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Abstract: Performance pay is of growing importance to the wage structure as it applies to a rising share of employees. At the same time wage dispersion is growing continuously. This leads to the question of how the growing use of performance pay schemes is related to the increase in wage inequality? German SOEP data for the years 1984 to 2009 confirm the large increase in the application of performance pay schemes. This in turn led to an upward shift of the wage distribution by about one log point. However, it did not contribute to the growth in wage inequality. Even though wage inequality grew within the group of employees who receive performance pay, it grew even more so within the group who do not receive it. Still, the wage difference between both wage schemes remained flat over the distribution. The empirical analysis employs sequential decompositions in a quantile regression framework.

Keywords: Performance Pay, Wage Structure, Quantile Regression, Sequential Decomposition
JEL-Classification: J31, J33, C21

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1 Introduction

Performance pay is of growing importance to the wage structure as it applies to a rising share of employees. This trend has been observed in several industrialized countries over the past decades (Lemieux et al., 2009). A parallel trend has been that of growing wage inequality (Autor et al., 2008). This prompts the following research question: How is the rise in wage inequality related to the growing use of performance pay schemes?

Performance pay has been found to contribute strongly to growing wage inequality in the US mainly in the top of the wage distribution (Lemieux et al., 2009; Heywood and Parent, 2009). Lemieux et al. (2009) quantify this effect to amount to 25% of the growth in wage dispersion between the late 1970s and the early 1980s. For Germany, this relation has not been studied yet. The case of Germany is interesting because its wage structure follows the international trends in growing wage dispersion (Dustmann et al., 2009) and the increasing use of performance pay schemes (Pannenberg and Spiess, 2009). At the same time, the labor market has experienced dramatic shifts from strong rigidity to more flexibility (Fitzenberger et al., 2011). These shifts rendered "Germany's jobs miracle" (Krugman, 2009) possible, that took place on the German labor market during the Great Recession (Möller, 2010). Still, the dramatic growth in wage inequality in Germany remains in parts unresolved. Several explanations are possible, one of which is skill-biased technological change (Katz and Autor, 1999; Autor et al., 2003). However, Antonczyk et al. (2009) find that changes in the tasks cannot explain the growing wage dispersion in Germany. Deunionization can explain only a small part of it (Antonczyk et al., 2010) while differences between industries and establishments play a large role (ibid., Card et al., 2012). Can performance pay provide the missing explanation for rising wage inequality?

The growing trend in the incidence of pay for performance is documented for several countries (Lemieux et al., 2009; Pannenberg and Spiess, 2009; Booth and Frank, 1999). Still, Brown and Heywood (2002b) conclude that there is no general trend towards more performance pay. Nevertheless, the end of the last century has been a time for large experiments (ibid.), which makes it interesting to study the growing use of performance pay schemes. Why should the incidence increase at all? Generally speaking, there is a growing heterogeneity of firms which goes hand in hand with a growing need for flexibility on the firm level (Card et al., 2012; Fitzenberger et al., 2011). This trend could for example be driven by trade globalization or skill-biased technological change (SBTC). Moreover SBTC, which changes the relative demand for skilled labor, translates into changed relative returns to skills (Katz and Autor, 1999; Katz and Murphy, 1992; Juhn et al., 1993). Lemieux et al. (2009) argue that in this context, pay for performance could serve as the channel by which changed returns to skills are converted into actual wage changes and therefore be growing (also see Heywood and Parent, 2009).[1]

Performance pay schemes could affect wages through different channels (see, e.g., Heywood and Parent, 2009; Brown and Heywood, 2002a). Above all, it is expected to induce higher effort which would in turn generate higher wages (Dohmen and Falk, 2011; Lazear, 2000; Booth and Frank, 1999). At the same time, performance pay leads to sorting of workers: As employees learn about their own productivity and about their willingness to provide effort, they sort into the preferred pay scheme (Lazear, 1986, 2000). Moreover, wage insecurity is higher in variable pay schemes, which could be compensated by higher wages (Seiler, 1984; Amuedo-Dorantes and Mach, 2003).

In addition to the level effect, performance pay is expected to go along with rising wage inequality. By definition, wages vary more on the individual level in a variable pay scheme than in a fixed wage, because productivity or performance vary more than the determinants of a fixed wage, such as education and tenure. In contrast, the performance depends on many more factors like ability, career-orientation, or health which generate higher vari-

[1] An alternative explanation for the growing use of performance pay is given by Lemieux et al. (2009) according to which monitoring costs decreased due to technological progress. Thus more employers now find it profitable to pay wages according to workers' performance. In theory, this could explain why the use of performance pay schemes is growing. However, they conclude from their empirical analysis that monitoring costs are unlikely be the driver of the rising incidence of performance pay.

ability in output and thus in wages (Seiler, 1984). Additional variation could be caused by outside factors (cooperating partners, product demand, etc.) or by the measurement mechanism itself (Lazear, 1986, p. 421). Hence, due to individual-level characteristics, wage variability is expected to grow as performance pay schemes become more prevalent over time. This has been confirmed empirically for within-firm variation (Barth et al., 2009; Lazear, 2000). In addition, wage level differences between the two remuneration schemes generate between-variation. How this affects wage inequality depends on how the wage difference evolves over time. Furthermore, recall that the growing incidence of pay for performance might be caused by skill-biased technological change. If SBTC requires larger wage differentiation between skill groups and performance pay was the mechanism to implement this into changes in the relative wages, then performance pay would drive wage inequality up. Lemieux et al. (2009) conclude that this has been the case in the U.S. in the last quarter of the past century.

Performance pay plays a special role in Germany given the background of the strong German system of industrial relations (Jirjahn, 2002, p. 158). Compared to collectively negotiated wages, performance pay is more flexible. Therefore it was seen as a way to increase the competitiveness of German firms and thus to reduce unemployment (Jirjahn, 2002, p. 163).[2] The incidence of performance pay has been increasing in Germany, but there are few studies which analyze a long time trend.[3] This current study provides a detailed description of the empirical trends for the time period from 1984 to 2009. The other main contribution of this paper is to analyze the relation between the growing use of performance pay and rising wage inequality for the German case.

[2]The interplay between unions and flexible payment schemes is mixed (as laid out in more detail in Jirjahn, 2002). On the one hand, unions are usually sceptical about profit-sharing, partly because these schemes are difficult to negotiate on a central level and partly because unions "fear" earnings dispersion (Jirjahn, 2002, p. 161). On the other hand, empirical studies show a positive relation between collective bargaining coverage and and group-based piece rates (Heywood and Jirjahn, 2002) and between works councils or union density and premium pay (Hübler and Jirjahn, 1998).

[3]The longest comparable panel study is provided by Pannenberg and Spiess (2009) for the period from 1991 to 2000.

Analyzing this question requires two things: First, in order to capture the entire distribution of wages, quantile regression methods are needed. These will be applied to a sequential decomposition. Second, a long panel data set with information on performance pay is necessary to perform the analysis. The empirical analyses in this paper are based on data from the German Socio-Economic Panel (SOEP). Performance pay jobs are defined as those job matches which in the past have at least once paid profit sharing, premiums or similar bonuses (similar to Lemieux, MacLeod, Parent, 2009 and Heywood, Parent, 2009).

The analyses confirm the strong increase of performance pay for Germany. Its incidence has more than doubled over the observation period from 1984 to 2009. For employees who receive this type of variable pay, it amounts to 1700 Euro per year at the median, which corresponds to the salary of half a month. Wage inequality has grown strongly over the observation period. Changes in the coefficients (i.e. in the remuneration scheme) are the largest contributors to this trend. Changes in the composition of the workforce also contribute strongly to growing wage dispersion. In contrast, the growing use of performance pay did not add to wage inequality. Still, there has been a small but significant upward shift in wages due to the growing use of performance pay. As more employees receive pay for performance, wage inequality grew within the group of performance pay job matches and even more so among those who do not receive pay for performance. The returns to observed characteristics increased more within performance pay jobs than within non-performance pay jobs. The wage difference between both types of jobs also grew over time, but remains flat. The stark changes in coefficients could be due to SBTC or trade globalization or other unresolved inter-industry differentials.

This paper proceeds as follows: The next section gives insight on the economic background and derives clear research questions. Section 3 explains the data, specific data problems and their solution and provides extensive descriptive statistics. Section 4 outlines the sequential decomposition method and presents the results. The final section concludes.

2 Economic background

Performance pay is a payment scheme that depends on output while salaries depend on input (most prominently on hours), according to the seminal work by Lazear (1986). Broadly speaking, there are many different types of pay for performance. These include piece rates, comissions, overtime premia, bonuses, as well as profit-sharing (De la Rica et al., 2010; Jirjahn, 2002). In addition, there exist many different mechanisms of how bonus pay is determined (e.g. tournaments). This results in a huge complexity in reward systems (Schaefer, 1998; Lazear, 1992; Parent, 1999, p. 437) and a large heterogeneity between or even within firms (Engellandt and Riphahn, 2011). Therefore the empirical researcher, trying to confront this large heterogeneity, has the option of a very specific or a more general approach. Very specific approaches often employ case studies[4] to go into great detail, whereas more general definitions are able to capture many employers and employees and thus achieve higher external validity.[5,6] This study choses the latter approach, attempting to capture the whole German workforce. For the purpose of limiting the analysis to a somewhat homogeneous pay component and due to data availability, "pay for performance" will be defined as profit-sharing, premia and bonuses excluding piece rates, comissions and overtime premia (see section 3).

How does pay for performance affect wages? Above all, pay for performance intends to stimulate effort and to increase productivity (e.g. Dohmen and Falk, 2011; Lazear, 2000; Brown and Heywood, 2002a). This function as

[4]Examples of single-firm case studies include Lazear (2000); Ockenfels et al. (2010); Engellandt and Riphahn (2011); Pfeifer (2012).

[5]See, e.g., De la Rica et al. (2010); Lemieux et al. (2009); Parent (2009, 1999); Heywood and Parent (2009); Amuedo-Dorantes and Mach (2003); Booth and Frank (1999); Henneberger et al. (2007)

[6]Inbetween these two types, some other studies analyze a single industry sector, like the chemical industry (Grund and Kräkel, 2012), the banking and financial sector (Kampkötter and Sliwka, 2011), the valve industry (Bartel et al., 2009), or the tree-planting industry in British Columbia (Paarsch and Shearer, 1999; Shearer, 2004). Still other studies are restricted to certain occupational positions, usually CEOs (Fabbri and Marin, 2012; Heimes and Seemann, 2011; Hallock et al., 2010).

an incentive wage is of particular relevance in situations where the worker-specific effort or corresponding output cannot be observed by the employer or where job complexity is high (Engellandt and Riphahn, 2011). However, the employee herself knows about her effort and productivity and therefore selects herself into the more profitable payment scheme, i.e. a fixed or variable pay scheme. This way, pay for performance induces the sorting of workers into pay schemes (Dohmen and Falk, 2011; Lazear, 2000). In consequence, wage differences that are observed between fixed and variable pay schemes should not be taken as causal, as they could be due to this sorting of workers. The wage insecurity an individual worker faces under a variable pay scheme could pose another explanation for higher wages in this pay scheme (Seiler, 1984; Parent, 1999; Amuedo-Dorantes and Mach, 2003).

Furthermore, starting from a standard Cobb-Douglas production function, classical labor economics theory assumes that wages equal the marginal product of labor, that is, productivity. However, wages often differ from this for different reasons such as asymmetric information, search frictions, delayed compensation, collective bargaining, etc. (see, e.g., De la Rica et al., 2010). Against this background, pay for performance can be seen as a mechanism to more closely align wages with productivity, in particular if productivity or output is observed and rewarded. Empirical support for this mechanism is given in the studies by Lemieux et al. (2009) and De la Rica et al. (2010). They show that in a fixed wage regime, wages are tied closer to job and firm characteristics whereas in a variable pay scheme, wages are more closely related to the individual worker's characteristics.

Over time, the incidence of performance pay has grown in several industrial countries (Lemieux et al., 2009; Heywood and Parent, 2009; Pannenberg and Spiess, 2009; Booth and Frank, 1999), even though this is not necessarily a general trend (Brown and Heywood, 2002b). An increase in the incidence of pay for performance is expected to cause a wage increase if wages are higher under this variable pay scheme. What does this mean for the distribution of wages?

Rising wage inequality has been the major empirical trend in labor economics in recent decades (OECD, 2011, 2008; Doerrenberg and Peichl, 2012). The strong increase in wage dispersion in the US and the UK since the 1980s has affected the entire distribution (Katz and Autor, 1999; Autor et al., 2008). In contrast, wage inequality in West Germany began to rise first at the top of the distribution in the 1980s, and has only started to grow at the bottom since the 1990s (Dustmann et al., 2009; Fitzenberger, 1999; Kohn, 2006; Gernandt and Pfeiffer, 2007; Dustmann et al., 2009; Antonczyk et al., 2009).[7] Recently, the growth in wage dispersion was dramatic with an increase of more than 10 log percentage points at the 90-10-differential from 2001 to 2006 (see Antonczyk et al., 2010). Growing wage inequality has been found to affect the top as well as the bottom of the wage distribution which makes it an important component in the debate on poverty and the low wage sector (ibid.).

How wage inequality is affected by the increasing use of performance pay depends on where in the wage distribution those bonuses are paid. On the one hand, if performance pay includes group incentives such as profit-sharing, all types of workers could potentially benefit from it, regardless of their effort. In this case, performance pay could affect all workers in those firms which reward group effort and could thus potentially affect the entire wage distribution. However, it is also plausible that performance pay affects mainly high-wage earners such as managers. The reason is that their effort is hard to monitor but decisive for the firm's success, which is a classical situation to implement an incentive pay system. Performance pay would then be expected to affect mainly the top of the wage distribution. This is the part of the distribution where inequality has grown most strongly (Autor et al., 2006; Katz and Autor, 1999). As Heywood and Parent (2009) and Lemieux et al. (2009) show, performance pay indeed tends to be associated with higher wage inequality at the top of the distribution and would therefore be expected to raise wage inequality. As the question is undecided from a theoretical point of view, the following analysis tries to shed light on it from an empirical

[7] The late 1980s will be the start of the observation period of this analysis.

perspective.

Thus, the key research question is the following: How would the wage structure have developed, had the incidence of pay for performance not increased?

In order to answer this question, this study will simulate the wage distribution under the assumption that the use of performance pay had not increased but had remained stable. This will be analyzed by means of a sequential decomposition method as explained in section 4.

Another way to think about it is in terms of within vs. between inequality. How did the growing use of performance pay schemes affect the wages of the "insiders", i.e. those employees who work in a variable pay scheme? For example, do different types of employees receive performance pay now compared to then, such that the composition of the characteristics of this group has changed? Put differently, was the positive selection of employees into job matches fostered or washed out over time? Or did the selection into performance pay job matches remain unchanged, but the remuneration scheme changed, i.e. the coefficients? This leads to the additional research question of how wage inequality has changed over time within the group of employees who are receiving pay for performance?

The same question applies to those employees who work under a fixed wage: Did the selection of this group worsen as more employees switch into a variable pay scheme? How did the characteristics of the group of employees with a fixed wage change over time? And did the remuneration scheme (i.e. the coefficients) of these employees change over time as performance pay increased?

Finally, how did the wage differences between these two groups of workers evolve? As more employees receive pay for performance, did the segregation between the two types raise the wage difference? Or are the two groups becoming more similar in terms of characteristics and/ or remuneration and, thus, in wages?

In summary, the key research question that evolves from this section is:

How would the wage structure have developed, had the incidence of pay for performance not increased? Before section 4 will shed light on this, section 3 provides an overview of the data and descriptive statistics.

3 Data and descriptive statistics

The empirical analyses in this paper are based on data from the German Socio-Economic Panel (SOEP), a large household survey for the years 1984 to 2009 (Socio-economic Panel (SOEP), 2011; for a description see Haisken-DeNew and Frick, 2005).[8] This data set is comparable to the PSID in the US and the BHPS in the UK, but larger in size. The empirical analysis in the present study is limited to full-time employees in West Germany aged 25 to 65, excluding self-employed and public-sector employees, as for these groups the meaning of pay for performance is not evident. This leaves a sample size of nearly 13,000 employees in more than 20,000 job matches. All procedures use sampling weights provided by the SOEP data in order to obtain representative results. The survey asks for several additional pay components from the employer of which one category is "profit-sharing, premiums and bonuses". It also asks for the corresponding gross amount. I will refer to this pay component as "performance pay" in this study. More precisely, in this study, "pay for performance" is defined as profit-sharing, premia and bonuses excluding piece rates, comissions and overtime premia as well as Christmas and vacation pay.

Given that this variable pay component depends on performance, some employees may not receive a bonus because their performance has not been satisfactory. For this reason, it is not sufficient to measure performance pay in the given year, but rather "performance pay jobs" are defined (following Lemieux, MacLeod, Parent, 2009 and Heywood, Parent, 2009). This new category captures all job matches with a variable pay scheme, regardless of

[8]The most recent available wave at the time of writing is from 2010, which refers to pay components in the year 2009.

whether a bonus was paid in the specific year or not. Thus performance pay-jobs ("PP jobs" in the following) are defined as those job matches which have paid for performance at least once in the past. This definition differs from the one of Lemieux, MacLeod, Parent (2009) and Heywood, Parent (2009) in that only bonus payments in the past or present define a PP job – not those in the future. This definition allows observing in the data the new introduction of pay for performance in a given job match.

This definition would however distort the observed share of employees in performance pay jobs at the beginning of the observation period, because pay for performance that was awarded in a given job match before 1984 is not observed in the data. In order to present descriptive statistics that are comparable over time, an end-point correction is applied following Lemieux et al. (2009), which is described in the appendix on page 37.

How has the incidence of performance pay in Germany developed over the past 25 years? Figure 6 and table 3 in the appendix show the answer using the aforementioned definition and correcting for the end-point problem discussed above. The share of employees working in PP jobs has been increasing continuously from 15.4% in 1984 to 39.6% in 2009. The steepest increase is observed in the late 1990s, from 25.9% in 1994 to 35.5% in 1999. This is followed by a period of stagnation and a sharp decline in the year 2002. From then on, the incidence of PP jobs is rising again. In times of the current financial crisis, the use of performance pay has declined mildly in 2007, peaked in 2008 and receded again in 2009.[9] Overall, the general trend has pointed towards a steady increase. The same data set has been used by Pannenberg and Spiess (2009) for the period 1991 to 2000, but they do not define "performance pay jobs", such that the exact numbers are not comparable. Still, their study also documents an increase in the incidence of performance pay over the 1990s.

Another question in the SOEP data explicitly asks for performance evaluations by the supervisor. According to this, the share of employees whose

[9] Qualitatively similar results are obtained from different subsamples of the data (available upon request).

performance was evaluated in the year 2004 ranges between 25% (Cornelißen et al., 2011) and 31% (Grund and Sliwka, 2010), depending on the exact specification of the data set. However, this survey question is only available for the years 2004 and 2008 and thus does not allow comparisons over a longer time period. In addition, it is asked whether bonuses depend on this performance evaluation. The share of employees whose performance evaluation by the supervisor determines their bonus payments comes to 15% in 2004 and 16% in 2008 in the current data set.[10] On the firm level, Berger et al. (2011) report that 37% of all firms use performance-related pay.

The particularity of this data set is that it provides the level of the performance payments. Among those employees who receive performance pay in the current year, the median value in this data set is 1700 Euro per year. This corresponds to one half of the monthly salary in bonuses per year (i.e. the share of yearly performance payments as a share of monthly earnings is 53.3%, see table 4 in the appendix).[11] Only a few other data sets also include the amount of pay for performance (Lemieux et al., 2009; De la Rica et al., 2010; Ockenfels et al., 2010; Kampkötter and Sliwka, 2011). For the US and for Spain, somewhat higher amounts are reported.[12]

As later on the entire wage distribution will be analyzed, it is interesting to look at the dissemination of pay for performance over the whole wage distribution.[13] Figure 7 shows how the volume of annual performance payments

[10]Conditional on being evaluated by the supervisor, this evaluation affects bonus payments for 46% of employees in 2004 and 47% in 2008. The salary is affected for 37% of those employees whose performance is evaluated by the supervisor.

[11]Monthly earnings are used as a reference point here, as annual earnings would include Christmas pay and the like. However, for comparison, expressed in terms of annual earnings, performance pay amounts to less than four percent.

[12]Lemieux et al. (2009) report that in the US performance pay makes up about 10% in annual earnings. For Spain, De la Rica et al. (2010) report that the share of performance pay in hourly wages (and thus in annual earnings) is more than 13%, but the reported numbers are hard to compare as different studies may measure different wage components. In addition, some studies are restricted to certain sectors or occupations with traditionally high bonus payments. This explains why Ockenfels et al. (2010) report that the level of performance pay is as high as 20% of annual earnings when studying a certain group of managers. These shares are also very high in the study of Kampkötter and Sliwka (2011) which only considers the banking sector in Germany.

[13]Wages are defined as real log hourly wages including overtime pay and overtime hours.

is distributed over the wage distribution in absolute terms (left side) and in relative terms as measured by the share of monthly earnings (right side). All these numbers are conditional on receiving pay for performance in the current year. As expected, both indicators for the volume of performance pay remain rather flat up to about the 70^{th} percentile and increase steeply at the very top of the wage distribution.

Over time, the incidence of pay for performance has increased. How does this affect the volume of payments for performance? As table 4 shows, the absolute amount of bonus payments has increased from 1500 to 1900 Euro per year at the median of the unconditional performance pay distribution. Again, it is important to consider the distribution of these payments over the entire wage distribution. It can be seen that the volume of pay for performance has grown strongest within the top part of the wage distribution.[14]

The goal of this study is to analyze wage changes over time and how they correspond to changes in performance pay over time. In order to document long-run trends, the time period for comparison should be as long as possible. To deal with the before-mentioned potential problem of observing to few individuals in PP jobs at the start of the observation period, the starting year of the comparison will not be 1984, but 1986. Moreover, the case numbers at the start of the observation period are somewhat low, such that several years have to be pooled. Therefore, the pooled observations from 1986 to 1989 will serve as the starting period. Correspondingly, the time frame for the end period will be the pooled observations from 2006 to 2009.

Table 5 in the appendix describes the group of employees in PP jobs and in non-PP jobs. It displays the share of observations within each pay scheme who are female/ have a university degree/ etc. The table shows that employees in PP jobs are better educated, have longer tenure, and work in larger firms, as compared to non-PP jobbers. The same result has for example been

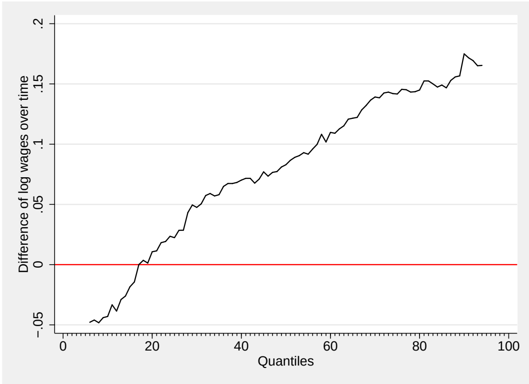
[14]The table hides that there are gains and losses in the amount of performance pay at the bottom as well as at the top of the wage distribution. However, note that care has to be taken with the distribution of the volume of performance pay in the early period (from 1986 to 1989) as the case numbers are quite low. For this reason there are no further conditional analysis of the volume of performance pay.

found by De la Rica et al. (2010) for Spain and Cornelißen et al. (2011) for Germany. With respect to occupational category it can be seen that out of the group of PP jobbers, 28% work as qualified professionals and 31% as highly qualified professionals. These shares are much lower for the group of non-PP jobbers, where a much larger share are trained workers (23%). These results are in line with Grund and Kräkel (2012) who show that performance pay is found more frequently with increasing tenure and hierarchical level. All this points towards a strong positive selection of employees into job matches with pay for performance (also see Dohmen and Falk, 2011). As a result, employees who work in PP job matches receive real hourly wages that are 30 log points higher than those of non-PP jobbers (i.e. 36%). However, this is not likely to be causally due to the PP job, but due to selection.

Table 5 also shows the distribution of the covariates for the two time periods which will be compared. As the share of PP jobs has increased over time, it is interesting to see whether the positive selection into these jobs has been fostered or washed out over time. The table also reflects the educational expansion that affects both PP and non-PP jobs. The same trend is observed in the occupational categories. Furthermore, for both groups of employees, the average age has increased slightly, with the opposite trend for tenure. More females are nowadays working in full-time jobs in the private sector in West Germany. Therefore, the share of females has increased in both job types. In addition, the literature has pointed to considerable gender differences in the incidence of performance pay (De la Rica et al., 2010; Grund and Sliwka, 2010; Jirjahn, 2002). In the present data set, the share of females differs between the two job types by about six percentage points.

The next section will analyze how the changes in wage inequality over time are related to changes in the use of performance pay. Table 1 and figure 1 display the difference between the two unconditional wage distributions from 1986 - 1989 and 2006 - 2009. It shows that wages have on average increased by 7.7 log points over the 20 years. However, at the bottom of the wage distribution, there have been any notable real wage losses (-4.3 log points at the 10^{th} percentile). At the same time, wage increases have been strongest

Figure 1: Increase in wage inequality
(comparing 1986-1989 to 2006-2009)



at the top of the distribution (+17.5 log points at the 90^{th} percentile). Thus, the 90-10 differential has widened by 21.6 log points over the observation period of 20 years.

Table 1: Increase in wage inequality (comparing 1986-1989 to 2006-2009)

Quantile	10	25	50	75	90
Total Difference	-0.043	0.022	0.083	0.142	0.175

The same trend has been found by Pannenberg and Spiess (2009) based on the same data set, but limited to the period of 1991 to 2000. Moreover, the trend of rising wage dispersion in West Germany has also been documented by Fitzenberger (1999); Dustmann et al. (2009) and Antonczyk et al. (2010). For West Germany, Dustmann et al. (2009) show that wage dispersion began to increase at the top of the wage distribution during the 1980s (see also Fitzenberger, 1999), whereas wage inequality at the bottom of the wage distribution only started to grow during the 1990s. In the 2000s, wage inequality continued to rise strongly at both ends of the wage distribution, with strong real wage losses at the bottom (Antonczyk et al., 2010).

Let us now turn to the central question of whether part of this increase in wage inequality can be explained by the growing use of performance pay schemes.

4 Decomposition results

The following analysis will decompose changes in the wage structure over time. The question to be answered is: How would the wage structure have developed, had the incidence of pay for performance not increased? To answer this question, a sequential decomposition procedure will be used and applied over the entire wage distribution in order to detect changes in wage inequality. The following subsection will explain in more detail the sequential decomposition method. Then, the results will be presented and explained. Afterwards, some further decomposition results will address the additional research questions. In the end, sensitivity checks are performed to scrutinize the key result.

4.1 Sequential decomposition method

To analyze the effect of pay for performance on the *entire wage distribution*, the following empirical analyses are based on linear quantile regression estimations. Specify the τth quantile of log hourly wages w conditional on the set of covariates as:

(1) $$q_w(\tau|X) = X'\beta(\tau)\ .$$

These quantile regressions are estimated separately for both time periods, that is 1986 – 1989 and 2006 – 2009. (In the following the notation will abbreviate these time periods, mentioning only the starting year.) The linear quantile regressions are specified as extended Mincer-type log wage equations and include the following covariates: individual-specific characteristics (educational degree, gender, age and age^2), job match specific covariates (tenure and tenure^2, occupational category, and a dummy for temporary contracts) and firm characteristics (firm size in categories, industry branch, and federal state).

In order to obtain results for the entire wage distribution, the classic decomposition approach of Oaxaca (1973) and Blinder (1973) is not sufficient as it refers only to the mean. Their method has been extended in the context of quantile regressions by Machado and Mata (2005). For the estimation, the procedure from Chernozhukov et al. (2008) and Chernozhukov et al. (2008) is employed. This implies treating τ as uniformly distributed over 99 even percentiles and drawing quantiles from the corresponding 99 simulations per observation.

The research question is: How would the wage structure have developed, had the incidence of pay for performance not increased? This question can be reformulated to resemble the decomposition terminology. That is: How would the wage structure have developed if PP job status and the pay scheme had remained constant? Hence, in the decomposition it is not sufficient to measure the contribution of the characteristics and the coefficients, but a PP job-term will be added.[15] Therefore, the decomposition follows this equation:

$$\underbrace{q(X_{06}, PP_{06}, \beta_{06}) - q(X_{86}, PP_{86}, \beta_{86})}_{\text{Overall wage change}} = \underbrace{q(X_{06}, PP_{06}, \beta_{06}) - q(X_{06}, PP_{06}, \beta_{86})}_{\text{Coefficients effect}} + \underbrace{q(X_{06}, PP_{06}, \beta_{86}) - q(X_{06}, PP_{86}, \beta_{86})}_{\text{PP-jobs effect}} + \underbrace{q(X_{06}, PP_{86}, \beta_{86}) - q(X_{86}, PP_{86}, \beta_{86})}_{\text{Characteristics effect}} \tag{2}$$

It decomposes the change in the wage structure over time (on the left hand side) into changes in coefficients (1^{st} term on the right), changes in the inci-

[15]Further explanation to the sequential decomposition can be found in Fortin et al. (2010). This method has been applied, e.g., by Antonczyk et al. (2009) and Antonczyk et al. (2010).

dence of PP jobs (2^{nd} term) and changes in characteristics (3^{rd} term). This way, the wage structure from 2006 is taken back to the wage structure in 1986 in three steps.

The first step involves simulation of the wage strucutre if individuals from 2006 were paid as in 1986, i.e. according to the remuneration scheme from 1986. This is denoted by the counterfactual wage distribution $q(X_{06}, PP_{06}, \beta_{86})$. The resulting coefficients effect resembles a treatment effect of time in the treatment literature. Put differently, it quantifies how changes in the remuneration scheme over time have contributed to changes in wage inequality.

Second, the hypothetical individuals from 2006 living in the labor market of 1986 have their PP job status set back to the level of 1986. This is denoted by the counterfactual wage distribution $q(X_{06}, PP_{86}, \beta_{86})$. This counterfactual wage distribution would have been observed for individuals from 2006 who are paid according to 1986 wages and for whom a hypothetical PP-job status for 1986 is simulated. Starting from this hypothetical wage distribution, the incidence of pay for performance is then raised to 2006 levels so as to quantify the contribution of performance pay to changes in the wage structure over time. Put differently, this step quantifies the contribution of the growing incidence of performance pay, holding the composition of the workforce and the wage structure constant.

Third, the final step in this sequential decomposition consists of changing the characteristics from 1986 to 2006 levels. This characteristics effect captures changes in the composition of the workforce such as the educational expansion and changes in the industry structure. Alternative orders of decomposition will be considered in the sensitivity checks in section 4.4.

The crucial assumption in any decomposition analysis is that a change in the covariates X will not change the parameters of the conditional distribution of the dependent variable (Fortin et al., 2010; Chernozhukov et al., 2008; DiNardo et al., 1996). In this application it means that changes in the covariates X (such as educational upskilling or changes in the industry structure) will not change the coefficients of the conditional distribution of the wage w given X, i.e. will not change the remuneration scheme. Therefore, a decomposition method by definition assumes away any general equilibrium effects.

The crucial step in the simulation process concerns the second component, i.e. the PP jobs effect. In order to estimate $q(X_{06}, PP_{86}, \beta_{86})$, the hypothetical PP jobs status in 1986 has to be simulated for individuals from 2006. To do so, the propensity of working in a PP job is estimated for both time periods separately. From this, the propensity of working in a PP job is predicted for the alternative time period. That is, $\phi(X_{06} * \beta_{86})$ gives the propensity for individuals from 2006 of having been working in a PP job in 1986 (and vice versa). Then, counterfactual individual wages for both hypothetical statuses are estimated, i.e. $w(X_{06}, PP_{86} = 1, \beta_{86})$ and $w(X_{06}, PP_{86} = 0, \beta_{86})$. For estimation of the quantiles of the counterfactual wage distribution $(X_{06}, PP_{86}, \beta_{86})$, both hypothetical wages are included and weighed by the propensity score (for the case with $PP_{86} = 1$) and $1 -$ propensity score (for the case with $PP_{86} = 0$), respectively. An alternative matching procedure will be explained as a sensitivity check in section 4.4. Let us now turn to the results of this sequential decomposition procedure.

4.2 Sequential decomposition results

The results of the decomposition analysis can be found in table 2 and in figure 2. Displaying the confidence bands graphically is not helpful as there would be four different confidence bands within one graph. Therefore only the confidence band that corresponds to the PP jobs effect of interest is displayed in figure 2.[16]

The results show that over the past 20 years, wage inequality in Germany has increased.[17]. Strong wage increases at the top of the wage distribution

[16]Inference is based on 100 bootstrap replications, applying a block bootstrap where individuals are resampled and using all observations over time for the resampled individuals.

[17]The reason why the wage difference to be decomposed here differs from the one in

Table 2: Result of sequential decomposition

Quantile	10	25	50	75	90
Total Difference	-0.024	0.030	0.088	0.135	0.162
(Standard error)	(0.020)	(0.019)	(0.027)	(0.034)	(0.041)
Coefficients Effect	-0.010	0.030	0.063	0.082	0.087
(Standard error)	(0.019)	(0.015)	(0.019)	(0.022)	(0.025)
PP-jobs Effect	0.004	0.006	0.010	0.012	0.013
(Standard error)	(0.006)	(0.004)	(0.004)	(0.004)	(0.005)
Characteristics Effect	-0.018	-0.006	0.015	0.041	0.061
(Standard error)	(0.014)	(0.011)	(0.012)	(0.018)	(0.022)

Standard errors are based on 100 bootstrap replications of person-specific blocks.

Figure 2: Result of sequential decomposition

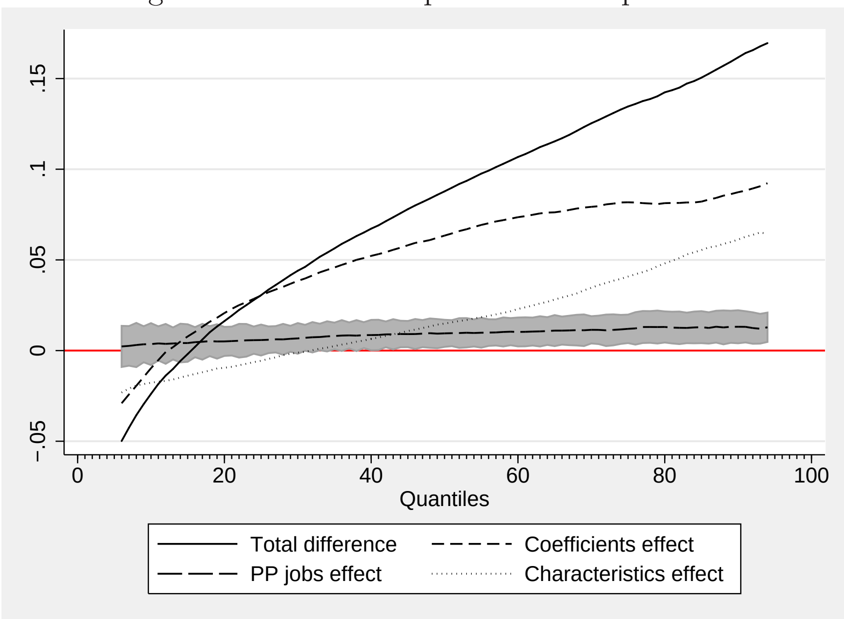


figure 1 is that, following Chernozhukov et al. (2008), here, the predicted wages from the quantile regressions form the basis. Because this smoothes out the error term, the total difference is not as erratic. This does not change the results (available upon request) have been accompanied by real wage losses at the bottom (also recall the description at the end of section 3). This difference over time is about to be explained by the sequential decomposition analysis.

The coefficients are the largest contributor to this increase in wage inequality. This means that changes in the remuneration scheme have contributed heavily to changes in the wage distribution over time. Below the median the coefficients effect is increasing strongly from negative values below the 13^{th} percentile to a value of 6.3 log points at the median. Above the median, the coeffients effect is rather flat, at around 8 log points. This means that changes in the remuneration scheme have contributed to rising wage inequality at the bottom of the wage distribution, but less so at the top. Still, the top half of the wage distribution has seen strong wage increases due to changing returns.

What could be the explanation for these strong changes in the returns to characteristics? Antonczyk et al. (2010) find very large effects due to changed returns to sector affiliation for Germany. Put differently, there are increasing between-industry differentials, but the cause for this remains unresolved. Very recent research by Card et al. (2012) points to the growing importance of firm- and invididual-specific heterogeneity as well as growing assortative matching between employees and employers. Several other explanations are possible among them the prominent hypothesis of skill-biased technological change (SBTC, see e.g. Katz and Autor, 1999; Autor et al., 2008). As SBTC changes the relative demand for skilled labor, the prices for skilled labor change. Price changes are reflected in the coefficients effect which subsumes the returns to observed characteristics. If skilled labor is found mainly at the top of the wage distribution, then it is not surprising to find the strongest wage gain from changes in the remuneration scheme in this part, too, which is in line with the results presented here. The negative coefficients effect found for the very bottom of the wage distribution suggests wage losses in this part of the wage distribution. However, this would stand in contrast to the task-based approach to SBTC (Autor et al., 2003) which predicts U-shaped wage changes over the wage distribution. An alternative explanation for changes in the returns to characteristics could be provided by trade globalization (Blinder, 2006). However, from the decomposition analysis employed here, it is not possible to differentiate between the causes that drive the coefficients effect up, so that further research is required. Still, it is an important contribution to document the large magnitude of this effect.

The characteristics effect affects wage inequality over the entire distribution. It is very pronounced in the top half of the wage distribution where the coefficients effect is rather flat. The characteristics effect amounts to -1.8 log points at the 10^{th} quantile and 1.5 log points at the median – a change in the 50-10 differential of 3.3 log points. At the 90^{th} percentile, the effect is 6.1 log points, implying a change in the 90-50 differential of 4.6 log points. Thus, due to changes in characteristics (such as educational upgrading and industry changes), the top of the wage distribution has experienced some wage increases, while the bottom saw real wage losses. One possible explanation could stem from employees with bad labor market characteristics who newly enter full-time work in the private sector in West Germany. Parts of this could be due to labor market reforms which took place in the early 2000s, although these should mainly affect employment in other than full-time jobs. Moreover, deunionization could affect the characteristics effect if collective bargaining coverage is correlated with the observed characteristics.[18] As Antonczyk et al. (2010) show in their characteristics effect, declining collective bargaining coverage contributes significantly to growing wage inequality, but the effect is small in magnitude.

Finally, the key result is given by the PP jobs effect. The results show that this effect completely flat over the distribution. The PP jobs effect ranges between 0.4 log points at the 10^{th} quantile and 1.3 log points at the 90^{th} percentile. This means that the change of the wage distribution that can be attributed to the rise in the incidence of pay for performance is an upward shift on the order of one log point. Although the magnitude of the

[18] Collective bargaining coverage cannot be identified from the data and therefore cannot be investigated further in this study.

effect seems small at first sight, it is not negligible. At the median, for example, the increase in the incidence of PP jobs explains about 11% of the entire change over time (1.0 log points out of 8.8 log points). Taking into account that this is the contribution of only one single component of the wage determination process, this is quite remarkable. However, while the growing incidence of PP jobs contributed to the wage level, it did not contribute to wage inequality, because the effect is flat. This result differs from the one found for the U.S. by Lemieux et al. (2009). They find that performance pay contributes to rising wage inequality, particularly above the 80^{th} percentile. Notwithstanding, they regard the growing use of performance pay schemes as a consequence of SBTC, a factor that also largely affects relative returns to observable skills, as captured by the coefficients effect. They reach their conclusion by analyzing wage changes within the group of performance pay jobs. This is what we will turn to next.

4.3 Additional decomposition results

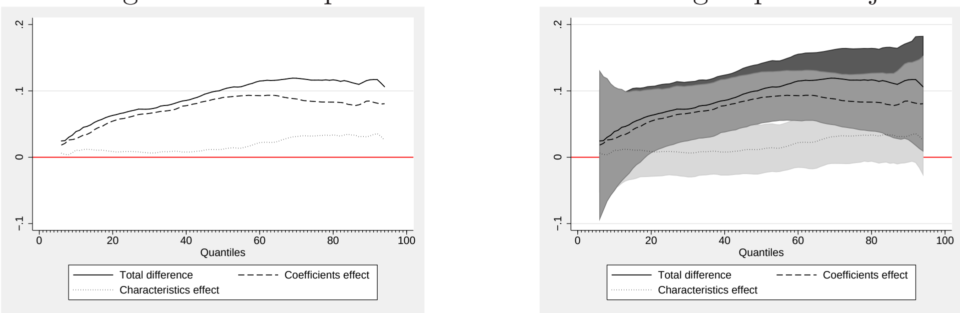
How did wage inequality change over time *within* performance pay jobs? The corresponding decomposition is simpler than the one considered so far, as the PP jobs effect drops out. Hence the decomposition is of the simpler classic type following Oaxaca (1973) and Blinder (1973) and follows this equation:

$$(3)\ \underbrace{q(X_{06}^{PP},\beta_{06}^{PP}) - q(X_{86}^{PP},\beta_{86}^{PP})}_{\text{Overall wage change}} = \underbrace{q(X_{06}^{PP},\beta_{06}^{PP}) - q(X_{06}^{PP},\beta_{86}^{PP})}_{\text{Coefficients effect}} + \underbrace{q(X_{06}^{PP},\beta_{86}^{PP}) - q(X_{86}^{PP},\beta_{86}^{PP})}_{\text{Characteristics effect}}$$

The result of this analysis can be found in figure 3 and in table 6. Again, bootstrapped confidence intervals do not improve visibility of the figure, therefore the results are displayed without (left) and with confidence bands (right side).

The results show that wages have increased over time for the group of performance pay workers throughout the entire wage distribution. The wage gain over time is increasing over the bottom half of the distribution (from 3.9 log

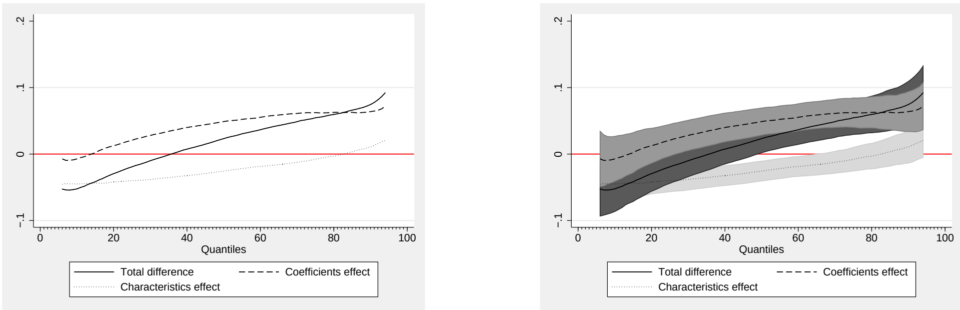
Figure 3: Decomposition results within the group of PP-jobs



points at the 10^{th} percentile to 10.2 log points at the median) and remains stable above that point (11.7 log points at the 90^{th} percentile). This means that within the group of PP jobbers, wage inequality has increased in the bottom half of the wage distribution. This increase is driven almost completely by changes in the coefficients, i.e. in the remuneration scheme. This means that returns to education, occupation, industry etc. have changed in a way as to raise wages for this group. In contrast, characteristics have contributed only slightly to an improvement of wages and have done so only in the top half of PP jobbers. This falsifies the hypothesis that the increased incidence of PP jobs leads to decreasing productive characteristics of employees in this wage regime.

What is the picture for employees in non-PP jobs? Figure 4 and table 7 displays the results. For the group of non-PP jobbers, the growth in wage inequality has been much more pronounced. While real hourly wages at the 10^{th} percentile decreased by 5.2 log points, they increased by 2.3 log points at the median and by 7.5 log points at the 90^{th} percentile. Put differently, over 20 years, wage inequality, as measured by the 90-10 differential, has increased by 12.7 log points. Again, a large part of the wage increase over time is driven by changes in the coefficients. At the same time, changes in the labor market characteristics of the employees contribute significantly to the wage losses. There are nowadays more employees with worse labor market characteristics in non-PP jobs. This could be reasonable if the labor market reforms of the decade of the 2000s in Germany had the effect of drawing more individuals into full-time employment and if these individuals work in non-PP jobs (at least at first). The curvature of this characteristics effect is rather steep, meaning that it contributes strongly to the growing wage inequality within this group of non-PP jobbers.

Figure 4: Decomposition results within the group of non-PP employees



It is important to compare the coefficients effect within PP jobs to the group of non-PP jobbers. The coefficients effect is larger in the former compared to the latter group. This means that returns to observable characteristics have increased more stronlgy for within PP jobs. This resembles the result found by Lemieux et al. (2009) who explain this by SBTC: According to them, performance pay serves as a channel to translate underlying changes in the productivities of different skill groups into higher wage inequality (ibid. p.45). The idea is that SBTC changes the relative demand for skilled labor and firms respond to this by using more performance pay schemes. This mechanism translates into higher wage inequality. The empirical results presented here are in line with this hypothesis. Thus, while the underlying cause for the increasing importance of coefficients remains unresolved, this analysis gives a clue by showing that it affects PP jobs more strongly than non-PP jobs.

With the increasing use of pay for performance, the wage difference between the two groups could have changed. This wage difference certainly cannot be causally attributed to performance pay. Instead, selection into performance pay jobs plays a major role. If the selection of individuals between the two groups changes over time, the characteristics effect determining the wage difference would grow over time. If instead, the changed selection affects the remuneration process, it would be revealed in the coefficients effect. In order to analyze this, the wage difference between PP and non-PP jobs is decomposed. Hence the the wage difference is decomposed as follows:

$$(4) \qquad \underbrace{q(X_{06}^{PP}, \beta_{06}^{PP}) - q(X_{06}^{no}, \beta_{06}^{no})}_{\text{Overall wage change}} = \underbrace{q(X_{06}^{PP}, \beta_{06}^{PP}) - q(X_{06}^{PP}, \beta_{06}^{no})}_{\text{Coefficients effect}} + \underbrace{q(X_{06}^{PP}, \beta_{06}^{no}) - q(X_{06}^{no}, \beta_{06}^{no})}_{\text{Characteristics effect}}$$

Analogously, the wage difference between both job types is analyzed within the early period of 1986 to 1989.

Figure 5: Wage difference PP jobs versus non-PP jobs

Early (1986-1989) Late (2006-2009)

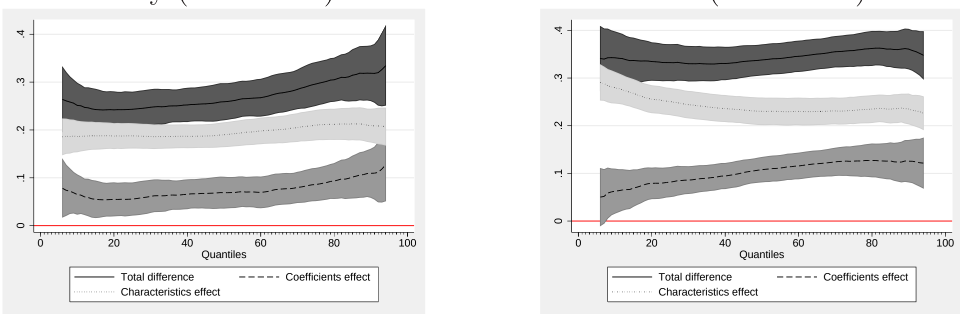


Figure 5 displays the decomposition results of the wage difference between PP and non-PP jobs for the early period (left) and the late period (right side). The numbers are displayed in tabular form in table 8. The results show that the wage difference between the two types of jobs is rather flat within both time periods. There are no significant differences within the total wage difference over the distribution. Over time, the level of the wage difference between PP and non-PP jobs has shifted upwards, from 26.0 log points at the median in 1986 to 33.8 log points at the median in 2006. In both time periods, characteristics explain a very large share of the wage difference. This reflects the strong selection of employees into the two wage schemes. How has this selection evolved over time? It can be seen that the characteristics effect has shifted upwards over time, particularly at the bottom of the wage distribution where the shift is significant. This suggests that the selection on observables plays a growing role in explaining the wage difference. This is likely due to the growing labor force participation of individuals who formerly would not have worked (least not full-time). Apparently, these individuals, who on average have less valued labor market characteristics, mostly work in non-PP jobs. This explains the growing wage differential between both job types and the growing contribution of characteristics to the wage difference. In addition, the contribution of coefficients to the wage difference is growing slightly over time, but the change is not significant.

What have we learned? Wage inequality has increased over the observation period of 20 years in West Germany. As more employees received pay for performance, wage inequality grew within the group of PP jobs and even more so within the group of non-PP jobs. The wage difference between both types of jobs also grew over time, but remains flat. These considerations add further evidence to the core result that the growing incidence of pay for performance did not contribute to growing wage inequality. Still, there has been a small but significant upward shift in wages which is due to the growing use of performance pay.

4.4 Sensitivity checks

Sequential decompositions are sensitive to the order of the decomposition (Fortin et al., 2010; Antonczyk et al., 2009; Chernozhukov et al., 2008; DiNardo et al., 1996). Therefore, to check the sensitivity of the results, the order of the decomposition will now be altered.

The original order of decomposition first extracted the coefficients effect, second the PP jobs effect and third the effect of characteristics. (The shorthand notation for this order will be: β, PP-job, X.) Now, let us alter the order of the decomposition the following way (i.e. to β, X, PP-job):

$$\underbrace{q(X_{06}, PP_{06}, \beta_{06}) - q(X_{86}, PP_{86}, \beta_{86})}_{\text{Overall wage change}} = \underbrace{q(X_{06}, PP_{06}, \beta_{06}) - q(X_{06}, PP_{06}, \beta_{86})}_{\text{Coefficients effect}} + \underbrace{q(X_{06}, PP_{06}, \beta_{86}) - q(X_{86}, PP_{06}, \beta_{86})}_{\text{Characteristics effect}} + \underbrace{q(X_{86}, PP_{06}, \beta_{86}) - q(X_{86}, PP_{86}, \beta_{86})}_{\text{PP-jobs effect}}$$

The first step remains the same. However, it is now the last step which consists of changing the PP job status. The difference to the original order of decomposition is that the characteristics of the employees in 1986 are now included instead of the characteristics from 2006. Thus the propensity score is now based on the probit regression from 2006 rather than from 1986.

Changing the order of a sequential decomposition can completely change the results, as the underlying sequence of counterfactual wage distributions changes. This said, it is astonishing to see the robustness of the results in figure 8 in the appendix. The results for two more permutations of the order are also displayed there. The PP jobs effect is always very flat, which confirms our result that it did not contribute to the rise in wage dispersion. At the same time, the significance of the PP jobs effect is not always given. Therefore, the result of a constant upward wage shift does not always remain significant when changing the order. Still, the result concerning wage inequality proves extremely robust in this test.

To check the sensitivity of the results to the prediction of the past PP job status, one way to proceed is to avoid the prediction procedure completely. Recall that the hypothetical PP job status in 1986 is predicted on the basis of the covariates from 2006. However, there is a group of individuals for whom the PP job status in 1986 can be observed directly from the data rather than being predicted. These are those individuals whose data can be observed both in the 1980s and in the 2000s, i.e. respondents who remain in the sample for a very long time period. For this particular group two results can be compared: Once using the prediction procedure as before and once using the true value instead. This way the contribution of the prediction procedure can be quantified. The results are found in figure 9 and table 9 in the appendix. The results in the left part of the figure are estimated identically to the previous results but with restriction to this particularly selected group of observations (n=467).[19] While the overall wage difference has shifted upwards compared to the general results by seven log points, the coefficients effect is notably steeper than before. The characteristics effect displays a considerably higher level and different shape which is due to the fact that now the same individuals are followed over time and attrition is suppressed, so that some characteristics change less than before while age increases monotonically. Finally, for the PP jobs effect, a flat effect on the order of zero is observed. Next, these results are compared to an estimation on the same observations but switching off the prediction of the PP job status in 1986 by using the true value (right panel in figure 9). This could affect the PP jobs effect as well as the characteristics effect, while the coefficients effect remains identical by definition. Using this simplified estimation procedure reduces the characteristics effect slightly by about two log points. This suggests that the characteristics effect is blown up slightly by the regular estimation procedure. In contrast, the PP jobs effect is larger when using the true rather than the predicted PP job status and remains rather flat but with minor increases over the wage distribution. If these results were generalized, this would suggest that the estimation procedure employed in this study estimates the PP jobs effect rather conservatively, i.e. attenuating it towards zero. Nevertheless, the core result of a small and flat PP jobs effect appears to be very robust.

To conclude, the result that the growing use of performance pay jobs has no direct effect on wage inequality is very robust to alternations in the estimation process.

[19] As a consequence of this low number of observations, bootstrapping is unfeasible and therefore no confidence intervals are provided.

5 Conclusions

This study provides a detailed description of the contribution of performance pay to the German wage structure. The growing incidence of variable pay schemes affects ever more employees and their productivity and wages. The share of employees working in a performance pay job (defined as a job match that has paid for performance at least once in the past) in Germany increased steadily, more than doubling over the observation period from 1984 to 2009. The steepest increase took place in the late 1990s. The volume of performance pay is not negligible as it amounts to 1700 Euro per year at the median, that is one half monthly salary. The volume of performance pay increases over the wage distribution.[20] Employees in performance pay jobs are positively selected.

One of the most important trends in empirical labor economics over the past few decades has been growing wage inequality. Several factors contribute to this trend such as globalization, skill-biased technological change and deunionization. As the increasing use of pay for performance runs parallel to the growth in wage inequality, it constitutes another potential contributing factor. So the question analyzed in this study is whether performance pay correlates with growing wage dispersion. This question is analyzed using quantile regressions and a sequential decomposition method (Chernozhukov et al., 2008; Fortin et al., 2010; DiNardo et al., 1996).

This article contributes to the literature by analyzing the contribution of the growing incidence of performance pay jobs to the increasing wage inequality in Germany. The results show that the growing use of performance pay did not contribute to the growth in wage dispersion. Still, there has been a small but significant upward shift in the wage distribution due to the growing use of performance pay. The magnitude of this shift is around one log point

[20] Future work could analyze in more detail how the volume of performance pay contributes to growing wage inequality. However, due to the inherent endogeneity problem of the level of performance pay in wages, a methodological solution is not trivial. Another direction of further research could extend the sequential decomposition method to consider effect heterogeneity in detail.

which explains about 11% of wage growth at the median. The growth in wage inequality is instead explained by changes in the characteristics of the workforce (particularly in the top half of the wage distribution) and returns to these characteristics (particularly in the bottom half). Finally, as more employees receive pay for performance, wage inequality grows within performance pay jobs – but even more so within those job matches that do not reward performance. The returns to observed characteristics increased more within performance pay jobs than within non-performance pay jobs. The wage difference between both types of jobs grew over time but remained flat.

The cause for growing wage inequality in Germany is not the growing use of variable pay schemes, as the present analysis has shown. Nevertheless, the empirical evidence presented here points to a growing importance of returns to characteristics that affects employees in performance pay jobs more strongly than in non-performance pay jobs, which Lemieux et al. (2009) would attribute to skill-biased technological change. The underlying cause for this trend needs further investigation. Potentially, this is related to recent findings of growing firm heterogeneity and assortiveness between employees and employers (Card et al., 2012). So long, a coherent explanation for the underlying cause of the steep growth in wage inequality seems still to be missing (at least for Germany). It appears that the main driving factor are neither changes in the job tasks, nor performance pay, and deunionization cannot explain everything. So the search continues.

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VI Appendix

VI.1 End-point correction

"Performance pay jobs" are defined as jobs that have paid for performance at least once in the past. Thus, job matches that are observed over a longer period are more likely to be observed as PP jobs. For this reason, job matches that are observed at the beginning of the observation period in 1984 may be misclassified as non-PP jobs if they paid for performance before 1984. In order to correct for this, an end-point correction is applied in analogy to Lemieux et al. (2009). It proceeds in three steps: First, PP jobs are estimated as a function of calender year and the number of years an individual job-match is observed in the sample. Second, the distribution of years that the job-matches are observed in the sample is held constant at a time in the middle of the observation period. Third, the share of PP jobs is predicted based on this hypothetical distribution of observation years. These shares deviate from the uncorrected shares at the beginning of the observation period. The corrected shares are depicted in the following figure 6 and table 3.

Figure 6: Development of the incidence of performance pay jobs (with end-point correction)

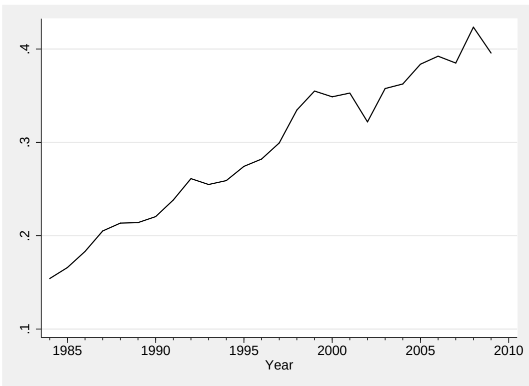

Table 3: Share of PP-jobs in percent (with end-point correction)

Year:	1984	1989	1994	1999	2004	2009
	15.4	21.4	25.9	35.5	36.3	39.6

Table 4: Volume of performance pay

	Mean	Quantile 10	25	50	75	90	N. obs.
Absolute value of pay for performance in Euro							
All times	4191	325	705	1700	4528	10422	8450
1986 - 1989	3539	361	722	1517	3250	9605	625
2006 - 2009	4976	385	841	1925	5441	11811	2218
Relative share of pay for performance (% of monthly earnings)							
All times	90.3%	12.2%	24.3%	53.3%	108.8%	207.6%	8450
1986 - 1989	83.1%	13.4%	26.1%	55.0%	96.2%	193.0%	625
2006 - 2009	102.3%	12.9%	28.1%	61.2%	125.0%	235.3%	2218

Results include only those individuals, who do receive pay for performance.

Figure 7: Volume of PP over the wage distribution

Absolute amount of PP

Relative amount of PP

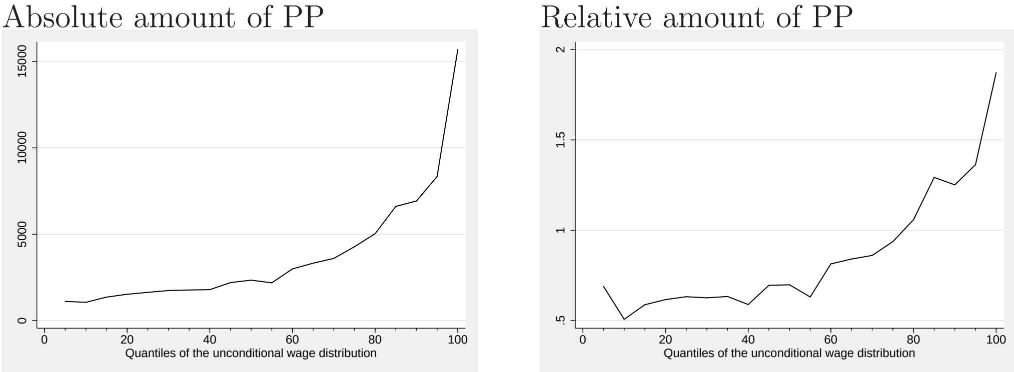

Table 5: Descriptive Statistics

	All years		PP jobs		Non-PP jobs	
	PP job	Non-PP job	1986-1989	2006-2009	1986-1989	2006-2009
Share of this job-type	0.24	0.75	0.17	0.32	0.82	0.67
Female	0.23	0.29	0.20	0.28	0.25	0.34
No training degree	0.06	0.13	0.08	0.03	0.17	0.09
Training degree	0.68	0.73	0.72	0.65	0.73	0.74
University degree	0.26	0.13	0.20	0.32	0.09	0.17
Age	42.5	41.0	42.2	43.3	40.7	41.7
Tenure	14.3	10.7	14.7	13.9	11.5	10.2
Temporary contract	0.02	0.04	0.00	0.03	0.02	0.07
Firm size	1654	887	1760	1562	993	748
Occupation:						
Untrained worker	0.01	0.04	0.01	0.01	0.04	0.04
Semi-trained worker	0.09	0.19	0.09	0.09	0.21	0.17
Trained worker	0.14	0.23	0.15	0.13	0.25	0.21
Foreman	0.09	0.07	0.10	0.07	0.08	0.06
Simple tasks	0.04	0.09	0.04	0.03	0.06	0.12
Qualified professional	0.28	0.23	0.31	0.29	0.24	0.24
Highly qualified professional	0.31	0.13	0.26	0.34	0.11	0.14
Managerial	0.04	0.01	0.05	0.03	0.01	0.01
Hourly wage	18.58	13.65	17.23	18.91	12.93	13.40
Log hourly wage	2.85	2.55	2.78	2.86	2.50	2.52
Number of observations	17,371	56,671	1,251	4,537	7,587	8,677

Table 6: Decomposition results within PP jobs

Quantile	10	25	50	75	90
Total Difference	0.039	0.070	0.102	0.116	0.117
(Standard error)	(0.022)	(0.016)	(0.015)	(0.018)	(0.022)
Coefficients Effect	0.028	0.061	0.090	0.084	0.085
(Standard error)	(0.029)	(0.016)	(0.014)	(0.015)	(0.021)
Characteristics Effect	0.011	0.009	0.012	0.032	0.032
(Standard error)	(0.021)	(0.013)	(0.014)	(0.015)	(0.015)

Table 7: Decomposition results within Non-PP jobs

Quantile	10	25	50	75	90
Total Difference	-0.052	-0.019	0.023	0.055	0.075
(Standard error)	(0.013)	(0.009)	(0.008)	(0.009)	(0.013)
Coefficients Effect	-0.007	0.021	0.049	0.062	0.064
(Standard error)	(0.013)	(0.009)	(0.008)	(0.009)	(0.012)
Characteristics Effect	-0.045	-0.040	-0.026	-0.008	0.011
(Standard error)	(0.009)	(0.006)	(0.006)	(0.007)	(0.009)

Table 8: Decomposition results of wage difference between job types

Quantile	10	25	50	75	90
			Early (1986-1989)		
Total Difference	0.251	0.243	0.259	0.296	0.318
(Standard error)	(0.016)	(0.013)	(0.013)	(0.016)	(0.020)
Coefficients Effect	0.065	0.056	0.069	0.086	0.109
(Standard error)	(0.014)	(0.012)	(0.012)	(0.012)	(0.018)
Characteristics Effect	0.186	0.188	0.190	0.219	0.209
(Standard error)	(0.012)	(0.010)	(0.009)	(0.012)	(0.013)
			Late (2006-2009)		
Total Difference	0.343	0.332	0.338	0.358	0.361
(Standard error)	(0.020)	(0.014)	(0.012)	(0.013)	(0.016)
Coefficients Effect	0.063	0.082	0.108	0.126	0.126
(Standard error)	(0.017)	(0.012)	(0.010)	(0.012)	(0.016)
Characteristics Effect	0.280	0.251	0.230	0.232	0.235
(Standard error)	(0.012)	(0.010)	(0.010)	(0.010)	(0.012)

Figure 8: Sensitivity check: Permutation of the order of decomposition

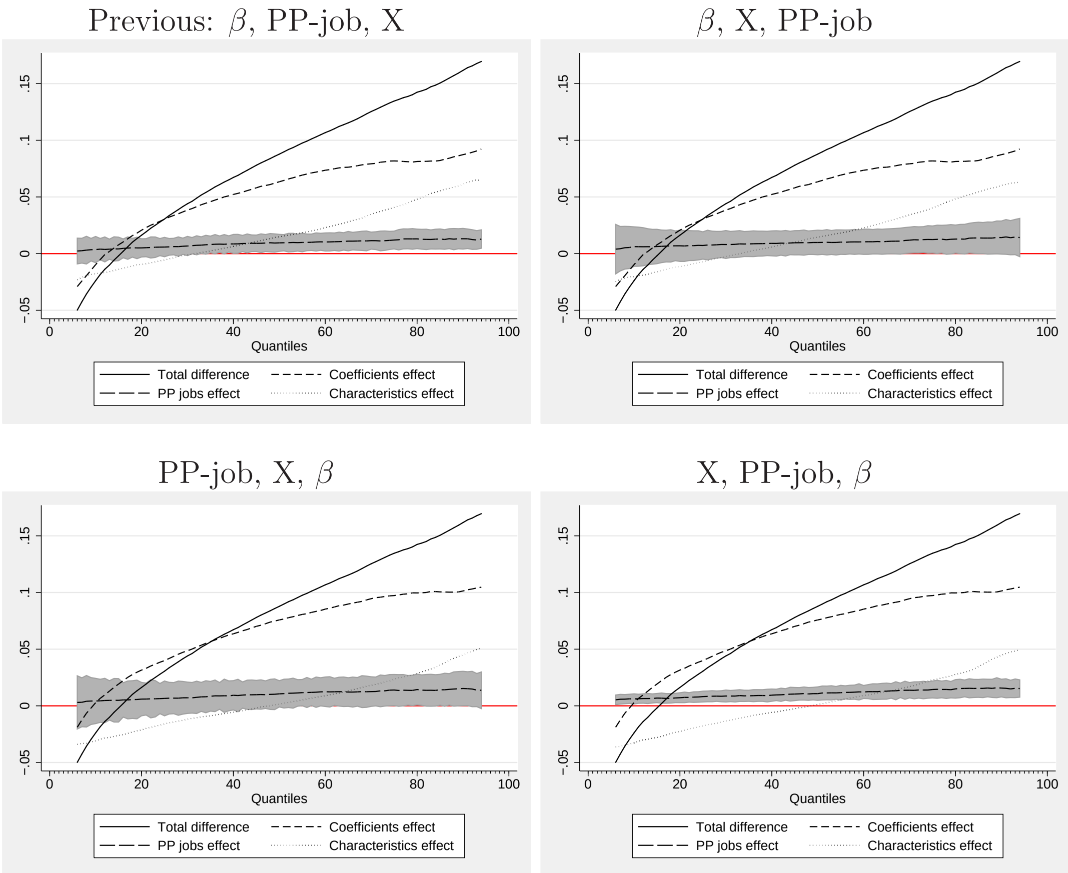

Figure 9: Sensitivtiy check: Subsample of long stayers in the survey

With prediction | Without prediction

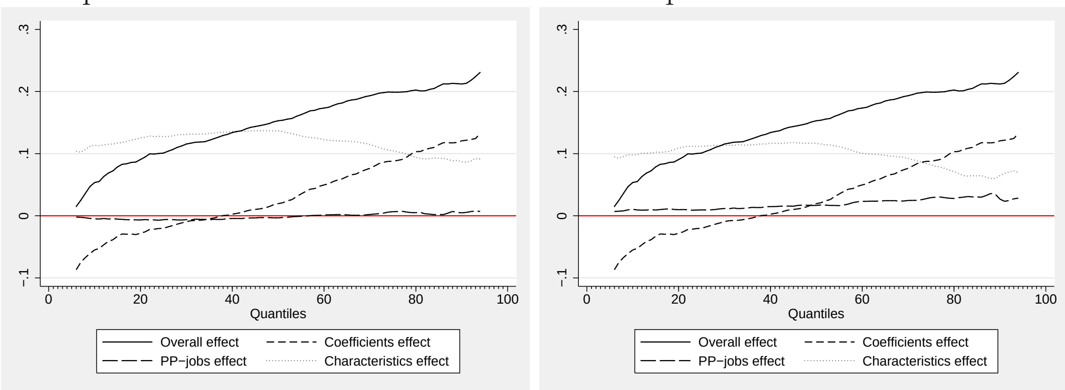

Table 9: Sensitivtiy check: Subsample of long stayers in the survey

Quantile	10	25	50	75	90
Total Difference	0.053	0.101	0.153	0.199	0.212
Coefficients Effect	-0.055	-0.020	0.020	0.088	0.121
With regular prediction procedure					
PP-jobs Effect	-0.005	-0.006	-0.003	0.007	0.005
Characteristics Effect	0.113	0.127	0.137	0.105	0.087
Switching the prediction procedure off					
PP-jobs Effect	0.010	0.009	0.017	0.029	0.027
Characteristics Effect	0.098	0.112	0.117	0.082	0.065