An Intra-Firm Perspective on Wage Profiles and Employment of Older Workers with Special Reference to Human Capital and Deferred Compensation

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Abstract

Human capital and deferred compensation might explain why firms employ but do not hire older workers. Adjustments of wage-tenure profiles for older new entrants are explored in the context of deferred compensation. From an equity theory perspective, such adjustments might lead to adverse incentive effects so that firms prefer to hire rather homogenous workers in terms of entry age. A personnel data set is analyzed which reveals that at least for white-collar workers entry age has a positive effect on entry wages and wage-tenure profiles are adjusted according to entry age.

JEL Classification: J14, J24, J31, J33, M51, M52

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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 respond 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 firm specific human capital (Becker, 1962). Another is deferred compensation as an incentive scheme (Lazear, 1979; Lazear, 1981).

In this paper, I will at first review the relevant empirical literature on wage-seniority profiles as well as on hiring of older workers (Section 2). Second, I will discuss the theories of human capital and deferred compensation and their consequences for wage profiles and employment – especially hiring – of older workers (Section 3). Third, a personnel data set of a large German company is examined to get an intra-firm perspective on wage profiles and employment of older workers (Sections 4 to 6). 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. Though it is only a quantitative case study, it can help us to understand employment policies of firms toward older workers. Moreover, the data set allows the important distinction between blue-collar and white-collar workers. The paper concludes with a summary and discussion (Section 7).

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. This argument was developed in Hutchens' (1986) 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. 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). My 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. For this reason, I propose several scenarios a firm might choose to adjust the wage profiles for newly hired older workers. However, all adjustment strategies might lead to adverse incentive effects (equity theory) if workers' entry ages differ, either because the absolute wage levels or wage growths favor the young or the old workers. A firm might, therefore, prefer not to adjust deferred compensation schemes and to hire homogenous entrants in terms of entry age. 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 work effort reductions.

The empirical analysis of a firm's personnel records shows that the analyzed firm employs a quite large share of older workers at every hierarchical level but does not hire many older workers. For example, more than 60 percent of newly hired workers are younger than 35 and only 1 percent is older than 55 years. Several wage regressions are estimated to analyze the effect of entry age on entry wages, the effect of tenure on wages, and the effect of entry age on wage-tenure profiles. Entry age has no significant impact on entry wages of blue-collar workers and a strong positive impact on entry wages of white-collar workers. An explanation from a human capital point of view might be that general human capital is more prevalent for white-collar workers and specific human capital more prevalent for blue-collar workers. On the one hand, previously acquired specific skills of blue-collar workers are not of productive use in this firm and the firm needs to train new blue-collar workers again. On the other hand, the firm pays higher entry wages to white-collar workers because they have acquired general skills in previous years which are also of productive use in this firm. Separate estimates by gender show that the positive effect of entry age on entry wages is much larger for male than female white-collar workers, which might be reasoned by employment interruptions of women (e.g., family gap), during which no human capital is accumulated.

Further, I estimate wage-tenure profiles (random and fixed effects models) that have a concave form for blue-collar as well as for white-collar workers. The profiles are, however, much steeper for white-collar workers. This is in line with human capital theory because the wage profiles for general human capital should be steeper than for specific human capital. But it is also consistent with deferred compensation schemes. If deferred compensation is more prevalent for white-collar workers than for blue-collar workers, wage-tenure profiles should be steeper for the former. Including interaction effects between tenure and entry age indicate that some kind of wage profile adjustment according to entry age goes on, which is more explicit for white-collar workers. On the one hand, white-collar 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, white-collar 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.

2. Previous Empirical Evidence

2.1 Wage-Seniority Profiles

Seniority 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 (see Section 3.1 for a thorough discussion of human capital theory). 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 and seniority – both to experience as well as tenure (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 (see Section 3.2 for a thorough discussion of deferred compensation theory).

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 (see Section 3.2 for a thorough discussion of deferred compensation theory). 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 (see Section 3.1 for a thorough discussion of human capital theory). 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 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 pay increases, 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 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 have a higher share of older workers, whereas firms with share ownership and profit sharing have 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: IAB Establishment Panel and IAB Employment Register) to show that firms with steeper wage-tenure profiles have higher tenured workers but hire fewer older workers (over age 50).

In sum, the empirical evidence is mostly consistent with both the theories of deferred compensation as well as human capital. While all the cited studies have analyzed individual data across firms or establishment data sets, no study has examined personnel data of a single company. Thus, this paper is the first that provides an intra-firm perspective. Though it is only a quantitative case study, it can help us to understand employment policies of firms toward older workers.

3. Theory

If productivity would decline with age, firms could adjust wages downward to keep older workers in their workforce and hire older workers. Instead we observe that wages increase with age and that firms employ older workers but do not hire them. The positive correlation of age and wages can be reasoned by human capital theory, which implies also increasing productivity profiles, as well as deferred compensation theory, which does not imply increasing productivity profiles (Hutchens, 1989). Both theories serve as rationales why firms might employ older workers but do not hire them and are discussed in detail in this section.

3.1 Human Capital

According to Becker (1962), human capital can be divided in general human capital (GHC) and firm specific human capital (SHC), which have different implications for cost coverage of training, the slope of wage profiles, entry wages, and the employment of older workers. As GHC has the same value in every job and firm, firms do not have an incentive to invest in workers' GHC because workers can change firms and receive the returns to investments while the training firm bears the costs. Thus, workers cover all costs of GHC investments but also receive all returns of the investments.[1] On the

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[1] This wide spread assumption has also been challenged by several authors (e.g., Eckaus, 1963; Katz and Ziderman, 1990; Chang and Wang, 1996; Acemoglu and Pischke, 1998; Acemoglu and Pischke, 1999), who show that firms in imperfect labor markets also bear part of investment costs in GHC and obtain part of the returns. The employing firm does not only learn about a worker's true ability but also knows if the undertaken human capital investments are general and how much training a worker received. If these information are not made public and not observed by other firms, the training firm gains informational monopsony power. A worker, therefore, will find it hard to get a new job at another firm that would pay him his full value of marginal product. On the one hand, this implies that worker incentives to invest in GHC are lower. On the other hand, if quit rates of workers are low, firms have an incentive to invest in GHC. The main implications in my subsequent discussion, which is based on Becker (1962), do not change, however, as long as the training firm bears a higher share of costs and retains a higher share of returns for SHC than for GHC and if the market can at least observe some of the general training a worker has received.

other hand, SHC is only of value in the training firm. If a worker would cover all costs of the investments in SHC, as was the case for GHC, he would suffer a capital loss when being laid off by the training firm. The firm also faces the problem that it would suffer a capital loss if it would bear all training costs in SHC and the worker leaves the training firm. The consequent solution to this problem is that workers and firm share the investment costs as well as the returns for SHC.

Figure 1 illustrates the productivity and wage profiles for GHC and SHC. For simplicity let us assume that the productivity profiles (*VMP*: value of marginal product) are identical for GHC and SHC. The productivity profiles are concave because the incentives to invest in human capital decline with age as the amortization period gets shorter (Becker, 1962, pp. 37-38) and because of depreciation of human capital (Mincer, 1974; Polachek, 2007). The wage profile (*W*) for GHC equals the productivity profile (*W=VMP*) because the worker bears all training costs and receives all returns. The shared investment decision for SHC, however, leads to a wage that is larger than the productivity in early periods and smaller than the productivity in later periods. Therefore, the wage profile for GHC is steeper than for SHC.

- insert Figure 1 about here

The differences between GHC and SHC have also implications for entry wages and hiring of older workers.[2] As GHC is of value in other firms too, firms pay higher entry

[2] While I consider only the hiring decision of firms in the context of human capital, Hutchens (1988) also incorporates the worker perspective in his analysis of clustering of newly hired older workers in a smaller set of occupations and industries. Hutchens (1988, p. 90) argues that jobs that offer training are less attractive to older workers and, therefore, older workers do not apply for these jobs. Since workers have to pay for most of general training and partly for specific training, those jobs are more attractive to younger workers who have a longer amortization period and, consequently, have a higher expected

wages to older workers than would be the case for SHC. Moreover, GHC is less likely to be an entry barrier than SHC because the hiring firm bears no additional costs of training older workers. In case of SHC, however, the firm needs to train newly hired workers and as older workers have a shorter amortization period, investments in – and therefore hiring of – older workers are less profitably.[3]

3.2 Deferred Compensation

Lazear's (1979; 1981) deferred compensation theory focuses on the incentive effect of upward sloping wage-tenure profiles. Workers receive wages below their productivity in 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. 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, lump

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present value income over the total employment spell with the firm. It is, however, not so evident why older workers need to invest in general training when joining a new firm because they might already possess the necessary general skills as these are transferable across firms.

[3] SHC can also be interpreted as fixed employment costs covered by the firm (Oi, 1962), which leads firms to prefer the recruitment of young workers.

sum paid by firm at the end of contract) to upward sloping linear and conventional concave wage profiles.[4]

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 (see Section 2.2 for an overview), 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* [Figure 2 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 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?*

[4] 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.

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)[5], which might only be paid if the firm really cheats and thus not imposing fixed costs on non cheating firms. 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-

[5] 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.

cause employment policies (James and Johnson, 2000) and age discrimination laws (Neumark and Stock, 1999).[6] 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 I will now turn to the exploration of scenarios a firm might choose to adjust the wage profiles for newly hired older workers.

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 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 without adjustment of wage profiles is depicted in Figure 2 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

[6] 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."

(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 2). 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 have the same wage-tenure profile (see diagram at the top of Figure 2). I suggest three 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.[7] 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.

- insert Figure 2 about here

The first adjustment strategy (scenario A) is depicted in Figure 3. 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. A different adjustment strategy (scenario B) is depicted in Figure 4. The firm could offer the young and the old worker the same slope of wage-tenure profiles. In this scenario, the entry wage needs to be

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

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 (scenario C in Figure 5). However, since the firm would never pay an entry wage above the productivity and a flatter wage-tenure profile has lower incentive effects, scenario C is constrained.[8] The scenarios indicate a negative correlation between entry wages and wage growth within deferred compensation schemes.

- insert Figure 3 about here

- insert Figure 4 about here

- insert Figure 5 about here

Let us consider equity theory and possible adverse incentive effects of the 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; 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 rationale workers equity between young and old is always given because

[8] 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.

$\sum W_{Yt}/\sum VMP_{Yt}=\sum W_{Ot}/\sum VMP_{Ot}=1$, which can be rewritten as $\sum W_{Yt}/\sum W_{Ot}=\sum VMP_{Yt}/\sum VMP_{Ot}=1$. However, workers might not be that rationale 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 $W_{Yt}\neq W_{Ot}$ because $W_{Yt}/W_{Ot}\neq 1$.

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 $dW_{Yt}\neq dW_{Ot}$ or $dW_{Ya}\neq dW_{Oa}$ because $dW_{Yt}/dW_{Ot}\neq 1$ or $dW_{Ya}/dW_{Oa}\neq 1$.[9] The wage growth in scenario A is larger for the old than for the

[9] Several studies show that wage growth has a positive effect on satisfaction as a proxy for utility and a negative effect on quit behavior, which should be negatively correlated with utility (e.g., Galizzi and Lang, 1998; Clark, 1999; Grund and Sliwka, 2007; Kwon and Meyersson Milgrom, 2007; Cornelissen, 2008).

young worker ($dW_{Yt}<dW_{Ot}$; $dW_{Ya}<dW_{Oa}$), i.e., the young worker reduces his VMP_Y, and in scenario C wage growth is larger for the young than for the old worker ($dW_{Yt}>dW_{Ot}$; $dW_{Ya}>dW_{Oa}$), i.e., the old worker reduces his VMP_O.

Overall, all three adjustment strategies might lead to adverse incentive effects if workers' entry ages differ, either because the absolute wage levels or wage growths favor the young or the old worker (see Table 1 for a summary of the effects). Therefore, a firm might prefer not to adjust deferred compensation schemes and to hire homogenous entrants in terms of entry age. 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.

- insert Table 1 about here

4. Data and Descriptive Statistics

The data set was extracted from computerized personnel records of a large German limited 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 distinguish between blue-collar and white-collar workers. 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. After excluding observations with missing values in the used variables, 50844 monthly observations of 786 blue-collar workers and 73293 monthly observations of 1250 white-collar workers remain in an unbalanced panel design.

At first, let us have a look at the distribution of age (kernel density estimates). I distinguish between the age of all workers, entry age of all workers, and entry age of newly hired workers in the observation period. Figure 6 provides information for blue-collar workers and Figure 7 for white-collar workers. For both worker groups the entry age is lower than the overall age. The entry age of all workers is lower than the entry age of newly hired workers in the observation period, because the former includes also entries as apprentices and trainees who stay in the firm after the training period has been finished. As we have only further information about entry wages and entry levels at the entry stage for newly hired workers during the observation period, the subsequent descriptive analyses focus on this group when considering entry age.

- insert Figure 6 about here

- insert Figure 7 about here

The collective contract comprises hierarchical levels for blue-collar as well as for white-collar workers. The levels are defined using task descriptions and qualifications needed to execute tasks on the job. Higher hierarchical levels are associated with higher levels of qualifications and higher wages. The highest level for white-collar workers consists of non-pay-scale employees which are not subject to collective agreements ("aussertariflich") and can be associated with upper management positions. Whereas new entrants are largely assigned to hierarchical levels according to their formal education, insiders can move up the hierarchy due to on-the-job learning and promotions. Table A.1 in Appendix A contains a further description of the hierarchical levels.

Table 2 presents number of observations, share of workers, mean age, and mean tenure for all workers as well as number of observations, share of workers, and mean age for new workers. Workers have on average quite long tenure (15 years for blue-collar and 14 years for white-collar workers) which indicates the importance of long term contracts in the firm. In the seven year observation period, the firm has hired 84 blue-collar workers and 357 white-collar workers. Most blue-collar workers enter the firm at level 1, which is an entry level for unskilled blue-collar workers, or at level 4, which is an entry level for skilled blue-collar workers with a regular apprenticeship degree.[10] Entry levels for white-collar workers are not so clear cut. Nevertheless, level 1 seems to be an entry level for lower skilled white-collar workers and level 3 for higher skilled white-collar workers with a university degree.[11] All workers are on average 42 years old, whereas new blue-collar workers are on average 6 years younger and new white-collar workers are on average 8 years younger. The age differences are highly significant in total and at every single level. The only exceptions of this pattern are unskilled blue-

[10] Strong gender segregation occurs for blue-collar workers because all new entrants at level 1 are women and all new entrants at higher levels are men.

[11] Note that the share of new workers is larger than the share of all workers at entry levels. For an extensive discussion of entry levels and characteristics of new workers compared to existent workers in the analyzed firm see Janssen and Pfeifer (2009) and Pfeifer (2009b).

collar workers at level 1, who are all female and for whom long-term contracts might not be very important.

- insert Table 2 about here

Table 3 informs about age categories of all workers and new entrants (a split into different levels for all workers can be found in Table A.2 and for new workers in Table A.3 in Appendix A). Among all blue-collar workers the share of workers under the age of 25 years is 2 percent, between 25 and 35 years the share is 19 percent, between 35 and 45 years it is 41 percent, between 45 and 55 years it is 30 percent, and above 55 years it is less than 8 percent. Of the newly hired blue-collar workers 11 percent are younger than 25 years, 44 percent are between 25 and 35 years, 21 percent are between 35 and 45 years, 23 percent are between 45 and 55 years, and only one single new worker is over the age of 55.[12] The picture for white-collar workers does not look much different as of all white-collar workers 3 percent are under 25 years, 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. Of the new white-collar workers 8 percent are younger than 25 years, 52 percent are between 25 and 35 years, 30 percent are between 35 and 45 years, 9 percent are between 45 and 55 years, and only three new workers are over the age of 55. The differences between all and new workers in each age category are presented at the bottom of the table. It can be seen that for blue-collar as well as for white-collar workers the share of older newly hired workers is lower than the share of older workers already employed. Because apprentices and trainees are excluded from the sample, the percent information for new older

[12] Actually this one blue-collar worker in the highest entry age category is a 55.6 year old female at level 1.

workers are even an upper boundary and would be lower if these on average young workers would have been included. In sum more than 60 percent of new workers are younger than 35 years and only 1 percent (4 workers out of 441) is older than 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), for which no information is available in the data.

- insert Table 3 about here

5. Econometric Results

5.1 Computation of Real Wages

Several wage regressions are estimated in the subsequent sections to analyze the effect of entry age on entry wages, the effect of tenure on wages, and the effect of entry age on wage-tenure profiles. The 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. For this purpose, I have estimated cross sectional earnings functions separately for blue-collar and white-collar workers with OLS, in which the log of nominal wages is the dependent variable and the observation month is the only regressor (see Table 4 for the results). The obtained coefficients are approximately 0.002 for blue-collar workers as well as for white-collar workers, 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 month minus one.[13] Real wages are therefore measured in January 1999 Euros.

- insert Table 4 about here

Table 4 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 show that average real wage growth has not been very large (1.08 percent for blue-collar workers and 0.53 percent for white-collar workers in seven years). Thus, the subsequent regression results for tenure and entry age in the next sections do not simply reflect a nominal wage growth but represent the effects of the variables.

5.2 Entry Wages and Entry Age

The sample in this section just includes newly recruited workers during the observation period because entry wages are observed only for them. The sample for blue-collar workers contains 84 observations and the sample for white-collar workers 357 observations. The estimated cross sectional earnings functions (OLS) are presented in Table 5 for blue-collar workers and in Table 6 for white-collar workers. In addition to

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

several specifications of the age variables, all estimates control for gender and the highest school degree. In the first specification, age is included in a linear fashion. Age has a statistically significant impact on entry wages of blue-collar and white-collar workers, but the size of the effects differs dramatically. One more year of entry age increases the wage of blue-collar workers on average by only 0.2 percent, whereas the average effect for white-collar workers is almost 2 percent.

- insert Table 5 about here

- insert Table 6 about here

The second specification allows for non-linearity of entry age in incorporating also squared, cubed, and quartic terms of entry age.[14] For a better interpretation of these results Figure 8 depicts the predicted profiles for the effect of entry age on entry wages of an average worker. It can be seen that the entry wage-entry age profile of blue-collar workers is rather flat. The profile of white-collar workers is upward sloping and concave with a quite linear segment between age 30 and 45 years. A third specification is estimated using dummies of entry age categories. 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 age category older than 45 years. Although new blue-collar workers older than 35 years earn on average about 3.5 percent higher entry wages, the effects are not statistically significant. The entry age categories have, however, a strong and statistically significant impact on entry wages of white-collar workers. Compared with the reference group of

[14] Even though the age coefficients are independently significant for blue-collar workers but not for white-collar workers, an F-test indicates that the age coefficients are jointly significant at 1 percent for white-collar workers but only at 8 percent for blue-collar workers.

new white-collar workers entering the firm under the age of 25 years, workers with an entry age between 25 and 35 years earn about 11 percent higher entry wages, workers with an entry age between 35 and 45 years earn about 34 percent higher entry wages, and workers with an entry age over 45 years earn about 59 percent higher entry wages.[15]

- insert Figure 8 about here

Overall, the effects in all three specifications are quite similar in their size and show that entry age has no significant impact on entry wages of blue-collar workers and a strong positive impact on entry wages of white-collar workers.[16] An explanation from a human capital point of view might be that GHC is more prevalent for white-collar workers and SHC more prevalent for blue-collar workers.[17] On the one hand, the firm pays higher entry wages to older white-collar workers because they have acquired general skills in previous years which are also of productive use in this firm. On the other hand, previously acquired specific skills of blue-collar workers are not of productive use in this firm and the firm needs to train new blue-collar workers again. The impact of schooling as a proxy for GHC supports this view because apprenticeship degrees have no significant effect on entry wages of blue-collar workers but white-collar workers

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[15] The percentage change is calculated by $(e^{\beta}-1)*100$, where βs are coefficients.

[16] This finding is robust to changes of the sample with respect to job levels. The relationships between entry wages and entry age do not change if observations from the lowest or the highest job levels are excluded from the estimates.

[17] In many firms white-collar workers are trained in and work with standardized computer programs (e.g., SAP Systems, MS Office) and common management techniques (e.g., controlling, accounting), whereas blue-collar workers are often trained at and work with unique machines and production processes. This is strongly the case in the analyzed company in this paper.

with higher school degrees receive significant higher entry wages.[18] A different explanation might be the adjustment of deferred compensation schemes according to entry age, which will be examined in the next section.

5.3 Wage-Tenure Profiles and Entry Age

The complete sample is used in this section 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). The regressors are tenure in years and its higher terms, dummies for the entry age categories, a female dummy, and dummies for highest schooling degrees. Summary statistics of the variables can be found in Table 7.

- insert Table 7 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

[18] Blue-collar workers with an apprenticeship degree earn about 1 percent higher entry wages. The insignificance of this small effect might be driven by the low variance since most (92 percent) blue-collar workers have an apprenticeship degree. Compared to white-collar workers with less than high school degrees, white-collar workers with high school degrees earn about 9 percent and white-collar workers with university degrees earn about 31 percent higher entry wages.

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. Therefore, 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[19], the Hausman test rejects the null hypothesis of no systematic differences in all estimates at high significance levels except for one specification (linear tenure for white-collar workers). Hence, the fixed effects model is 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 8 for blue-collar workers and in Table 9 for white-collar workers. 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 0.6 percent for blue-collar workers and 1.5 percent for white-collar workers. Specifications three and four include also higher terms of tenure until the quartic term to allow for non-linearity. For an easier interpretation the wage-tenure profiles for an average worker are plotted in Figure 9 based on the fixed effects results (specification

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[19] 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.

four). It can be seen that for both types of workers the wage-tenure profiles are concave and flatten out strongly after approximately 20 years of tenure. Moreover, entry wages are higher and wage-tenure profiles are steeper for white-collar workers than for blue-collar workers. An explanation might be that GHC is more prevalent for white-collar workers and SHC is more prevalent for blue-collar workers. As discussed in Section 3.1, GHC implies steeper wage-tenure profiles because workers cover the costs and keep the returns to GHC investments. It could, however, also be that blue-collar workers invest less in human capital than white-collar workers. Another explanation might be deferred compensation that is more prevalent in white-collar than blue-collar jobs because work effort and productivity is easier to verify in production than in administration work.

- insert Table 8 about here

- insert Table 9 about here

- insert Figure 9 about here

The time invariant control variables in the random effects models in Table 8 and Table 9 show furthermore that blue-collar workers entering the firm with higher entry age receive a small and non significant wage premium, whereas entry age of white-collar workers has a large and significant effect on current wages. Compared to white-collar workers with an entry age below 25 years, white-collar 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 white-collar workers with the same tenure as younger workers earn ceteris paribus higher wages, which is consistent with adjustment of deferred compensation schemes discussed in Section 3.2 as well as higher productivity due to acquisition of GHC before entering the firm. Moreover, female blue-collar workers earn on average about 13 percent lower wages than men and female white-collar workers earn on average about 16 percent lower wages than men.[20] The results for schooling indicate a wage premium for blue-collar workers with an apprenticeship degree of 6 to 7 percent as well as a wage premium for white-collar workers with a high school degree of about 4 percent and with a university degree of about 31 percent compared to white-collar workers with less than high school degrees.

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 10 for blue-collar workers and Table 11 for white-collar workers). 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 now even more complex, the results are again illustrated in graphs.

- <u>insert Table 10 about here</u>

- <u>insert Table 11 about here</u>

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

Figure 10 informs about the results of the fixed effects estimates for blue-collar workers. 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 slopes of wage-tenure profiles for blue-collar workers with entry age below 25 years and with entry age between 25 and 35 years are not significantly different from each other, whereas the slope for workers with entry age 35 to 45 years is flatter and the slope for workers with entry age over 45 years is steeper.

- insert Figure 10 about here

The results from the random effects model for blue-collar workers are plotted in Figure 11, which enables the inclusion of wage levels. It can be seen that predicted entry wages for blue-collar workers do not differ much. Only workers with an entry age between 35 and 45 years earn between 0.55 and 0.75 Euros more. The slopes of the wage-tenure profiles are virtually identical to the fixed effects estimates. Interestingly, workers in the two older entry age categories earn higher wages than younger workers in the first 10 years of tenure. While Figure 11 illustrates the wage-tenure profiles from a tenure perspective, Figure 12 illustrates them from an age perspective. For this purpose the wage-tenure profiles from Figure 11 are positioned to the right by an additional 10 years for every older entry age category.[21] From this age perspective can be seen that workers in older entry age categories earn lower wages than workers at the same age with longer tenure (younger entry age categories). Only few results for blue-collar workers are consistent with adjustment of deferred compensation and the overall picture is not very

[21] 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.

clear cut. This might be plausible if deferred compensation plays a minor role in blue-collar jobs. Moreover, the results for the highest entry age group have to be treated with caution because only 37 workers are in this category.

- insert Figure 11 about here

- insert Figure 12 about here

Figure 13 informs about the results of the fixed effects estimates for white-collar workers. It can be nicely seen that 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. Figure 14 plots the random effects results, which indicate that not only entry wages are higher but also wage levels throughout the career, i.e., at every point of tenure older entry age workers earn higher wages than younger entry age workers. The results from this tenure perspective are in line with adjustment of deferred compensation, because wages are higher and wage growth is lower at every point of tenure for workers with older entry age. The age perspective in Figure 15 with a shift of wage-tenure profiles to the right of an additional 10 years per entry age category is also consistent with adjustment of deferred compensation. Older entry age groups earn lower wages and have higher wage growths than younger entry age workers at every point of age.

- insert Figure 13 about here

- insert Figure 14 about here

- insert Figure 15 about here

The lower wage growth of older entry age groups in the tenure perspective and the higher wage growth of older entry age groups in the age perspective are due to the concavity of the wage-tenure profiles. The concavity of the wage-tenure profiles leads to a different outcome than the scenarios from the simple linear case that was utilized in the theoretical exploration of adjustment strategies of deferred compensation in Section 3.2. Scenario A implied a higher wage growth and scenario C implied a lower wage growth from tenure as well as age perspectives. The concave results show, however, that linearity has oversimplified issues. Nevertheless, the results for white-collar workers strongly support the view that the analyzed firm adjusts wage profiles according to the entry age of new workers. As this is possible, the question remains open why it is not done in more cases and more older workers are hired. The rationale might be the discussed adverse incentive effect due to fairness perceptions (equity theory). In a short-term perspective inequity evolves from several sources. From a tenure perspective older white-collar workers earn higher wage levels but have lower wage growth than younger workers. From an age perspective older white-collar workers earn lower wage levels but have higher wage growth than younger workers. Consequently, young and old workers might adjust work effort downwards to re-establish equity. An advantage of concave wage-tenure profiles in the context of equity theory is that the differences in wage levels and wage growths decrease with tenure so that inequity gets smaller.

6. Gender Perspective

As re-entry into the labor market might be especially important for women because they are more likely to interrupt employment due to family responsibilities, a gender perspective might give some additional insights. I only use the sample of white-collar workers in this section. First, white-collar jobs are more important for females than blue-collar jobs. Second, in the entire observation period only 15 female blue-collar workers were newly hired which makes an empirical analysis not very feasible. Moreover, all these women were hired at the lowest blue-collar level and no men were hired (or even employed) at this level so that descriptive statistics in Table 2 in Section 4 and Table A.3 in Appendix A already include an implicit gender perspective. The newly hired female blue-collar workers were on average quite old (45 years). When performing the previous estimates for blue-collar workers without (female) blue-collar workers at the lowest level, the results do not change significantly.

Descriptive statistics show that the share of females is about 6 percentage points higher among newly hired white-collar workers (33.6 percent) than among all white-collar workers (27.5 percent). All women are on average 4.5 years younger and have about 2 years less tenure than all men. Newly recruited women are on average 2.6 years younger than newly recruited men.[22] All differences are significant at the 1 percent level in a t-test. Figure 16 depicts the distribution of age among all workers by gender. Figure 17 informs about the distribution of entry age among all workers by gender. Figure 18 depicts the distribution of entry age among new workers by gender. It can be seen in

[22] See Pfeifer (2009b) for a discussion of gender differences in experience and schooling at separate hierarchical levels.

each figure that the entire age distributions of women are on the left from the age distributions of men. Combining the distributions in one figure for each gender (see Figure 19 for men and Figure 20 for women) shows that the distributions have the same pattern for both genders. Entry age is remarkable lower than overall age.

- insert Figure 16 about here

- insert Figure 17 about here

- insert Figure 18 about here

- insert Figure 19 about here

- insert Figure 20 about here

Table 12 informs about the age categories of all and new white-collar workers by gender. Comparing all workers by gender shows that women are more clustered in the younger age groups and men are more clustered in the older age groups. The shares of men below the age of 35 years is 20 percent and over the age of 45 years is 45 percent, whereas the shares of women below 35 years is 35 percent and over the age of 45 years is 25 percent. Among new entrants relative fewer men enter the firm below the age of 25 years (4.6 percent vs. 15 percent) and relative more men in the age group between 45 and 55 years (10.5 percent vs. 6.7 percent). For both genders less than 1 percent of new entrants are over 55 years. The differences between all and new workers show the same pattern for both genders that the firm employs a higher share of older workers than it hires.

- insert Table 12 about here

The effects of entry age on entry wages by gender are estimated with cross sectional earnings functions for new male and female white-collar workers (see Table 13). The first specification includes age in a linear fashion. One more year of entry age increases the wage on average by 2.7 percent for men and by 0.5 percent for women. The second specification includes also higher terms of age.[23] The results are plotted in Figure 21. For young workers the gender differences in entry wages are small. But the gender differences in entry wages increase with entry age. For men the effect of entry age is quite linear increasing and large, whereas the effect for women is rather small. It is noteworthy that the effect for women is slightly increasing until the age of 30 years, quite constant between 30 and 40 years, and after the age of 40 years rising again. The third specification includes dummies for age categories which confirm these results. An explanation for the gender differences might be employment interruptions of women due to family responsibilities during which they cannot accumulate GHC, whereas men are paid for their acquired general skills in previous employment with other firms (e.g., Waldfogel, 1998; Davies and Pierre, 2005). Another explanation might be cohort effects, i.e., younger women are less disadvantaged than older women (Shaw, 1994; Blau, 1998; Fitzenberger et al., 2004).

- <u>insert Table 13 about here</u>

- <u>insert Figure 21 about here</u>

Pfeifer and Sohr (2008) have analyzed the underlying personnel data set in detail to study the gender wage gap so that only two relevant results for this paper are briefly summarized here. An Oaxaca-decomposition shows that lower returns to entry age for

[23] Note that the age coefficients are jointly significant at the 1 percent level in an F-test for both genders.

female white-collar workers explain a large part of the gender wage gap. Separately estimated wage-tenure profiles are concave for both genders but steeper for men, which might indicate that women accumulate less human capital or that deferred compensation is less prevalent for women. This finding could be reasoned by the higher probability of women leaving the firm and their shorter average tenure, which reduces incentives for women and the firm to invest in human capital as well as reduces the benefits of deferred compensation. Estimates for the adjustment of deferred compensation according to entry age are not very meaningful because few women in the total data set are in the older entry age groups (only 48 female workers in the entry age group 35 to 45 years and only the newly recruited 9 female workers in the oldest entry age group). Estimates for men, however, produce quite similar results as in the total sample.

7. Conclusion

The theoretical part of this paper has argued that wage-tenure profiles are upward sloping and concave from a human capital perspective, that wage profiles should be steeper for GHC than for SHC, and that entry wages should be positively correlated with entry age if GHC is important. Moreover, Hutchens' (1986) fixed cost explanation for deferred compensation as recruitment barrier for older workers was criticized because there are some good 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). Several possible adjustment strategies of deferred compensation according to entry age were discussed. A disadvantage of all adjustment scenarios is that short-term concerns might be important to workers.

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 (equity theory). Thus, a firm might prefer to hire rather homogenous workers in terms of entry age, which are likely to be younger workers. This equity theory argument is a new rationale in the literature why firms with deferred compensation schemes employ older workers but do not hire them.

The empirical analysis of personnel records of a large German company indicates that the company employs many old workers but seldom hires an old worker. Estimates for entry wages have shown that entry age has no significant impact on entry wages of blue-collar workers but a quite large impact on entry wages of white-collar workers. This result is consistent with human capital theory if GHC is more important for white-collar than blue-collar jobs. Wage-tenure profiles are concave for both types of workers but much steeper for white-collar workers than for blue-collar workers, which is consistent with GHC and SHC explanations of sharing costs and returns to investments. Wage-tenure profiles might also be steeper for white-collar workers because deferred compensation schemes are more prevalent in white-collar than blue-collar jobs. Entry age has a mixed impact on wage-tenure profiles for blue-collar workers, which is in sum not very supportive of adjustment of deferred compensation. The results for white-collar workers are strongly consistent with the adjustment of deferred compensation according to entry age. On the one hand, white-collar 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, white-collar workers with older entry age earn lower wage levels but have higher wage growths than younger workers at every point of age. From this follows that also inequity perceptions and adjustment of work effort to re-establish equity might arise so that the firm might hire fewer older workers than it would do otherwise. An additional gender perspective indicates for both genders that the firm employs a higher share of older white-collar workers than it hires. The positive relationship between entry age and entry wages of white-collar workers is much smaller for women than for men. This finding might be caused by employment interruptions of women (e.g., family responsibilities) during which they cannot accumulate GHC.

There are two caveats to my empirical analysis. First, the used data set is only a quantitative case study of one German company and not representative. Hence, an extension of the analysis to linked employer-employee data sets (LIAB and GLS for Germany) is intended in the future. Second, no information on productivity to clearly distinguish between human capital and deferred compensation arguments is available in my data. As it stands, the results are mostly consistent with both theories.

Future research might also look more strongly at the supply side of the labor market, i.e., at older job applicants. As Bellmann and Brussig (2007) find for Germany that few firms receive job applications from older workers, it might in fact not be firm discrimination against older workers because in principle individual adjustments of wage-tenure profiles are possible. If older unemployed workers have high reservation wages (e.g., strong preferences for leisure, high unemployment benefits), they might prefer to stay unemployed until the retirement age is reached (e.g., Prasad, 2000; Christensen, 2003; Dietz et al., 2006; Ljungqvist and Sargent, 2008). This might be especially the case for blue-collar workers and female white-collar workers since the empirical findings of this paper suggest that their entry wages do not increase much with age. Hence, instead of aiming at the demand side (e.g., age discrimination laws), policy could directly focus on older workers in increasing incentives to take up employment again. This does not necessarily mean a reduction in unemployment benefits but can also be accomplished with wage or hiring subsidies paid explicitly to the worker or implicitly with income tax reductions (e.g., Orszag and Snower, 2003; Dietz et al., 2006; Brussig et al., 2006; Blundell, 2006).

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Appendix A

Table A.1: Definition of hierarchical levels

Level	Blue-collar workers	White-collar workers
1	Unskilled work (instruction)	Simple tasks (instruction or basic training)
2	Semi-skilled work (basic training)	Somewhat difficult tasks (three-year apprenticeship)
3	Semi-skilled work (two-year apprenticeship)	Moderately difficult tasks (university of applied science degree)
4	Somewhat difficult skilled work (three-year apprenticeship)	Difficult tasks, making decisions of limited scope (university degree)
5	Moderately difficult skilled work (three-year apprenticeship)	Very difficult tasks, making decisions of broader scope (university degree)
6	Difficult skilled work (three-year apprenticeship)	Upper management tasks, non-pay-scale (not subject to collective contract)
7	Very difficult skilled work (three-year apprenticeship)	

Note: Levels and descriptions obtained from industry-level collective contract.

Table A.2: Age categories of all workers by levels

		All blue-collar workers						All white-collar workers					
			Age categories						Age categories				
Level	Statistics	Total	<25	25-35	35-45	45-55	>55	Total	<25	25-35	35-45	45-55	>55
1	Number obs	4441	67	685	2084	1319	286	7560	2017	2666	1688	843	346
	Share in row (%)	100.00	1.51	15.42	46.93	29.7	6.44	100.00	26.68	35.26	22.33	11.15	4.58
	Share in column (%)	8.73	5.78	7.2	9.93	8.58	7.52	10.31	84.43	17.35	6.34	3.88	4.82
2	Number obs	3242	3	207	1593	1218	221	17232	301	4844	7476	3258	1353
	Share in row (%)	100.00	0.09	6.38	49.14	37.57	6.82	100.00	1.75	28.11	43.38	18.91	7.85
	Share in column (%)	6.38	0.26	2.18	7.59	7.92	5.81	23.51	12.6	31.53	28.09	14.98	18.86
3	Number obs	5075	74	659	2458	1545	339	18634	68	5103	7119	5183	1161
	Share in row (%)	100.00	1.46	12.99	48.43	30.44	6.68	100.00	0.36	27.39	38.2	27.81	6.23
	Share in column (%)	9.98	6.38	6.93	11.71	10.05	8.91	25.42	2.85	33.22	26.75	23.83	16.18
4	Number obs	20635	950	6056	8011	4369	1249	10842	3	1920	4138	3671	1110
	Share in row (%)	100.00	4.6	29.35	38.82	21.17	6.05	100.00	0.03	17.71	38.17	33.86	10.24
	Share in column (%)	40.58	81.97	63.66	38.16	28.42	32.83	14.79	0.13	12.5	15.55	16.88	15.47
5	Number obs	9495	65	1459	3601	3511	859	8220	0	438	2894	3878	1010
	Share in row (%)	100.00	0.68	15.37	37.93	36.98	9.05	100.00	0.00	5.33	35.21	47.18	12.29
	Share in column (%)	18.67	5.61	15.34	17.15	22.84	22.58	11.22	0.00	2.85	10.87	17.83	14.08
6	Number obs	5659	0	306	2457	2286	610	10805	0	392	3299	4920	2194
	Share in row (%)	100.00	0.00	5.41	43.42	40.4	10.78	100.00	0.00	3.63	30.53	45.53	20.31
	Share in column (%)	11.13	0.00	3.22	11.7	14.87	16.04	14.74	0.00	2.55	12.4	22.62	30.58
7	Number obs	2297	0	141	790	1126	240	-	-	-	-	-	-
	Share in row (%)	100.00	0.00	6.14	34.39	49.02	10.45	-	-	-	-	-	-
	Share in column (%)	4.52	0.00	1.48	3.76	7.32	6.31	-	-	-	-	-	-
Total	Number obs	50844	1159	9513	20994	15374	3804	73293	2389	15363	26614	21753	7174
	Share in row (%)	100.00	2.28	18.71	41.29	30.24	7.48	100.00	3.26	20.96	36.31	29.68	9.79
	Share in column (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table A.3: Age categories of new workers by levels

Level	Statistics	New blue-collar workers						New white-collar workers					
			Age categories						Age categories				
		Total	<25	25-35	35-45	45-55	>55	Total	<25	25-35	35-45	45-55	>55
1	Number obs	15	1	1	4	8	1	75	24	29	20	2	0
	Share in row (%)	100.00	6.67	6.67	26.67	53.33	6.67	100.00	32.00	38.67	26.67	2.67	0.00
	Share in column (%)	17.86	11.11	2.70	22.22	42.11	100.00	21.01	82.76	15.59	18.87	6.06	0.00
2	Number obs	1	1	0	0	0	0	59	0	42	9	7	1
	Share in row (%)	100.00	100.00	0.00	0.00	0.00	0.00	100.00	0.00	71.19	15.25	11.86	1.69
	Share in column (%)	1.19	11.11	0.00	0.00	0.00	0.00	16.53	0.00	22.58	8.49	21.21	33.33
3	Number obs	8	0	4	2	2	0	114	4	74	31	5	0
	Share in row (%)	100.00	0.00	50.00	25.00	25.00	0.00	100.00	3.51	64.91	27.19	4.39	0.00
	Share in column (%)	9.52	0.00	10.81	11.11	10.53	0.00	31.93	13.79	39.78	29.25	15.15	0.00
4	Number obs	55	7	31	9	8	0	41	1	26	12	2	0
	Share in row (%)	100.00	12.73	56.36	16.36	14.55	0.00	100.00	2.44	63.41	29.27	4.88	0.00
	Share in column (%)	65.48	77.78	83.78	50.00	42.11	0.00	11.48	3.45	13.98	11.32	6.06	0.00
5	Number obs	5	0	1	3	1	0	24	0	6	12	6	0
	Share in row (%)	100.00	0.00	20.00	60.00	20.00	0.00	100.00	0.00	25.00	50.00	25.00	0.00
	Share in column (%)	5.95	0.00	2.70	16.67	5.26	0.00	6.72	0.00	3.23	11.32	18.18	0.00
6	Number obs	0	0	0	0	0	0	44	0	9	22	11	2
	Share in row (%)	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	20.45	50.00	25.00	4.55
	Share in column (%)	0.00	0.00	0.00	0.00	0.00	0.00	12.32	0.00	4.84	20.75	33.33	66.67
Total	Number obs	84	9	37	18	19	1	357	29	186	106	33	3
	Share in row (%)	100.00	10.71	44.05	21.43	22.62	1.19	100.00	8.12	52.10	29.69	9.24	0.84
	Share in column (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Appendix B

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.

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

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

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

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.

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

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.

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

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).

Figures and Tables Included in Text

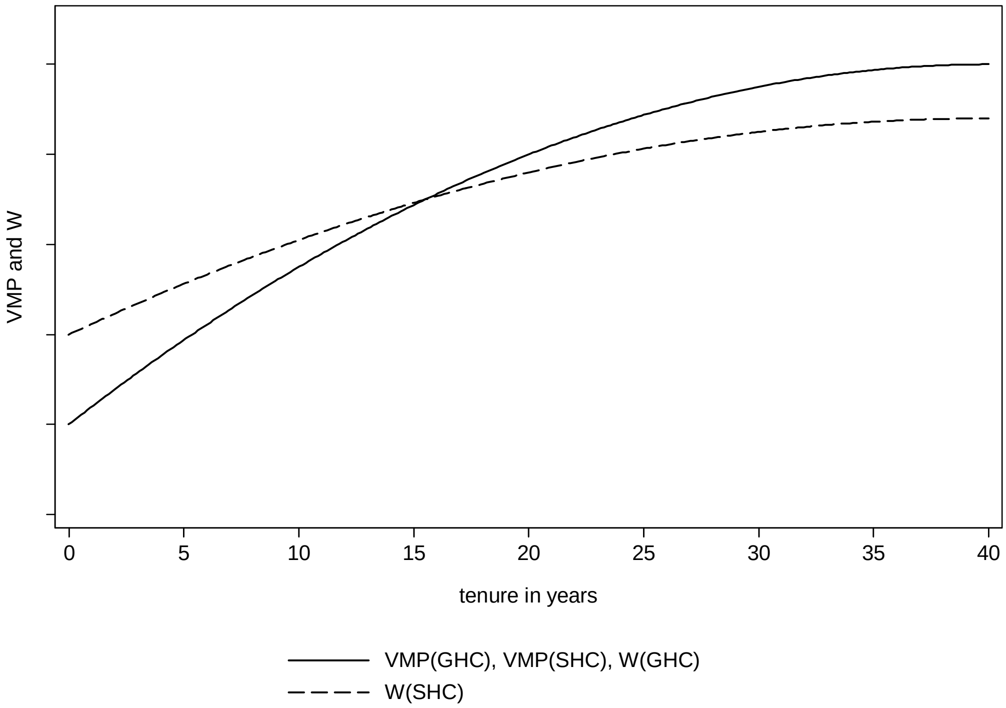


Figure 1: Human capital and wage profiles

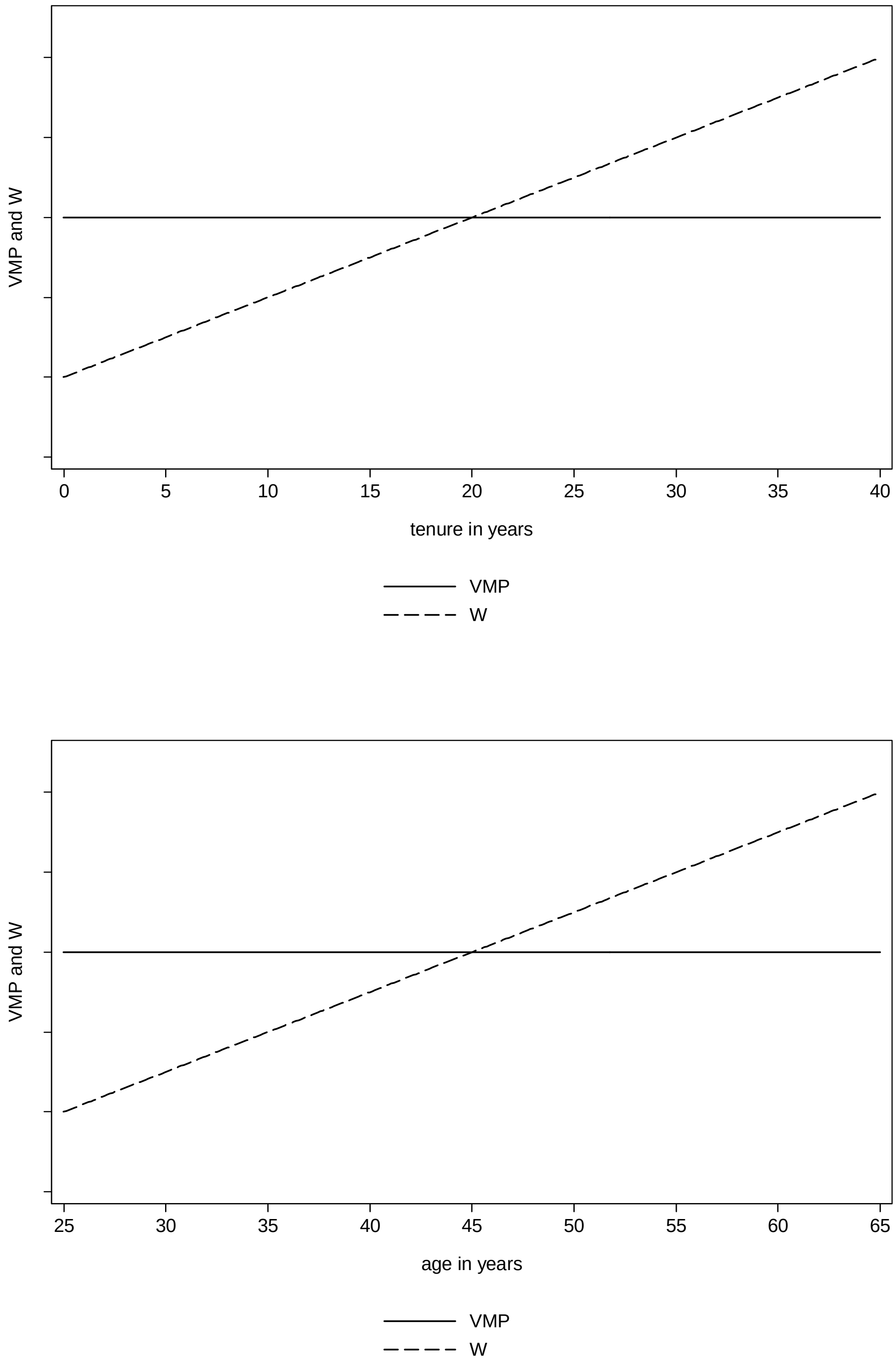
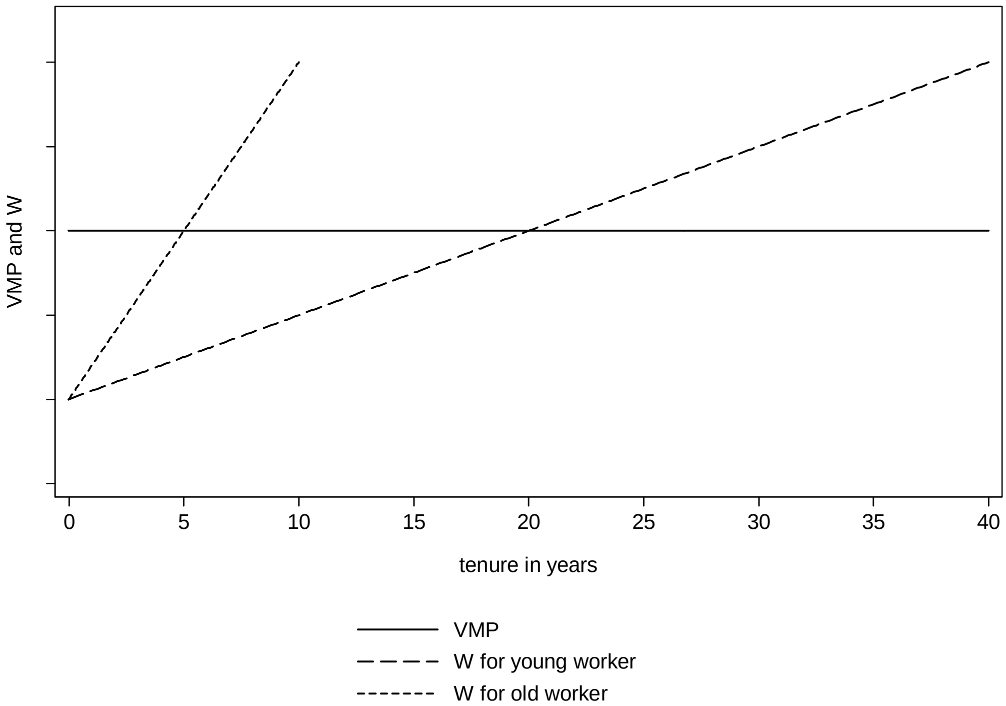


Figure 2: Deferred compensation



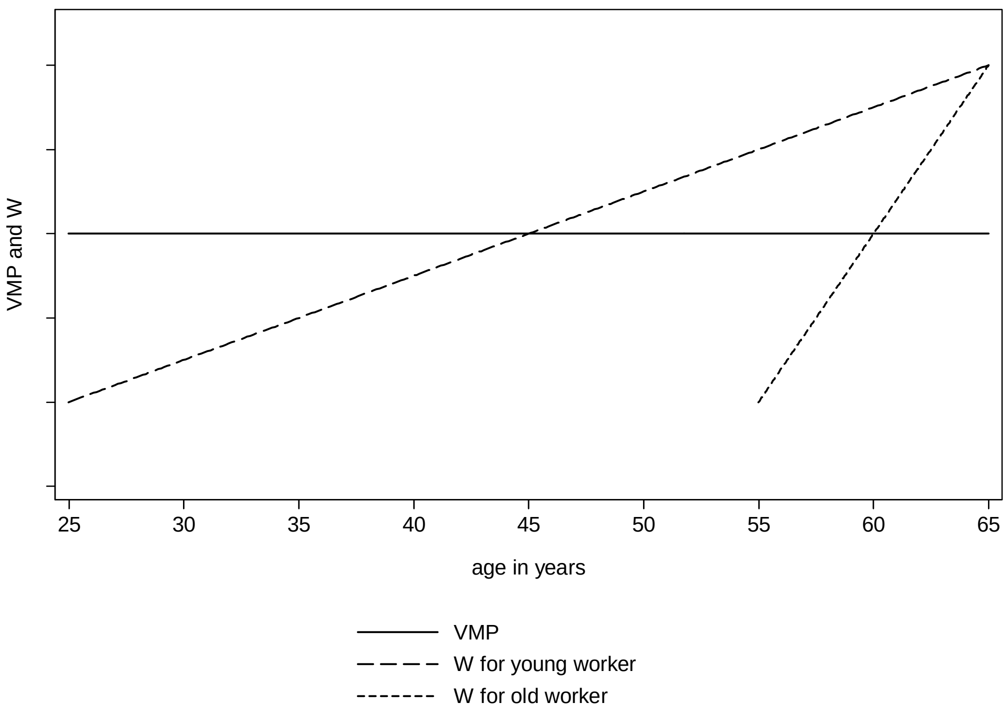


Figure 3: Adjustment of deferred compensation with same entry wage and higher slope (scenario A)

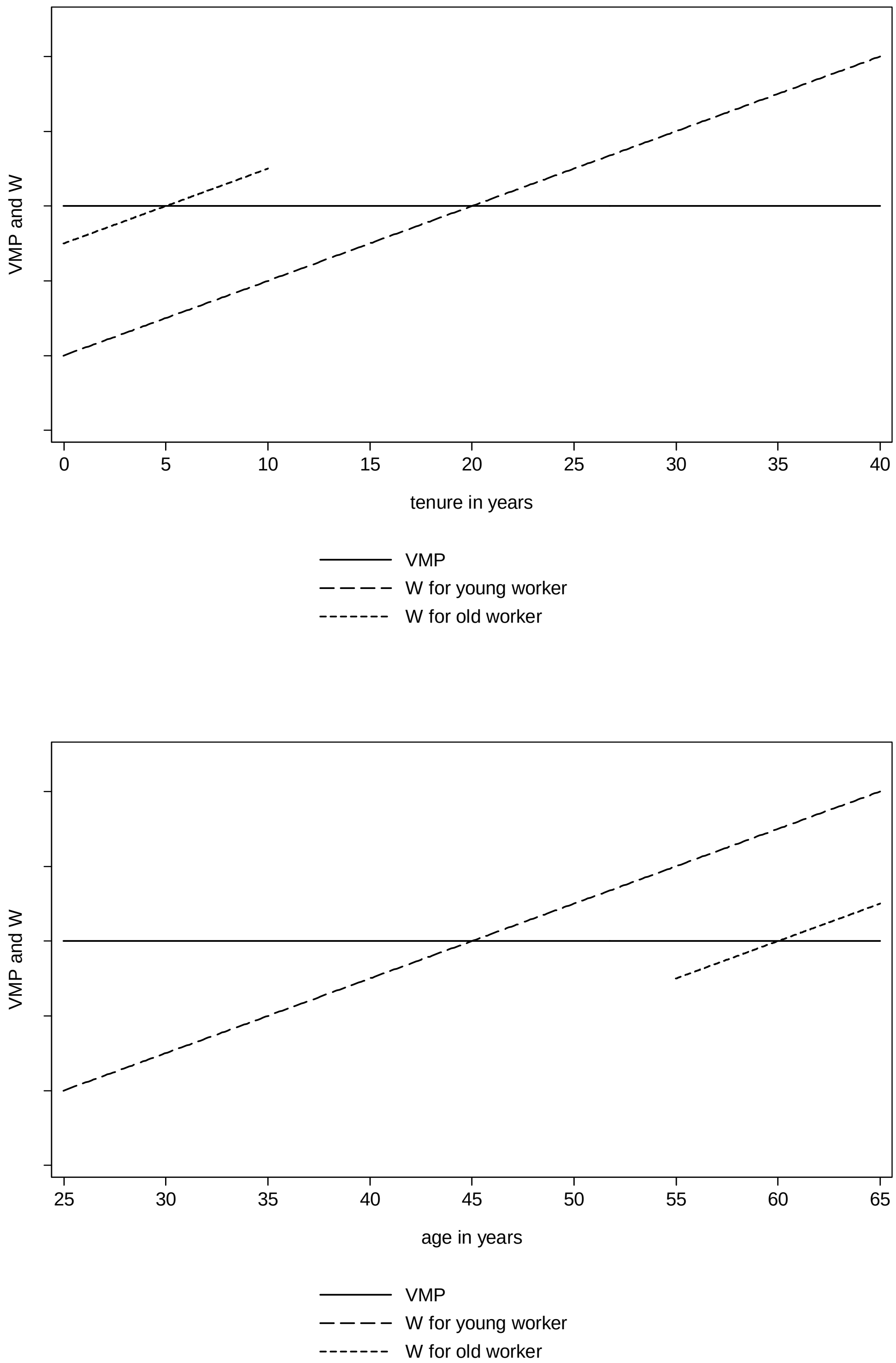
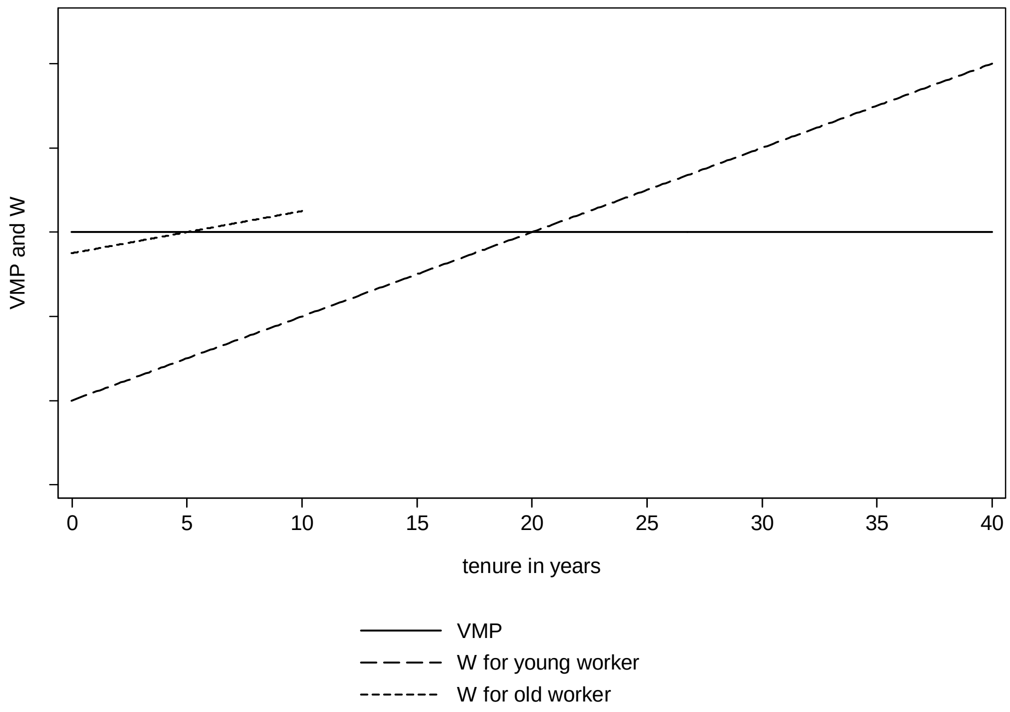


Figure 4: Adjustment of deferred compensation with higher entry wage and same slope (scenario B)



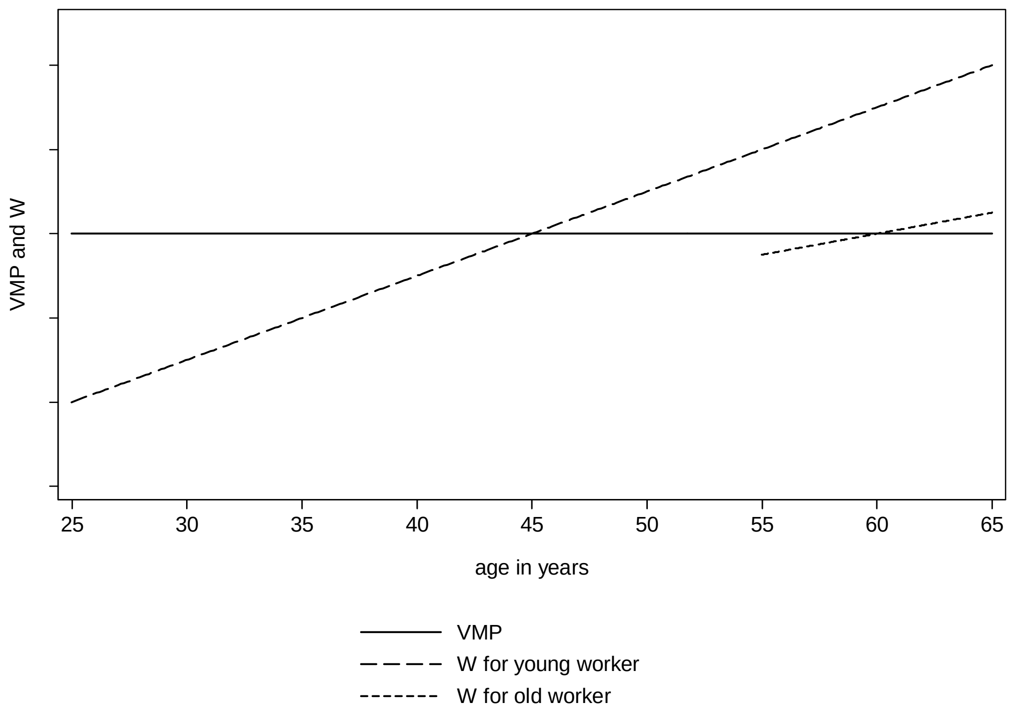


Figure 5: Adjustment of deferred compensation with higher entry wage and lower slope (scenario C)

Table 1: Adjustment of deferred compensation, inequity, and adverse incentive effects

	Tenure perspective		Age perspective		Tenure and age perspective	
Scenario	Wage level	Consequence for productivity	Wage level	Consequence for productivity	Wage growth	Consequence for productivity
A	$W_Y<W_O$	$VMP_Y\downarrow$	$W_Y>W_O$	$VMP_O\downarrow$	$dW_Y<dW_O$	$VMP_Y\downarrow$
B	$W_Y<W_O$	$VMP_Y\downarrow$	$W_Y>W_O$	$VMP_O\downarrow$	$dW_Y=dW_O$	–
C	$W_Y<W_O$	$VMP_Y\downarrow$	$W_Y>W_O$	$VMP_O\downarrow$	$dW_Y>dW_O$	$VMP_O\downarrow$

Figure 6: Distribution of age and entry age for blue-collar workers

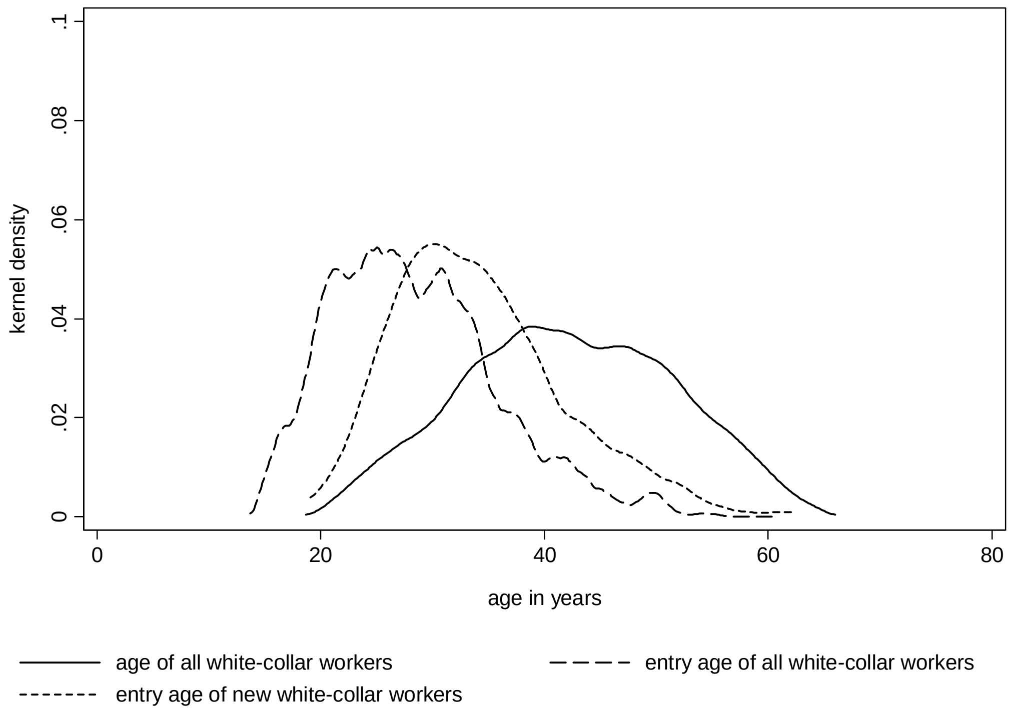


Figure 7: Distribution of age and entry age for white-collar workers

Table 2: Descriptive information on all workers and new workers

	All blue-collar workers				New blue-collar workers			Difference All-New		
Level	Number obs	Share (in %)	Age (mean)	Tenure (mean)	Number obs	Share (in %)	Age (mean)	Share	Age	Age t-test (p-value)
1	4441	8.73	42.47	12.66	15	17.86	45.10	-9.13	-2.63	0.09
2	3242	6.38	44.62	16.16	1	1.19	23.69	5.19	20.93	-
3	5075	9.98	42.77	15.36	8	9.52	36.25	0.46	6.51	<0.01
4	20635	40.58	39.48	11.28	55	65.48	33.61	-24.90	5.87	<0.01
5	9495	18.67	44.06	18.16	5	5.95	38.59	12.72	5.47	0.07
6	5659	11.13	45.40	21.18	0	0.00	-	-	-	-
7	2297	4.52	46.52	23.33	0	0.00	-	-	-	-
Total	50844	100.00	42.23	15.05	84	100.00	36.09	0.00	6.14	<0.01
	All white-collar workers				New white-collar workers			Difference All-New		
Level	Number obs	Share (in %)	Age (mean)	Tenure (mean)	Number obs	Share (in %)	Age (mean)	Share	Age	Age t-test (p-value)
1	7560	10.31	33.38	7.76	75	21.01	30.23	-10.70	3.15	<0.01
2	17232	23.51	40.30	13.40	59	16.53	34.19	6.98	6.11	<0.01
3	18634	25.42	41.19	13.50	114	31.93	32.76	-6.51	8.43	<0.01
4	10842	14.79	43.69	14.90	41	11.48	34.05	3.31	9.64	<0.01
5	8220	11.22	46.61	16.51	24	6.72	39.54	4.50	7.07	<0.01
6	10805	14.74	48.10	16.06	44	12.32	41.20	2.42	6.90	<0.01
Total	73293	100.00	42.17	13.81	357	100.00	34.11	0.00	8.06	<0.01

Table 3: Age categories of all workers and new workers

		Blue-collar workers						White-collar workers					
			Age categories						Age categories				
Level	Statistics	Total	<25	25-35	35-45	45-55	>55	Total	<25	25-35	35-45	45-55	>55
All	Number obs	50844	1159	9513	20994	15374	3804	73293	2389	15363	26614	21753	7174
	Share in row (%)	100.00	2.28	18.71	41.29	30.24	7.48	100.00	3.26	20.96	36.31	29.68	9.79
New	Number obs	84	9	37	18	19	1	357	29	186	106	33	3
	Share in row (%)	100.00	10.71	44.05	21.43	22.62	1.19	100.00	8.12	52.10	29.69	9.24	0.84
All-New	Share in row	0.00	-8.43	-25.34	19.86	7.62	6.29	0.00	-4.86	-31.14	6.62	20.44	8.95

Table 4: Computation of real wages

	Blue-collar workers	White-collar workers
OLS for log nominal wages		
Month t (1-84) [β]	0.00219***	0.00213***
	[0.00002]	[0.00004]
Constant	2.60123***	3.02303***
	[0.00114]	[0.00203]
Observations	50844	73293
R-squared	0.1622	0.0347
Mean log nominal wage	2.6956	3.1150
Mean hourly wages in Euros		
Nominal wage (January 1999, t=1)	13.3463	21.2803
Real wage (January 1999, t=1)	13.3463	21.2803
Nominal wage (December 2005, t=84)	15.9389	25.1784
Real wage (December 2005, t=84)	13.4903	21.3930
Wage growth 01/1999 – 12/2005		
Nominal wage growth (%)	19.4256	18.3179
Real wage growth (%)	1.0790	0.5296

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

Table 5: Entry age and entry wages for new blue-collar workers

	Mean	(1)	(2)	(3)
Age (years)	36.0945	0.0020**	-0.4052**	
	[9.4631]	[0.0009]	[0.1939]	
Age squared / 100	13.9130		1.7015**	
	[7.2347]		[0.8237]	
Age cubed / 1000	56.9345		-0.3048**	
	[43.6475]		[0.1503]	
Age quartic / 10000	245.2888		0.0198*	
	[244.1636]		[0.0100]	
Age 25-35 (dummy)	0.4405			-0.0040
	[0.4994]			[0.0257]
Age 35-45 (dummy)	0.2143			0.0364
	[0.4128]			[0.0315]
Age >45 (dummy)	0.2381			0.0356
	[0.4285]			[0.0300]
Female (dummy)	0.1786	-0.1179***	-0.1209***	-0.1166***
	[0.3853]	[0.0202]	[0.0232]	[0.0216]
Schooling apprenticeship degree (dummy)	0.9167	0.0111	0.0018	0.0093
	[0.2780]	[0.0238]	[0.0281]	[0.0256]
Constant		2.4362***	5.9610***	2.4945***
		[0.0396]	[1.6565]	[0.0345]
Observations = number of workers	84	84	84	84
R-squared		0.2896	0.3325	0.2972
Mean log real wage (January 1999 Euros)	2.4967	2.4967	2.4967	2.4967

Note: OLS for log real hourly wages. Robust standard errors and standard deviations in brackets. Coefficients are significant at * 10%, ** 5%, and *** 1%. Reference group for age categories is age less than 25 years.

Table 6: Entry age and entry wages for new white-collar workers

	Mean	(1)	(2)	(3)
Age (years)	34.1098	0.0188***	-0.2904	
	[7.5566]	[0.0021]	[0.2593]	
Age squared / 100	12.2042		1.1236	
	[5.6456]		[1.0541]	
Age cubed / 1000	45.8404		-0.1726	
	[33.6276]		[0.1837]	
Age quartic / 10000	180.7257		0.0094	
	[188.7714]		[0.0116]	
Age 25-35 (dummy)	0.5210			0.1023***
	[0.5003]			[0.0332]
Age 35-45 (dummy)	0.2969			0.2954***
	[0.4575]			[0.0443]
Age >45 (dummy)	0.1008			0.4663***
	[0.3015]			[0.0633]
Female (dummy)	0.3361	-0.1728***	-0.1765***	-0.1867***
	[0.4730]	[0.0293]	[0.0297]	[0.0291]
Schooling high school degree (dummy)	0.1653	0.0866*	0.0889**	0.0775*
	[0.3719]	[0.0447]	[0.0444]	[0.0461]
Schooling university degree (dummy)	0.5910	0.2689***	0.2758***	0.2679***
	[0.4923]	[0.0265]	[0.0275]	[0.0270]
Constant		2.1468***	5.1811**	2.6062***
		[0.0767]	[2.3083]	[0.0365]
Observations = number of workers	357	357	357	357
R-squared		0.4735	0.4786	0.4574
Mean log real wage (January 1999 Euros)	2.9026	2.9026	2.9026	2.9026

Note: OLS for log real hourly wages. Robust standard errors and standard deviations in brackets. Coefficients are significant at * 10%, ** 5%, and *** 1%. Reference group for age categories is age less than 25 years. Reference group for schooling is less than high school degree.

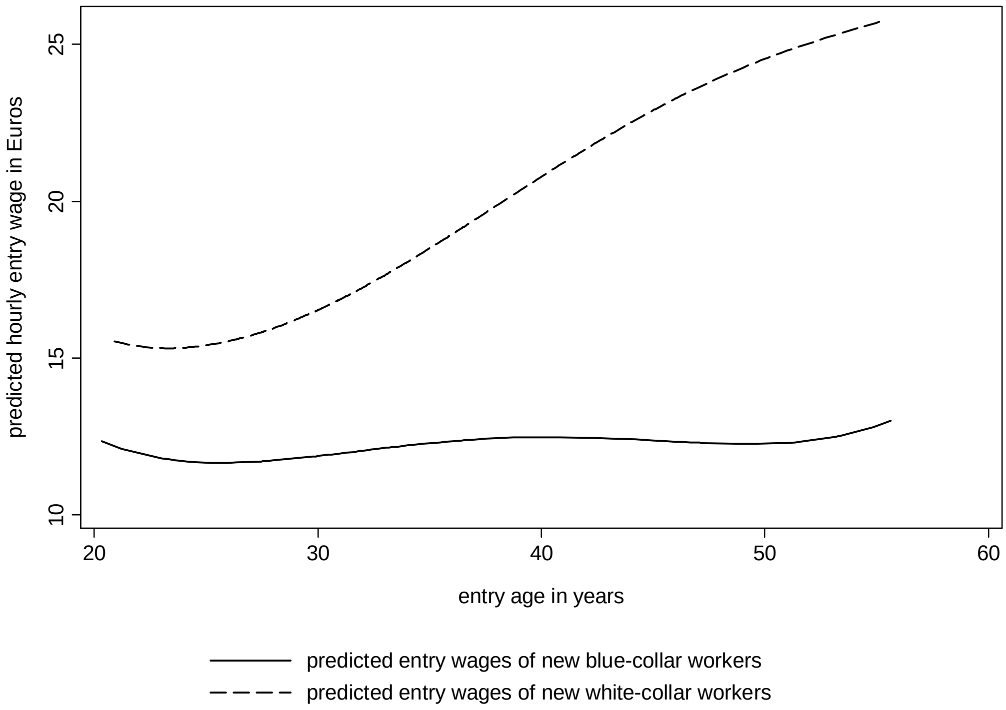


Figure 8: Predicted profiles for the effect of entry age on entry wages

Table 7: Descriptive statistics of variables in complete samples

	All blue-collar workers			
	Mean	Std. Dev.	Min	Max
Real hourly wage in January 1999 Euros	13.6746	1.6405	8.8571	31.6447
Log real hourly wage	2.6085	0.1177	2.1812	3.4546
Tenure in years	15.0485	9.1878	0.0055	49.1096
Entry age in years	27.1810	7.4904	13.7041	55.5315
Entry age <25 (dummy, reference group)	0.4932	0.5000	0	1
Entry age 25-35 (dummy)	0.3361	0.4724	0	1
Entry age 35-45 (dummy)	0.1414	0.3485	0	1
Entry age >45 (dummy)	0.0293	0.1686	0	1
Female (dummy)	0.1897	0.3920	0	1
Schooling apprenticeship degree (dummy)	0.7233	0.4473	0	1
	All white-collar workers			
	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 50844 for 786 blue-collar workers and 73293 for 1250 white-collar workers.

Table 8: Tenure and wages for blue-collar workers

	(1) RE	(2) FE	(3) RE	(4) FE
Tenure (years)	0.0061***	0.0062***	0.0152***	0.0152***
	[0.0001]	[0.0001]	[0.0003]	[0.0003]
Tenure squared / 100			-0.0279***	-0.0271***
			[0.0033]	[0.0033]
Tenure cubed / 1000			-0.0033**	-0.0037***
			[0.0013]	[0.0013]
Tenure quartic / 10000			0.0011***	0.0011***
			[0.0002]	[0.0002]
Entry age 25-35 (dummy)	-0.0047		-0.0033	
	[0.0070]		[0.0070]	
Entry age 35-45 (dummy)	0.0077		0.0121	
	[0.0090]		[0.0090]	
Entry age >45 (dummy)	0.0109		0.0278*	
	[0.0150]		[0.0150]	
Female (dummy)	-0.1259***		-0.1259***	
	[0.0081]		[0.0081]	
Schooling apprenticeship degree (dummy)	0.0593***		0.0692***	
	[0.0073]		[0.0073]	
Constant	2.4983***	2.5152***	2.4469***	2.4690***
	[0.0075]	[0.0011]	[0.0075]	[0.0013]
R-squared (within)	0.1349	0.1349	0.1893	0.1893
R-squared (between)	0.4135	0.1297	0.3954	0.1091
R-squared (overall)	0.3966	0.1207	0.3799	0.0950
Breusch Pagan test (χ^2)	1524345***		1533422***	
F-test		556***		593***
Hausman test (χ^2)	24.4397***		74.3562***	

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.

Table 9: Tenure and wages for white-collar workers

	(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 (χ^2)	1911052***		1929421***	
F-test		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.

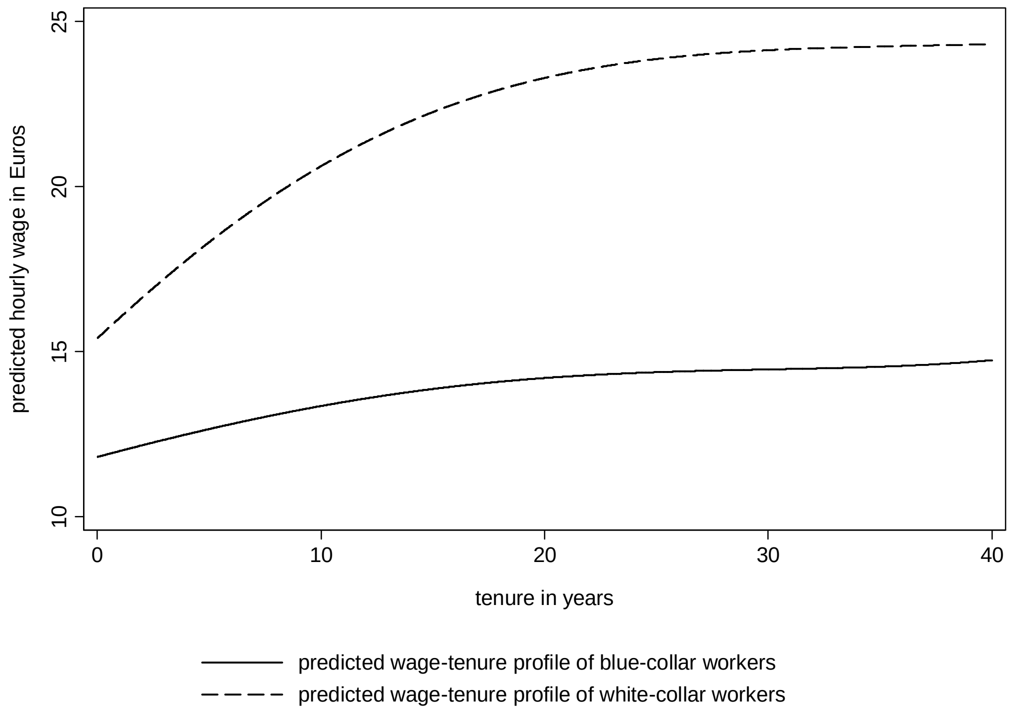


Figure 9: Predicted wage-tenure profiles (fixed effects)

Table 10: Interaction effect of entry age and tenure on wages for blue-collar workers

	(1) RE	(2) FE	(3) RE	(4) FE
Tenure (years)	0.0052***	0.0052***	0.0168***	0.0170***
	[0.0001]	[0.0001]	[0.0006]	[0.0006]
Entry age 25-35 (dummy) * Tenure	0.0025***	0.0026***	0.0006	0.0003
	[0.0002]	[0.0002]	[0.0008]	[0.0008]
Entry age 35-45 (dummy) * Tenure	0.0001	0.0002	0.0010	0.0007
	[0.0002]	[0.0002]	[0.0012]	[0.0012]
Entry age >45 (dummy) * Tenure	0.0065***	0.0066***	0.0345***	0.0352***
	[0.0005]	[0.0005]	[0.0034]	[0.0034]
Tenure squared / 100			-0.0271***	-0.0277***
			[0.0054]	[0.0054]
Entry age 25-35 (dummy) * Tenure squared / 100			-0.0054	-0.0017
			[0.0096]	[0.0096]
Entry age 35-45 (dummy) * Tenure squared / 100			-0.1584***	-0.1571***
			[0.0201]	[0.0202]
Entry age >45 (dummy) * Tenure squared / 100			-0.7582***	-0.7730***
			[0.0809]	[0.0811]
Tenure cubed / 1000			-0.0057***	-0.0057***
			[0.0019]	[0.0019]
Entry age 25-35 (dummy) * Tenure cubed / 1000			0.00001	-0.0015
			[0.0043]	[0.0043]
Entry age 35-45 (dummy) * Tenure cubed / 1000			0.1000***	0.0997***
			[0.0116]	[0.0116]
Entry age >45 (dummy) * Tenure cubed / 1000			0.5514***	0.5640***
			[0.0721]	[0.0722]
Tenure quartic / 10000			0.0014***	0.0014***
			[0.0002]	[0.0002]
Entry age 25-35 (dummy) * Tenure quartic / 10000			0.0003	0.0005
			[0.0007]	[0.0007]
Entry age 35-45 (dummy) * Tenure quartic / 10000			-0.0176***	-0.0175***
			[0.0021]	[0.0021]
Entry age >45 (dummy) * Tenure quartic / 10000			-0.1302***	-0.1338***
			[0.0216]	[0.0216]
Entry age 25-35 (dummy)	-0.0388***		0.0027	
	[0.0073]		[0.0077]	
Entry age 35-45 (dummy)	-0.0021		0.0634***	
	[0.0093]		[0.0096]	
Entry age >45 (dummy)	-0.0297**		0.0181	
	[0.0152]		[0.0154]	
Female (dummy)	-0.1249***		-0.1301***	
	[0.0081]		[0.0080]	
Schooling apprenticeship degree (dummy)	0.0609***		0.0655***	
	[0.0073]		[0.0072]	
Constant	2.5141***	2.5182***	2.4323***	2.4589***
	[0.0075]	[0.0011]	[0.0079]	[0.0017]
R-squared (within)	0.1427	0.1427	0.2018	0.2018
R-squared (between)	0.4015	0.0946	0.3973	0.1130
R-squared (overall)	0.3847	0.0800	0.3807	0.0926
Breusch Pagan test (χ^2)	1521730***		1530505***	
F-test		559***		593***

Hausman test (χ^2)	50.2185***	98.7291***

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.

Table 11: Interaction effect of entry age and tenure on wages for white-collar workers

	(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 (χ^2)	1923895***		1971342***	
F-test		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.

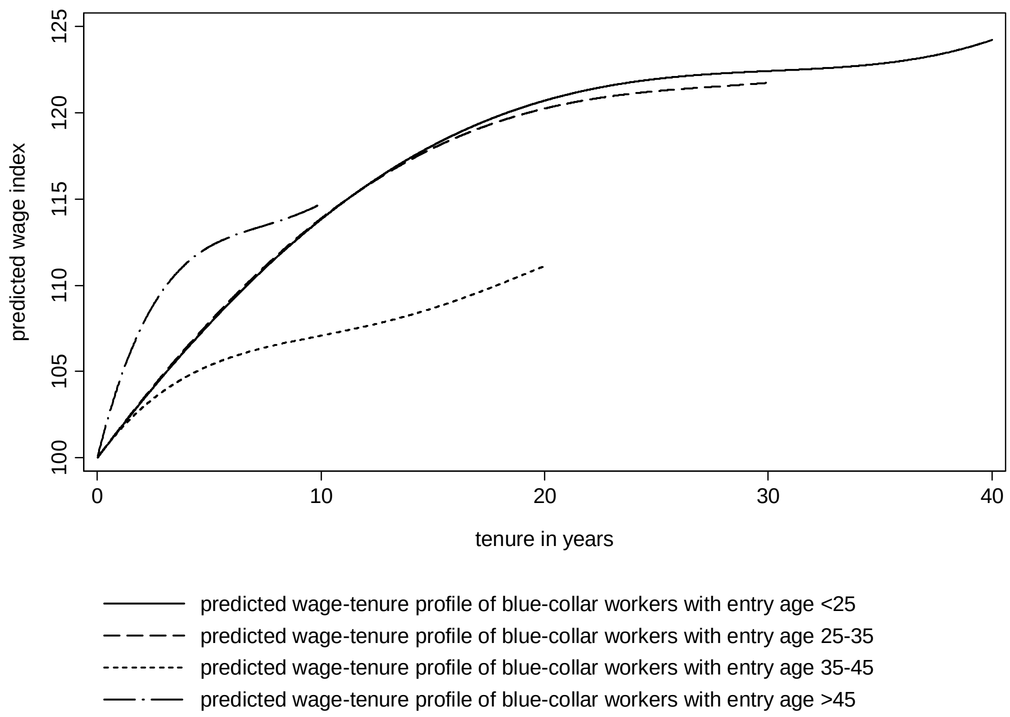


Figure 10: Predicted effects of entry age on the slope of wage-tenure profiles of blue-collar workers (fixed effects)

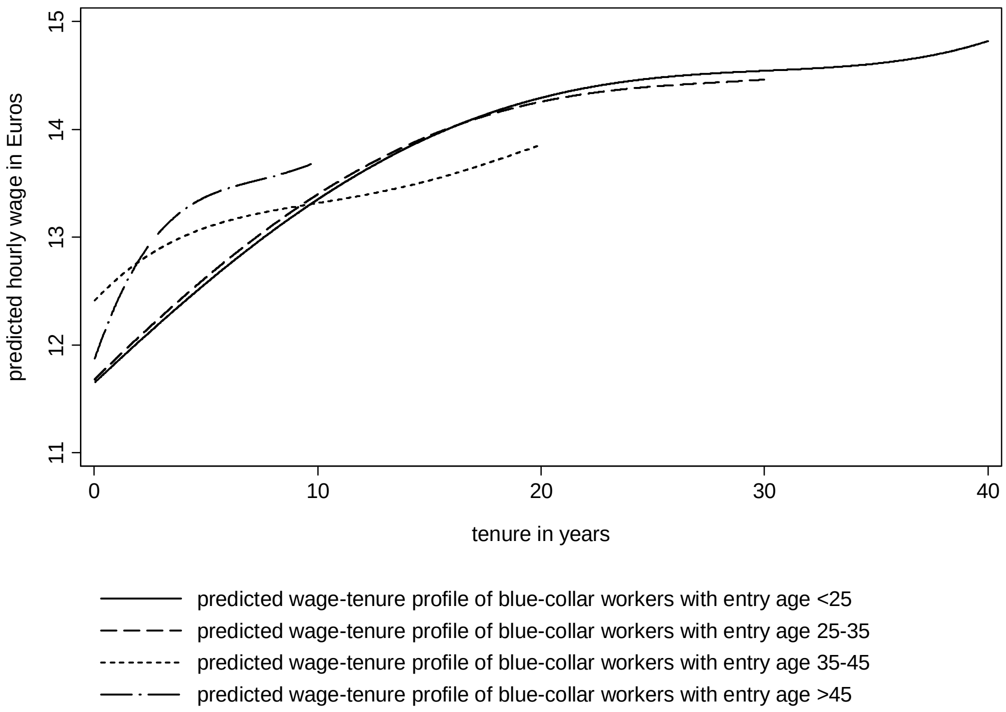


Figure 11: Predicted effects of entry age on wage-tenure profiles of blue-collar workers (random effects)

Figure 12: Predicted effects of entry age on wage-tenure profiles of blue-collar workers in an age perspective (random effects)

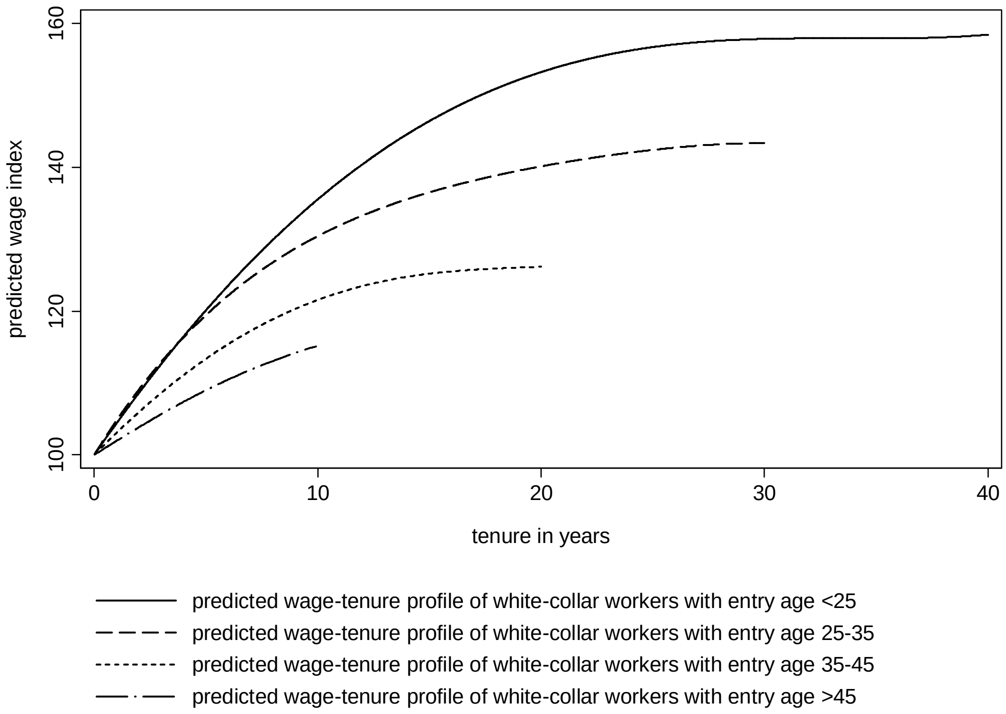


Figure 13: Predicted effects of entry age on the slope of wage-tenure profiles of white-collar workers (fixed effects)

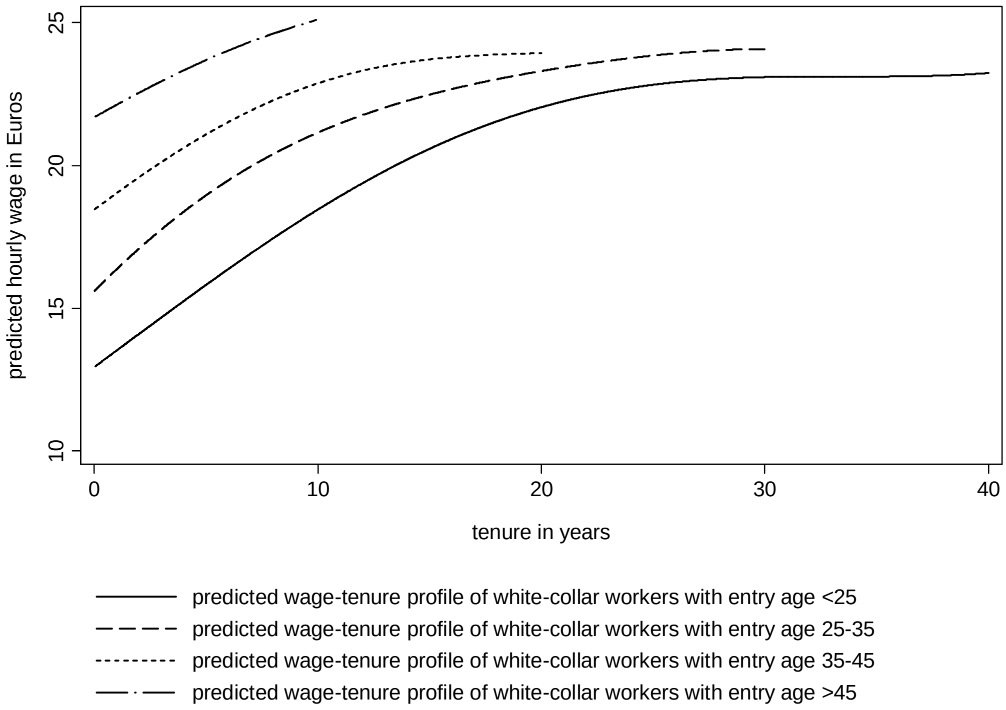


Figure 14: Predicted effects of entry age on wage-tenure profiles of white-collar workers (random effects)

Figure 15: Predicted effects of entry age on wage-tenure profiles of white-collar workers in an age perspective (random effects)

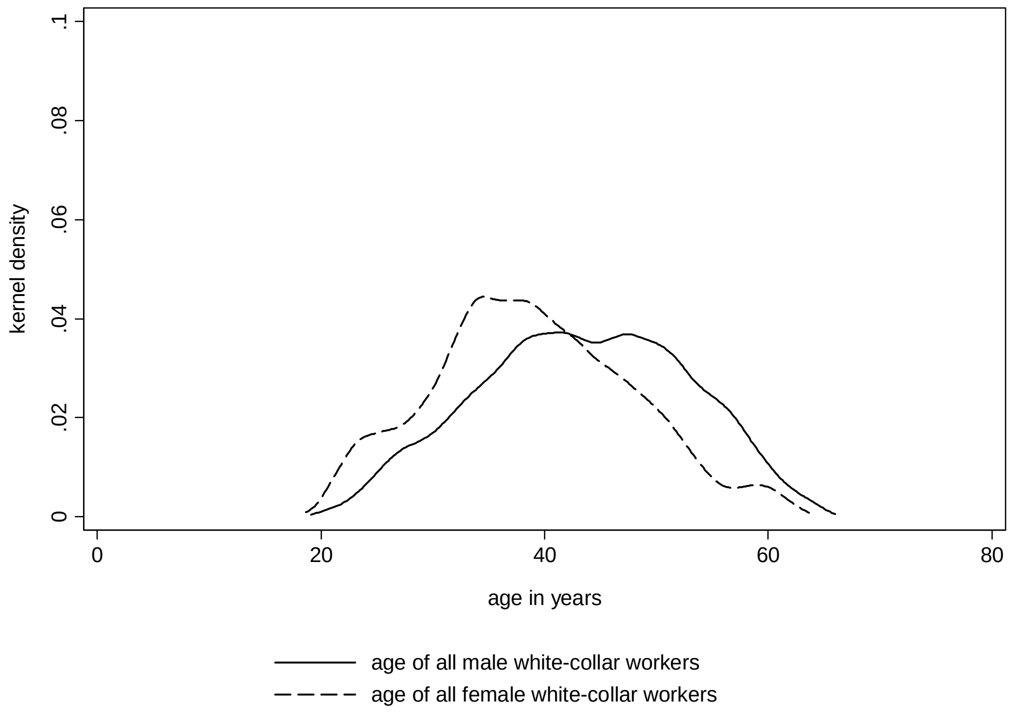


Figure 16: Distribution of age for all white-collar workers by gender

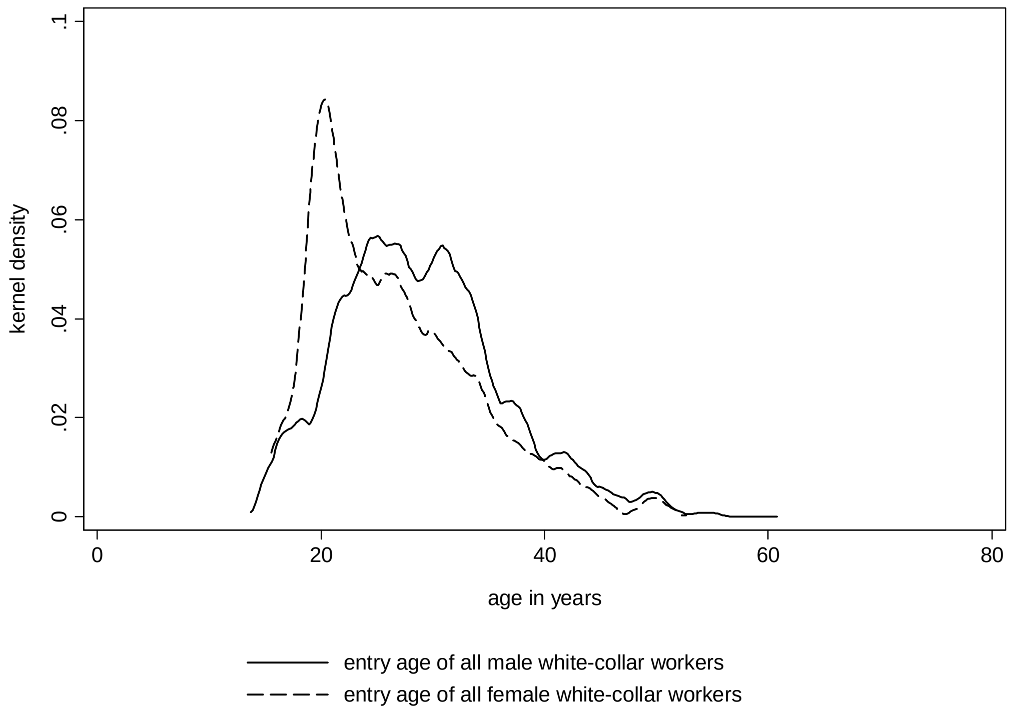


Figure 17: Distribution of entry age for all white-collar workers by gender

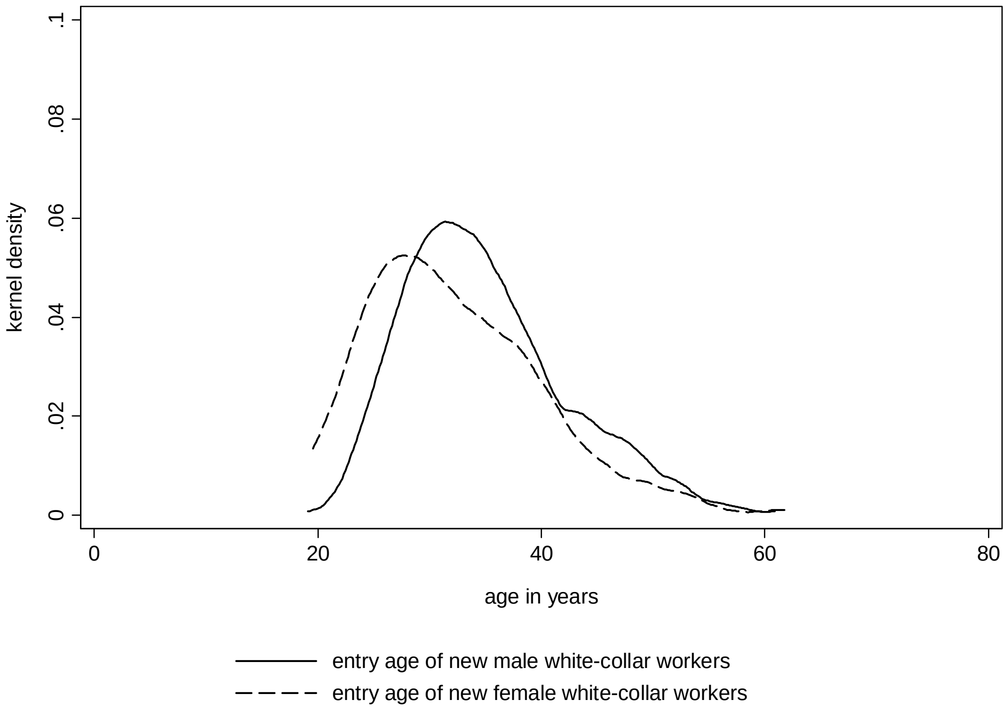


Figure 18: Distribution of entry age for new white-collar workers by gender

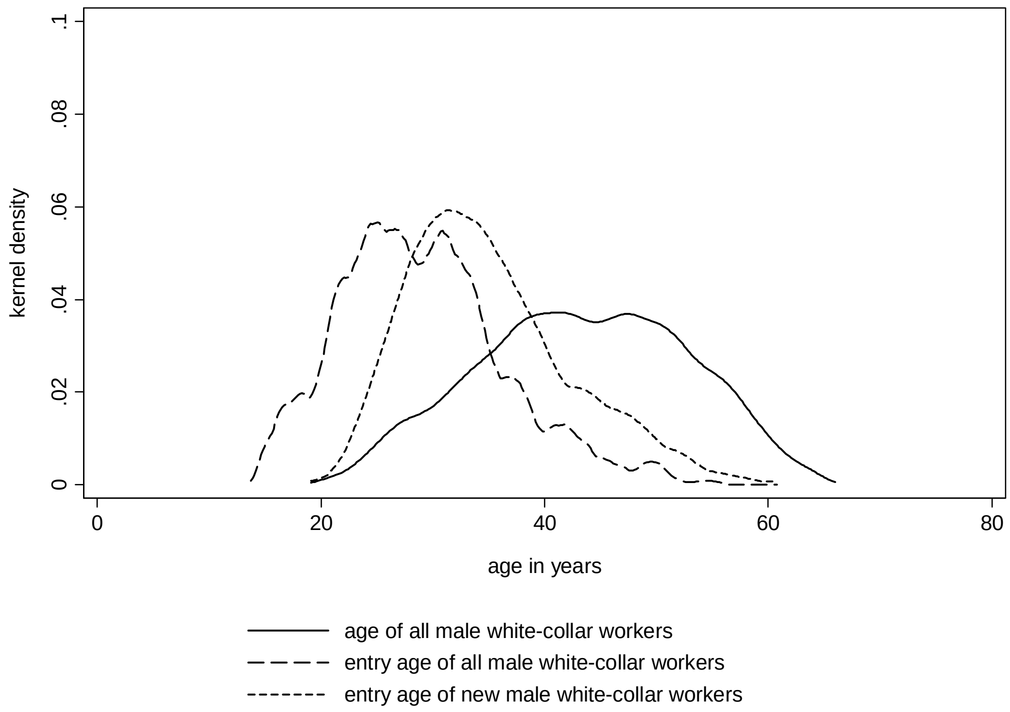


Figure 19: Distribution of age and entry age for male white-collar workers

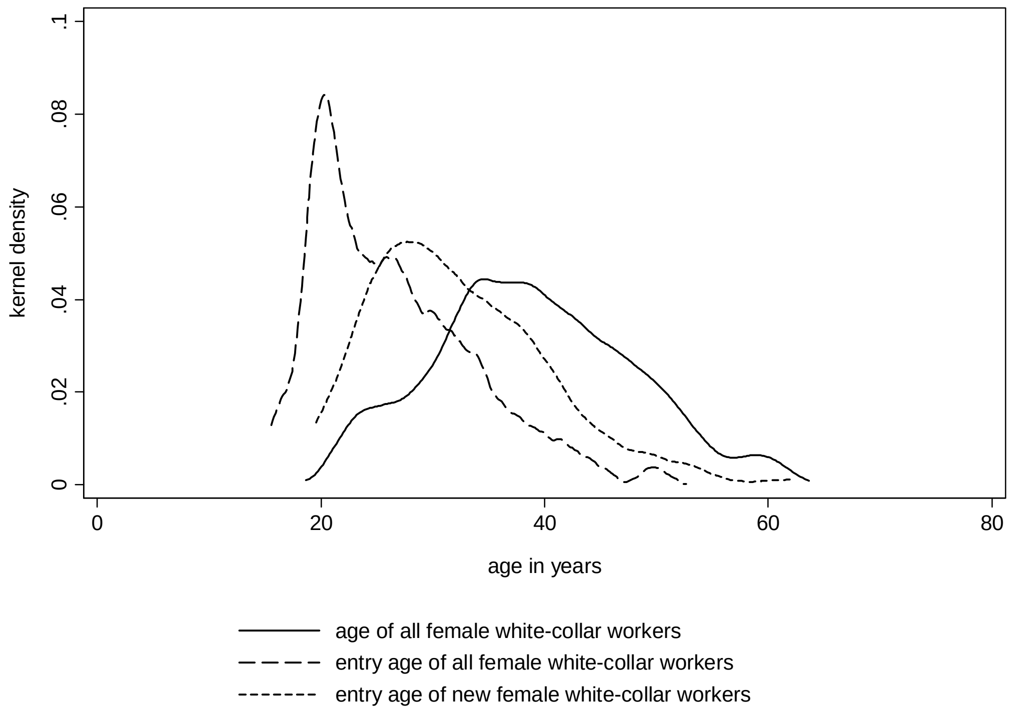


Figure 20: Distribution of age and entry age for female white-collar workers

Table 12: Age categories of all and new white-collar workers by gender

		Male white-collar workers						Female white-collar workers					
			Age categories						Age categories				
Level	Statistics	Total	<25	25-35	35-45	45-55	>55	Total	<25	25-35	35-45	45-55	>55
All	Number obs	53116	1099	9568	18606	17531	6312	20177	1290	5795	8008	4222	862
	Share in row (%)	100.00	2.07	18.01	35.03	33.01	11.88	100.00	6.39	28.72	39.69	20.92	4.27
New	Number obs	237	11	125	74	25	2	120	18	61	32	8	1
	Share in row (%)	100.00	4.64	52.74	31.22	10.55	0.84	100.00	15.00	50.83	26.67	6.67	0.83
All-New	Share in row	0.00	-2.57	-34.73	3.81	22.46	11.04	0.00	-8.61	-22.11	13.02	14.25	3.44

Table 13: Entry age and entry wages for new white-collar workers by gender

	Male white-collar workers			Female white-collar workers		
	(1)	(2)	(3)	(1)	(2)	(3)
Age (years)	0.0262***	-0.3757		0.0050*	0.2325	
	[0.0025]	[0.3151]		[0.0027]	[0.3567]	
Age squared / 100		1.641			-0.8867	
		[1.2854]			[1.4523]	
Age cubed / 1000		-0.2828			0.1463	
		[0.2252]			[0.2519]	
Age quartic / 10000		0.0174			-0.0086	
		[0.0143]			[0.0157]	
Age 25-35 (dummy)			0.1977***			0.0831**
			[0.0460]			[0.0344]
Age 35-45 (dummy)			0.4798***			0.0571
			[0.0569]			[0.0482]
Age >45 (dummy)			0.6251***			0.2807**
			[0.0778]			[0.1074]
Schooling high school degree (dummy)	0.1234*	0.1225*	0.1316*	-0.0161	-0.0243	-0.0302
	[0.0730]	[0.0723]	[0.0763]	[0.0437]	[0.0471]	[0.0418]
Schooling university degree (dummy)	0.2647***	0.2668***	0.2595***	0.2421***	0.2353***	0.2299***
	[0.0317]	[0.0328]	[0.0333]	[0.0473]	[0.0554]	[0.0498]
Constant	1.8873***	5.3881*	2.4808***	2.4628***	0.3842	2.5543***
	[0.0858]	[2.7983]	[0.0427]	[0.0982]	[3.1383]	[0.0348]
Observations = number of workers	237	237	237	120	120	120
R-squared	0.4690	0.4765	0.4236	0.2967	0.3005	0.3432
Mean log real wage (January 1999 Euros)	2.9973	2.9973	2.9973	2.7157	2.7157	2.7157

Note: OLS for log real hourly wages. Robust standard errors in brackets. Coefficients are significant at * 10%, ** 5%, and *** 1%. Reference group for age categories is age less than 25 years. Reference group for schooling is less than high school degree.

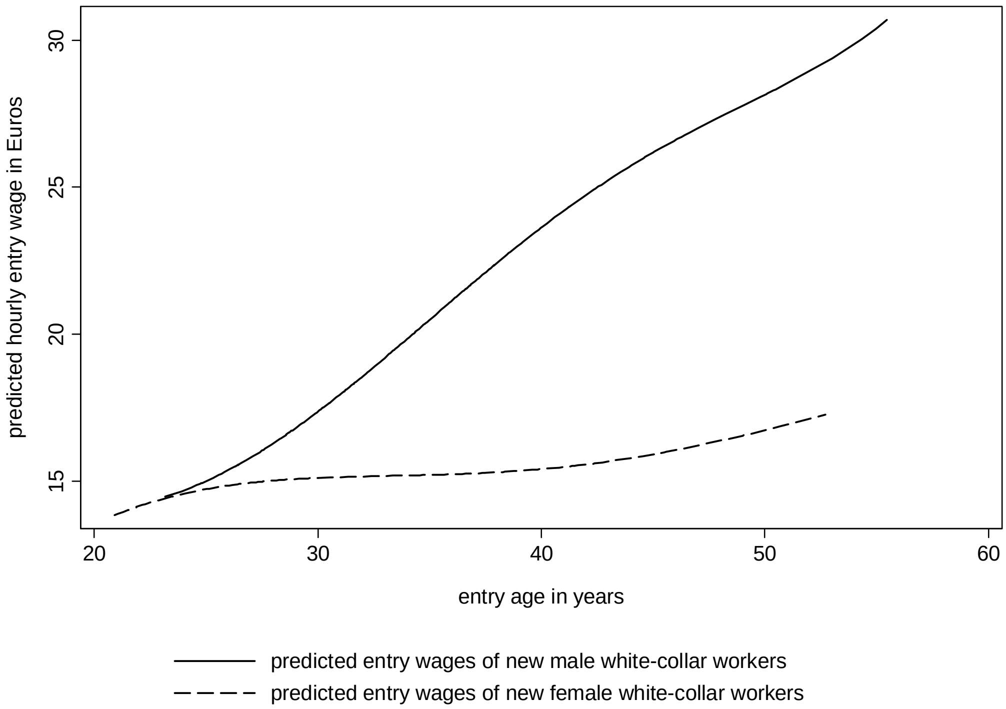


Figure 21: Predicted profiles for the effect of entry age on entry wages by gender