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Wage-Tenure Profiles and Mobility

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Abstract

The Dutch labour market is characterized by low job mobility and high average duration of unemployment for older jobseekers. This study investigates the role of wage-tenure profiles in explaining patterns of job mobility. Based on a large administrative database, the estimates show that wage-tenure profiles in the Netherlands are relatively steep. Furthermore, industries with high returns to tenure appear to have a high share of older workers, as well as high average job tenure. This implies that steep wage-tenure profiles are related to low levels of mobility.

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

JEL Codes: J31, J62

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1. Introduction

The ageing of the workforce demands a sound understanding of the relationship between wage-tenure profiles and the labour-market position of older workers. This particularly applies to countries with rigid labour markets, such as the Netherlands. Compared to other countries Dutch job mobility is low, while the average duration of unemployment for older jobseekers and employment protection are high. Furthermore, international data suggest that wages in the Netherlands increase steeper with age than they do in many other countries (e.g., OECD, 2006). These characteristics are likely to be interrelated: The wages of older workers are high due to tenure- and age-related labour-market institutions that protect workers with long tenures, while low job mobility among older workers is caused by the steep wage-tenure profiles.

The aim of this research is to provide a set of estimates on wage-tenure profiles in the Netherlands. These estimates reveal whether or not wage-tenure profiles in the Netherlands are steep and whether or not such profiles are related to labour-market institutions and low mobility. The paper 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 overall experience in the labour market. Returns to tenure are estimated using several models that address the problem of endogeneity of tenure in the wage equation (e.g., Altonji and Shakotko, 1987 and Topel, 1991). Returns to tenure are generally interpreted as the firm-related component of wages, which may act as an impediment to mobility. The returns may reflect the return on firm-specific human capital (Becker, 1962) or deferred compensation schemes, with senior employees receiving wages in excess of marginal productivity (Lazear, 1981). If the worker moves to another firm, he will no longer receive this wage component. Next, the effect of workers' seniority positions on wages is analysed. The underlying idea is that workers with the longest tenures may have a good bargaining position, possibly because they are protected by labour-market institutions (e.g., Buhai et al., 2008). Finally, the research investigates whether or not there is a correlation between high returns to tenure and the low job mobility of older workers across different sectors (e.g., Zwick, 2008).

Three main results are obtained. First, Dutch wage-tenure profiles are steep compared to those of other countries. The estimates suggest that wage growth is partly related to firm-specific elements, which are lost in the case of job mobility. Second, the estimates suggest that seniority increases wages: conditional on overall experience in the labor market and

tenure, real wages are 3-4 percent higher when comparing the recently hired worker with the most senior worker. This estimate does not explain the steep wage-tenure profile because the effect is modest in an international comparison. Third, a correlation between high returns to tenure and low mobility is found: the higher the returns to tenure in a sector, the higher the share of older workers, and the average age and the average tenure of the sector's workforce.

From a policy perspective, it is important to note that steep wage-tenure profiles and low job mobility do not necessarily pose a problem for the Dutch labour market. Firms may adopt increasing wage profiles for several reasons. For example, wage profiles do not necessarily push the wages of older workers above their marginal productivity when the costs and benefits of firm-specific investments are shared between employer and employee. Firms could even have an incentive to lower the mobility of workers to lengthen the period of the returns to the training investments or to lower transaction costs associated with hiring. Firms could use wage-tenure profiles to promote worker effort. If this is what is going on, returns to tenure and low job mobility could be optimal from a social point of view. With the ageing of the workforce, the mechanisms favouring steep wage-tenure profiles could however be under pressure. The reason is that the period of employment lengthens, increasing the risk that the knowledge of older workers becomes obsolete (e.g., De Grip and Van Loo, 2002). In addition, a rigid labour market harms labour market efficiency by preventing an optimal allocation of workers to jobs. Low mobility reduces the flexibility of the economy in case of a technological shock or when the economic environment becomes more challenging (e.g., Ter Weel et al., 2010).

The paper is organised as follows. Section 2 discusses the theoretical background and the empirical strategy. Section 3 presents the data. Section 4 presents the basic estimates and compares them to estimates for other countries from previous studies. Sections 5 and 6 discuss the estimates showing the importance of seniority and differences across firms in explaining tenure profiles in the Netherlands. Section 7 concludes.

2. Background and strategy

The measurement and interpretation of wage-tenure profiles is not without debate in the economic literature. There are several ways to estimate the returns to tenure. The seminal approaches by Altonji and Shakotko (1987), Abraham and Farber (1987) and Topel (1991) are likely to produce biased estimates. The reason is that tenure is not a fully exogenous

explanatory variable of wages, since unobserved individual and match-specific characteristics determine both the wage level as well as tenure. In other words, highly productive individuals tend to experience fewer quits and layoffs and high-quality matches tend to survive longer. Nevertheless, the first analyses in this paper use these approaches to present a sound international comparison.

Topel (1991) finds substantial returns to tenure for the United States. He applies a two-stage first-differences procedure, in which the second step is a wage regression at job entry to identify the effect of experience on wages. A problem with this model is that workers who start a new job are a mixture of workers who are improving on their previous wage, workers who have been fired, and workers who have been displaced because of firm closure, all of whom find the current offer more attractive relative to unemployment. The impact of experience on wages is upward biased in case most new jobs are due to voluntary job mobility. This biases the estimated effect of tenure downward. The true bias is unknown because the fraction of voluntary and involuntary mobility is unknown. Furthermore, the method does not fully take individual heterogeneity into account and this biases the estimated effect of tenure upward (e.g., Altonji and Williams, 2005 for a discussion). In the first step, a wage equation expressed in first differences is estimated on a sample of workers who work for the same firm since at least a year:

$$\Delta Y_{ijt} = \Delta X_{ijt} \beta_1 + \Delta X_{ijt}^2 \beta_2 + \dots + \Delta T_{ijt} \beta_3 + \Delta T_{ijt}^2 \beta_4 + \dots + \Delta \varepsilon_{ijt} \quad (1)$$

where ΔY_{ijt} denotes the first difference in the real hourly wage of individual i in job j between time t and $t-1$, X_{ijt} is potential labour-market experience, T_{ijt} is job tenure in the current job and ε_{ijt} is the error term with the usual assumptions. Estimating in first differences assures that fixed job and individual effects are controlled for. A drawback is that the linear effects of tenure and experience cannot be distinguished because both rise by one year ($\Delta X = \Delta T = 1$). Therefore, a second step is needed to disentangle the linear effects of tenure and experience. In the second step, workers who started a new job are used to estimate the impact of experience on wages.¹

¹ First, simulated wages at the start of the job (calculated using results from the first-difference equation) are estimated using simulated experience at the start of the job as an explanatory variable. Second, the wage change of involuntary job switchers (who received unemployment benefit before starting the job) is regressed on

Next to the Topel-approach, this research estimates models suggested by Altonji and Shakotko (1987) and Abraham and Farber (1987). The endogeneity problem is addressed by using instrumental variables (IV) for tenure and experience. The degree to which an individual's actual tenure deviates from his average tenure over the observed job spell is used as an instrument² for that tenure, and likewise for experience:

$$Y_{ijt} = \tilde{X}_{ijt}\beta_1 + \tilde{X}_{ijt}^2\beta_2 + \dots + \tilde{T}_{ijt}\beta_3 + \tilde{T}_{ijt}^2\beta_4 + \dots + \epsilon_{ijt} \quad (2)$$

with

$$\tilde{X}_{ijt} = X_{ijt} - \bar{X}_{ijt} \quad \text{and} \quad \tilde{T}_{ijt} = T_{ijt} - \bar{T}_{ijt}.$$

\tilde{X}_{ijt} is defined as the deviation of X_{ijt} from the mean over job spell \bar{X}_{ijt} , and similarly for \tilde{T}_{ijt} .

Two models are distinguished: a model for which only tenure is instrumented, and a model for which both tenure and experience are instrumented. As the method does not deal with unobserved match-specific characteristics the resulting estimates provide underestimates of the true effect of tenure on wages (e.g., Altonji and Williams, 2005 for a discussion).

Two recent studies address the problem of unobserved match-specific characteristics and show its relevance. Dustmann and Meghir (2005) exploit information on displaced workers to identify the effect of experience and tenure on wages. The idea is that displaced workers due to firm closure are a random sample, because they switched jobs neither by their own choice nor by being selected for dismissal by the firm. The estimates point at positive returns to job tenure in Germany, especially for unskilled workers. Buchinsky *et al.* (2010) exploit a structural dynamic model with endogenous mobility. They confront the model with the data by estimating a wage equation along with separate equations for mobility and participation. The estimates suggest low returns to tenure in France and high returns in the United States. The latter are even higher than the estimates of Topel (1991). The

experience. The average return to experience from these two approaches is subtracted from the joint effect of tenure and experience to determine returns to tenure.

² The variables \tilde{X}_{ijt} and \tilde{T}_{ijt} serve as instruments in the technical sense that they correlate with tenure and experience respectively, while the correlation with the individual random effect is eliminated.

interpretation of these estimates is that returns to tenure in the United States are likely to serve as a device to counter excess job mobility.

A variety of theoretical models explains the rise of wages with job tenure, including theories on human capital and incentives. First, human capital accumulation due to investments in specific human capital provide an explanation for why wages rise with tenure (e.g., Becker, 1962 and Ben-Porath, 1967).³ Second, incentive theories emphasise that, since effort is often difficult to observe, deferred compensation may be optimal (e.g., Lazear, 1981). 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 their marginal productivity when tenure is still low and a wage above their marginal productivity when tenure rises. Third, search and matching models explain returns to tenure by focussing on the costs of hiring and firing (e.g., Burdett, 1978; Jovanovic, 1979). Fourth, bargaining theories are congruous with wages rising with tenure. In the current study an attempt is made to quantify the wage effect of bargaining power, possibly derived from the LIFO layoff rule. 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).

Not many empirical studies exist on the relation between wages and productivity, because labour productivity is often unobserved. Borghans *et al.* (2007) give an 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. For the Netherlands, Van Ours *et al.* (2011) found that many 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

³ 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 bear the entire risk of the investment and receive all quasi-rents, since firms can diversify risks on the capital market. In practice labour contracts are incomplete, leaving room for renegotiation during the contract period (e.g., Grout, 1984 and Hosios, 1990).

both increase with age. Their study concludes that the productivity–wage gap at high ages is bound to be small in the Netherlands.

Some recent studies address the relation between the wage-tenure profile and mobility. For the Netherlands, Borghans *et al.* (2007) finds a high wage growth for older workers to be related to a low outflow of older workers. For Germany, Zwick (2008) finds that establishments with high returns to tenure are characterized by high average tenures of workers and less inflow of older employees.

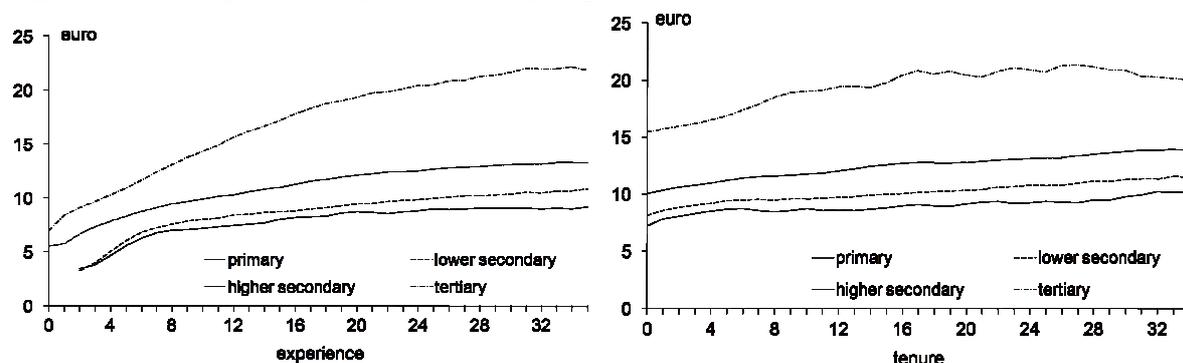
3. Data

The main dataset applied in this research is the Dutch Social Statistical Database (SSB-jobs). It contains information for the years 1999-2005. It is a linked employer-employee dataset and based on administrative data. It includes information about all jobs, with information on gross wages and hours worked available for about one-third of the observations. Since the sample of observations that includes wages and hours worked remains the same over time, the dataset has the characteristics of a panel. The level of educational attainment is included by merging SSB-jobs to the Dutch Labour Force Survey (DLFS). The DLFS is a repeated cross-section covering about 10 percent of the labour force. Education is assumed to be time invariant. We further restrict our analysis to male workers, working full-time (35 hours or more), employed in the private sector, aged 18-64, 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 empirical model 300-400 thousand observations are obtained.

Since the exact starting date of jobs is known, tenure can be computed. A job is defined as a contractual relationship between an employee and an employer. Internal mobility within a firm is not observed. Potential experience is defined as age minus years of education.

Figure 1a and 1b show the average real hourly wages by experience and tenure in the Netherlands. The horizontal axis measures years of labour-market experience (Panel a) and tenure with the firm (Panel b). The average real hourly wages for males shows a concave relationship in experience. This is true for each level of education but seems to be more pronounced for workers with higher levels of education. The same is true for the patterns of tenure across education groups, as Figure 1b shows.

Figure 1. Average real wages of men by experience (a) and tenure (b)



4. The wage-tenure profiles

Table 1 presents the cumulative effects of tenure on the real wages of male workers in the private sector. The top row in the top panel shows estimates of equation (1) and the top rows in the middle and bottom panels display the estimates from estimating equation (2). 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. As discussed above in Section 2, the first-differences approach (shown in the top panel of Table 1) generates a higher return to tenure. The results from the IV-models (middle and bottom panels of Table 1) indicate that the return of remaining in a job for 10 years, compared to leaving earlier, is 6-7 percent in terms of real wages. After 20 years of tenure, the cumulative return is between 11-12 percent.

Table 1: Returns to tenure (in percentages)

	5 years	10 years	15 years	20 years
First differences				
Netherlands 2000-2005 ^(a)	21	42	62	81
Topel (1991) USA 1968-1983	18	25	28	34
Lefranc (2003) USA 1981-1992	6	11	15	19
Lefranc (2003) France 1990-1997	8	15	20	25
Williams (2009) UK 1991-2001	8	11	N.A.	9
Zwick (2008) West Germany 1998-2003	23	40	56	73
Instrumental variables for tenure ^(b)				
Netherlands 1999-2005 ^(a)	3	7	9	12
Altonji <i>et al.</i> (1987), USA 1968-1983	3	3	3	4
Dustmann <i>et al.</i> (2005), West Germany 1991-1997	1	2	4	6
Williams (2009), UK 1991-2001	5	6	NA	8
Zwick (2008), West Germany 1998-2003	6	8	9	10
Instrumental variables for tenure and experience				
Netherlands 1999-2005 ^(a)	4	7	10	11
Altonji <i>et al.</i> (1987), USA 1968-1983	4	3	4	5
Dustmann <i>et al.</i> (2005), W-Germany 1991-1997	-1	-2	-3	-3
Zwick (2008), West Germany 1998-2003	5	5	5	5

a) The figures refer to the cumulative returns to tenure (in %) according to the different estimation techniques with additional correction for experience, demographics and educational attainment. For all regressions the impact of tenure is highly significant. The cumulative returns are based on point estimates; estimated coefficients and standard errors are presented in the Appendix, table A.1-A.2. The results on the method of first differences are based on Topel (1991), while the results for the instrumental variables are based on Altonji and Shakotko (1987) and Abraham and Farber (1987).

b) For comparison, returns to *experience* after 10 (20) years according to the IV model with tenure being instrumented amount to 62% (80%) for the Netherlands, 47% (91%) for the US (Altonji *et al.*, 1987), and 68% (132%) for West Germany (Zwick, 2008).

To assess whether or not wage-tenure profiles in the Netherlands are steep, the estimation results are compared with other countries' outcomes obtained by the same regression techniques. Compared to other studies, the first-differences model appears to generate relatively high returns to tenure in the Netherlands, much higher than those found for the United States. In addition, compared to several European countries, the returns in the Netherlands are high. Only the returns to tenure in West Germany are of the same order of magnitude. Cross-country comparison of the IV models confirms this picture. Again, the

returns in the Netherlands are comparable to those in West Germany. The returns in the United States are lower. For the IV models with tenure and experience, the returns to tenure are relatively high in the Netherlands compared to both the United States and West Germany.

Relative to the returns to tenure, the returns to experience are high (see Table 1, footnote b)). This is not only the case for the Netherlands; it is a common finding across countries. Since experience is not necessarily firm-related, returns to experience are not an impediment to labour mobility.

5. Seniority

One source of high returns to tenure is the increase in bargaining power of more senior workers. This power may increase with seniority due to for example LIFO layoff rules in the Netherlands.⁴ We assess the impact of seniority on hourly wages, apart from the effect of tenure, by estimating the effect on wages of a worker's relative seniority position in the firm.

The seniority index, which describes the seniority of an individual relative to that of his colleagues in the same firm, is determined using information about all workers in all firms in all years. The seniority index is defined, consistent with Buhai *et al.* (2008), in such a way that it is zero for the most recent hire and rising in the time workers are employed with the firm.⁵ The seniority index is useful but not a perfect approximation of the potential increase in bargaining power of senior workers. Labour-market institutions play a role and job heterogeneity within firms can restrict the representativeness of the index because employers may want to reduce employment in some age groups more than in others.

The empirical analysis of the impact of seniority 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 discussed earlier in this section. The effect of seniority is measured in addition to that of tenure, so that it can be seen as the impact of higher seniority if all other characteristics, including tenure, are equal.

Table 2 presents the estimates. All specifications suggest that seniority has a significant positive effect on real wages. An effect of 0.004 implies that, if a worker develops from being the most newly hired worker to the most senior worker in a firm, his real wage

⁴ In case of collective dismissal or dismissal for economic reasons, the LIFO principle is applied per job group. The Dutch government implemented a reform in 2006, which is however outside our period of observation.

⁵ The seniority index of worker i in firm j at period t is defined as $-\log(\text{number of workers in firm } j \text{ at period } t \text{ employed at least as long as worker } i)/(\text{total number of workers in firm } j \text{ at time } t)$. See Buhai *et al.* (2008) for more information.

increases by about 3 percent due to seniority.⁶ The magnitude of the Dutch seniority effect is low in comparison to the effects for Portugal and Denmark, as found by Buhai *et al.* (2008). This is remarkable because employment-protection legislation for regular contracts in the Netherlands is stricter than in Denmark. Although there is some positive effect of seniority on wages, Dutch workers apparently exploit their individual bargaining power derived from their seniority position only to a limited extent. A possible interpretation of the modest effect is that the pivotal role of unions in the Netherlands reflects a high social value attached to wage equality and low importance of wage renegotiations at the individual level. A second possible interpretation is that the need to exploit individual bargaining power is low because returns to tenure are high for other reasons.

Table 2: Effect of the seniority index on real wages ^(a)

	Netherlands (b)		Denmark (c)		Portugal (c)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
First difference	0.002	** (0.0008)	0.005	*** (0.0004)	0.014	*** (0.0007)
IV (tenure and experience)	0.004	* (0.0024)				

a) 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. Standard errors in parentheses. b) Own estimation results. c) Buhai *et al.* (2008). This study also reports results for Fixed Effect, and also for this method the impact for the Netherlands is clearly smaller than for Denmark and Portugal.

6. Composition of the workforce

The composition of the workforce, and in particular the share of older workers in an industry, may be related to the returns to tenure in that industry. This will not explain high returns to tenure in the Netherlands relative to other countries, but it sheds light on patterns of returns within the Netherlands. These patterns may be related to the share of older workers, average age and to average job duration. In particular the latter variable is related to job mobility as a high average duration would indicate low mobility.

The relationship between the composition of the workforce and returns to tenure is analysed by regressing an outcome variable, for example the share of older workers in firm,

⁶ For example, for a firm with 1,000 workers, when a worker moves from being the newest hire to the most senior worker, the effect on wages is the estimated coefficient times the change in seniority index, that is, $0.006 * ((-\log(0.001)) - (-\log(0.999))) = 0.04$.

on an industry-specific tenure effect (conditional on several control variables).⁷ Alternative variables, like average age, average tenure, share of young workers and share of flexible workers, are analysed as well.⁸ The measure for the industry-specific tenure effect is derived from the wage-tenure analysis described earlier, where now the specification of the IV model with tenure and experience is extended by introducing one extra variable that measures tenure in a specific industry.⁹ In total, 33 industries in the private sector are distinguished. The regression produces 33 estimated industry-specific tenure coefficients, which serve as a measure of the effect of tenure on wages in these particular industries.

Table 3 presents the coefficient of the measure for the industry-specific tenure effect; coefficients for other control variables are not presented. Each row relates to a regression with the same right-hand side variables, but with a different left-hand side variable. All effects are significant at the one percent level. The results suggest that the higher the returns to tenure, the higher the share of older workers (aged 55–64) in the firm and the lower the share of younger workers (aged 15–24) and workers with flexible contracts. Furthermore: the higher the returns to tenure, the higher the average age and tenure of workers in the firm. In particular the correlation with the average tenure suggests there is also a positive correlation between the wage-tenure profiles and the composition of the workforce.

Economic theory offers several possible explanations for a positive correlation between wage-tenure profiles and mobility. First, such a correlation may be obtained when firms apply deferred compensation schemes as a tool to purposefully reduce the mobility of their workforce. High transaction costs when hiring workers may, for example, be an argument for firms to apply deferred compensation. It lengthens the period of return of their investments. Second, the correlation may indicate that firm-specific human capital investments are important. The returns to firm-specific investments will take place for employer-employee matches with a long expected duration. The causality may however also run the other way around: a high share of older workers in a firm may generate steep wage profiles as well-protected older workers may use their wage bargaining position. Another

⁷ The variables regarding the composition of the workforce are calculated using an integral dataset of all workers in all Dutch firms.

⁸ 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’.

⁹ The extra variable is an interaction consisting of an industry dummy variable times the linear tenure variable.

explanation may be that older workers are overrepresented in sectors of industry where investments in firm-specific human capital are important.

Table 3. Estimation results regarding various aspects of the composition of the workforce of firms ^(a)

Left-hand side variable	Coefficient of industry-specific tenure effect		
Share of workers aged 55-64	1.0	***	(0.10)
Share of workers aged 15-24	-7,1	***	(0.17)
Share of flexible workers	-7.8	***	(0.16)
Average age workforce *100	1.8	***	(0.06)
Average tenure workforce *100	1.1	***	(0.05)

(a) Estimation results for five separate regressions explaining different aspects of the workforce composition 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. Standard errors in parentheses. Complete estimation results are presented in the Appendix, table A.3-A.4.

7. Conclusion

With an ageing labour force, there is an increasing need to understand the relation between wage-tenure profiles and the labour-market position of older workers. This applies in particular to the Dutch labour market, which is relatively rigid. This paper investigates whether the wage-tenure profiles in the Netherlands are steep and whether such profiles are related to the seniority position of a worker and to the composition of the workforce using a large linked employer-employee dataset.

The estimates presented in this paper suggest that the returns to tenure in the Netherlands are high relative to other countries. The estimates suggest that for older workers it is not very attractive to be mobile. Furthermore, the seniority position of a worker turns out to increase wages. This may be related to labour-market institutions protecting senior workers relative to younger workers. However, the estimates suggest that the impact of seniority on wages is not particularly large. Finally, the results suggest that firms in industries with high returns to tenure employ relatively high shares of older workers. These industries also employ workers with high average tenures, indicating that steep wage-tenure profiles are correlated with low mobility.

In the Netherlands, investments in firm-specific human capital may be high or deferred compensation schemes may prevail in many industries and firms. Another explanation is that a high share of older workers in firms generates steep wage-tenure

profiles. Although from a theoretical point of view high returns to tenure and low job mobility may be optimal in terms of welfare, the ageing of the workforce underlines the policy relevance of the subject. With the ageing of the workforce, the mechanisms favouring wage-tenure profiles become under increasing pressure. As the period of employment at old age lengthens, the knowledge of workers risks becoming obsolete, and the employment share of young workers decreases. In addition, a rigid labour market can harm labour market efficiency by preventing an optimal allocation of workers across jobs.

A limitation of this research is that the data do not allow pinning down all possible determinants of steep wage-tenure profiles. For example, investments in firm-specific human capital are difficult to identify and the importance of deferred payment schemes is not explicitly addressed. So a remaining question is: Which are the underlying mechanisms inducing Dutch wage-tenure profiles to be steep? Perhaps the high share of large firms in the Netherlands, offering large internal labour markets with high specific investments and deferred payment schemes contributes to the explanation. It is a challenge for future research to pin down such underlying mechanisms in more detail.

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Appendix

Table A.1 Regression results for Instrumental Variables

	IV for tenure			IV for tenure and experience		
	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	11.973	***	0.1010	12.229	***	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 (excluding / including seniority index)

	FD			FD		
	Coef.		Std. Err.	Coef.		Std. Err.
Dep. variable: ln (real hourly wage growth)						
	-					
Δ tenure ²	0.0082	***	0.0019	-0.0076	***	0.0021
	-					
Δ experience ² / 100	0.2696	***	0.0094	-0.3994	***	0.0088
Δ experience ³ / 1000	0.0512	***	0.0030	0.0885	***	0.0029
	-					
Δ experience ⁴ / 10000	0.0041	***	0.0003	-0.0077	***	0.0003
Δ ln (number of workers firm)	0.0014	***	0.0001	0.0037	***	0.0009
Δ seniority index				0.0020	**	0.0008
constant	0.0837	***	0.0025	0.1031	***	0.0025
number of observations	258692			253016		
adj. R-squared	0.0613			0.0709		

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. The regression including the seniority index refers to age group 18-60 (consistent with table 2); for the age group 23-60 the estimated coefficient for the seniority index would be 0.0014 * (std. err. 0.0008).

Table A.3 Regression results age structure firms

	Share Age 55-64			Share Age 15-24			Share Flexible Contracts		
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
sector specific tenure coef.	10.228	***	0.1003	-71.327	***	0.1695	-7.8176	***	0.1537
share educ lower sec.	-0.0172	***	0.0032	0.0161	***	0.0053	-0.0215	***	0.0048
share educ higher sec.	-0.0208	***	0.0030	-0.0090	*	0.0051	-0.0370	***	0.0046
share educ tertiary	-0.0289	***	0.0032	-0.0877	***	0.0054	-0.0596	***	0.0049
ln (number of workers firm)	-0.0026	***	0.0003	0.0034	***	0.0005	0.0116	***	0.0005
growth firm size	-0.0077	***	0.0009	0.0128	***	0.0016	0.0006		0.0015
contant	0.1026	***	0.0034	0.2161	***	0.0059	0.0700	***	0.0053
number of observations	36650			36650			36650		
adj. R-squared	0.0373			0.1011			0.1154		

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 a certain group of workers (aged 55-64; aged 15-24; working on a flexible contract) 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.4 Regression results for average age and tenure of firms

	average age firm*100			average tenure firm*100		
	Coef.		Std. Err.	Coef.		Std. Err.
sector specific tenure coef.	1.7533	***	0.0627	1.0685	***	0.0504
share educ lower sec.	-0.0100	***	0.0019	-0.0009		0.0016
share educ higher sec.	-0.0092	***	0.0018	0.0012		0.0015
share educ tertiary	-0.0021		0.0020	-0.0093	***	0.0016
ln (number of workers firm)	-0.0019	***	0.0002	0.0025	***	0.0002
growth firm size	-0.0067	***	0.0006	-0.0101	***	0.0005
constante	0.3734	***	0.0002	0.0516	***	0.0017
number of obs.	36650			36650		
adj. R-squared	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*100 and the average tenure in the firm*100. 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.



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