.0238	0.1870***	0.0253	0.1701***	0.0245
Sales per employee ($1/10^5$)			0.0004	0.0008	0.0004	0.0008
Wage bill per employee ($1/10^4$)			1.0434***	0.3409	1.0356***	0.3489
Very high or high state of the technology			0.0146	0.0127	0.0119	0.0127
Average weekly working hours					-0.0208***	0.0054
Overtime					0.0300**	0.0138
No overtime compensation					0.0467	0.0668
Improving work-child compatibility					-0.0098	0.0138
Workplace health promotion					0.0218	0.0141
Workplace with physical or mental stress					0.0114	0.0133
Workplace with high flexibility needs					0.0009	0.0126
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no		yes / yes / no	
Log pseudolikelihood	-5,249.51		-2,154.62		-1,626.10	
Observations	75,340		75,340		75,340	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 8, continued: Estimates of Tobit wage regressions for female employees, eastern Germany

	Specification (7)		Specification (8)		Specification (9)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1209***	0.0309	-0.0442	0.0462	-0.2231***	0.0387
Age	0.0372***	0.0023	0.0394***	0.0034	0.0416***	0.0033
Age squared ($1/10^2$)	-0.0423***	0.0027	-0.0462***	0.0036	-0.0484***	0.0037
Job tenure (in month)	0.0032***	0.0003	0.0047***	0.0008	0.0038***	0.0006
Job tenure squared ($1/10^2$)	-0.0012***	0.0002	-0.0017***	0.0006	-0.0012***	0.0004
Foreigner	0.0104	0.0198	0.0522	0.0356	0.0505*	0.0306
Without vocational training	0.8617*	0.5230	-0.0637***	0.0185	-0.0587***	0.0168
Graduate degree	-0.2419	0.2020	0.3162***	0.0130	0.2901***	0.0122
Simple blue-collar occupation	10,861	0.7980	-0.0659***	0.0307	-0.0272	0.0238
Qualified blue-collar occupation	2.2363***	0.4579	-0.0429*	0.0260	-0.0258	0.0220
Engineers	2.5088***	0.5216	0.1935***	0.0263	0.1862***	0.0250
Clerical and administrative occupation	1.7888***	0.4112	0.2001***	0.0323	0.1685***	0.0241
Profession, manager and others	1.7561***	0.4345	0.2760***	0.0223	0.2742***	0.0236
Employment size ($1/10^3$)	0.0565***	0.0211			0.1426***	0.0299
Employment size squared ($1/10^6$)	-0.0050	0.0044			-0.0143	0.0074
Industry-wide wage agreement	0.0995***	0.0206				
Firm-specific wage agreement	0.0154	0.0213				
Works council	0.1630***	0.0234				
Sales per employee ($1/10^5$)	0.0005	0.0008				
Wage bill per employee ($1/10^4$)	0.9937***	0.3406				
Very high or high state of the technology	0.0177	0.0118				
Average weekly working hours	0.0061	0.0083	-0.0294***	0.0068	-0.0358***	0.0063
Overtime	0.0899**	0.0414	0.0542*	0.0306	0.0600***	0.0222
No overtime compensation	0.0414	0.0689	-0.0832	0.0688	-0.0376	0.0802
Improving work-child compatibility	0.0755***	0.0257	0.1145***	0.0245	0.0182	0.0193
Workplace health promotion	0.0353	0.0408	0.1222***	0.0273	0.0749***	0.0212
Workplace with physical or mental stress	0.0438	0.0274	0.0235	0.0212	0.0051	0.0167
Workplace with high flexibility needs	0.0237	0.0295	-0.0062	0.0218	-0.0047	0.0176
Region / Industry controls / Interaction terms	yes / yes / yes		yes / yes /no		yes / yes / no	
Log pseudolikelihood	-705.27		-16,884.69		-9,985.71	
Observations	75,340		75,340		75,340	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 8, continued: Estimates of Tobit wage regressions for female employees, eastern Germany

	Specification (10)		Specification (11)		Specification (12)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1906***	0.0000	-0.3493***	0.0467	-0.3000***	0.0395
Age	0.0392***	0.0000				
Age squared ($1/10^2$)	-0.0450***	0.0000				
Job tenure (in month)	0.0036***	0.0000				
Job tenure squared ($1/10^2$)	-0.0014***	0.0000				
Foreigner	0.0271	0.2590				
Without vocational training	-0.0477***	0.0030				
Graduate degree	0.2803***	0.0000				
Simple blue-collar occupation	-0.0309	0.1300				
Qualified blue-collar occupation	-0.0323	0.0890				
Engineers	0.1865***	0.0000				
Clerical and administrative occupation	0.1691***	0.0000				
Profession, manager and others	0.2538***	0.0000				
Employment size ($1/10^3$)	0.0736***	0.0030	0.2326***	0.0339	0.1130***	0.0261
Employment size squared ($1/10^6$)	-0.0056	0.2990	-0.0306***	0.0082	-0.0138***	0.0052
Industry-wide wage agreement	0.1209***	0.0000			0.1410***	0.0304
Firm-specific wage agreement	0.0119	0.6570			0.0115	0.0359
Works council	0.2167***	0.0000			0.3003***	0.0289
Sales per employee ($1/10^5$)						
Wage bill per employee ($1/10^4$)						
Very high or high state of the technology						
Average weekly working hours	-0.0219***	0.0000				
Overtime	0.0425***	0.0130				
No overtime compensation	0.0518	0.4610				
Improving work-child compatibility	0.0102	0.5280				
Workplace health promotion	0.0310*	0.0560				
Workplace with physical or mental stress	-0.0019	0.8940				
Workplace with high flexibility needs	-0.0008	0.9560				
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no		yes / yes /no	
Log pseudolikelihood	-4,616.97		-27,218.58		-20,404.96	
Observations	75,340		75,340		75,340	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 8, continued: Estimates of Tobit wage regressions for female employees, eastern Germany

	Specification (13)		Specification (14)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.
Female proportion	-0.1874***	0.0388	-0.1901***	0.0373
Age				
Age squared ($1/10^2$)				
Job tenure (in month)				
Job tenure squared ($1/10^2$)				
Foreigner				
Without vocational training				
Graduate degree				
Simple blue-collar occupation				
Qualified blue-collar occupation				
Engineers				
Clerical and administrative occupation				
Profession, manager and others				
Employment size ($1/10^3$)	0.0814***	0.0224	0.0810***	0.0227
Employment size squared ($1/10^6$)	-0.0111***	0.0039	-0.0105***	0.0039
Industry-wide wage agreement	0.1090***	0.0282	0.1054***	0.0269
Firm-specific wage agreement	0.0142	0.0285	0.0097	0.0269
Works council	0.2229***	0.0310	0.2063***	0.0298
Sales per employee ($1/10^5$)	0.0007	0.0008	0.0008	0.0008
Wage bill per employee ($1/10^4$)	1.3758***	0.4359	1.3656***	0.4459
Very high or high state of the technology	0.0274*	0.0143	0.0230*	0.0140
Average weekly working hours			-0.0192***	0.0065
Overtime			0.0381	0.0151
No overtime compensation			0.0199	0.0935
Improving work-child compatibility			-0.0079	0.0160
Workplace health promotion			0.0127	0.0162
Workplace with physical or mental stress			0.0117	0.0158
Workplace with high flexibility needs			0.0141	0.0144
Region / Industry controls / Interaction terms	yes / yes / no		yes / yes / no	
Log pseudolikelihood	-16,563.54		-16,164.01	
Observations	75,340		75,340	

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Clustered standard errors at the establishment level. The estimated coefficients for the regional, industry controls and interaction terms are available upon request from the author.
Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: LIAB cross-sectional model 2002.

Table C 9: Coefficients for the proportion of females in establishments in various specifications of a log wage equation

	Western Germany		Eastern Germany	
Specification	Males	Females	Males	Females
(1) proportion of females	0.1071***	-0.2316***	0.1717***	-0.0099
	(0.0368)	(0.0298)	(0.0567)	(0.0567)
(2) (1) + human capital + occupation + regions	-0.2082***	-0.2669***	-0.0889*	-0.0819
	(0.0241)	(0.0254)	(0.0458)	(0.0556)
(8) (2) + workplace characteristics	-0.1553***	-0.1810***	-0.0675*	-0.0442
	(0.0169)	(0.0215)	(0.0414)	(0.0462)
(9) (8) + establishment size + industry	-0.1549***	-0.1896***	-0.1354***	-0.2231***
	(0.0199)	(0.0257)	(0.0324)	(0.0387)
(10) (9) + institutional setting	-0.1555***	-0.1669***	-0.1296***	-0.1906***
	(0.0195)	(0.0252)	(0.0318)	(0.0334)
(5) (10) + achievement potential	-0.0793***	-0.0462**	-0.0728**	-0.1203***
	(0.0188)	(0.0225)	(0.0345)	(0.0321)
Number of observations	565,100	192,814	120,985	75,340

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Standard errors are in parentheses and are adjusted for clustering at the establishment level. The complete estimation results are in Tables C5 – C8. Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: own calculation, LIAB cross-sectional model 2002.

Table C 10: Coefficients for the proportion of females in establishments in various specifications of a log wage equation without controlling for individual productivity-related characteristics

Specification		Western Germany		Eastern Germany	
		Males	Females	Males	Females
(1)	proportion of females	0.1071***	-0.2316***	0.1717***	-0.0099
		(0.0368)	(0.0298)	(0.0567)	(0.0567)
(11)	(1) + establishment size + industry	0.0717***	-0.3069***	-0.0054	-0.3493***
		(0.0301)	(0.0333)	(0.0424)	(0.0467)
(12)	(11) + institutional setting	0.0671**	-0.2656***	0.0109	-0.3000***
		(0.0302)	(0.0314)	(0.0418)	(0.0395)
(13)	(12) + achievement potential	0.1829***	-0.0825***	0.0889**	-0.1874***
		(0.0241)	(0.0290)	(0.0434)	(0.0388)
(14)	(13) + workplace characteristics	0.1767***	-0.0816***	0.0804*	-0.1901***
		(0.0236)	(0.0286)	(0.0427)	(0.0373)
Number of observations		565,100	192,814	120,985	75,340

Note: The dependent variable is the log of the real daily wage. The results are based on Tobit regressions. Standard errors are in parentheses and are adjusted for clustering at the establishment level. The complete estimation results are in Tables C5 – C8. Significance levels: *: 10 percent **:5 percent ***: 1 percent
Source: own calculation, LIAB cross-sectional model 2002.

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Selbständigkeitserklärung

Hiermit erkläre ich, dass ich außer von den in der Danksagung genannten Personen keine weitere Hilfe von anderen Personen bei der Abfassung der Dissertation erhalten habe. Darüber hinaus habe ich außer der angeführten Literatur und in der Dissertation angegebenen Hilfsmitteln keine weiteren Hilfsmittel verwendet. Ich bezeuge durch meine Unterschrift, dass meine Angaben über die bei der Abfassung meiner Dissertation benutzten Hilfsmittel, über die mir zuteil gewordene Hilfe sowie über frühere Begutachtungen meiner Dissertation in jeder Hinsicht der Wahrheit entsprechen.

Mannheim, 02. Juni 2008