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Adjustment of Deferred Compensation Schemes, Fairness Concerns, and Hiring of Older Workers

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Abstract

Hutchens (1986, Journal of Labor Economics 4(4), pp. 439-457) argues that deferred compensation schemes impose fixed-costs to firms and, therefore, they employ older workers but prefer to hire younger workers. This paper shows that deferred compensation can be a recruitment barrier even without these fixed-costs, because adjustments of wage-tenure profiles for older new entrants can lead to adverse incentive effects from a fairness perspective. A personnel data set and a linked employer-employee data set reveal that wage-tenure profiles of white-collar workers are indeed adjusted according to entry age but that firms still hire few older workers.

JEL Classification: J14, J31, J33, M51, M52

Keywords: deferred compensation, entry age, fairness, internal labor markets, wages

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1. Introduction

Why do firms employ older workers but do not hire them? This question has been analyzed in several studies and the answers are important when considering the lower reemployment probabilities and often long unemployment durations of older workers as well as the need to activate them as a response to the upcoming demographic challenges (e.g., Chan and Stevens, 2001). In international comparison, unemployment rates – especially long-term unemployment – are relatively higher and labor force participation rates are relatively lower for older workers in Germany than in most OECD countries including the U.S., the U.K., and the Scandinavian countries (OECD, 2005). There are two dominant economic rationales for firms not to hire older workers (Hutchens, 1986; Hutchens, 1988). One is human capital theory and especially firm investments in specific human capital (Becker, 1962). Another is deferred compensation as an incentive scheme (Lazear, 1979; Lazear, 1981), on which this paper focuses.

At first, I review the empirical literature on wage-seniority profiles as well as on hiring of older workers (Section 2). Next, the theory of deferred compensation as a recruitment barrier for older workers is discussed (Section 3). Third, a personnel data set of a large German company is examined (Section 4). Whereas all reviewed studies on hiring of older workers have used individual data across firms or establishment data sets, no study has analyzed personnel data of a single company. Thus, this paper is the first that provides an intra-firm perspective on wage profiles and employment of older workers. Though it is only a quantitative case study, it can help us to understand wage and employment policies of firms toward older workers. Furthermore, German linked employer-employee data (LIAB) are analyzed to allow some generalization of the results (Section 5). The paper concludes with a short summary and discussion (Section 6).

A special contribution to the literature is made by developing a new rationale why firms with deferred compensation schemes do not hire older workers. While deferred compensation is likely to foster long-term implicit contracts and ongoing employment of older workers, it might also discourage firms from hiring older workers. Hutchens (1986) developed a prominent rationale in his article "Delayed Payment Contracts and a Firm's Propensity to Hire Older Workers" in the Journal of Labor Economics. Hutchens' (1986) argument of deferred compensation as recruitment barrier for older workers, however, is solely based on the idea of fixed costs associated with deferred compensation. These fixed costs arise because the firm has to compensate a worker for the risk of being fired before the end of the contract (firm cheating). I think that there are good reasons to believe that in many cases the probability of such firm cheating is in fact close to zero (e.g., reputation effects, severance pay, employment protection laws, works councils and unions). These reasons make it not so likely that firms cheat on workers and, consequently, Hutchens' (1986) fixed cost explanation for deferred compensation as recruitment barrier for older workers not so convincing anymore.

In this paper, I propose several strategies a firm might choose to adjust the wage profiles for newly hired older workers in deferred compensation schemes. All adjustment strategies have in common that fairness (equity) perceptions of workers might be negatively affected because either absolute wage levels or wage growths favor young or old workers. If the wage policy is perceived as unfair, workers might reduce their work effort. A firm, therefore, might prefer not to adjust deferred compensation schemes and rather hire homogenous entrants in terms of entry age, which are likely to be young. This is a new rationale why firms with deferred compensation schemes employ older workers but do not hire them, which does not build on Hutchens' (1986) fixed cost argument that workers need to be compensated for the risk of firm cheating but on possible unfairness perceptions of workers and consequent adverse incentive effects.

The empirical analysis of personnel records shows that the analyzed firm employs a quite large share of older workers but does not hire many older workers. Estimated earnings functions with interaction effects between tenure and entry age indicate that wage-tenure profiles are adjusted according to entry age. On the one hand, workers with older entry age earn higher wage levels but have lower wage growths than younger workers at every point of tenure. On the other hand, workers with older entry age earn lower wage levels but have higher wage growths than younger workers at every point of age. This might cause inequity and downward adjustment of work effort to re-establish equity so that the firm might hire fewer older workers than it would otherwise do. The findings also hold on average for a large representative German linked employer-employee data set. Moreover, this data set is suitable to analyze the different strategies firms might choose to adjust wage profiles with respect to entry age. The dominant strategy seems to be the same as in the analyzed single company because most firms pay higher entry wages and flatter wage-tenure paths to older new entrants.

2. Previous Empirical Evidence

2.1 Wage-Seniority Profiles

Employment duration can be divided into general labor market experience and firm tenure. In the framework of human capital theory, experience serves as a proxy for general human capital and tenure as a proxy for firm specific human capital (Becker, 1962). The rates of return to human capital investments are usually estimated in some form of the Mincer earnings function (Mincer, 1974), which mostly show a concave relationship between wages experience as well as tenure (Murphy and Welch, 1990; Polachek, 2007). However, methodological issues have been of concern as the estimated rates of return might be biased due to unobserved individual and job characteristics as well as matching quality. Altonji and Shakotko (1987) developed an instrumental variable approach to deal with the issue of unobserved heterogeneity. They found that the rates of return to tenure are much smaller than previously estimated and experience accounts for the largest share of wage growth during a worker's career. Abraham and Farber (1987) also found a strong upward bias in the rates of return to tenure that reflects an omitted variable bias. Topel (1991), however, could only find a small upward bias in conventional OLS estimates and shows that the impact of tenure on wages is substantial. Though there is an ongoing debate about methodological issues and the size of the effects (e.g., Altonji and Williams, 2005; Dustmann and Meghir, 2005; Zwick, 2008), it seems uncontested that seniority has a positive effect on wages.

Whereas most studies use individual data across firms that are subject to job heterogeneity and measurement errors, some recent studies use personnel data of single companies in several countries. The estimated earnings functions in those studies reveal also a positive and concave relationship between wages and seniority (Medoff and Abraham, 1980; Medoff and Abraham, 1981; Baker et al., 1994a; Baker et al., 1994b; Lazear, 1999; Flabbi and Ichino, 2001; Treble et al., 2001; Dohmen, 2004; Grund, 2005; Lin, 2005; Shaw and Lazear, 2008; Pfeifer, 2008). Some of these studies also estimate the relationship between productivity and seniority, which is less strong than between wages and seniority (Medoff and Abraham, 1980; Medoff and Abraham, 1981; Lazear and Moore, 1984; Lazear, 1999; Flabbi and Ichino, 2001; Dohmen, 2004; Shaw and Lazear, 2008). The result that wages increase more than productivity with tenure are not consistent with human capital theory but with the theory of deferred compensation as an incentive mechanism (Lazear, 1979; Lazear, 1981; Hutchens, 1989).

2.2 Hiring of Older Workers

Hutchens (1986) argues that deferred compensation schemes impose fixed-costs to firms and, therefore, these firms employ older workers but prefer to hire younger workers. He also finds empirical evidence for the U.S. (National Longitudinal Survey of Men) that jobs for which older workers (over age 55) are employed but not hired are more likely to have pensions, long job tenure, high wages, and mandatory retirement, which is consistent with his argument. The existence of pensions, long tenure, and high wages are, however, also consistent with the theory of firm-specific human capital because it also imposes fixed-costs to firms (Becker, 1962; Oi, 1962). Hutchens (1988) shows for the U.S. (Current Population Survey) that job opportunities decline with age, which is also consistent with deferred compensation as well as general and specific human capital. Recently hired older workers (over age 55) are concentrated in a smaller set of occupations and industries than all older workers and recently hired younger workers. Hirsch et al. (2000) report in an occupation based view for the U.S. (Current Population Survey) that older workers (over age 50) are less likely to enter occupations with steeper wage profiles, pension benefits, and computer usage. Scott et al. (1995) show with U.S. data (own survey and Current Population Survey) that firms with health care plans hire fewer older workers (over age 55) and that the costs of these health care plans have a negative impact. Hu (2003) finds for the U.S. (Current Population Survey and Bureau of Labor Statistics Survey of Employer-Provided Training) that larger firms prefer to hire younger workers, because larger firms invest more in firm specific human capital and younger workers have longer potential tenure, which makes their employment more profitable.

Heywood et al. (1999) find for Hong Kong (own survey) that firms hire fewer older workers (over age 35) and prefer to hire younger workers if their workforce is higher skilled, has more tenure, and gets pensions and if anticipated service length is an important hiring criterion. Daniel and Heywood (2007) report evidence from U.K. linked employer-employee data (Workplace Employment Relations Survey) that firms with pensions, higher average wage growth, and preference for internal recruitments (promotions) hire fewer older workers (over age 50). Moreover, they report mixed results for training, which seems to have overall a rather negative impact on hiring of older workers. Adams and Heywood (2007) use Australian linked employer-employee data (Australian Workplace Industrial Relations Survey) to analyze the determinants of being an older hire and the age when hired. They find that higher qualified workers and workers who received training in the firm are less likely to be an older hire and are significantly younger. Further, new hires tend to be younger in firms with a higher tenure-wage ratio as a measure of the steepness of earnings profiles.

Heywood et al. (2008) report evidence from German establishment data (Hannover Firm Panel) that proxies for deferred compensation (pensions and share ownership) are negatively correlated with the propensity of hiring workers older than 50 years, whereas proxies for contemporaneous compensation (profit sharing and high wages) are positively correlated with the hiring of older workers. Firms with a more skilled workforce tend to hire younger workers. Surprisingly, financing of further training for blue-collar workers has a positive impact on hiring of older workers. Heywood et al. (2008), moreover, find that firms with pensions employ a higher share of older workers, whereas firms with share ownership and profit sharing employ a lower share of older workers in their workforce. Bellmann and Brussig (2007) also analyze German establishment data (IAB Establishment Panel) and find that only about a quarter of all firms receive applications from older workers (over age 50). Half of these firms hired older workers. Bellmann and Brussig (2007) conclude that job search behavior of older workers and signaling of firms about job opportunities for older workers play a key role in explaining their results. Zwick (2008) uses German linked employer-employee data (LIAB) to show that firms with steeper wage-tenure profiles have higher tenured workers but hire fewer older workers (over age 50).

3. Deferred Compensation and Adjustment of Wage-Tenure Profiles

Lazear's (1979; 1981) deferred compensation theory focuses on the incentive effect of upward sloping wage-tenure profiles. Workers receive wages below their productivity during the beginning of their career and wages above their productivity later in their career so that incentives to shirk – and to lose the higher wages – are minimized. The upward sloping wage profile does not reflect an increasing productivity but steeper wage profiles are associated with higher incentives over the entire contract length (Hutchens, 1989). Lazear (1979, pp. 1270-1271; 1981, pp. 610-611) argues that several wage paths are possible within the theory of deferred compensation, ranging from flat wage-tenure profiles with constant payments (e.g., bond paid by worker at the beginning of the contract and lump sum paid by firm at the end of the contract) to upward sloping linear and conventional concave wage profiles.[1]

While deferred compensation is likely to foster long-term implicit contracts and ongoing employment of older workers, it might also discourage firms from hiring older workers. This popular view is highlighted in most economic research on the hiring problem of older workers, which started with Hutchens' (1986) article "Delayed Payment Contracts and a Firm's Propensity to Hire Older Workers" in the Journal of Labor Economics. Hutchens (1986, pp. 441-442) wrote:

> *"It is not, however, obvious why the firm does not hire both long-term and short-term workers under such contracts. To introduce issues, suppose that the firm in figure 1* [see Figure 1 in this paper] *usually hires 25-year-olds who work until age 65. They are underpaid for the first 20 years and overpaid for the last 20 years. If a new 55-year-old with the same VMP as workers already with the firm applied for a job, would the firm hire him? Clearly, it would not hire him if it must pay the new worker the same wage that it pays 55-year-olds already with the firm. Since these previously hired older workers receive a wage that exceeds their VMP, a profit-maximizing firm would not pay a new worker such a high wage. The*

[1] As in Germany a legal retirement age of 65 to 67 years exists, the problem of mandatory retirement age in contracts discussed in Lazear (1979) is not of major concern in the German case.

> *question becomes more interesting if the firm can offer a new worker a different wage path. One would think that the firm could enter into a 10-year contract with the new older worker that perhaps underpays him over the first 5 years and overpays him over the last 5 years. In this case why would the firm prefer the long contract with the young worker to the short contract with the older worker, ceteris paribus?*
>
> *This paper argues that the longer contract is preferred because delayed payment schemes imply a form of fixed costs."*

Hutchens' (1986) argument of deferred compensation as recruitment barrier for older workers is solely based on the idea of fixed costs associated with deferred compensation. These fixed costs arise because the firm has to compensate a worker for the risk of being fired before the end of the contract, in which case the firm does not pay the worker a lump sum at the end of the contract and retains the worker's bond paid at the start of the contract. As Hutchens (1986, p. 449) acknowledges: "*If workers are certain that the firm will not renege on the contract, the fixed cost is zero. [...] Thus fixed costs arise only when there is a finite probability of firm cheating.*"

I think that there are good reasons to believe that in many cases the probability of firm cheating is in fact close to zero. Lazear already argued that reputation effects might induce firms not to cheat on workers (Lazear, 1981, pp. 607-608) and efficient contracts contain severance pay as compensation for cheating (Lazear, 1981, p. 614; see also James and Johnson, 2000)[2], which do not impose fixed costs on non cheating firms.

[2] Even though German labor law does not clearly regulate severance payments, many dismissed employees receive severance payments that are either voluntary paid by firms or decided in court decisions (Grund, 2006). The upper limit of severance pay is denominated in the law. For older employees with many years of tenure it is 18 monthly wages. A legal reform in 2004 sets severance payments to 0.5 monthly wages per year of tenure.

Moreover, unions and works councils could be efficient institutions to monitor firm behavior (Lazear, 1981, p. 619). In Germany, works councils are involved in layoff processes and often bargain severance payments in social compensation plans ("Sozialplan") (Eger, 2004; Grund, 2006). Another restraint for firm cheating is the legal protection against dismissals like just-cause employment policies (James and Johnson, 2000) and age discrimination laws (Neumark and Stock, 1999; Adams, 2004).[3] In Germany, the employer has to prove lack of capability ("personenbedingte Kündigung") or misconduct ("verhaltensbedingte Kündigung") of the dismissed employee and in case of layoffs due to economic reasons ("betriebsbedingte Kündigung") social selection criteria ("Sozialauswahl") have to be followed, from which seniority and age are two explicit criteria (Seifert and Funkel-Hötzel, 2003; Eger, 2004; Pfeifer, 2006, pp. 134-135). All these arguments make it not so likely that firms cheat on workers and, therefore, Hutchens' (1986) fixed cost explanation for deferred compensation as recruitment barrier for older workers not so convincing anymore. So ex-ante it cannot be ruled out that firms adjust wage profiles for newly hired older workers to maintain incentives.

For simplicity of illustration, I use the simple case in which the upward sloping wage-tenure profile is linear (*W*), productivity (*VMP*) is constant over the career, and young

[3] Neumark and Stock (1999) report empirical evidence for the U.S. that age discrimination laws steepen age-earnings profiles, which can be interpreted as enforcement of delayed payment contracts. As firms would have a stronger incentive to cheat if the wage profile is steeper (Lazear, 1981, p. 608), age discrimination laws might serve as a precommitment mechanism that encourages workers to enter delayed payment contracts. Adams (2004, p. 225, footnote 8) brings forward the argument that "*If laws allay worker fears that a firm will renege completely (as would be the case if enforcement of the laws were strong and punishment severe), we could see the fixed hiring cost associated with delayed payment contracts described by Hutchens disappear.*"

and old workers have the same productivity. Capital markets are perfect, the rate of discount is zero, and the present value of *W* is equal to the present value of *VMP* over the entire contract length. The general case is depicted in Figure 1 and similar to Lazear (1979, p. 1265; 1981, p. 607) and Hutchens (1986, p. 441). For the purpose of this paper, it is helpful not only to consider tenure (see diagram at the top) but also age (see diagram at the bottom) on the abscissas. As Hutchens (1986, p. 441, see above quote) has pointed out, a firm would certainly not hire an older worker (e.g., 55-year-old with 10 years of contract length) if he receives the same wage as workers at the same age, who are already with the firm and have been underpaid at the beginning of the contract, because this new older worker would be paid above his *VMP* throughout the entire contract length (see diagram at the bottom of Figure 1). On the other hand, an older worker would certainly not agree to work for the same entry wage as a young worker because he would be underpaid throughout the remaining contract length if both workers would have the same wage-tenure profile (see diagram at the top of Figure 1). I suggest simple adjustment strategies of delayed compensation to solve this dilemma. In order to make the adjustment strategies concrete, I consider a young worker at the entry age of 25 with 40 years of contract length and an old worker at the entry age of 55 with 10 years of contract length.[4] Note that throughout the subsequent discussion the terms young and old workers refer to the entry age and not to the actual age and that wage-tenure profiles and not wage-age profiles are discussed even if age is on the abscissa.

- <u>insert Figure 1 about here</u>

[4] I assume a legal retirement age of 65 years for both workers. This example is similar to Hutchens (1986).

Figure 1 also includes possible adjustment strategies. At first, the firm could offer the young and the old worker the same entry wages. The wage-tenure profile needs to be steeper for the old worker so that he participates. However, the firm could offer the young and the old worker also the same slope of wage-tenure profiles. In this scenario, the entry wage needs to be higher for the old worker so that he participates. If the firm pays a high enough entry wage to the old worker, the wage-tenure profile could even be flatter for the old worker than for the young worker. As the firm would never pay an entry wage above the productivity and a flatter wage-tenure profile has lower incentive effects, the adjustment possibilities are constrained.[5] The scenarios indicate a negative correlation between entry wages and wage growth within deferred compensation schemes.

Let us now consider fairness concerns and possible adverse incentive effects resulting from adjustment strategies of deferred compensation. According to equity theory, a worker feels unfairly treated and will reduce his work effort if the ratio between his outcomes and his inputs is lower than the ratio for other workers in a reference group (e.g., Adams, 1965; Akerlof and Yellen, 1990; Rees, 1993; Pfeifer, 2009a). All adjustment strategies of deferred compensation imply that a worker's present value of total income equals his present value of productivity over the entire contract length. If W is the wage (outcome), VMP the value of marginal product (input), and t a time index for tenure, we can write this assumption as $\sum W_t = \sum VMP_t$. If we now consider young workers, denoted with Y, and old workers, denoted with O, it is $\sum W_{Yt} = \sum VMP_{Yt}$ as well as $\sum W_{Ot} = \sum VMP_{Ot}$. For rational workers equity between young and old is always given

[5] In the extreme case, the firm could pay a worker an entry wage that equals his productivity without any future wage growth; thus, no delayed payment is used anymore.

because $\sum W_{Yt}/\sum VMP_{Yt}=\sum W_{Ot}/\sum VMP_{Ot}=1$, which can be rewritten as $\sum W_{Yt}/\sum W_{Ot}=\sum VMP_{Yt}/\sum VMP_{Ot}=1$. However, workers might not be that rational and short-term concerns might also be important to workers (e.g., Kahneman et al., 1986; Akerlof and Yellen, 1987; Thaler et al. 1997; O'Donoghue and Rabin, 1999; Kahneman, 2003). Hence, emotional fairness perceptions at every point in time might matter and distort equity. If we assume that $VMP_Y=VMP_O$ and VMP is constant over time, only W_{Yt} and W_{Ot} play a role and unfairness evolves if $W_{Yt}\neq W_{Ot}$ or $W_{Yt}/W_{Ot}\neq 1$, respectively.

On the one hand, all three adjustment scenarios imply that the wage of the old worker is higher than the wage of the young worker at every point of tenure ($W_{Yt}<W_{Ot}$), which means that the young worker might perceive his outcome as unfair and reduces his inputs, i.e., he reduces his VMP_Y to establish equity again. On the other hand, an old worker might compare himself with workers at the same age who have entered the firm when they were young. As the adjustment scenarios have shown that the wage of the old worker is lower than the wage of the young worker at every point of age a ($W_{Ya}>W_{Oa}$), the old worker might perceive his outcome as unfair and reduces his inputs, i.e., he reduces his VMP_O to re-establish equity. In addition to the wage level W, workers might also interpret wage growth dW as outcome so that unfairness evolves if $dW_{Yt}\neq dW_{Ot}$ ($dW_{Yt}/dW_{Ot}\neq 1$) or $dW_{Ya}\neq dW_{Oa}$ ($dW_{Ya}/dW_{Oa}\neq 1$).[6]

Overall, all adjustment strategies can lead to adverse incentive effects if workers' entry ages differ, either because the absolute wage levels or wage growths favor the young or

[6] Several studies report that wage growth has a positive effect on satisfaction as a proxy for utility and a negative effect on quit behavior, which is negatively correlated with utility (e.g., Galizzi and Lang, 1998; Clark, 1999; Grund and Sliwka, 2007; Kwon and Meyersson Milgrom, 2007; Cornelissen, 2009).

the old worker. A firm might, therefore, prefer not to adjust deferred compensation schemes and to hire homogenous entrants in terms of entry age. Because a firm usually faces more young than old job applicants (Bellmann and Brussig, 2007), it is rational to recruit young workers. If the firm recruits an older worker, this older worker needs to have a sufficient high productivity to offset the adverse incentive effects. This can be interpreted quite similar as handicapping of outside job applicants to maintain incentives for insiders in tournament models (Chan, 1996; Pfeifer, 2009b). The presented fairness and adverse incentive argument is a new rationale why firms with deferred compensation schemes employ older workers but do not hire them, which does not build on Hutchens' (1986) fixed cost argument that workers need to be compensated for the risk of firm cheating.

4. Evidence from Personnel Data

4.1 Data and Descriptive Statistics

The personnel data set was extracted from computerized personnel records of a large German limited liability company that produces innovative products for the world market. The company has a works council and is subject to an industry wide collective contract. The personnel records contain information on all employees in the company's headquarter on a monthly basis from January 1999 to December 2005. The subsequent empirical analyses focus on white-collar workers as deferred compensation is more important in white-collar jobs than in blue-collar jobs. Apprentices, trainees, employees in early retirement schemes, and employees who are absent on a permanent basis (e.g., parental leave) are excluded from the sample. The used sample includes 73,293 monthly observations of 1,250 white-collar workers in an unbalanced panel design.[7]

Table 1 informs about age and entry age categories across the sample. It can be seen that entry age is significantly lower than age and that entry age has less variance than age. About 3 percent of the workers are under 25 years old, 21 percent are between 25 and 35 years, 36 percent are between 35 and 45 years, 30 percent are between 45 and 55 years, and 10 percent are over 55 years. 37 percent of these workers have entered the firm when they were younger than 25 years, 46 percent were between 25 and 35 years, 14 percent were between 35 and 45 years, 2.5 percent were between 45 and 55 years, and almost no worker has an entry age over the age of 55 years. Thus, even though the firm employs many old workers, it seldom hires an old worker. This finding, however, might not necessarily reflect discrimination of older workers but simply less applications of older workers for new jobs (Bellmann and Brussig, 2007). Unfortunately, no information about not hired applicants is available in the data.

- insert Table 1 about here

4.2 Wage-Tenure Profiles and Entry Age

The personnel data are used to analyze the effect of tenure on wages and the effect of differences in entry age on wage-tenure profiles. The dependent variable is the log of real hourly wages measured in 1999 Euros (see Appendix A for details about the computation of real wages). The regressors are tenure in years and its higher terms,

[7] For a detailed description of the personnel data see Pfeifer (2009c).

dummies for the entry age categories, a female dummy, and dummies for highest schooling degrees. As was shown in the descriptive statistics that virtually no worker older than 55 years has entered the firm, this last category is merged with the category 45 to 55 years, which results into the new entry age category older than 45 years. Table 2 informs about the descriptive statistics of the variables.

- insert Table 2 about here

To exploit the panel nature of the data, I estimate earnings functions with random effects GLS (generalized least squares) as well as fixed effects (within estimator) OLS (see Appendix B for a description of random and fixed effects models). In all random effects estimates the Breusch and Pagan (1980) Lagrange multiplier test shows that the random effects model is more appropriate than cross sectional OLS, because the null hypothesis that the variance of the random effects equals zero is rejected at high significance levels. In all fixed effects estimates the F-test indicates that the fixed effects are jointly significant at high levels. The underlying assumption in the random effects model of no correlation between the random effects and the covariates might be critical and random effects estimators might be inconsistent, whereas the fixed effects estimators might be inefficient. Hence, the Hausman (1978) specification test is applied to compare results between the random effects and the fixed effects models. Though differences between the two models are small[8], the Hausman test rejects the null hypothesis of no systematic differences in all estimates at high significance levels

[8] Let v_i denote the worker specific effect and ε_{it} the 'usual' residual. σ_v and σ_ε are larger zero in all estimates so that the random effects model uses information available from the between and the within estimator. However, as σ_v is significantly larger than σ_ε and the fraction of variance due to v_i is larger 0.9, the random effects results are close to the fixed effects results. For further descriptions of the random effects and fixed effects models see Appendix B.

except for one specification (linear tenure in Table 3). The fixed effects model is, therefore, the more appropriate estimation strategy. A disadvantage of the fixed effects model is, however, that only wages and tenure vary over time so that no coefficients for the time invariant variables entry age, gender, and schooling can be estimated, i.e., no information about wage levels for entry age can be obtained.

The results for the average impact of tenure on wages are presented in Table 3. Tenure is included in a linear fashion in the first specification for the random effects model and in the second specification for the fixed effects model. One year more tenure increases the wage on average by 1.5 percent. Specifications three and four include also higher terms of tenure until the quartic term to allow for non-linearity (Murphy and Welch, 1990). The estimated wage-tenure profiles are concave and flatten out strongly after approximately 20 years of tenure. The time invariant control variables in the random effects models show furthermore that workers entering the firm with higher entry age receive a significant wage premium. Compared to workers with an entry age below 25 years, workers with an entry age between 25 and 35 years earn about 11 percent higher wages, workers with an entry age between 35 and 45 years earn about 24 percent more, and workers with an entry age over 45 years earn about 43 percent higher wages. This result can be interpreted in the way that older workers with the same tenure as younger workers earn ceteris paribus higher wages. One explanation can be the adjustment of wage profiles in the context of deferred compensation. Another explanation might be higher productivity due to acquisition of general human capital before entering the firm. Moreover, women earn on average about 16 percent lower wages than men.[9] The results

[9] For a discussion of the gender wage gap in the analyzed firm see Pfeifer and Sohr (2008).

for schooling indicate a wage premium for workers with a high school degree of about 4 percent and with a university degree of about 31 percent compared to workers with less than high school degrees.

- insert Table 3 about here

The impact of entry age on wage-tenure profiles is analyzed in re-estimating the previous specifications with additional interaction terms between entry age categories and tenure (see Table 4). Note that entry age categories are time invariant but can still be interacted with tenure in fixed effects models without obtaining a wage level effect for entry age. Even though the results of the linear specifications of tenure are included in the regression tables, only the results of the non-linear treatment of tenure will be discussed. As the interpretation of the coefficients is quite complex, the results are illustrated in graphs.

- insert Table 4 about here

Figure 2 informs about the results of the fixed effects model. As no information on the wage level is obtained from the fixed effects estimates, the predicted wage index is plotted over tenure, which starts with a wage level of 100 at the beginning of employment for all entry age groups. The wage-tenure profiles are flatter for each older entry age category. For example after the first ten years of tenure, the youngest entry age group has experienced a total wage growth of almost 36 percent, workers with an entry age between 25 and 35 years a wage growth of almost 31 percent, workers with an entry age between 35 and 45 years a wage growth of almost 22 percent, and workers in the oldest entry age group only a wage growth of about 15 percent.

- insert Figure 2 about here

Figure 3 plots the random effects results, which enables the inclusion of wage levels. The slopes of the wage-tenure profiles are virtually identical to the fixed effects estimates. From the upper diagram can be seen that not only entry wages of older entry age workers are higher but wage levels throughout the career, i.e., at every point of tenure older entry age workers earn higher wages than younger entry age workers. While the upper diagram illustrates the wage-tenure profiles from a tenure perspective, the diagram at the bottom illustrates them from an age perspective. For this purpose the wage-tenure profiles are positioned to the right by an additional 10 years for every older entry age category.[10] From this age perspective can be seen that workers in older entry age categories earn lower wages but have higher wage growths than workers at the same age with longer tenure (younger entry age categories).

- insert Figure 3 about here

The findings strongly support the view that the analyzed firm adjusts wage profiles according to the entry age of new workers. But the results also show that adjustment of deferred compensation is a source of inequity. From a tenure perspective, wages are higher and wage growths are lower at every point of tenure for workers with older entry age. From an age perspective, wages are lower and wage growths are higher at every point of age for workers with older entry age. Consequently, young and old workers might adjust work effort downwards to re-establish equity. These adverse incentive effects due to fairness perceptions might be the rationale for the firm not to hire more older workers even if wage-tenure profiles can be adjusted with respect to entry age.

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[10] The adjustment by 10 years per entry age category is feasible because means as well as minima and maxima in entry age differ by approximately 10 years between categories.

5. Evidence from Linked Employer-Employee Data

5.1 Data and Descriptive Statistics

A large representative data set is used in this section to allow some generalization of the previous findings. Since we are interested in wage-tenure profiles in firms, the necessary data needs to be a linked employer-employee data set, which contains information on as many workers in a given firm as possible. The linked employer-employee data set at the Institute for Employment Research (IAB), called LIAB, fulfills this requirement (Alda et al., 2005). The LIAB links employer side information from the IAB Establishment Panel with employee information from process-produced person specific data.

The IAB Establishment Panel is a yearly survey that includes a random sample of firms with at least one employee covered by social security. The sample is drawn from stratification cells of establishment size classes and industries. The firms are asked about their employment structure, personnel policy etc. For the purpose of this study, information about commitment to union bargained collective contracts, existence of a works council, the share of qualified employees, establishment age, location in East Germany, establishment size, and industry are used, which are all available on a yearly basis. The process-produced person specific data stems basically from the notification procedure for unemployment, pension, and health insurances. At the start and at the end of an employment relationship as well as on the last day of each year, employers have to notify the social security agencies about all employees that are covered by social security. The information used for the subsequent analysis are gender, age, tenure, entry age, schooling, and daily wage in Euros. The daily wage is censored at the upper earnings limit for social security contributions, i.e., we observe too low wages for high wage workers (see Appendix C for a discussion of the censored wage problem).[11] Another problem is that the data comprise no information about working hours. Therefore, only fulltime employed white-collar workers aged from 18 to 65 years, who are covered by social security, are included in the analysis. As earnings functions on the firm-level are estimated in the next section, only firms with at least 100 workers in every observation year are included. The final sample contains 3,997,114 yearly observations of 1,526,575 fulltime white-collar workers in 3,109 different firms in an unbalanced panel design for the period from 2000 to 2005.[12] The average nominal daily wage is 115.59 Euros (standard deviation of 33.49), the average log nominal wage is 4.7 (SD=0.32), mean tenure is 10.05 years (SD=7.95), and mean entry age is 31.47 years (SD=9.18).[13]

Table 5 informs about age and entry age categories across the entire sample. The results are quite similar to the results from the personnel data as entry age is significantly lower than age. Only a little more than a quarter of all employed workers is younger than 35 years, whereas more than two thirds of the workers have entered their firm at an age below 35 years. Even though more than ten percent of the workers are now older than 55 years, less than one percent has entered the firm at an age above 55. Hence, the

[11] Approximately eleven percent of the workers in the final sample have right-censored wages.

[12] I use the cross section version of the LIAB for the years 2000 to 2005 because the sample size of the IAB Establishment panel was increased in 2000 and because the notification procedure for social security has changed in 1999 (for detailed information about the LIAB like data description and codebooks see http://fdz.iab.de).

[13] Descriptive statistics for all control variables can be requested from the author.

statement that firms employ older workers but do not hire them is also valid in this large representative data set.

- insert Table 5 about here

5.2 Wage-Tenure Profiles and Entry Age

Because wages are censored at the upper earnings limit for social security contributions, censored regression models are applied to estimate earnings functions (see Appendix C). For censored regression models only random effects estimators are available, which have the advantage of enabling us to look at wage effects of entry age, too. The previous estimates with personnel data in Section 4.2 are largely replicated. The main difference is that the dependent variable is now the log of nominal daily wages instead of the log of real hourly wages. Included time dummies for observation years cover the issue of real wages as well as other aggregated influences. Furthermore, the regressions include additional control variables.

Table 6 informs about the results across the entire sample of all workers in all firms. The overall results confirm the findings from the analysis with personnel data. First, wages increase on average with tenure and entry age. Second, wage-tenure profiles are adjusted according to entry age, i.e., older entry age workers earn on average significant higher wages but have on average significant lower wage growth.[14]

[14] The results for the control variables are as usual (e.g., women earn lower wages, higher educated workers earn higher wages, wages in East Germany are lower, wages are on average higher in firms with collective contracts and works councils) and can be requested from the author.

- insert Table 6 about here

As different firms might pursue different adjustment strategies, the earnings functions are re-estimated for every single firm.[15] The first specification includes only tenure and entry age in years as well as the control variables. The second specification includes the additional interaction term between tenure and entry age. The distributions (kernel density estimation using Epanechnikov kernel function) of the estimated coefficients are depicted in Figure 4 and Figure 5. It can be seen that wages are positively correlated with tenure and entry age in almost all firms (see Figure 4). Moreover, many firms adjust wage-tenure profiles according to entry age, mostly with flatter wage-tenure profiles for older entry age workers (see Figure 5).

- insert Figure 4 about here

- insert Figure 5 about here

In the theoretical part of this paper (see Section 3), I have assumed that firms can adjust wage-tenure profiles in simple ways. On the one hand, firms can pay the same entry wage to young and old workers and offer old workers steeper wage profiles than young workers. On the other hand, firms can pay old workers higher entry wages to reduce the slope of their wage profiles. Thus, we should expect a negative correlation between the estimated coefficients for entry age and the coefficients for the interaction term between entry age and tenure. Indeed, a significant correlation coefficient of -0.65 is calculated, i.e., if entry age is more positively correlated with earnings, the wage-tenure profiles for older entry age workers are on average flatter in these firms. Figure 6 depicts the

[15] Only the linear specifications 3 and 4 in Table 6 are re-estimated on the firm-level to obtain a feasible number of coefficients so that they can be interpreted and their distribution across firms can be illustrated.

distributions of the estimated coefficients for entry age separately for firms with steeper (positive coefficient for the interaction term between entry age and tenure) and flatter (negative coefficient for the interaction term between entry age and tenure) wage-tenure profiles for older new entrants. Firms, in which older entry age workers have steeper wage-tenure profiles than younger workers, do not pay much higher entry wages, whereas firms, in which older entry age workers have flatter wage-tenure profiles than younger workers, pay significant higher entry wages. It should be noted that more than 80 percent of the firms in the sample pursue the latter adjustment strategy with flatter wage profiles and higher entry wages for older new entrants. Overall, the results are consistent with the adjustments of wage-tenure profiles discussed in Section 3.

- insert Figure 6 about here

6. Conclusion

The theoretical part of this paper has challenged Hutchens' (1986) fixed cost explanation for deferred compensation as recruitment barrier for older workers because there are several reasons why these fixed costs might be close to zero, especially in the German case (reputation effects, severance payments, unions, works councils, employment protection laws). Adjustment of wage profiles with respect to entry age was discussed in the context of deferred compensation. A disadvantage of all adjustment scenarios is that fairness concerns might be important to workers in the short-term (equity theory). Workers might feel unfairly treated and reduce their work effort if they receive lower wage levels or wage growths than workers in a comparison group. Thus, a firm might prefer to hire rather homogeneous workers in terms of entry age, which are likely to be younger workers because relatively fewer older workers apply for new jobs. This fairness argument is a new rationale in the literature why firms with deferred compensation schemes employ older workers but do not hire them.

The empirical analyses of personnel records and linked employer-employee data confirms that firms employ many old workers but seldom hire old workers although adjustments of wage profiles according to entry age occur. Estimated wage and wage growth profiles show that inequity perceptions and consequential adverse incentive effects might indeed arise. On the one hand, workers with older entry age earn higher wage levels but have lower wage growths than younger workers at every point of tenure. On the other hand, workers with older entry age earn lower wage levels but have higher wage growths than younger workers at every point of age. Firms might hire fewer older workers than they would do otherwise to avoid such inequality. Results from the linked employer-employee data, furthermore, support the theoretical consideration that firms have different adjustment strategies. Whereas most firms pay older new entrants higher entry wages and flatter wage-tenure profiles than young new entrants, some firms pay older new entrants steeper wage profiles but then without higher entry wages. This negative correlation between entry wages and wage growth is again consistent with the theoretical considerations made in this paper.

Both used data sets have their advantages and disadvantages. An obvious limitation of the personnel data set is that results of such a quantitative case study cannot per se be generalized. So a large representative linked employer-employee data set is examined, which unfortunately has the disadvantage of censored daily wages and no information about working hours. Wages and working hours are, however, precisely measured in the personnel data set. The combination of both data sets gives the fundamental results more persuasive power.

Another major limitation of the empirical analysis is that worker productivity is observed neither in one data set nor the other. Information about productivity would be ideal to distinguish accurately between deferred compensation and human capital effects on wage profiles. Nevertheless, the presented results from personnel record as well as linked employer-employee data are strongly consistent with the theoretical considerations about adverse incentive effects from adjustments of deferred compensation schemes as a recruitment barrier for older workers. Human capital explanations for the adjustment of wage profiles with respect to entry age, however, are not completely in line with the results as discussed in the subsequent paragraphs.

If we assume, on the one hand, that human capital is entirely general, productivity and earnings would be positively correlated with age as proxy for experience but not with tenure. Thus, older new entrants should earn higher entry wages than younger workers but the effect on the slope of the earnings profile should be different from the deferred compensation model. Linear wage profiles would imply the same slope for old and young new entrants. Concave wage profiles would imply the same slope from an age perspective but flatter wage profiles for older workers from a tenure perspective. If we assume, on the other hand, that human capital is entirely firm specific, productivity and earnings would be positively correlated with tenure but not with age. This implies that old and young workers earn the same entry wages and have the same wage-tenure profiles because they do not differ in their productivity. In an age perspective and with concave profiles, however, the older new entrant would have a steeper wage-tenure profile than the younger worker.

While the estimated adjustment of wage profiles in personnel data is in line with some of these implications, it also shows inconsistencies. First, it is inconsistent within the general human capital framework that concave wage profiles are steeper for older new entrants in the age perspective as found in the data. Second, the positive correlation of entry wages and entry age is inconsistent within the firm specific human capital framework. Since general and specific human capital often go hand in hand in the real world, the effects of entry age on human capital acquisition and hence on productivity and wages are far more complex. For example, the general part of human capital could be responsible for higher entry wages for older workers, whereas the specific part could be responsible for steeper profiles in an age perspective. Thus, further theoretical as well as empirical research, ideally with data on wages as well as productivity and training investments, is necessary to fully understand the mechanisms behind age-dependent adjustments of wage profiles.

References

Abraham, K.G., Farber, H.S. (1987). Job duration, seniority, and earnings. *American Economic Review* 77(3), 278-297.

Adams, J.S. (1965). Inequity in social exchange. *Advances in Experimental Social Psychology* 2, 267-299.

Adams, S.J. (2004). Age discrimination legislation and the employment of older workers. *Labour Economics* 11(2), 219-241.

Adams, S.J., Heywood, J.S. (2007). The age of hiring and deferred compensation: evidence from Australia. *Economic Record* 83(2), 174-190.

Akerlof, G.A., Yellen, J.L. (1987). Rational models of irrational behaviour. *American Economic Review* 77(2), 137-142.

Akerlof, G.A., Yellen, J.L. (1990). The fair wage-effort hypothesis and unemployment. *Quarterly Journal of Economics* 105(2), 255-283.

Alda, H., Bender, S., Gartner, H. (2005). The linked employer-employee dataset created from the IAB establishment panel and the process-produced data of the IAB (LIAB). *Schmollers Jahrbuch* 125(2), 327-336.

Altonji, J.G., Shakotko, R.A. (1987). Do wages rise with job seniority? *Review of Economic Studies* 54(3), 437-459.

Altonji, J.G., Williams, N. (2005). Do wages rise with job seniority? A reassessment. *Industrial and Labor Relations Review* 58(3), 370-397.

Baker, G., Gibbs, M., Holmstrom, B. (1994a). The internal economics of the firm: evidence from personnel data. *Quarterly Journal of Economics* 109(4), 881-919.

Baker, G., Gibbs, M., Holmstrom, B. (1994b). The wage policy of a firm. *Quarterly Journal of Economics* 109(4), 921-955.

Becker, G.S. (1962). Investment in human capital: a theoretical analysis. *Journal of Political Economy* 70(5, part 2), 9-49.

Bellmann, L., Brussig, M. (2007). Recruitment and job applications of older jobseekers from the establishments' perspective. *IZA Discussion Paper* No. 2721.

Breusch, T.S., Pagan, A.R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *Review of Economic Studies* 47(1), 239-253.

Chan, S., Stevens, A.H. (2001). Job loss and employment patterns of older workers. *Journal of Labor Economics* 19(2), 484-521.

Chan, W. (1996). External recruitment versus internal promotion. *Journal of Labor Economics* 14(4), 555-570.

Clark, A.E. (1999). Are wages habit-forming? Evidence from micro data. *Journal of Economic Behavior and Organization* 39(2), 179-200.

Cornelissen, T. (2009). The interaction of job satisfaction, job search, and job changes: an empirical investigation with German panel data. *Journal of Happiness Studies* 10(3), 367-384.

Daniel, K., Heywood, J.S. (2007). The determinants of hiring older workers: UK evidence. *Labour Economics* 14(1), 35-51.

Dohmen, T.J. (2004). Performance, seniority, and wages: formal salary systems and individual earnings profiles. *Labour Economics* 8(6), 741-763.

Dustmann, C., Meghir, C. (2005). Wages, experience and seniority. *Review of Economic Studies* 72(1), 77-108.

Eger, T. (2004). Opportunistic termination of employment contracts and legal protection against dismissal in Germany and the USA. *International Review of Law and Economics* 23(4), 381-403.

Flabbi, L., Ichino, A. (2001). Productivity, seniority and wages: new evidence from personnel data. *Labour Economics* 8(3), 359-387.

Galizzi, M., Lang, K. (1998). Relative wages, wage growth, and quit behaviour. *Journal of Labor Economics* 16(2), 367-391.

Greene, W.H. (2003). *Econometric analysis*. 5th edition, Pearson Education, Upper Saddle River.

Grund, C. (2005). The wage policy of firms: comparative evidence for the US and Germany from personnel data. *International Journal of Human Resource Management* 16(1), 104-119.

Grund, C. (2006). Severance payments for dismissed employees in Germany. *European Journal of Law and Economics* 22(1), 49-71.

Grund, C., Sliwka, D. (2007). Reference-dependent preferences and the impact of wage increases on job satisfaction: theory and evidence. *Journal of Institutional and Theoretical Economics* 163(2), 313-335.

Hausman, J.A. (1978). Specification tests in econometrics. *Econometrica* 46(6), 1251-1271.

Heywood, J.S., Ho, L.S., Wei, X. (1999). The determinants of hiring older workers: evidence from Hong Kong. *Industrial and Labor Relations Review* 52(3), 444-459.

Heywood, J.S., Jirjahn, U., Tsertsvardze, G. (2008). Hiring older workers and employing older workers: German evidence. *Journal of Population Economics* (forthcoming).

Hirsch, B.T., Macpherson, D.A., Hardy, M.A. (2000). Occupational age structure and access for older workers. *Industrial and Labor Relations Review* 53(3), 401-418.

Hu, L. (2003). The hiring decisions and compensation structures of large firms. *Industrial and Labor Relations Review* 56(4), 663-681.

Hutchens, R. (1986). Delayed payment contracts and a firm's propensity to hire older workers. *Journal of Labor Economics* 4(4), 439-457.

Hutchens, R.M. (1988). Do job opportunities decline with age? *Industrial and Labor Relations Review* 42(1), 89-99.

Hutchens, R.M. (1989). Seniority, wages and productivity: a turbulent decade. *Journal of Economic Perspectives* 3(4), 49-64.

James, H.S. Jr., Johnson, D.M. (2000). Just-cause provisions, severance pay, and the efficiency wage hypothesis. *Managerial and Decision Economics* 21(2), 83-88.

Kahneman, D. (2003). Maps of bounded rationality: psychology for behavioural economics. *American Economic Review* 93(5), 1449-1475.

Kahneman, D., Knetsch, J.L., Thaler, R. (1986). Fairness as a constraint on profit seeking: entitlement in the market. *American Economic Review* 76(4), 728-741.

Kwon, I., Meyersson Milgrom, E.M. (2007). Status, relative pay, and wage growth: evidence from M&A. *Mimeo*.

Lazear, E.P. (1979). Why is there mandatory retirement? *Journal of Political Economy* 87(6), 1261-1284.

Lazear, E.P. (1981). Agency, earnings profiles, productivity, and hours restrictions. *American Economic Review* 71(4), 606-620.

Lazear, E.P. (1999). Personnel economics: past lessons and future directions. *Journal of Labor Economics* 17(2), 199-236.

Lazear, E.P., Moore, R.L. (1984). Incentives, productivity, and labor contracts. *Quarterly Journal of Economics* 99(2), 275-296.

Lin, M.-J. (2005). Opening the black box: the internal labor markets of company X. *Industrial Relations* 44(4), 659-706.

Medoff, J.L., Abraham, K.G. (1980). Experience, performance, and earnings. *Quarterly Journal of Economics* 95(4), 703-736.

Medoff, J.L., Abraham, K.G. (1981). Are those paid more really more productive? The case of experience. *Journal of Human Resources* 16(2), 186-216.

Mincer, J. (1974). *Schooling, experience, and earnings*. National Bureau of Economic Research, New York.

Murphy, K.M., Welch, F. (1990). Empirical age-earnings profiles. *Journal of Labor Economics* 8(2), 202-229.

Neumark, D., Stock, W.A. (1999). Age discrimination laws and labor market efficiency. *Journal of Political Economy* 107(5), 1081-1125.

O'Donoghue, T., Rabin, M. (1999). Doing it now or later. *American Economic Review* 89(1), 103-124.

OECD (2005): *Ageing and Employment Policies – Germany*. OECD, Paris.

Oi, W.Y. (1962). Labor as a quasi-fixed factor. *Journal Political Economy* 70(6), 538-555.

Pfeifer, C. (2006). Die Akzeptanz des Kündigungsschutzes – Empirische Evidenz aus einer repräsentativen Telefonumfrage. *Industrielle Beziehungen* 13(2), 132-149.

Pfeifer, C. (2008). An empirical note on wages in an internal labour market. *Economics Letters* 99(3), 570-573.

Pfeifer, C. (2009a). Impact of wages and job levels on worker absenteeism. *International Journal of Manpower (forthcoming)*.

Pfeifer, C. (2009b). Handicaps in job assignment: insiders, outsiders, and gender. *Mimeo.*

Pfeifer, C. (2009c). An intra-firm perspective on wage profiles and employment of older workers with special reference to human capital and deferred compensation. *Faculty of Economics and Management, Leibniz University Hannover, Discussion Paper No.* 413.

Pfeifer, C., Sohr, T. (2008). Analysing the gender wage gap using personnel records of a large German company. *IZA Discussion Paper* No. 3533.

Polachek, S.W. (2007). Earnings over the lifecycle: the Mincer earnings function and its applications. *IZA Discussion Paper* No. 3181.

Rees, A. (1993). The role of fairness in wage determination. *Journal of Labor Economics* 11(1, part 1), 243-252.

Scott, F.A., Berger, M.C., Garen, J.E. (1995). Do health insurance and pension costs reduce the job opportunities of older workers? *Industrial and Labor Relations Review* 48(4), 775-791.

Seifert, A., Funken-Hötzel, E. (2003). Wrongful dismissals in the Federal Republic of Germany. *Comparative Labor Law and Policy Journal* 25(4), 487-517.

Shaw, K., Lazear, E.P. (2008). Tenure and output. *Labour Economics* 15(4), 705-724.

Stata (2007). *Longitudinal/panel-data reference manual*. Stata Press.

Thaler, R.H., Tservsky, A., Kahneman, D., Schwartz, A. (1997). The effect of myopia and loss aversion on risk taking: an experimental test. *Quarterly Journal of Economics* 112(2), 647-661.

Topel, R. (1991). Specific capital, mobility, and wages: wages rise with job seniority. *Journal of Political Economy* 99(1), 145-176.

Treble, J., van Garmeren, E., Bridges, S., Barmby, T. (2001). The internal economics of the firm: further evidence from personnel data. *Labour Economics* 8(5), 531-552.

Winkelmann, R., Boes, S. (2006). *Analysis of microdata*. Springer, Berlin, Heidelberg, New York.

Wooldridge, J.M. (2002). *Econometric analysis of cross section and panel data*. MIT Press, Cambridge, London.

Zwick, T. (2008). The employment consequences of seniority wages. *ZEW Discussion Paper* No. 08-039.

Appendix A: Computation of Real Wages in Personnel Data

Several earnings functions are estimated in Section 4.2 to analyze the effects of tenure and entry age on wages as well as the effect of entry age on wage-tenure profiles. The personnel data set contains nominal hourly gross wages in Euros. As wages are estimated at different points in time, real wages are the preferable outcome variable.[16] For this purpose, I have estimated cross sectional earnings functions with OLS, in which the log of nominal wages is the dependent variable and the observation month is the only regressor (see Table A.1 for the results). The obtained coefficient is approximately 0.002, which means that workers experience on average a monthly nominal wage growth of 0.2 percent or a yearly nominal wage growth of 2.5 percent. As these values are only slightly higher than the inflation rate and quite similar to the average wage growth of union negotiated wages in Germany, the results are plausible. The nominal wage of each worker in each month is then divided by one plus the obtained coefficient of the time trend times the number of months minus one.[17] Real wages are therefore measured in January 1999 Euros.

Table A.1 also contains a comparison of mean nominal and real wages in January 1999, which are of course identical, and in December 2005. More interesting is the comparison between mean real wages in January 1999 and December 2005, which shows that average real wage growth has not been very large (0.53 percent in seven

[16] Note that the inclusion of time fixed effects might interfere with tenure in individual fixed effects models which exploit only the within variance (see Appendix B).

[17] The month (*t*: time trend) variable ranges from 1 (January 1999) to 84 (December 2005). The computation formula is $W_{t,\text{real}} = W_{t,\text{nominal}} / \left(1 + \beta(t-1)\right)$.

years). Thus, the presented regression results for tenure and entry age do not simply reflect a nominal wage growth but represent the effects of the variables.

Table A.1: Computation of real wages in personnel data

OLS for log nominal wages	
Month t (1-84) [β]	0.00213***
	[0.00004]
Constant	3.02303***
	[0.00203]
Observations	73293
R-squared	0.0347
Mean log nominal wage	3.1150
Mean hourly wages in Euros	
Nominal wage (January 1999, t=1)	21.2803
Real wage (January 1999, t=1)	21.2803
Nominal wage (December 2005, t=84)	25.1784
Real wage (December 2005, t=84)	21.3930
Wage growth 01/1999 – 12/2005	
Nominal wage growth (%)	18.3179
Real wage growth (%)	0.5296

Note: Robust standard errors in brackets. Coefficients significant at *** 1%.
Real wages are in January 1999 Euros.

Appendix B: The Panel Estimators

The basic model of the earnings function is equation (B.1), in which i is a worker index and t a time index. Further, w denotes the log hourly wage, α a constant, X' a vector of covariates, β a vector of coefficients, ν the worker specific residual, and ε the 'usual' residual.

(B.1) $$w_{it} = \alpha + X_{it}^{'}\beta + \nu_i + \varepsilon_{it}$$

From (B.1) the between estimator in (B.2) can be derived.

(B.2) $$\overline{w}_i = \alpha + \overline{X}_i^{'}\beta + \nu_i + \overline{\varepsilon}_i$$

The within estimator of the fixed effects model in (B.3) is then derived by subtracting (B.2) from (B.1). It can be seen that time invariant covariates are dropped in the fixed effects model.

(B.3) $$\left(w_{it} - \overline{w}_i\right) = \left(X_{it}^{'} - \overline{X}_i^{'}\right)\beta + \left(\varepsilon_{it} - \overline{\varepsilon}_i\right)$$

The random effects model in (B.4) uses a weighted average of the estimates of the between estimator in (B.2) and the within estimator in (B.3), in which θ is a function of σ_ν^2 and σ_ε^2. θ would be zero if $\sigma_\nu^2=0$, i.e., the worker specific residuals are always zero and the between estimator would contain all information. θ would be one if $\sigma_\varepsilon^2=0$, i.e., the fixed effects estimator would contain all information.

(B.4) $$\left(w_{it} - \theta\overline{w}_i\right) = \left(1-\theta\right)\alpha + \left(X_{it}^{'} - \theta\overline{X}_i^{'}\right)\beta + \left(1-\theta\right)\nu_i + \left(\varepsilon_{it} - \theta\overline{\varepsilon}_i\right)$$

For a further discussion and assumptions of the models see for example Wooldridge (2002, pp. 247-291), Greene (2003, pp. 283-334), and Stata (2007, pp. 390-413).

Appendix C: Censored Wages in Linked Employer-Employee Data

The daily wages in the LIAB are right censored at the upper earnings limit for social security contributions. Hence, we observe too low wages (wages equal the social security contribution limit) for high wage workers (wages above the social security contribution limit). This likely leads to a downward bias of the estimated effects of tenure and entry age in OLS regressions because workers with long tenure and older entry age earn high wages. Censored (interval) regression models account for this problem by incorporating the censoring probability in the log-likelihood function. If only one censoring level would exist, a Tobit model could be estimated. The upper earnings limits for social security contributions, however, have changed from year to year (144 Euros in 2000, 146 Euros in 2001, 148 Euros in 2002, 168 Euros in 2003, 169 Euros in 2004, and 171 Euros in 2005) so that the more general censored regression model is appropriate.

The basic regression model of the earnings function is equation (C.1), in which i is a worker index and t a time index. Further, w^* denotes the latent log daily wage, X' a vector of covariates, β a vector of coefficients, and ε the 'usual' residual.

$$\text{(C.1)} \quad w_{it}^{*} = X_{it}^{'}\beta + \varepsilon_{it}$$

Because wages in period t are only observed for wage levels below the censoring value c in period t, the observed dependent variable is $w=w^*$ if $w^*<c$ and $w=c$ if $w^*\geq c$. The first (uncensored) case ($w=w^*$) occurs with the probability in (C.2) and the second (censored) case ($w=c$) with the probability in (C.3).

(C.2) $$f\left(w_{it}, w_{it} < c_t \left| X_{it}^{'}; \beta, \sigma\right.\right) = \left(\frac{1}{\sigma}\right)\phi\left(\frac{w_{it} - X_{it}^{'}\beta}{\sigma}\right)$$

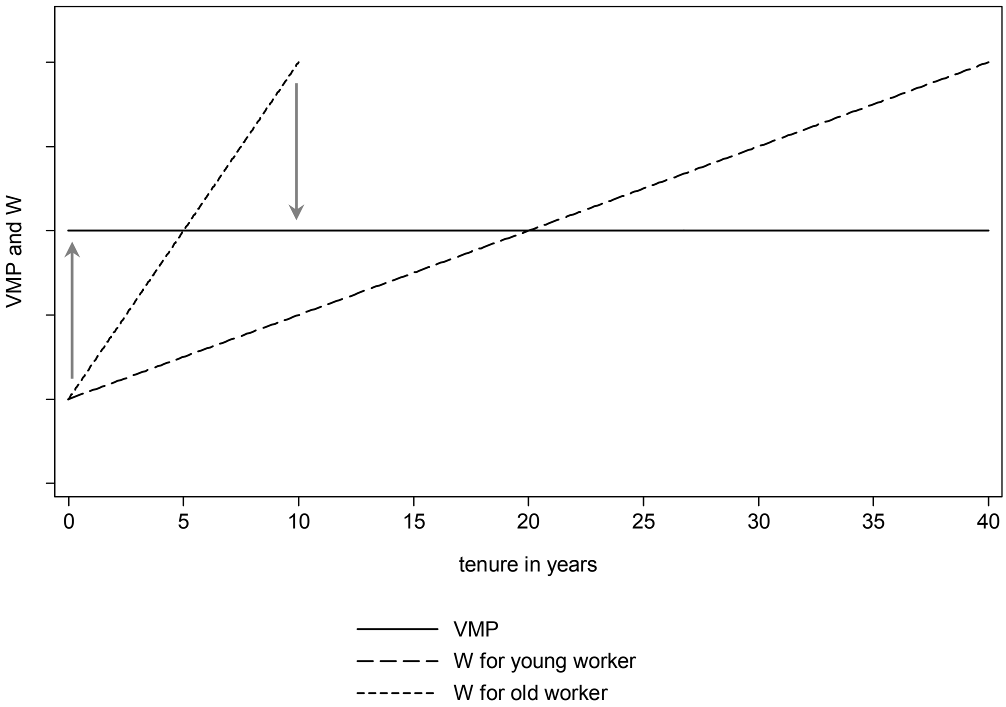
(C.3) $$\Pr\left(w_{it}^{*} \geq c_t \left| X_{it}^{'}\right.\right) = 1 - \Phi\left(\frac{c_t - X_{it}^{'}\beta}{\sigma}\right)$$

The generated log-likelihood function, which has to be maximized, looks consequently as in equation (C.4).

(C.4) $$\log L = \sum_{w_{it}^{*} \geq c_t} \log\left[1 - \Phi\left(\frac{c_t - X_{it}^{'}\beta}{\sigma}\right)\right] - \frac{1}{2}\sum_{w_{it}^{*} < c_t}\left[\log\left(2\pi\sigma^2\right) + \left(\frac{w_{it} - X_{it}^{'}\beta}{\sigma}\right)^2\right]$$

Unfortunately only a random effects estimator is available for censored regression models. For a further discussion of censored regression models and random effects estimation see for example Wooldridge (2002, pp. 517-544), Greene (2003, pp. 761-780), Winkelmann and Boes (2006, pp.207-238), and Stata (2007, pp.170-176).

Figures and Tables Included in Text



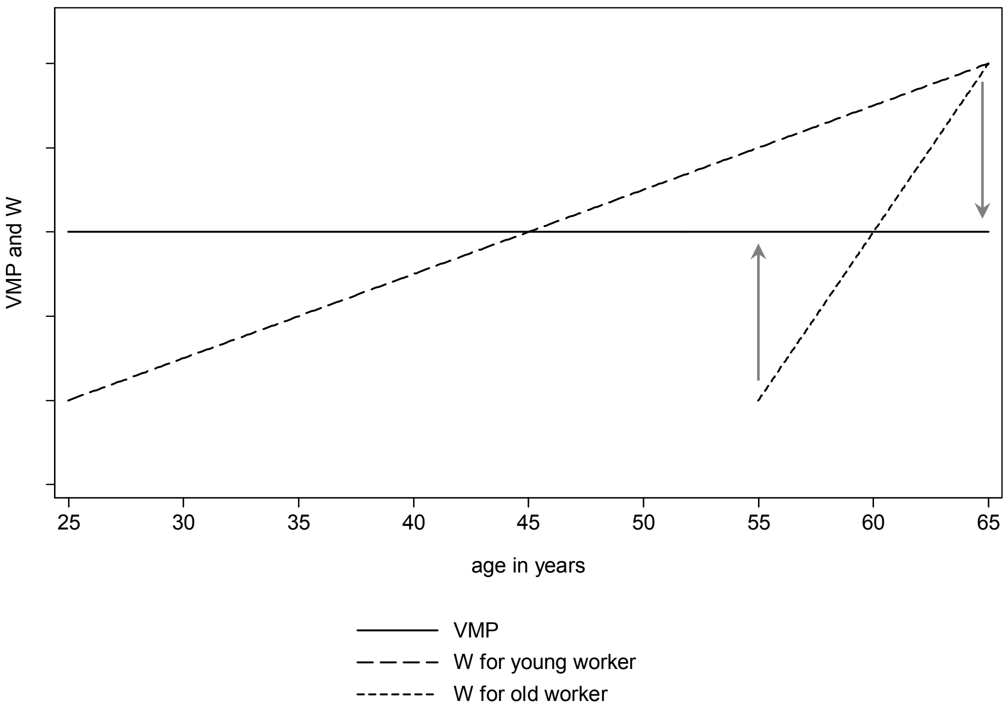


Figure 1: Adjustment strategies of deferred compensation

Table 1: Age and entry age categories in personnel data

	Mean	Std. Dev.	Age categories (share in %) <25	25-35	35-45	45-55	>55	Total
Age	42.17	9.44	3.26	20.96	36.31	29.68	9.79	100.00
Entry age	28.32	7.38	36.92	46.08	14.41	2.58	0.02	100.00
Difference	13.85	2.06	-33.66	-25.12	21.90	27.10	9.77	0.00

Note: Number of monthly observations is 73,293 for 1,250 white-collar workers.

Table 2: Descriptive statistics of variables in personnel data

	Mean	Std. Dev.	Min	Max
Real hourly wage in January 1999 Euros	21.4731	6.2041	7.5592	76.0312
Log real hourly wage	3.0300	0.2664	2.0228	4.3311
Tenure in years	13.8075	9.5938	0.0055	48.2000
Entry age in years	28.3218	7.3756	13.7041	60.7890
Entry age <25 (dummy, reference group)	0.3692	0.4826	0	1
Entry age 25-35 (dummy)	0.4608	0.4985	0	1
Entry age 35-45 (dummy)	0.1441	0.3511	0	1
Entry age >45 (dummy)	0.0260	0.1590	0	1
Female (dummy)	0.2753	0.4467	0	1
Schooling less than high school degree ("Haupt-/ Realschule") (dummy, reference group)	0.4846	0.4998	0	1
Schooling high school degree ("Abitur") (dummy)	0.1632	0.3696	0	1
Schooling university degree (dummy)	0.3522	0.4776	0	1

Note: Schooling degrees are the highest obtained degrees of workers. Wages and tenure vary over time. Entry age, gender, and schooling are time invariant. Number of monthly observations is 73,293 for 1,250 white-collar workers.

Table 3: Tenure, entry age and wages in personnel data

	(1) RE	(2) FE	(3) RE	(4) FE
Tenure (years)	0.0150***	0.0150***	0.0410***	0.0411***
	[0.0001]	[0.0001]	[0.0004]	[0.0004]
Tenure squared / 100			-0.1382***	-0.1383***
			[0.0042]	[0.0042]
Tenure cubed / 1000			0.0203***	0.0202***
			[0.0017]	[0.0017]
Tenure quartic / 10000			-0.0011***	-0.0010***
			[0.0002]	[0.0002]
Entry age 25-35 (dummy)	0.1175***		0.1037***	
	[0.0147]		[0.0146]	
Entry age 35-45 (dummy)	0.2192***		0.2130***	
	[0.0188]		[0.0187]	
Entry age >45 (dummy)	0.3610***		0.3614***	
	[0.0315]		[0.0312]	
Female (dummy)	-0.1523***		-0.1492***	
	[0.0133]		[0.0132]	
Schooling high school degree (dummy)	0.0465***		0.0363**	
	[0.0167]		[0.0166]	
Schooling university degree (dummy)	0.2673***		0.2730***	
	[0.0141]		[0.0140]	
Constant	2.6566***	2.8232***	2.5847***	2.7347***
	[0.0122]	[0.0013]	[0.0121]	[0.0014]
R-squared (within)	0.2533	0.2533	0.3825	0.3825
R-squared (between)	0.5151	0.0886	0.5079	0.0867
R-squared (overall)	0.4968	0.0958	0.4887	0.0969
Breusch Pagan test for random effects (χ^2)	1911052***		1929421***	
F-test for fixed effects		861***		1031***
Hausman test (χ^2)	0.5116		49.4669***	

Note: Random effects GLS (specifications 1 and 3) and fixed effects (within estimator) OLS (specifications 2 and 4) for log real hourly wages. Standard errors in brackets. Coefficients and test values are significant at * 10%, ** 5%, and *** 1%. Reference group for entry age categories is entry age less than 25 years. Reference group for schooling is less than high school degree. Number of monthly observations is 73,293 for 1,250 white-collar workers.

Table 4: Interaction effect of entry age and tenure on wages in personnel data

	(1) RE	(2) FE	(3) RE	(4) FE
Tenure (years)	0.0149***	0.0149***	0.0450***	0.0450***
	[0.0002]	[0.0002]	[0.0008]	[0.0008]
Entry age 25-35 (dummy) * Tenure	0.0002	0.0002	0.0055***	0.0055***
	[0.0002]	[0.0002]	[0.0010]	[0.0010]
Entry age 35-45 (dummy) * Tenure	-0.0003	-0.0001	-0.0133***	-0.0133***
	[0.0003]	[0.0003]	[0.0014]	[0.0014]
Entry age >45 (dummy) * Tenure	-0.0016**	-0.0011	-0.0248***	-0.0254***
	[0.0008]	[0.0008]	[0.0041]	[0.0041]
Tenure squared / 100			-0.0935***	-0.0935***
			[0.0074]	[0.0074]
Entry age 25-35 (dummy) * Tenure squared / 100			-0.1716***	-0.1714***
			[0.0106]	[0.0106]
Entry age 35-45 (dummy) * Tenure squared / 100			-0.0006	0.0012
			[0.0224]	[0.0224]
Entry age >45 (dummy) * Tenure squared / 100			0.0562	0.0874
			[0.1148]	[0.1151]
Tenure cubed / 1000			-0.0027	-0.0028
			[0.0027]	[0.0027]
Entry age 25-35 (dummy) * Tenure cubed / 1000			0.0756***	0.0756***
			[0.0045]	[0.0045]
Entry age 35-45 (dummy) * Tenure cubed / 1000			-0.0134	-0.0142
			[0.0137]	[0.0137]
Entry age >45 (dummy) * Tenure cubed / 1000			-0.0344	-0.0603
			[0.1058]	[0.1060]
Tenure quartic / 10000			0.0018***	0.0018***
			[0.0003]	[0.0003]
Entry age 25-35 (dummy) * Tenure quartic / 10000			-0.0100***	-0.0100***
			[0.0006]	[0.0006]
Entry age 35-45 (dummy) * Tenure quartic / 10000			0.0064**	0.0066**
			[0.0027]	[0.0027]
Entry age >45 (dummy) * Tenure quartic / 10000			0.0170	0.0235
			[0.0318]	[0.0318]
Entry age 25-35 (dummy)	0.1155***		0.1876***	
	[0.0147]		[0.0145]	
Entry age 35-45 (dummy)	0.2214***		0.3555***	
	[0.0187]		[0.0184]	
Entry age >45 (dummy)	0.3681***		0.5169***	
	[0.0312]		[0.0305]	
Female (dummy)	-0.1522***		-0.1527***	
	[0.0131]		[0.0128]	
Schooling high school degree (dummy)	0.0464***		0.0591***	
	[0.0165]		[0.0160]	
Schooling university degree (dummy)	0.2670***		0.2691***	
	[0.0139]		[0.0135]	
Constant	2.6570***	2.8233***	2.4977***	2.7113***
	[0.0121]	[0.0014]	[0.0120]	[0.0016]
R-squared (within)	0.2533	0.2533	0.4057	0.4057
R-squared (between)	0.5164	0.0896	0.5419	0.0421
R-squared (overall)	0.4977	0.0973	0.5195	0.0405

Breusch Pagan test for random effects (χ^2)	1923895***		1971342***	
F-test for fixed effects		843***		1013***
Hausman test (χ^2)	44.5347***		127.2156***	

Note: Random effects GLS (specifications 1 and 3) and fixed effects (within estimator) OLS (specifications 2 and 4) for log real hourly wages. Standard errors in brackets. Coefficients and test values are significant at * 10%, ** 5%, and *** 1%. Reference group for entry age categories is entry age less than 25 years. Reference group for schooling is less than high school degree. Number of monthly observations is 73,293 for 1,250 white-collar workers.

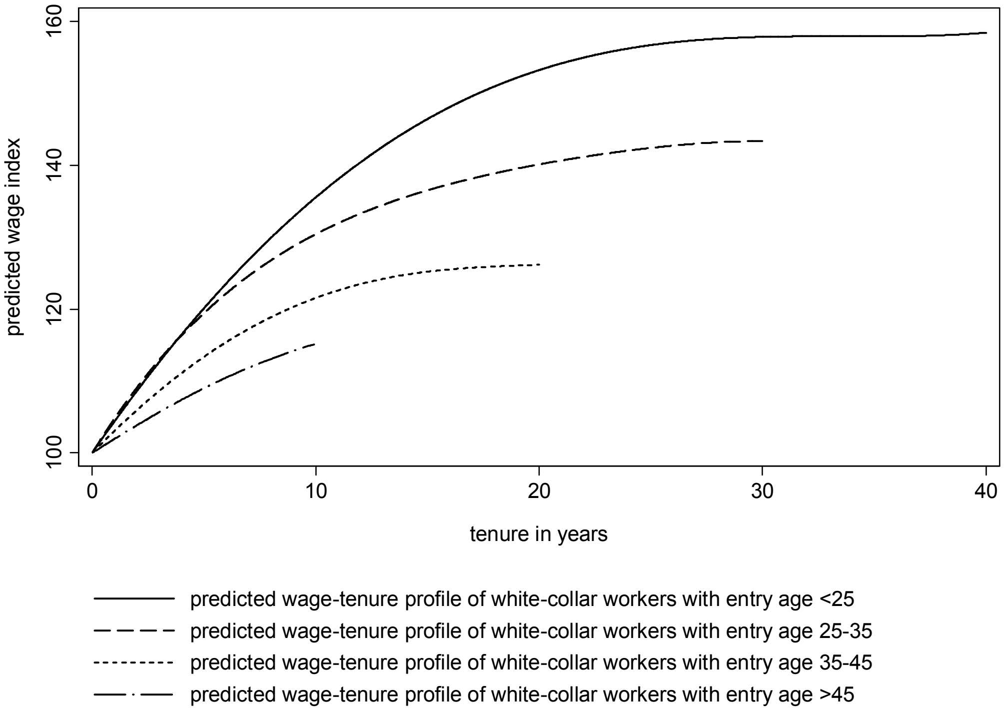


Figure 2: Predicted effects of entry age on the slope of wage-tenure profiles in personnel data (fixed effects model)

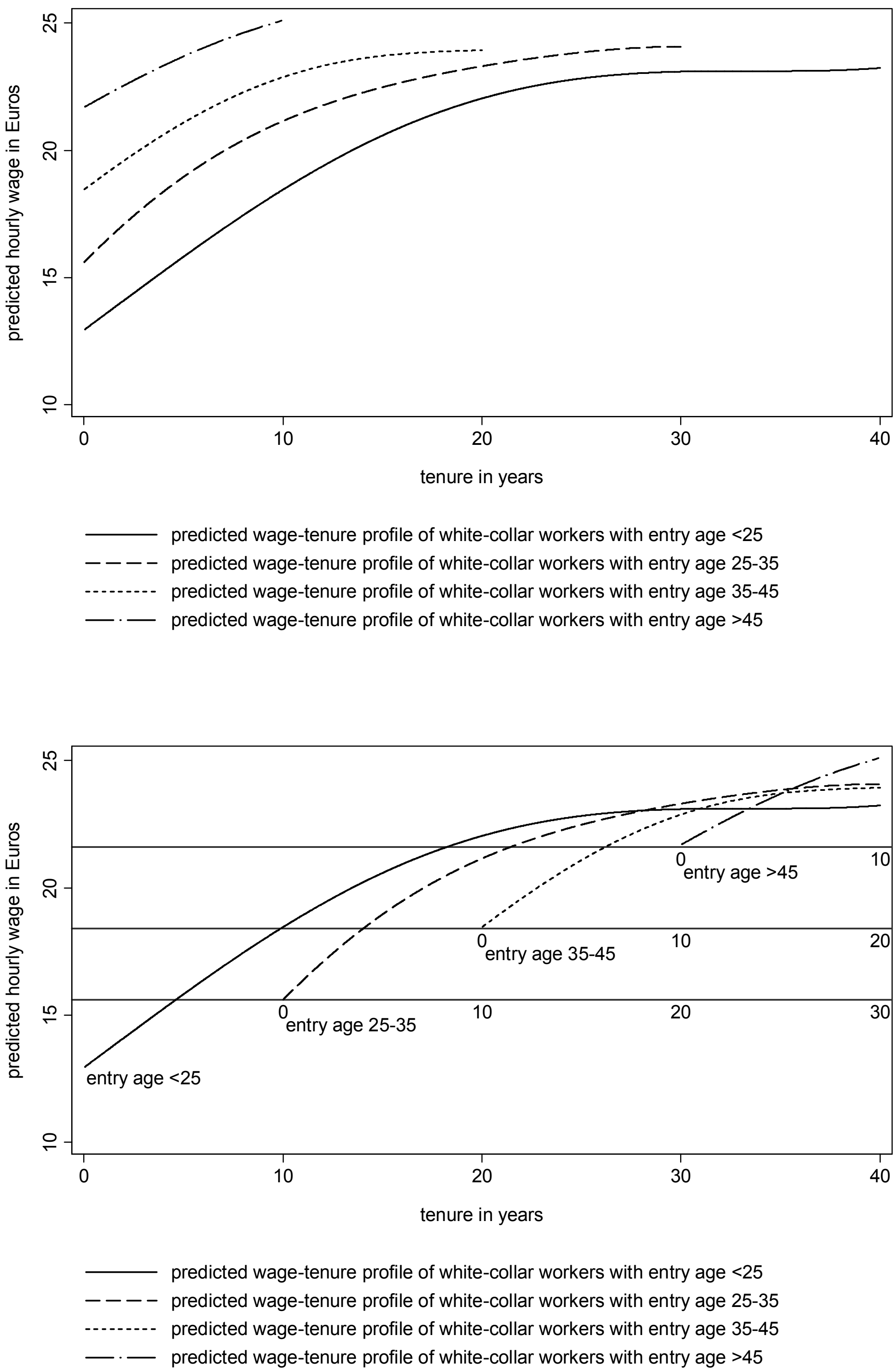


Figure 3: Predicted effects of entry age on wage-tenure profiles in personnel data (random effects model)

Table 5: Age and entry age categories in LIAB

	Mean	Std. Dev.	Age categories (share in %)					
			<25	25-35	35-45	45-55	>55	Total
Age	41.52	9.97	3.97	22.72	33.88	28.44	10.99	100.00
Entry age	31.47	9.18	26.61	41.17	22.93	8.41	0.88	100.00
Difference	10.05	0.79	-22.64	-18.45	10.95	20.03	10.11	0.00

Note: Number of yearly observations is 3,997,114 for 1,526,575 full-time white-collar workers in 3,109 firms.

Table 6: Tenure, entry age, interaction effect and wages in LIAB

	(1)	(2)	(3)	(4)
Tenure (years)	0.0125***	0.0181***	0.0130***	0.0232***
	[0.00002]	[0.00004]	[0.00002]	[0.00007]
Entry age (years)			0.0097***	0.0121***
			[0.00002]	[0.00003]
Entry age (years) * Tenure (years) / 100				-0.0352***
				[0.0002]
Entry age 25-35 (dummy)	0.1451***	0.2272***		
	[0.0005]	[0.0007]		
Entry age 35-45 (dummy)	0.2229***	0.3265***		
	[0.0005]	[0.0007]		
Entry age >45 (dummy)	0.2582***	0.3524***		
	[0.0007]	[0.0009]		
Entry age 25-35 (dummy) * Tenure		-0.0073***		
		[0.00004]		
Entry age 35-45 (dummy) * Tenure		-0.0112***		
		[0.00006]		
Entry age >45 (dummy) * Tenure		-0.0120***		
		[0.0001]		
Log likelihood	1431382	1454703	1429223	1439590
LR-test for random effects (χ^2)	3.3e+06***	3.3e+06***	3.3e+06***	3.3e+06***

Note: Random effects censored regressions (ML) for log nominal daily wages. All regressions include a female dummy, six schooling dummies, dummy for East Germany, dummies for collective contract and works council in firm, share of qualified workers in firm, dummy for firm founded before 1990, four firm size dummies, sixteen industry dummies, and five year dummies. Standard errors in brackets. Coefficients and test values are significant at * 10%, ** 5%, and *** 1%. Number of yearly observations is 3,997,114 for 1,526,575 full-time white-collar workers in 3,109 firms. Number of right-censored observations is 440,992 (11%).

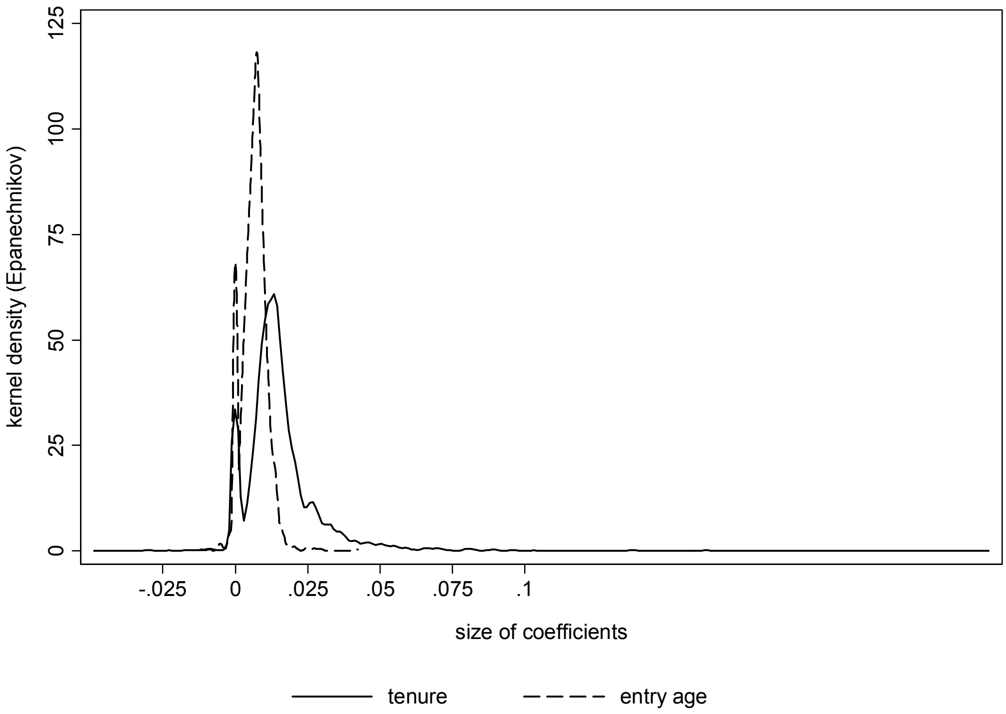


Figure 4: Distribution of coefficients for tenure and entry age across firms in LIAB

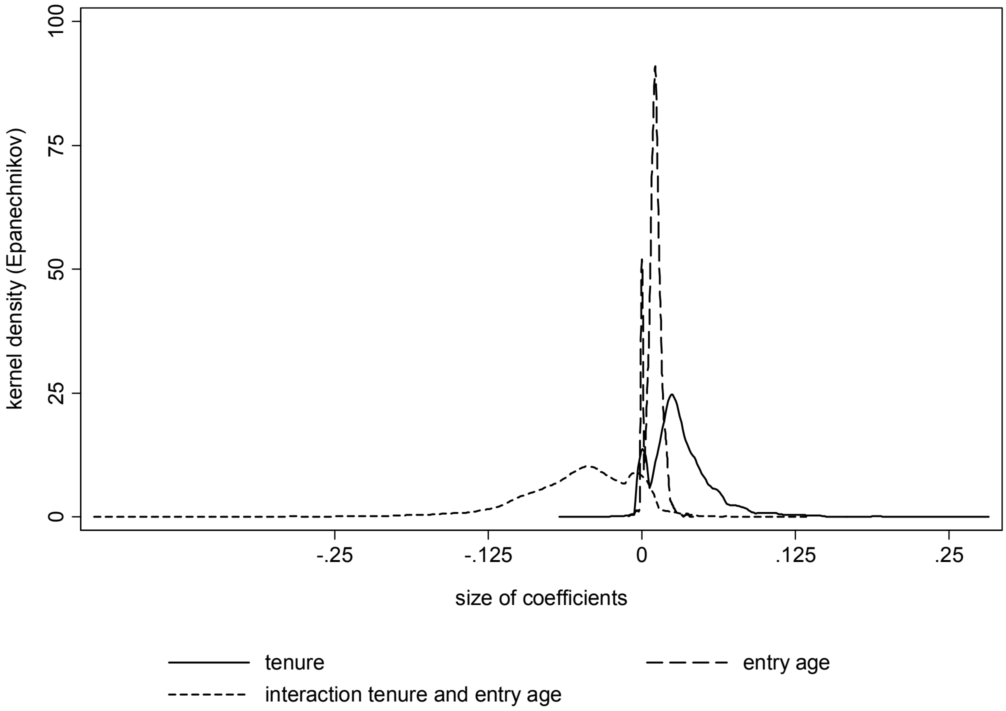


Figure 5: Distribution of coefficients for tenure, entry age, and their interaction across firms in LIAB

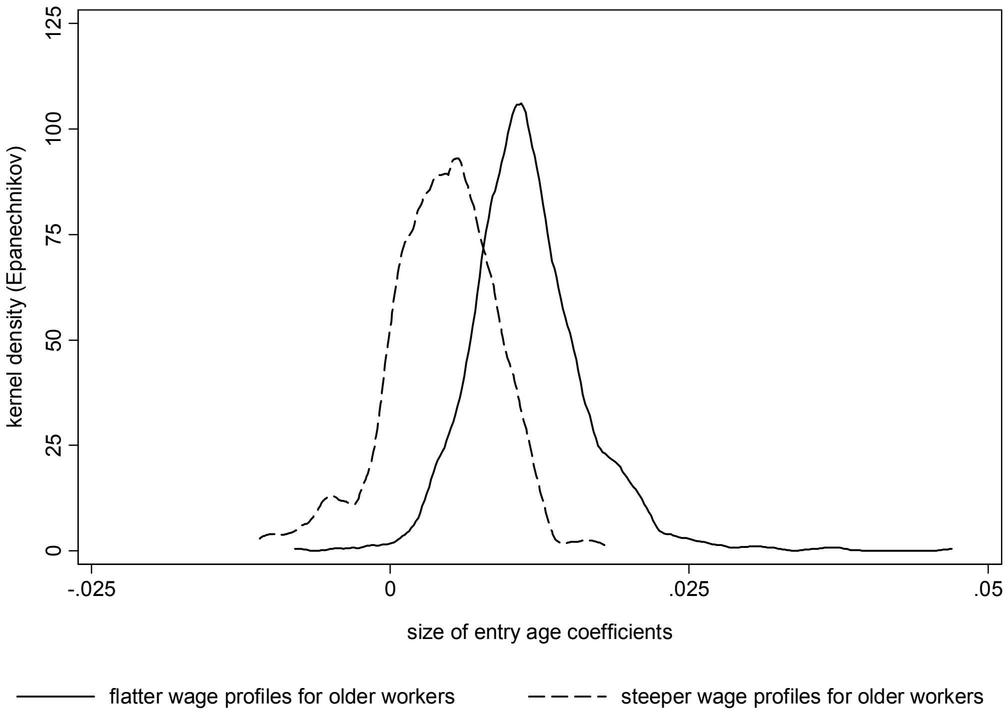


Figure 6: Distribution of coefficients for entry age for firms with steeper and flatter wage-profile adjustment in LIAB

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