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Analyzing the Effects of Innovative Workplace Practices on Intra-Firm Gender Wage Gaps Using Linked Employer-Employee Data

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Abstract

This paper provides a new approach to assess the impact of organisational changes fostering employee involvement, performance related pay schemes and other relevant trends in personnel policy on the gender wage gap. Our results indicate that innovative human resource practices tend to limit the wage differential between men and women. The innovation of this study is that we use linked employer-employee data to look at *within-firm* gender wage differentials. To investigate the theoretical hypotheses regarding the effect of selected human resource measures on gender wage inequality, we calculate a firm-specific gender wage gap accounting for differences in individual characteristics.

JEL Classification: J16 and J31

Keywords: gender wage gap; within-firms wage differentials, organizational change, performance-related pay systems.

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Non-technical summary

According to the theory of discrimination (Becker 1957), firms must forego profits in order to dwell on the taste for discrimination of customers, employees or executives. Hence, disparate remuneration of men and women is not for free. Given the increasing competitive pressure caused by globalisation and the adoption of technological innovations, shareholders more and more push for the reorganization of work processes. The question we hence want to answer is whether women benefit from innovative human resource policy or not.

The fundamental innovation of this research is that we provide a new approach to assess the impact of organisational changes fostering employee involvement, performance related pay schemes and other relevant trends in personnel policy on the gender wage gap (GWG). In contrast to the existing literature, we base our analysis on *within-firm* gender wage differentials. To investigate the theoretical hypotheses regarding the effect of selected human resource measures on wage inequality, we calculate a firm-specific GWG under the assumption that male and female employees had the same characteristics within each firm. Using this measure of an "unexplained" wage differential as dependent variable in the second step, we can determine the impact of selected firm characteristics and personnel policy measures on the wage inequality within firms using regression analyses. The empirical analysis is based on the German LIAB data, a representative linked employer-employee panel.

Consistent with the theoretical arguments, our empirical results indicate that organizational changes fostering the participation of employees limit the wage differences between men and women within the same establishments. Our results further indicate that continuous training programs reduce the within-firm GWG. Both the share of training participants in all employees as well as the female share among training participants further reduces the wage difference between men and women. We hence conclude that training helps to balance existing gender differences in job-related human capital. Also equal opportunity programs tend to reduce the pay differential, albeit the effect is not statistically significant. Performance depending pay systems do not involve lower gender wage gaps within firms. This result is consistent with the hypothesis that the crowding out of voluntary co-operation and intrinsic motivation by performance related pay systems is more relevant for women. Furthermore, the share of women affected by extensive performance pay schemes is rather small. Finally, performance related bonuses may in practice relate to the base salary. As a consequence, the incentive pay system manifests the original pay gap.

1. Introduction

Unequal treatment of men and women in the labor market is a very persistent abuse. Despite the shrinking difference between men and women with respect to occupational skills, experience and labor market attachment, women still tend to earn lower wages than men. Traditionally, the wage differences between men and women are assigned to either differences in individual characteristics or differences in remuneration. The „unexplained" part of the measured gender wage gap (GWG) is often interpreted as discrimination and taken for granted. Recently, however, politics and umbrella organizations of the industry in several countries came up with new anti-discrimination laws and agreements to foster equal opportunities for women and men.

According to the theory of discrimination (Becker 1957), firms must forego profits in order to dwell on the taste for discrimination of customers, employees or executives. Hence, disparate remuneration of men and women is not for free. Taking into account that the interests of managers and executives do not perfectly accord with the proprietor's goals, they may still use any opportunity to follow their taste of discrimination. Given the increasing competitive pressure caused by globalisation and the adoption of technological innovations, especially in terms of information and communication technology, shareholders more and more push for the reorganization of work processes. If the adoption of innovative workplace practices actually helps to gain structural competitive advantages by increasing the efficiency of the organization (see e. g. Becker and Gerhart 1996; Huselid, Jackson and Schuler 1997; Ichniowski, Shaw and Prennushi 1997; Appelbaum et al. 2000), it is par for the course that the innovations in the workplace organization also help to limit the inherent and costly taste for discrimination and hence reduce the GWG within establishments. The question we hence want to answer in this paper is whether women benefit from innovative human resource policy or not.

To illustrate the importance of the organizational structure for the wage setting process, just recall that individuals deciding on wage rates are part of an organization embodying a specific philosophy and defining rather strict rules and norms of collaboration. Managing a firm always requires an overall concept of how processes should work, how people should interact among each other and within the courses of action and how performance should be rewarded. Looking closely at the design of work and decision processes, pay systems, internal qualification activities and firm philosophy often reveals the firm's image of male

and female employees and its attitude towards gender equality. In this study, we will therefore focus on whether the gender pay differential is affected by selected human resource practices and specific features of firm policy, primarily their attitude towards gender equality. Apart from Drolet (2002) as well as Datta Gupta and Eriksson (2006), we are not aware of any other study looking at the effect of new workplace practices on the distribution of male and female wages. While Drolet (2002) finds evidence that participation in self-directed work groups and performance-based pay help to explain wage differences between men and women, Datta Gupta and Eriksson (2006) are rather sceptical about the discrimination-reducing effect of new workplace practices.

Although changes in the work organisation during the last decades are diverse and difficult to summarize by a few key concepts, there has emerged an agreement that employee involvement and monetary incentive systems represent the most pervasive changes in modern personnel management (Delery and Doty 1996; Appelbaum et al. 2000; Godard 2004). Even if the percentage of workplaces reporting selected management initiatives are somewhat higher in other European countries – especially in Sweden and the United Kingdom – flattening management structures, using team-based work organization, involving lower level employees or performance-related pay systems are no more rare events in German establishments (OECD 1999). While the impact of increasing employee involvement and financial incentives on firm performance is widely analyzed (Becker and Gerhart 1996; Huselid, Jackson and Schuler 1997; Ichniowski, Shaw and Prennushi 1997; Appelbaum et al. 2000; Godard and Delany 2000; Wolf and Zwick 2002; Black and Lynch 2001 and 2004), the empirical evidence on the specific benefit for male and female wages is rather limited. Considering the importance of these organizational changes, we will extend the existing literature by assessing the effect on the firm-specific GWG in Germany.

The reorganisation of work – away from a task-specialized structure towards a more task-integrated organizational structure – often evokes the need for *additional* vocational training (Black and Lynch 1998). Apart from that, the exigency for *continuous* training permanently increases due to the fast and ongoing technological change. Continuous training allows the employees to adapt to the new requirements resulting from organisational and technological changes and hence to maintain their productivity. Note, however, that men and women suffer and benefit in different ways from these occurrences. At first, the unremitting depreciation of human capital accumulated during initial training diminishes primary differences in human capital endowment between male and female employees. This process in fact holds a chance for women to catch up. Whether women may actually get the opportunity to adapt to the

technological and organisational changes and catch up with their male colleagues hence depends crucially upon the training program of their employer. Our aim in this paper is to investigate whether in-plant training programs and the share of female participation have a positive effect on the within-firm GWG or whether continuous training is less accessible to women and consequently increases gender inequality.

Finally, we state an increasing social and political alertness for the disadvantages of women in the labor market. In Germany, for instance, the government and the central associations of the German industry agreed on a convention to foster equal opportunities of women and men in the private sector („Vereinbarung zur Förderung der Chancengleichheit von Frauen und Männern in der Privatwirtschaft“) in July 2001. This voluntary commitment includes personnel measures to force the professional opportunities of women and facilitate the reconciliation of family and work for mothers and fathers. The offers range from flexible working hours, seminars for employees who are in maternity leave to child care facilities and information centres. Also studies from other countries lead one to suppose that measures to balance work and life become more and more popular (see e.g. Evans 2001 and 2002, OECD 2003 or Fernie and Gray 2002). In the following study, we will investigate whether the corporate accord on fostering equal opportunities of women and men in the private sector also results in lower wage differentials between men and women.

The fundamental innovation of this research is that we provide a new approach to assess the impact of organisational changes fostering employee involvement, performance related pay schemes and other relevant trends in personnel policy on the GWG. In contrast to the existing literature, we base our analysis on *within-firm* gender wage differentials. International evidence shows that women concentrate in low paying jobs, firms and industries (OECD 2002, Dolado et al. 2001, Bayard et al. 2003). Our descriptive figures also illustrate that the mean cross-section GWG within firms is somewhat smaller than the mean overall GWG, which hints at a selection of women into low-paying firms. Using the *within-firm* GWG as an explanatory variable, our analysis describes the effect of innovative human resource practices on the GWG, taken the selection into firms – a process which is very difficult to explain without special survey data on job seeking and selection procedures of firms – as given. Accepting that the distribution of women among firms is not random, the analysis of *intra-firm* wage differences may reveal new insights into the nature and sources of pay differentials between male and female colleges.

To investigate the theoretical hypotheses regarding the effect of selected human resource measures on wage inequality, we calculate a firm-specific GWG under the assumption that male and female employees had the same characteristics within each firm. Using this measure as dependent variable in the second step, we can determine the impact of selected firm characteristics and personnel policy measures on the wage inequality within firms using regression analyses. The empirical analysis is based on the German LIAB data, a representative linked employer-employee panel including information on all employees of firms 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 IAB, which is based on administrative social security records). Given the rich information on the establishments in our survey, we can control for many firm-specific attributes and features, such as size, wage level, female share or qualification level of the staff as well as the institutional setting, that is, the existence of works councils or collective agreements.

The remainder of the paper is organized as follows. In the next section, we discuss some theoretical considerations regarding the diverse channels through which the GWG may be affected by human resource practices and selected firm-specific characteristics. After a description of the design and source of the data in use, we discuss our empirical approach. Section 5 provides a rough picture of our sample and the use of innovative workplace organizations. The estimation results are presented in Section 6. The last section concludes.

2. How do innovative organizational structures affect male and female wages?

Researchers have stressed that firms have to adjust their organizational structure to adapt to changing requirements of the product markets and maximize the benefits of technological innovations, such as the use of computers. In short, firms put more emphasis on teams and skills (Bresnahan, Brynjolffson and Hitt 2002, Ichniowski and Shaw 2003 and Caroli and Van Reenen 2001). Accepting that the adoption of innovative human resource measures as well as training have an impact on productivity (see e.g. Huselid 1995, Ichniowski, Shaw and Prennushi 1997, Appelbaum et al. 2000, Godard and Delany 2000 or Lazear 2000, Dearden, Reed and Van Reenen 2006), it is easily comprehensible that also the wage level corresponds to this firm policy (see e.g. Bauer and Bender 2001, Cappelli 2000 or Hunter and Lafkas 2003, Osterman 2006). Most studies ignore, however, that the effects on

productivity and/or wages may differ by individuals, for example, by men and women. Although there is no comprehensive theory formalizing the effects of employee involvement and performance pay on the GWG, there exist various links between personnel and organizational policy and the wage structure within establishments. In the following, we will hence expound the interaction between employee involvement, performance related pay systems, continuous training and corporate agreements to foster equal opportunities of women and men in more detail.

The main principle behind all initiatives to increase the involvement of workers is to get the lower level staff more involved in the decision making and work process and to grant these employees greater autonomy and control over job tasks and methods of work (Cappelli and Rogovsky 1994). Typical measures to achieve that goal are teamwork, lean management, or reduced hierarchic levels (Godard 2004). But how may increased employee involvement affect the wage differentials between men and women? First of all, decentralization gives women a formalized opportunity to play an active part in decision-making and helps to reveal their competences. Given that the need for recognition is generally more pronounced among men, this institutional speaking tube may be very beneficial for women who are intimidated by dominant male colleagues. Second, team work fosters the interaction and cooperation between employees. Thanks to the intense exchange of skills and information within teams, female employees can better appraise their own contribution to the output of the team and contrast their personal value added with their own and their colleagues' wage rates. It may be argued, however, that female members within teams often perform better than their male colleagues, but their remuneration is restricted by the average team performance. Admittedly, teams would prevent positive wage premiums for women in this setting, but they also avoid negative wage cuts. As a result, team work is likely to limit the potential of continuously unequal treatment of men and women.

Third, the reorganization of work towards "holistic" organization generally goes along with task enrichment, versatile work and learning across tasks, that is the use of experience gained at one task to enhance performance at another task (Lindbeck and Snower 2000). Empirical evidence also suggests that the use of innovative workplace practices increases the importance of interpersonal interaction in the job (Borghans, ter Weel and Weinberg 2005). According to experimental studies of psychologists, women are more versed in multitasking, communication and team playing (see e.g. Rubinstein, Meyer and Evans 2001) and hence may benefit from this task enrichment and the increased emphasis on interactive skills. In contrast to these positive effects on the position of women within their firms, there exists

some evidence that teamwork and flatter hierarchies generally increase inequality among the colleagues, because it is mainly the upper part of the income distribution who benefits from these work practices (see e.g. Bauer and Bender 2001). Thanks to our data, we can identify establishments having introduced different measures fostering employee involvement.

Owing to these organizational changes, traditional Fordist control measures are put into question or rendered more costly, because individual effort cannot be measured easily any more (Kruse 1993; Holmstrom and Milgrom 1994; Milgrom and Roberts 1995). Hence, the establishment of flatter organisational structures and the adoption of other work practices fostering employee involvement are usually accompanied by a shift to performance-based pay schemes. Provided that women's wages suffer from discrimination, that is, the GWG does not represent real differences in productivity, they should benefit from performance related pay systems. According to Baker et al. (1988) one can distinguish between objective and subjective performance measures. While objective measures, such as sales or profits, rely on quantifiable performance criteria and therefore prevent disparate remuneration of men and women[1], subjective measures generally rely on the evaluation by supervisors and hence still provide some scope for discrimination. Compared to fixed wage rates – bargained secretly between employee and management – incentive pay systems based on the evaluation of the supervisor may still limit discretion due to the increased transparency, bureaucratic rules in compensation decisions and the need of vindication by the supervisor (see e.g. Prendergast and Topel 1996). Jirjahn and Stephan (2004) show, for instance, that the GWG among German blue-collar workers is substantially lower if wages rely on piece-rates than in the time-wage regime.

Even if objective measures seem to be more traceable by employees, Holmstrom and Milgrom (1991) argue that all kinds of measurable performance indicators upon which rewards are based may aggregate highly disparate aspects of performance into one single number, but may always omit other important aspects of performance that are essential to achieve the firm's goal. Given this incomplete set of performance measures and the ignorance on how agents respond to these incentives, the motivating effect of these incentive schemes are rather questionable. To circumvent this problem, firms may rather use

[1] The degree to which performance-related pay systems decrease the gender-specific wage rate depends upon the correlation between the relevant performance indicators and actual productivity. If, for instance, the wage rate is linked to parameters that are subject to factors employees can not control, such as changes in global demand or institutional changes, the gap between productivity and wage rate does not necessarily shrink and hence the GWG does not decrease either. Dressler (1999) as well as Kaschube and Rosenstiel (2000) even show that performance-related pay systems whose basis for assessment is only loosely linked with individual performance evoke little effect on motivation and future performance.

subjective performance measures or implement other instruments to control their agent's performance (e.g. job design, competing activities). Another issue might be that material incentives may crowd out voluntary co-operation and intrinsic motivation (see e.g. Eisenberger and Cameron, 1996; Deci et al., 1999, Frey and Jegen, 2000 or Fehr and Gächter, 2001). If this discouraging effect is larger for women than for men, the equalizing effect of performance related pay system is foiled. To evaluate the impact of performance related pay schemes on the within wage gap, we can revert to the comprehensive information on shared-ownership and profit sharing in our data.

Despite the increasing equalization of educational degrees among men and women in Germany, human capital in terms of works experience does still differ significantly due to the unequal incidence of employment breaks, in particular family-related career interruptions (Beblo and Wolf 2002, Kunze 2005). During an employment break different forces are at work which result in future wage cuts. In principle, one can distinguish between missing experience, human capital decay and additional, productivity-related effects. Productivity-related effects may either reflect an actual drop in productivity or may be attributed to a stigma imposed by the demand side of the labor market. Participation in continuous training programs may not only help to fill the gaps in one's knowledge, but also act as a positive signal to current or future employers.

Apart from that, the ongoing technological and organizational change increases the demand for continuous training. Hence, access to training activities accomplishes a key role among the human resource measures potentially reducing the GWG. From an economic point of view, there exist good arguments to belief that corporate training programs are aligned with the requirements and time schedule of men. Since the firm's benefit of continuous training increases with the employee's number of working hours and his or her solidarity, firms are likely to invest more in male employees who traditionally work more hours and are less mobile (Knoke and Ishio 1998, OECD 2002). Furthermore, it is argued that education and training are complements, which is supported by the evidence that high-educated and high-wage workers are trained more (see the recent surveys of Asplund 2004, Leuven 2005 or Bassanini et al. 2005). This purely economic calculus would generate lower participation rates in training programs among women. According to the official report on training in Germany, the participation rate in continuous training among women increased from 6% in 1979 to 24% in 2003. But still men participate more in continuous training than women. Considering, however, that women are more likely to work reduced hours and that part-time workers exhibit lower participation rates than full-timers (29% vs. 36%), this result reverses

if we account for differences in working hours. Among full-time employees, the participation rate in continuous training amounts to 40% for women and only 34% for men (BMBF 2006). These figures hint at the expected result that part-time workers have reduced access to further education, but that managers seem to have good reasons to invest in women – be it because they are more motivated, they generate higher positive external effects because they are more likely to share their knowledge with others or because they feel more committed to their sponsoring employer. Considering that women seem to yield higher returns to training (see e.g. Pischke 2001), we will explore whether in-plant training programs and furthermore the share of female participation help to overcome wage differences between male and female employees or not.

An additional pervasive effect on the wage gap between men and women should be achieved by corporate agreements to foster equal opportunities of women and men. Establishments that commit themselves to the equalization of gender are presumably more aware of discriminating work processes, pay schemes and training conditions. At most, they may draw on professional consulting to reshape their workplace such that it satisfies the requirements of specific certificates (such as the audit "BERUF & FAMILIE" in Germany). The awarding of such an official seal may depend on the working hours policy[2], the opportunity to take sabbaticals, the career opportunities of male and female employees, the (financial) support of child care facilities, the extent of gender segregation within the establishment or programs to help mothers or other individuals with career interruptions to integrate into employment. In any case, we expect that firms that decided to equalize the professional opportunities of men and women are more likely to implement some of these human resource measures and thus exhibit smaller wage gaps. Since our knowledge on these commitments is restricted to two brief questions in our data, we will exploit this information to test whether the wage difference between men and women corresponds to this firm policy.

Even if the information on the training activities as well as the use of innovative workplace practices represent crucial features of the firm philosophy and policy, our knowledge on the actual organizational structure and other human resource projects is very fragmented. It is hence straightforward to look for other observable variables which presumably correlate with firm policy. In the literature, the role of firm age is primarily analyzed with respect to

[2] In principle, flexible working hours are an effective means to help women balancing home and work responsibilities. In practice, flextime may, however, imply that employees are supposed to be available all day long. Which of the converse implications dominate, crucially depends upon the initial motive for work time flexibility and the actual implementation in the corresponding establishment. Given our limited information on the exact use of flexible work schedules, we do not analyze this question in our empirical model.

gender segregation. Arguments mainly rely on the perception that new founded organizations are strongly driven by structures and practices that correspond to broad, cohort-specific social understandings about how an organization ought to be run (Baron 1991). Metaphorically speaking, the norms and ideals present at the time of an organization's founding are imprinted on its structure, norms and behaviour and will persist through time (Baron and Newman 1990). Hence, new founded organizations are supposed to be more likely to integrate women in all hierarchical levels and tasks than older organizations that were founded when offering women only bad paying jobs was considered business as usual (see e.g. Baron, Mittman and Newman 1991 or Huffman 1999 for segregation in managerial positions). Concerning the wage structure within firms, one could also argue that firms founded in times of increased emancipation and integration of women in the labor market as well as the awareness of substantial and persistent skill gaps are less likely to discriminate against women. We will test this hypothesis by including an indicator whether the establishment is founded before or after 1990.

3. The data source

The effects of firm policy on the wage inequality within firms can be evaluated best with data including linked information on employers and employees. Thus, the data set we use is constructed by merging the IAB-establishment panel and the IAB employment statistic of the German Federal Services based on a unique firm identification number.

The IAB- establishment panel is an annual survey of German establishments, which started in West-Germany in 1993 and was extended to East Germany in 1996.[3] The sample of selected establishments is random and stratified by industries firm 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 a response rate above 70% which is high compared to other non-official German establishment panel studies (Kölling 2000) and helps to reduce panel attrition to less than 20% per year.[4] In order to keep the panel representative and correct for panel mortality,

[3] Detailed information on the IAB-establishment panel is given by Kölling (2000).
[4] The establishments are first approached by a letter indicating the goals of the survey. This letter is accompanied by separate letters of recommendation by the president of the Federal Employment Services and the leader of the German employer's association. Some weeks after this announcement letter, the establishment is contacted by telephone in order to arrange an individual appointment for the interview.

exits, and newly-founded units, additional establishments are drawn each year, yielding an unbalanced panel. These additional establishments are stratified with respect to ten categories of establishment size and 34 economic sectors.

The sample unit is the establishment as the local business unit. Assuming that human resource management varies within multiple establishment firms, we believe that the establishment is the preferred level of analysis for this research question. Note that firm and establishment are used as synonyms in this paper, though. 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, self-employed and establishments that employ only people not covered by social security (mineworkers, farmers, artists, journalists, etc.) as well as public employers with solely civil servants do not belong to the original sample. The data set is a representative sample of German establishments employing at least one employee who pays social security contributions. The establishments covered by the survey have been questioned every year about turnover, number of employees, personnel problems, industrial relations, wage policies, apprenticeship training, investments, innovations, and business strategies. From time to time, additional topics, such as training, pay systems and human resource policies, were added to the questionnaire.

The IAB employment statistic of the German Federal Services, so-called Employment Statistics Register, is an administrative panel data set of all employees in Germany paying social security contributions.[5] 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 2003, that is, every person who was employed for at least one day from 1975 to 2003 and/or with claims to pension benefits is included.[6] 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 West German employees. According to the statutory provisions, employers have to report information for all employed contributors at the beginning and end of their employment spells. In addition an annual report for each

[5] Information on the Employment Statistics Register is given by Bender, Haas and Klose (2000).
[6] These are people who, as employees, have paid contributions to the pension system or who have been covered by the pension system through contributions by the unemployment insurance or by being a parent (depending on the birth year of the child, a fixed number of years is counted as child caring time during which the non-working parent becomes entitled to receive pension benefits).

employee is compulsory at the end of a year. This report contains information on an employee's occupation, the occupational status, qualification, sex, age, nationality, industry and the size of the employer. Also the available information on daily gross earnings refers to employment spells that employers report to the Federal Employment Service.[7] If the wage rate exceeds the upper earnings limit ("Beitragsbemessungsgrenze"), the daily social security threshold is reported instead.[8] Note that the daily wage rate is therefore censored from above – mostly relevant for men.

Both data sets contain a unique firm identifier which is used to match information on all employees paying social security contributions with the establishment in the IAB-establishment panel. Due to the lack of explicit information to working hours[9] we consider only full-time employees. In order to avoid modelling human capital formation and retirements decisions, we also drop individuals younger than 20 and older than 60. Furthermore, we exclude firms which employ less than 20 full-time employed men and women respectively who are subject to social insurance contributions and aged between 20 and 60 years, because the calculation of a firm-specific GWG is statistically not very robust. Finally, we restrict our sample to West German establishments of the private sector who participated in the IAB-establishment panel in one year from 1998 to 2003. In contrast to the private industry, pay systems in the public sector are highly centralized and regulated by the Federal Act on the Remuneration of Civil Servants (Bundesbesoldungsgesetz). This bill requires equal pay for all individuals with the same seniority and qualification who work in a specific job. As a result, the GWG in the public sector is significantly lower than in private firms (see e.g. Melly 2005). Furthermore, we expect little or no impact of personnel policy on the firm-specific gender wage gap in the public sector. East German firms are not considered in the analysis, because both the wage level, the GWG as well as the wage setting process is still very different. Given that many East-German firms are founded after the German Unification, firm philosophy and the type and degree of organizational change may differ tremendously by region. Even if our data provide a set of variables describing these differences, we can only account for a small part of the regional firm heterogeneity. Hence, a common investigation of both regions would not be very meaningful. A separate analysis for

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

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

[9] The data set only distinguishes between full- and part-time workers whereby, for instance, part-time can mean 4 or 6 hours per day.

East Germany is not possible either, because the number of larger firms is too small to derive reliable results. Apart from that, the wage setting process and the resulting GWG in East German establishments is likely to be driven by internal processes, which can not be captured by our data, such as the financial devaluation of female labor as well as the crowding out of working women, in particular women in occupations which were dominated by females in East Germany before unification.

4. Implementing theory in an empirical model

The empirical assessment of all these interactions between personnel policy, organizational change or pay systems and the GWG within establishments requires a rich data base of linked employer-employee information. To minimize the computational costs, we apply a two-step procedure, which subsumes the individual-specific information in the first stage into firm-specific variables in the second estimation step.

The basic idea of our approach is that we define a firm-specific GWG as dependent variable and regress this measure on explanatory variables derived from the theoretical hypothesis expounded in Section 2. The sources of the observed wage gap within establishments can be manifold. On the one hand male and female employees differ with regard to their human capital endowment and other labor market relevant characteristics. On the other hand the endowments of men and women are remunerated in different ways. Finally, workplace characteristics may effectively determine the size of the GWG. Since we want to assess the effect of personnel policy, organizational change or pay systems on "unexplained" wage differences between men and women, our measure of firm-specific GWG should be adjusted by wage difference due to gaps in occupational skills, human capital or other observable characteristics. The dependent variable Gap_j is hence defined as follows:

$$(1) \quad Gap_j = Gap_j^{obs} - \left(\hat{\beta}_j^m \overline{X_{ij}^m} - \hat{\beta}_j^m \overline{X_{ij}^f}\right)$$

Gap_j^{obs} represents the observed wage gap within firm *j*. Since the wage information in our data set is right-censored, the observed wage gap underestimates the actual raw wage differential. In order to determine the actual observed wage gap we apply a simple Tobit model.[10] By estimating the following equation for each firm *j*, we can directly derive the firm-specific wage differential between male and female employees:

[10] Alternatively, we could use imputed wage information which is available in the data. However these wage rates are estimated in a different model. Thus other explanatory variables and a different sample are used to explain the wages.

(2) $\ln w_{ij} = \alpha_j + \gamma_j fem_{ij} + \mu_{ij}$,

where the dependent variable *ln* w_{ij} denotes the log earnings for individual *i* at firm *j*. α is an absolute term measuring the average wage rate in firm *j*, *fem* is a dummy variable reflecting the gender of individual *i* and μ_{ij} denotes the error term. The estimated coefficients $\hat{\gamma}_j$ then represents the raw GWG in firm *j* (Gap_j^{obs}) taking into account that w_{ij} is censored from above.

To adjust the observed wage gap by differences in human capital (see equation (1)), we use the vector $\overline{X}_{ij}$ which includes mean characteristics of the individuals *i* at firm *j*. $\hat{\beta}_j^m$ is a vector of estimated coefficients – derived from wage regressions – of the individual characteristics X_{ij} of male employees in firm *j*. Hence, Gap_j reflects the difference in the rewards for individual human capital characteristics as well as earnings differences due to workplace characteristics and unobserved wage effects between male and female employees within each firm *j*. Note that the calculation of this measure requires the estimation of wage equations for male employees only. One innovation of our study is the firm-specific estimation of wage equations, which allows for the heterogeneity and complexity of the wage setting process. We hence estimate separate wage equations for each firm *j*:

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

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, we exclude them from our wage equation. Therefore, X_{ij}^m includes potential experience (squares), dummy variables for different education levels and job tenure. 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 are statistically meaningful, we restrict this procedure to firms with at least hundred male full-time employees. The estimation of firm-specific wage rates is especially suitable to accommodate the heterogeneity of wage-setting processes among firms. This benefit is, however, only feasible at the expense of the number of considered firms. In order to maximize the number of establishments in the second estimation step, we determine the GWG in firms with less than hundred male employees by running a pooled wage regression for all establishments with twenty up to ninety-nine male employees:

(4) $\ln w_i^m = \beta^m X_i^m + \varepsilon_i^m$

In contrast to equation (3), where we determine firm-specific coefficients (β_j), we now estimate the average impact of human capital characteristics in all smaller firms (β). By applying different strategies for smaller and larger firms, we are able to determine the adjusted wage gap for the vast majority of the establishments in our sample.

Given the results of equation (3) and (4) respectively, we can calculate Gap_j which describes the GWG within firms assuming that men had the same human capital endowment as women within a firm. In other words, Gap_j describes the within-firm GWG adjusted by observed differences in human capital. Note, however, that part of the differences in characteristics may be caused by inequality with respect to access and the encouragement to education, though. 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 firms.[11]

Using this measure of firm-specific wage differentials as dependent variable allows us to analyze the effect of personnel policy, organizational change and pay systems on the wage inequality within firms.

(5) $Gap_j = \delta Z_j + \varepsilon_j$.

The GWG which is adjusted for the difference in human capital characteristics is assumed to depend on the vector Z_j including firm characteristics and information on workplace policy of firm j. δ captures the impact of the corresponding explanatory variables, derived from the theories expounded in Section 2. In this second estimation step we can exploit the panel structure of the data by applying a random effects model. As a result, firm specific heterogeneity is captured by the random effect determined by the estimation model. Even if it was straightforward to apply a random effects Tobit model in the first estimation step, we currently refrain from this approach because of computer time restrictions.

A general issue in assessing the effect of workplace practices is that the firm's decision to use innovative human resource measures may be driven by the outcome variable under consideration (see e.g. OECD 1999), because the estimated parameters are then likely to be biased due to endogeneity. In our setting, this problem would become relevant if establishments with high gender wage gaps were more or less likely to foster employee involvement,

[11] 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.

incentive pay systems, training activities or gender equality. Assuming that firms have strong preferences for equality between male and female employees and our selected human resource practices are regarded as efficient means to limit discrimination, the estimated coefficients tend to be upward biased, because there are unobserved characteristics which are positively correlated with both, small GWGs and the use of innovative personnel policy. Our estimation results may then be interpreted as upper bounds of the actual effect. We argue, however, that equality is presumably not the driving force when thinking about organizational change with all its different aspects. There exists consistent evidence that technological changes (see e.g. Bresnahan, Brynjolfsson and Hitt 2002) and productivity shocks strongly affect the use of innovative workplace practices (see e.g. Nickell, Nicolitsas and Patterson 2001 or OECD 1999). In that case, our estimation is not biased due to endogeneity.

Another concern that should be considered is the effect of unobserved heterogeneity and omitted variables. It is well documented in the literature that the adoption of new workplace practices is often driven by innovations in the production process or changes on the product market. If these underlying events evoke a direct effect on the GWG within firms, the omission of these variables would result in upward biased coefficients of our selected firm policy variables. Since especially changes in the production technology might affect male and female wages in different ways, we try to limit this bias by using all available information of the technical state and innovations in the production process. Finally it may be argued that firms with innovative workplace practices and establishments with more traditional human resource policies differ in many other dimensions we cannot control for. Tanks to our rich data set we can use detailed information on all kinds of firm-characteristics which allows us to extract much of the usually unobserved establishment-specific effects. Apart from that, we exploit the panel structure of our data in order to account for unobserved heterogeneity.

5. A rough picture of selected variables in our sample

Due to our strict selection criterions, it may be argued that our sample represents a biased picture of entrepreneurship in Germany. Table 1 hence provides the distributions of firm size and industries in the original LIAB data and our selected sub-sample. The most striking difference between our sample and the representative LIAB data concerns the low share of small establishments. Because of the exclusion of establishments with less than 20 male or female full-time employees aged between 20 and 60 years, the share of workplaces with 20

to 49 employees is less than 1 percent. As a consequence, larger firms (with more than 100 employees) are rather overrepresented in our sample. This selection is not completely harmless with respect to the distribution of industries. While the manufacturing sector is more pronounced in our data, we are missing firms in the construction and firm-related service sectors as well as the trade and repair industry. Given that establishments in these sectors are generally not that big, this result is not really surprising. Summing up, our sample is biased towards bigger firms to some extent. Keeping these differences in mind, we argue that we can nonetheless derive interesting and new conclusion form our analyses.

Table 1: Firm size and industry distribution in the LIAB data and our sample (2001)

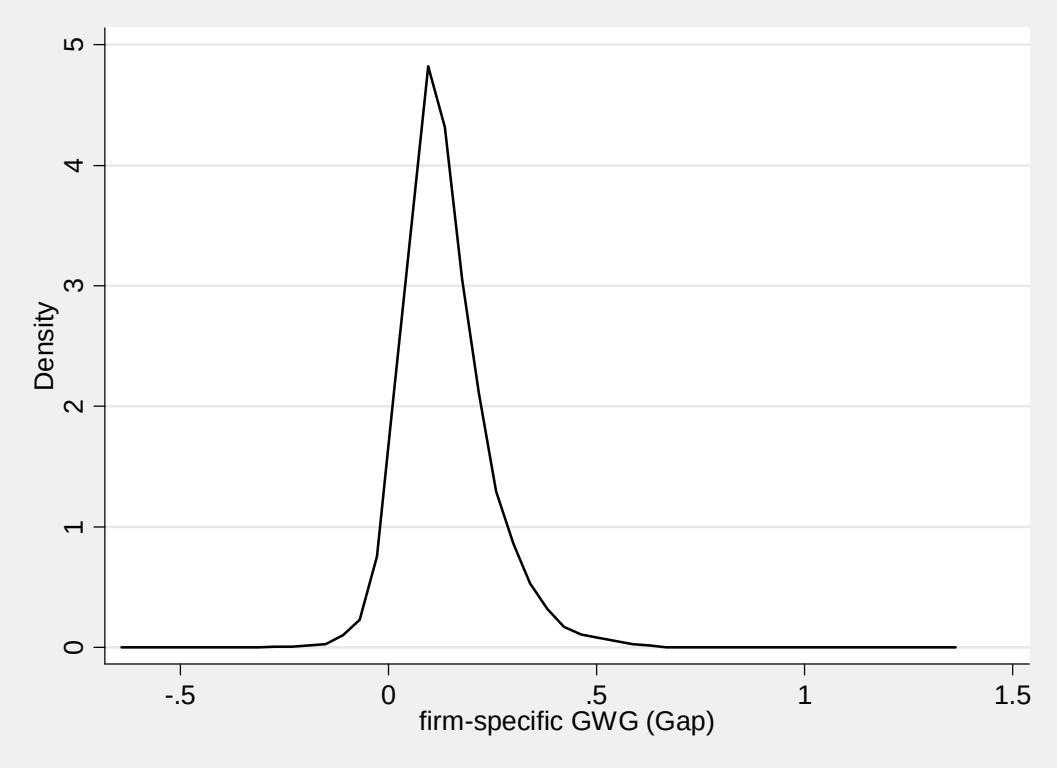
Firm size	Shares . . .		Industry	Shares . . .	
	in the LIAB	in our sample		in the LIAB	in our sample
20 – 49 employees	29.47	0.61	Farming, forestry and mining	2.59	2.15
50 – 99 empl.	20.01	7.03	Manufacturing	34.23	42.83
100 – 199 empl.	15.92	18.73	Construction	6.60	1.05
200 – 499 empl.	17.56	33.11	Trade and repair	13.4	9.25
500 – 999 empl.	9.45	21.79	Communication and information transmission	5.18	3.68
1000 – 4999 empl.	6.93	17.08	Credit and insurance industry	4.65	9.64
5000 – 9999 empl.	0.38	0.99	Firm-related services	10.90	7.49
> 10000 empl.	0.27	0.66	Other services	19.68	20.89
			Lobbies	2.75	2.62

Note: The sample includes all workplaces with 20 and more employees, which do not refer to the public sector (civil services, social security and defense). Our sample further excludes establishments whose full-time employees aged between 20 and 60 years are solely male or female.
Source: LIAB-Data 2001.

Before looking at the estimation results, we want to give more insight into the distribution of our dependent variable. Figure 1 shows the distribution of the calculated GWG in all firms of our sample. *Gap* has a mean of 0.14 and the standard deviation amounts to 0.16. Selected points of the distribution are presented in Table 2. Furthermore, this table contains the mean gap by year and the corresponding number of observations. While the observed GWG within firms decreases by about 1 percentage point between 1998 and 2003, the average wage differences between men and women calculated under the assumption that male employees had the same characteristics as female employees (*Gap*) remained rather constant over time. This implies that the share of "unexplained" pay gap increased over time.

The distribution of the adjusted GWG reveals that more than 5 % of the establishments exhibit negative gaps, implying that men with the same characteristics as women would earn lower wage rates.

Figure 1: Kernel estimation of the firm-specific GWG



Note: *Gap* describes the gender wage gap under the assumption that male employees had the same characteristics as female employees. This measure accommodates the censoring of our wage variable by applying Tobit estimates.
Source: own calculation; LIAB-Data 1998-2003

Table 2: Distribution and evolution of the firm-specific GWG

Percentil	Gap	Year	Mean(*Gap*)	Mean(Gap^{obs})	Mean(Gap^{obs} across firms)	Number of establishm.
5%	-0.0039	1998	0.1335	0.2209	0.2208	1278
10%	0.0216	1999	0.1329	0.2175	0.2207	1283
25%	0.0696	2000	0.1411	0.2205	0.2238	1850
50%	0.1219	2001	0.1381	0.2159	0.2152	2120
75%	0.1899	2002	0.1346	0.2144	0.2185	1951
95%	0.3263	2003	0.1348	0.2106	0.2280	2040
mean	0.1362					

Note: *Gap* describes the gender wage gap (in log wages) under the assumption that male employees had the same characteristics as female employees. The observed GWG describes the raw difference between male and female wages within firms.
Source: own calculation; LIAB-Data 1998-2003

Finally, we want to have a brief look into the nature of innovative firm policy by comparing firm characteristics of "adopters" and "non-adopters" of the human resource measures and firm characteristics presumably affecting the firm-specific GWG. Along the way, we expound the exact definition of our human resource variables. Table 3 reveals that almost 60% of the establishment in our sample enforced organisational changes until the year 2001.

The exact wording of the underlying question is: “Have there been one or more of the following organizational changes in your establishment during the last two years?” Possible answers are (among others): “Shift of responsibility and decisions to lower levels of hierarchy”, “Introduction of team work/self-responsible teams”, and “Introduction of units with own cost/result determination”. This question is asked in the years 2001, 2000, 1998 and 1995. Our indicator for the use of human resource practices fostering employee involvement is set to one if the establishment answered yes to one of the alternatives in the years 2001, 2000 or 1998. The resulting variable tells us if one of these measures has been introduced until the end of 2001. Establishments with and without movements towards participative organisation structures differ especially with respect to firm size (measured by the number of employees). Since adopting firms are about twice as large as establishments that did not adopt any of the selected human resource measures within our observation period, they pay higher wages and are more likely to have works councils and follow collective agreements. Finally, we can see that both the adjusted GWG – that is, the dependent variable in our empirical analysis – as well as the observed GWG is larger in non-adopting firms.

Incentive pay schemes are less prevalent than organisational changes in our sample. This information is based on questions in the years 1998, 2000, and 2001. In 2000 and 2001 the wording of the underlying question is: “Which additional financial incentives do you offer to employees in your establishment?” Possible answers are: “Profit sharing” and “Employee share ownership”. In 1998, the question is more general, that is we can not distinguish between profit sharing and employee share ownership. The amount of disbursed compensation is unfortunately not available. As we do not know the date when these measures were implemented, we derive our conclusions form differences between establishments that introduced these human resource practices until 2001 and those that did not. More than one third of the establishments in our data either provide profit sharing or employee share ownership programs. Again, adopters and non-adopters differ primarily in terms of firm size. Apart from that, the female share in establishments offering incentive pay systems is somewhat lower. Furthermore, the average wage rate as well as the technical state of the art is higher in adopting firms. Despite these diverse differences between adopters and non-adopters of performance related pay systems, it is interesting to note that the differences in the GWG are ignorable. This descriptive result leads one to suppose that performance related pay systems do not contribute to more gender equality.

Table 3: Firm characteristics of "adopters" and "non-adopters" of selected human resource measures in 2001

	OC		Incentive pay		Formation before 1990		Training		Equal opportunities [a]	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Share of firms	58.2	41.8	36.6	63.4	11.5	88.5	93.9	6.1	37.0	63.0
Share of women	0.40	0.45	0.37	0.46	0.37	0.43	0.42	0.43	0.45	0.40
Share of women with fix-term contracts	0.08	0.07	0.06	0.09	0.11	0.07	0.08	0.09	0.08	0.07
Firm size [b] (in 1000 empl.)	0.98	0.55	1.13	0.61	0.78	0.81	0.83	0.26	1.26	0.54
Working hours	37.4	37.9	37.3	37.8	37.7	37.6	37.6	37.8	37.6	37.6
Works council [c]	0.91	0.85	0.90	0.87	0.85	0.89	0.89	0.71	0.96	0.85
Coll. Agreement[c]	0.86	0.81	0.84	0.84	0.78	0.85	0.85	0.77	0.92	0.79
Wage rate	4.92	4.79	5.32	4.61	5.00	4.86	4.91	4.17	5.20	5.12
State of the art	2.91	2.95	3.01	2.88	2.97	2.92	2.94	2.77	2.95	2.91
Adjusted GWG	0.13	0.15	0.15	0.14	0.11	0.14	0.14	0.16	0.11	0.15
Observed GWG	0.20	0.23	0.22	0.22	0.18	0.22	0.22	0.22	0.20	0.22

Note: [a] The information on equal opportunity programs refer to the year 2002; [b] in 1000 employees; [c] in percent.
Source: LIAB-Data 2001 and 2002.

Whether an establishment is founded before or after 1990 can not be denoted as an adopted human resource measure in the strict sense, it may capture, however, important information on the corporate approach, firm philosophy and the management style. In our data, about 12 percent of all firms were founded after the German Unification. Not surprisingly, younger firms employ less staff than long-established firms. The difference is, however, not much pronounced. Nonetheless, firms founded after 1990 are less subject to collective agreements and are less likely to have works councils. A rather striking difference is that newly founded firms employ fewer women and pay higher wage rates. Furthermore, the share of fixed-term contracts among the female employees is about 3 percentage points higher. Given that between 1995 and 2002 more than half of the newly founded firms refer to consumption-related services this finding is even more surprising. Note, however, that the share of company formations in the knowledge-based service sector – which are paying relatively high wage rates – increased from 12% in 1995 to 15% in the year 2000 (Rammer 2004). Differences with respect to the average number of working hours and the state of the art are not very pronounced. Compared to the other human resource measures, the "impact" on the observed and adjusted GWG seems to be more important. For instance, the observed firm-specific GWG is about 4 percentage points larger in establishments founded before 1990.

The support for continuous training is very widespread among German workplaces. Almost 94 percent either directly pay for training or provide special (day-)releases from work. Differences between training and non-training firms are substantial, though. First of all, establishments offering opportunities to invest in their human capital are more than three time larger than the rest of our sample. Consequently, the share of firms covered by collective agreements or works councils is higher among training firms. Also differences with respect to the female share, the average wage rate and the state-of-the-art are more pronounced compared to the adopters and non-adopters of other human resource practices. Establishments with training activities employ more women, pay higher wage rates (presumably because they make their employees more productive) and are better technically equipped (which may require more training). Considering that the support of training activities is not correlated (much) with the observed and adjusted GWG, women do not seem to benefit notably from advanced continuous training.

Finally, we consider crucial characteristics of firms with agreements to foster equal opportunities of women and men. While the corresponding question in 2002 distinguishes between corporate agreements, commitments resulting from collective agreements and purely voluntary arrangements, the questionnaire for 1998 only includes a general question on equal opportunity agreements. Comparable information of the other years is missing. In 2002, about 37 percent of all establishments in our sample report that they are subject to any type of equal opportunity agreement. Four years before, the corresponding share amounts to 24 percent only. In accordance with all other human resource measures, adopting firms employ more workers and hence the share of establishments with works councils or collective agreements is higher. Also not surprisingly, the female share is much higher in workplaces looking at equal opportunities. This result is consistent with the idea that either women select into firms that provide the best conditions to realize their career plans or establishments employing many women are more likely to be open-minded about equal opportunity programs. The number of working hours, the average wage rate as well as the technical state of the art does not really vary among adopters and non-adopters in this case. The difference with respect to the observed and adjusted GWG implies that firms whose firm policy includes measures to equalize the career opportunities of men and women actually exhibit smaller GWGs. All in all, we conclude that workplaces adopting specific human resource measures also tend to be “different” in many other respects. Final conclusions on the effect of selected characteristics of human resource policy can hence only be derived

from multivariate analysis. In the following, we will present the results of our two-step estimation model.

6. Estimation results

6.1 First estimation step: wage regression

To calculate the within-firm GWG under the assumption that male employees had the same characteristics as female employees within each firm, we first have to determine wage estimates for all establishments in our sample. For firms with at least 100 full-time male employees, we estimate 2200 wage equations with a Tobit model in order to account for the censoring. The estimated firm-specific wage coefficients are used to determine our dependent variable according to equation (1). We do not apply this estimation strategy to firms with fewer employees, because the within-firm estimation would yield no reliable results. In this case, we estimate a pooled wage equation across all firms. Our wage equation is a Mincer-type specification, thus we suppose that the individual wage rate is determined by age, age squared, job tenure and the education level. Year dummies are added in all wage equations.

Table 4: Coefficients of the wage estimations in a Tobit model (firms ≥ 100 male full-time employees)

Coefficients	No. of Obs.	Mean of the coeff.	Mean of the t-value	Share of significant coeff.	Standard deviation of coeff.	Quotient (5)/(2)
	(1)	(2)	(3)	(4)	(5)	
Age	2,200	0.0427	6.84	0.86	0.0293	0.69
$(Age)^2/100$	2,200	-0.0004	-5.81	0.81	0.0003	-0.76
Job tenure (in days)	2,200	0.1054	6.57	0.81	0.1977	1.88
Low education without vocational training	1,437	-0.4003	-9.97	0.88	0.2218	-0.55
Vocational training	2,161	-0.0938	-3.10	0.77	0.2620	-2.79
Secondary school (with and without vocational training)	1,163	0.0912	1.86	0.75	0.3187	3.50
College of higher education or university	1,605	0.3595	9.68	0.85	0.2467	0.69

Note: Coefficients result from wage regressions in firms with at least 100 male full-time employees and 20 full-time female employees. The first column contains the number of different estimated coefficients. The next two columns present the means of the estimated coefficients and t-values. The 4th column shows the share of estimated coefficients which are significant at the 5%-level. The 5th column contains the standard deviation of the estimated coefficients from the mean coefficient of all firms. The last column includes a quotient between the mean of the coefficients and the corresponding standard deviation as absolute values.
Source: own calculation; LIAB-Data 1998-2003.

Since the estimated coefficients from the 2576 large firms can not be displayed in detail, we present a summary of the firm-specific estimation results in larger firms in Table 4.

Column 1 describes the number of estimated coefficients for each characteristic. Note that some characteristics are missing in some firms, such that specific coefficients can not be determined in every firm. The second column presents the mean of the estimated coefficients of the firm-specific wage estimations and column 3 shows the corresponding mean of the estimated t-values. Note that the table contains coefficients for all possible education levels because the left-out category differs from firm to firm. 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. In order to receive 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%-level. We can see that about 75 to 90 percent of the estimated coefficients are statistically different from zero. Furthermore, the table includes the mean standard deviation of the estimated coefficients to illustrate the heterogeneity of the wage regressions across firms (see column 5). The last column includes a quotient of the standard deviation of the coefficients and the absolute value of the corresponding means. Hence, this figure illustrates the standardized variation of coefficients across the firms. 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 firms. Small values are signaling moderate heterogeneity of wage returns to the corresponding characteristics. The results in Table 4 point out, for example, that the remuneration of job tenure varies much more across firms than the coefficients for age. In consideration of the varying coefficients, the wage estimation in each firm seems to be advantageously to determine the correct remuneration of the characteristics.

Table 5: Coefficients of the pooled wage estimations in a Tobit model (firms with 20 to 99 full-time male employees)

	Coefficients	Standard deviation of coefficients	t-value
Age	0.0599	0.0006	106.3600
Age2/100	-0.0006	0.0000	-90.9500
Job tenure (in days)	0.0701	0.0008	83.4300
Low education without vocational training	-0.3254	0.0023	-143.4100
Vocational training (reference group)	-	-	-
Secondary school (with and without vocational training)	0.1701	0.0026	64.9200
College of higher education or university	0.4335	0.0021	210.6200
No. of observations		187,920	
Log likelihood		-54,546.86	

Note: The regression includes male employees from firms with 20 to 99 male full-time employees and more than 20 female full-time employees.
Source: own calculation; LIAB-Data 1998-2003.

6.2 Second estimation step: explaining the firm-specific gender wage gap

Once the firm-specific GWG is calculated based on the wage estimates presented above, we can assess the effect of personnel policy and other firm characteristics on the within wage differences between male and female employees. In the second estimation step, we therefore regress selected firm-level and industry-level variables on the adjusted firm-specific wage gaps. Since the variance of the calculated gender wage gap varies by firm size per definition, we calculate robust standard errors accommodating heteroscedasty in the dependent variable.

Table 6 presents the estimation results of three alternative specifications of the random effects model. Model 1 represents the baseline model including the central information on the actual personnel policy, that is, organisational change, incentive pay, continuous training and the period of foundation. Since the number of average contracted full-time working hours within each establishment – which turns out to be an important determinant of the GWG – is not available in 2003, we extrapolate the working hours from 2002 to the subsequent year. Model 2 further exploits the available information on corporate training activities. Note, however, that the corresponding questions are missing in the years 1998, 2000 and 2002 such that the number of observations is significantly lower in this specification. To use as much information as possible, we decide to estimate this model for the years 1999, 2001 and 2003 and extrapolate the working hours from 2002 to the

subsequent year.[12] In order to measure the effect of equal opportunity programs, we specify a model including the corresponding information for 1998 and 2002. As a result, we need to skip the training variables (Model 3). Accordingly, the number of observations is lowest in Model 3 (2388 establishments) and highest in Model 1 (4898 establishments).

Table 6: Estimation results

	Model 1		Model 2		Model 3	
Variables	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
Constant	0.1035	2.23	0.0778	1.55	-0.0732	-1.04
Employees (in 1000)	-0.0114	-8.03	-0.0134	-6.59	-0.0093	-5.26
Employees^2 (in 1000)	0.0003	4.67	0.0004	3.23	0.0002	4.67
Share of women	0.0191	2.11	0.0353	3.06	0.0436	3.13
Share of women with fix-term contracts	-0.0189	-1.72	-0.0193	-1.24	-0.0213	-1.06
Working hours	0.0021	1.72	0.0028	2.13	0.0078	4.28
State of the art	0.0019	1.39	0.0033	1.73	0.0035	1.42
Investment in information and communication technology	0.0018	0.78	0.0000	-0.01	0.0064	1.47
Works council	-0.0274	-3.99	-0.0284	-3.53	-0.0381	-3.97
Collective agreement	-0.0069	-1.73	-0.013	-2.61	-0.0153	-2.2
Average wage rate	0.0012	1.54	0.0017	1.64	-0.0027	-2.96
Wage rate > collective agreement	0.0093	3.70	0.0168	4.97	0.0097	2.18
Founded after 1990	-0.0095	-1.35	-0.014	-1.64	-0.0217	-3.16
Organisational change	-0.0100	-3.46	-0.011	-2.98	-0.0081	-2.09
Incentive pay	0.0017	0.78	0.0009	0.26	0.0057	1.55
Continuous training	-0.0099	-2.38	-0.0079	-1.25	-	-
Share of training participants	-	-	-0.0058	-1.79		
Female share of all training participants	-	-	-0.016	-2.1	-	-
Equal opportunities	-	-	-	-	-0.0041	-1.25
No. of observations	4,898		3,298		2,388	
No. of groups	2,315		2,116		1,901	
Wald Test	328.65		342.3		391.74	
Roh	0.8621		0.8432		0.8414	

Note: Model 1 is estimated with a sample covering the years 1999 to 2001 and 2003. Model 2 is based on observations from 1999, 2001 and 2003. Model 3 includes the years 1998 and 2002 only. All models also include control variables for the year, the region and the industry sector.

Consistent with our theoretical arguments, organisational changes fostering the participation of employees limit the wage differences between men and women within the same establishment in all three models. This negative and significant effect may be driven by the fact that women benefit more from formalized opportunities to take part in decision-making

[12] Alternative specifications with respect to the working hour variable are presented in Table A4 in the appendix.

and the change towards more integrated tasks.[13] These findings contrast with the evidence for Denmark, where the use of new work practices tends to widen the pay gap between men and women (Datta Gupta and Eriksson 2006). They argue that women may have a stronger preference for less hierarchical work organizations allowing for more collaboration than men, such that the negative effect on female wages can be interpreted as a compensating wage differential. Also in Canada, men seem to benefit more from self-directed work-groups than women (Drolet 2002).

In contrast, incentive pay schemes do not seem to prevent wage differences between women and men. This result may have different explanations. If, for example, the amount of performance-related bonus depends on the base salary, the pay gap between men and women would not shrink, even if the bonus is strictly linked to actual productivity. Second, the crowding out of voluntary co-operation and intrinsic motivation of performance related pay systems found in some empirical analysis may be more relevant for women. Third, it is predominantly men who select into firms offering extensive performance pay schemes (see e.g. Drolet 2002 for Canada or Jirjahn and Stephan 2004 for Germany). Experiments show that this seems to be also true if women earned more money under the performance related pay scheme (Niederle and Vesterlund 2005). Finally, it may be argued that women's contribution to the output is more difficult to measure, because their comparative advantages are typically in the field of communication, coordination and team-playing – all abilities which are not easy to evaluate and whose impact on firm performance in unclear. In that case, incentive systems based on a set of objective measures fail to reward "invisible" performance and hence do not help to reduce the inequality between men and women.[14]

Our baseline model further indicates that firms offering continuous training programs exhibit lower GWGs. This result leads one to suppose that the offered training programs are aligned with the organisational and professional requirements of women. Model 2 is augmented by further information on the training activities. Both the share of training participants in all employees as well as the female share among training participants further reduces the wage difference between men and women within the same firm. A Wald-test on the joint significances of all training variables amounts to $\chi^2 = 16.56$, which is highly significant. We hence conclude that part of the adjusted GWG is still caused by differences in job-related

[13] We also created an alternative measure of organizational change which cumulates all organizational changes aiming to foster the participation of employees. As a result, this variable exhibits a higher variance and contains more information on the firms' history. Using this variable in Model 1 to 3 (see Table A6 in the appendix) results in almost the same effects of organizational change on the GWG.

[14] Excluding the insignificant incentive pay variable does not change the effects of the other firm characteristics on the GWG (see Table A5 in the appendix).

human capital. Presumably, these differences are triggered by the fact that women stay less time within the same firm and provide a higher probability of job changes.

The effect of equal opportunity programs is consistent with our expectations, but the variance of the effect is rather large (see Model 3). This constricted effect of agreements to foster gender equality is consistent with the notion that some firms implement specific human resource measures in the firm philosophy – partly driven by peer-group pressure or for the sake of publicity – the everyday life of the establishment, however, is not affected by these principles.

Given that our information on the corporate culture and the personnel policy is fragmented and therefore imperfect, we further add a dummy variable that indicates whether the establishment was founded before or after 1990 capturing the social norms and trends during the foundation period. We can show that establishments founded before 1990 differentiate much more between men and women than younger firms. This result may imply that the perception and situation of women in the society – which changed towards a more egalitarian role association of men and women – affects the collaboration and division of labor within firms. Note, however, that this effect is not significant at the 5%-level in Model 1 and 2.

Apart from these variables describing the firm-specific personnel policy, we add a set of firm characteristics to control for heterogeneity. Our results indicate that bigger firms – measured by the number of employees – tend to pay relatively higher wage rates to women compared to men. However, the positive coefficient of the quadratic term points to the fact that the negative impact of the number of employees decreases at a certain firm size.[15] This finding is consistent with the hypothesis that large firms are more in the focus of the public and hence evoke much civil commotion by discretionary decisions to the disadvantage of women. Alternatively it may be argued that male and female employees in large firms are more likely to work in comparable job positions (unless jobs are not fully segregated) which limits the potential of discrimination (see also Heinze and Wolf 2006).

Firms with a high share of female employees exhibit higher GWGs than less segregated organizations. These results are not surprising and in line with the comprehensive literature on the wage effects of segregation within firms (see e.g. Jurajda 2005, Allmendinger und Podsiadlowski 2001). The share of female employees with limited contracts tends to reduce the earnings differential between men and women. The effect is statistically not significant,

[15] The point of inflection differs by model specification and varies between 16,750 and 23,250 employees.

though. It is interesting to note that establishments with longer contractual weekly working hours are more prone to wage differences between male and female employees. Given that we also control for industry sectors, collective agreements and firm size, this effect can not only be driven by differences in the industrial relations and the occupational structure. We, therefore, argue that longer working hours may be interpreted as an indicator for a human resource policy aligned with the time schedule of traditional bread-winners, that is, men. Hence, firms whose work time policy is geared to the employment behaviour of male employees – which are more likely to shift child care responsibilities to their wives or partners and accept longer weekly working hours – distinguish more between men and women.[16]

Since in Germany, the wage setting process is not just the result of free negotiations between the individual and its employer, we also control for the way how the right of co-determination is implemented and put into practice and whether firms are subject to collective wage agreements or not. In accordance with earlier studies, our results indicate that both works councils and collective agreements are in favor of women's relative wages (Gartner and Stephan 2004, Achatz, Gartner and Glück 2005, Heinze and Wolf 2006, Addison, Teixeira and Zwick 2006). The negative union effect may be explained by the reduced wage dispersion among employees covered by the same collective bargaining agreement (see e.g. Freeman and Medoff 1984, Fitzenberger and Kohn 2005) and the reduced arbitrariness in the wage setting process (Elvira and Saporta 2001). Also international evidence hint at limited wage dispersion in those countries with centralized collective bargaining, which is – to a great part – caused by a more compressed inter-firm wage dispersion (Blau and Kahn 1999, 2000 and 2003). The impact of works councils seems to be much more important, though. Works councils in German firms provide an extensive framework for establishment-level negotiations on wages, working hours and other working conditions and thus play an important role in the wage setting process. Their implementation is formally designated by law, but depends upon the activity of the employees. According to Baron (1984), work councils often act as *equalizing agents* by looking at the compliance of corporate or legal principals claiming equal opportunity and avoiding discrimination. Accepting the hypothesis that employees' representations follow up the aim of reducing inequality among employees within firms, this finding is not surprising.

[16] To check whether this result is driven by the imputation of working hours in 2003, we run Model 1 and Model 2 based on original working hours only. As can be seen in Table A4 in the appendix, the alternative specification yields almost the same results.

High wage level per se does not necessarily imply that the within GWG is small. In contrast, the positive coefficients of the wage bill per employee in Model 1 and 2 exposes that the GWG is larger in high wage firms, which is consistent with 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 firms. Given that this effect is not significant at the 5%-significance level and even reverses in Model 3, we should be reluctant to jump to conclusions. The positive and significant coefficient of the dummy variable indicating that wage rates may exceed collective agreements corroborates our supposition that women benefit less from high intra-firm wage levels.

Finally, we control for differences with respect to the technical state-of-the-art and past investments in information and communication technologies supposing that well equipped establishments are more likely to implement innovative work practices which make their investment even more productive. It may be argued, for instance, that in the course of technological changes, the traditional division of labor must be revised and may become obsolete. Hence, the chance of a more egalitarian collaboration among men and women increases. Another argument for including these variables is that the corporate training activities are likely to correlate with technological innovations and changes (due to human capital obsolescence) and thus tend to be biased (see e.g. Hempell 2003). The empirical result is, however, not in line with this train of thoughts. The effect of the technical equipment on the firm-specific GWG is positive and insignificant and investments in information and communication technologies do not affect the firm-specific gender wage gap at all.

7. Summary and discussion

The „unexplained“ part of the GWG varies between 40 and 50 percent of the total wage gap and is often interpreted as discrimination. According to Becker (1957), the disparate remuneration of men and women is driven by an inherent taste for discrimination by employers. We argue that specific features of personnel policy and workplace organization limit the arbitrariness of managers and increase the barriers to treat men and women differently. As a result, innovative workplace practices may help to reduce the GWG within establishments.

In this paper, we hence explore the relationship between the firm-specific design of work and decision processes, pay systems, internal qualification activities and the firm’s attitude

towards gender equality. Based on the German LIAB data, a representative linked employer-employee panel including information on all employees of firms covered by the IAB establishment survey, we provide the first approach to assess the impact of selected variables describing personnel policy on the level of establishments on the GWG in Germany. Our empirical approach is based on the *within-firm* gender wage differentials. Given that the distribution of women among firms is not random, results and interpretation of our approach may differ from traditional analyzes looking at overall wage differentials only.

Consistent with the theoretical arguments, our empirical results indicate that organisational changes fostering the participation of employees limit the wage differences between men and women within the same establishments. This effect can, for instance, be explained by the institutional speaking tube which helps women to play an active part in decision-making and reveal their competences. Apart from other interpretations, it may be argued that team work is likely to limit the potential of continuous unequal treatment of men and women.

Our results further indicate that continuous training programs reduce the within-firm GWG. Both the share of training participants in all employees as well as the female share among training participants further reduces the wage difference between men and women. We hence conclude that training helps to balance existing gender differences in job-related human capital. Also equal opportunity programs tend to reduce the pay differential, albeit the effect is not statistically significant. Note, however, that pay equality is not the ultimate ambition of these agreements. A judgement on the overall utility of these efforts to improve gender equality within firms would thus be premature, because our results just refer to the effect on the GWG.

Interpreting the results, we should keep in mind that we can not absolutely rule out that the adoption of employee involvement, training or equal opportunity programs is correlated with unobserved characteristics which are positively correlated with both, small intra-firm gender GWGs and the use of innovative human resource practices. According to the standard of knowledge, organizational change is mainly driven by technological changes and productivity shocks and not for gender equality reasons. We therefore argue that the potential bias in our results may be ignored.

Performance depending pay systems do not involve lower gender wage gaps within firms. This result is consistent with the hypothesis that the crowding out of voluntary co-operation and intrinsic motivation by performance related pay systems is more relevant for women. Furthermore, the share of women affected by extensive performance pay schemes is rather

small. Finally, performance related bonuses may in practice relate to the base salary. As a consequence, the incentive pay system manifests the original pay gap.

Based on our information about firm age, we find some evidence for the hypothesis that the in-plant culture is affected by the increasing awareness of gender inequality in the society. In all estimation specifications, firms founded after 1990 tend to exhibit lower gender wage gaps than older establishments. That is, managers and supervisors are no isolated individuals who act detached from their social environment, but are influenced by social norms and trends (see e.g. Baron 1984; Acker 1990, 1992).

We hence conclude that the reorganization of work within German establishments, appearing in team work, worker participation in decision-making and continuously training helps to limit the arbitrariness with regard to wages. Nonetheless, the use of these practices does not guarantee equal treatment of men and women. Especially training programs, if aligned with the typical time schedule and employment career of men, involve some risk to manifest the traditional gender disparity with respect to wages. But also the implementation of measures to foster employee involvement should be guided by a gender mainstreaming concept to ensure that both men and women benefit from these expensive organizational changes.

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Appendix

Table A1: Summary statistic of individual characteristics for the firm-specific wage regressions (pooled over 1998-2003)

Variables	Men		Women	
	Mean	Std. Dev.	Mean	Std. Dev.
Daily wage rate (in log)	4.67	0.25	4.50	0.29
Low education without vocational training	0.11	0.31	0.16	0.37
Vocational training	0.67	0.47	0.62	0.49
Secondary school (with and without vocational training)	0.06	0.23	0.12	0.33
College of higher education or university	0.16	0.37	0.10	0.30
Age (in years)	40.97	9.35	38.44	10.08
Job tenure (in days/1000)	1.52	1.01	1.27	0.96
Share of censored wage rates	0.18	0.39	0.06	0.24
Observations	3796630		1185802	

Note: The results refer to firms with at least 100 male full-time and 20 female full-time employees.
Source: own calculation; LIAB-Data 1998-2003.

Table A2: Summary statistic of individual characteristics for the pooled wage regression (pooled over 1998-2003)

Variables	Men		Women	
	Mean	Std. Dev.	Mean	Std. Dev.
Daily wage rate (in log)	4.55	0.34	4.33	0.32
Low education without vocational training	0.10	0.30	0.15	0.36
Vocational training	0.65	0.48	0.70	0.46
Secondary school (with and without vocational training)	0.08	0.27	0.08	0.26
College of higher education or university	0.17	0.37	0.07	0.26
Age (in years)	41.28	9.68	39.22	10.42
Job tenure (in days/1000)	1.17	0.96	1.12	0.92
Share of censored wage rates	0.15	0.35	0.02	0.16
Observations	187920		214362	

Note: The results refer to firms with 20-99 male full-time and more than 20 female full-time employees.
Source: own calculation; LIAB-Data 1998-2003.

Table A3: Summary statistic of firm characteristics (pooled over 1998-2003)

Variables	Model 1		Model 2		Model 3	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Number of Employees (in 1000)	0.858	1.86	0.773	1.57	0.909	1.94
Share of women	0.417	0.24	0.422	0.24	0.412	0.24
Share of women with fix-term contracts	0.074	0.12	0.073	0.12	0.067	0.11
Working hours (with imputation)	37.541	1.68	37.582	1.65	37.467	1.68
Working hours (without imputation)	37.521	1.71	37.560	1.69	37.467	1.68
State of the art	2.939	0.71	2.936	0.71	2.932	0.71
Investment in information and communication technology	0.848	0.36	0.841	0.37	0.812	0.39
Works council	0.907	0.29	0.907	0.29	0.910	0.29
Collective agreement	0.863	0.34	0.862	0.34	0.887	0.32
Average wage rate	4.905	1.62	4.873	1.60	5.001	2.00
Wage rate > collective agreement	0.531	0.50	0.516	0.50	0.539	0.50
Founded after 1990	0.093	0.29	0.091	0.29	0.096	0.29
Organisational change	0.600	0.49	0.601	0.49	0.592	0.49
Incentive pay	0.311	0.46	0.317	0.47	0.328	0.47
Continuous training	0.945	0.23	0.947	0.22	-	-
Share of training participants	-	-	0.278	0.35	-	-
Female share of all training participants	-	-	0.388	0.27	-	-
Equal opportunities	-	-	-	-	0.299	0.46
Year						
Year dummy 1998	0	0	0	0	0.442	0.50
Year dummy 1999	0.178	0.38	0.240	0.43	0	0
Year dummy 2000	0.278	0.45	0	0	0	0
Year dummy 2001	0.346	0.48	0.491	0.50	0	0
Year dummy 2002	0	0	0	0	0.558	0.50
Year dummy 2003	0.197	0.40	0.269	0.44	0	0
Instustry sectors						
Agriculture and forestry; electricity, gas and water supply, mining	0.021	0.14	0.019	0.14	0.028	0.17
Manufacturing I	0.112	0.32	0.097	0.30	0.144	0.35
Manufacturing II	0.253	0.43	0.230	0.42	0.322	0.47
Construction	0.009	0.09	0.009	0.09	0.011	0.10
Wholesale and retail trade	0.068	0.25	0.065	0.25	0.085	0.28
Transport and communication	0.028	0.16	0.025	0.16	0.030	0.17
Financial intermediation	0.078	0.27	0.070	0.26	0.102	0.30
Real state, renting and business activities	0.042	0.20	0.040	0.20	0.047	0.21
Education	0.025	0.16	0.023	0.15	0.034	0.18
Other service activities	0.169	0.37	0.153	0.36	0.199	0.40
Regions						
Berlin-West	0.059	0.24	0.062	0.24	0.064	0.24
Schleswig Holstein	0.020	0.14	0.019	0.14	0.022	0.15
Hamburg	0.059	0.24	0.053	0.22	0.042	0.20
Niedersachsen	0.106	0.31	0.106	0.31	0.098	0.30

Table A3: continued

Bremen	0.026	0.16	0.026	0.16	0.025	0.16
North Rhine-Westphalia	0.232	0.42	0.221	0.41	0.238	0.43
Hesse	0.102	0.30	0.117	0.32	0.119	0.32
Rhineland-Palatinate	0.068	0.25	0.066	0.25	0.067	0.25
Baden-Wuerttemberg	0.147	0.35	0.144	0.35	0.145	0.35
Bavaria	0.156	0.36	0.159	0.37	0.162	0.37
Saarland	0.024	0.15	0.027	0.16	0.019	0.14
Observations	4898		3298		2388	

Note: The results refer to firms with at least 20 male full-time and 20 female full-time employees.
Source: own calculation; LIAB-Data 1998-2003

Table A4: Robustness checks 1: Estimation results without imputation of working hours

	Model 1a		Model 2a	
Variables	Coeff.	z-value	Coeff.	z-value
Constant	-0.0573	-0.96	-0.0691	-1.08
Employees (in 1000)	-0.0111	-6.90	-0.0109	-5.10
Employees^2 (in 1000)	0.0003	4.77	0.0003	3.04
Share of women	0.0492	4.15	0.0735	4.81
Share of women with fix-term contracts	-0.0134	-1.13	-0.0258	-1.37
Working hours	0.0069	4.37	0.0071	4.28
State of the art	0.0027	1.82	0.0040	1.67
Investment in information and communication technology	0.0018	0.74	0.0022	0.50
Works council	-0.0360	-4.63	-0.0434	-4.45
Collective agreement	-0.0052	-1.23	-0.0082	-1.30
Average wage rate	0.0013	1.49	0.0016	1.14
Wage rate > collective agreement	0.0051	1.79	0.0142	3.03
Founded after 1990	-0.0092	-1.22	-0.0138	-1.51
Organisational change	-0.0090	-3.21	-0.0081	-2.14
Incentive pay	-0.0011	-0.49	-0.0069	-1.76
Continuous training	-0.0073	-1.55	-0.0069	-0.81
Share of training participants	-	-	-0.0042	-0.93
Female share of all training participants	-	-	-0.0155	-1.38
No. of observations	3,993		2,411	
No. of groups	2,146		1,925	
Wald Test	427.6		416.5	
Roh	0.8830		0.8410	

Note: Model 1a and Model 2a uses only the original information on working hours and is hence not based on observations from the year 2003. All models also include control variables for the year, the region and the industry sector.

Table A5: Robustness checks 2: Estimation results with alternative information on workplace practices: without incentive pay

	Model 1b		Model 2b		Model 3b	
Variables	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
Constant	0.1028	2.24	0.7437	1.49	-0.0789	-1.13
Employees (in 1000)	-0.0104	-7.12	-0.0131	-6.55	-0.0091	-5.30
Employees^2 (in 1000)	0.0002	4.34	0.0003	3.22	0.0002	4.73
Share of women	0.0200	2.24	0.0374	3.29	0.0464	3.38
Share of women with fix-term contracts	-0.0188	-1.73	-0.0212	-1.37	-0.0191	-0.99
Working hours	0.0021	1.78	0.0029	2.23	0.0078	4.35
State of the art	0.0019	1.41	0.0033	1.77	0.0037	1.55
Investment in information and communication technology	0.0016	0.71	-0.0002	-0.06	0.0051	1.21
Works council	-0.0276	-4.04	-0.0290	-3.63	-0.0348	-3.75
Collective agreement	-0.0073	-1.88	-0.0141	-2.88	-0.0157	-2.33
Average wage rate	0.0011	1.53	0.0016	1.60	-0.0024	-2.78
Wage rate > collective agreement	0.0096	3.85	0.0170	5.10	0.0102	2.37
Founded after 1990	-0.0101	-1.44	-0.0154	-1.85	-0.0206	-3.17
Organisational change	-0.0097	-3.39	-0.0104	-2.88	-0.0074	-1.95
Continuous training	-0.0103	-2.55	-0.0072	-1.17	-	-
Share of training participants	-	-	-0.0057	-1.78	-	-
Female share of all training participants	-	-	-0.0165	-2.21	-	-
Equal opportunities	-	-	-	-	-0.0037	-1.15
No. of observations	4,982		3,373		2,479	
No. of groups	2,353		2,170		1,959	
Wald Test	323.71		353.24		403.96	
Roh	0.8623		0.8423		0.8435	

Note: Model 1 is estimated with a sample covering the years 1999 to 2001 and 2003. Model 2 is based on observations from 1999, 2001 and 2003. Model 3 includes the years 1998 and 2002 only. The number of observation is slighlty higher compared to the results presented in Tabel 6 because of missing values of the incentive pay variable. All models also include control variables for the year, the region and the industry sector.

Table A6: Robustness checks 3: Estimation results with alternative information on workplace practices: with an accumulated measure on workplace practices, without incentive pay.

	Model 1c		Model 2c		Model 3c	
Variables	Coeff.	z-value	Coeff.	z-value	Coeff.	z-value
Constant	0.0815	1.60	0.0610	1.12	-0.1055	-1.39
Employees (in 1000)	-0.0100	-6.57	-0.0119	-6.53	-0.0093	-4.65
Employees^2 (in 1000)	0.0002	4.34	0.0003	3.77	0.0003	3.21
Share of women	0.0189	1.87	0.0345	2.8	0.0442	2.99
Share of women with fix-term contracts	-0.0162	-1.33	-0.0114	-0.67	-0.0119	-0.59
Working hours	0.0028	2.08	0.0033	2.3	0.0083	4.22
State of the art	0.0007	0.49	0.0024	1.17	0.0036	1.45
Investment in information and communication technology	0.0021	0.88	-0.0012	-0.35	0.0056	1.26
Works council	-0.0274	-3.54	-0.0286	-3.2	-0.0282	-2.86
Collective agreement	-0.0077	-1.81	-0.0141	-2.71	-0.0145	-2.03
Average wage rate	0.0011	1.25	0.0016	1.48	-0.0025	-2.81
Wage rate > collective agreement	0.0085	3.17	0.0148	4.15	0.0110	2.44
Founded after 1990	-0.0069	-0.87	-0.0127	-1.33	-0.0167	-2.36
Organisational change	-0.0038	-3.74	-0.0044	-3.67	-0.0046	-3.32
Continuous training	-0.0128	-2.97	-0.0105	-1.6	-	-
Share of training participants	-	-	-0.0048	-1.43	-	-
Female share of all training participants	-	-	-0.0128	-1.57	-	-
Equal opportunities	-	-	-	-	-0.0035	-1.06
No. of observations	4,138		2,839		2,207	
No. of groups	1,908		1,772		1,689	
Wald Test	287.82		316.21		353.32	
Roh	0.8670		0.8438		0.8447	

Note: Model 1 is estimated with a sample covering the years 1999 to 2001 and 2003. Model 2 is based on observations from 1999, 2001 and 2003. Model 3 includes the years 1998 and 2002 only. All models also include control variables for the year, the region and the industry sector.