

Wage tenure profiles and mobility¹

Anja Deelen², CPB Netherlands Bureau for Economic Policy Analysis

January 28, 2011

Abstract³

In the public debate it is often suggested that the low level of job mobility in the Netherlands, especially among older workers, may be related to the Dutch wage structure. This paper contributes to the debate by presenting new micro econometric evidence that, compared to those in other countries, Dutch wage tenure profiles are steep. The results indicate that Dutch wages are partly related to firm specific elements. Moreover, employment protection is found to increase wages of older workers, because it strengthens their bargaining position. Finally, we find that firms in industries which have high returns to tenure have relatively high shares of older workers in their workforce, as well as high average tenures, indicating that steep tenure profiles are indeed correlated with low mobility.

Keywords: Wage-tenure profiles, job mobility, linked employer-employee data

JEL Codes: J31, J62

¹ The author thanks Frank Cörvers (ROA), Rob Euwals (CPB), Andries de Grip (ROA) and Daniël van Vuuren (CPB) for useful comments and suggestions on an earlier version of this paper.

² Address of correspondence: Netherlands Bureau for Economic Policy Analysis. P.O. Box 80510 2508 GM The Hague, Email: A.P.Deelen@cpb.nl.

³ This paper is based on the homonymous chapter in the CPB/ROA book "Labour Market Flexibility in the Netherlands - the role of contracts and self-employment", The Hague, 2011.

1 Introduction

There is a growing awareness that the Dutch labour market is relatively rigid for older workers (CPB, 2009). Compared to other countries, employment protection for workers on regular contracts is high, job mobility is low, and unemployment duration is long. Last, but not least, cross-sectional data suggest that Dutch wages increase quite steeply with age (OECD, 2006). These characteristics may be interrelated: The wages of older workers may be high due to bargaining power derived from strict tenure- and age-related employment protection, while low job mobility among older workers may be caused by steep wage–tenure profiles. With an ageing labour force, there is an increasing need to understand the relation between wage profiles and the labour market position of older workers.

This paper aims to increase our understanding of the Dutch labour market. It focuses on the impact of tenure (the duration of a match between a worker and a firm) on wages as opposed to the impact of experience on wages. In empirical studies, the effect of experience on wages is often interpreted as returns to investment in general human capital. Since general human capital is not firm related, its returns are no impediment to mobility. On the other hand, the effect of tenure is generally interpreted as the firm-related component of wages, for example, the return on firm-specific human capital (Becker, 1964) or deferred compensation schemes (with junior employees receiving wages below their marginal productivity and senior employees receiving wages in excess of marginal productivity; see Lazear (1981)). If the worker moves to another firm, he or she will no longer receive this wage component. Thus, unlike experience, tenure can be an impediment to mobility. Given the low job mobility of older workers in the Netherlands, it is important to gain a better understanding of the magnitude of Dutch returns to tenure.

Therefore, this paper's main research question is as follows: Are Dutch wage–tenure profiles steep compared to those in other countries and to what extent is this reflected in lower job mobility? The first part of the question is analysed by estimating the returns to tenure, controlling for experience, and by investigating wage losses experienced in involuntary job switches. Ideally we would want to not only assess the magnitude of returns to tenure, but also know the underlying reasons for the steep wage–tenure profiles. Unfortunately, our data do not allow us to pin down all the possible determinants of steep wage–tenure profiles. For example, the effect of deferred payment schemes and investments in firm-specific human capital cannot be identified. Our data do, however, allow us to analyse a third possible source of returns to tenure: quasi-rents that senior workers are able to capture due to the bargaining power deriving from their seniority resulting from the last-in, first-out (LIFO) layoff rule. Therefore, the effect of workers' seniority positions (relative to their colleagues in the same firm) on wages is analysed. Finally, we investigate whether there is a correlation between the high returns to tenure measured in some sectors and the low job mobility of older workers in these sectors' firms. The empirical research is performed by means of regression analysis techniques, using an extensive micro dataset.

It is important to note that the combination of steep wage–tenure profiles and low job mobility does not necessarily pose a problem for the Dutch labour market. Firms can adopt wage–tenure profiles for several reasons. For instance, to lengthen the payback period of investment in their workers (e.g., transaction costs associated with hiring), they may wish to reduce their workers’ mobility. Alternatively, they may use wage–tenure profiles as a tool for promoting worker effort. Furthermore, when rents of firm-specific investments are shared between employer and employee, wage–tenure profiles do not necessarily push the wages of older workers above their marginal productivity. In all these cases, returns to tenure and low job mobility may be optimal in terms of welfare.

With the ageing of the workforce, these mechanisms favouring wage–tenure profiles may, however, face increasing pressure as the period of employment at old age increases, the knowledge of workers risks becoming obsolete (De Grip & Van Loo, 2002), and the relative number of young workers decreases. In addition, a rigid labour market can harm efficiency by preventing an optimal allocation of workers over jobs. Low mobility then reduces the flexibility of the economy in case of a technological shock or when the economic environment gets more dynamic, for example, due to globalisation. Strict (tenure-based) employment protection may add to this effect.

Three main conclusions can be drawn from this empirical study. First, Dutch wage–tenure profiles are steep compared to those of other countries. The results indicate that wage growth is partly related to firm-specific elements, which are lost in the case of job mobility. Second, the findings suggest that quasi-rents obtained due to the LIFO layoff rule increase the wages of senior workers. However, this seniority effect is modest when compared internationally, and wage–tenure profiles remain steep after correcting for this aspect of Dutch employment protection legislation. A possible interpretation is that quasi-rents obtained due to tenure-related notice periods and severance payments may be captured in the estimated returns to tenure. Hence, the measured seniority effect is a lower limit of the total effect on wages of enhanced bargaining power for older workers. Third, a correlation between high returns to tenure and low mobility is found: the higher the returns to tenure in an industry, the higher the share of older workers, the average age, and the average tenure in firms belonging to that industry. Several explanations are possible for this correlation. It may indicate that deferred compensation prevails in these industries and firms, giving older workers an incentive to remain with their firm. But the causality can also run the other way: The presence of a high share of older workers in a firm can generate steep wage–tenure profiles, as can well-protected older workers who use their strong position in wage bargaining.

The paper is organised as follows. Section 2 reviews the economic literature on wage–tenure profiles and discusses some potential determinants of steep wage–tenure profiles. Section 3 briefly presents some Dutch institutions surrounding labour contracts, particularly institutions surrounding wage formation. It also provides descriptive statistics regarding job mobility, tenure, and wages. Section 4 presents new empirical evidence for the Netherlands on wage–tenure profiles and mobility. Section 5 concludes and discusses a few policy options.

2 Literature review

A variety of theoretical models explain the rise of wages over job tenure. First, human capital accumulation by workers due to investment in specific human capital (Becker, 1964) may provide an explanation, as far as workers are able to capture part of the specific value of the investment.⁴ Second, incentive theories emphasise that, since effort is often difficult to observe, deferred compensation (Lazear, 1981) may be optimal. Firms and workers enter into an implicit contract that serves as an incentive device which solves the agency problem of the firm. Workers receive a wage below the marginal productivity while their tenure is still low and a wage above their marginal productivity when tenure becomes high. Third, search and matching models are able to explain stylised facts on returns to tenure (Burdett, 1978; Jovanovic, 1979). Unobservable characteristics inducing high wages are at the same time responsible for fewer quits and layoffs, which leads to a positive relation between tenure and wages. Fourth, bargaining theories are congruous with wages rising over tenure. Since firm-specific capital represents a value to the firm, under certain assumptions it is in the firm's interest to avoid workers quitting. One such strategy may be to let wages increase gradually with tenure (Burdett and Coles, 2003). Other theories say that firms need senior workers to instruct and cooperate with new workers (Lindbeck and Snower, 1990) and that incumbent workers receive a seniority profile in wages as well as a LIFO layoff rule in exchange (Kuhn and Robert, 1989).

The theoretical literature therefore offers no single explanation for tenure-related wages. Meanwhile, the empirical literature shows a lack of agreement on how to calculate returns to tenure. Early studies regarding the United States address the problem of tenure endogeneity in the wage equation. Tenure is not a fully exogenous explanatory variable of wages, since unobserved individual characteristics and match-specific characteristics may determine both the wage level as well as tenure. In other words, high-productivity individuals tend to experience fewer quits and layoffs and high-quality matches tend to survive longer. Altonji and Shakotko (1987) and Abraham and Farber (1987) solve the endogeneity problem by using instrumental variable (IV) estimators. The impact of tenure on wages found is much lower than the least-squares estimates and the experience slopes are steeper, indicating that this technique corrects for the heterogeneity bias. Topel (1991) addresses the endogeneity problem by applying a two-stage first-differences (FD) estimation procedure and finds substantial returns to tenure for the United States.⁵ Alternatively, one can use panel data

⁴ However, investment in specific human capital does not necessarily imply that wages depend on job tenure. In an ideal world, the firm, instead of the risk-averse worker, should both bear the entire risk of the investment and receive all the quasi-rents, since firms can diversify risks on the capital market. In practice, however, labour contracts are incomplete, leaving room for renegotiation during the contract period (Grout, 1984; Hosios, 1990).

⁵ In a reassessment, Altonji and Williams (2005) explain the differences between Topel (1991) and Altonji and Shakotko (1987). They argue that Topel's estimator of the return to tenure is biased upward by individual heterogeneity, while the estimator in the latter paper is biased downward by job match heterogeneity.

models that control for fixed effects (FE) to tackle the endogeneity problem (Abowd *et al.*, 1999).

Studies of wage losses after job displacement, however, take a different angle (Kletzer, 1989; Jacobson *et al.*, 1993; Hijzen *et al.*, 2010), suggesting that firm-specific factors are an important determinant of wage growth. Dustmann and Meghir (2005) use a sample of displaced workers to identify the effect of tenure on wages. The underlying idea is that these workers constitute a random sample, since they switched job not by choice but due to firm closure, which is an exogenous event.⁶ The authors find strong evidence of positive returns to firm tenure in Germany, especially for unskilled workers. Beffy *et al.* (2006) take on another approach to cope with the endogeneity of the mobility decision. They use a structural model, estimating the wage equation along with separate equations for mobility and participation and controlling for unobserved person heterogeneity in the wage equation. The authors find low returns to tenure for France, although these rise with worker educational level. For the United States, the authors find higher returns to tenure, and their interpretation is that returns to tenure there serve as a device to counter excess job mobility.

The heterogeneity of workers as well as of firms has received increasing attention in the literature to explain countries' wage structures (Postel-Vinay and Robin, 2002; Abowd *et al.*, 1999). Lazear and Shaw (2008) explore the structure of wages based on linked employer–employee data for various countries, including the Netherlands. The authors find as a stylised fact that while there is high wage dispersion within firms, the average wages of firms also differ considerably between firms, with 'high-wage firms' and 'low-wage firms'. High-wage firms are, in general, characterised by low turnover. In the Netherlands, however, the authors find that there is little variation in wage growth between industries; wage differences at the firm level contribute for 12% of differences in wage growth, while 87% of the variation is due to individual differences (Lazear and Shaw, 2008; Chapter 4). Firm heterogeneity thus seems less important in explaining Dutch wage variation between individuals than worker heterogeneity.

Not many empirical studies exist on the relation between wages and productivity, because labour productivity is often unobserved. Borghans *et al.* (2007) give a nice overview of studies on productivity–wage gaps regarding the United States and Canada. These studies (Medoff and Abraham, 1981; Kotlikoff *et al.*, 1993; Dostie, 2006) generally provide evidence that older workers are paid wages exceeding their marginal productivity. Van Ours *et al.* (2010) conducted the only recent empirical study available for the Netherlands in this field: Many of the specifications estimated in their study indicate that older workers are relatively overpaid. The final specification, however, accounting for the potential endogeneity of the change in age composition, shows that productivity and wage both increase with age. Their study concludes that the productivity–wage gap at high ages is bound to be small in the Netherlands.

⁶ As in Topel (1991), a two-step approach is followed. In the first step, the effect of tenure and experience cannot yet be distinguished. In the second step, Dustmann and Meghir use the sample of displaced workers to estimate the unbiased effect of experience on wages; the result is then used to obtain the effect of tenure separately.

Regarding the relation between wages and mobility, the empirical analysis in Borghans *et al.* (2007) shows that a higher wage growth of older workers in firms is correlated with a lower outflow of older workers towards other jobs or early retirement. High wage variation within firms is found to be correlated with the greater mobility of both younger and older workers; more flexible remuneration is thus associated with greater mobility.

3 Wage-setting institutions and long-tenured contracts in the Netherlands

Negotiations between labour unions and employer organisations play a pivotal role in the Dutch wage formation process. Collective labour agreements can be concluded at the industry level, as well as at the company or plant level. Agreements at the industry level are reached between one or more employers or employer organisations and one or more workers' organisations. They are binding for all firms and employees represented by these parties. However, it is common practice that the parties request the Minister of Social Affairs and Employment to declare the agreement to be 'universally binding', implying that the agreement is extended to all employers in the industry. Although the Dutch union density (or membership) rate is fairly low (19%), the coverage of collective labour agreements in the Netherlands (79%) is relatively high from an international perspective. Several continental European countries (Germany, Italy, Portugal) feature comparable levels, while coverage in the United Kingdom (35%), the United States (13%), and, for example, Denmark (52%) is considerably lower.⁷ Dutch wage bargaining is characterised by an intermediate level of centralisation, since agreements are predominantly closed at the industry level. However, this is combined with a fairly high level of coordination at the national level. Tripartite consultation in the Social Economic Counsel serves as an important channel here.

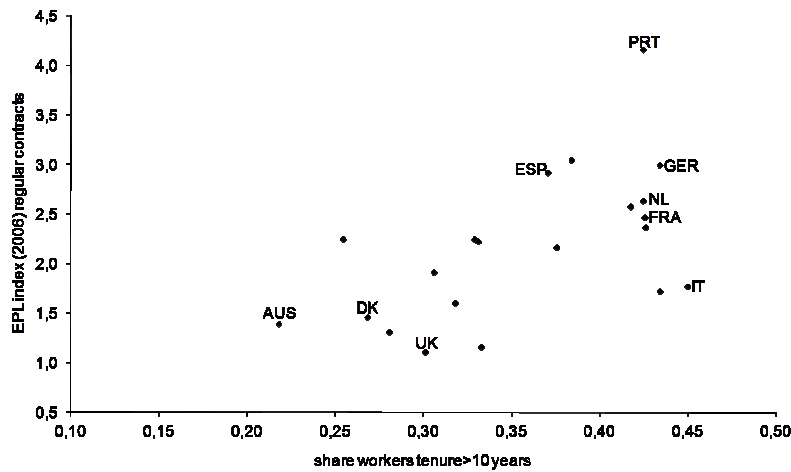
Flexible components of remuneration are fairly common in the Netherlands: For about 30% of workers, the yearly adjustment of individual wages is explicitly based on an evaluation of accomplishments. This incidence decreases with age, all other things being equal (Tijdens *et al.*, 2008). Other forms of flexible remuneration, such as once-only payments and bonuses related to performance at the company level, are less common. These types of flexible remuneration generally do not have a structural effect on wage levels.

It is sometimes suggested that wage profiles are steep not because older workers get paid high wages, but because young workers are paid low wages. As such, it is interesting to pay some attention to the (youth) minimum wage system. Dutch minimum wage levels are fairly high from an international perspective, although the Netherlands do not stand alone. The real hourly minimum wage (US\$8.22 in terms of 2008 purchasing power parity) is comparable to that in countries such as France, Belgium, and the United Kingdom. Minimum wage levels in southern European countries (Portugal, Spain, and Greece) are about half as high. The United

⁷ The source of the figures mentioned is Boeri and van Ours (2008), Table 3.1.

States and Canada take an intermediate position. Expressed as a percentage of the average wage of full-time workers, the Dutch minimum wage (0,38) falls between that of the United States (0,25) and France (0,50). The United Kingdom and Canada show figures similar to those of the Netherlands, which may mean that the minimum wage has an uplifting effect on large parts of the wage structure. Young workers up to the age of 22 are covered by a system of youth minimum wages. The minimum wage increases quickly over age: For example, the minimum wage of a worker aged 18 amounts to 45,5% of the adult minimum wage level. For a worker aged 20, this increases to 61,5%, while at age 22 the minimum wage is 85% of the adult minimum wage level. Since, however, this increase is age-related, no impact is expected on returns to tenure in the empirical analysis.

Figure 1 Share of workers with 10+ years of tenure plotted against EPL index on regular contracts



Source: OECD StatExtracts (tenure) and OECD Going for growth, 2009 (EPL).

The international position of the Netherlands concerning the incidence of long tenures is illustrated by Figure 1, which plots the share of workers with 10 or more years of tenure against the strictness of employment protection for regular contracts as measured by the OECD Employment Protection Legislation (EPL) index. Figure 1 suggests a positive correlation between employment protection and the incidence of long tenures. In other words, there is a negative relation between job mobility and employment protection. It is striking that both the Dutch EPL index and the share of long tenures exceed those of most countries.

Table 1 Share of male workers holding a job with tenure > 10 years, by age group, 2009

Age	20 to 29	30 to 44	45 to 54	55 to 64	Total
Australia	0.02	0.19	0.39	0.46	0.22
Korea	0.00	0.21	0.41	0.26	0.22
Mexico	0.06	0.30	0.50	0.50	0.25
Denmark	0.01	0.21	0.43	0.57	0.27
Canada	0.02	0.25	0.51	0.53	0.28
Iceland	0.04	0.24	0.44	0.54	0.28
United Kingdom	0.04	0.30	0.48	0.51	0.30
Hungary	0.02	0.30	0.49	0.53	0.31
Ireland	0.03	0.31	0.58	0.67	0.32
Norway	0.01	0.26	0.52	0.69	0.33
Poland	0.02	0.37	0.55	0.55	0.33
Switzerland	0.03	0.28	0.52	0.68	0.33
Spain	0.03	0.32	0.62	0.72	0.37
Czech Republic	0.03	0.40	0.57	0.60	0.38
Finland	0.01	0.33	0.60	0.72	0.38
Luxembourg	0.00	0.38	0.67	0.74	0.42
Netherlands	0.04	0.36	0.63	0.75	0.42
Portugal	0.06	0.43	0.66	0.70	0.42
Austria	0.06	0.44	0.69	0.75	0.43
Belgium	0.02	0.40	0.69	0.79	0.43
France	0.03	0.42	0.69	0.75	0.43
Germany	0.05	0.41	0.65	0.74	0.43
Italy	0.04	0.40	0.67	0.76	0.45
Average (unweighted)	0.03	0.33	0.56	0.63	0.35

Source: OECD, StatExtracts.

Table 1 specifies the share of long tenures by age group. For each age group the Dutch shares exceed the OECD average. The deviation from the OECD average increases with age. Of workers aged 55–64 years, 75% have held their current position for 10 years or more, compared with 51% in the United Kingdom and 46% in Australia. Only in Italy and Belgium is the share of older workers working that long at the same employer higher, while France and Austria show figures similar to that of the Netherlands. The counterpart is that the share of Dutch workers aged 55–64 (aged 45–54) in a new job (tenure < 1 year) is only 2% (4%).⁸ The outflow of older workers into early retirement and disability schemes presumably plays a role. For younger age groups, the Netherlands is less of an outlier, but the overall share of long tenures still remains fairly high. In addition, data on worker flows point to moderate job mobility in the Netherlands⁹; both accession and separation rates seem a bit lower than in other countries, although the set of countries for which these data are available is limited.

⁸ Source: OECD StatExtracts.

⁹ Jongen (2010), Table 2.1.

4 Wage profiles and mobility: new empirical evidence for the Netherlands

This section answers four empirical research questions. First, are Dutch wage–tenure profiles steep by international standards? Second, to what extent is wage growth over the job spell lost in case of an involuntary job switch? These two questions combined indicate the degree in which firm-specific elements play a role in wage setting, possibly providing an explanation for the low job mobility in the Netherlands. The data do allow us to assess the importance of one possible source of returns to tenure: quasi-rents that senior workers are able to capture due to the bargaining power derived from their seniority as a result of the LIFO layoff rule. Therefore, the third question is what is the impact of the relative seniority position of workers (compared to colleagues in the same firm) on wages? And fourth, is there a correlation between the impact of tenure on wages and the share of older workers in a firm? Using an extensive micro dataset, these questions are answered using regression analysis techniques.

4.1 Data

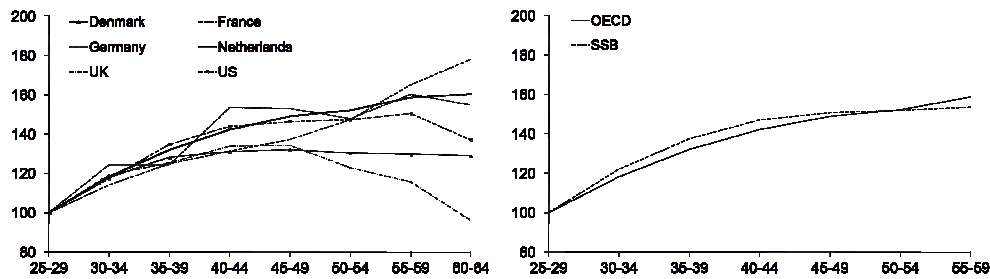
The core dataset used is the Dutch Social Statistical Database (SSB-jobs) for the years 1999–2005. This linked employer–employee dataset is based on administrative data. It is a complete dataset of all Dutch jobs, but information on gross wages and hours worked is available only for about one-third of the observations. Since this subsample remains largely the same over time, the dataset has the characteristics of a panel dataset. The level of educational attainment is included by merging SSB-jobs to the Dutch Labour Force Survey (DLFS) 1996–2005, which contains repeated cross sections covering about 10% of the labour force. The educational attainment level an individual has in DLFS is assigned to all years of our administrative dataset SSB-jobs, assuming that this variable is time invariant. After selecting on the availability of gross wages as well as educational attainment, about 1.7 million observations remain. We further restrict our analysis to male workers, working full-time (defined as a workweek of 35 hours or more) in the private sector, aged 18–60, and working in firms with at least 10 employees. Standby employees and employees working for temporary work agencies are excluded from the sample. Depending on the specification of the wage regressions, 300,000–400,000 observations remain.

Tenure can be calculated accurately, since the exact starting date of jobs is included in the dataset. A job is defined here as a contractual relationship between an employee and an employer. Internal mobility within a firm is not observed in the dataset. Potential experience is defined as the age of an individual minus the expected years of education given the attainment level.

An international comparison of cross-sectional data suggests that the Dutch wage profile is relatively steep (Figure 2, left). This pattern, as published by the OECD (OECD, 2006; CPB, 2009), is fairly similar to that found in our administrative dataset SSB-jobs (Figure 2, right): The

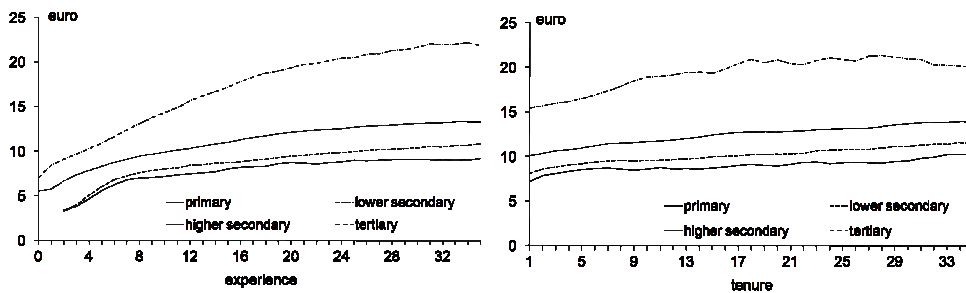
average real wage for males in the sample shows a substantial increase over age that gradually levels off. For each level of educational attainment in our administrative dataset, the average real wage for men increases with potential experience. The increase is more pronounced for higher levels of education (Figure 3, left). Moreover, for each level of educational attainment, the average real wage seems to increase with job tenure (Figure 3, right).¹⁰ However, it is complicated to interpret these descriptive statistics, since cross-sectional averages do not control for selectivity or for the correlation between experience and tenure. Since our interest is in the marginal effect of tenure on wages, conditional on experience and other characteristics, regression techniques are used to analyse the data in the remainder of this paper.

Figure 2 Wage profiles by age for males for a selection countries (left) and a comparison of OECD data with dataset SSB (right)



Source: Live Longer, Work Longer¹, OECD, 2006.

Figure 3 Average real wages of men by experience (left) and tenure (right)



The figure refers to men, aged 18-64, working full-time in the market sector in firms with 10 or more employees.

Source: own calculations, SSB-jobs 1999-2005 and Dutch Labour Force Survey 1996-2006 (level of attained education).

¹⁰ This is consistent with Borghans *et al.* (2007). Exploring the same dataset, they find that the highest percentiles experience the highest wage increases.

4.2 Empirical model wage–tenure profiles

To assess the effect of tenure on wages, three methods that are common in the literature are applied. All of these methods address the problem of endogeneity of tenure and/or experience in the wage equation, but in different ways.¹¹ The endogeneity problem, as discussed in Section 2, relates to the facts that high-productivity individuals tend to experience fewer quits and layoffs and high-quality matches tend to survive longer. Therefore simple ordinary least squares (OLS) regressions would lead to biased coefficients. The first method to address this problem is Topel's (1991) approach, which consists of a two-stage estimation procedure to assess the effect of tenure and experience on wages. In the first step, the wage equation, expressed in FD, is estimated on a sample of stayers (individuals who work for the same firm since at least a year). Estimating in FD assures that fixed job and individual effects are controlled for.¹² A drawback is that the linear effects of tenure and experience cannot be distinguished, since both increase by one year. Therefore, a second step is needed in Topel's approach to disentangle the linear effects of tenure, on the one hand, and experience, on the other. Second, the approach of Altonji and Shakotko (1987) is followed, where the endogeneity problem is addressed by using instrumental variables (IV) for tenure and experience.

Following Altonji and Shakotko (1987), the degree to which the actual tenure of an individual deviates from his or her average tenure over the observed job spell is used as an IV for that individual's tenure, and likewise for experience. Unfortunately, it is difficult to give an economic interpretation of these instruments. Two models are distinguished: the IV-ten model, where only tenure is instrumented, and IV-tenexp, where both tenure and experience are instrumented. Third, a fixed effects (FE) model¹³ is estimated to control for unobserved heterogeneity at the level of the employer–employee match.

4.3 Estimation results wage–tenure profiles

This section presents the estimated effect of tenure on real wages according to the various estimation models. Table 2 presents the cumulative effects of tenure on the real wages of male workers in the private sector. The cumulative effect of tenure can be interpreted as an estimate of what a typical worker would lose if his job were to end exogenously. The results

¹¹ For a more elaborate overview of both the empirical model and the estimation results, see 'The returns to tenure and seniority – New evidence for the Netherlands', Deelen, 2011 (forthcoming).

¹² The FD estimates are conducted using a two-step approach. The first step obtains the joint linear effect of tenure and experience. To distinguish the effect of tenure, two approaches are applied in the second step. First, following Topel (1991), simulated wages at the start of the current job (calculated using the estimation results from the FD equation) are estimated using the simulated experience at the start of the job as an explanatory variable. The second approach is to regress the wage change of involuntary job switchers (who have a tenure of less than one year by definition) on experience (where *involuntary* is determined by using a sample of job switchers who received unemployment benefits before starting in a new job). The average return to experience from these two approaches is subtracted from the joint effect of tenure and experience to determine returns to tenure.

¹³ The FE model is equivalent to an OLS model where all variables are taken in deviations from means over the job spell.

for the IV and FE models indicate that the return of remaining in a job for 10 years, compared to leaving earlier, is 6–7% in terms of real wages. After a tenure of 20 years, the cumulative return amounts to 9–12%. As is well known from the literature, the FD approach generates a much higher return to tenure¹⁴ than the IV and FE models.

To answer the question whether wage–tenure profiles in the Netherlands are steep, the estimation results are compared with other countries' outcomes obtained by the same regression techniques. Focussing on the actual level of the returns seems less fruitful, because of the variation between different methods. Compared to other studies, the FD model appears to generate relatively high returns to tenure for the Netherlands, much higher than those found for the United States (Table 3). In addition, compared to several European countries, the returns for the Netherlands are substantial. Only the returns to tenure for West Germany are of the same order of magnitude. According to the IV-ten model, again the returns to tenure are relatively high compared to those for other countries (Table 4, upper panel). The Dutch returns are again comparable with those for West Germany, as found by Zwick (2008). The returns for the United States vary: Altonji *et al.* (1987) find moderate returns, whereas Beffy (2006) reports returns of the same magnitude as found for the Netherlands. The latter's interpretation is that in the United States returns to tenure serve as a device to counter excess job mobility. Finally, the results of the IV-tenexp model (Table 4, lower panel) also indicate that the Dutch returns to tenure are substantial.

Compared to returns to tenure, returns to experience are much higher. This is not only the case for the Netherlands; it is common throughout the literature.¹⁵ Since experience is not firm related, returns to experience – which are generally associated with general human capital – are no impediment to mobility.

To summarise, this subsection investigates whether wage–tenure profiles in the Netherlands are steep. The empirical findings confirm that returns to tenure in the Netherlands are indeed high compared to those in other countries. In other words, it pays not to be mobile on the Dutch labour market.

¹⁴ The FD return in Table 2 is the average of the returns obtained when applying the two different methods in the second step.

¹⁵ To illustrate, returns to experience after 10 (20) years according to the IV-ten model amount to 62% (80%) for the Netherlands, 47% (91%) for the United States (own calculation based on estimation results in Altonji *et al.*, 1987), and 68% (132%) for West Germany (Zwick, 2008).

Table 2 Estimated cumulative return to job tenure

	5 years	10 years	15 years	20 years
First Differences	0.21	0.42	0.62	0.81
Instrumental variables (for tenure)	0.03	0.07	0.09	0.12
Instrumental variables (tenure and experience)	0.04	0.07	0.10	0.11
Fixed Effects	0.04	0.06	0.08	0.09

Figures refer to the cumulative returns to tenure according to different estimation techniques with additional correction for experience, demographic and educational variables. For all regressions the impact of tenure is highly significant

Table 3 Returns to tenure for various countries according to First Differences (FD) model

	5 years	10 years	15 years	20 years
Netherlands 2000-2005 a)	0.21	0.42	0.62	0.81
Topel (1991) for USA 1968-1983	0.18	0.25	0.28	0.34
Lefranc (2003) for USA 1981-1992	0.06	0.11	0.15	0.19
Lefranc (2003) for France 1990-1997	0.08	0.15	0.20	0.25
Williams (2008) for UK 1991-2001	0.08	0.11	N.A.	0.09
Zwick (2008) for West Germany 1998-2003	0.23	0.40	0.56	0.73

a) Figures refer to the cumulative returns to tenure according to the First Differences model, including corrections for experience and demographic and educational variables. The impact of tenure is highly significant.

Table 4 Returns to tenure for various countries according to Instrumental Variables (IV) models

	5 years	10 years	15 years	20 years
IV_ten				
Netherlands 1999-2005 a)	0.03	0.07	0.09	0.12
Altonji <i>et al.</i> (1987), USA 1968-1983	0.03	0.03	0.03	0.04
Dustmann <i>et al.</i> (2005), W-Germany 1991-1997	0.01	0.02	0.04	0.06
Beffy <i>et al.</i> (2006), USA 1968-1983 b)	0.10	0.11	0.11	0.12
Beffy <i>et al.</i> (2006), France 1976-1995 b)	-0.01	-0.03	-0.04	-0.06
Williams (2008), UK 1991-2001	0.05	0.06	NA	0.08
Zwick (2008), West Germany 1998-2003	0.06	0.08	0.09	0.10
IV_tenexp				
Netherlands 1999-2005 a)	0.04	0.07	0.10	0.11
Altonji <i>et al.</i> (1987)	0.04	0.03	0.04	0.05
Dustmann <i>et al.</i> (2005), W-Germany 1991-1997	-0.01	-0.02	-0.03	-0.03
Zwick (2008), West Germany 1998-2003	0.05	0.05	0.05	0.05

a) Figures refer to the cumulative returns to tenure according to two Instrumental Variables models. In the IV_ten model, only tenure is instrumented (IV_ten) while in the IV_tenexp model, both tenure and experience are instrumented. Both specifications include corrections for experience and demographic and educational variables. The impact of tenure is highly significant

4.4 Job switchers

Another way to learn about the impact of tenure on real wages is by analysing the real wage change of involuntary job switchers, since returns to tenure are match specific and not expected to carry over to the new job. Recent studies, however, recognise that labour market skills are not either fully general or fully specific to a firm but, rather, partially transferable across occupations, especially if individuals move to occupations with similar task requirements (Lazear, 2003; Gathmann and Schönberg, 2006). This may mitigate wage losses in case of job mobility.

In the empirical analysis, two subsamples of job switchers are distinguished. The first subsample consists of all individuals (again males, aged 18–64, and working full-time in the market sector) who were in different jobs in two subsequent years (9,026 observations). The second subsample consists of those job switchers who received unemployment benefits in between two jobs held in two subsequent years (737 observations).¹⁶ The latter group proxies for the group of involuntary switchers; it can be assumed that selectivity in the mobility decision is of minor importance for this group, since their job loss is closer to an exogenous event.

The average real wage increase between jobs amounts to 4.5% for the group of all switchers, whereas involuntary switchers, on average, face a wage drop of 1.3%. The positive wage rise for all switchers matches our expectations, since this group exists for the larger part of voluntary switchers. Selection effects play a role here, since the wage change will be one of the determinants in the mobility decision.

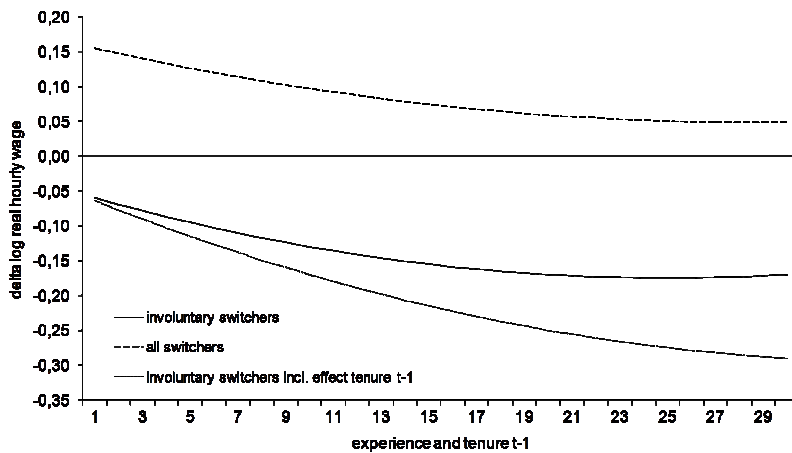
The effects of experience and tenure on the wage change of job switchers are identified using OLS regressions, where the real wage change of job switchers acts as dependent variable, while experience (including experience squared) and tenure in the previous job are the explanatory variables of interest. The impact of experience on the real wage change for all switchers is depicted by the topmost line in Figure 4. The more experienced the worker, the lower his average wage increase. The same is found for involuntary switchers, since the middle line in Figure 4 indicates that wage loss grows with experience, although this effect eventually flattens out. The bottommost line in Figure 4 depicts the effect of both experience and tenure in the departed job.¹⁷ Tenure is found to have a negative impact on the wage change of involuntary switchers: After 10 years the effect is 4% and after 20 years of tenure the additional wage loss (above the effect of experience) amounts to 8%.¹⁸

¹⁶ Note that all jobs observed in the sample are jobs existing in December, since the survey (which covers one-third of the SSB dataset) from which the data on wages and hours worked stem is held in December each year. Selecting cases that receive unemployment benefits in the second year is therefore a good proxy for individuals who receive benefits between two observed jobs. Instead of using unemployment benefits as an indicator of involuntary job mobility, one could use data on collective dismissals (see Fouarge *et al.*, 2010).

¹⁷ In Figure 4, it is assumed that tenure and experience move together, so the bottommost line can be interpreted as the wage effect of time for an individual who remains in one and the same firm over his or her entire career.

¹⁸ The additional downward effect of tenure in the previous year on the real wage growth is found for the subsample of all switchers as well (not depicted in Figure 4), but to a lesser extent.

Figure 4 Wage change of (involuntary) job switchers by experience and tenure in the previous job



¹ The topmost line depicts the effect of experience on the real wage change of all switchers, the middle line shows the effect of experience on the real wage change for involuntary switchers, and the bottommost line depicts the effect of both experience and tenure in the departed job for involuntary switchers.

These results can be interpreted as showing that wage growth over a job spell partly depends on firm-specific factors. This part of the wage growth is lost in case of job mobility. This finding is in line with the robust results from the growing literature on displaced workers, where the wage losses of displaced workers increase with tenure on the lost job. Moreover, these results confirm the findings in the previous section, that there are positive returns to tenure in the Netherlands. The fact that the effect of tenure on the wage losses of involuntary job switchers is slightly smaller than the returns to tenure found in the previous section may indicate that a minor part of the effects of tenure are transferable to new jobs (Kuhn and Sweetman, 1999). However, the results need to be interpreted carefully. First, the sample of involuntary job switchers is of limited size, and receiving unemployment benefits is perhaps an imperfect proxy for involuntary unemployment. Second, the sample is probably subject to selection effects: For example, wages are only observed for individuals who actually find a job. Older workers often have alternatives such as unemployment or disability benefits or early retirement arrangements, leading to relatively high reservation wages.

To summarise, this subsection empirically analyses the wage change of Dutch job switchers. The results indicate that, on average, involuntary switchers experience a real wage drop when moving to a new job. The wage decrease is larger the higher the tenure in the departed job, indicating that wage growth over the job spell partly depends on firm-specific factors, which is lost in the case of job mobility. These results confirm the findings in the previous section of positive returns to tenure in the Netherlands.

4.5 Seniority index

The last two sections provide evidence that there are positive returns to tenure in the Netherlands and indicate that these returns are substantial from an international perspective. No attempt has been made so far to explain these positive returns to tenure. The data do not allow one to determine the importance of, for example, deferred payment schemes and investments in firm-specific human capital. Another possible source of returns to tenure is quasi-rents that senior workers may be able to capture due to the bargaining power they derive from their seniority, to which the LIFO layoff rule in the Netherlands probably contributes.¹⁹ This section empirically assesses the impact of seniority on real wages, apart from the effect of tenure, by estimating the effect on wages of a worker's relative seniority position in his firm.

The seniority index, which describes the seniority of an individual relative to that of his colleagues in the same firm, is determined empirically using the complete datasets for each year, comprising all workers in all firms. The seniority index is defined, in conformity with Buhai *et al.* (2008), in such a way²⁰ that the seniority index of the most recently hired employee in a firm is zero, and the more senior a worker in the firm, the higher his seniority index. The seniority index is not a perfect approximation of the probability of being dismissed, *inter alia*, because in the Netherlands the LIFO layoff rule is not applied across the board but per job group. Therefore, job heterogeneity within firms can restrict the representativeness of the seniority index, because employers may want to reduce some job groups more than others. Moreover, firms can actively change the categorisation of workers over job groups in the preamble of reorganisations to affect the selection of workers to be fired.

The empirical analysis of the impact of the seniority index on real wages is implemented by extending the real wage equation with the seniority index. This has been done for the standard specifications of the various models (FD, FE, and IV) discussed earlier in this section. Hence, the effect of seniority is measured on top of that of tenure so that it can be seen as the impact of higher seniority if all other characteristics, including tenure, are equal between two workers. In line with the theoretical expectation that the enhanced bargaining power obtained by the LIFO layoff rule will lead to higher wages, all the models presented in Table 5 find the seniority index to have a significant positive effect on real wages. An effect of 0,006 implies that, if a worker develops from being the most newly hired worker to the most senior worker in a firm, his real wage increases by 3–4%²¹ solely due to the improvement in his seniority

¹⁹ In case of collective dismissal or dismissal for economic reasons, the LIFO principle, applied per job group, prevailed up to early 2006, at which time the Dutch government implemented a minor policy reform. Since then, the LIFO principle has been replaced by the so-called reflection principle. Under this new system, employees per job group are classified in 10-year age groups and the LIFO layoff rule is applied to each of these groups. The underlying policy aim is to distribute dismissals more evenly over the age groups.

²⁰ The seniority index of worker i in firm j at period t is defined as $-\log(\text{number of workers in firm } j \text{ at period } t \text{ employed at least as long as worker } i) / (\text{total number of workers in firm } j \text{ at time } t)$ (Buhai *et al.*, 2008).

²¹ For example, for a firm with 1,000 workers, when a worker moves from being the newest hire (999 colleagues have higher seniority) to the most senior worker, the effect on wages is the estimated coefficient times the change in seniority index, that is, $0.006 * (-\log(0.001) - (-\log(0.999))) = 0.04$.

position. If the seniority index is left out of the specification, this effect is picked up by the tenure variable, so the tenure effect presented partly reflects the effect of seniority.

The magnitude of the Dutch seniority effect is, however, low in comparison to the effects for Portugal and Denmark, as found in Buhai *et al.* (2008). This is a striking result, since employment protection legislation for regular contracts in the Netherlands is stricter than in Denmark, according to the OECD EPL index. Moreover, the Dutch score for the item 'difficulty of unfair dismissal' of this index (1,5), which relates, among other things, to LIFO, lies in between the scores of Denmark (0) and Portugal (2) (OECD, 2004). Although there is some positive effect of seniority on wages, Dutch senior workers apparently exploit their individual bargaining power derived from their seniority position only to a limited extent.

Finally, in interpreting the results, one should bear in mind that the seniority index is not a perfect measure of the probability of being dismissed, as pointed out earlier. A possible interpretation of the modest effect found is that the pivotal role of unions in the Netherlands reflects a high social value attached to wage equality and the minor importance of wage renegotiations at the individual level. A second possible interpretation is that the need to exploit the individual bargaining power derived from the seniority position is low because Dutch returns to tenure are already high for other reasons, in contrast with, for example, Denmark.²² Since both notice periods and severance payments are strongly tenure related in the Netherlands, LIFO may not be the only source of enhanced bargaining power for older workers. Therefore, returns to tenure as measured may still partly reflect quasi-rents captured by high-tenured workers, apart from the effect of seniority. Hence, the measured seniority effect is a lower limit of the effect of older workers' enhanced bargaining power on wages.

To recap, this subsection empirically assesses the impact of seniority on real wages, separate from the effect of tenure, by estimating the effect on wages of a worker's relative seniority position in a firm. In line with the theoretical expectation that the enhanced bargaining power obtained by the LIFO layoff rule will lead to higher wages, a significant and positive effect of seniority on real wages is found. Compared internationally, the effect is modest. Apparently, quasi-rents obtained as a result of the LIFO layoff rule are not a major factor in explaining the steep Dutch tenure profiles. On top of this, quasi-rents due to tenure-related notice periods and severance payments may be captured in the estimated returns to tenure. Hence, the measured effect is a lower limit of the real effect of older workers' enhanced bargaining power on wages.

²² In Denmark returns to tenure are relatively small, and the seniority effect is large compared to the return to tenure (Buhai *et al.*, 2008, footnote 16).

Table 5 Effect of the seniority index on real wages

	Netherlands		Denmark		Portugal	
FD	0.002	**	0.005	***	0.014	***
FE	0.006	***	0.010	***	0.019	***
IV_tenexp	0.004	*				

The seniority index measures the seniority position of a worker relative to his colleagues in the same firm. ***, ** and * indicate that the estimated coefficient is significant at 1%, 5% respectively 10% level.

4.6 Relation between return to tenure and the share of older workers in a firm’s workforce

This subsection investigates whether there is a correlation between steep wage–tenure profiles and low job mobility in the Netherlands. More precisely, the research question of interest is whether firms belonging to industries with relatively high returns to tenure display a higher share of older workers and higher average tenure.

Deferred compensation schemes (where the young are paid below their marginal productivity in favour of older workers) may serve as a tool for firms to purposefully reduce the mobility of their workforce. High transaction costs, for example, when hiring workers may be an argument for firms to apply deferred compensation²³; this way employers lengthen the payback period of their investments. Hence, if deferred compensation schemes are applied, empirically a positive correlation is expected between returns to tenure and the share of older workers in a firm, or the average age and tenure.

The relationship between mobility and returns to tenure is analysed by regressing the share of older workers in firms²⁴ on a measure for the industry-specific tenure effect (next to several control variables). Firm-level regressions for other variables regarding the composition of the workforce of firms (e.g., average age, average tenure, share of young workers, and share of flexible workers) are also performed.²⁵ The measure for the industry-specific tenure effect is derived from the wage–tenure analysis described earlier, where now the specification of the IV-tenexp model is extended by introducing one extra variable that measures tenure in a specific industry.²⁶ In total, 33 industries in the private sector are distinguished. The

²³ Two other main arguments for deferred compensation schemes are the following: First, firms want to stimulate workers’ efforts and, second, firms are uncertain about the productivity of newly hired workers and want to preserve their existing highly productive workers by paying them higher wages (Blinder, 1982).

²⁴ The variables regarding the composition of the workforce are calculated using the integral dataset, containing all workers in all Dutch firms.

²⁵ Zwick (2008) performs a similar analysis for Germany and finds that ‘German establishments paying stronger seniority wages than the average establishment in their sector have a higher tenure of their employees’.

²⁶ The extra variable is an interaction variable consisting of an industry dummy variable times the linear tenure variable as measured at the individual level.

regression then produces 33 estimated industry-specific tenure coefficients, which serve as a measure of the effect of tenure on wages in these particular industries.

Table 6 only presents the coefficient of the measure for the industry-specific tenure effect; coefficients for other (control) variables are not presented. Hence, each row relates to a separate regression. All effects are significant at the 1% level. The results clearly show that the higher the returns to tenure (in the industry a firm belongs to), the higher the share of older workers (aged 55–64) in the firm and the lower the share of young workers (aged 15–24) and workers on flexible contracts. Furthermore, the higher the returns to tenure in the industry concerned, the higher the average age and tenure of workers in the firm.

Summarising, a clear correlation is found between steep wage profiles and the low mobility of older workers. Several explanations are possible. The correlation found may indicate that deferred compensation prevails in these industries and firms, giving older workers an incentive to remain with their firms for a longer period. But the causality can also run the other way: a high share of older workers in a firm may generate steep wage–tenure profiles as well-protected older workers use their strong wage bargaining position. Another possibility is that older workers are highly represented in sectors of the industry where investments in firm-specific human capital are important.

Table 6 Estimation results regarding various aspects of the composition of the workforce of firms

	coefficient	industry-specific tenure effect
Share of workers aged 55-64	1.02	***
Share of workers aged 25-54	6.03	***
Share of workers aged 15-24	-7.13	***
Share of flexible workers	-7.82	***
Average age workforce	175.33	***
Average tenure workforce	106.85	***

The figures display the estimation results for six separate regressions explaining different aspects of the composition of the workforce of firms. Variable of interest is a measure of the industry-specific tenure effect. The regressions include control variables for firm characteristics like firm size and firm growth. *** indicates that the estimated coefficient is significant at 1% level.

5 Summary and conclusions

This paper investigates Dutch wage–tenure profiles using an extensive administrative dataset. Empirical evidence is provided that returns to tenure are high by international standards. In other words, for older workers, it pays not to be mobile on the Dutch labour market. This is confirmed by the finding that involuntary job switchers, on average, experience a wage drop between jobs. This wage drop is larger the higher the tenure was in the departed job. This finding can be interpreted as wage growth over a job spell partly depends on firm-specific factors, which is lost in the case of job mobility.

Unfortunately, the data do not allow one to assess the importance of all possible sources of steep wage–tenure profiles, such as returns to firm-specific human capital or deferred compensation. One possible source of high returns to tenure that could be analysed, however, is quasi-rents. Senior workers may be able to capture quasi-rents due to strong bargaining power derived from their seniority position because of the LIFO layoff rule. Empirically, we find a significant but modest positive effect of seniority on real wages. Apparently, quasi-rents obtained as a result of the LIFO layoff rule are not a major factor in explaining the steep Dutch tenure profiles. However, on top of that, quasi-rents due to tenure-related notice periods and severance payments may be captured in the estimated returns to tenure. Hence, the measured seniority effect is a lower limit of the total effect of older workers' enhanced bargaining power on wages.

Moreover, a clear correlation is found between steep wage profiles and the low mobility of older workers. Several possible explanations exist for this finding. It can be an indication that deferred compensation prevails in these industries and firms; high investments in specific human capital may also be a reason. Another possible explanation is that a high share of older workers in a firm generates steep wage–tenure profiles, as well-protected older workers using their strong position in wage bargaining.

A remaining question is what causes Dutch wage profiles to be steep? Returns to investment in firm-specific human capital may play a role, but it is unclear why Dutch firm-specific investments would be larger than in other countries. Perhaps the high share of large firms in the Netherlands, offering large internal labour markets with high specific investments, contributes to the explanation. Deferred payment schemes may play a role as well, but again the question remains why Dutch schemes should differ from their international counterparts. Furthermore, quasi-rents following tenure-related notice periods and severance payments may be captured in the estimated returns to tenure. All in all, these constitute an open invitation for future research.

References

- Abowd, J., F. Kramarz and D. Margolis, 1999, "High-Wage Workers and High-Wage Firms", *Econometrica*, 67, 2, 251-333.
- Abraham, K. and Farber, H., 1987, "Job Duration, Seniority and Earnings", *American Economic Review*, 77 (June), 278-297
- Altonji, J.G. and R. Shakotko, 1987, "Do Wages Rise with Job Seniority?", *Review of Economic Studies*, Blackwell Publishing, vol. 54(3), pages 437-59, July.
- Altonji, J.G and N. Williams, 2005. "Do wages rise with job seniority? A reassessment," *Industrial and Labour Relations Review*, Cornell University, vol. 58(3), pages 370-397, April
- Becker, G. (1964), *Human Capital*, University of Chicago Press, Chicago
- Beffy, M., M. Buchinsky, D. Fougère, Th. Kamionka and F. Kramarz, 2006, "The Returns to Seniority in France (and Why are They Lower than in the United States?)", CEPR DP5486, C.E.P.R. Discussion Papers.
- Boeri T. and J. van Ours, 2008, *The Economics of Imperfect Labor Markets*, Princeton University Press
- Borghans, L., F. Cörvers, B. Kriechel and R. Montziaan, "Productiviteit, beloning en arbeidsmarktparticipatie van ouderen", ROA-R-2007/5, ROA, Maastricht.
- Buhai, S., M. Portela, C. Teulings and A. Van Vuuren, 2008, "Returns to Tenure or Seniority?", IZA Working Paper No. 3302, IZA, Bonn.
- Burdett, K. (1978), "A Theory of Employee Job Search and Quit Rates", *American Economic Review*, 68, 212-220.
- Burdett, K and Coles, M.G. (2003), "Equilibrium Wage/Tenure Contracts," *Econometrica*, Vol. 71. No. 5 (Sept.) 1377-1404.
- Dostie, B., 2006, "Wages, productivity and aging", *IZA discussion paper 2496*, Bonn.
- Dustmann, Chr. and C. Meghir, 2005, "Wages, Experience and Seniority", *Review of Economic Studies* Vol. 72, pp. 77–108.

Dustmann, Chr. and S. Peirera, 2005, "Wage Growth and Job Mobility in the UK and Germany", IZA Discussion paper 1586, IZA, Bonn.

Euwals, R., R. de Mooij and D. van Vuuren, "Rethinking Retirement - from participation towards allocation", 2009, CPB Netherlands Bureau for Economic Policy Analysis, The Hague.

Gathmann, Chr. and U. Schönberg, 2009, "How General is Human Capital? A Task-Based Approach", 2009, *Journal of Labor Economics*, 28, 1-49.

Grout, P.A., "Investments and Wages in the Absence of Binding Contracts: a Nash Bargaining Approach", *Econometrica*, March 1984, 52(2), pp. 449-60.

Hosios, A.J. (1990), "On the efficiency of matching and related models of search and unemployment", *Review of Economic Studies*, 57, pp. 279-98.

Jacobson, L., R. Lalonde and D. Sullivan (1993), "Earnings Losses of Displaced Workers", *American Economic Review*, 83, 685-709.

Jongen, E., 2010, *Modelling the impact of labour market policies in the Netherlands*, Thela Thesis Publishers, Amsterdam.

Jovanovic, B. (1979), "Job Matching and the Theory of Turnover," *Journal of Political Economy*, 87 (5), 972-990

Kletzer, L. (1989), "Returns to Seniority after Permanent Job Loss", *American Economic Review*, 79, 536-53.

Kotlikoff, L.J. and J. Gokhale, 1992, "Estimating a firm's age-productivity profile using the present value of workers' earnings", *Quarterly Journal of Economics*, Vol. 107, 1215-1242.

Kuhn, P. and J. Robert, "Seniority and Distribution in a Two-Worker Trade Union", *The Quarterly Journal of Economics*, Vol. 104, No. 3 (Aug., 1989), pp. 485-505, The MIT Press

Kuhn, P. and A. Sweetman, "Vulnerable Seniors: Unions, Tenure, and Wages following Permanent Job Loss", *Journal of Labour Economics*, 1999, vol. 17, no. 4, pt. 1

Lazear, E.P., 1981, "Agency, Earnings Profiles, Productivity, and Hours Restrictions", *American Economic Review*, Vol.71: pp. 606-620.

- Lazear, E.P., 2003, Firm-Specific Human Capital: A Skill-Weights Approach, NBER Working Paper No. W9679
- Lazear, E.P. and K.L. Shaw, 2009, "The Structure of Wages – An International Comparison", The University of Chicago Press, Chicago.
- Lefranc, A., 2003, "Labor Market Dynamics and Wage Losses of Displaced Workers in France and the United States", William Davidson Institute Working Paper 614.
- Lindbeck, A. and D. Snower, 1991, "Interactions between the efficiency wage and insider-outsider theories", *Economics Letters*, Elsevier, vol. 37(2), pages 193-196, October.
- Medoff, J.L. and K.G. Abraham, 1981, "Are those paid more really more productive? The case of experience", *Journal of Human Resources*, Vol. 16, 186-216.
- OECD, 2006, "Live Longer, Work Longer", OECD Publishing, Paris.
- Ours, C. van, and L. Stoeldraijer, 2010, "Age, Wage and Productivity", CEPR DP7713, C.E.P.R. Discussion Papers.
- Topel, R.H., 1991. "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority," *Journal of Political Economy*, University of Chicago Press, vol. 99(1), pp. 145-76.
- Topel, R.H. and M.P. Ward, 1988, "Job Mobility and the Careers of Young Men", *Quarterly Journal of Economics*, Vol. 107 (May 1992): 441-79.
- Tijdens, K. and M. van Klaveren, 2008, Flexibele belonging in Nederland, TPEdigitaal 2008 2(4) pp. 71-91.
- Williams, N., 2009, "Seniority, Experience and Wages in the UK", *Labour Economics*, Vol. 16 (3) pp. 272-283.
- Zwick, Th., 2008, "The Employment Consequences of Seniority Wages", ZEW Discussion Paper No. 08-039, Mannheim.

Appendix

Table A.1 Regression results IV_ten and IV_tenexp model

	IV_ten		IV_tenexp	
	Coef.	Std. Err.	Coef.	Std. Err.
Dep. variable: ln (real hourly wage)				
tenure	0.0085	0.0011	0.0087	0.0022
tenure^2	-0.0109	0.0030	-0.0158	0.0031
seniority index	0.0037	0.0023	0.0040	0.0024
indicator job tenure < 1 year	-0.0085	0.0063	-0.0069	0.0064
experience	0.1012	0.0013	0.0870	0.0037
experience^2	-0.4898	0.0121	-0.3768	0.0463
experience^3	0.1105	0.0041	0.0767	0.0168
experience^4	-0.0096	0.0005	-0.0060	0.0021
ln(number of workers firm)	-0.0013	0.0004	-0.0005	0.0015
year dummy 2001	0.0221	0.0017	0.0215	0.0022
year dummy 2002	0.0185	0.0017	0.0171	0.0034
year dummy 2003	0.0232	0.0018	0.0213	0.0045
year dummy 2004	0.0245	0.0018	0.0222	0.0054
year dummy 2005	0.0185	0.0018	0.0157	0.0063
dummy education:				
lower secondary	0.1143	0.0030	0.1212	0.0104
higher secondary	0.3134	0.0029	0.3282	0.0233
tertiary	0.7184	0.0029	0.7354	0.0280
sector of industry:				
mining Industry	0.3020	0.0095	0.3030	0.0096
manufacturing	0.0190	0.0068	0.0206	0.0069
energy and water supply	0.1735	0.0073	0.1679	0.0144
construction	0.0830	0.0068	0.0808	0.0072
wholesale and retail trade	0.0221	0.0067	0.0275	0.0089
hotels and restaurants	-0.0354	0.0089	-0.0347	0.0097
transport and communication	0.0707	0.0068	0.0710	0.0069
financial interm. & comm. services	0.1409	0.0066	0.1412	0.0067
constant	1.1973	0.1010	1.2229	0.0719
number of observations	363274		363274	
adj. R-squared	0.4592		0.4591	

Note: In the IV_ten regression tenure, tenure^2 and seniority index are instrumented, while in the IV_tenexp regression tenure, tenure^2, seniority index, experience, experience^2, experience^3 and experience^4 are instrumented. In all cases the variables are instrumented by the deviation from its average over the job spell. The regression is carried out on a sample of full time working males, aged 18-60, employed in the private sector in enterprises with at least 10 employees.

Table A.2 Regression results FD-model

	FD	
	Coef.	Std. Err.
Dep. variable: ln (real hourly wage growth)		
Δ tenure ²	-0.0082	0.0019
Δ experience ² / 100	-0.2696	0.0094
Δ experience ³ / 1000	0.0512	0.0030
Δ experience ⁴ / 10000	-0.0041	0.0003
ln (number of workers firm)	0.0014	0.0001
constant	0.0837	0.0025
number of observations	258692	
adj. R-squared	0.0613	

Note: This regression refers to step one of the FD-model (See Topel, 1991). Note that Δ experience and Δ tenure (which are equal to 1 each year by definition) are not included; their effect are included in the estimated constant. The regression is carried out on a sample of full time working males, aged 23-60, employed in the private sector in enterprises with at least 10 employees. As control variables are included: 5 year dummies (2001-2005), 3 dummy variables for level of attained education, 8 dummy variables for sector of industry and 40 dummy variables for occupation.

Table A.3 Regression results FE-model (including / excluding seniority index)

	FE		FE	
	Coef.	Std. Err.	Coef.	Std. Err.
tenure	0.0085	0.0009	0.0094	0.0009
tenure ²	-0.0350	0.0053	-0.0399	0.0053
tenure ³	0.0071	0.0021	0.0086	0.0021
tenure ⁴	-0.0006	0.0003	-0.0007	0.0003
seniority index	0.0057	0.0007		
experience	0.0980	0.0016	0.0980	0.0016
experience ²	-0.4045	0.0086	-0.4046	0.0086
experience ³	0.0906	0.0027	0.0905	0.0027
experience ⁴	-0.0080	0.0003	-0.0080	0.0003
constant	1.4209	0.0366	1.4226	0.0366
number of observations	413281		413281	
number of groups	143398		143398	

Note: The regressions are carried out on a sample of full time working males, aged 18-60, employed in the private sector in enterprises with at least 10 employees. As control variables are included: 5 year dummies (2001-2005), 3 dummy variables for level of attained education, 8 dummy variables for sector of industry.

Table A.4 Regression results all switchers and involuntary switchers

	all switchers		involuntary switchers	
	Coef	Std. Err.	Coef.	Std. Err.
Dep. variable: ln (real hourly wage growth)				
tenure t-1	-0.0007	0.0003	-0.0040	0.0017
Δ experience	-0.0085	0.0008	-0.0104	0.0038
Δ experience ²	0.0139	0.0021	0.0205	0.0094
ln (number of workers firm)	-0.0011	0.0010	-0.0021	0.0038
constant	0.1629	0.0395	-0.0498	0.1650
number of observations	9026		737	
adj. R-squared	0.0489		0.0268	

Note: As control variables are included: 5 year dummies (2001-2005), 3 dummy variables for level of attained education, 8 dummy variables for sector of industry and 40 dummy variables for occupation. Note that Δ experience (which is equal to 1 each year by definition) is not included; its effect is included in the estimated constant.

Table A.5 Regression results age structure firms

	share_5564		share_2554		share_1524	
	Coef	Std. Err.	Coef	Std. Err.	Coef	Std. Err.
sector specific tenure coef	1.0228	0.1003	6.0260	0.1654	-7.1327	0.1695
share educ lower sec.	-0.0172	0.0032	0.0081	0.0052	0.0161	0.0053
share educ higher sec.	-0.0208	0.0030	0.0381	0.0050	-0.0090	0.0051
share educ tertiary	-0.0289	0.0032	0.1113	0.0053	-0.0877	0.0054
ln (number of workers firm)	-0.0026	0.0003	-0.0016	0.0005	0.0034	0.0005
growth firm size	-0.0077	0.0009	-0.0076	0.0016	0.0128	0.0016
constante	0.1026	0.0034	0.6603	0.0057	0.2161	0.0059
number of obs.	36650		36650		36650	
adj. R ²	0.0373		0.0092		0.1011	

Note: These three regressions are carried out at the firm level. Year dummies 2001-2005 are included as control variables. The dependent variables are the share of workers in a certain age group (55-64, 25-54, 15-24) in the firm. The variable of interest is the sector specific tenure coefficient. This coefficient is obtained from an IV_tenexp-regression comparable to the one in table A.1, but extended with the following interaction term: sector of industry * tenure.

Table A.6 **Regression results average age and tenure firm**

	average age firm		average tenure firm	
	Coef	Std. Err.	Coef	Std. Err.
sector specific tenure coef	175.3316	6.2711	106.8479	5.0367
share_oplk2	-1.0023	0.1978	-0.0862	0.1589
share_oplk3	-0.9208	0.1883	0.1164	0.1513
share_oplk4	-0.2075	0.2008	-0.9343	0.1613
logfirmsize	-0.1911	0.0189	0.2526	0.0152
g_wn_beid	-0.6683	0.0600	-1.1010	0.0482
constante	37.343	0.02166	5.1594	0.1740
number of obs.	36650		36650	
adj. R ²	0.0493		0.0355	

Note: These two regressions are carried out at the firm level. Year dummies 2001-2005 are included as control variables. The dependent variables are the average age in the firm and the average tenure in the firm. The variable of interest is the sector specific tenure coefficient. This coefficient is obtained from an IV_tenexp-regression comparable to the one in table A.1, but extended with the following interaction term: sector of industry * tenure.