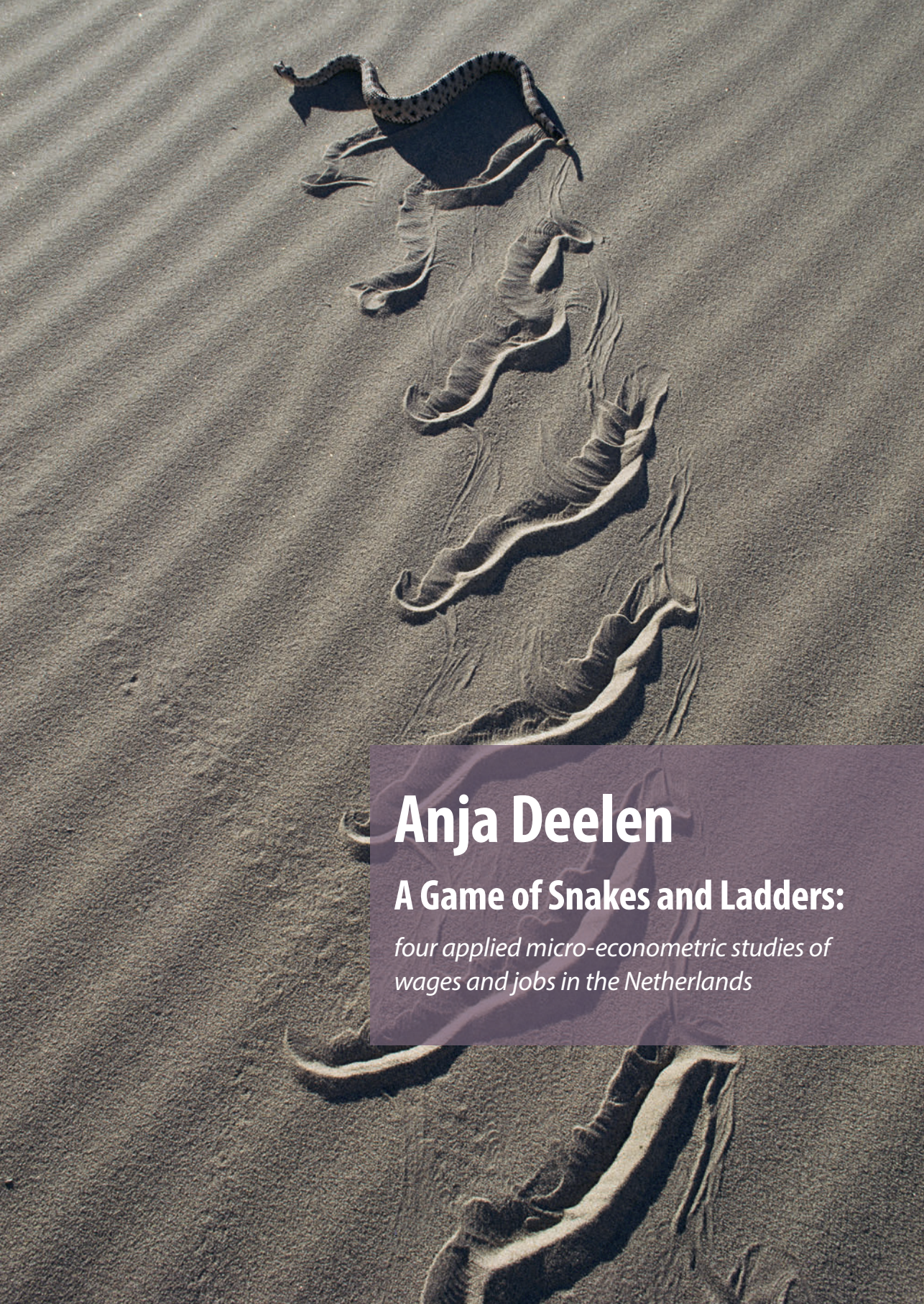

Anja Deelen

A Game of Snakes and Ladders:

four applied micro-econometric studies of wages and jobs in the Netherlands

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A Game of Snakes and Ladders:
four applied micro-econometric studies of wages and jobs
in the Netherlands

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vier toegepaste micro-econometrische studies naar lonen en banen
in Nederland

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Preface

One advantage of conducting my PhD research in the past few years is that I could benefit from the extensive microdata recently made available through the Remote Access facility of Statistics Netherlands. It remains impressive to have access to (anonymised) administrative data of, for instance, all Dutch employees. Interesting questions have arisen concerning the functioning of the Dutch labour market that beg to be explored though these data.

When I began the research, the goal of a PhD thesis was only in the back of my mind, as I took the approach that I would 'cross that bridge when I come to it'. As the work progressed, this goal became more tangible and came to the forefront. The research work alone has always given me a great sense of determination and motivation, but I must admit that completing this thesis feels rather satisfying.

This dissertation benefited from the cooperation with and support of many people. I am very grateful for the opportunity offered by my former heads of department, prof.dr. Bas ter Weel and prof.dr. Daniël van Vuuren to develop my own research ideas and for the confidence they placed in me. My thanks also go to my co-authors Rob Euwals, Marloes de Graaf-Zijl and Wiljan van den Berge for their inspiring and purposeful collaboration, which has been a stimulating experience for me. I want to express my gratitude to my promotor, prof.dr.ir. Jan van Ours for his valuable guidance that certainly helped me to stay on course. Furthermore I am grateful to the members of the PhD committee, prof.dr. Robert Dur, prof.dr. Dinand Webbink, prof.dr. Bas ter Weel, prof.dr. Olivier Marie and Dr. Hans van Kippersluis for their time and effort.

I would also like to thank my bright and ever-helpful colleagues at the CPB units of Labour and Education for enlightening discussions and often-witty conversations over lunch. I thank my paranymphs Nicole Bosch and Suzanne Heijnen for their recent kind support. Last but not least, I thank my relatives and friends for being there when it matters, Erwin for his ceaseless support and encouragement, and my daughter and son for keeping me balanced between work and family life.

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Introduction

Not unlike life itself, the labour market resembles a game of 'Snakes and Ladders'.[1] Over time, workers develop skills and move along the wage ladder. When they happen to run into a snake and lose their job, they often face a disadvantage, at least in the short run. Whereas the board game is a simple contest based on sheer luck, in the labour market the dice may be loaded: the probabilities of losing and finding a job can vary by worker, job contract and firm characteristics, as do the sizes of wage drops when a new job is found. In the terms of this metaphor, chapters 1 and 2 study the steepness of Dutch 'wage ladders', and chapter 3 analyses the consequences of encountering a 'snake' for various groups of workers. Chapter 4 considers both the ladders and the snakes in studying how firms react to headwinds: do they adjust wages, or do they predominantly adjust employment?

The Dutch labour market is characterized by strict employment protection for open-ended contracts, especially for long-tenured jobs (Deelen et al. (2006)), combined with strong growth in temporary contracts. Compared to other countries, job mobility among older workers is low (Deelen et al. (2014b)), while the average duration of unemployment for older jobseekers is high. Moreover, international data suggest that wages in the Netherlands increase more steeply with age than they do in many other countries (e.g., OECD (2006)).

This inadequately functioning labour market for older workers, combined with an ageing workforce, is the problem that motivates the first three chapters of this thesis. Understanding this problem demands a sound grasp of the relationship between wage profiles and their determinants, on the one hand,

[1] 'Snakes and Ladders' is an ancient Indian board game considered worldwide today to be a classic. Played between two or more players on a game board having numbered, gridded squares, the board pictures a number of 'ladders' and 'snakes', each connecting two specific board squares. The object of the game is to navigate one's game piece, according to the die rolls, from the start (bottom square) to the finish (top square), helped or hindered by ladders and snakes, respectively. The historic version offered morality lessons, where a player's progression up the board represented a life journey complicated by virtues (ladders) and vices (snakes; source: Wikipedia).

and the labour-market position of older workers, on the other hand. The fourth chapter discusses downward wage rigidity, analysing how firms adjust their wage bills when sales decline.

The research questions of this thesis follow.

- Chapter 1, 'Wage-tenure profiles and mobility': How can wage-tenure profiles explain patterns of job mobility? The chapter provides a set of estimated wage-tenure profiles for 1999–2005 and analyses the relationship between workers' seniority and wages. The correlation between high returns to tenure and the job mobility of older workers is analysed at the sector level.

- Chapter 2, 'Do wages continue increasing at older ages? Evidence on the wage cushion in the Netherlands': Does the wage cushion—that is the difference between actual wages and collectively agreed-upon (maximum) contractual wages—contribute to the fact that wages continue to increase at older ages? This chapter investigates older male workers' wages from 2006 to 2010 by comparing actual wages with wage information obtained from collective labour agreements.

- Chapter 3, 'Labour market effects of job displacement for prime-age and older workers': Which factors explain that older workers are in more vulnerable positions after job loss? This chapter studies the effects of bankruptcies on the employment status and wages of prime-age and older workers using Dutch administrative data from 2000 to 2011. We investigate to what extent the differences over age groups correlate with three factors: (1) long tenures in the job prior to displacement, (2) finding re-employment in a different industry and (3) local labour market conditions in the industry from which workers have been displaced.

- Chapter 4, 'Flexible wages or flexible workers? A decomposition of wage bill adjustment by Dutch firms, 2006–2013': To what extent do firms adjust wages and employment in periods of adverse economic circumstances? How do adjustment strategies vary with firm characteristics, and what role is played by downward wage rigidity?

Chapter 1 and 4 are single-author papers. In the early phase of the research for chapter 4, Wouter Verbeek provided data assistance. Chapter 2 was joint work with Rob Euwals, while Richard de Groot and Janneke Rijn provided data assistance in the early stage of the project. Chapter 3 is joint work with Marloes de Graaf-Zijl and Wiljan van den Berge, with Adri den Ouden providing data assistance in the initial phase of the project.

Moksha Patam ('Snakes and ladders') board on cotton cloth. Gujarat, dated 1834. 63x63 cm. Calico Museum of Textiles, Ahmedabad.

Chapter 1

Wage-Tenure Profiles and Mobility[1]

1.1 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 and average unemployment duration 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.

[1]This chapter has been published in De Economist (2012) 160: 141. The final publication is available at Springer via https://doi.org/10.1007/s10645-011-9183-4. The paper benefitted from comments and suggestions from the editor and referees of this journal, Frank Cörvers, Rob Euwals, Andries de Grip, Daniël van Vuuren and Bas ter Weel.

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. (2014)). 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 (2012)).

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 labour 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 1.2 discusses the theoretical background and the empirical strategy. Section 1.3 presents the data. Section 1.4 presents the basic estimates and compares them to estimates for other countries from previous studies. Sections 1.5 and 1.6 discuss the estimates showing the importance of seniority and differences across firms in explaining tenure profiles in the Netherlands. Section 1.7 concludes.

1.2 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:

$$\Delta Y_{ijt} = \Delta X_{ijt}\beta_1 + \Delta {X_{ijt}}^2\beta_2 + ... + \Delta T_{ijt}\beta_3 + \Delta {T_{ijt}}^2\beta_4 + ... + \Delta\epsilon_{ijt} \quad (1.1)$$

where ΔX_{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.[2]

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 instrument[3] for that tenure, and likewise for experience:

$$\widetilde{Y}_{ijt} = \widetilde{X}_{ijt}\beta_1 + \widetilde{X}^2_{ijt}\beta_2 + ... + \widetilde{T}_{ijt}\beta_3 + \widetilde{T}^2_{ijt}\beta_4 + ... + \epsilon_{ijt} \tag{1.2}$$

with $\widetilde{Y}_{ijt} = Y_{ijt} - \overline{Y}_{ijt}$ and $\widetilde{T}_{ijt} = T_{ijt} - \overline{T}_{ijt}$ and where $\widetilde{X}_{ijt}$ is defined as the deviation of X_{ijt} from the mean over job spell $\overline{X}_{ijt}$, and similarly for $\widetilde{T}_{ijt}$.

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

[2]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 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.

[3]The variables $\widetilde{X}_{ijt}$ and $\widetilde{T}_{ijt}$ 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.

are even higher than the estimates of Topel (1991). The 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)).[4] 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 focusing 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 (1991)) 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 and Gokhale (1992); Dostie (2011)) generally provide evidence that older workers are paid wages exceeding their marginal productivity. For the Netherlands, Van Ours and Stoeldraijer (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 both increase with age. Their study concludes that the productivity–wage gap at high ages is bound to be small in the Netherlands.

[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 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).

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 (2012) finds that establishments with high returns to tenure are characterized by high average tenures of workers and less inflow of older employees.

1.3 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.

1.4 The wage-tenure profiles

Table 1.1 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(1.1) and the top rows in the middle and bottom panels display the estimates from estimating equation(1.2). 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 1.2, the first-differences approach (shown in the top panel of Table 1.1) generates a higher return to tenure. The results from the IV-models (middle and bottom panels of Table 1.1) 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 1.1: Returns to tenure (in percentages)

	5 yrs	10 yrs	15 yrs	20 yrs
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 (2012) West-Germany 1998–2003	23	40	56	73
Instrumental variables for tenure (b)				
Netherlands 1999–2005 (a)	3	7	9	12
Altonji and Shakotko (1987) USA 1968–1983	3	3	3	4
Dustmann and Meghir (2005) W.-Germany 1991–'97	1	2	4	6
Williams (2009) UK 1991–2001	5	6	N.A.	8
Zwick (2012) West-Germany 1998–2003	6	8	9	10
Instrumental variables for tenure and experience				
Netherlands 1999–2005 (a)	4	7	10	11
Altonji and Shakotko (1987) USA 1968–1983	4	3	4	5
Dustmann and Meghir (2005), W.-Germany 1991–'97	-1	-2	-3	-3
Zwick (2012) West-Germany 1998–2003	5	5	5	5

Notes: (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 and Shakotko (1987)), and 68% (132%) for West Germany (Zwick (2012)).
Source: Own calculations using registration data from Statistics Netherlands

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 1.1, 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.

1.5 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.[5] 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. (2014), in such a way that it is zero for the most recent hire and rising in the time workers are employed with the firm.[6] 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 1.2 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

[5] 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.

[6] The seniority index of worker i in firm j at period t is defined as -log(number of workers in firm j at period t employed at least as long as worker i)/(total number of workers in firm j at time t). See Buhai et al. (2014) for more information.

worker in a firm, his real wage increases by about 3 percent due to seniority.[7] The magnitude of the Dutch seniority effect is low in comparison to the effects for Portugal and Denmark, as found by Buhai et al. (2014). 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 1.2: Estimation results regarding the effect of the seniority index on real wages

	Netherlands (a)	Denmark (b)	Portugal (b)
First difference	0.002 *	0.005	0.014 ***
	(0.0008)	(0.0004)	(0.0007)
IV (tenure and experience)	0.004 ***		
	(0.0024)		

Notes: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.
(a) Own estimation results.
(b) Buhai et al. (2014). 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.
Source: Own calculations using registration data from Statistics Netherlands

1.6 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.

[7] 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.

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, on an industry-specific tenure effect (conditional on several control variables).[8] Alternative variables, like average age, average tenure, share of young workers and share of flexible workers, are analysed as well.[9] 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.[10] 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 1.3 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

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

[9] Zwick (2012) 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'.

[10] The extra variable is an interaction consisting of an industry dummy variable times the linear tenure variable.

may use their wage bargaining position. Another explanation may be that older workers are overrepresented in sectors of industry where investments in firm-specific human capital are important.

Table 1.3: Estimation results regarding various aspects of the composition of the workforce of firms

Dependent variable	Coef. industry-specific tenure effect		Std. Error
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)

Notes: a) The table depicts 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 A1.4-A1.3.
Source: Own calculations using registration data from Statistics Netherlands

1.7 Conclusions

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.

Appendix A: Additional regression results

See Tables A1.1, A1.2, A1.3 and A1.4

Table A1.1: Regression results for Instrumental Variables estimations

	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 comm.	0.0707	***	0.0068	0.0710	***	0.0069
-Financial services	0.1409	***	0.0066	0.1412	***	0.0067
Constant	11.9730	***	0.1010	12.2290	***	0.0719
Number of observations	363,274			363,274		
Adj. R-squared	0.4592			0.4591		

Source: Own calculations using registration data from Statistics Netherlands

Table A1.2: Regression results FD-model (excluding/including seniority index)

	FD Coef.		Std. Err.	FD 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	258,692			253,016		
Adj. R-squared	0.0613			0.0709		

Notes: This regression refers to step one of the FD-model (See Topel (1991)). Note that Δexperience 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, and 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 1.2); for the age group 23-60 the estimated coefficient for the seniority index would be 0.0014 *(std. err. 0.0008).

Source: Own calculations using registration data from Statistics Netherlands

Table A1.3: Regression results for average age and tenure of firms

	Average age in firm*100 Coef.		Std. Err.	Average tenure in firm*100 Coef.		Std. Err.
Sector specific tenure coef.	17.5330	***	0.0627	10.6850	***	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.	36,650			36,650		
Adj. R-squared	0.0493			0.0355		

Notes: 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 for tenure and experience'-regression comparable to the one in Table A1.1, but extended with the following interaction term: sector of industry *tenure.

Source: Own calculations using registration data from Statistics Netherlands

Table A1.4: Estimations for the composition of firms in terms of age and flexible contract

	Share age 55–64			Share age 15–24			Share flexible contracts		
	Coef.		Std. Err.	Coef.		Std. Err.	Coef.		Std. Err.
Sector specific tenure coef.	10.2280	***	0.1003	-71.3270	***	0.1695	-78.1760	***	0.1537
Share lower sec. educ.	-0.0172	***	0.0032	0.0161	***	0.0053	-0.0215	***	0.0048
Share higher sec. educ.	-0.0208	***	0.0030	-0.0090	*	0.0051	-0.0370	***	0.0046
Share tertiary educ.	-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	36,650			36,650			36,650		
Adj. R-squared	0.0373			0.1011			0.1154		

Notes: 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 for tenure and experience'-regression comparable to the one in Table A1.1, but extended with the following interaction term: sector of industry *tenure.
Source: Own calculations using registration data from Statistics Netherlands

Chapter 2

Do Wages Continue Increasing at Older Ages? Evidence on the Wage Cushion in the Netherlands[1]

2.1 Introduction

The central research question in this study is whether the wage cushion is more important at older ages and contributes to the fact that wages continue increasing at older ages.[2] Wages that continue increasing at older ages are perceived to be partly responsible for the unfavourable labour-market opportunities of older workers in many countries, including the Netherlands (OECD (2006),OECD (2014)). Wages that continue to increase with age hint at a wage-productivity gap at older ages, as empirical evidence suggests that productivity at best remains stable at older ages (Börsch-Supan and Weiss (2011), Van Ours and Stoeldraijer (2011)). Note that in cases in which productivity decreases with age, even a constant wage profile over age can be associated with a wage-productivity gap.

Empirical studies show that wages continue increasing at older ages in

[1]This chapter is joint work with Rob Euwals and has been published in De Economist (2014) 162:433–460; The final publication is available at Springer via https://doi.org/10.1007/s10645-014-9237-5. The authors thank Rob Alessie, Rik Dillingh, Marike Knoef, Bas van der Klaauw, Daniël van Vuuren and an anonymous referee for useful comments and suggestions.

[2]The wage cushion, defined as the difference between actual wages and contractual wages as stipulated in collective labour agreements, consists of two parts: the first comprises additional wages paid above the contractual wage, and the second consists of the degree to which contractual wages exceed the highest wage-scale ceiling, as stipulated in the collective labour agreement.

several European countries. On the basis of descriptive statistics from survey data, Table 3.3 of OECD (2006) concludes that wages continue increasing at older ages in Austria, Belgium, Finland, France, Italy, Spain and Switzerland. Applying panel data analysis to longitudinal administrative data, Zwick (2012) and Deelen (2012) find that wages continue increasing with experience at older ages in Germany and the Netherlands. These results are surprising because in continental European countries, wages are perceived to be determined largely by collective bargaining. The collective labour agreements generally include wage ceilings for the various wage-scales in a sector of industry. In such a system, wages that increase with experience or tenure at older ages are not evident, unless the wage cushion plays an important role at older ages.

Several studies have assessed the incidence of wage cushions, but none of them associate the cushion with seniority wages. Cardoso and Portugal (2005) investigate how a system of collective bargaining can coexist with low unemployment and high wage flexibility in Portugal. They find that the wage cushion serves as a means to overcome the constraints imposed by collective bargaining. The results indicate that the wage cushion enhances the returns to workers and firm attributes. Jung and Schnabel (2011) find that more than forty per cent of German plants whose employees are covered by collective agreements pay wages above the level stipulated in the agreement, giving rise to a wage cushion. Their results indicate that the wage cushion varies with profits and labour shortages. While plants with single-employer agreements are less likely to have wage cushions, plants bound by multi-employer agreements seem to pay wage premiums to overcome the restrictions imposed by the centralized bargaining system in the western part of Germany. Our study investigates how a system of collectively-bargained wage-scales can coexist with wages that continue increasing at older ages.

We investigate how older workers' wages develop over time using administrative panel data on contractual and additional wages in twenty-two Dutch CLA (Collective Labour Agreement) sectors of industry.[3] Our dataset is comprised of male workers between the ages of 23–63 in these sectors for the period 2006 – 2010. We merge our administrative data with wage-scale data collected from collective labour agreements, such as the number of wage-scales, the minimum and maximum wages per scale and the number of spinal points (the wage levels associated with standard increments along a wage-scale). Combining actual wages with wage-scale data enables us to analyse the effect of the wage-scale system on actual wages.

[3]The contractual wage refers to the wage that is agreed upon in the labour contract. The additional wage refers to the sum of the incidental wage (performance-related, not part of the contract) and extra wage (a regular, extra wage component; for example, a thirteenth month of salary). Overtime pay is part of neither the contractual nor the additional wage.

First, wage regressions show how gross hourly wages develop after twenty or more years of potential experience and tenure.[4] Using the results of similar regressions done with contractual hourly wages, we define an indicator for receiving a contractual wage that is equal to a collectively-agreed wage-scale ceiling. We cannot tell with certainty whether a worker is receiving a contractual wage that is equal to the wage-scale ceiling of a particular wage-scale, as hourly wages are prone to measurement error, even in administrative data. Second, regressions show whether the likelihood of receiving a contractual wage at a wage-scale ceiling—or, alternatively, exceeding the highest wage ceiling—increases with age and tenure. Third, wage regressions show whether workers receiving a contractual wage equal to a wage ceiling receive more in additional wages. Fourth, wage growth regressions show whether workers receiving a wage exceeding the highest wage ceiling experience more contractual wage growth.

The results indicate that in the public sector, wage ceilings stipulated in collective agreements are guiding for older workers' wages. wage-scale ceilings are, however, less restrictive in the private sector. Older workers in the private sector more often receive a contractual wage exceeding the highest wage-scale ceiling, resulting in a wage cushion in accordance with our definition. Workers earning a contractual wage equal to a wage-scale ceiling do not receive more in additional wages. Workers earning a contractual wage exceeding the highest wage ceiling, however, experience higher contractual wage growth. In the private sector, this group of workers contributes to the steepness of the age-wage profile. Our study shows the limited role of the wage bargaining system in explaining wage growth at older ages. In the public sector, wage growth at older ages is limited by the system, as wage growth is actually restricted by the wage ceilings. In the private sector, wage growth at older ages is the result of the wage cushion.

The structure of this paper is as follows: the next section discusses the system of wage-scales and wage bargaining as it prevails in the Netherlands, section 2.3 describes the empirical methodology of our analysis, section 2.4 presents descriptive statistics, section 2.5 presents the analysis of the wage cushion, section 2.6 gives the sensitivity analysis and section 2.7 concludes.

[4]Potential experience is defined as age minus years of education, determined using the highest level of education attained, minus 4 years that represent the period before entering primary school. Time in the educational system cannot be less than 12 years because education is compulsory until age 16.

2.2 Institutional setting

Many sectors of industry in the Netherlands have a wage system that defines starting wages, wage increments and wage ceilings for the various wage-scales in a sector. Wage negotiations and the resulting collective labour agreements generally contain an agreement on the general wage growth for all workers.

The twenty-two sectors of industry in this study are chosen on the basis of their size, measured as the number of total workers covered by a collective agreement. Almost all collective agreements cover over 100,000 workers[5], ensuring a large sample size in our empirical analysis. Note that we do not consider the total number of workers in a sector of industry because not all workers may be covered by the same agreement. The financial sector, for example, drops out of our selection, as most banks have their own firm-level agreement. The largest agreement in this sector therefore covers substantially fewer than 80,000 workers. We collect information on wage-scales, wage floors, wage ceilings and spinal points for all twenty-two sectors (see Appendix A for details).

Table 2.1: Wage system of the transportation sector, gross monthly wages, 2006

wage-scale number:	1	2	3	4	5	6	7	8
Floor	1,432	1,503	1,563	1,629	1,711	1,793	1,876	1,958
Ceiling	1,710	1,800	1,878	2,000	2,181	2,371	2,606	2,855
Spinal points	5	5	5	5	6	7	8	9

The sectors we consider in this study have a similar wage system. The transportation sector serves as an example (see Table 2.1). In 2006 and in the following years, the wage system has contained eight wage-scales. Each job in the sector has wages according to one or more wage-scales. Drivers of standard trucks may have wages according to wage-scale 1, while drivers of special trucks (for example, of chemical products) may have wages according to wage-scales 2, 3 and 4. Logistics planners will have wages according to higher wage-scales, while managers are likely to be paid according to the highest wage-scales. The lowest wage-scales have five spinal points. Drivers in wage-scale 1 will normally start at the wage floor and may have four wage increases during their career as a driver. The speed at which a driver climbs the ladder within a wage-scale is at the discretion of the firm. The same holds for placing workers on a higher wage-scale. Wage policy is likely to vary among firms, and it is also likely that worker performance and market circumstances play

[5]Except for the coachwork industry (over 80,000 workers), public administration-region (over 13,000 workers), police and social work activities (each about 65,000 workers).

an important role. Note furthermore that the wage-scales overlap. The ceiling of wage-scale 1, for example, is higher than starting wages in wage-scales 2, 3 and 4.

The wage systems of the various sectors differ with respect to wage floors, wage ceilings and the number of wage-scales and spinal points. As Table 2.2 shows for the year 2006, the sectors have four (secondary education) to twenty (public administration at the municipality level) wage-scales. The wage floors in the lowest wage-scales vary from 1,173 (police) to 2,242 (secondary education) euros per month. The wage ceilings in the lowest wage-scales vary from 1,250 (cleaning) to 3,427 (secondary education) euros. The lowest wages in primary and secondary education are high, as the sector requires a high level of education of its employees. The number of spinal points in the lowest wage-scale is zero in sectors in which the wage ceiling is equal to the starting wage (retail sale, clothing and footwear, cleaning and home care). The education sector has the greatest number of spinal points in the lowest wage-scale. In some sectors, wages are flexible within a wage-scale (building construction, hotel and catering, temporary employment agencies and public administration at the regional level). The wage floors in the highest wage-scales vary from 1,671 (clothing and footwear) to 6,164 (public administration at the municipality level) euros. The wage ceilings in the highest wage-scales vary from 1,764 (cleaning) to 8,311 (public administration at the regional level) euros. The number of spinal points in the highest wage-scales varies from six (clothing and footwear) to nineteen (social work activities). Note that the wage ceilings of the highest wage-scales are substantially higher in the public sector than in the private sector. The wage-scale system of the public sector includes all managerial jobs, while in the private sector this may not be the case.

Wage negotiations and collective labour agreements generally take the wage system as given. Consequently, negotiations between employers and unions generally lead to the same wage growth for all workers. Employers can reach agreement with one or more unions, and the Dutch Ministry of Social Affairs and Employment can extend the agreement to all workers in the sector, in cases in which these unions represent a large portion of the employees. Agreements are almost always extended; thus, the wage systems we consider here are in place for a large majority of workers.

Wage negotiations and collective bargaining may lead to differences in wage increases within a sector or to a reform of the wage system. In sectors such as hotel and catering and the police, the increase in the wage ceiling during the period from 2006–2010 was larger than the average wage increase. Furthermore, the wage ceilings of the highest wage-scales in the home care sector increased substantially as it merged with the sector comprised of nursing

Table 2.2: Wage system of 22 large sectors of industry (a), gross monthly wages, 2006

			Lowest wage-scale			Highest wage-scale		
	sbi08	#sc.	floor	ceiling	#sp.p.	floor	ceiling	#sp.p.
Private sector								
Basic metal industry	240	11	1,472	1,485	1	2,166	2,855	10
Metal products industry	250	10	1,265	1,537	3	1,738	3,079	14
Coachworks industry	292	10	1,265	1,537	3	1,738	3,079	14
Construction installation	432	10	1,265	1,537	3	1,738	3,079	14
Repair of (motor) vehicles	452	10	1,265	1,537	3	1,738	3,079	14
Retail sale (large stores)	472	9	1,523	1,523	0	3,160	3,504	Flex
Retail sale (small stores)	472	9	1,523	1,523	0	3,160	3,504	Flex
Clothing and footwear	477	5	1,285	1,285	0	1,671	1,972	6
Transport	494	8	1,432	1,710	5	1,958	2,855	9
Hotel and catering	551	11	1,339	1,559	Flex	2,844	3,584	Flex
Temp, Empl, Agencies (b):								
- TAE (I)	782	9	1,317	1,666	Flex	1,941	3,290	Flex
- TAE (II)	782	9	1,317	1,666	Flex	1,941	3,290	Flex
Cleaning	812	7	1,250	1,250	0	1,698	1,764	12
Public sector								
Social unemployment relief	329	12	1,252	1,297	2	2,461	3,979	11
Public administration:								
- municipality, revised (b)	841	20	1,283	1,646	11	5,783	8,220	11
- municipality	841	19	1,283	1,540	5	6,164	8,220	9
- region	841	18	1,263	1,598	Flex	5,818	8,311	Flex
- state	841	18	1,287	1,618	10	6,044	7,934	10
Police	842	18	1,173	1,751	10	5,470	7,598	11
Secondary education	853	4	2,242	3,427	17	2,912	4,933	17
Nursing homes for disabled	872	16	1,266	1,543	7	5,200	7,350	14
Social work activities	889	15	1,342	1,985	15	3,454	7,885	19

Notes: (a) The sectors of industry are chosen on the basis of their large size and the fact that all workers in these industries are covered by the same collective agreement. The code sbi08 refers to standard business classification codes in 2008, #sc. refers to the number of wage-scales, and the floor and ceiling are the lowest and highest wages, respectively, according to the wage-scale. #sp.p. refres to the number of spinal points per wage-scale ('Flex' meaning that no spinal points are specified). (b) Two separate collective labour agreements for temporary work agencies are taken into account. Due to a reform, there are two different wage-scale systems for municipalities' public administrations. The revised system holds for employees who started their jobs in 1996 or later.

homes for the elderly and disabled. Moreover, the wage system was reformed during our period of observation in the metal products and coachwork industries, as well as in the cleaning sector. Such reforms were partly responsible for newly-defined wage ceilings. The changes in the wage ceilings and wage systems have subsequently led to additional variation in the wage ceilings. Such variation will contribute to the identification of the impact of the wage ceilings on wage growth at older ages. We nevertheless decide not to exploit these changes and reforms as natural experiments due to the fact that the necessary assumption of exogeneity in these experiments is likely to be false, as the changes and reforms may be driven by labour-market considerations.[6]

2.3 Empirical methodology

The central question is how wages can continue increasing at older ages in a wage system with wage bargaining and wage ceilings. We define an indicator $I_{it}^{=}$ for the likelihood of receiving a contractual wage that is equal to a wage ceiling of a wage-scale for individual i at time t. Remember that all sectors have a wage system with more than one wage-scale. Furthermore, we will define an indicator I_{it}^{+} for the likelihood of receiving a contractual wage exceeding the highest wage ceiling in a sector. The indicators will be used to answer a number of empirical questions to unravel the puzzle of wages that continue increasing at older ages:

1. Does the likelihood of being at a wage ceiling continue increasing at older ages? Or alternatively, does the likelihood of receiving a contractual wage above the highest wage ceiling continue increasing at older ages?

2. Do workers receiving a contractual wage that is equal to a wage ceiling receive more in additional wages?

3. Do workers that receive a contractual wage above the highest wage ceiling experience more contractual wage growth?

A positive answer to the first part of the first question may be interpreted as evidence against wages that continue increasing at older ages. Wages paid above the wage ceiling, however, leave room for wages that continue increasing at older ages. The second and third questions also leave room for wages to continue increasing at older ages. Each question will be answered using empirical models for (1) the indicators, (2) additional wages and (3) wage growth. The

[6] In 1999, the government made a mistake in wage negotiations for the police, leading to higher wage growth than intended for police officers in certain wage-scales. This would be a true natural experiment.

first empirical model will explain the indicators from individual demographic and educational characteristics, while the second and third empirical models will also include the indicators as explanatory variables. Note that both the second part of the first question and the third question refer to parts of the wage cushion (see footnote 2).

The empirical complication to answering the questions is that we do not observe the wage-scale of individual workers. In other words, we first need to define measures for the indicators of being paid the maximum on a wage-scale and being paid more than the highest wage ceiling. To do this, the section defines an empirical model with specification and measurement errors for wages. The model is used to determine the workers' wages vis-à-vis the ceilings in the wage-scales of the sectors of industry concerned. We will propose measures for indicators $I_{it}^{=}$ and I_{it}^{+}. In addition, the empirical model for wages is used to check whether wages continue increasing with experience or tenure at older ages—i.e., whether the results of Zwick (2012) and Deelen (2012) are reproduced with these data.

We follow contractual and additional wages of male workers in twenty-two large Dutch sectors of industry over the period from 2006 – 2010, using administrative data from the Social Statistical Database of Statistics Netherlands.[7] The sectors of industry are chosen such that all workers are covered by the same collective agreement (see also Section 2). Individual, contractual wages are compared to wage ceilings to determine the 'likelihood' of receiving a contractual wage that is equal to the ceiling of a wage-scale.[8] We also determine the likelihood of receiving a contractual wage exceeding the highest wage ceiling in a sector of industry. Our data sources do not indicate with certainty whether or not a worker receives a wage equal to a wage ceiling for two reasons. First, wage assessment contains measurement error, even in the case of administrative data. For example, information on working hours is used to calculate full-time wages, and this information may contain measurement error. Second, we do not observe the wage-scales of individual workers. Since adjacent wage-scales may be partly overlapping (see Table 2.1 for an example), a worker receiving a contractual wage equal to a wage ceiling may

[7]The Social Statistical Database of Statistics Netherlands actually consists of several databases that can be merged; our main datasets ('polisikvbus' and 'polisikobus') contain administrative data from employers, the tax authority and social security organisation, UWV. Employers provide a code for the collective labour agreement under which the workers operate, which is used as a key variable to merge the wage-scale data obtained from the collective labour agreements (see Appendix A). In addition, we used a dataset containing data from municipal base administrations (GBA) as well as data on the level of education of workers.

[8]We determine an indicator for the probability of receiving a contractual wage equal to the highest wage ceiling; we cannot determine the true probability, as we do not observe the salary scale of a worker.

not be at this ceiling, as he may receive a wage according to a higher adjacent wage-scale. We assume a worker is at a ceiling when (1) his wage is close to a wage ceiling of a wage-scale and (2) his contractual wage growth is close to the contractual wage growth stipulated in the collective labour agreement.

Define W_{it} as the observed wage of individual i at time t. All wage equations will be sector-specific whereby we suppress the sector index. Assume the following random effects wage equation:

$$W_{it} = X_{it}^{'}\beta + \omega_i + \omega i, t \tag{2.1}$$

where ω_i and ω_{it} are individual job-specific and idiosyncratic error terms, respectively. Individuals with more than one job during our period of observation have more than one draw from the distribution of the individual job-specific error terms, but for notational convenience we suppress the job index. The vector X_{it} contains standard demographic and human capital variables including (potential) labour-market experience and tenure. The vector β contains parameters. The error terms are assumed to be independent and identically distributed. We will allow the individual specific wage equation error ω_i to be correlated with tenure and potential experience. The model is still to be interpreted as a random effects model, although because of the allowed correlation with some exogenous variables it contains elements of a fixed effects model.

The estimation model will be used for two purposes. First, we will investigate whether the gross hourly wage continues increasing with experience or tenure at older ages. We instrument experience with the deviation between experience and the individual job average of experience, and tenure with the deviation between tenure and the individual job average of tenure (Altonji and Shakotko (1987), Abraham and Farber (1987)). As this method does not deal with unobserved, match-specific characteristics, the results underestimate the true effect of tenure and experience on wages (Altonji and Williams (2005)). Dustmann and Meghir (2005) deal with match-specific characteristics and Buchinsky et al. (2010) deal with endogenous mobility, but such issues are beyond the scope of this study.

Second, we apply the model to gross hourly contractual wages since the second purpose of the model is to use the results to calculate an indicator of the likelihood that an individual worker receives a contractual wage at the wage ceiling of a wage-scale. Note the error terms ω_i and ω_{it} contain two types of errors: measurement error and specification error. Define ω_i and ω_{it}as individual specific and idiosyncratic measurement error, respectively. The distribution of these error terms cannot be identified from Eq.(2.1), but we know the variances of measurement error ($\sigma^2_{\epsilon 1}$, $\sigma^2_{\epsilon 2}$) are smaller than or equal to the variances of the estimated model for the contractual wages ($\sigma^2_{\omega 1}$, $\sigma^2_{\omega 2}$).

Define W_{it}^{*} as the true (unobserved) contractual wage of individual i at time t. Two conditions must be met for an individual worker to receive a true contractual wage equal to the wage ceiling $W^{m}ax_{j}$ of wage-scale j: (1) the wage must be equal to the wage ceiling of wage-scale j, and (2) the contractual wage growth must be equal to the contractual wage growth stipulated in the collective labour agreement (CLA): which for reasons of convenience we assume it to be zero here, but we do take it into account in the empirical exercise. We implement condition (1) as follows:

$$P\left(W_{it}^{*}=W_{j}^{max}\right)=P\left(\left(W_{it}-W_{j}^{max}\right)-\delta h_{1}<\epsilon_{it}^{T}\leq\left(W_{it}-W_{j}^{max}\right)+\delta h_{1}\right) \tag{2.2}$$

with ϵ_{it}^{T}=ϵ_{i}+ϵ_{it} $\sim N\left(0,\left(\gamma_{1}\sigma_{\omega1}^{2}+\gamma_{2}\sigma_{\omega2}^{2}\right)\right)$

whereby we define h_1 as half of the average contractual wage increment in a sector of industry when a worker moves to the next spinal point on his wage-scale. Two sensitivity parameters are important in determining the probability of receiving a contractual wage equal to the maximum wage level of a job: δ determines how large the bandwidth of the wage system is and γ_1 and γ_2 determine which portion of the error term of the empirical wage model is due to measurement error. Next, we implement condition (2) as follows:

$$P\left(W_{it}^{*}-W_{it-1}^{*}=0\right)=P\left(\left(W_{it}-W_{it-1}\right)-2\delta h_{2}<\epsilon_{it}^{U}\leq\left(W_{it}-W_{it-1}\right)+2\delta h_{2}\right) \tag{2.3}$$

with ϵ_{it}^{U}=ϵ_{it} - ϵ_{it-1} $\sim N\left(0,\left(2\gamma_{2}\sigma_{\omega2}^{2}\right)\right)$

whereby we define h_2 as half of the average year-to-year change in contractual wages at a particular spinal point of the wage-scale in a sector of industry. In order to calculate the joint probability of both conditions one needs to take into account the fact that the error terms (ϵ_{it}^{T}, ϵ_{it}^{U}) are correlated as both contain error term ϵ_{it} (see Appendix B for details). For the base case we assume the sensitivity parameters δ=1, γ_1=0.01 and γ_2=0.05. This implies that we assume wages are equal to a wage-scale ceiling in cases in which they are less than half of a wage increment from the ceiling, and in Eq.(2.2) we assume one percent of the individual error terms and five percent of the idiosyncratic error terms of the empirical model to be due to measurement error. We will provide sensitive analyses for the choices of parameters (δ, γ_1 and γ_2).

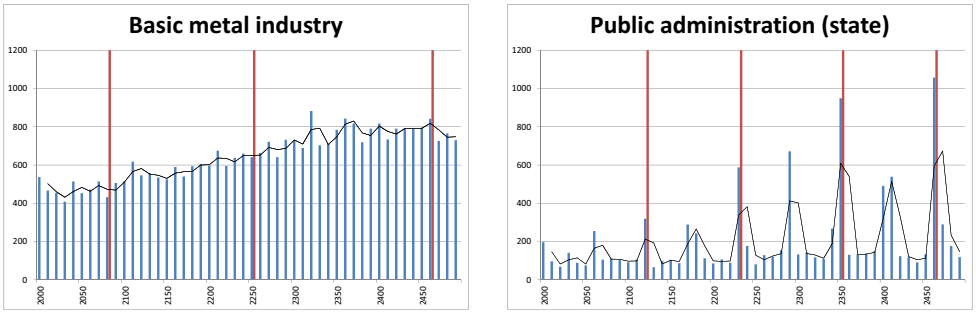
We define indicator $I_{it}^{=}$ as the joint probability of receiving a contractual wage that is equal to a wage ceiling of a wage-scale and a contractual wage

growth that is equal to zero. We define indicator I_{it}^{+} as the probability of receiving a contractual wage exceeding the highest wage ceiling in a sector (Appendix B). Note that although these indicators are defined as probabilities, they should not be interpreted as true probabilities of being at a wage ceiling or being paid above the wage ceiling as we do not observe this directly. In other words, they remain to be interpreted as indicators. These indicators are used to answer the three empirical questions defined at the beginning of this section.

2.4 Descriptive statistics

In the public sector, contractual wage levels appear to be fairly close to the exact wage levels stipulated in the collective labour agreement, while in the private sector the CLA-wage scheme seems to be less of a constraint on contractual wages. The histograms in Figure 1, displaying the frequencies of contractual wages from 2000–2500 euros per month (with a bin width of 10 euros) for the basic metal industry and the state public administration, provide illustrative examples. wage-scale ceilings are clearly recognizable as spikes in the contractual wage distribution of the public administration, while this is not the case for the basic metal industry. It is unclear whether this reflects true deviation from the wage-scale system or measurement error. For this reason, it is difficult to assess whether an individual worker's contractual wage equals the CLA-wage ceiling in the private sector. Therefore, the contractual wage growth also has to be taken into account in order to assess whether a worker's wage is at the ceiling of the wage-scale.

Figure 2.1: Histograms of contractual wages for the basic metal industry and the state public administration (wage range 2000–2500 euros, bin width 10 euros).



Source: Own calculations based on registration data from Statistics Netherlands.
Notes: vertical lines depict the ceilings of CLA-wage-scales.

Table 2.3 shows the CLA-sample to be representative of the total population of men. The table presents mean, median and standard deviation of main characteristics for the total population of male workers, as well as for male workers in the sample of industries for which CLA-data are collected. Demographic characteristics such as age are similar in both datasets. Potential experience and tenure are only slightly higher in the CLA-sample. In the sample, large firms ($\geq$ 500 employees) are slightly overrepresented, at the expense of small firms. About eighty per cent of the workers operate on a full-time contract in both datasets. Higher-educated individuals seem to be slightly underrepresented in the CLA-sample.

The major difference between the full dataset and the CLA-sample concerns the wages.[9] Contractual wages are about 16 percent lower in the CLA-dataset compared to the full dataset, while median wages are 12 percent lower. The average additional wage is also significantly lower in the CLA-sample. This is mainly caused by differences in the upper part of the distribution, since the median is fairly similar. The main reason for the deviations in wages is that high-paying sectors such as financial services, ICT and professional services are not included in the CLA-sample.

Table 2.4 focuses on the development of average wages over age ranges. The first four columns, displaying the average contractual wage by industry, show a steep increase between ages 23–34 and ages 35–44. In age ranges 35–44 and 45–54, private sector wages on average increase by 7 per cent, compared to 12 per cent in the public sector. Between the ages of 45–54 and 55–64, average contractual wages decrease by 5 percent in the private sector, while on average remaining constant in the public sector. Cohort effects may play a role here. The second set of four columns in Table 2.4 displays the average additional wage, which is the sum of the incidental wage and extra salary, over age ranges. Again, there is a clear but flattening increase up to ages 45–54. This pattern is much more pronounced in the private than in the public sector. Between age groups 45–54 and 55–64, average additional wages decrease by only 2 percent in the private sector and by 11 percent in the public sector. Demonstrating the opposite of the patterns for contractual wages, which hardly decrease at older ages in the public sector but do decrease in the private sector, additional wages typically decrease in the public sector but remain at the same level in the private sector. The level of additional wages, relative to that of contractual wages, is higher in the public sector (9 percent for age group 35–44) than in the private sector (6 percent), probably because a thir-

[9] In order to prevent that unrealistically low wages or exceptionally high wages influence the outcomes, real hourly wages below 6 euro's and above 200 euro's are excluded from the data throughout the analysis.

Table 2.3: Wage system of 22 large sectors of industry, gross monthly wages, 2006

	All men (a)			CLA-sample (a)		
	mean	p50	sd	mean	p50	sd
Age	42.3	42.0	10.8	42.4	43.0	11.0
Tenure	8.5	5.6	9.0	8.9	5.8	9.5
Potential experience (b)	25.1	25.0	11.6	25.6	26.0	11.5
Dummy firm size:						
- 10-18 employees	0.08		0.27	0.07		0.26
- 20-49 employees	0.12		0.33	0.12		0.32
- 50-99 employees	0.09		0.28	0.09		0.29
- 100-199 employees	0.09		0.28	0.09		0.29
- 200-499 employees	0.11		0.32	0.12		0.33
- $\geq$ 500 employees	0.39		0.49	0.44		0.50
Dummy reg. contract (c)	0.95		0.21	0.89		0.31
Dummy fulltime contract	0.83		0.38	0.80		0.40
Dummy educational level (d):						
- low	0.04		0.20	0.05		0.22
- intermediate	0.12		0.33	0.12		0.33
- high	0.16		0.36	0.10		0.31
Wages (in euros) (e):						
- yearly contractual wage	35,026	31,239	23,383	29,256	27,505	15,943
- yearly incidental wage	2,328	273	15,996	1,205	241	6,404
- yearly extra salary	875	0	2,680	812	0	1,867
- contractual wage per month	3,129	2,750	1,889	2,635	2,429	1,276
- gross wage per month	3,030	2,691	2,658	2,612	2,457	1,331

Notes: (a) statistics for 'all men' are based on 3,3 million observations, while statistics for 'CLA-sample' are based on 1,0 million observations for male workers. (b) potential experience is defined as age minus years of education, determined using the highest level of education attained, minus four years that represent the period before entering primary school. Time in the educational system cannot be less than 12 years because education is compulsory until age 16. (c) regular contract is defined as no TWA/on-call contract (d) Level of education is available for approximately one third of the observations in our dataset. (e) Wages are observed in the month October as we consider this as a relatively representative month, we do not consider yearly wages as the wage level of many workers changes during the year.

Table 2.4: Average gross contractual and additional wages per age group, by collective labour agreement, 2008

	Average contractual wage				Average additional wage (a)			
	23–34	35–44	45–54	55–64	23–34	35–44	45–54	55–64
Private sector								
Basic metal industry	27,954	35,896	37,938	37,763	1,973	3,084	3,601	3,527
Metal products industry	25,226	32,383	34,518	33,096	1,326	1,939	2,208	2,389
Coachworks industry	23,948	30,544	31,896	29,347	776	1,013	1,107	1,082
Construction installation	25,866	33,758	36,468	35,186	1,286	2,209	2,626	2,537
Repair of (motor) vehicles	23,900	32,016	33,432	29,322	1,163	1,802	1,784	1,489
Retail sale (large stores)	20,506	29,904	32,234	32,957	897	1,364	1,592	2,103
Retail sale (small stores)	19,116	29,615	33,449	28,772	382	825	1,097	1,537
Clothing and footwear	18,985	29,580	33,043	29,072	671	1,573	1,761	1,039
Transport	23,260	26,837	27,152	25,398	995	1,288	1,273	1,153
Hotel and catering	16,646	22,410	22,863	19,323	265	743	762	560
Temp, Empl, Agencies I(b)	12,044	15,734	16,960	17,196	414	528	486	514
Temp, Empl, Agencies II(b)	10,885	13,878	14,644	14,351	283	366	370	371
Cleaning	16,847	20,901	21,361	19,228	349	569	644	531
Public sector (incl, health care)								
Social unemployment relief	16,670	18,553	19,587	19,678	615	688	739	744
Public administration:								
- municipalities, revised (c)	29,020	35,754	39,318	38,517	2,538	3,168	3,562	3,292
- municipalities,	29,421	35,671	39,618	39,137	2,844	3,231	3,635	3,262
- region	32,106	39,284	43,576	43,110	3,627	4,563	5,028	4,956
- state	30,225	41,470	45,559	47,687	3,200	3,755	3,555	3,031
Police	28,168	37,113	42,980	43,909	4,880	5,381	5,641	5,437
Secondary education	25,312	32,481	39,692	40,923	1,909	2,505	3,154	3,250
Nursing homes for disabled	21,447	27,131	31,956	32,682	,111	1,473	1,759	1,768
Social work activities	22,217	28,679	32,345	32,260	1,142	1,492	1,685	1,727

Notes: (a) Additional wages refers to the sum of incidental wages (performance-related, not part of the contract) and extra wages (a regular extra wage component, e.g., a thirteenth month of salary). (b) Two separate collective labour agreements for temporary work agencies are taken into account. (c) Due to a reform, there are two different wage-scale systems for municipalities' public administrations. The revised system holds for employees who started their jobs in 1996 or later.

teenth month of salary is common in the public sector. Additionally, sectors that probably have high productivity-related pay, such as financial services, ICT and professional services, are not included in the CLA-sample. Note that the descriptive statistics do not take into account all kinds of composition effects such as level of education.

The first four columns of Table 2.5, presenting the incidence of additional wages, show that in the public sector, it is common for workers to receive additional wages, while in the private sector, the incidence varies widely across sectors of industry. The second set of four columns shows the incidence of wages exceeding the highest wage-scale ceiling. While wages exceeding the wage ceiling of the highest scale are rare in the public sector, probably because wages in the highest wage-scales are high, it is common in the private sector where the wages in the highest wage-scales are relatively low in some sectors of industry. Evidently, wage ceilings stipulated in collective agreements do not serve as a cap on wages in the private sector and probably not all managerial jobs are included in the system. The incidence increases between ages 23–34 and ages 35–44 and remains constant over older age ranges.

Table 2.6 presents descriptive statistics on the indicators discussed in Section 2.3 for the private- and public-sector CLAs as a group (information per CLA-industry can be found in the Appendix, Table A2.1). Indicator I1 (reflecting the proximity of the individual contractual wage to the wage ceiling of a wage-scale) is higher in the public sector than in the private sector. This holds especially true for public administration and may be related to the fact that the contractual wage distribution of public administration tends to be clustered around scale ceilings. Also, indicator I2 (reflecting the proximity of contractual wage growth to collectively-agreed wage growth) is on average higher in the public sector, indicating that the public sector has a larger share of workers at a scale ceiling than the private sector. Indicator I= (the indicator of the contractual wage being at the wage ceiling of a wage-scale) combines both sources of information. Indicator I+ (the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale) is on average higher in the private sector. Table A2.1 shows that in general, indicator I+ is approximately zero in the public sector.[10] Since wages above the highest wage-scale ceiling are very rare in the public sector, we leave out its results regarding I+ in the subsequent tables.

The calculations of the indicators of 2.6 are based on wage regressions for contractual wages. The regressions are implemented for each CLA-sector

[10]The secondary education sector is an exception, caused by the fact that we included wage ceiling for teachers in the dataset, while we are unable to distinguish teachers from governors. The CLA for secondary education contains multiple wage-scale tables for various occupations within the sector.

Table 2.5: Incidence of additional wage and of contractual wages exceeding collectively agreed wage ceiling, by CLA and age-groups, 2008

	Incidence additional wage				Incidence wage exceeding ceiling highest CLA-scale			
Age-group:	23–34	35–44	45–54	55–64	23–34	35–44	45–54	55–64
CLA								
Private sector								
Basic metal industry	0.92	0.89	0.90	0.88	0.03	0.01	0.00	0.01
Metal products industry	0.95	0.94	0.94	0.92	0.06	0.21	0.25	0.25
Coachworks industry	0.94	0.93	0.94	0.90	0.04	0.15	0.16	0.18
Construction install. activ.	0.94	0.94	0.94	0.92	0.06	0.25	0.32	0.32
Repair of (motor) vehicles	0.93	0.92	0.92	0.88	0.05	0.19	0.22	0.20
Retail sale (large stores)	0.77	0.73	0.73	0.74	0.03	0.10	0.14	0.14
Retail sale (small stores)	0.37	0.40	0.38	0.39	0.02	0.10	0.17	0.15
Clothing and footwear	0.60	0.56	0.53	0.51	0.32	0.68	0.72	0.73
Transport	0.86	0.84	0.83	0.80	0.10	0.17	0.16	0.14
Hotel and catering	0.32	0.35	0.34	0.33	0.01	0.05	0.06	0.06
Temp. empl. agencies (a)	0.67	0.68	0.63	0.63	0.02	0.04	0.05	0.07
Temp. empl. agencies (a)	0.71	0.72	0.72	0.7	0.02	0.03	0.04	0.08
Cleaning	0.48	0.51	0.52	0.48	0.30	0.42	0.41	0.41
Public sector (incl. health care)								
Social unempl. relief	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Public adm. (munic.) (b)	0.99	1.00	0.99	0.98	0.00	0.00	0.00	0.01
Public adm. (munic.) (b)	0.96	0.99	1.00	1.00	0.00	0.00	0.00	0.00
Public adm. (region)	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.01
Public adm. (state)	1.00	1.00	1.00	0.99	0.00	0.00	0.01	0.01
Police	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.01
Secondary education	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.02
Nursing homes disabled	0.99	0.99	0.99	0.98	0.00	0.00	0.01	0.02
Social work activities	0.98	0.98	0.98	0.98	0.00	0.00	0.00	0.00

Notes: (a) Two separate collective labour agreements for temporary work agencies are taken into account. (b) Due to a reform, there are two different wage-scale systems for municipalities' public administrations. The revised system holds for employees who started their jobs in 1996 or later.

Table 2.6: Descriptive statistics Indicators (a)

	I1				I2			
	mean	sd	min	max	mean	sd	min	max
Private sector	0.81	0.36	0	1	0.38	0.32	0	0.92
Public sector	0.90	0.23	0	1	0.50	0.35	0	0.99
	Indicator wage equal to scale ceiling (I=)				Indicator wage above highest ceiling (I+)			
	mean	sd	min	max	mean	sd	min	max
Private sector	0.31	0.32	0	0.92	0.15	0.34	0	1
Public sector	0.44	0.35	0	0.96	0.02	0.09	0	1

Notes: (a) Indicator I1 reflects the proximity of the individual contractual wage to the wage ceiling of a wage-scale (equation (2.2) in Section 2.3), indicator I2 reflects the proximity of contractual wage growth to collectively agreed wage growth (equation (2.3) in Section 2.3), indicator I= is the indicator of the contractual wage being at the wage ceiling of a wage-scale and combines the information of I1 and I2 (Appendix B). Indicator I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale (Appendix B). Descriptive statistics for the underlying CLA-sectors are presented in the Appendix, Table A2.1.

separately to calculate sector-specific variances (see Section 2.3).

Appendix Table A2.2 presents the pooled results for the private and public sectors and for four separate CLA-sectors. Similar regressions, but for real gross hourly wages (instead of contractual wages), are presented in the Appendix, Table A2.4, in columns (1) and (3). The lower panel of Table A2.4 shows the cumulative effects of potential experience and tenure on the log real hourly gross wages. The estimation results confirm the results of Zwick (2012) and Deelen (2012), who found that wages continue increasing with experience and tenure at older ages. Wages do indeed continue increasing with experience, although slightly less so than reported in Deelen (2012), which was based on administrative data for the time period 1999-2005.

2.5 Analysis of the wage cushion

Descriptive statistics show that wage cushions exist in the Dutch private sector, just like in Portugal (Cardoso and Portugal (2005)) and Germany (Jung and Schnabel (2011)). The central research question in this study is whether these wage cushions are more important at older ages and contribute to the fact that wages continue increasing with experience at older ages. We first investigate whether older workers are more likely to be at a wage ceiling of a wage-scale, using indicator I=, or receive a wage above the ceiling of the highest wage-scale, using indicator I+, for the private and public sector separately.

Table 2.7 shows the results of regressions explaining the indicators. In the private sector, the indicator of being at a wage-scale ceiling increases slightly with age, whereas in the public sector this indicator increases strongly with age and continues increasing at higher ages. This is in line with the fact that the wage-scale system is more extended in the public sector. The effect of tenure is clearly positive in the public sector, while in the private sector, the effect of tenure is more modest. The indicator for a wage above the highest wage ceiling increases strongly with age in the private sector.

Table 2.7: The effects of age and tenure on the indicators describing the position of contractual wages vis-à-vis the CLA-wage-scales (a)

	Indicator wage equal to scale ceiling (I=)		Indicator wage above highest ceiling (I+)
	Private sector	Public sector	Private sector
Years of age			
30	0.08	0.39	0.55
40	0.10	0.48	0.64
50	0.10	0.54	0.68
60	0.10	0.58	0.68
Years of tenure			
10	0.04	0.08	0.01
20	0.04	0.12	0.01
30	0.05	0.12	0.01
40	0.08	0.11	0.02

Notes: Indicator I= is the indicator of the contractual wage being at the wage ceiling of a wage-scale and combines the information of I1 and I2 (Indicator I1 reflects the proximity of the individual contractual wage to the wage ceiling of a wage-scale, indicator I2 reflects the proximity of contractual wage growth to collectively agreed wage growth). Indicator I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale. The effects of age and tenure are obtained from random effects regressions containing age and age^2 and tenure, tenure^2, tenure^3 and tenure^4. Included as control variables are two dummy variables for the level of education, four year variables, a dummy for fulltime contracts, five dummies representing the size class of the firm as well as dummies for the CLA sectors of industry. The underlying regression results for I= and I+ can be found in the Appendix (Table A2.3). The results of I+ in the public sector are left out since according to Table 2.5 the incidence of wages above the highest wage-scale is very low.

Do workers whose wages are equal to the wage-scale ceiling receive more in additional wages, as a means to enhance their motivation and productivity? If so, it could help to explain the fact that wage profiles continue increasing over age despite the fact that sooner or later, most workers end up at a wage-scale ceiling. Does the position of wages vis-à-vis the CLA-wage-scales explain the share of additional wages (incidental wages plus extra wages) in total wages (contractual wages plus additional wages)? Regression results in the

first row of Table 2.8 show a negative effect of the indicator of a wage at a wage-scale ceiling on the additional wage share, in both the private and public sectors. Hence, workers receiving a wage at a wage-scale ceiling receive relatively less in additional wages than workers who have not yet reached a ceiling. Apparently, additional wages are not used as a means to motivate workers who find themselves at the ceiling of their wage-scale.

For workers receiving a contractual wage exceeding the highest wage-scale ceiling, the picture is different. In the private sector, wages exceeding the highest wage ceiling go hand in hand with extra additional wages, as the effect of the indicator I+ is significantly positive.

To conclude, for the private sector, the finding that workers with contractual wages exceeding the highest wage ceiling receive more in additional wages provides an explanation for a paradox: wage profiles are increasing over time, while workers reach the end of their wage-scale sooner or later. We find, however, no indication that additional wages are used to motivate workers who have a wage equal to the maximum of their wage-scale.

Table 2.9 analyses the effect of the position of wages relative to the wage-scales on the growth in contractual wages and additional wages. A wage equal to a wage-scale ceiling implies relatively low contractual wage growth, by definition (see Eq.(2.3)). The growth in additional wages is lower for workers who have not yet reached the ceiling. Workers earning wages that exceed the highest wage-scale ceiling experience a relatively high contractual wage growth. Beyond the boundaries of the CLA-scale system, not only the level but also the growth of contractual wages is higher. The growth of their additional wages is lower, apparently due to the fact that there is less need to use additional wages if contractual wages can be set freely.

2.6 Sensitivity analysis

Table 2.10 repeats the analysis of Table 2.9 for two different sets of parameter values used in the calculation of the indicators I= and I+. The indicators change, as do the estimated coefficients, but the overall picture does not change: workers earning wages that exceed the highest wage-scale ceiling experience relatively high contractual wage growth.

What is the effect of wages exceeding the highest wage-scale ceiling on the age-wage profile? In the Appendix, A2.5, columns (2) and (5) present wage regressions in which jobs exceeding the highest wage-scale ceiling in any year are removed from the dataset in all years. The lower panel of A2.5 shows the cumulative effects of potential experience. Comparing column (2) with column (1), which refers to the full sample, shows that excluding wages exceeding the

Table 2.8: Does additional wage depend on the indicators?

	Private sector	Public sector
Indicator wage equal to scale ceiling (I=)	-0.0038 ***	-0.0042 ***
	(0.000153)	(0.000142)
Indicator wage above highest ceiling (I+)	0.0073 ***	
	(0.000337)	
Observations	1,524,927	1,336,327
Groups	585,358	438,227
R2 within	0.0002	0.1457
R2 overall	0.0738	0.1371
R2 between	0.0912	0.1368

Notes: Standard errors in parentheses; * p<0.05 ** p<0.01 *** p<0.001. The results are based on random effects regressions. The dependent variable is the growth in contractual wages or additional wages. Additional wages refer to the sum of annual incidental wages (performance-related, not part of the contract) and extra wages (regular, extra wage component; e.g., a thirteenth month of salary). Growth in contractual wages is based on the wage for October and is rescaled to a full-time wage in cases of part-time contracts.
Explanatory variables of interest: Indicator I= is the indicator of the contractual wage being equal to the wage ceiling of a wage-scale. Indicator I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale.
Control variables: tenure is instrumented with the deviation between tenure, and the individual job average of tenure and potential experience is instrumented likewise. Furthermore, we have taken into account all four-year variables, two dummy variables for the level of education, a dummy for full-time contracts, five dummies representing the size class of the firm, as well as 22 dummies for the CLA sectors of industry and a constant. The results of I+ in the public sector are left out since, according to Table 2.5, the incidence of wages above the highest wage-scale is very low.

Table 2.9: Does wage growth depend on the indicators?

	Growth in contractual wage		Growth in additional wage	
	Private sector	Public sector	Private sector	Public sector
Indicator for wage equal to scale ceiling (I=)	-0.0183***	-0.0544***	-1.465***	-0.302***
	(0.00355)	(0.00255)	(0.38300)	(0.05280)
Indicator for wage above highest ceiling (I+)	0.390***		-1.914**	
	(0.00823)		(0.60500)	
Observations	1,524,927	1,336,327	1,267,886	1,305,273
Groups	585,358	438,227	512,370	428,324
R2 within	0.0163	0.0052	0.0018	0.0012
R2 between	0.0012	0.0037	0.0010	0.0006
R2 overall	0.0003	0.0039	0.0008	0.0006

Notes: Standard errors in parentheses; * p<0.05 ** p<0.01 *** p<0.001. The results are based on random effects regressions. The dependent variable is the growth in contractual wages or additional wages. Additional wages refer to the sum of annual incidental wages (performance-related, not part of the contract) and extra wages (regular, extra wage component; e.g., a thirteenth month of salary). Growth in contractual wages is based on the wage for October and is rescaled to a full-time wage in cases of part-time contracts.
Explanatory variables of interest: Indicator I= is the indicator of the contractual wage being equal to the wage ceiling of a wage-scale. Indicator I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale.
Control variables: tenure is instrumented with the deviation between tenure, and the individual job average of tenure and potential experience is instrumented likewise. Furthermore, we have taken into account all four-year variables, two dummy variables for the level of education, a dummy for full-time contracts, five dummies representing the size class of the firm, as well as 22 dummies for the CLA sectors of industry and a constant. The results of I+ in the public sector are left out since, according to Table 2.5, the incidence of wages above the highest wage-scale is very low.

Table 2.10: Does contractual wage growth depend on the indicators? Sensitivity analysis with alternative indicators

	Private sector CLAs			Public sector CLAs		
	Base case	Altern. 1	Altern. 2	Base case	Altern. 1	Altern. 2
I=	-0.0183***	-0.0263***	-0.0884***	-0.0544***	-0.0882***	-0.0131***
	(0.00355)	(0.00703)	(0.0226)	(0.00255)	(0.00432)	(0.00586)
I+	0.390***	0.357***	0.468***			
	(0.00823)	(0.00785)	(0.00987)			
#Obs.	1,524,927	1,524,927	1,524,927	1,336,327	1,336,327	1,336,327
#Groups	585,358	585,358	585,358	438,227	438,227	438,227
R2:						
-within	0.0163	0.0154	0.0203	0.0052	0.0057	0.0064
-overall	0.0012	0.0012	0.0013	0.0037	0.0036	0.0042
-between	0.0003	0.0003	0.0004	0.0004	0.0036	0.0044

Notes: Standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001.
Sensitivity analysis regarding different sets of parameter values in the calculation of the indicators, based on random effects regressions.
Base case: δ=1,0; γ_1=0.01; γ_2=0.05. The mean of $I^{=} = 0.31$ and the of mean $I^{+} = 0.15$
Alternative 1: δ=0.5; γ_1=0.01; γ_2=0.05. The mean of $I^{=} = 0.13$ and the of mean $I^{+} = 0.18$
Alternative 2: δ=1,0; γ_1=0.05; γ_2=0.25. The mean of $I^{=} = 0.25$ and the of mean $I^{+} = 0.19$
For each case we assume $h_1 = 0.10$ and $h_2 = 0.015$.
The dependent variable is the growth in contractual wages or additional wages. Additional wages refer to the sum of annual incidental wages (performance-related, not part of the contract) and extra wages (regular, extra wage component; e.g., a thirteenth month of salary). Growth in contractual wages is based on the wage for October and is rescaled to a full-time wage in cases of part-time contracts.
Explanatory variables of interest: I= is the indicator of the contractual wage being equal to the wage ceiling of a wage-scale. I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale. Control variables: tenure is instrumented with the deviation between tenure, and the individual job average of tenure and potential experience is instrumented likewise. Furthermore, we have taken into account all four-year variables, two dummy variables for the level of education, a dummy for full-time contracts, five dummies representing the size class of the firm, as well as 22 dummies for the CLA sectors of industry and a constant. The results of I+ in the public sector are left out since, according to Table 2.5, the incidence of wages above the highest wage-scale is very low.

highest wage-scale ceiling clearly reduces the steepness of the wage profile over potential experience. In other words, the group of workers that is paid above the highest CLA-wage ceiling pulls up the age-wage profile.

Column (3) of Table A2.4 explores how much self-selection out of work affects the wage profile. The specification includes an attrition dummy measured at time t+1, which is also interacted with tenure. The results indicate that the effects of self-selection out of work on the age-wage profile are small; the cumulative effects in the lower panel of the table are grosso modo equal to the effects in column (1). In other words, we find no evidence that self-selection at time t+1 is an important explanatory variable in the increasing wage profile over potential experience.

2.7 Conclusions

This study investigates the anatomy of older workers' wages in order to explain the fact that in the Netherlands, wage profiles continue increasing at older ages, despite the fact that most workers end up at a wage-scale ceiling sooner or later. The central research question is whether the wage cushion, defined as the difference between actual wages and (maximum) contractual wages as stipulated in collective labour agreements, contributes to the fact that wages continue increasing at older ages. This wage cushion consists of two parts: the first comprises additional wages paid above the contractual wage, and the second consists of the degree to which contractual wages exceed the highest wage-scale ceiling, as stipulated in the collective labour agreement.

In the public sector, we find no evidence of a wage cushion leading to wages that continue to increase at older ages. wage-scale ceilings stipulated in collective agreements turn out to be guiding for older workers' wages, whereby the public wage-scale system also includes all types of managerial jobs. Workers earning a contractual wage equal to a wage-scale ceiling are not compensated with higher additional wages. Moreover, workers receiving a wage at a wage-scale ceiling receive even less in additional wages than workers who have not yet reached a wage ceiling. Apparently, additional wages are not used to motivate workers who find themselves at the ceiling of their wage-scales.

In the private sector, we do find evidence of a wage cushion leading to wages that continue to increase at older ages. In contrast to the public sector, the wage-scale systems in the private sector do not seem to include all types of higher and better paid (managerial) jobs. So wage-scale ceilings are not restrictive, as many workers receive a contractual wage exceeding the highest wage-scale ceiling. The likelihood of earning such a contractual wage increases with age. Furthermore, workers earning such a contractual wage receive more in

additional wages and experience higher contractual wage growth. The growth of their additional wages is, however, low compared to other workers, possibly due to the fact that there is less of a need to use additional wages if contractual wages can be set freely. As a result, in the private sector, the wage cushion enhances wage differentiation, and wages higher than the highest wage-scale ceiling contribute to the steepness of the age-wage profile. The result leads to the natural question on why the private sector has wage-scales with wage ceilings, but we consider this question beyond the scope of the paper and a possible topic for future research on labour-market institutions.

In order to draw policy conclusions from our finding that a wage cushion exists in the Dutch private sector, one should know more about the reasons behind it. The fact that wages continue increasing at older ages may be related to firm-specific human capital. Since empirical evidence suggests that productivity at best remains stable at older ages (Börsch-Supan and Weiss (2011) and Van Ours and Stoeldraijer (2011)), firm-specific human capital that continues increasing at older ages is not a likely explanation. However, firm investments in firm-specific human capital may go hand in hand with deferred compensation schemes in order to tie employees to their firms. In these cases, wages that continue increasing at older ages may be the result of optimal firm behaviour. Wages that continue increasing at older ages may, however, also be the result of the strong bargaining positions of older workers (Euwals et al. (2009)). This may lead to a wage-productivity gap at older ages, negatively affecting job mobility by older workers.

Although we cannot tell what exactly causes wages to continue increasing at older ages, our empirical evidence at least suggests that collective wage bargaining and the collective wage-scale systems cannot be a major cause. Wages that continue increasing at older ages in the private sector are the result of a wage cushion—especially that portion of wages that is on top of the collectively-agreed (maximum) wages. Our results indicate that wage differentiation is greater than that suggested by the uniform wage-setting system that prevails in the Netherlands, due to the fact that collective labour agreements usually extend to all workers in a sector of industry. So, at least for the wages of older workers, this may serve as a counterargument to the plea for more decentralized wage-setting institutions. Wage cushions seem to allow for wage differentiation between and within age groups, but it remains unsettled to what degree this wage differentiation allows for heterogeneity across sectors of industry and/or firms. Future research on linked employer-employee data should therefore address to which extent heterogeneity of wages and total wage costs reflects differences in productivity across sectors of industry and firms.

Appendix A: Collection and merging of wage system information

To investigate the impact of the wage systems on wages, and in particular the impact of wage ceilings on wages of older workers, we collected the wage system information of twenty-two Dutch sectors of industry. The twenty-two sectors are chosen on the basis of their size, in number of workers covered by a collective agreement, to guarantee a large number of observations in the empirical analysis. The wage system information is stipulated in the collective labour agreements. We extract the information from a database of collective labour agreements from the Dutch Ministry of Social Affairs and Employment. We extract information on the code of the collective labour agreement, the SBI1993 and SBI2008 codes, the starting and final dates of the agreement, the hours of a full-time working week, the number of wage-scales and, for each wage-scale, the wage floor, the wage ceiling and the number of spinal points.

The wage system information is merged with administrative employment and income data for all Dutch citizens. The two data sources are merged on the basis of the collective agreement code.

Appendix B: Calculation of the indicators

We assume a worker receives a contractual wage W_{it} equal to the wage ceiling W_j^{max} of wage-scale j in cases in which (1) his wage is close to the wage ceiling of the wage-scale and (2) his real wage growth is close to zero. To calculate the joint probability of both conditions, one needs to take into account the fact that the error terms are correlated. Section 3 defines the probability of the two events separately; the joint probability is defined as follows:

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$$I_{it}^{=} = P\left(\begin{pmatrix} W_{it}-W_j^{max} \\ W_{it}-W_{it-1} \end{pmatrix} - \begin{pmatrix} \delta h_1 \\ 2\delta h_2 \end{pmatrix} < \begin{pmatrix} \epsilon_{it}^T \\ \epsilon_{it}^U \end{pmatrix} \leq \begin{pmatrix} W_{it}-W_j^{max} \\ W_{it}-W_{it-1} \end{pmatrix} + \begin{pmatrix} \delta h_1 \\ 2\delta h_2 \end{pmatrix}\right)$$

$$\text{with } \begin{pmatrix} \epsilon_{it}^T \\ \epsilon_{it}^U \end{pmatrix} = \begin{pmatrix} \epsilon_{it}+\epsilon_i \\ \epsilon_{it}-\epsilon_{it-1} \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} (\gamma_1\sigma_{\omega 1}^2+\gamma_2\sigma_{\omega 2}^2) & \gamma_2\sigma_{\omega 2}^2 \\ \gamma_2\sigma_{\omega 2}^2 & 2\gamma_2\sigma_{\omega 2}^2 \end{pmatrix}\right)$$

I_{it}^{+} is calculated as:

$$I_{it}^{+} = \; P\left(W_{it}^{*} > W_{j}^{max}\right) = P\left(\epsilon_{it}^{T} \leq \left(W_{it} - W_{j}^{max}\right) - \delta h_1\right)$$

with $\epsilon_{it}^{T} = \epsilon_i + \epsilon_{it} \;\sim\; N\left(0, \quad \left(\gamma_1 \sigma_{\omega 1}^2 + \gamma_2 \sigma_{\omega 2}^2\right)\right)$

Appendix C: Additional statistics and regressions

See Tables A2.1, A2.2, A2.3, A2.4 and A2.5

2.7 Appendix C

Table A2.1: Descriptive statistics of indicators I1 and I2

	I1				I2			
CLA	mean	sd	min	max	mean	sd	min	max
Private sector								
Basic metal industry	0.74	0.41	0	1	0.38	0.31	0	0.79
Metal products industry	0.85	0.33	0	1	0.39	0.32	0	0.83
Coachworks industry	0.89	0.29	0	1	0.45	0.37	0	0.92
Construction install. act.	0.84	0.34	0	1	0.38	0.33	0	0.83
Repair of (motor) vehicles	0.86	0.33	0	1	0.45	0.34	0	0.86
Retail sale (large stores)	0.74	0.23	0	0.87	0.40	0.34	0	0.81
Retail sale (small stores)	0.91	0.23	0	1	0.61	0.37	0	0.92
Clothing and footwear	0.61	0.45	0	1	0.32	0.28	0	0.72
Transport	0.86	0.32	0	1	0.34	0.27	0	0.66
Hotel and catering	0.87	0.29	0	1	0.38	0.33	0	0.83
Temp. employment agencies	0.66	0.43	0	1	0.31	0.29	0	0.71
Temp. employment agencies	0.65	0.35	0	0.90	0.31	0.28	0	0.70
Cleaning	0.73	0.41	0	1	0.34	0.33	0	0.77
Public sector (incl. health care)								
Social unempl. relief	0.33	0.03	0	0.34	0.40	0.42	0	0.99
Public administration (munic.)	0.98	0.12	0	1	0.51	0.34	0	0.88
Public administration (munic.)	0.97	0.06	0	1	0.64	0.31	0	0.87
Public administration (region)	0.97	0.10	0	1	0.63	0.37	0	0.96
Public administration (state)	0.97	0.08	0	1	0.56	0.35	0	0.91
Police	0.94	0.16	0	0.99	0.31	0.16	0	0.48
Secondary education	0.97	0.07	0	1	0.33	0.37	0	0.92
Nursing homes disabled	0.96	0.13	0	1	0.49	0.37	0	0.92
Social work activities	0.81	0.36	0	1	0.49	0.36	0	0.93

Notes: Standard errors in parentheses, * p<0.05 ** p<0.01 *** p<0.001. Based on random effects regressions, with tenure instrumented with the deviation between tenure and the individual job average of tenure, and potential experience is instrumented likewise. Dependent variables: Indicator I1 reflects the proximity of the individual contractual wage to the wage ceiling of a wage-scale (equation (2.2) in Section 2.3), indicator I2 reflects the proximity of contractual wage growth to collectively agreed wage growth (equation (2.3) in Section 2.3). Control variables taken into account are two dummy variables for the level of education, three time dummies (we use the transformation proposed by Deaton and Paxson (1994), where all time effects add up to zero: due to these transformations, there are no real time effects), cohort dummies (year of birth 1946-1950, 1981-1985, and 1986-1987), a dummy for full-time contracts, five dummies representing the size class of the firm as well as 22 dummies (not presented) for the CLA sectors of industry and a constant. For the base case we assume the sensitivity parameters $\delta = 1$, $\gamma_1 = 0.01$ and $\gamma_2 = 0.05$. For each CLA-sector we assume $h_1 = 0.10$ and $h_2 = 0.015$.

Table A2.2: Descriptive statistics of the indicators I= and I+

	I=				I+			
CLA	mean	sd	min	max	mean	sd	min	max
Private sector								
Basic metal industry	0.28	0.31	0	0.79	0.25	0.42	0	1
Metal products industry	0.33	0.32	0	0.83	0.13	0.33	0	1
Coachworks industry	0.40	0.37	0	0.92	0.08	0.27	0	1
Construction install. act.	0.32	0.33	0	0.82	0.14	0.34	0	1
Repair of (motor) vehicles	0.38	0.35	0	0.85	0.11	0.31	0	1
Retail sale (large stores)	0.30	0.28	0	0.71	0.07	0.25	0	1
Retail sale (small stores)	0.56	0.33	0	0.92	0.03	0.17	0	1
Clothing and footwear	0.18	0.27	0	0.72	0.37	0.46	0	1
Transport	0.29	0.24	0	0.66	0.1	0.29	0	1
Hotel and catering	0.34	0.31	0	0.83	0.03	0.16	0	1
Temp. employment agencies	0.21	0.14	0	0.71	0.04	0.19	0	1
Temp. employment agencies	0.22	0.35	0	0.63	0.08	0.25	0	1
Cleaning	0.26	0.31	0	0.77	0.23	0.40	0	1
Public sector (incl. health care)								
Social unempl. relief	0.13	0.14	0	0.33	0.02	0.09	0	1
Public administration (munic.)	0.49	0.35	0	0.88	0.00	0.04	0	1
Public administration (munic.)	0.63	0.31	0	0.87	0.00	0.04	0	1
Public administration (region)	0.61	0.36	0	0.96	0.00	0.03	0	1
Public administration (state)	0.55	0.35	0	0.91	0.00	0.06	0	1
Police	0.24	0.19	0	0.48	0.01	0.10	0	1
Secondary education	0.32	0.36	0	0.92	0.07	0.04	0	1
Nursing homes disabled	0.48	0.37	0	0.92	0.01	0.08	0	1
Social work activities	0.41	0.37	0	0.92	0.00	0.03	0	1

Notes: Standard errors in parentheses, * p<0.05 ** p<0.01 *** p<0.001. Results for random effects regressions, with tenure instrumented with the deviation between tenure and the individual job average of tenure, and potential experience is instrumented likewise. Dependent variables: I= is the indicator of the contractual wage being equal to the wage ceiling of a wage-scale (combining the information of I1 and I2). I+ is the indicator of the contractual wage exceeding the wage ceiling of the highest wage-scale. Control variables taken into account are two dummy variables for the level of education, three time dummies (we use the transformation proposed by Deaton and Paxson (1994), where all time effects add up to zero: due to these transformations, there are no real time effects), cohort dummies (year of birth 1946-1950, 1981-1985, and 1986-1987), a dummy for full-time contracts, five dummies representing the size class of the firm as well as 22 dummies (not presented) for the CLA sectors of industry and a constant. For the base case we assume the sensitivity parameters $\delta = 1$, $\gamma_1 = 0.01$ and $\gamma_2 = 0.05$. For each CLA-sector we assume $h_1 = 0.10$ and $h_2 = 0.015$.

Table A2.3: Regressions for log real hourly contractual wage and resulting wage profiles over tenure and potential experience

	(1) Private sector CLAs	(2) Public sector CLAs	(3) Basic metal industry	(4) Transport	(5) Public adm. (state)	(6) Secondary education
Tenure	0.00118***	0.00588***	0.00266***	0.00330***	0.00524***	-0.00000645
	(0.000133)	(0.000176)	(0.000247)	(0.000423)	(0.000260)	(0.000390)
Tenure^2	-0.0120***	-0.0407***	-0.0169***	-0.0254***	-0.0305***	-0.00303
	(0.000928)	(0.000995)	(0.00155)	(0.00349)	(0.00142)	(0.00281)
Tenure^3	0.00266***	0.00269***	0.00214***	0.00483***	0.00307***	-0.00119
	(0.000186)	(0.000174)	(0.000284)	(0.000860)	(0.000236)	(0.000633)
Potential experience	0.0851***	0.0692***	0.0942***	0.0706***	0.0806***	0.0418***
	(0.000647)	(0.000667)	(0.00120)	(0.00227)	(0.00104)	(0.00140)
$\text{Potential experience}^2$	-0.319***	-0.190***	-0.320***	-0.287***	-0.261***	0.167***
	(0.00451)	(0.00446)	(0.00820)	(0.0154)	(0.00678)	(0.00970)
$\text{Potential experience}^3$	0.0616***	0.0282***	0.0605***	0.0551***	0.0461***	-0.0598***
	(0.00128)	(0.00121)	(0.00229)	(0.00429)	(0.00181)	(0.00267)
$\text{Potential experience}^4$	-0.00475***	-0.00169***	-0.00456***	-0.00412***	-0.00351***	0.00523***
	(0.000125)	(0.000114)	(0.000221)	(0.000414)	(0.000168)	(0.000252)

Table A2.3 Continued from previous page

	(1) Private sector CLAs	(2) Public sector CLAs	(3) Basic metal industry	(4) Transport	(5) Public adm. (state)	(6) Secondary education
Dummy variables:						
-Intermediate level of education	0.0944***	0.0661***	0.105***	0.112***	0.0531***	0.107***
	(0.000837)	(0.000992)	(0.00176)	(0.00260)	(0.00142)	(0.00259)
-High level of education	0.392***	0.256***	0.417***	0.473***	0.216***	0.261***
	(0.00126)	(0.00111)	(0.00214)	(0.00455)	(0.00184)	(0.00236)
DP 2008	-0.0000111	-0.00677***	-0.00478***	0.00876***	-0.00414***	-0.0413***
	(0.000130)	(0.000137)	(0.000238)	(0.000377)	(0.000201)	(0.000315)
DP 2009	-0.00799***	-0.00259***	-0.00616***	-0.00536***	-0.000304	-0.0376***
	(0.000117)	(0.000126)	(0.000218)	(0.000338)	(0.000187)	(0.000295)
DP 2010	0.00689***	0.00608***	0.00870***	-0.000595*	0.00450***	0.0476***
	(0.0000916)	(0.0000968)	(0.000169)	(0.000271)	(0.000143)	(0.000229)
Firm size 20-49	0.00489***	-0.00174	0.000473	0.0108***	0.00157	0.00465
	(0.000401)	(0.00173)	(0.00144)	(0.00118)	(0.00611)	(0.0112)
Firm size 50-99	0.0105***	-0.000199	0.00851***	0.0242***	0.00939	0.00553
	(0.000496)	(0.00187)	(0.00153)	(0.00135)	(0.00652)	(0.0114)
Firm size 100-199	0.0144***	0.000887	0.0167***	0.0230***	-0.00428	-0.00181
	(0.000556)	(0.00187)	(0.00158)	(0.00148)	(0.00624)	(0.0114)
Firm size 200-499	0.0193***	-0.000208	0.0224***	0.0333***	-0.0104	-0.00393
	(0.000613)	(0.00187)	(0.00162)	(0.00162)	(0.00648)	(0.0114)
Firm size 500+	0.0237***	0.00227	0.0349***	0.0285***	-0.0239***	-0.0112

Table A2.3 Continued from previous page

	(1) Private sector CLAs	(2) Public sector CLAs	(3) Basic metal industry	(4) Transport	(5) Public adm. (state)	(6) Secondary education
	(0.000671)	(0.00188)	(0.00173)	(0.00171)	(0.00645)	(0.0114)
Cohort 1946-1950	-0.00626	0.106***	-0.0133	-0.0186	-0.0740***	0.124***
	(0.00507)	(0.00451)	(0.0104)	(0.0111)	(0.00924)	(0.00982)
Cohort 1951-1955	0.00142	0.152***	0.0407***	-0.0222	-0.0991***	0.245***
	(0.00512)	(0.00450)	(0.0105)	(0.0115)	(0.00907)	(0.00982)
Cohort 1956-1960	0.0316***	0.149***	0.114***	-0.00825	-0.110***	0.332***
	(0.00516)	(0.00457)	(0.0105)	(0.0118)	(0.00909)	(0.0100)
Cohort 1961-1965	0.0709***	0.140***	0.185***	0.0121	-0.113***	0.436***
	(0.00518)	(0.00466)	(0.0105)	(0.0120)	(0.00916)	(0.0104)
Cohort 1966-1970	0.0846***	0.149***	0.221***	0.0251*	-0.122***	0.621***
	(0.00522)	(0.00482)	(0.0106)	(0.0122)	(0.00936)	(0.0110)
Cohort 1971-1975	0.0944***	0.192***	0.260***	0.0298*	-0.111***	0.837***
	(0.00529)	(0.00504)	(0.0107)	(0.0126)	(0.00955)	(0.0115)
Cohort 1976-1980	0.115***	0.246***	0.312***	0.0538***	-0.0978***	1.044***
	(0.00540)	(0.00529)	(0.0109)	(0.0131)	(0.00987)	(0.0120)
Cohort 1981-1985	0.151***	0.273***	0.385***	0.0938***	-0.0838***	1.194***
	(0.00552)	(0.00563)	(0.0112)	(0.0136)	(0.0106)	(0.0131)
Cohort 1986-1987	0.185***	0.280***	0.452***	0.116***	-0.0722***	1.306***
	(0.00609)	(0.00803)	(0.0138)	(0.0150)	(0.0187)	(0.0241)

Table A2.3 Continued from previous page

	(1) Private sector CLAs	(2) Public sector CLAs	(3) Basic metal industry	(4) Transport	(5) Public adm. (state)	(6) Secondary education
Observations	1,782,966	1,437,157	468,007	305,964	328,892	130,120
Groups	676,493	416,450	152,922	120,952	83,676	40,746
Sigma_u	.259	.303	.291	.225	.308	.260
Sigma_e	.079	.079	.076	.099	.056	.054
R2 within	.100	.103	.161	.030	.179	.633
R2 overall	.291	.180	.208	.111	.213	.165
R2 between	.327	.202	.231	.119	.234	.168

Notes: Standard errors in parentheses, * p<0.05 ** p<0.01 *** p<0.001 Note: Based on random effects regressions, with tenure instrumented with the deviation between tenure and the individual job average of tenure, and potential experience is instrumented likewise. Control variables taken into account are two dummy variables for the level of education, three time dummies (DP 2008/2009/2010: we use the transformation proposed by Deaton and Paxson (1994), where all time effects add up to zero: due to these transformations, there are no real time effects), cohort dummies (year of birth 1946-1950, ..., 1981-1985, and 1986-1987), a dummy for full-time contracts, five dummies representing the size class of the firm as well as 22 dummies (not presented) for the CLA sectors of industry and a constant.

Table A2.4: Regressions explaining the indicators

	Private sector I=	Public sector I=	Private sector I+
Tenure	0.00799***	0.0129***	0.0000690
	(0.000401)	(0.000449)	(0.000217)
$Tenure^2$	-0.0578***	-0.0547***	0.0104***
	(0.00454)	(0.00479)	(0.00275)
$Tenure^3$	0.0176***	0.0119***	-0.00496***
	(0.00183)	(0.00182)	(0.00120)
$Tenure^4$	-0.00174***	-0.00112***	0.000639***
	(0.000236)	(0.000225)	(0.000162)
Age	0.00395***	0.0162***	0.0252***
	(0.000255)	(0.000304)	(0.000203)
Age^2	-0.0000383***	-0.000108***	-0.000232***
	(0.00000295)	(0.00000338)	(0.00000240)
Dummy interm. level of education	-0.0234***	-0.00451***	0.0374***
	(0.00103)	(0.00110)	(0.000899)
Dummy high level of seducation	-0.123***	-0.0109***	0.252***
	(0.00132)	(0.000886)	(0.00124)
Observations	1,524,927	1,336,327	2,380,953
Groups	585,358	438,227	860,736
R2 within	.005	.033	.021
R2 overall	.046	.204	.119
R2 between	.062	.305	.126

Notes: Standard errors in parentheses ; * p<0.05 ** p<0.01 *** p<0.001. Indicator I= is the indicator of the contractual wages being at the wage ceiling of a wage-scale and combines the information of I1 and I2 (Indicator I1 reflecting the proximity of the individual contractual wage to the wage ceiling of a wage-scale, indicator I2 reflecting the proximity of contractual wage growth to collectively-agreed wage growth). Indicator I+ is the indicator of the contractual wages exceeding the wage ceiling of the highest wage-scale. The effects of age and tenure are obtained from random effects regressions containing age and age2 and tenure, tenure2, tenure3 and tenure4. Included are dummy variables for intermediate level of education and high level of education. Included as control variables are four year variables, a dummy for full-time contracts, five dummies representing the size class of the firm, as well as dummies for the CLA sectors of industry. The cumulative effects of age and tenure on the indicators, according to the estimated coefficients, can be found in Table 2.7.

Table A2.5: Regressions for log real hourly gross wage and resulting wage profiles over tenure and potential experience, for private and public sector CLAs as a group

	(1) Private sector	(2) Public sector excl. jobs exceeding highest wage-scale ceiling in any year	(3) Private sector	(4) Public sector	(5) Public sector excl. jobs exceeding highest wage-scale ceiling in any year
Tenure	0.00266***	0.00282***	0.00268***	0.00540***	0.00621***
	(0.000207)	(0.000223)	(0.000592)	(0.000209)	(0.000210)
Tenure^2	-0.0215***	-0.0230***	-0.0200***	-0.0358***	-0.0422***
	(0.00144)	(0.00157)	(0.00517)	(0.00118)	(0.00116)
Tenure^3	0.00448***	0.00480***	0.00391***	0.00237***	0.00380***
	(0.000288)	(0.000318)	(0.00108)	(0.000207)	(0.000202)
Potential experience	0.0781***	0.0741***	0.0787***	0.0693***	0.0724***
	(0.00100)	(0.00102)	(0.00110)	(0.000795)	(0.000785)
$\text{Potential experience}^2$	-0.286***	-0.287***	-0.283***	-0.165***	-0.199***
	(0.00699)	(0.00726)	(0.00800)	(0.00532)	(0.00524)
$\text{Potential experience}^3$	0.0519***	0.0523***	0.0512***	0.0183***	0.0273***
	(0.00198)	(0.00209)	(0.00235)	(0.00145)	(0.00143)
$\text{Potential experience}^4$	-0.00376***	-0.00368***	-0.00369***	-0.000651***	-0.00144***
	(0.000194)	(0.000206)	(0.000233)	(0.000136)	(0.000134)

Table A2.5 Continued from previous page

	(1) Private sector	(2) Public sector excl. jobs exceeding highest wage-scale ceiling in any year	(3) Private sector	(4) Public sector	(5) Public sector excl. jobs exceeding highest wage-scale ceiling in any year
Tenure * leave t+1			-0.000132		
			(0.000423)		
Tenure^2 * leave t+1			0.000261		
			(0.00459)		
Tenure^3 * leave t+1			0.000133		
			(0.00103)		
Dummy leave t+1			-0.00420**		
			(0.00143)		
Observations	1,782,477	1,280,196	1,782,412	1,431,683	1,277,680
Groups	676,275	505,043	676,262	415,849	368,270
Sigma_u	0.261	.168	0.278	.313	.375
Sigma_e	.122	.108	0.122	.0931	.091
R2 within	.037	.044	0.037	.0840	.081
R2 overall	.225	.212	0.225	.165	.169
R2 between	.268	.269	0.268	.176	.176

Table A2.5 Continued from previous page

	(1) Private sector	(2) Public sector excl. jobs exceeding highest wage-scale ceiling in any year	(3) Private sector	(4) Public sector	(5) Public sector excl. jobs exceeding highest wage-scale ceiling in any year
Cumulative effects on log real hourly gross wage:					
Years of potential experience:					
10	0.54	0.50	0.55	0.55	0.55
20	0.77	0.69	0.79	0.86	0.85
30	0.87	0.75	0.90	1.04	1.00
40	0.91	0.77	0.95	1.15	1.09
Years of tenure:					
10	0.01	0.01	0.01	0.02	0.02
20	0.00	0.00	0.00	-0.02	-0.01
30	0.01	0.01	0.01	-0.10	-0.09
40	0.05	0.05	0.04	-0.20	-0.18

Notes: Standard errors in parentheses * p<0.05 ** p<0.01 *** p<0.001. Based on random effects regressions, with tenure instrumented with the deviation between tenure and the individual job average of tenure, and potential experience instrumented likewise. Control variables taken into account are two dummy variables for the level of education, three year dummies (a la Altonji and Paxton), cohort dummies (year of birth: 1946-1950, ..., 1981-1985, and 1986-1987), a dummy for full-time contracts, five dummies representing the size class of the firm, as well as 22 dummies (not presented) for the CLA sectors of industry and a constant. "leave t+1" is an attrition dummy, indicating that the worker is not present anymore in the dataset in year t+1.

Chapter 3

Labour Market Effects of Job Displacement for Prime-Age and Older Workers[1]

3.1 Introduction

Displacement may pile the burden of economic adjustments on an unfortunate minority of workers. Especially for older workers finding new employment after displacement appears to be a challenge. The labour market position of older displaced workers is of specific interest due to the ageing population and the ensuing policy targets to keep older workers in the work force. This paper investigates to what extent the impact of firm bankruptcy differs between older and prime-age workers and studies how long tenure in the previous job, finding work in a different industry than the one from which they lost their previous job and the local labour market conditions in the industry from which workers are displaced correlate with these differences.

There are several reasons for a stronger displacement effect among older workers. On the demand side, older workers may be less attractive to new employers due to a relatively high wage costs-to-productivity ratio for older workers. This higher ratio may be the result of deferred compensation schemes (Lazear, 1981; Daniel and Heywood, 2007; Heywood et al., 2010), and of

[1]This chapter is joint work with Marloes de Graaf-Zijl and Wiljan van den Berge; an earlier version of this study has been published as CPB Discussion Paper No.285 (2014). We thank Anna Salomons, Daniel van Vuuren, Bas ter Weel, seminar participants at the European Society for Population Economics 2014 conference (Braga, Portugal), participants at the Utrecht School of Economics seminar (March 2014) and seminar participants at the "Labour Market for OlderWorkers: Mechanisms and Institutions" conference at the Dutch Ministry of Social Affairs in 2014 for their helpful comments.

a strong bargaining position of well-protected older workers that are well-represented by labour unions who negotiate costly special provisions for older workers in collective bargaining schemes (De Hek and Van Vuuren, 2011). On the supply side, older workers generally have higher reservation wages due to longer benefit entitlements (Van Ours and Vodopivec, 2006) or better options to retire from the labour market (Ichino et al., 2013), sometimes with generous early retirement schemes. In addition, many older workers embody substantial firm-specific human capital, which is forgone when they are displaced (Poletaev and Robinson, 2008), sector-specific capital which is lost upon displacement if the worker cannot find new employment in the same sector (Carrington, 1993; Neal, 1995), or task specific human capital (Gibbons and Waldman, 2004) that is lost if a worker needs to change occupation. Many older workers end up in shrinking occupations (Autor and Dorn, 2009; **?**), which increases the probability that they will need to find a new job in another occupation.

Earlier research has established a substantial and persistent effect of displacement on labour-market success. Especially in the U.S., researchers have been interested in this phenomenon for decades.[2] They have shown a severe and permanent drop in earnings after displacement. The European literature on displacement is more recent and focuses more on the incidence of (un)employment instead of just on earnings or wages.[3] In general, the U.S. literature has found that losses are primarily caused by lower wages in post-displacement jobs, whereas evidence from many European countries finds almost no wage losses for those who re-enter employment, but find significantly lower employment probabilities instead (Hijzen et al., 2010). Differences between age groups are found in both the U.S. and in Europe[4]. Some studies explore the relation between labour-market success after displacement and long tenure in the previous job (Hijzen et al. (2010), Kuhn (2002)) or changing industry (Burda and Mertens (2001), Huttunen et al. (2011)), but they do not analyse how these correlations differ between age groups.

Our study adds a new perspective to the literature by analysing three factors that vary within and between age groups: job tenure, working in weak labour markets and switching industries. Using the difference-in-difference techniques that have been the standard in the literature since the seminal work

[2]See e.g. Hamermesh (1989) and Fallick (1996) for overviews. Jacobsen et al. (1993) were the first to use a comparison with non-displaced workers. Most recently several studies by Kenneth Couch add to the US-literature on displaced workers (Couch and Placzek, 2010; Couch et al., 2011).

[3]Important examples of European studies are Burda and Mertens (2001), Kuhn (2002), Dustmann and Meghir (2005), Hijzen et al. (2010), Tatsiramos (2010), Huttunen et al. (2011) and OECD (2013).

[4]E.g. Topel (1990) , Farber (1993), Farber (1997), Couch (1998), Jacobsen et al. (1993), Eliason and Storrie (2006), Couch and Placzek (2010), OECD (2013), Ichino et al. (2013)

of Jacobsen et al. (1993), we determine the effect of firm bankruptcies on employment participation and wages of the workers involved. We improve on this method by estimating heterogeneous treatment effects within this difference-in-difference approach, which allows us to determine to what extent differences within age groups exist and analyse how these differences vary between age groups.

Our strategy is to apply a difference-in-difference approach combined with exact matching. We use extensive administrative linked employer-employee data for the Netherlands that include all workers, in combination with data on firm bankruptcies that are drawn from an administrative source as well. We take a sample of workers who were displaced due to firm bankruptcies in the period 2000 – 2009 and follow them up to 2011. The size of our dataset allows us to construct a control group of non-displaced workers using exact matching techniques, following Ichino et al. (2013). In doing so, we reduce the potential bias that might result from the selection of the controls (Hijzen et al., 2010; Huttunen et al., 2011), since the treated and controls have the exact same observable characteristics. In total we have nearly 45,000 treated and 158,000 controls in the age-group 35-54 years old. We test for heterogeneous treatment effects by expanding the standard difference-in-difference specification.

Our results indicate that the labour-market outcomes after displacement are highly contingent on age, especially in terms of employment probabilities. Within the older age group the outcomes are related to job tenure in the former job, the local labour-market situation in the sector from which people are displaced and whether people find work in another sector. For prime-age workers tenure in the job before displacement makes less of a difference for their outcomes after displacement than it does for older workers. Likewise, older displaced workers are more sensitive to the situation in the local labour market in the industry from which they are displaced and experience stronger negative effects of changing industries after displacement on their post-displacement wages, probably due to industry-specific human capital that is lost upon displacement. These results suggest that job and sector specific factors are important for understanding the more vulnerable position of older workers after job loss.

The paper is organized as follows. Section 3.2 shows how we constructed the data from various administrative data sources, displays descriptive graphs and presents our empirical strategy. Section 3.3 discusses the results of our analyses and section 3.4 presents sensitivity analyses. Section 3.5 concludes.

3.2 Data and empirical strategy

3.2.1 Data

This paper uses administrative linked employer-employee data in which all jobs of all Dutch citizens can be followed over time from 1999 until 2011. This so-called Social Statistical File (SSB) includes information on the exact start and end date of jobs and the wages earned in those jobs. We merged these data with information on personal characteristics from municipal registrations (GBA) and data on jobs involved in firm bankruptcies in the period 2000–2009. From these data we formed a treatment group of workers who were involved in firm bankruptcies at some point in time between 2000 and 2009, and a control group of workers who were not displaced due to firm bankruptcies within the first 12 months after the displacement date of the worker they are matched to. Sections 2.2 and 2.3 provide more information about the selection of treatment and control group.

Employment is defined as having positive wage information, or positive income from self-employment, in our monthly earnings records. This implies that the individual worked at least one hour in the private or public sector, or as a self-employed worker, in that month. We do not distinguish between employment as dependent employee or as self-employed worker. Nor do we distinguish between unemployment and inactivity, because we do not have information about the individual's job search behaviour.

The data contain yearly information on the wages earned in a specific job. From this information we constructed monthly real gross wages by combining the yearly wage information with the start and and date of the job. Many earlier studies used quarterly earnings that were sensitive to the number of weeks that a person worked during that quarter. Finding new employment during a quarter impacted earnings in those studies, and the displaced group was impacted by this more than the control group of non-displaced workers, inducing a bias. According to Topel (1990) virtually all of the short-run recovery of annual earnings is due to an increase in weeks worked, rather than to increases in weekly earnings. In this paper we disentangle the employment probability from the wages earned. In order to do so, we use monthly wages, corrected for the number of days that a person actually worked in the specific month. This implies that our wage measure is not sensitive to people finding new employment during the month. The wage measure that we actually use is the monthly real gross wage relative to the wage 13 months before the displacement, since this presentation facilitates the interpretation of the estimation coefficients. We choose the 13th month before displacement because this is before the common dip in the months leading up to displacement that

was first established by Jacobsen et al. (1993).

3.2.2 The treatment group

Our treatment group consists of workers between 35 and 54 years of age who were involved in firm bankruptcies at some point in time between 2000 and 2009. We include all workers who exited the firm during the year their firm went bankrupt or during the year before.[5] The reason for doing so lies in the potential selectivity bias that may result when workers possess private information about an impending displacement (Burda and Mertens, 2001). If the bankruptcy is anticipated, workers with the best outside options might leave the ship before it sinks and one may end up with a selective sample of workers. Therefore, it is common to include all workers who exited the firm up to one year, and in some studies even two years, before bankruptcy as displaced. Taking a wider window mitigates the problem of early leavers, but increases the risk that workers are included who moved for reasons other than firm closure. Dustmann and Meghir (2005) and Eliason and Storrie (2006) tested the effect of using a 2 year time window. According to Dustmann and Meghir (2005) the wider window led to weaker results, but the difference is insignificant, while Eliason and Storrie find that the wider window led to stronger results. Our dataset treats all employment separations (both dismissals and employee-initiated separations) at firms where the court has issued a bankruptcy in year t or year $t+1$ as displaced.

We do not restrict our sample to long-tenured workers, to workers in large firms, to men or to a certain sector of industry, like some other studies. Instead we include the broad array of workers who were hit by firm bankruptcies and estimate the differences between these various groups of workers. The seminal work of Jacobsen et al. (1993) found strong effects of job displacement that may to a substantial part be attributed to their focus on long-tenured workers: it led to more negative results than one would find for the full sample of workers that were hit by mass layoffs and firm closures (Hijzen et al., 2010). We therefore include both long and short-tenured workers in our treatment group and later estimate the differences in the outcomes between both groups. Other common restrictions on the sample of displaced workers are to exclude workers from small firms, focus on men or on a certain sector, restrict to prime-age

[5] Under the Dutch law, a debtor with at least two creditors who has ceased to pay, can be declared bankrupt under the Bankruptcy Act of 1893. Bankruptcies may be filed at the request of creditors or of the firm itself and are issued by court. Firm closures not due to bankruptcies apply almost exclusively to small businesses; among larger businesses almost all firm closures are due to bankruptcies. Unlike other collective dismissals, workers involved in a bankruptcy usually receive no compensation such as severance payments or outplacement services.

workers (e.g. 20 – 49 is a common restriction). Our sample includes men and women from all industries and all ages,[6] and focuses on the differences between age groups. We choose to exclude workers older than 55 to be certain that our results for the old-age group are not impacted by early retirement or other ways to leave the labour market.[7] An alternative retirement channel for older workers is inflow into disability insurance. However, the inflow into disability insurance has plummeted in recent decades due to policy reforms.[8]. Finally, we exclude workers younger than 35 because they typically include a large share of people who are still in education and are employed in small part-time jobs on the side.[9]

3.2.3 The control group

Our control group was taken from the same dataset as the treatment group. To create our potential control group, we selected workers who were in work during the entire month in which the bankruptcy occurred in which a person from the treatment group was involved. Our control group was not restricted to the people who remained employed in the months after the treated were displaced. Hijzen et al. (2010) and Huttunen et al. (2011) have shown that such a restriction on the control group leads to an upward bias in the results. The only restrictions that we used when we created our potential control group is that they were in employment the entire month during which a treated person was displaced, and that controls are not displaced due to firm bankruptcies within the first 12 months after the displacement date of the worker they are matched to.[10] Besides this restriction, both displaced and controls are subject to the same labour-market risks, such as dismissals on individual grounds, mass layoffs and future firm closures, voluntary quits or job mobility.

Following Ichino et al. (2013), we apply a procedure of exact matching to find matches for the displaced workers with exactly the same observed characteristics.[11] Matching variables are age in years, sex, industry, education

[6]The only restriction is the fact that someone was employed the entire year before displacement and the availability of all demographic information.

[7]In 2006 – 2009 only 1.2 percent of workers aged 50 – 54 was retired (age 55 – 59: 6.2%, age 60 – 64: 34.5%) (http://statline.cbs.nl)

[8]The inflow of workers aged 45 – 54 in disability arrangements has come down from 33,200 persons in 2000 to 19,000 in 2004 and 10,100 in 2006 (www.uwv.nl)

[9]Moreover, unlike collective dismissals, where workers often receive compensation in the form of a social plan, workers involved in a bankruptcy usually receive no compensation such as (age and tenure-dependent) severance payments or outplacement services that might bias our results (Van den Berge, 2016).

[10]Due to the large number of potential controls relative to the number of treated, this restriction should not affect our estimates.

[11]Eliason and Storrie (2006); Hijzen et al. (2010) and Couch and Placzek (2010) use

level, working hours, region and tenure class.[12] For each displaced worker, a maximum of 5 exactly matching controls was drawn from the data. In principle, a control person can serve as control for more than one displaced person, but given the large number of potential controls relative to the number of treated, the probability that one person appears more than once as a control are very small.

3.2.4 Descriptive statistics

Table 3.1 presents descriptive statistics of the pre- and post-matching samples of the treated and controls for the year 2005. Out of nearly 5,000 workers aged 35 to 54 displaced in 2005 we have been able to find one or more exactly matching controls for almost 2,000 'treated' workers. For these 2,000 workers that were involved in a firm bankruptcy, a control group of more than 7,000 non-displaced workers was drawn from the entire population of nearly 5.5 million.[13] In total for all years we observe displaced workers due to firm bankruptcies we have 44,688 observations of matched treated and 158,034 observations of matched controls between 35 and 54 years of age, leaving us with an average of 3.5 controls per treated.

Before the matching procedure the potential control group differed markedly from the treatment group in terms of age, sex, sector of industry and other characteristics. After the matching procedure these differences have vanished to a large extent. The sample of post-matching controls (column 4) resembles the sample of post-matching treated in terms of age, job positions and sectors of industry. For example, 17% of the matched treated and controls originate from the financial sector, while only 4% of the pre-matching controls works in the financial sector. Moreover, 25% of the matched treated and 22% of the matched controls are female, while 43% of the pre-matching controls are female. Regarding region of residence there is no selection before or after matching (not in table).

Note that, although we applied exact matching, the shares of the matched

propensity score matching to determine the effects of job displacement.

[12] Education is measured in three levels: low (up to primary education), middle (up to upper secondary education) and high (up to tertiary education). Working hours are measured in three groups: 0 to 18 hours, 18 to 36 hours and 36 hours or more. For region of residence we take the twelve Dutch provinces. We matched exact on those with 1–5 years of tenure, and for those with longer tenures we matched on classes of 5 years until 30 years. Everyone with more than 30 years of tenure was included in one class.

[13] Since we only observe education for about two thirds of our sample and to test the sensitivity of our matching procedure, we have also applied the same procedure without education and using wages as a proxy for education. Apart from leaving us with a larger sample, the three matching procedures produce similar results.

Table 3.1: Summary statistics

	Pre-matching		Post-matching	
	Treated	Controls	Treated	Controls
Monthly wage (euros)	2,810.93	2,875.00	3,022.49	3,321.86
(std. dev.)	1,765.14	2,426.86	1,599.87	2,316.04
Tenure (years)	6.45	7.77	10.35	10.64
(std. dev.)	6.45	7.20	6.17	5.65
Age	42.84	43.01	43.05	42.96
(std. dev.)	5.74	5.68	5.85	5.85
Education				
Low	.12	.06	.09	.07
Middle	.68	.57	.70	.72
High	.20	.37	.21	.21
Female	.31	.43	.25	.22
Part-time	.30	.43	.20	.18
Permanent contract	.96	.96	.99	.99
Position				
Director and major shareholder	.02	.02	.03	.03
Temporary agency worker	.03	.03	.00	.00
On-call employee	.01	.02	.00	.00
Other	.94	.92	.97	.97
Sector of industry				
Manufacturing	.25	.13	.31	.31
Wholesale and retail trade	.13	.10	.10	.10
Transport and storage	.07	.05	.05	.04
Accommodation and food serving	.01	.01	.00	.00
Information and communication	.00	.01	.00	.00
Financial institutions	.12	.04	.17	.17
Consultancy, research	.14	.12	.11	.11
Renting and leasing of tangible goods	.05	.06	.01	.01
Public administration	.00	.09	.00	.00
Education	.00	.09	.00	.00
Health and social activities	.04	.17	.04	.04
Culture, sport and recreation	.01	.01	.00	.00
Other services	.02	.01	.02	.01
Other	.16	.11	.19	.21
Observations	4,509	13,657,011	1,963	7,144

Notes: The summary statistics refer to 2005. The table only only includes workers between 35 and 54 years of age.
Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

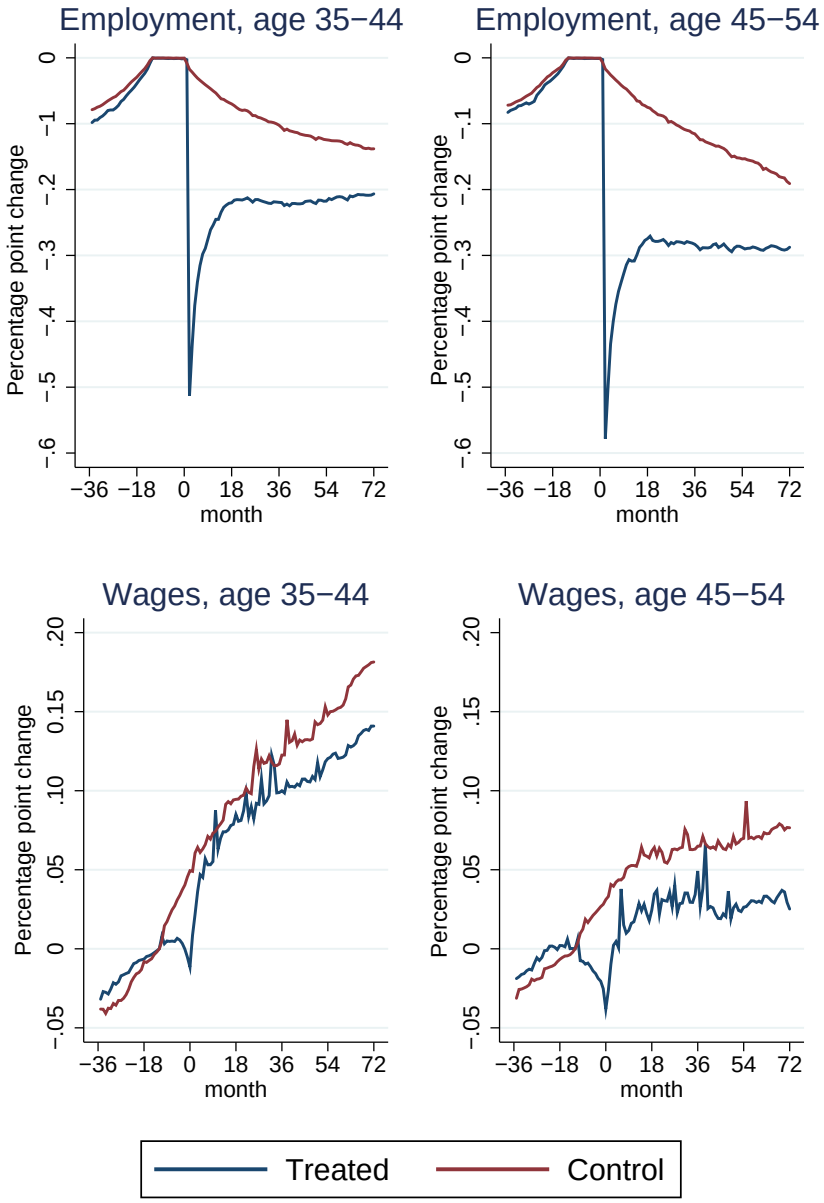
treated and the matched controls are close but not always exactly the same. The shares may diverge because not all sub groups (male vs. female; part-time vs. full-time, etc.) have the same number of controls. For example, in the case of sex the divergence is caused by the fact that treated males are on average matched to more controls than treated females are. We did not match on wages, and this shows in a divergence between post-matching treated and controls. The previously mentioned effect may play a role here as well: the relatively high wages have more controls than low wages. Difference in the absolute wage levels between treated and controls should not affect our estimates, since our outcome variable is the wage relative to the wage 13 months before displacement.

Descriptive statistics in Figure 3.1 indicate that the employment probabilities after firm bankruptcies are clearly lower for older workers than for younger workers. The upper panel of Figure 3.1 shows the change in the employment probabilities (in percentage points) over the period from 36 months before up to 72 months after the bankruptcy, relative to 13 months before the bankruptcy, for treated and controls in the two age groups. The employment probability in the period between 13 months before displacement up to displacement is 1 by definition, since we require that workers were employed the entire year up to displacement. Directly after firm bankruptcy, employment probabilities plummet by about 51 respectively 57 percentage points for prime-age and older displaced workers. This means that close to half of those workers who lost their job in a bankruptcy were able to make a job-to-job transition. After the recovery period, the probability to be in employment remains about 22 percentage points below that prior to the bankruptcy for prime-age workers and about 27 percentage points for older workers. Although the older control group reduces its employment rate more strongly, the relatively large gap between the employment rate of the displaced and controls is persistent.

The lower panel of Figure 3.1 shows the change (in percentage points) in the average wage over the period from 36 months before up to 72 months after firm bankruptcy, relative to the wage 13 months before displacement, for treated and controls in the two age groups. Wage profiles of controls are clearly steeper for prime-age workers than for older workers. In line with many other studies, we observe a wage dip before displacement.[14] The wage dip before displacement amounts to about 1 respectively 4 percentage points for

[14]Most other studies in the large literature regarding the earnings effects of job displacement have established the sharp drop in earnings prior to job loss, that was first exhibited by Jacobsen et al. (1993). Studies that do not find a dip in the wages before displacement are Couch (2001), Lengermann and Vilhuber (2002) and Schoeni and Dardia (2003). Some others (Couch and Placzek (2010) and Hildreth et al. (2007)) find upward spikes in earnings in the year prior to separation.

Figure 3.1: Descriptive statistics for displaced workers and controls, by age group (month 0 = displacement).



Source: Own calculations based on registration data from Statistics Netherlands.
Notes: The x-axis shows the time since displacement (0 = displacement). The y-axis shows the percentage point change relative to the employment probability or wage 13 months before displacement.

prime-age and older displaced workers. After displacement, wages of those in employment clearly recover over the course of the first year. For older workers a relatively large wage gap between displaced and control group results, which remains persistent in the longer run.

3.2.5 Empirical strategy

We use the difference-in-difference techniques that have been the standard in the literature since the seminal work of Jacobsen et al. (1993). We follow the recent literature and apply diff-in-diff estimates to the matched sample (e.g. Eliason and Storrie (2006); Hijzen et al. (2010); Couch and Placzek (2010); Ichino et al. (2013)). This allows us to estimate the causal effect of job displacement.[15] While displacement due to firm bankruptcies is probably the most exogenous type of dismissal, we cannot exclude selection bias. Firms experiencing bankruptcies may differ from surviving firms, not only in firm characteristics but also in terms of employee characteristics. If confounding factors indeed influence both the probability to receive treatment and the potential outcomes of the treated, the estimated treatment effect is biased. By combining difference-in-difference techniques with matching we reduce the bias in the estimated treatment effect by assuring that treated and controls have the same distributions of observable factors. The size of our dataset allows us to apply exact matching.

We start with a specification that follows Ichino et al. (2013) and focuses on two age groups of old versus prime-age workers. The basic model specification is:

$$Y_{i,t} = \sum_{d=-2}^{d=6} \alpha_d Z_i T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \beta_d T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \gamma_d Z_i D_{i,t}^d + \sum_{d=-2}^{d=6} \delta_d D_{i,t}^d + \eta_i + \theta_t + \epsilon_{i,t} \tag{3.1}$$

where $Y_{i,t}$ is the outcome of interest (employment status or wage), i is the individual worker, t is time measured in months, Z_i is an indicator taking value 1 if a worker is aged 45 - 54 and 0 if a workers is aged 35 - 44, T_i is a dummy taking 1 if the worker is displaced due to firm bankruptcy and $D_{i,t}^d$ is a dummy taking 1 for the record in which worker i is observed at d years distance from (d=0), which is the (actual or fictional) date of displacement. η_i is the unobserved individual fixed effect, θ_t captures calendar time effects (flexibly specified as a set of dummy variables for each calendar year) and $\epsilon_{i,t}$ is the individual and time-specific error term. We include 8 year dummies to

[15] Eichler and Lechner (2002); Origo (2009), referring to techniques developed in Heckman et al. (1997), give a good overview of the issues involved.

flexibly estimate how the treatment effect evolves over time. Our base period is two years before the actual or fictional date of displacement.

To aid the interpretation, we present results as expected values of $Y_{i,t}$ for a given worker. For example, if we want to know the effect of displacement for older workers compared to prime-age workers, we calculate the following expected value (suppressing conditioning on the fixed effects and time trend):

$$\begin{aligned}(\mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 1, D^d_{i,t} = 1) - \mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 0, D^d_{i,t} = 1)) - \\ (\mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 1, D^d_{i,t} = 1) - \mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 0, D^d_{i,t} = 1))\end{aligned}$$

This is equal to:

$$((\delta_d + \gamma_d + \beta_d + \alpha_d) - (\delta_d + \gamma_d)) - ((\delta_d + \beta_d) - (\delta_d)) = \alpha_d$$

We expand upon the standard methodology in the literature by further exploring the treatment effects estimated with equation 3.1. We examine whether the different outcomes of older and prime age workers after displacement are related to, for example, their tenure or industry by estimating heterogeneous treatment effects within the difference-in-difference specification. For instance, older displaced workers may be more sensitive to longer job tenure, the local labour- market situation in the sector of economic activity from which they are displaced[16] or changing sectors. Note that these estimates cannot be interpreted as treatment effects, since there is not necessarily a common trend in the employment probabilities and wages of, for example, the long and short tenured workers. Rather, the estimates should be interpreted as an exploration of the reason behind the observed differences between older and prime age workers in their labour-market situation after displacement. See section 3.5 in the Appendix for more on the calculation of expected values.

3.3 Results

In line with the literature on job displacement, our results from the difference-in-difference analysis on the matched sample indicate that both employment probabilities and wages plummet upon displacement, and subsequently recover in the period thereafter (Table 3.2). Although labour-market outcomes of displaced workers improve over time, they do not reach the level of the counterfactual within our period of observation, neither for older nor for prime-age

[16]The structural decline in the local labour market is calculated as the moving average of the employment per region and sector given by $\Delta E = \frac{E_{t-1}+E_t+E_{t+1}}{E_{t-2}+E_{t-1}+E_t}$. We distinguish 16 sectors of industry and 12 regions (Dutch provinces).

workers. The negative effects of displacement are persistent, at least up to six years after the firm closed down.[17]

Our results confirm that the effects of job displacement on employment probabilities are more negative for age group 45–54 (older workers) than for age group 35–44 (prime-age workers). Panel A of Table 3.2 shows the employment probabilities for both age groups from one until 6 years after displacement. Compared to the control group, older workers (column 1) see their employment probabilities deteriorate by 32 percentage points immediately after displacement. For prime-age workers (column 2) this is 26 percentage points. The second year after displacement, the older age group still has an employment rate about 20 percentage points lower than the control group, while displaced prime-age workers have a 14 percentage point lower employment rate; these figures decline over the remaining four years to 7 and 6 percentage points, respectively. The difference in treatment effects between displaced older and prime-age workers is almost 6 percentage points in the first year and comes down only gradually in subsequent years. The difference is statistically significant up to five years after displacement, confirming that older workers suffer stronger and longer-lasting effects from being displaced than prime-age workers.

In terms of wages older displaced workers are hit harder than prime-age displaced workers as well (Panel B of Table 3.2). We focus on the real gross monthly wage (normalised by the level 13 months before displacement) of the treatment group compared to the control group.

Upon displacement older workers suffer a 7 percentage points wage loss, while prime-age workers lose about 4 percentage points relative to the control group.[18] For prime-age workers the negative impact declines to about 3 percentage points and remains persistent up to six years after displacement. For older workers the negative impact gradually decreases to about 5 percentage points, but also remains persistent up to six years after displacement. Hence, older workers' wages are hit harder; the difference declines to −2 percent-

[17] An implicit assumption in diff-in-diff analyses is that there are no spillover effects or treatment externalities. This means that it is important to assure that the share of displaced workers is relatively low compared to the overall labour force. Unfortunately, we don't have data on the share of all types of dismissals per region and sector. Statistics on the inflow in unemployment benefits per municipality may however give some indication. In the first quarter of 2010 the average (weighted by the municipal labour forces) inflow in UB as a fraction of the relevant municipal labour forces was 1.5%, whereas the variation was limited: in 95% of the municipalities this fraction remained below 2.2%.

[18] Keep in mind that the wages of displaced workers might be biased. They might be biased upwards, because those who do find and accept a job are likely those with the better prospects. On the other hand, those who accept a job quickly after displacement might be the ones with low reservation wages.

age points in year 5 while in year 6 the difference is no longer statistically significant.[19]

The persistent gap between age groups might be related to the characteristics of the age groups. Due to longer job tenure, older workers may embody substantial firm-specific human capital, which is forgone when they are displaced (Poletaev and Robinson, 2008). In addition, older workers may have built up industry-specific capital by a long work experience in a specific industry, and this is lost upon displacement if the worker cannot find new employment in the same industry (Carrington, 1993; Neal, 1995). Older workers may be especially vulnerable to this effect, since they are more likely to end up in shrinking occupations (Autor and Dorn, 2009; Bosch and ter Weel, 2013). Wages of older, long-tenured workers may also be relatively high due to deferred compensation schemes and because tenure-related elements in the employment protection legislation (i.e., severance payments, notice periods, lifo-rules) may strengthen their wage bargaining position.

Table 3.3 shows that older workers on average indeed have longer tenure than the prime-age group. The difference in the share that was displaced from a declining labour market is small and the share of workers that changes industry after displacement does not differ between older and prime-aged workers.

But even if older workers would not have longer tenure, or were not displaced from declining labour markets more often, they might be affected stronger by these factors. This would for instance be the case if employers are more willing to invest in new firm or industry specific capital for prime-age workers than in older workers because they have more time to recoup their investment costs.

To provide more insight into the reasons behind the persistent gap between the age groups, the heterogeneous treatment effect in our difference-in-difference estimation tests to what extent job tenure and sector characteristics affect older worker's employment probabilities and wages after displacement in comparison to prime-age workers. From now on we refer to this as older workers' "sensitivity" to these characteristics. More specifically, we examine whether older workers are more sensitive to long job tenure, to the local labour-market situation in the industry from which they are displaced and to making a transition to another industry.

Table 3.4 presents the effects on the expected values of $Y_{i,t}$ for displaced older and prime age workers with different characteristics. It compares workers with long and shorter tenure (with a cut-off at 7 years)[20], workers in a declining

[19] Note that already before displacement there is a gap between older and prime-age displaced workers of approximately 0,5 percentage point (Table A3.1).

[20] We have estimated the same specification with different cut-offs for tenure and the results are in line with those presented here.

Table 3.2: Effects on the expected values of $Y_{i,t}$ for displaced older and prime-age workers and the difference between them.

	Treatment effect old (45 - 54)	Treatment effect prime-age (35 - 44)	Difference between old and prime-age
Panel A: Employment			
Year 1	-0.3178***	-0.2589***	-0.0588***
	(0.0032)	(0.0023)	(0.0039)
Year 2	-0.1954***	-0.1425***	-0.0529***
	(0.0036)	(0.0024)	(0.0043)
Year 3	-0.1573***	-0.1121***	-0.0452***
	(0.0041)	(0.0027)	(0.0049)
Year 4	-0.1273***	-0.0937***	-0.0336***
	(0.0047)	(0.0029)	(0.0056)
Year 5	-0.0981***	-0.0771***	-0.0210***
	(0.0052)	(0.0031)	(0.0060)
Year 6	-0.0676***	-0.0600***	-0.0076
	(0.0057)	(0.0033)	(0.0066)
Panel B: Wages			
Year 1	-0.0700***	-0.0399***	-0.0301***
	(0.0047)	(0.0047)	(0.0066)
Year 2	-0.0690***	-0.0331***	-0.0359***
	(0.0039)	(0.0035)	(0.0053)
Year 3	-0.0610***	-0.0293***	-0.0318***
	(0.0047)	(0.0050)	(0.0069)
Year 4	-0.0520***	-0.0306***	-0.0214***
	(0.0067)	(0.0047)	(0.0082)
Year 5	-0.0508***	-0.0313***	-0.0195**
	(0.0061)	(0.0058)	(0.0084)
Year 6	-0.0461***	-0.0323***	-0.0138
	(0.0068)	(0.0068)	(0.0096)

Notes: Calculations on the basis of fixed effects estimates of equation 3.1. Calculations for employment and wages are based on separate regressions. Full results and calculation method presented in the Appendix. Significance levels: $*$: 10% $**$: 5% $***$: 1%. Estimates are based on 16,742,131 observations for employment and 15,210,215 for wages.
Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

Table 3.3: Characteristics of older and prime-age workers in the treatment group.

	Old (45 – 54)	Prime (35 – 44)
Long tenure ($\geq$ 7 years)	0.43	0.29
Declining sectoral-regional labour market	0.68	0.66
Changing sectors	0.23	0.25

Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

local labour market with those in a growing local labour market and workers who find a job in a different (2-digit) sector after displacement with those who don't.[21]

Older workers are impacted more severely by displacement if they had a long tenure in their previous job. Column 1 shows that the employment probability of displaced older workers with long tenures is especially low in the first year after displacement: almost 10 percentage point lower than for older displaced workers with short tenures. This negative effect comes down gradually in the subsequent years, remaining significant up to four years after displacement. For prime age workers (column 2) the differences between long and short tenured workers are much smaller in the short run and in the longer run the effect evaporates. Hence, compared to prime-age workers, long tenures go along with an extra reduction in employment probability of 2 to 3 percentage point for older workers. The difference in the wage effect of displacement between long and short tenured workers is large. This holds for both older and prime-age workers; the difference between the results for the two age groups is not statistically significant.

The conditions in the labour market from which older workers are displaced partly explains their labour-market outcomes too. In accordance with the observation by Carrington (1993) we find that older workers are more sensitive to the local sectoral labour market from which they are displaced. If they are displaced from a declining local labour market, older workers experience a 3.5 percentage point larger loss in their employment probability in the the first year than if they are displaced from a stable or growing industry. This difference declines to 1.7 percentage point in the third year and disappears in the longer run. The adverse impact is concentrated among older workers, since for prime age workers the impact is small and mostly insignificant. Finding a match in which older workers can use their (probably relatively obsolete) specific human capital may be a problem if the whole sector is declining. The estimated effect of being displaced from a declining labour market on wages is about -2 percentage point in the second year for both age groups; the effect fades out in subsequent years.

Our results also support the hypothesis that older workers are more sensitive to switching industries. Older displaced workers who find new employment in a different industry than the one from which they were displaced suffer a wage loss of about 8 to 9 percentage points compared to those who found a job in the same industry. For prime-age workers these effects are about 4 percentage points and decline over time. The results indicate that the difference

[21] Since switching sectors requires having found a new job, it is impossible to estimate the "effect" for employment probabilities.

between older workers and prime-age workers are large and increase over time. In general, our results suggest that job and sector specific factors are important for understanding the more vulnerable position of older workers after job loss.

Table 3.4: Effects on the expected values of $Y_{i,t}$ for older and prime-age displaced workers displaced with different characteristics (W) and the difference between them.

	Longer tenure			Declining local labour market			Sector change		
	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference
Panel A: Employment									
Year 1	-0.0994^{***}	-0.0700^{***}	-0.0294^{***}	-0.0391^{***}	-0.0038	-0.0353^{***}			
	(0.0060)	(0.0046)	(0.0076)	(0.0066)	(0.0046)	(0.0080)			
Year 2	-0.0436^{***}	-0.0215^{***}	-0.0221^{***}	-0.0198^{***}	0.0001	-0.0199^{**}			
	(0.0066)	(0.0048)	(0.0081)	(0.0070)	(0.0047)	(0.0084)			
Year 3	-0.0349^{***}	-0.0095^{*}	-0.0254^{***}	-0.0110	0.0060	-0.0170^{*}			
	(0.0074)	(0.0053)	(0.0091)	(0.0078)	(0.0050)	(0.0092)			
Year 4	-0.0264^{***}	-0.0083	-0.0181^{*}	0.0043	-0.0012	0.0055			
	(0.0084)	(0.0059)	(0.0102)	(0.0086)	(0.0054)	(0.0102)			
Year 5	-0.0063	-0.0004	-0.0059	-0.0022	-0.0113^{**}	0.0091			
	(0.0090)	(0.0063)	(0.0110)	(0.0093)	(0.0057)	(0.0109)			
Year 6	0.0040	0.0089	-0.0050	0.0035	-0.0106^{*}	0.0141			
	(0.0099)	(0.0068)	(0.0119)	(0.0103)	(0.0060)	(0.0119)			
Panel B: Wages									
Year 1	-0.0519^{***}	-0.0300^{**}	-0.0219	-0.0019	-0.0079	0.0060	-0.0754^{***}	-0.0426^{***}	-0.0328^{***}
	(0.0095)	(0.0143)	(0.0171)	(0.0081)	(0.0084)	(0.0114)	(0.0051)	(0.0040)	(0.0065)
Year 2	-0.0708^{***}	-0.0726^{***}	0.0018	-0.0208^{***}	-0.0197^{***}	-0.0011	-0.0851^{***}	-0.0406^{***}	-0.0444^{***}
	(0.0066)	(0.0062)	(0.0091)	(0.0073)	(0.0067)	(0.0097)	(0.0053)	(0.0042)	(0.0067)
Year 3	-0.0821^{***}	-0.0947^{***}	0.0126	-0.0071	-0.0100	0.0030	-0.0825^{***}	-0.0379^{***}	-0.0446^{***}
	(0.0078)	(0.0081)	(0.0112)	(0.0085)	(0.0092)	(0.0123)	(0.0061)	(0.0049)	(0.0078)
Year 4	-0.0852^{***}	-0.1065^{***}	0.0213	-0.0118	-0.0151^{*}	0.0033	-0.0922^{***}	-0.0370^{***}	-0.0551^{***}
	(0.0113)	(0.0078)	(0.0139)	(0.0127)	(0.0082)	(0.0151)	(0.0093)	(0.0061)	(0.0112)
Year 5	-0.0814^{***}	-0.1288^{***}	0.0474^{***}	-0.0229^{**}	-0.0403^{***}	0.0173	-0.0886^{***}	-0.0283^{***}	-0.0604^{***}
	(0.0099)	(0.0088)	(0.0133)	(0.0110)	(0.0094)	(0.0144)	(0.0084)	(0.0076)	(0.0113)
Year 6	-0.0882^{***}	-0.1512^{***}	0.0629^{***}	-0.0193	-0.0539^{***}	0.0346^{**}	-0.0925^{***}	-0.0261^{***}	-0.0664^{***}
	(0.0110)	(0.0098)	(0.0148)	(0.0125)	(0.0108)	(0.0164)	(0.0096)	(0.0088)	(0.0130)

Notes: Calculations on the basis of fixed effects estimates of equation 3.3. Calculations for employment, wages and additional variables are based on separate regressions. Full results and calculation method presented in the Appendix. Significance levels: $*$: 10% $**$: 5% $***$: 1%. Estimates are based on 16,742,131 observations for employment and 15,210,215 for wages.

3.4 Sensitivity analyses

Identification of the treatment effect of displacement depends on a common trend between the treatment (displaced) and control group. While this assumption is not testable, we can examine whether it is likely to hold by estimating a so-called placebo effect. We impose a placebo "treatment" at 2.5 years before the actual displacement [22] in a simple diff-in-diff equation:

$$Y_{i,t} = \alpha + \beta_1 * \text{POST}_i + \beta_2 * \text{POST}_i * \text{TREATMENT}_i + \eta_i + \epsilon_{i,t} \qquad (3.2)$$

where $Y_{i,t}$ is our outcome variable, POST indicates the period after the placebo treatment, and η_i controls for fixed differences between treated and controls. Coefficient β_2 is the coefficient of interest and measures the effect of the placebo treatment. We estimate this equation for periods up to two years after the placebo treatment, so excluding the actual period after displacement. We use a sample containing both both older and prime age workers.

Table 3.5 reports coefficient β_2 for employment probabilities and wages. The estimated diff-in-diff parameters for employment are statistically insignificant in the first two periods, which are closest to the placebo treatment, indicating that prior to displacement the groups of treated and controls are indeed comparable. Approaching actual displacement we find a statistically significant but economically very small negative effect. For wages we find no statistically significant estimates for the first two periods, again indicating that the groups of treated and controls are indeed very comparable prior to the treatment. If we move further from the placebo treatment and closer to the actual treatment, negative effects on wages appear that are statistically significant. These effects point to the fact that the treatment group experiences a decline in their wage relative to the control group in the period leading up to actual displacement (see section 3.2.2). The reason is most likely that firms are typically in financial difficulty before they declare bankruptcy and this could lead to lower wage growth than would otherwise have been the case. Though we find some statistically significant effects for the pre-treatment period, they are very small and economically insignificant. This suggests that the common trend assumption is likely to hold.

Finally, we provide some further sensitivity tests. First, we estimate our main equation separately for men and women. Table 3.6 show the results for the overall displacement effects for older and prime-age men and women. It is clear that especially older men lose more in terms of employment probabilities than older women. For wages, on the other hand, older women generally lose

[22] The specification is robust to using other periods for the placebo treatment.

Table 3.5: Diff-in-diff coefficient for placebo treatment (Equation 3.2) of displaced older and prime age workers.

	Employment	Wages
Up to 6 months	−.0005	.0001
Up to 12 months	.0011	−.0025
Up to 18 months	.0020*	−.0043**
Up to 24 months	−.0047***	−.0085***

Notes: Calculations on the basis of fixed effects estimates of equation 3.2; the coefficients refer to separate estimations for specific distances from the placebo treatment (at 2.5 years before the actual displacement). All parameters are the result of separate regressions. Significance levels: $***$: 0.1%. Estimates are based on 503,312 observations.
Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

more than older men. So the adaptation process to a job loss runs for older women more through lower wages than for men, while employment probabilities drop more for older men than for older women. A potential explanation can be found in the shorter benefit rights for prime-age and older women, who usually have disrupted careers. In addition, women may be more risk averse and therefore have lower reservation wages. A lower reservation wage for women may also be the result of the fact that their income usually makes up a smaller share of the household income. Alternatively, women in the control group may retire earlier than men in the control group, which would lead to higher employment for women in the treatment group relative to the control group.

In October 2006, the Dutch government introduced a comprehensive reform of the system of unemployment benefits. For most unemployed workers this reform reduced the period of benefit entitlement, sometimes the reduction was as strong as 22 months, although it did increase the entitlement period for some other groups by at most 2 months. Previous empirical evidence shows that this reform increased job finding rates, but led to a decrease in the quality of the jobs found (De Groot and van der Klaauw, 2014). We have run the same specifications as above, but now separated those displaced before the reform from those displaced after the reform. Table 3.7 show the results for the overall displacement effects. Our results confirm that employment probabilities of displaced workers have improved after the reform, especially for the older age group, at least in the short run. We also observe that the wage reductions of the prime-age group are larger after the reform. Hence, the disadvantaged position of the older displaced workers compared to prime-age displaced workers is mitigated, both in terms of employment opportunities as wages. The interpretation of the long run effects is less clear, since the Dutch labour market

was hit by the Great Recession in 2009. This means that our results likely overestimate the actual impact of the reform on wages and underestimate the impact on employment.[23]

Finally we test the sensitivity of our results by estimating the treatment effects separately for different education levels. Table 3.8 shows that higher educated workers have a slightly lower employment probability than low and middle educated workers. In terms of wages, the disadvantage for older workers compared to their prime-age counterparts is largest for higher educated workers, probably because they are prone to have accumulated much firm-specific human capital.

For all sensitivity checks we also estimated the heterogeneous treatment effects in the diff-in-diff specification and the results are in line with those presented. In addition, we have tested the robustness of our main results by running similar specifications as above with different cut-off points for age, tenure and other variables.[24] The overall picture arising from these tests confirms our main results: older workers labour-market position is more negatively affected by displacement than that of prime-age workers, whereas within age groups, those with longer tenure tend to be affected more, especially among the older ones.

[23]Note that this also partly applies to the short run estimates for those laid off in 2008.
[24]The results are not reported here, but are available on request.

Table 3.6: Effects on the expected values of $Y_{i,t}$ for displaced older and prime age workers separately estimated for men and women.

	Men			Women		
	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference
Panel A: Employment						
Year 1	-0.3322^{***}	-0.2586^{***}	-0.0736^{***}	-0.2808^{***}	-0.2596^{***}	-0.0212^{***}
	(0.0037)	(0.0027)	(0.0046)	(0.0060)	(0.0042)	(0.0073)
Year 2	-0.2010^{***}	-0.1425^{***}	-0.0585^{***}	-0.1812^{***}	-0.1424^{***}	-0.0389^{***}
	(0.0042)	(0.0029)	(0.0051)	(0.0066)	(0.0044)	(0.0080)
Year 3	-0.1612^{***}	-0.1123^{***}	-0.0489^{***}	-0.1476^{***}	-0.1114^{***}	-0.0362^{***}
	(0.0048)	(0.0031)	(0.0057)	(0.0083)	(0.0050)	(0.0097)
Year 4	-0.1311^{***}	-0.0957^{***}	-0.0354^{***}	-0.1186^{***}	-0.0883^{***}	-0.0303^{***}
	(0.0054)	(0.0034)	(0.0064)	(0.0101)	(0.0057)	(0.0116)
Year 5	-0.1041^{***}	-0.0794^{***}	-0.0247^{***}	-0.0817^{***}	-0.0708^{***}	-0.0109
	(0.0058)	(0.0036)	(0.0069)	(0.0111)	(0.0061)	(0.0126)
Year 6	-0.0739^{***}	-0.0601^{***}	$-0.0138*$	-0.0502^{***}	-0.0592^{***}	0.0090
	(0.0064)	(0.0039)	(0.0075)	(0.0122)	(0.0065)	(0.0138)
Observations	12,112,482	12,112,482	12,112,482	4,629,649	4,629,649	4,629,649
Panel B: Wages						
Year 1	-0.0656^{***}	-0.0381^{***}	-0.0275^{***}	-0.0823^{***}	-0.0433^{***}	-0.0390^{***}
	(0.0059)	(0.0061)	(0.0085)	(0.0069)	(0.0069)	(0.0097)
Year 2	-0.0661^{***}	-0.0391^{***}	-0.0270^{***}	-0.0776^{***}	-0.0193^{**}	-0.0583^{***}
	(0.0045)	(0.0038)	(0.0059)	(0.0079)	(0.0077)	(0.0111)
Year 3	-0.0571^{***}	-0.0363^{***}	-0.0208^{***}	-0.0723^{***}	-0.0118	-0.0605^{***}
	(0.0052)	(0.0057)	(0.0077)	(0.0102)	(0.0105)	(0.0147)
Year 4	-0.0509^{***}	-0.0380^{***}	-0.0129	-0.0543^{***}	-0.0114	-0.0429^{**}
	(0.0077)	(0.0051)	(0.0092)	(0.0132)	(0.0105)	(0.0169)
Year 5	-0.0536^{***}	-0.0405^{***}	-0.0131	-0.0396^{**}	-0.0067	-0.0329
	(0.0061)	(0.0065)	(0.0089)	(0.0172)	(0.0123)	(0.0212)
Year 6	-0.0490^{***}	-0.0427^{***}	-0.0064	-0.0342^{**}	-0.0046	-0.0296
	(0.0072)	(0.0077)	(0.0106)	(0.0169)	(0.0135)	(0.0217)
Observations	11,018,287	11,018,287	11,018,287	4,191,928	4,191,928	4,191,928

Notes: Calculations on the basis of fixed effects estimates of equation 3.3. Calculations for employment, wages and additional variables are based on separate regressions. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Table 3.7: Effects on the expected values of $Y_{i,t}$ for displaced older and prime age workers seperately estimated for the sample entering unemployment before the UB reforms of October 2006 and the sample entering unemployment after the reforms.

	Before October 2006			After October 2006		
	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference
Panel A: Employment						
Year 1	-0.3728^{***}	-0.2869^{***}	-0.0859^{***}	-0.2752^{***}	-0.2296^{***}	-0.0456^{***}
	(0.0050)	(0.0034)	(0.0060)	(0.0040)	(0.0030)	(0.0050)
Year 2	-0.2156^{***}	-0.1469^{***}	-0.0688^{***}	-0.1813^{***}	-0.1437^{***}	-0.0377^{***}
	(0.0054)	(0.0034)	(0.0064)	(0.0047)	(0.0034)	(0.0058)
Year 3	-0.1705^{***}	-0.1151^{***}	-0.0554^{***}	-0.1610^{***}	-0.1303^{***}	-0.0306^{***}
	(0.0055)	(0.0035)	(0.0065)	(0.0067)	(0.0047)	(0.0082)
Year 4	-0.1425^{***}	-0.1008^{***}	-0.0418^{***}	-0.1527^{***}	-0.1176^{***}	-0.0350^{**}
	(0.0056)	(0.0036)	(0.0066)	(0.0121)	(0.0079)	(0.0145)
Year 5	-0.1163^{***}	-0.0859^{***}	-0.0304^{***}	-0.1331^{***}	-0.1120^{***}	-0.0211
	(0.0057)	(0.0036)	(0.0068)	(0.0272)	(0.0154)	(0.0313)
Year 6	-0.0860^{***}	-0.0689^{***}	-0.0171^{**}			
	(0.0061)	(0.0037)	(0.0072)			
Observations	11,011,464	11,011,464	11,011,464	5,730,667	5,730,667	5,730,667
Panel B: Wages						
Year 1	-0.0636^{***}	-0.0273^{***}	-0.0364^{***}	-0.0752^{***}	-0.0548^{***}	-0.0204^{***}
	(0.0098)	(0.0092)	(0.0134)	(0.0039)	(0.0031)	(0.0050)
Year 2	-0.0716^{***}	-0.0252^{***}	-0.0464^{***}	-0.0696^{***}	-0.0452^{***}	-0.0244^{***}
	(0.0064)	(0.0062)	(0.0089)	(0.0049)	(0.0038)	(0.0062)
Year 3	-0.0689^{***}	-0.0260^{***}	-0.0429^{***}	-0.0568^{***}	-0.0394^{***}	-0.0175^{*}
	(0.0066)	(0.0076)	(0.0101)	(0.0073)	(0.0053)	(0.0090)
Year 4	-0.0600^{***}	-0.0292^{***}	-0.0308^{***}	-0.0464^{***}	-0.0365^{***}	-0.0098
	(0.0079)	(0.0065)	(0.0102)	(0.0119)	(0.0092)	(0.0150)
Year 5	-0.0586^{***}	-0.0301^{***}	-0.0285^{***}	-0.0625^{***}	0.0002	-0.0626^{*}
	(0.0071)	(0.0071)	(0.0101)	(0.0219)	(0.0234)	(0.0320)
Year 6	-0.0540^{***}	-0.0310^{***}	-0.0230^{**}			
	(0.0077)	(0.0079)	(0.0110)			
Observations	9,848,835	9,848,835	9,848,835	5,361,380	5,361,380	5,361,380

Notes: Calculations on the basis of fixed effects estimates of equation 3.3. Calculations for employment, wages and additional variables are based on separate regressions. We don't observe the sixth year after job loss for those entering after October 2006. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Table 3.8: Effects on the expected values of $Y_{i,t}$ for displaced older and prime age workers separately for low, middle and high skilled workers.

	Low educated			Middle educated			High educated		
	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference	Older age (45 - 54)	Prime age (35 - 44)	Difference
Panel A: Employment									
Year 1	-0.3115^{***}	-0.2496^{***}	-0.0619^{***}	-0.3199^{***}	-0.2617^{***}	-0.0582^{***}	-0.3251^{***}	-0.2626^{***}	-0.0625^{***}
	(0.0055)	(0.0049)	(0.0073)	(0.0043)	(0.0031)	(0.0053)	(0.0090)	(0.0046)	(0.0101)
Year 2	-0.2014^{***}	-0.1413^{***}	-0.0602^{***}	-0.1891^{***}	-0.1410^{***}	-0.0481^{***}	-0.2049^{***}	-0.1466^{***}	-0.0583^{***}
	(0.0062)	(0.0053)	(0.0081)	(0.0048)	(0.0032)	(0.0058)	(0.0099)	(0.0049)	(0.0110)
Year 3	-0.1583^{***}	-0.1104^{***}	-0.0479^{***}	-0.1544^{***}	-0.1117^{***}	-0.0427^{***}	-0.1660^{***}	-0.1137^{***}	-0.0523^{***}
	(0.0072)	(0.0058)	(0.0092)	(0.0056)	(0.0036)	(0.0067)	(0.0114)	(0.0053)	(0.0126)
Year 4	-0.1265^{***}	-0.0994^{***}	-0.0270^{***}	-0.1222^{***}	-0.0915^{***}	-0.0307^{***}	-0.1489^{***}	-0.0907^{***}	-0.0581^{***}
	(0.0082)	(0.0064)	(0.0104)	(0.0065)	(0.0040)	(0.0076)	(0.0129)	(0.0058)	(0.0142)
Year 5	-0.1058^{***}	-0.0835^{***}	$-0.0223**$	-0.0863^{***}	-0.0785^{***}	-0.0078	-0.1231^{***}	-0.0644^{***}	-0.0587^{***}
	(0.0089)	(0.0068)	(0.0112)	(0.0071)	(0.0042)	(0.0082)	(0.0141)	(0.0061)	(0.0153)
Year 6	-0.0693^{***}	-0.0671^{***}	-0.0022	-0.0622^{***}	-0.0597^{***}	-0.0026	-0.0848^{***}	-0.0501^{***}	-0.0347^{**}
	(0.0098)	(0.0072)	(0.0122)	(0.0078)	(0.0045)	(0.0090)	(0.0153)	(0.0065)	(0.0166)
Observations	4,209,795	4,209,795	4,209,795	9,033,812	9,033,812	9,033,812	3,498,524	3,498,524	3,498,524
Panel B: Wages									
Year 1	-0.0637^{***}	-0.0445^{***}	-0.0193	-0.0742^{***}	-0.0400^{***}	-0.0342^{***}	-0.0681^{***}	-0.0342^{***}	-0.0339^{**}
	(0.0102)	(0.0128)	(0.0163)	(0.0052)	(0.0056)	(0.0076)	(0.0110)	(0.0086)	(0.0140)
Year 2	-0.0602^{***}	-0.0374^{***}	-0.0228^{**}	-0.0704^{***}	-0.0359^{***}	-0.0345^{***}	-0.0855^{***}	-0.0209^{**}	-0.0646^{***}
	(0.0064)	(0.0073)	(0.0097)	(0.0052)	(0.0042)	(0.0066)	(0.0136)	(0.0091)	(0.0163)
Year 3	-0.0493^{***}	-0.0234^{***}	$-0.0259**$	-0.0619^{***}	-0.0410^{***}	$-0.0209**$	-0.0877^{***}	-0.0070	-0.0807^{***}
	(0.0073)	(0.0085)	(0.0112)	(0.0064)	(0.0053)	(0.0083)	(0.0158)	(0.0156)	(0.0222)
Year 4	$-0.0320**$	-0.0317^{***}	-0.0003	-0.0628^{***}	-0.0359^{***}	-0.0269^{***}	-0.0621^{***}	-0.0173	-0.0448^{**}
	(0.0145)	(0.0090)	(0.0170)	(0.0070)	(0.0057)	(0.0091)	(0.0182)	(0.0126)	(0.0222)
Year 5	-0.0401^{***}	-0.0250^{**}	-0.0151	-0.0580^{***}	-0.0392^{***}	-0.0188^{*}	-0.0520^{**}	-0.0214	-0.0306
	(0.0088)	(0.0098)	(0.0131)	(0.0086)	(0.0065)	(0.0108)	(0.0208)	(0.0177)	(0.0273)
Year 6	-0.0363^{***}	-0.0210^{**}	-0.0153	-0.0496^{***}	-0.0464^{***}	-0.0032	-0.0589^{**}	-0.0138	-0.0452
	(0.0100)	(0.0096)	(0.0138)	(0.0093)	(0.0069)	(0.0116)	(0.0233)	(0.0225)	(0.0324)
Observations	3,746,108	3,746,108	3,746,108	8,226,452	8,226,452	8,226,452	3,237,655	3,237,655	3,237,655

Notes: Calculations on the basis of fixed effects estimates of equation 3.3. Calculations for employment, wages and additional variables are based on separate regressions. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

3.5 Conclusions

This paper analysed the effect of firm bankruptcies on the employment probabilities and wages of the workers involved. Our results support findings in the literature that displaced workers experience substantial and persistent effects on employment probabilities and wages. The size of these employment and wage effects are contingent on age. Displaced older workers face worse employment prospects than displaced prime-age workers and displaced older workers who do find a job typically experience larger wage losses than displaced prime-age workers. This picture is clear from descriptive statistics, and remains after comparing the outcomes of displaced workers to a control group of workers with exactly the same observed characteristics, who were not involved in firm bankruptcies.

Our result are probably a lower bound of the actual treatment effect, since a placebo test shows that wages start to decline more than a year before the actual job loss, while we used the 13th month before displacement as the reference point for the wage loss. Comparing to a point further in the past would likely lead to a smaller underestimation, but this would imply a restriction on the treatment and control groups regarding the employment duration before displacement. Imposing such a restriction could lead to an overestimation of the actual result, since long-tenured workers suffer stronger effects.

The results clearly show heterogeneity of the displacement effect within the group of older workers. Older workers with job tenure shorter than seven years have much better prospects than those with longer tenure. High-tenured displaced older workers experience a 5 percentage-points larger drop in employment probabilities and 4 percentage-point larger declines in their relative wages in the first two years after displacement than short-tenured displaced older workers. This difference remains persistent for wages. For prime-age workers tenure in the job before displacement makes less of a difference for their outcomes after displacement. In general they have shorter tenure as well. These results suggest that factors related to long tenures (for example accumulated firm specific human capital, high wages due to deferred compensation schemes or strong bargaining positions of well protected older workers) are an important explanation for the more severe consequences for older workers upon bankruptcy of their firm.

Labour-market outcomes of older workers are also related to the condition of the local labour market in the industry from which they are displaced. Workers displaced from industries in which the local labour market was structurally declining have worse employment probabilities and wage prospects. In the first two years after displacement employment probabilities and relative

wages for older workers displaced from declining industries are respectively around 4 and 3 percentage points below those of older workers displaced from better performing industries, whereas the wage effect persists in the long run. In general, older workers are not more often displaced from declining industries than prime-age workers, but within the group of older workers the ones displaced from declining industries perform worse. Prime-age workers are less sensitive to the situation in the local labour market in the industry from which they were displaced. Our results suggest that job and sector specific factors are important for understanding the more vulnerable position of older workers after job loss.

The latter conclusion is also supported by our finding that switching industries is related to the wage effect job loss. Older displaced workers who find new employment in a different sector than the one from which they were displaced suffer wage losses that are almost 10 percentage points stronger than those who find work in the same industry. This holds for prime-age workers as well, but to a lesser extent. Older workers switch to other industries almost as often as prime-age workers, but they suffer stronger wage losses after making this transition.

Theoretically, we can explain the more severe outcomes of older workers after displacement from relatively high labour costs, which result from delayed compensation schemes, higher wages due to the strong bargaining position of well-protected older workers or costly special provisions for older workers in collective bargaining schemes. Alternatively, the wage-to-productivity ratio may be higher for displaced older workers due to firm-specific, industry specific or task specific human capital, which is lost upon displacement, especially in case of long job tenure and when switching industries. Also, the wage-to-productivity ratio might be higher due to declining productivity with age. On the other hand supply side arguments may play a role as well. Older workers have longer benefit entitlements, which causes higher reservations wages and they have more options to retire from the labour market. Our results confirm that job tenure and switching industries are important, which supports the firm and industry specific capital argument. But a substantial part of the difference between age groups remains after controlling for these factors. This suggests that other factors may also play a role.

Appendix A: Calculation of expected values

To aid in the interpretation of our results, we calculate expected values of our outcome variables at different points of interest. The baseline specification is:

$$Y_{i,t} = \sum_{d=-2}^{d=6} \alpha_d Z_i T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \beta_d T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \gamma_d Z_i D_{i,t}^d + \sum_{d=-2}^{d=6} \delta_d D_{i,t}^d + \eta_i + \theta_t + \epsilon_{i,t} \tag{3.1}$$

where $Y_{i,t}$ is the outcome of interest (employment status or wage), i is the individual worker, t is time measured in years, Z_i is an indicator taking value 1 if a worker is aged 45 - 54 and 0 if a workers is aged 35 - 44, T_i is a dummy taking 1 if the worker is displaced due to firm bankruptcy and $D_{i,t}^d$ is a dummy taking 1 for the record in which worker i is observed at d years distance from the (actual or fictional) date of displacement. η_i is the unobserved individual fixed effect, θ_t captures calendar time effects (specified as a set of dummie variables for each year) and $\epsilon_{i,t}$ is the individual and time-specific error term. This is associated with the following expected values:

$$\begin{aligned}
\mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 0, D_{i,t}^d = 1) &= \delta_d \\
\mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 1, D_{i,t}^d = 1) &= \delta_d + \beta_d \\
\mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 0, D_{i,t}^d = 1) &= \delta_d + \gamma_d \\
\mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 1, D_{i,t}^d = 1) &= \delta_d + \beta_d + \gamma_d + \alpha_d
\end{aligned}$$

For example, if we want to know the effect of displacement for older workers compared to prime-age workers, we calculate the following expected value (suppressing conditioning on the fixed effects and time trend):

$$\begin{aligned}
&(\mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 1, D_{i,t}^d = 1) - \mathbb{E}(Y_{i,t}|Z_i = 1, T_i = 0, D_{i,t}^d = 1)) - \\
&(\mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 1, D_{i,t}^d = 1) - \mathbb{E}(Y_{i,t}|Z_i = 0, T_i = 0, D_{i,t}^d = 1))
\end{aligned}$$

This is equal to:

$$((\delta_d + \gamma_d + \beta_d + \alpha_d) - (\delta_d + \gamma_d)) - ((\delta_d + \beta_d) - (\delta_d)) = \alpha_d$$

We do the same for the diff-in-diff specification with heterogeneous treatment effects. The expanded specification is:

$$
\begin{aligned}
Y_{i,t} = & \sum_{d=-2}^{d=6} \kappa_d W_i Z_i T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \alpha_d Z_i T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \mu_d W_i T_i D_{i,t}^d + \\
& \sum_{d=-2}^{d=6} \phi_d W_i Z_i D_{i,t}^d + \sum_{d=-2}^{d=6} \beta_d T_i D_{i,t}^d + \sum_{d=-2}^{d=6} \gamma_d Z_i D_{i,t}^d + \sum_{d=-2}^{d=6} \lambda_d W_i D_{i,t}^d + \\
& \sum_{d=-2}^{d=6} \delta_d D_{i,t}^d + \eta_i + \theta_t + \epsilon_{i,t}
\end{aligned}
\tag{3.3}
$$

where W_i is a dummy variable that differs in its interpretation in the various specifications: it either represents long tenure, displacement from a declining local labour market or changes sectors after displacement. All other variables are defined as before. In the same fashion as above, we can compute expected values of $Y_{i,t}$. The expected values associated with this equation are the following:

$$
\begin{aligned}
\mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 0, T_i = 0, D_{i,t}^d = 1) =& \delta_d \\
\mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 0, T_i = 1, D_{i,t}^d = 1) =& \delta_d + \beta_d \\
\mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 1, T_i = 0, D_{i,t}^d = 1) =& \delta_d + \gamma_d \\
\mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 1, T_i = 1, D_{i,t}^d = 1) =& \delta_d + \beta_d + \gamma_d + \alpha_d \\
\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 0, T_i = 0, D_{i,t}^d = 1) =& \delta_d + \lambda_d \\
\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 0, T_i = 1, D_{i,t}^d = 1) =& \delta_d + \beta_d + \lambda_d + \mu_d \\
\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 1, T_i = 0, D_{i,t}^d = 1) =& \delta_d + \gamma_d + \lambda_d + \phi_d \\
\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 1, T_i = 1, D_{i,t}^d = 1) =& \delta_d + \beta_d + \gamma_d + \alpha_d + \lambda_d + \mu_d + \phi_d + \kappa_d
\end{aligned}
$$

For example, if we want to know the average "effect" of longer tenure ($W_i = 1$) for older ($Z_i = 1$) displaced ($T_i = 1$) workers, we have to compute the following expected value:

$$
\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 1, T_i = 1, D_{i,t}^d = 1) - \mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 1, T_i = 1, D_{i,t}^d = 1)
$$

This is equal to:

$$
(\delta_d + \beta_d + \gamma_d + \alpha_d + \lambda_d + \mu_d + \phi_d + \kappa_d) - (\delta_d + \beta_d + \gamma_d + \alpha_d) = \lambda_d + \mu_d + \phi_d + \kappa_d
$$

The expected values for prime-age workers are:

$$\mathbb{E}(Y_{i,t}|W_i = 1, Z_i = 0, T_i = 1, D^d_{i,t} = 1) - \mathbb{E}(Y_{i,t}|W_i = 0, Z_i = 0, T_i = 1, D^d_{i,t} = 1)$$

This is equal to:

$$(\delta_d + \beta_d + \lambda_d + \mu_d) - (\delta_d + \beta_d) = \lambda_d + \mu_d$$

Subtracting this from the "effect" of longer tenure for older workers, we get a measure that indicates the difference between older workers and prime-aged workers regarding the extent to which longer tenure affects the employment probabilities or wages:

$$(\lambda_d + \mu_d + \phi_d + \kappa_d) - (\lambda_d + \mu_d) = \phi_d + \kappa_d$$

where ϕ_d captures the difference between older workers with longer tenure and older workers with shorter tenure and κ_d captures the difference between treated older workers with longer tenure and treated older workers with shorter tenure. Together they determine the difference between older workers and prime-age workers in how tenure affects the employment probabilities (or wages).

Appendix B: Full estimation results of the main specifications.

See TableA3.1

Table A3.1: Full set of estimates for the results presented in Table 3.2 and Table 3.4.

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
Old * T * Year -1	0.0030*	−0.0050	0.0036	−0.0072	0.0026	−0.0234***	−0.0042
	(0.0017)	(0.0036)	(0.0026)	(0.0054)	(0.0032)	(0.0073)	(0.0035)
Old * T * Year 1	−0.0588***	−0.0301***	−0.0386***	−0.0231***	−0.0360***	−0.0390***	−0.0167***
	(0.0039)	(0.0066)	(0.0052)	(0.0066)	(0.0069)	(0.0083)	(0.0049)
Old * T * Year 2	−0.0529***	−0.0359***	−0.0428***	−0.0326***	−0.0428***	−0.0398***	−0.0114**
	(0.0043)	(0.0053)	(0.0057)	(0.0075)	(0.0074)	(0.0088)	(0.0055)
Old * T * Year 3	−0.0452***	−0.0318***	−0.0332***	−0.0277***	−0.0337***	−0.0389***	−0.0122*
	(0.0049)	(0.0069)	(0.0065)	(0.0096)	(0.0080)	(0.0097)	(0.0066)
Old * T * Year 4	−0.0336***	−0.0214***	−0.0205***	−0.0116	−0.0313***	−0.0234**	−0.0043
	(0.0056)	(0.0082)	(0.0074)	(0.0121)	(0.0085)	(0.0111)	(0.0094)
Old * T * Year 5	−0.0210***	−0.0195**	−0.0145*	−0.0115	−0.0181*	−0.0255*	−0.0036
	(0.0060)	(0.0084)	(0.0080)	(0.0117)	(0.0094)	(0.0139)	(0.0093)
Old * T * Year 6	−0.0076	−0.0138	−0.0069	−0.0026	−0.0136	−0.0210	−0.0015
	(0.0066)	(0.0096)	(0.0085)	(0.0130)	(0.0108)	(0.0164)	(0.0109)
Old * Year -1	−0.0040***	−0.0061***	0.0042***	0.0009	−0.0051***	0.0022	−0.0072***
	(0.0009)	(0.0018)	(0.0014)	(0.0027)	(0.0017)	(0.0038)	(0.0018)
Old * Year 1	−0.0018	−0.0192***	0.0022	−0.0137***	−0.0018	−0.0154***	−0.0203***
	(0.0012)	(0.0022)	(0.0018)	(0.0033)	(0.0022)	(0.0041)	(0.0020)
Old * Year 2	−0.0087***	−0.0339***	−0.0062**	−0.0276***	−0.0068**	−0.0301***	−0.0344***
	(0.0017)	(0.0025)	(0.0024)	(0.0037)	(0.0029)	(0.0044)	(0.0022)
Old * Year 3	−0.0195***	−0.0596***	−0.0197***	−0.0550***	−0.0220***	−0.0565***	−0.0521***
	(0.0022)	(0.0032)	(0.0030)	(0.0046)	(0.0035)	(0.0052)	(0.0026)
Old * Year 4	−0.0328***	−0.0842***	−0.0375***	−0.0864***	−0.0375***	−0.0857***	−0.0739***
	(0.0026)	(0.0036)	(0.0036)	(0.0050)	(0.0040)	(0.0057)	(0.0033)
Old * Year 5	−0.0444***	−0.1117***	−0.0492***	−0.1184***	−0.0524***	−0.1150***	−0.0951***
	(0.0029)	(0.0047)	(0.0040)	(0.0065)	(0.0047)	(0.0083)	(0.0038)
Old * Year 6	−0.0549***	−0.1397***	−0.0559***	−0.1506***	−0.0586***	−0.1526***	−0.1167***
	(0.0033)	(0.0053)	(0.0044)	(0.0072)	(0.0054)	(0.0100)	(0.0044)

Table A3.1 Continued from previous page

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
T * Year -1	0.0007	−0.0395***	0.0012	−0.0380***	0.0019	−0.0381***	−0.0394***
	(0.0012)	(0.0026)	(0.0015)	(0.0035)	(0.0021)	(0.0056)	(0.0025)
T * Year 1	−0.2589***	−0.0399***	−0.2442***	−0.0389***	−0.2498***	−0.0366***	−0.0236***
	(0.0023)	(0.0047)	(0.0027)	(0.0042)	(0.0039)	(0.0058)	(0.0033)
T * Year 2	−0.1425***	−0.0331***	−0.1369***	−0.0268***	−0.1333***	−0.0262***	−0.0175***
	(0.0024)	(0.0035)	(0.0029)	(0.0045)	(0.0040)	(0.0058)	(0.0036)
T * Year 3	−0.1121***	−0.0293***	−0.1093***	−0.0225***	−0.1086***	−0.0281***	−0.0126***
	(0.0027)	(0.0050)	(0.0032)	(0.0064)	(0.0042)	(0.0063)	(0.0043)
T * Year 4	−0.0937***	−0.0306***	−0.0914***	−0.0264***	−0.0906***	−0.0331***	−0.0140***
	(0.0029)	(0.0047)	(0.0035)	(0.0059)	(0.0044)	(0.0068)	(0.0052)
T * Year 5	−0.0771***	−0.0313***	−0.0764***	−0.0266***	−0.0703***	−0.0257***	−0.0189***
	(0.0031)	(0.0058)	(0.0037)	(0.0072)	(0.0047)	(0.0093)	(0.0066)
T * Year 6	−0.0600***	−0.0323***	−0.0604***	−0.0277***	−0.0496***	−0.0297**	−0.0187**
	(0.0033)	(0.0068)	(0.0039)	(0.0083)	(0.0051)	(0.0119)	(0.0074)
Year - 1							
Year 1	−0.0574***	0.0118***	−0.0742***	0.0177***	−0.0575***	0.0182***	0.0157***
	(0.0009)	(0.0019)	(0.0011)	(0.0023)	(0.0014)	(0.0037)	(0.0020)
Year 2	−0.1163***	0.0180***	−0.1471***	0.0280***	−0.1147***	0.0307***	0.0260***
	(0.0016)	(0.0033)	(0.0020)	(0.0040)	(0.0026)	(0.0068)	(0.0034)
Year 3	−0.1650***	0.0290***	−0.2063***	0.0419***	−0.1567***	0.0441***	0.0346***
	(0.0022)	(0.0048)	(0.0028)	(0.0060)	(0.0038)	(0.0101)	(0.0046)
Year 4	−0.2094***	0.0359***	−0.2611***	0.0522***	−0.1928***	0.0592***	0.0453***
	(0.0029)	(0.0065)	(0.0037)	(0.0082)	(0.0049)	(0.0138)	(0.0060)
Year 5	−0.2562***	0.0458***	−0.3181***	0.0637***	−0.2338***	0.0771***	0.0549***
	(0.0036)	(0.0087)	(0.0045)	(0.0111)	(0.0060)	(0.0191)	(0.0074)
Year 6	−0.3017***	0.0549***	−0.3743***	0.0738***	−0.2789***	0.1015***	0.0620***
	(0.0041)	(0.0105)	(0.0053)	(0.0134)	(0.0070)	(0.0241)	(0.0086)

Table A3.1 Continued from previous page

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
1999	-0.0608^{***}	-0.1723^{***}	-0.1056^{***}	-0.1684^{***}	-0.0460^{***}	-0.1613^{***}	-0.1647^{***}
	(0.0033)	(0.0068)	(0.0039)	(0.0078)	(0.0050)	(0.0121)	(0.0061)
2000	-0.0273^{***}	-0.0628^{***}	-0.0621^{***}	-0.0613^{***}	-0.0161^{***}	-0.0545^{***}	-0.0544^{***}
	(0.0026)	(0.0050)	(0.0030)	(0.0058)	(0.0039)	(0.0091)	(0.0044)
2001	-0.0040^{**}	-0.0214^{***}	-0.0263^{***}	-0.0219^{***}	0.0037	-0.0168^{***}	-0.0157^{***}
	(0.0020)	(0.0035)	(0.0022)	(0.0040)	(0.0029)	(0.0063)	(0.0031)
2002	0.0003	-0.0078^{***}	-0.0108^{***}	-0.0087^{***}	0.0039^{**}	-0.0064	-0.0051^{***}
	(0.0013)	(0.0028)	(0.0014)	(0.0030)	(0.0017)	(0.0039)	(0.0020)
2003							
2004	0.0283^{***}	0.0049	0.0387^{***}	0.0062^{*}	0.0245^{***}	0.0039	0.0020
	(0.0013)	(0.0032)	(0.0014)	(0.0033)	(0.0016)	(0.0041)	(0.0017)
2005	0.0754^{***}	0.0330^{***}	0.0965^{***}	0.0368^{***}	0.0671^{***}	0.0285^{***}	0.0341^{***}
	(0.0019)	(0.0033)	(0.0021)	(0.0040)	(0.0024)	(0.0061)	(0.0029)
2006	0.1223^{***}	0.0560^{***}	0.1538^{***}	0.0647^{***}	0.1109^{***}	0.0475^{***}	0.0548^{***}
	(0.0025)	(0.0047)	(0.0029)	(0.0058)	(0.0033)	(0.0091)	(0.0044)
2007	0.1647^{***}	0.0958^{***}	0.2052^{***}	0.1073^{***}	0.1494^{***}	0.0845^{***}	0.0951^{***}
	(0.0028)	(0.0058)	(0.0035)	(0.0074)	(0.0043)	(0.0120)	(0.0055)
2008	0.1901^{***}	0.1243^{***}	0.2415^{***}	0.1380^{***}	0.1719^{***}	0.1115^{***}	0.1258^{***}
	(0.0031)	(0.0068)	(0.0040)	(0.0088)	(0.0053)	(0.0147)	(0.0066)
2009	0.1852^{***}	0.1248^{***}	0.2475^{***}	0.1413^{***}	0.1638^{***}	0.1105^{***}	0.1269^{***}
	(0.0037)	(0.0081)	(0.0048)	(0.0105)	(0.0064)	(0.0177)	(0.0079)
2010	0.2063^{***}	0.1322^{***}	0.2783^{***}	0.1512^{***}	0.1798^{***}	0.1143^{***}	0.1308^{***}
	(0.0044)	(0.0095)	(0.0057)	(0.0123)	(0.0076)	(0.0207)	(0.0092)

Table A3.1 Continued from previous page

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
Old * W * T * Year -1			−0.0022	0.0057	0.0004	0.0271***	
			(0.0029)	(0.0064)	(0.0038)	(0.0084)	
Old * W * T * Year 1			−0.0246***	−0.0181	−0.0346***	0.0120	−0.0144
			(0.0079)	(0.0176)	(0.0084)	(0.0124)	(0.0123)
Old * W * T * Year 2			−0.0162*	0.0004	−0.0159*	0.0041	−0.0225**
			(0.0088)	(0.0101)	(0.0091)	(0.0111)	(0.0098)
Old * W * T * Year 3			−0.0265***	−0.0001	−0.0199*	0.0074	−0.0144
			(0.0101)	(0.0130)	(0.0103)	(0.0140)	(0.0106)
Old * W * T * Year 4			−0.0307***	−0.0179	−0.0026	−0.0022	−0.0124
			(0.0114)	(0.0153)	(0.0115)	(0.0168)	(0.0136)
Old * W * T * Year 5			−0.0193	−0.0129	−0.0051	0.0078	0.0064
			(0.0125)	(0.0156)	(0.0124)	(0.0175)	(0.0156)
Old * W * T * Year 6			−0.0086	−0.0211	0.0085	0.0093	0.0152
			(0.0136)	(0.0174)	(0.0137)	(0.0201)	(0.0183)
Old * W * Year - 1			−0.0046***	−0.0170***	0.0013	−0.0125***	
			(0.0015)	(0.0033)	(0.0019)	(0.0043)	
Old * W * Year 1			−0.0049**	−0.0038	−0.0007	−0.0060	−0.0184*
			(0.0022)	(0.0040)	(0.0026)	(0.0049)	(0.0105)
Old * W * Year 2			−0.0059*	0.0014	−0.0040	−0.0052	−0.0220***
			(0.0033)	(0.0044)	(0.0036)	(0.0053)	(0.0072)
Old * W * Year 3			0.0011	0.0126*	0.0030	−0.0044	−0.0302***
			(0.0042)	(0.0065)	(0.0045)	(0.0067)	(0.0072)
Old * W * Year 4			0.0125**	0.0392***	0.0080	0.0054	−0.0428***
			(0.0051)	(0.0065)	(0.0054)	(0.0074)	(0.0078)
Old * W * Year 5			0.0134**	0.0603***	0.0142**	0.0095	−0.0668***
			(0.0051)	(0.0065)	(0.0061)	(0.0099)	(0.0107)
Old * W * Year 6			0.0036	0.0840***	0.0057	0.0253**	−0.0816***
			(0.0066)	(0.0091)	(0.0068)	(0.0117)	(0.0129)

Table A3.1 Continued from previous page

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
T * W * Year -1			0.0006	−0.0033	−0.0013	−0.0022	
			(0.0019)	(0.0045)	(0.0025)	(0.0063)	
T * W * Year 1			−0.0553***	−0.0003	−0.0150***	−0.0056	−0.0019
			(0.0048)	(0.0144)	(0.0048)	(0.0089)	(0.0088)
T * W * Year 2			−0.0196***	−0.0222***	−0.0148***	−0.0114	−0.0066
			(0.0051)	(0.0068)	(0.0050)	(0.0074)	(0.0062)
T * W * Year 3			−0.0074	−0.0255***	−0.0047	−0.0016	−0.0103*
			(0.0058)	(0.0094)	(0.0055)	(0.0100)	(0.0061)
T * W * Year 4			−0.0045	−0.0145	−0.0024	0.0057	−0.0122*
			(0.0065)	(0.0090)	(0.0060)	(0.0095)	(0.0074)
T * W * Year 5			0.0039	−0.0163	−0.0094	−0.0103	−0.0126
			(0.0070)	(0.0105)	(0.0064)	(0.0118)	(0.0111)
T * W * Year 6			0.0116	−0.0157	−0.0152**	−0.0045	−0.0221*
			(0.0076)	(0.0118)	(0.0068)	(0.0142)	(0.0134)
W * Year -1			−0.0387***	−0.0026	0.0054***	0.0038	
			(0.0009)	(0.0023)	(0.0014)	(0.0032)	
W * Year 1			−0.0147***	−0.0297***	0.0112***	−0.0023	−0.0406***
			(0.0013)	(0.0023)	(0.0017)	(0.0035)	(0.0079)
W * Year 2			−0.0019	−0.0504***	0.0149***	−0.0082**	−0.0340***
			(0.0018)	(0.0026)	(0.0022)	(0.0036)	(0.0045)
W * Year 3			−0.0021	−0.0692***	0.0107***	−0.0084*	−0.0277***
			(0.0023)	(0.0048)	(0.0024)	(0.0046)	(0.0037)
W * Year 4			−0.0038	−0.0920***	0.0012	−0.0208***	−0.0248***
			(0.0028)	(0.0042)	(0.0027)	(0.0050)	(0.0041)
W * Year 5			−0.0043	−0.1126***	−0.0019	−0.0299***	−0.0157*
			(0.0032)	(0.0055)	(0.0029)	(0.0075)	(0.0081)
W * Year 6			−0.0027	−0.1355***	0.0046	−0.0495***	−0.0040
			(0.0035)	(0.0064)	(0.0032)	(0.0096)	(0.0100)

Table A3.1 Continued from previous page

	Baseline		Tenure		Structural decline		Sector change
	Employment	Wages	Employment	Wages	Employment	Wages	Wages
Constant	0.9481^{***}	1.0487^{***}	0.9558^{***}	1.0442^{***}	0.9457^{***}	1.0482^{***}	1.0415^{***}
	(0.0014)	(0.0023)	(0.0014)	(0.0023)	(0.0016)	(0.0028)	(0.0016)
Observations	16,742,131	15,210,215	16,742,131	15,210,215	16,531,942	15,015,110	14,237,391

Notes: Fixed effects estimates of equation 3.1 (Columns 1 - 2) and equation 3.3 (Columns 3 - 7). Standard errors in parentheses. Variable OLD is 1 if workers are aged [45,54] and 0 if workers are aged [35,44] at the moment of displacement. W is $TENURE$ in columns 3 - 4, $DECLINE$ in columns 5 - 6 and $SECTORCHANGE$ in column 7. $TENURE$ is 1 if tenure is larger than 7 years at the moment of displacement and 0 if smaller than 7 years. $DECLINE$ is 1 if employment in the regional-sectoral labour market declined during the years before/after displacement, where employment change is calculated as $\Delta E = \frac{E_{t-1}+E_t+E_{t+1}}{E_{t-2}+E_{t-1}+E_t}$. $SECTORCHANGE$ is 1 if a worker found a new job in a different sector than the one she previously worked in and 0 if not (see the main text for more information on the construction of these variables). Significance levels: $*$: 10% $**$: 5% $***$: 1%.
Source: Own calculations using registration data from Statistics Netherlands on displaced workers.

Chapter 4

Flexible Wages or Flexible Workers? A Decomposition of Wage Bill Adjustment by Dutch Firms, 2006–2013[1]

4.1 Introduction

Rising unemployment during The Great Recession has led to renewed interest in wage rigidity. Downward wage rigidity can occur for a variety of reasons. Shapiro and Stiglitz (1984) argued that it is optimal for firms to pay wages above the market-clearing level to give workers an incentive to provide high effort, with the quasi-rent workers lose if they get fired possibly preventing them from shirking. Insider-outsider theories state that unions and collective bargaining generate wages that exceed the market-clearing level and that such wages respond little to adverse labour market situations (Lindbeck and Snower (1986)). Smoothing wages over the business cycle may also be optimal because firms can diversify firm-specific risks, while risk-averse workers can not (Teulings and Bovenberg (2009)).

Though smoothing wages over time may be optimal from some perspectives, it has large implications for employment volatility. In a negative demand shock, there is a trade-off between the responsiveness of wages and reduction in employment. In a basic labour demand-supply framework with an inelastic labour supply, a leftward shift of the labour demand curve due to a demand

[1]The author thanks Daniël van Vuuren and Leon Bettendorf, participants of the labour-health seminar series at Tilburg University (December 2015) and the EALE-conference in Ghent (September 2016) for their useful comments on earlier versions of this paper.

shock leads to unemployment if wages do not fall (Pessoa and Van Reenen (2014)). Moreover, search and matching models require wages that are unresponsive to current labour-market conditions to generate the volatility in job-finding rates and unemployment that are observed in the data across the business cycle (Hall (2005), Shimer (2004), Shimer (2005)). On the other hand, wages in new job matches often do show volatility.[2]

Recent research indeed suggests that both nominal and real wages are downwardly rigid in many European countries (Babecký et al. (2012), Knoppik and Beissinger (2009), Holden and Wulfsberg (2014)). Still, studies of wage rigidity have their limitations. Firstly, measurement of wage rigidity is often restricted to the wages of workers who have remained working at a firm for two consecutive years (stayers), but firms may partly offset the downwardly rigid wages of stayers by using job turnover to adjust their average wages. Secondly, studies of downward wage rigidity often focus on the lower end of the distribution of wage changes, for example by comparing the left hand side of the actual distribution of wage changes with that of a symmetric, theoretical distribution representing a situation without downward wage rigidity (Dickens et al. (2007), Goette et al. (2007)). However, firms may compensate for rigid downward wages through moderate wage growth at the middle and higher segments of their wage change distribution; therefore, the relationship between downward wage rigidity and changes in employment is not clear-cut (Elsby (2009), Stüber and Beissinger (2012)). Studies of the United States confirm that wage stickiness is highly heterogeneous between groups of workers, both between stayers and movers (Pissarides (2009)) and among percentile groups (Robin (2011)). Thirdly, most studies of wage rigidity focus on contractual wages, so micro-econometric studies of wage rigidity generally do not reveal to what extent firms use other wage components to adjust their wage bills. Given these limitations of wage-rigidity studies, analysing how firms respond to adverse shocks requires considering how wages of non-stayers, wages at the middle and higher ends of the wage-change distribution, and wage components other than contractual wages all react.

Little is known, however, about the strategies firms use to reduce their labour costs in response to adverse sales shocks, nor about the possible impediments firms face to such adjustments. Adjustment of employment at the extensive margin may, for example, be limited by employment-protection legislation and rules concerning the use of temporary contracts. At the intensive margin, institutions such as partial unemployment insurance and regulation of

[2]With a modification based on fixed matching costs, the canonical search and matching model can generate both cyclical unemployment volatility and wage flexibility in new matches (Pissarides (2009)).

working hours play a role. Whether adjustment takes place in terms of wages or in terms of employment is quite important, since unemployment and job insecurity are costly to individual workers leading to large losses in income, skills and human capital, as well as a lower state of well-being (Origo and Pagani (2009), Clark et al. (2010)). Especially for older workers, the cost of losing a job is high; their probability of finding a new job after displacement is substantially lower and their wage drop (if they do find a new job) larger than for prime-age workers Deelen et al. (2014a). Given the lack of clarity of how firms adjust wages and employment (and, as a result, labour productivity) to adverse shocks, the answer has to come from empirical research.

Empirical studies typically aim to explain the development of either employment or wages. This study takes a wider perspective, focussing on the way firms adjust their wage bills (the sum of all wages paid by a firm) in times of declining demand. I study adjustments to wages and job flows simultaneously and from a firm perspective, using an extensive, administrative linked employer-employee panel dataset for the Netherlands, which contains wages and participation data for all workers. Firm characteristics are, however, typically not available across the whole sample. I focus on a sample of firms with 25 workers or more for which data concerning year-to-year changes in sales are available. This data-set comprises more than 75,000 firm-year observations, which are based on 12.3 million job-year observations.

The study has two parts: (1) decomposition and (2) regression analysis. In the first part, changes in the contractual wage bills of firms are decomposed into items related to price (hourly wages) and volume (hours worked, number of jobs), distinguishing between stayers and workers entering and exiting the firm. I also considered overtime pay and incidental wages. I analyse the impact of adverse sales shocks of various sizes on this decomposition by estimating the asymmetry in the responses by firms to falling or growing sales. The decompositions are examined through various variables, such as sales growth (by group) and the share of open-term contracts. The results of these decompositions are accompanied by additional detailed information regarding job flows, wages and hours worked by groups of workers and types of contract. The decomposition-analysis discloses how firms choose their mix of wage mitigation and employment reduction in response to adverse sales growth. One limitation arises, however, that comparing decompositions of two groups of firms does not take into account the differences in observed characteristics.

The second part of the analysis comprises multivariate regressions which relate wage changes, job flows or employment growth to a number of firm characteristics. Again, the unit of observation is the firm. The analyses generally focus on firm-year observations for which sales decrease, or even decline

sharply, since this is when adjustments typically occur.

The main findings of the paper are the following. The decomposition analysis shows that employment reduction is by far the most important channel for contracting wage bills, indicating downward wage rigidity. In this regard, firms use not only increased exits but also reduced entries, probably to avoid firing costs. A striking result is that the contractual wage growth of stayers is only somewhat lower at firms hit by an adverse shock, compared to firms with increasing sales, and wage changes remain positive on average. Over the years, however, wage growth has decelerated across the board. I find no indication that job flows are used as a vehicle to reduce the average wage; wages of entrants do not lag further behind those of stayers when sales growth is more adverse. Hence, contractual wages have minor importance for wage-bill adjustment in adverse times for both stayers and entrants. Contractual working hours provide some downward flexibility, as do overtime pay and incidental wages, but the magnitude of the effect is small.

Regression analysis confirms that, in the short run, stayers' wage growth is only somewhat responsive to negative sales shocks. By contrast, employment growth is quite sensitive to firm characteristics, especially with larger negative sales shocks are larger. Employment loss, however, does not hit a random group of workers: given a severe negative shock in sales, employment losses are larger at firms with higher percentages of immigrants, short-tenured workers, temporary contracts, non-regular job-types and part-time jobs. Moreover, I find a significant negative relationship between firms' degree of downward wage rigidity and their employment growth, suggesting that employment reduction would be significantly lower if wages were more downwardly flexible. These findings point to a segmented labour market, where, on the one hand, employment adjustments predominantly affect workers in a relatively weak labour market position, whereas ongoing workers are assured that wage increases will not be jeopardised by sales shocks suffered by their firms.

The remainder of this paper is organised as follows. Section 4.2 describes the methodology. Section 4.3 discusses the data and the institutional features of the Dutch labour market. The results of the decomposition analysis are presented in subsection 4.4.1. Estimated relationships among job flows, wage or employment growth and firm characteristics are presented in subsection 4.4.2, and subsection 4.4.3 discusses the results. Section 4.5 concludes.

4.2 Methodology

The first part of the analysis, the decomposition of firms' changing wage bills, is inspired by Fuss (2009), which decomposed wage-bill changes at the firm

level into components due to wage changes and components due to flows of employment. That study used administrative, matched employer–employee data of individual earnings merged with firms' annual accounts for Belgium from 1997 to 2001. Fuss' results agreed with what one would expect from a downwardly rigid wage environment (which stems, among other things, from the Belgian system of full automatic indexation under which the base-wage of all workers is adjusted to inflation). On average, Fuss finds that wage-bill contractions result essentially from employment cuts in spite of wage increases.

The contractual wage bill is the sum of the monthly contractual wages of firm i. By contractual wage I mean, the base wage, excluding overtime pay and performance-related pay, such as incidental pay, extra pay and bonuses. At time t, firm i employs $J_{i,t}$ workers (indexed by j), earning a monthly contractual wage $w_{ji,t}$. The changes in the wage bill are scaled on the average wage bill over both years, following Davis and Haltiwanger (1992). As a first step, Equation 4.1 simply decomposes the growth rate of the wage bill $\mathring{WB}_{i,t}$ into a component related to the change in the average monthly contractual wage and a component related to the change in the number of workers.

$$\begin{aligned} \mathring{WB}_{i,t} &= \frac{\Sigma_{Ji,t} w_{ji,t} - \Sigma_{Ji,t-1} w_{ji,t-1}}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \\ &= \frac{J_{t-1}(\bar{w}_t - \bar{w}_{t-1}) + (J_t - J_{t-1})\bar{w}_t}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \end{aligned} \tag{4.1}$$

Out of the $J_{i,t}$ workers that firm i employs at time t, $S_{i,t}$ are stayers, workers employed by firm i in both t and (t−1), and $N_{i,t}$ are entrants, employed by firm i at t but not yet employed by this firm at (t−1). Out of the $J_{i,t-1}$ workers that firm i employs at time (t−1), $E_{i,t-1}$ are exiters, employed by firm i at (t−1) but not at t, and $S_{i,t-1}$ stayers. The change in the wage bill of a firm is equal to the sum of the wages of stayers and entrants in year t minus the sum of the wages of stayers and exiters in year (t-1):

$$\begin{aligned} \mathring{WB}_{i,t} = &\frac{(\Sigma_{Ji,t \in S_{i,t}} w_{ji,t} + \Sigma_{Ji,t \in N_{i,t}} w_{ji,t})}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} - \\ &\frac{(\Sigma_{Ji,t-1 \in S_{i,t-1}} w_{ji,t-1} + \Sigma_{Ji,t-1 \in E_{i,t-1}} w_{ji,t-1})}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \end{aligned} \tag{4.2}$$

Replacing the sum of contractual wages of each group (S, N or E) by the number of workers in that group times their average contractual wage and rewriting the equation gives the decomposition of the change in the contrac-

tual wage bill (equation 4.3). The first component reflects the contribution from the change in the average contractual monthly wage of stayers, while the second component represents the contribution from the net change in employment. The third and fourth components relate to the contribution of job flows. For example, if exiters are replaced by an equal number of lower-waged entrants, the change in net employment is zero, but job flows negatively contribute to the change in the wage bill lowering the average wage level. More specifically, the third component reflects new entrants and their wages, relative to those of stayers. Since the average wage of newly hired workers is below that of stayers, the component is negative: hiring new workers reduces wage-bill growth. Analogously, the last component reflects the contribution of workers exiting the firm and their wages, relative to the wages of stayers. Since the average wage of exiters is below that of stayers, workers leaving increases wage-bill growth.[3]

$$\mathring{WB}_{i,t} = \frac{(N_t - E_{t-1})\bar{w}_t^S + S_t(\bar{w}_t^S - \bar{w}_{t-1}^S) + N_t(\bar{w}_t^N - \bar{w}_t^S) - E_{t-1}(\bar{w}_{t-1}^E - \bar{w}_t^S)}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \tag{4.3}$$

Since the contractual monthly wage (w) is equal to the contractual number of working hours per month (H) times the contractual hourly wage (w^h), the wage-bill change can be further decomposed in terms of number of jobs, hours worked and the hourly wages of stayers, entrants and exiters (equation 4.4). The first component is again the contribution of the net change in employment, valued at the average wage of stayers in year t. The contribution of stayers is split into one component for the change in hourly wage (the second component in equation 4.4) and one for the change in the average working hours of stayers (the third component in equation 4.4). The fourth and fifth components depict the job-flow contributions of hourly wages by non-stayers, while the last two components represent job-flow contributions of hours worked by non-stayers. The tables in the results section contain six items, since the last two components are presented as a single component, 'hours worked, non-stayers'. Besides the contractual wage bill, wider definitions of the wage bill are also considered on top of this: one including overtime pay and another including incidental and extra pay.

[3]Wages of stayers are used as a common benchmark for the wages of both entrants and exiters. Direct comparison between wages of entrants and exiters would only be possible for firms that featured both entrants and exiters in a particular year. Note that these components compensate 'overshooting' by the second component, which is caused by the fact that the change in net employment is valued at the average wage of stayers in year t.

$$\overset{\circ}{WB}_{i,t} = \frac{(N_t - E_{t-1})\bar{w}_t^S + \Sigma_S(w_t^{hS} - w_{t-1}^{hS})H_t^S + \Sigma_S(H_t^S - H_{t-1}^S)w_{t-1}^{hS}}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} +$$

$$\frac{(\bar{w}_t^{hN} - \bar{w}_t^{hS})N_t\bar{H}_t^N - (\bar{w}_{t-1}^{hE} - \bar{w}_t^{hS})E_{t-1}\bar{H}_{t-1}^E}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} +$$

$$\frac{(\bar{H}_t^N - \bar{H}_t^S)N_t\bar{w}_t^{hS} - (\bar{H}_{t-1}^E - \bar{H}_t^S)E_{t-1}\bar{w}_t^{hS}}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} \tag{4.4}$$

Having computed the decomposition of the change in wage bill for each firm-year combination, the next step is to assess to what extent wage-bill adjustments are *symmetric* between favourable and adverse states. I define a firm-year combination as an adverse state if the firm's sales decreased compared to the year before, whereas a firm-year combinations in which sales of a firm increase or remain constant are termed favourable.[4] The analysis focusses on the way firms adapt to an exogenous shock in sales.[5] I therefore analyse the impact of an adverse sales shock on firms' wage-change decompositions by estimating the asymmetry between firm-year observations with falling and growing sales (or, alternatively, between severe and more moderate negative sales shocks). To estimate this asymmetry, for each item of the decomposition a Student's t-test is performed for the hypothesis that there is no difference in the mean between the two states. In this regard, the next simple equation is estimated using maximum likelihood—for sake of consistency with the method used by Fuss (2009)—, taking into account common year effects γ_t:

$$\Delta x_{k_{i,t}} = \alpha_k + \beta_k.dum_{k_{i,t}} + \gamma_{k_t} + \epsilon_{k_{i,t}} \tag{4.5}$$

where k = 1, ..., 6, since equation 4.5 is estimated separately for each item of equation 4.4[6]

[4] Parsimonious regressions in Table A4.1 in Appendix A illustrate that wage-bill contraction is strongly correlated with sales reduction. As a robustness check, in Table B4.1 in Appendix B, I use the wage-bill change instead of sales growth to distinguish between favourable (positive wage-bill growth) and adverse (negative wage-bill growth) states.

[5] Although reversed causality cannot be fully excluded (for example, high wages may lead to overpriced products, inducing low sales), sales reduction may to a large extent be considered an exogenous shock, perhaps even more so since the observed period is characterized by reduced demand.

[6] The tables in the results section refer to the items $\Delta x_{k_{i,t}}$ as the contributions to the gross contractual wage-bill growth by the change in:

The second part of the paper relates employment growth, job flows and wage growth to an extensive set of firm characteristics, applying linear and logistic regression analyses. Again the firm is the unit of observation. As with the decomposition analysis, the regression analysis focusses on the adjustment in cases of adverse sales shocks. Indicators for nominal and real downward wage rigidity have been included as explanatory variables in the regressions to analyse the relation between downward wage rigidity and employment growth (see Appendix C for more detailed information on the indicators of wage rigidity).

4.3 Data and institutional features of the Dutch labour market

4.3.1 Data

This paper uses administrative, linked employer–employee data for the Netherlands covering the period 2006–2013. Data from the Social Statistical Datasets (SSD), containing wages, hours worked and other characteristics for all jobs in the Netherlands, have been merged with workers' personal characteristics and firm data (see Appendix C for more detailed information on the creation of the dataset and the applied selections).

Data regarding wages and hours worked are available for all workers in all firms, an improvement compared to Fuss (2009), whose data do not cover all Belgian firms. Moreover, the data here contain exact information on the start and end date of all jobs; however, dismissals and voluntary exits can not be distinguished. Firm-level data such as that concerning sales, however, are generally only available for a subset of firms.

I choose to restrict the sample to workers aged 23 to 65. The main reason to exclude workers younger than 23 is that the Dutch mandatory youth minimum wage follows a steep profile: from the age of 15 to 23, the minimum wage increases yearly by 15 to 17%. Hence, workers on a youth minimum wage see automatic wage increases by two-digit percentages. As a result, youth workers in some sectors also face a higher probability of dismissal as their birthday approaches (Kabátek (2015)). The inclusion of young workers in my data could thus mask a possible downward adjustment of stayers' wages in

1) net employment: $(N_t - E_{t-1})\bar{w}_t^S/D$
2) hourly wage, stayers: $\Sigma_S(w_t^{hS} - w_{t-1}^{hS})H_t^S/D$
3) hourly wage, entrants: $(\bar{w}_t^{hN} - \bar{w}_t^{hS})N_t\bar{H}_t^N/D$
4) hourly wage, exiters: $(\bar{w}_{t-1}^{hE} - \bar{w}_t^{hS})E_{t-1}\bar{H}_{t-1}^E/D$
5) hours worked, stayers: $\Sigma_S(H_t^S - H_{t-1}^S)w_{t-1}^{hS}/D$
6) hours worked, non-stayers: $(\bar{H}_t^N - \bar{H}_t^S)N_t\bar{w}_t^{hS} - (\bar{H}_{t-1}^E - \bar{H}_t^S)E_{t-1}\bar{w}_t^{hS}/D$,
where D = denominator $0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})$.

response to a negative shock. Workers aged over 65 are also excluded from the data; working after the mandatory retirement age is possible, but contracts generally require renegotiation. Hence, these age groups may experience large individual wage changes for reasons that are not the primary focus of this paper.

For each set of two subsequent years, wage-bill changes are decomposed for all private-sector firms that exist in October of both years. In the main analysis, firm-year combinations are excluded that are characterised by firm dynamics, such as mergers and acquisitions. A robustness check explores how including such combinations affects the results. Summarized, I focus in this study on wages paid to workers aged 23 to 65 in ongoing, private-sector firms which are not subject to firm dynamics.

4.3.2 Descriptive statistics

The period observed in this study, 2007–2013, is characterised by two major economic contractions. Macro-economic growth plummeted from 1.7% in 2008 to -3.8% in 2009 and dropped below zero again in 2012 (-1.1%) and 2013 (-0.2%) (CPB (2016)). Graph 4.1 in Appendix A presents yearly kernel densities for several key variables, based on the data used in this study that refers to firms with 25 or more workers. Sales growth (depicted in the graph in the first row, left) starts to falter in 2008 and then drops sharply in 2009; not only does the distribution shift to the left but the left tail of the distribution is also very fat. Sales growth improves over the following years, dropping again in 2012 and 2013, although not as much as in 2009. The other variables show a similar pattern, although the temporary improvement in sales in 2010 is not followed immediately by wage and job growth; in fact 2010 is the weakest year. Furthermore, the densities of contractual wage-bill growth and particularly growth in the gross monthly wages of stayers (respectively: first row, right; second row, left) are, strikingly, much more compressed than those of sales. In adverse years (2010, 2013), the left tail is thin, suggesting wages are downwardly rigid. Employment growth (second row, right) strongly recovers in 2011, thereby returning to the levels found before the first dip. The job exit rate (third row, left) is highest in years characterised by high employment growth. The job enter rate (third row, right) is much more dispersed than the exit rate. Note that the exit rate reflects both voluntary quitting, which increases in times of employment growth, and dismissals, which increase in adverse times; the data do not allow distinction between these two types of exits.

Table 4.1 presents descriptive statistics for all private-sector firms that exist in two subsequent years and are not subject to firm dynamics (e.g.,

Table 4.1: Descriptive statistics

	Mean	SD	Q1	Median	Q3
Growth in contractual wage bill (in %)	-0.4	21.7	-6.0	1.6	8.4
Employment growth (in %)	-3.8	27.6	-8.3	0.0	5.8
# Jobs	118.6	528.8	31.0	46.0	85.0
# Working hours per month per worker	147.1	24.2	137.8	153.4	163.4
Share exiters (t−1) (in %)	19.0	17.1	8.1	13.8	23.1
Share entrants (t) (in %)	16.6	16.4	5.9	12.5	21.9
Share aged 60-65 among exiters (t−1) (in %)	10.2	17.3	0.0	0.0	14.3
Share aged 55-64 among exiters (t−1) (in %)	5.6	11.3	0.0	0.0	7.7
Average age stayers (t−1)	41.1	4.3	38.5	41.4	43.9
Age exiters /age stayers (t−1)	96.9	14.3	88.5	96.1	1.0
Age entrants /age stayers (t)	85.6	13.8	77.4	85.5	93.6
Δ Log wage stayers (hourly); permanent contract	2.4	7.8	-0.1	2.6	5.3
Δ Log wage stayers (hourly); temporary contract	4.0	17.5	-1.3	3.3	8.4
Δ Log hours worked stayers; permanent contract	0.2	7.8	-1.9	-0.0	1.8
Δ Log hours worked stayers; temporary contract	-0.7	16.5	-3.9	0.0	3.7
Log wage exiters - log wage stayers (hourly)	-10.7	21.6	-22.4	-11.0	0.1
Log wage entrants - log wage stayers (hourly)	-14.6	22.0	-26.7	-14.8	-3.5
Log hours exiters - log hours stayers	-9.5	24.1	-15.6	-3.7	3.0
Log hours entrants - log hours stayers	-7.6	24.9	-12.7	-0.9	4.4
Δ Log overtime hours	-0.05	2.24	-0.26	0.00	0.17
Δ Log share part-time jobs	-0.0	10.2	-3.3	-0.0	3.1
Share stayers. permanent (t) (in %)	70.4	25.1	61.1	78.1	88.2
Share stayers. temporary (t) (in %)	13.0	18.0	1.6	6.6	17.4
Share exiters. permanent (t−1) (in %)	11.0	11.7	4.0	7.9	13.8
Share exiters. temporary (t−1) (in %)	8.0	14.3	0.0	3.1	8.3
Share entrants. permanent (t) (in %)	6.8	10.1	0.0	3.5	8.8
Share entrants. temporary (t) (in %)	9.8	14.4	0.0	4.9	12.9
# Firm-year observations	124,551				
# Worker-year observations (*mln)	15.5				

Notes: The data concern pooled annual observations for 2006–2013. The sample comprises all private sector firms employing 25 workers existing in two subsequent years and not subject to firm dynamics (mergers etc.). The statistics present the (unweighted) mean, standard deviation and quantiles of pooled firm-year observations. The variables partly concern (unweighted) averages per firm (for example in case of Δlog wage stayers) or the difference between averages per firm (for example in case of 'log wage exiters - log wage stayers').
Source: Own calculations using registration data from Statistics Netherlands.

mergers) and employ 25 or more workers. The growth in contractual wage bill exceeds employment growth at all quartiles, consistent with the generally positive growth in the wages of stayers. Job flows are substantial: on average 19.0% of workers leave a firm every year, while 16.6% are newly hired workers, typically relatively young. The wage growth of stayers on temporary contracts shows more variation than those on permanent contracts. Wages of newly

hired workers, and to a lesser extent those of exiters, are typically below those of stayers. Whilst most newly hired workers enter the firm on temporary contracts, workers on this type of contract have a much higher probability of exiting the firm. Appendix C provides more detailed information on the creation of this dataset and the applied selections.

4.3.3 Institutional features of the Dutch labour market

Institutions partly determine the room firms have to adjust employment and wages. After some OECD statistics on the relevant trends, this sub-section concisely overviews the institutional background in the Netherlands. Temporary employment as a share of dependent employment has increased from 16.6% in 2006 to 20.5% in 2013, much higher than the average share in the EU-28 (13.7% in 2013). The chances of moving from a temporary job to an open-ended contract are moderate. Also, the share of self-employed workers has increased from 12.8% in 2003 to 15.9% in 2013. The employment rate of those aged 55–64 year has increased sharply, from 47.7% in 2006 to 59.2% in 2013, in reaction to changes in the costs of early retirement and an increase in the statutory retirement age. Part-time work is exceptionally common in the Netherlands, with almost four out of ten jobs on part-time contracts, more than twice the EU-28 and OECD average. For women, this rate is six out of ten, with the average number of working hours rising with the attained level of education (low-educated and highly educated women work 23 and 32 hours each week, respectively (Portegijs and Brakel (2016))). Another trend is increasing labour-market polarisation, with high- and low-wage occupations simultaneously expanding at the expense of middle-wage occupations, although the trend's magnitude in the Netherlands is smaller than in other countries (Berge and Ter Weel (2015)).

Partial labour-market reforms were implemented during the 1990s: employment protection regulations for regular contracts remained more or less unchanged, while rules concerning the use of temporary contracts were relaxed. In 1999, the 'Flexibility and Security Law' aimed to increase employers' flexibility to use temporary employment, while at the same time increasing protections for flexible workers as their contracts progress. The discrepancy in employment protection between regular and temporary contracts is large, according to the OECD- employment protection legislation (EPL)index; protection of regular jobs is high by international comparison, principally due to procedural inconveniences. Although firms can choose among several routes for dismissal, in any case they have to apply the last-in, first-out rule (within 10-year age brackets to distribute dismissals more evenly over the workforce).[7]

[7]The Dutch employment-protection regime has changed since the observed period. In the

To cope with the crisis, firms could make use of a part-time unemployment benefit regulation from April 2009 until the end of 2010. At its maximum extent, 40,000 workers made use of the regulation, remaining to work on average 60% of their original working hours for three quarters of a year. The perceived effect of the arrangement is limited: Hijzen and Venn (2011) found that the part-time unemployment benefit regulation saved five to six thousand full-time jobs.

Unemployment benefits (UB) during the first two months of unemployment amount to 75% of the pre-unemployment salary (capped for high salaries) and 70% afterwards. Compared internationally, the replacement ratio (benefit level/average gross wage) is fairly high. The eligibility requirement is that one has worked at least 26 out of the previous 36 weeks. The duration of UB depends on the number of years worked, with a maximum benefit duration in the observed period of 38 months, which is long from an international perspective.

Regarding wage setting, a system of collective wage bargaining, vital roles for social partners and a relatively high minimum wage are the most relevant institutions in the Netherlands. Collective labour agreements which have been negotiated at the enterprise level can be extended to the entire sector if the firm concluding the contract employs at least 60% of the workers in the sector. Due to this extension policy, union coverage is high, although union density is low. Collective labour agreements typically contain pay scales that guide yearly wage increases. The Dutch statutory minimum wage level for adults is one of the highest in the OECD area, in terms of net wage, gross wage and labour costs. Social partners (representatives of employers and labour unions) and the government consult each other regularly on the Social Economic Council. Since 1982, there is a system of 'controlled decentralization' in which the government does not intervene directly in wages directly; whereas government and social partners coordinate wage negotiations centrally, the actual negotiations concerning wage differentiation and the terms of employment are conducted on a decentralised basis. In the Spring Agreement 2009, the social partners and the government centrally agreed upon a contractual wage increase of 1% for 2009 and 0% for 2010. Half a year earlier, they had

observed period, the Netherlands had a dual employment protection system. Large firms often went to court to dismiss workers, owing severance payments that increased with age and years of tenure. Smaller firms mostly applied for authorization at the public employment service (PES). This route was generally free of severance payment, but included a term of notice, so the procedure took longer. However, this route also often involved mandated 'social plans', which may include some kind of severance payment anyway, as well as arrangements regarding work-to-work mediation. A third, fast-growing, route was dismissal by mutual consent, where employer and employee agree on dismissal terms. This route has the advantage for the employer of offering more freedom to choose which employee to dismiss.

agreed upon a wage increase of 3.5% for 2009, but the deteriorated forecasts published by the CPB Netherlands bureau for Economic Policy Analysis induced a quick new agreement, which only concerned new collective labour agreements. There were no changes to existing collective labour agreements (CLAs) (Harteveld (2012)).

4.4 Results and discussion

4.4.1 Results of decomposition

The decomposition analysis explores how firms adjust their wage bills to adjust to adverse sales shocks compared to situations of positive sales growth. In Table 4.2, the first four columns refer to the decomposition of firms' growth in contractual wage bills. The upper panel of the table shows the decomposed items, which sum to the growth in the contractual wage bill displayed in the first line of the lower panel. The second and third lines of the lower panel present growth in the wage bill according to broader definitions of the wage bill. Column 1 and 2 refer to firms-year combinations that are characterised by positive and negative sales growth, respectively; the figures are the unweighted averages over firms. Column 3 presents for each item separately the $\hat{\beta}$, the estimated difference between 'adverse times' (sales falling) and 'good times' (sales increasing), according to equation 4.5, reflecting an asymmetrical response between favourable and adverse periods. Columns 5–10, discussed subsequently, explore the heterogeneity of wage-bill adjustments over percentile groups of sales growth.

Table 4.2: Decomposition of wage-bill changes 2007–2013 by sales growth (percentiles) groups

	$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$		P75–P100	P25–P75	$\hat{\beta}$		P1–P25	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by:											
-change in net employment	0.51	-7.64	-6.99	***	1.94	-1.69	-3.08	***	-11.07	-8.26	***
-hourly wage, stayers	2.27	1.84	-0.35	***	2.45	2.04	-0.28	***	1.82	-0.32	***
-hourly wage, entrants	-2.32	-1.61	0.48	***	-2.73	-1.92	0.55	n.s.	-1.49	0.31	***
-hourly wage, exiters	1.76	2.06	0.29	***	2.00	1.59	-0.21	***	2.45	0.77	***
-hours worked, stayers	0.71	0.40	-0.17	***	0.71	0.67	-0.06	n.s.	0.22	-0.17	***
-hours worked, non-stayers +	0.36	0.53	0.21	**	0.33	0.44	0.00	n.s.	0.57	0.20	**
Gross wage-bill change (in %):											
-contractual	3.30	-4.42	-6.33	***	4.69	1.12	-3.05	***	-7.48	-7.42	***
-contractual + overtime pay	3.30	-4.65	-6.61	***	4.76	1.03	-3.23	***	-7.80	-7.68	***
-contractual + overtime, inc. & extra pay	3.36	-4.62	-7.11	***	4.84	1.02	-3.49	***	-7.65	-7.94	***
# firm-year observations	42997	32605			18072	39950			17580		
# worker-year observations (*mln)	6.7	5.6			2.4	7.5			2.5		

Notes: Data refer to private sector firms with at least 25 employees for which Δ sales is available for year (t), whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. ΔS = change in sales, P1–P25, P25–P75 and P75–P100 are subsamples of firms based on the yearly percentile distribution of the change in sales. $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately: $\hat{\beta}$ in column 3 refers to $\Delta S<0$ compared to $\Delta S \geq 0$; $\hat{\beta}$ in column 6 refers to P25–P75 compared to P75–P100; $\hat{\beta}$ in column 9 refers to P1–P25 compared to P25–P75. The relationship between the items of the decomposition and equation 4.4 is explained in footnote 6. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

The lower panel shows that enterprises with increasing sales grew their contractual wage bill by 3.30% on average, while firms with decreasing sales had wage bills that declined by 4.42%. The asymmetry between the favourable and adverse state is -6.33% (which is the estimated β for the dummy-variable in equation 4.5), or somewhat larger if overtime pay, incidental wages and extra pay are taken into account.

Considering the decomposition in more detail, all $\hat{\beta}$'s in column 3 differ significantly from zero, confirming that firms' wage-bill adjustment is asymmetric between adverse and favourable times, but the decomposed items are evidently not equally important. 'Change in net employment' is by far the most important channel for wage-bill adjustment in adverse times. Hours worked are hardly reduced, indicating that firms only use the extensive margin to downwardly adjust their wage bills. In good times, on the other hand, the item 'change in net employment' is small; firms thus may increase their labour productivity through corporate restructuring and/or adopting technological change instead of expanding their employment.[8]

A striking result is that growth in the hourly wages of stayers remains positive in adverse times, reduced only slightly (from 2.27 to 1.84) compared to more favourable times. Hence, employment reduction contributes about 20 times more to the reduction in wage bills than reduction in the wage of stayers (the β respectively being equal to -6,99 and -0,35). This finding matches the existence of relatively high downward real-wage rigidity in the Netherlands (especially among workers who are older, more highly educated or on open-end contracts and/or full-time contracts) as measured by Deelen and Verbeek (2015). Hence, mitigating the hourly wages of stayers is not an important channel to reduce wage bills during adverse demand shocks.

Regarding the intensive margin, changes in the working hours of stayers do mitigate the wage bill in adverse times compared to good times, but only in a limited way. Similar to the growth in the hourly wage of stayers, the growth in working hours remains positive, albeit smaller than when sales increase. The positive contribution of 'hours worked by non-stayers' reflects the fact that exiters, and to a lesser extent entrants, work in jobs with fewer hours than stayers; $\hat{\beta}$ is negative, but mainly because there are more exiters in adverse times. Overall, for entrants and exiters taken together, adjustments to working hours have a minor effect on the wage bill.

Job flows could be another channel to adjust the wage bill, especially if firms reduce wages of new hires or dismiss high-waged workers during adverse

[8]Note that the contribution by 'net change in employment' is calculated using the monthly wage level of stayers; insofar as wages and hours worked of non-stayers are below those of stayers, this affects the decomposition items 'hourly wage, entrants', 'hourly wages, exiters' and 'hours worked, non-stayers'.

periods. What happens to the wages of entrants or exiters cannot be seen directly from the decomposition table. The complementary information in Table A4.2 in Appendix A shows that entrants' wages are generally lower than those of stayers, in line with steep wage profiles over tenure, but the data give no indication that firms offer especially low starting wages during adverse times. The item 'hourly wage, entrants' in the decomposition is less negative in adverse times, mainly because of the reduced volume of cheap entrants. The magnitude of the item 'hourly wage, exiters' in the decomposition is more positive in adverse times: increased exit of low-paid workers contributes positively to the decomposition of changes in the wage bill.[9]

To see how firms adjust to more adverse circumstances, the right-hand side of Table 4.2 explores the heterogeneity of wage-bill adjustments over percentile groups of sales growth. The decomposition is presented for the high end (P75–P100) of the sales growth distribution, the middle part (P25–P75) and the low end (P1–P25), the latter referring to a severe downward shock in sales. $\hat{\beta}$ in column 6 refers to P25–P75 compared to P75–P100, whereas $\hat{\beta}$ in column 9 refers to P1–P25 compared to P25–P75. Results show that during a relatively severe shock, the change in net employment still remains the main channel for downward wage-bill adjustment. Growth in the contractual working hours of stayers slows but remains positive. Changes in the contractual wage of stayers mitigate the wage-bill change by only 0.32 to 1.82 percentage-points. Hence, the growth in the hourly contractual wage of stayers is scarcely lower at the lower end of the sales distribution for stayers on both permanent and temporary contracts (Table A4.2), probably because collective labour agreements put a floor on contractual wage growth. Besides, as the lower panel shows, firms cut overtime pay and incidental wages during adverse sales shocks.

Exits and entries respond differently to sales; the share of newly hired workers decreases roughly linearly when sales deteriorate, while exits show a U-shaped pattern. Exits are subject to two opposite effects which cannot be disentangled from the data: voluntary job-switches are more abundant when the economy is robust, whereas firms dismiss more workers and renew fewer temporary contracts when business deteriorates. Comparing the upper (P75–P100) and the lower (P1–P25) end of the sales distribution, Table A4.2 shows that the average share of entries decreases more than the share of exits increases. Hence, reduced entries are an important means to reduce wage bills when sales decline since the firm has more control over entries than over the entirety of exits and no dismissal costs are involved.

[9]Exiters also have lower wages than stayers, although in bad times more highly paid workers tend leave the firm, as Table A4.2 shows, that the share of older workers among exiters rises, probably into early retirement. That said, whereas the wage differential between exiters and entrants reduces in bad times, the number of exiters is higher.

Although firms at the lower end of the sales-growth distribution hire substantially fewer new workers, the complementary information does not suggest that firms apply extra reductions in starting wages. Wages of entrants are below those of stayers (i.e., log wage entrants - log wage stayers is positive) but this difference becomes smaller when sales growth is lower (i.e., the estimated β comparing these states is positive). The exact effect is difficult to assess, however, because the composition of the group of stayers itself and therefore its average wage is affected by inflows and outflows. Since the last-in, first-out rule is applied within 10-year age brackets, dismissals reduce the share of older workers, who generally earn higher wages. However, the findings suggest that, even at the lower end of the sales distribution, contractual wages are not an important means to adjust the wage bill, with respect to neither stayers nor new hires.

One might suppose that in the short run, adjustment could predominantly run through employment, but that firms will adjust wages downward if sales growth remains adverse over a longer period. Therefore, I analyse to what extent the decomposition results are sensitive to the *persistence* of an adverse sales shock. To do so, I repeat the decomposition analysis for the (smaller) sample of firms for which data on sales growth are available for both the year of observation (t) and the year before, (t−1). I split this sample into three groups: first, firms with positive sales growth in the year of observation (t); second, firms with sales decrease in (t) and sales growth in (t−1); and third, firms with sales decrease in both (t) and (t−1). $\hat{\beta}$ in column 3 of Table 4.3 refers to the asymmetry between the second and first groups of firms, while $\hat{\beta}$ in column 6 refers to the asymmetry between the third and first groups of firms. In case of a protracted sales decrease (Table 4.3, column 5), the wage-bill contraction is more than twice as high as when sales drop after a year of sales growth (column 2). Even so, the wage increase of stayers is still positive and only slightly lower. Hours worked by stayers reduce only slightly. Reductions in overtime pay, incidental and extra pay contribute to wage-bill reduction, but to a limited extent and not by much more then after a one-time drop in sales. Even if these items are reduced strongly, their impact is still limited because they represent only a small part of the wage bill (for example, in 2009/2010 the average amount of overtime, incidental and extra pay amounted to about 5% of the amount received as contractual wages. Hence, these data support the picture that firms only choose employment reduction as a means to reduce their wage bills, even if their sales remain depressed for a prolonged period. Even if I repeat the same decomposition analysis for the sub-sample of firms for which data on sales growth are available for both the year of observation and for year (t−1) and (t−2), no additional wage mitigation is found on average

for sales drops of three years in a row compared to two years, whereas the reduction in employment is substantially larger in this case.[10]

Employment reduction is far more important for firms that have a *share of open-term contracts* below the median and hence a higher share of temporary contracts. The more flexible firms in terms of their contract types use net employment to a greater extent to adjust their wage bills. Of course, firms will have tailored the mix of contract types to their needs, given the specific environments in which they operate. Firms with a higher share of open-term contracts are more inclined to cut down on incidental and extra pay, but there is no large difference regarding contractual wages. The hourly wages and hours worked by stayers are only slightly reduced, remaining positive for such firms in adverse periods.

[10] I repeat the decomposition analysis for the sub-sample of firms for which data on sales growth are available for both the year of observation and years (t−1) and (t−2). Out of this sample, I compare three groups: first, firms with positive sales growth in the year of observation (t) whereas sales growth in (t−1) and (t−2) may be positive or negative, 20,360 observations; second, firms with decreasing sales in (t) and (t−1) and positive sales growth in (t−2), 3,082 firms; third: firms with decreasing sales in both (t), (t−1) and (t−2), 4,939 observations. The $\hat{\beta}$ describing the asymmetry between groups 2 and 1 amounts to −5.77 for gross wage-bill growth, −5.98 for the net change in employment and −0.31 for the hourly wage of stayers. The $\hat{\beta}$ describing the asymmetry between groups 3 and 1 amounts to −8.75 for gross wage-bill growth, −10.15 for the net change in employment and −0.36 for the hourly wage of stayers.

Table 4.3: Decomposition of wage-bill changes 2007–2013 by sales growth in current and prior year

		$\Delta S_t \geq 0$	$\Delta S_t<0$ $\Delta S_{t-1} \geq 0$	$\hat{\beta}$		$\Delta S_t<0$ $\Delta S_{t-1}<0$	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by:								
-net change in employment		-1.42	-5.15	-3.15	***	-10.40	-7.51	***
-hourly wage, stayers		2.30	2.02	-0.10	n.s.	1.68	-0.39	***
-hourly wage, entrants		-2.06	-1.59	0.32	***	-1.30	0.56	***
-hourly wage, exiters		1.91	1.77	-0.03	n.s.	2.05	0.08	n.s.
-hours worked, stayers		0.43	0.45	-0.14	**	0.08	-0.28	***
-hours worked, non-stayers	+	0.33	0.40	0.11	n.s.	0.55	0.22	n.s.
Gross wage-bill change (in %):								
-contractual		1.49	-2.11	-3.08	***	-7.34	-7.04	***
-contractual + overtime pay		1.47	-2.43	-3.38	***	-7.46	-7.23	***
-contractual + overtime, inc. & extra pay		1.52	-2.47	-3.68	***	-7.43	-7.86	***
# firm-year obs.		32,581	13,534			10,528		
# worker-year obs. (*mln)		4.9	2.2			2.2		

Notes: Data refer to all private sector firms with at least 25 employees for which Δ sales is available for both year (t) and year (t−1) (therefore the sample is smaller than in Table 4.2). This sample is split into three groups: first, firms with positive sales growth in the year of observation (t) and no requirements for sales growth in (t−1) and (t−2); second, firms with sales decrease in (t) and sales growth in (t−1); third, firms with sales decrease in both (t) and (t−1). $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately: $\hat{\beta}$ in column 3 refers to the asymmetry between the second and the first group of firms, while $\hat{\beta}$ in column 6 refers to the the asymmetry between the third and the first group of firms. The relationship between the items of the decomposition and equation 4.4 is explained in footnote 6. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

Table 4.4: Decomposition of wage-bill changes 2007–2013, firms by share of open-term contracts

		Share open-term contracts $\geq P50$				Share open-term contracts $<P50$			
		$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$		$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by:									
-net change in employment		-0.07	-6.72	-5.36	***	1.06	-8.62	-8.94	***
-hourly wage, stayers		2.28	1.88	-0.32	***	2.27	1.80	-0.39	***
-hourly wage, entrants		-1.60	-1.01	0.42	***	-3.01	-2.25	0.56	***
-hourly wage, exiters		1.10	1.30	0.15	*	2.39	2.86	0.53	***
-hours worked, stayers		0.68	0.36	-0.16	***	0.74	0.43	-0.18	***
-hours worked, non-stayers	+	0.28	0.33	0.04	n.s.	0.45	0.74	0.37	**
Gross wage-bill change (in %)									
-contractual		2.68	-3.85	-5.20	***	3.90	-5.02	-7.74	***
-contractual + overtime pay		2.69	-4.07	-5.47	***	3.87	-5.27	-8.00	***
-contractual + overtime, inc. & extra pay		2.79	-4.02	-6.23	***	3.90	-5.25	-8.26	***
# firm-year observations		20,994	16,845			22,003	15,760		
# worker-year observations (*mln)		3.3	2.8			3.4	2.7		

Notes: Data refer to all private sector firms with at least 25 employees, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. ΔS = change in sales. P50 is the median based on the yearly percentile distribution of the share of open-term contracts of firms. $\hat{\beta}$ is the estimation result for applying equation 4.5 to the wage bill and each of its its components separately The relationship between the items of the decomposition and equation 4.4 is explained in footnote 6. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

These differences by contract type are consistent with those over *sectors of economic activity*. The business services and Horeca (hotel/restaurant/café) sectors, where job flows (the share of both entrants to and exiters from the workforce) are two-to-three times larger compared to manufacturing, construction and goods trade, have a considerable flexible, non-core workforce (see the decomposition results by sector of economic activity in Table A4.3 in Appendix A). Several features suggest that these sectors have a segmented labour market.[11] First, compared to other sectors, the share of temporary contracts among entrants and exiters is much higher in the business services and Horeca sectors and the wage level of non-stayers falls further short to that of stayers. Second, the share of older workers among exiters is remarkably low in these sectors. In the Horeca sector, the age of both entrants and exiters is remarkably low compared to stayers. Wage changes for stayers are relatively high in the business services sector, which might indicate that insiders in this segmented labour market have strong bargaining positions.

Despite some variation by sector of economic activity, the conclusion that wages of stayers continue to grow in bad times and is almost as much as in favourable times continues to stand for all sectors. Moreover, where wage changes are already moderate with positive sales growth, as in the transport and communications and Horeca sectors, there seems to be less room to reduce wage changes when sales deteriorate, suggesting downward wage rigidity. The mandatory minimum wage may put a floor on wage increases in these sectors. Moreover, pay scales in collective labour agreements create strong guidelines for wage changes in sectors with low- and middle-income jobs. High-wage jobs, however, are often paid above the maximum of the highest pay scales, offering more room to adjust contractual wages (Deelen and Euwals (2014))

wage-bill growth has varied largely over *years* (Table A4.4). In 2007–2008, firms facing drops in sales reduced their wage bills on average by 0.76%, whereas in 2008–2009 the average reduction was 5.66%; the number of firms facing fewer sales rose by almost 50%. wage-bill contraction by these firms found its trough in the next year, 2009–2010. Overtime pay and incidental wages offered some downward flexibility, -0.50 percentage-points in 2008–2009.

Notably, hourly wage growth of stayers generally has come down between 2007 and 2012. In 2011–2012 the change in hourly wages of stayers even became negative, although this was almost fully offset by a positive growth in hours worked. It has already been established that firms offer not much lower contractual wage growth in adverse conditions than in favourable periods. Over the years, however, the wage growth of stayers has been gradually

[11] Tables with complementary information by sectors of industry and by year are available upon request.

reduced across the board, possibly due to a relatively high level of coordination. In the Netherlands, the outcomes of the consultations of the Dutch social partners serve as important guidelines for wage bargaining at the enterprise and sector levels.

4.4.2 Regression analysis of wages, job flows and employment

While the decomposition analysis in the last subsection provides insight into the balance between the elements of wage-bill change, this analysis only allows exploration of variations over a single dimension, such as the share of open-term contracts (see Table 4.4); if decompositions of two groups of firms are compared, the differences in observed characteristics are not considered. Therefore, I use a multivariate regression analysis to examine the relative importance of various covariates. Again, the unit of observation is the firm, while the covariates often concern the shares of certain groups of workers in the firm (in percentages) or dummy variables related to categorical variables.

The regressions explain variables underlying the results of decomposition, such as the wage growth of stayers, employment growth and job flows. I focus on these underlying variables rather than on the decomposed items themselves, because the latter may be impacted by, for example, both wages and the size of the group of workers, which would make the results more difficult to interpret.

The regressions elucidate the role of labour-market rigidities and firm characteristics.[12] Since the main interest here is the balance between the adjustments to wages and to employment, I include employment growth as a covariate in the wage-growth regressions, while I include wage-growth and indicators for downward wage rigidity in the regressions for job flows and employment. To address reverse-causality issues, other explanatory variables are mostly measured at year t−1, whereas the dependent variables refer to changes in year t relative to t−1 and an instrumental variable is used for the shares of migrant workers per firm (as explained in Appendix C). However, although the dataset is quite rich, some variables may still be lacking; therefore, I cannot exclude the possibility that omitted-variable bias plays a role in the results.

Table 4.5 offers results for both wage and employment growth, highlighting the most relevant covariates that illustrate variation over sales shocks.[13] Col-

[12] OLS is applied, but SUR regressions give very comparable results. Table A4.8 explores Random Effects and Fixed Effects estimations as alternatives to the OLS regressions used in the main analysis. The results are described in the note underneath that table.

[13] Other covariates are often similar over the sales growth samples. These covariates merely reflect variations in productivity or bargaining positions and are less relevant with respect to adjustments to sales shocks. For example, higher training expenditures, a higher share of highly educated workers and larger firm size are typically associated with higher wage

umn 1 presents results for the sub-sample of firm-year observations for which sales increased. Columns 2 and 3 show regressions on samples with increasingly adverse sales growth, observations respectively below the median and below the 10th percentile of the sales-growth distribution. Hence, the third column contains the fewest observations, comprising those firms that experienced a severe downturn. Columns 4, 5 and 6, concern employment growth in the same fashion.

Concerning the wage growth of stayers, a comparison of 'average' (column 2) and severe (column 3) negative sales shocks reveals that most covariates are strikingly similar. Wage growth of stayers hardly responds to the magnitude of firms' sales decreases, with a small and insignificant coefficient for sales growth. Although sales may impact wage growth partly through other covariates, such as the business result (profit rate) and whether the firm ceases to exist during the following year, these effects are also small. The low sensitivity of stayers' wages to sales growth is consistent with the findings of the decomposition analysis in Tables 4.2 and 4.3.

growth. The full results can be found in Tables A4.5 and A4.6 in Appendix A.

Table 4.5: OLS-Regressions of the growth of hourly wages and employment of firms by sales growth groups

Dependent variable:	Growth rate hourly wage			Growth rate employment		
Sample:	$\mathring{S} \geq 0$	$\mathring{S}<P50$	$\mathring{S}<P10$	$\mathring{S} \geq 0$	$\mathring{S}<P50$	$\mathring{S}<P10$
State of business						
Growth rate sales (t)	0.0188^{***}	0.0021	0.0048	0.1158^{***}	0.3145^{***}	0.3442^{***}
Growth rate sales, squared (t)	-0.0094^{***}	0.0013	0.0023	-0.0751^{***}	0.1376^{***}	0.1543^{***}
Growth rate sales (t−1)	0.0047^{***}	0.0044^{***}	0.0010	0.0292^{***}	0.0621^{***}	0.0793^{***}
Profit (t−1)	0.0022^{***}	0.0040^{***}	0.0027	0.0386^{***}	0.0608^{***}	0.1007^{***}
Firm ceasing to exist in (t+1)	0.0022	0.0017	−0.0006	−0.0053	-0.0273^{***}	-0.0456^{**}
Contracttype						
Share of open-term contracts (t−1)	−0.0017	−0.0029	-0.0085^{**}	0.0281^{***}	0.0386^{***}	0.0447^{***}
Share of regular jobs (t−1)	-0.0114^{***}	0.0002	0.0034	0.0188	0.0402^{***}	0.0747^{**}
Share of full-time jobs (t−1)	0.0720^{***}	0.0591^{***}	0.0553^{***}	0.0401^{***}	0.0427^{***}	0.1040^{***}
Share of job tenure ≥ 10 years (t−1)	-0.0046^{**}	-0.0047^{**}	-0.0093^{**}	0.0271^{***}	0.0278^{***}	0.0109
Type of collective labour agreement						
Enterprise level (t−1)	0.0058^{***}	0.0069^{***}	0.0061^{*}	0.0007	−0.0029	0.0056
Sector level, no extension (t−1)	−0.0024	−0.0009	0.0040	-0.0143^{***}	-0.0195^{***}	−0.0190
Extended to sector level (t−1)	−0.0008	0.0007	0.0022	0.0025	0.0026	0.0001
Immigrant workers						
Share from EU-enlargement '04, '07	-0.0282^{*}	-0.0386^{**}	−0.0605	0.0245	0.0933	0.1420
Share from other western countries	−0.0020	0.0003	−0.0021	-0.0830^{***}	-0.1142^{***}	-0.2015^{***}
Share from non-western immigrants	-0.0143^{**}	-0.0233^{**}	−0.0284	-0.0390^{*}	−0.0227	−0.1788
indicator downward wage rigidity						
Nominal wage rigidity (t)				-0.3452^{***}	-0.4153^{***}	-0.7624^{***}
Real wage rigidity (t)				-0.3479^{***}	-0.3734^{***}	-0.6987^{***}
Constant	0.0360^{**}	0.0511^{**}	0.0335	0.3153^{***}	0.2387^{***}	0.6759^{***}
# Observations	34,150	31,814	6,363	33,124	30,848	6,177
R-squared	0.2183	0.2008	0.1844	0.2932	0.2454	0.2255

Notes: See Appendix C for variable description and Table A4.5 and A4.6 for the full results. Columns (1) and (4) refer to positive sales growth, (2) and (4) to sales growth below the median, (3) and (6) refer to the first decile of the sales growth distribution, representing a severe negative shock in sales. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Table 4.6: OLS-regressions of employment growth and job flows of firms by sales growth groups

Dependent variable:	Empl.growth	sh_N	sh_E	Empl.growth	sh_N	sh_E
Sample:	$\mathring{S}$<P50	$\mathring{S}$<P50	$\mathring{S}$<P50	$\mathring{S}$<P10	$\mathring{S}$<P10	$\mathring{S}$<P10
State of business						
Growth rate sales (t)	0.3145^{***}	0.0384^{***}	-0.2760^{***}	0.3442^{***}	0.0272^{**}	-0.3170^{***}
Growth rate sales, squared (t)	0.1376^{***}	0.0195^{***}	-0.1181^{***}	0.1543^{***}	0.0141^{***}	-0.1402^{***}
Growth rate sales (t−1)	0.0621^{***}	0.0096^{***}	-0.0525^{***}	0.0793^{***}	0.0085^{**}	-0.0709^{***}
Profit (t−1)	0.0608^{***}	0.0054^{***}	-0.0554^{***}	0.1007^{***}	0.0140^{***}	-0.0867^{***}
Firm ceasing to exist in (t+1)	-0.0273^{***}	-0.0112^{***}	0.0161^{**}	-0.0456^{**}	-0.0205^{***}	0.0251
Contract type						
Share of open-term contracts (t−1)	0.0386^{***}	-0.0431^{***}	-0.0817^{***}	0.0447^{***}	-0.0236^{***}	-0.0684^{***}
Share of regular jobs (t−1)	0.0402^{***}	-0.1961^{***}	-0.2363^{***}	0.0747^{**}	-0.1881^{***}	-0.2628^{***}
Share of full-time jobs (t−1)	0.0427^{***}	-0.0208^{***}	-0.0635^{***}	0.1040^{***}	−0.0037	-0.1078^{***}
Share of job tenure ≥ 10 years (t−1)	0.0278^{***}	-0.0422^{***}	-0.0699^{***}	0.0109	-0.0452^{***}	-0.0561^{***}
Type of collective labour agreement						
Enterprise level (t−1)	−0.0029	0.0042^{**}	0.0070^{*}	0.0056	0.0112^{***}	$0.0056s$
Sector level, no extension (t−1)	-0.0195^{***}	0.0092^{***}	0.0287^{***}	−0.0190	0.0084	0.0274^{**}
Extended to sector level (t−1)	0.0026	0.0011	−0.0015	0.0001	−0.0012	−0.0014
Immigrant workers						
Share from EU-enlargement '04, '07	0.0933	−0.0130	-0.1063^{**}	0.1420	−0.0048	−0.1468
Share from other western countries	-0.1142^{***}	0.0006	0.1148^{***}	-0.2015^{***}	−0.0178	0.1837^{***}
Share from non-western immigrants	−0.0227	0.0381^{**}	0.0607^{*}	−0.1788	−0.0294	0.1494
Indicator downward wage rigidity						
Nominal wage rigidity (t)	-0.4153^{***}	0.0511^{*}	0.4665^{***}	-0.7624^{***}	0.0621	0.8245^{***}
Real wage rigidity (t)	-0.3734^{***}	0.0655^{**}	0.4390^{***}	-0.6987^{***}	0.0863	0.7850^{***}
Constant	0.2387^{***}	0.3063^{***}	0.0676	0.6759^{***}	0.3528^{***}	-0.3231^{*}
# Observations	30,848	30,848	30,848	6,177	6,177	6,177
R-squared	0.2454	0.6958	0.4765	0.2255	0.6903	0.4189

Notes: See Appendix C for variable description and Table A4.7 for the full regression results. The left three columns refer to sales below the median, whereas the right three columns refer to the first decile of the sales growth distribution. Note that coefficients for employment are equal to the difference between the coefficients for the share of entrants en the share of exiters. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Wage growth of stayers is generally weakly related to the firms' share of open-term contracts (consistent with the findings of the decomposition analysis in Table 4.4); apparently, higher job security does not translate into a stronger wage bargaining position, probably partly because variables concerning the workforce composition (such as level of education, migrant-status, age) cover the group with open-term contracts to a large extent. A large share of long-tenured jobs is generally associated with lower wage growth, consistent with wage-profiles flattening over tenure. During sharp downturns, workers on open-ended and long-tenured contracts seem to trade their job security for a slightly lower wage increase. Seniority-related employment protection rights, such as last-in, first-out dismissal rules and tenure-based severance pay and notice periods not only imply high dismissal costs for employers but also discourage voluntary job mobility among highly protected workers, who lose their rights when they enter a new job.

At the enterprise level, CLAs are positively associates with growth in the hourly wage of stayers, which may indicate that collective bargaining at the enterprise level increases bargaining power compared to workers having no CLA. CLAs at the sector level, either directly or through extension of contracts at the enterprise level, do not lead to apparent higher wage growth.[14]

Regarding the share of immigrants at firms, I find some negative effects, except for severe downturns.[15] A higher share of immigrants originating from countries that became part of the EU in 2004 or 2007 is associated with lower wage growth. Since these workers immigrated recently (after the accession of their countries in 2004 or 2007), they are entitled to limited UB duration and employment protection, so their bargaining power is low. Moreover, their reservation wage may be lower, perhaps for example because their dependents live in their country of origin where their earnings have higher purchasing power. Also, a higher share of immigrants from non-western countries is associated with lower wages at a firm.

[14] OECD (2004) states: 'It is unclear how much emphasis should be placed on ranking organisational structures of collective bargaining in terms of their implications for macroeconomic performance. That structural orientation has informed a rich body of research, as exemplified by the influential study of Calmfors and Driffill (1988) and the literature it stimulated. However, the great difficulty encountered by researchers attempting to identify robust associations between differences in bargaining organisation and differences in macroeconomic performance suggest that quite different organisational forms may be capable of similar performance.'

[15] The theoretical literature is inconclusive about the effect of migration on wages and employment. If the skill-mix of migrants is similar to that of native workers, no effect is expected. If their skill-mix does not match that of natives, the effects of migration on wages and employment depend on the flexibility of the economy to change its output mix and on its openness to international trade Dustmann and Meghir (2005).

The picture is altogether different regarding employment growth. The large and highly significant coefficients for the growth rate of sales in columns 5 and 6 of Table 4.5 indicate that changes in net employment are quite sensitive to sales growth, especially for firms with declining sales. The profit rate and whether the firm ceases to exist in the subsequent year also have large impacts. The worse the state of the firm, the more strongly its response in terms of job loss, whereas firms display no identified increase in the responsiveness of wages.

Type of contract, of course is one important determinant of the amount of employment adjustment; open-term contracts, regular job types and full-time jobs are associated with more employment growth or less job loss. This sensitivity of employment reduction to the share of non-core contract types is particularly high among firms facing severe downturns in sales.

Firms with CLAs concluded at the sector level are associated with less employment growth or more employment loss compared to firms without a CLA. This may indicate that wage agreements concluded at a higher level of centralization fit individual firms less well, leading these firms to reduce employment as they cannot adjust wages under the terms of the sector CLA.

A higher share of migrant workers, especially from western countries, is accompanied by significantly lower job growth or more job reduction.[16]. Especially conditional on a large sales drop, employment reduction of firms is very sensitive to the share of workers with a migration background.

Last but not least, I find a strong, negative relationship between the incidence of downward wage rigidity at firms and their employment growth.[17] Wage rigidity indicators were derived from the stayers' distribution of wage changes, see variable description in Appendix C. A higher share of jobs at a firm for which wage growth clumps around zero (nominal wage rigidity) or around inflation expectations (real wage rigidity), causes a spike in the wage growth distribution and a higher wage-rigidity indicator. The negative relationship between downward wage rigidity and employment growth is even more distinct in cases of strong sales shocks. This finding clearly indicates that nominal and real downward wage rigidity come at a cost in terms of employment: if wages were more downwardly flexible, there would be fewer job losses during demand shocks. To indicate the magnitude: if the average share

[16]This group includes the four largest immigrant groups to the Netherlands: those from Suriname, the Netherlands Antilles, Turkey and Morocco

[17]I control for the growth in the hourly wages of stayers: in general, there is a positive relationship between wage and employment growth in firms, so more favourable conditions are matched by both more jobs and higher wage growth. Conditional on that, I find a negative effect of the indicators of downward wage rigidity on employment growth; a larger spike in the wage-growth distribution at zero or at the expected inflation rate is associated with less employment growth. See Table A4.6 in Appendix A.

of workers with a wage freeze increases by one percentage-point, employment growth is reduced by 0.35 percentage-points with sales growth below the median, whereas employment growth is reduced by 0.65 percentage-points during a severe (below P10) negative shock in sales.[18]

As employment growth results from changes in job flows, Table 4.6 explores the sensitivity of employment growth and the share of entrants and exiters in the workforce to sales shocks.[19] The left three columns refer to sales below the median, while the right three columns refer to the first decile of the sales growth distribution. Note that the coefficients for employment are equal to the difference between the coefficients for the share of entrants and the share of exiters. Exits show more variation than entries over the presented firm characteristics. A higher share of open-ended and regular contracts merely leads, as expected, to less outflow of workers. CLAs at the sector level are clearly associated with more outflow of workers. Also, the effect of a high share of immigrants from other western countries runs mainly through more exits. Finally, the negative effect of wage rigidity on employment runs fully through a response in terms of exits, most probably dismissals.

To summarize, most covariates show little impact on wage growth in cases of an average or severe negative sales shocks: insofar wage growth is mitigated, this effect is small and holds across the board. By contrast, employment growth is quite sensitive to firm characteristics[20] and to the magnitude of the sales shock. Employment reduction is clearly higher with a larger share of migrant workers or workers on a temporary or having a non-regular job type. Hence, employment reduction in bad times predominantly hits groups of workers with a relatively weak labour-market positions, predominantly through increased exits: immigrants, employees on temporary contracts, non-regular job-types and part-time jobs, predominantly through increased exits. Also, downward wage rigidity is strongly associated with more exits and less employment, especially after a severe shock in sales.[21] These findings point to

[18]For this exercise, wage freezes are defined as a monthly wage growth between -0.1% and +0.1%; among firms with decreasing sales, on average 6.4% of their workers have a wage freeze (sd 0.1424). The indicator of nominal downward wage rigidity has a high correlation (0.85) with a firm's share of wage freezes. The mentioned effects of a 1 percentage-point impulse in the share of workers having wage freezes are thus calculated as 0.85 times the estimated coefficient in Table 4.5.

[19]Table A4.7 presents the full regression results.

[20]The firm characteristics themselves are generally fairly stable, however, over the various regression samples. See Table B4.3 in Appendix B

[21]Similar regressions for incidental wage growth, growth in hours worked by stayers and the wages of entrants compared to those of stayers, provide no indication–agreeing with the findings of the decomposition analysis–that any of these are used as important adjustment mechanisms to severe sales shocks.

a segmented labour market, where, on the one hand, employment adjustment predominantly affects workers with relatively weak labour-market position, while, on the other hand, ongoing workers can be assured that sales shocks suffered by the firm will not strongly affect their increasing wages.

4.4.3 Discussion

One of the main findings of this paper is that firms in the Netherlands downwardly adjust wage bills predominantly by reducing employment. In the short run, the contractual wage growth of continuing workers is rather insensitive to whether the sales of the firm for which they work increase or (sharply) decrease. Over the longer run, however, wage growth has decelerated across the board. This may be due to a high level of coordination, as outcomes of consultations of the Dutch social partners serve as important guidelines for wage bargaining at the enterprise and sector levels in the Netherlands. This model of 'controlled decentralisation' has the merit that stayers' wage increases are moderate and predictable and labour-market unrest is avoided. One likely rationale is that employers are afraid to harm the workers' motivation. On a recent survey (Dalen and Henkens (2015)) employers mentioned this factor as a main argument against the demotion (reducing an employee's rank and salary) of older workers. A positive relationship between effort and the wage level is acknowledged by empirical studies of, among others, Fehr and Falk (1999) and Bewley (1999); the latter finds that good morale (related to fairness) among a firm's workforce has positive effect on profits by increasing the workers' productivity and effort, while wage cuts decrease morale.

The first possible drawback of the model of 'controlled decentralisation' is that wage growth at some firms may be more moderate than necessary, which can be undesirable from a macro-economic point of view in case of low spending. The second possible drawback may be that wage flexibility is limited; wage-bill adjustments are then largely provided by job reduction, which affects a non-random group of workers. This is consistent with the results of an international survey of employers (ECB (2009)), which showed that Dutch firms stand out in their strong reliance on the destruction of flexible jobs to adjust their wage bills in periods of adverse sales growth.

Deelen and Verbeek (2015) observe relatively high downward real wage rigidity is in the Netherlands, concentrated among workers who are relatively older, highly educated, or on open-term contracts and have full-time jobs. These are also the groups that are best-represented by labour unions. Recently, the Social Economic Council advised enlarging the support for collective labour agreements by involving groups that are underrepresented among the union membership (SER (2013)).

4.5 Conclusions

This chapter offers insight into how Dutch firms adjust their wage bill during downturns. wage-bill changes were firstly decomposed and secondly job flows, employment and wage growth were regressed on job and firm characteristics. I used extensive, administrative linked employer–employee data for the Netherlands for the period 2006-2013.

The first part decomposes wage-bill changes into components related to changes in hourly wages, hours worked and number of jobs, separated for stayers and workers entering and exiting the firm. I find that job destruction is, by far, the most important channel for wage-bill contraction, suggesting that wages are downwardly rigid. In this regard, not only increased exits but also reduced entries are used, probably to prevent firing costs. Compared to firms with growing sales, increases in the hourly contractual wages of stayers is only somewhat lower in firms hit by an adverse shock in sales, presumably because collective labour agreements put a floor on contractual wage growth for all firms. On average, employment reduction contributes about 20 times more to wage-bill reduction than wage reductions of stayers. Over the years, however, wage growth has been reduced across the board, probably due to a relatively high level of coordination. Job flows have not served as an important mechanism to reduce the average wage; there is no indication that entrants' wages are reduced extra below those of stayers during periods of adverse sales growth. Contractual working hours provide some downward flexibility of relatively small magnitude compared to the overall wage bill, as do overtime pay and incidental wages.

In the second part of this study, regressions relating changes in wages and employment to firm characteristics confirmed that the wage growth of stayers is not very responsive to the size of sales decreases. By contrast, the response of employment growth is quite sensitive to both firm characteristics and the magnitude of negative sales shocks. Employment losses are concentrated in firms with a higher share of immigrants, short-tenured workers, younger as well as older workers, employees on temporary contracts, non-regular job types and part-time jobs.

Moreover, I found a significant negative relation between downward wage rigidity and employment growth in firms. This suggests that more downwardly flexible wages would significantly lower the reduction in employment caused by adverse shocks.

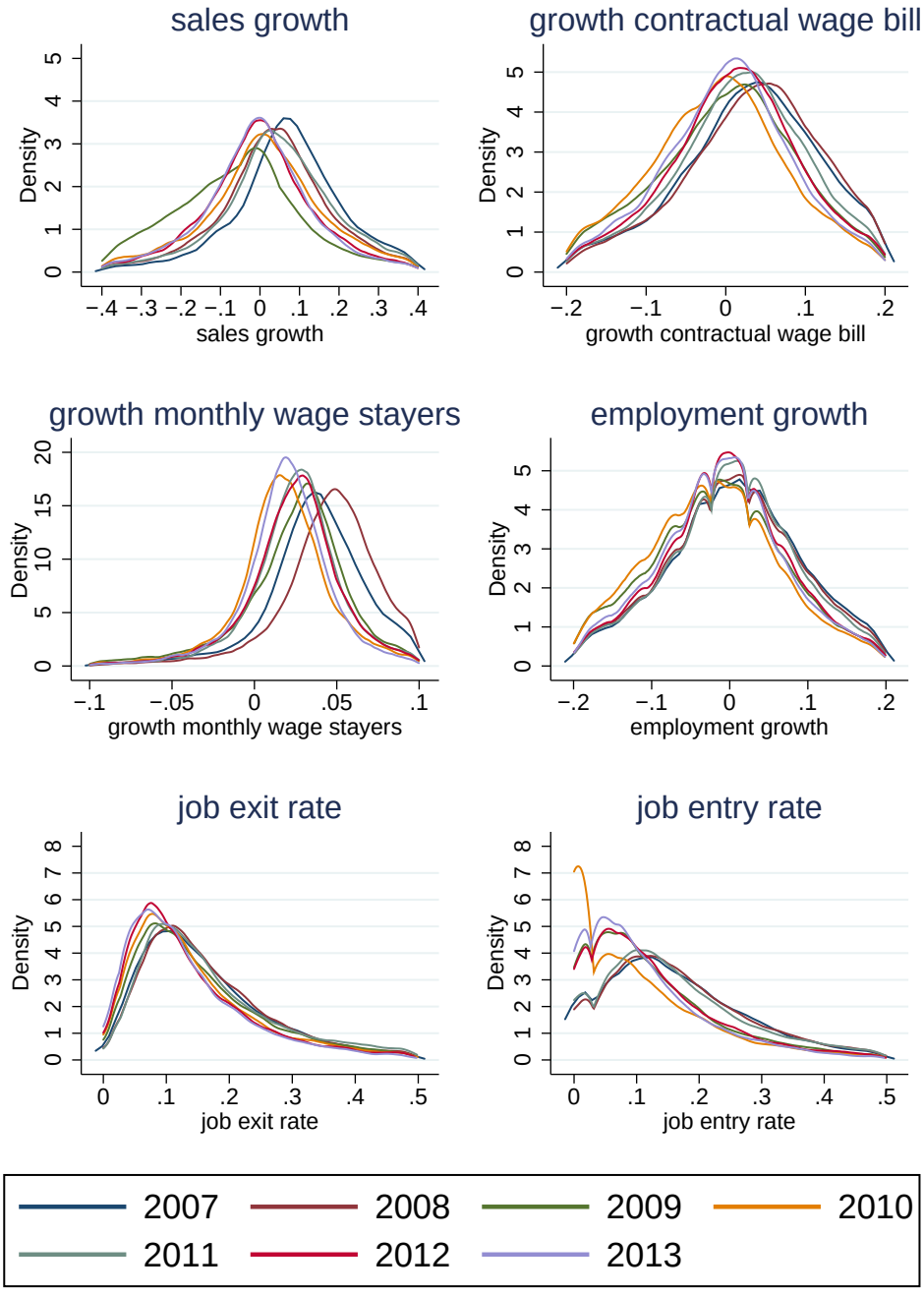
These findings point to a segmented labour market, where, on the one hand, employment adjustment predominantly affects workers with a relatively weak labour-market position, while continuing workers can be assured, on the other hand, that their wage increase will not be jeopardised by sales shocks

suffered by the firm at which they work. This segmentation could, however, result from rational behaviour by employers, given the institutional context. More research is therefore needed to assess the relationship between labour-market outcomes and the nature of the labour-market institutions, such as those involved in employment protection and wage formation.

Appendix A: Additional tables and graphs

wage-bill contraction is strongly correlated with sales reduction: the parsimonious regressions in Table A4.1 indicate that for firms with decreasing sales a drop in sales of 10% is associated with a reduction of the contractual wage bill by on average $3\% - 4\%$ (columns 3 and 4). The wage-bill reduction is even larger if sales were also decreasing in the year before. In contrast, for firms with growing sales (columns 1 and 2) the correlation between sales growth and wage-bill growth is rather low.

Figure 4.1: Kernel density graphs firms ≥ 25 workers, by year



Source: Own calculations based on registration data from Statistics Netherlands.

Table A4.1: Relationship between sales growth and contractual wage-bill growth for various sub-samples

Dependent variable:	$\Delta S \geq 0$	$\Delta S \geq 0$	$\Delta S<0$	$\Delta S<0$	$\Delta S<0$	$\Delta S<0$
Sample:	$\geq$ 25 workers	$\geq$ 25 workers	$\geq$ 25 workers	$\geq$ 25 workers	all firm sizes	all firm sizes
Growth rate sales (t)	0.0135^{***}	0.0114^{***}	0.3518^{***}	0.3375^{***}	0.4033^{***}	0.3782^{***}
	(0.0026)	(0.0048)	(0.0208)	(0.0399)	(0.0188)	(0.0367)
Growth rate sales $(t)^2$	-0.0017^{***}	-0.0011^{*}	0.0579	−0.1216	0.1673^{***}	−0.0485
	(0.0003)	(0.0005)	(0.0369)	(0.0712)	(0.0321)	(0.0640)
Growth rate sales (t-1)		0.0057^{**}		0.1356^{***}		0.1231^{***}
		(0.0020)		(0.0167)		(0.0151)
Firm size 25-99	0.0653^{***}	0.0706^{***}	0.0245^{***}	0.0242^{**}	-0.0072^{**}	−.0073
	(0.0042)	(0.0056)	(0.0051)	(0.0087)	(0.0022)	(0.0045)
Firm size 100-499	0.0515^{***}	0.0554^{***}	0.0149^{**}	0.0174	−0.0170	−0.0140
	(0.0044)	(0.0058)	(0.0054)	(0.0092)	(0.0030)	(0.0056)
Firm size $\geq$ 500					-0.0321^{***}	-0.0311^{**}
					(0.0060)	(0.0100)
Year 2008	0.0074^{**}		0.0130^{**}		0.0143^{***}	
	(0.0026)		(0.0042)		(0.0039)	
Year 2009	-0.0232^{***}	-0.0288^{***}	-0.0172^{***}	-0.0236^{***}	-0.0145^{***}	-0.0240^{***}
	(0.0033)	(0.0039)	(0.0040)	(0.0072)	(0.0037)	(0.0069)
Year 2010	-0.0520^{***}	-0.0613^{***}	-0.0485^{***}	-0.0312^{***}	-0.0489^{***}	-0.0333^{***}
	(0.0029)	(0.0043)	(0.0042)	(0.0070)	(0.0039)	(0.0066)
Year 2011	-0.0138^{***}	-0.0164^{***}	-0.0202^{***}	-0.0223^{***}	-0.0163^{***}	-0.0260^{***}
	(0.0026)	(0.0034)	(0.0043)	(0.0076)	(0.0039)	(0.0071)
Year 2011	-0.0144^{***}	-0.0178^{***}	-0.0153^{***}	-0.0242^{***}	-0.0124^{***}	-0.0282^{***}
	(0.0030)	(0.0036)	(0.0041)	(0.0075)	(0.0037)	(0.0069)
Intercept	-0.0126^{**}	−0.0022	0.0010	−0.0002	0.0340^{***}	0.0348^{***}
	(0.0044)	(0.0057)	(0.0060)	(0.0105)	(0.0036)	(0.0072)
N	38,108	15,042	27,538	8,420	43,787	11,724

Notes: Excluded from the sample are the first and highest percentile of the sales growth distribution as well as firm-year combinations subject to firm dynamics (e.g. mergers, etc.). Sectors of industry dummies are not included in this specification; the coefficients would be insignificant and those for sales unaffected. OLS estimation is used, but an RE-specification gives very similar results. Robust standard errors in parentheses. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. *Source*: Own calculations using registration data from Statistics Netherlands

Table A4.2: Complementary info for Table 4.2, the decomposition by sales growth groups

	$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$		P75-P100	$\hat{\beta}$		P25-P75	$\hat{\beta}$		P1-P25
Growth in contractual wage bill (in %)	3.30	-4.42	-9.34	***	4.69	-4.79	***	1.12	-10.28	***	-7.48
Growth in # of jobs	0.25	-7.48	-10.35	***	1.36	-4.75	***	-1.71	-11.76	***	-10.79
Share exiters (t−1)	16.90	18.46	1.59	***	18.63	-0.34	***	15.88	2.83	***	20.35
Share entrants (t)	17.05	13.32	-4.24	***	19.48	-2.81	***	14.67	-4.18	***	13.05
Share aged 60-65 among exiters (t−1)	9.88	10.89	-0.10	n.s.	9.59	0.28	n.s.	10.48	-0.61	***	10.69
Share aged 55-59 among exiters (t−1)	5.31	5.77	0.27	***	5.30	0.01	n.s.	5.38	0.28	**	6.00
Average age stayers (t−1)	40.85	41.42	-0.01	n.s.	40.55	-0.00	n.s.	41.20	-0.02	**	41.43
Age exiters to age stayers (t−1)	96.81	97.25	0.18	n.s.	97.26	-0.74	***	96.64	0.14	***	97.56
Age entrants to age stayers (t)	85.74	84.44	-0.70	***	86.77	-1.37	***	84.67	0.16	n.s.	84.74
Δ Log wage stayers (hourly), permanent	2.56	2.11	-0.30	***	2.75	-0.23	***	2.29	-0.24	***	2.13
Δ Log wage stayers (hourly), temporary	4.19	3.59	-0.46	**	4.57	-0.69	***	3.79	-0.26	n.s.	3.59
Δ Log hours worked stayers, permanent	0.35	-0.02	-0.15	**	0.38	-0.23	***	0.27	-0.07	n.s.	-0.21
Δ Log hours worked stayers, temporary	-0.70	-1.02	-0.15	n.s.	-0.64	-0.17	n.s.	-0.76	-0.21	n.s.	-1.23
Log h.wage exiters - Log h.wage stayers	-10.32	-9.60	0.63	**	-10.45	0.36	n.s.	-10.03	0.55	**	-9.51
Log h.wage entrants - Log h.wage stayers	-14.54	-13.53	0.99	***	-14.37	0.22	n.s.	-14.51	1.26	***	-12.87
Log hours exiters - Log hours stayers	-8.53	-7.41	0.85	***	-8.34	0.29	n.s.	-8.60	1.16	***	-6.47
Log hours entrants - Log hours stayers	-5.59	-6.93	-1.03	***	-5.23	-0.67	***	-6.22	-0.94	***	-7.00
Δ Log overtime hours	0.04	-0.16	-0.17	***	0.11	-0.12	***	-0.03	-0.16	***	-0.22
Δ Log Share part-time jobs	0.07	-0.20	0.01	n.s.	0.19	-0.17	*	-0.05	0.09	n.s.	-0.29
Share stayers, permanent (t)	71.05	74.70	3.30	***	68.49	2.25	***	73.49	3.28	n.s.	74.93
Share stayers, temporary (t)	11.89	11.98	0.82	***	12.04	0.35	***	11.84	1.01	***	12.01
Share exiters, permanent (t−1)	9.76	11.00	1.25	***	10.33	-0.16	*	9.44	2.21	***	12.20
Share exiters, temporary (t−1)	7.14	7.46	0.52	***	8.30	-0.09	n.s.	6.43	0.78	***	8.15
Share entrants, permanent (t)	6.81	5.34	-1.55	***	7.73	-1.38	***	5.86	-1.39	***	5.29
Share entrants, temporary (t)	10.24	7.98	-2.68	***	11.74	-1.47	***	8.81	-2.81	***	7.76

Notes: Data refer to all private sector firms with at least 25 employees for which Δ sales is available; firm-year combinations with firm dynamics (mergers etc.) are excluded from the sample. ΔS = change in sales, P1-P25, P25-P75 and P75-P100 are subsamples of firms based on the yearly percentile distribution of the change in sales. ΔWB_2 includes contractual as well as overtime pay, ΔWB_3 includes incidental and extra wage on top of this. $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately: column 3 refers to $\Delta S<0$ compared to $\Delta S \geq 0$; column 6 to P25-P75 compared to P75-P100; column 9 refers to P1-P25 compared to P25-P75. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. *Source*: Own calculations using registration data from Statistics Netherlands

Table A4.3: Decomposition of wage-bill changes 2007–2013 by sectors of economic activity

	Manufacturing		Construction		Goods Trade		Horeca		Transport Comm.		Business services	
	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$
Contribution to gross contractual wage-bill change by:												
-net change in employment	−6.01	-5.09^{***}	−6.55	-4.25^{***}	−4.93	-4.29^{***}	−6.19	-8.04^{***}	−7.65	-7.94^{***}	−14.01	-13.19^{***}
-hourly wage, stayers	2.16	-0.26^{***}	1.65	−0.14	1.72	-0.46^{***}	1.62	−0.33	1.51	−0.22	1.82	-0.55^{***}
-hourly wage, entrants	−0.72	0.45^{***}	−0.97	0.23^{**}	−1.51	0.49^{***}	−3.84	0.79^{**}	−1.36	0.50^{***}	−3.17	0.73^{***}
-hourly wage, exiters	1.18	0.23^{**}	1.20	0.31^{*}	1.54	0.07	3.73	0.15	1.70	0.24	4.33	0.72^{***}
-hours worked, stayers	0.32	-0.15^{***}	0.36	-0.24^{*}	0.44	−0.07	0.28	−0.14	0.81	−0.26	0.27	-0.20^{**}
-hours worked, non-stayers +	0.23	0.02	0.18	0.05	0.48	0.07	0.72	0.60	0.49	0.32^{**}	1.18	0.51
Gross wage-bill change (in %):												
-contractual	−2.83	-4.79^{***}	−4.14	-4.49^{***}	−2.25	-4.58^{***}	−3.66	-6.88^{***}	−4.51	-7.37^{***}	−9.56	-11.46^{***}
-contr. + overtime pay	−3.14	-5.13^{***}	−4.34	-5.85^{***}	−2.42	-4.78^{**}	−3.75	-6.99^{***}	−4.98	-7.79^{***}	−9.67	-11.60^{***}
-idem + incid. & extra pay	−2.96	-5.65^{***}	−4.30	-5.98^{***}	−2.44	-5.77^{***}	−3.72	-6.82^{***}	−5.10	-8.19^{***}	−9.73	-11.90^{***}
# firms $\Delta S \geq 0$	12,775		3,880		11,082		975		4,692		9,505	
# firms $\Delta S<0$	9,741		3,269		8,772		708		3,071		6,966	
# workers (1)			1.7	0.5	1.4		0.2		0.9		1.9	
# workers (2)			1.5	0.4	1.1		0.1		0.8		1.6	

Notes: Data refer to all private sector firms with at least 25 employees for which Δ sales is available, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. ΔS = change in sales. ΔWB_2 includes contractual as well as overtime pay, ΔWB_3 includes incidental and extra wage on top of this. $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately and refers to $\Delta S<0$ compared to $\Delta S \geq 0$. The relationship between the items of the decomposition and equation 4.4 is explained in footnote 6. # workers (1) = # workers in firms $\Delta S \geq 0$ (mln); # workers (2) = # workers firms $\Delta S<0$ (mln). Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

Table A4.4: Decomposition of wage-bill changes 2007–2013, by year

	2006-2007		2007-2008		2008-2009		2009-2010		2010-2011		2011-2012		2012-2013	
	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$	$\Delta S<0$	$\hat{\beta}$
Contribution to gross contractual wage-bill change by:														
-net change in empl.	−6.29	-7.78^{***}	−5.68	-6.75^{***}	−8.76	-8.38^{***}	−10.90	-7.91^{***}	−7.88	-8.73^{***}	−6.53	-8.23^{***}	−6.35	-7.24^{***}
-h. wage, stayers	1.73	−0.20	4.09	-0.20^{***}	3.19	-0.55^{***}	2.49	-0.30^{**}	2.03	-0.40^{***}	−2.05	-0.35^{***}	1.26	-0.48^{***}
-h. wage, entrants	−1.91	0.50^{***}	−2.02	0.42^{***}	−1.19	1.04^{***}	−1.32	0.49^{***}	−2.18	0.50^{***}	−1.63	0.65^{***}	−1.36	0.71^{***}
-h. wage, exiters	2.11	0.52^{**}	2.42	0.34^{**}	2.31	0.16	2.16	0.44^{**}	2.81	0.53^{**}	1.26	0.31^{***}	1.39	0.14
-hours, stayers	1.54	-0.16^{***}	0.09	−0.11	−1.22	-0.11^{***}	−1.02	-0.33^{**}	−0.09	−0.10	3.95	−0.12	0.27	-0.23^{***}
-hours, non-stayers +	0.47	0.01.	0.34	0.20	0.01	0.00	0.84	0.39^{**}	0.73	0.19	1.01	0.53^{***}	0.45	0.03
Gross wage-bill change (in %):														
-contractual	−2.34	-7.06^{***}	−0.76	-6.10^{***}	−5.66	-7.83^{***}	−7.75	-7.23^{***}	−4.57	-8.01^{***}	−3.98	-7.23^{***}	−4.34	-7.08^{***}
-contr.+ overtime pay	−2.59	-7.28^{***}	−1.18	-6.31^{***}	−6.13	-8.13^{***}	−7.72	-7.59^{***}	−4.71	-8.12^{***}	−4.14	-7.39^{***}	−4.46	-7.28^{***}
-idem + inc./extra pay	−2.40	-7.19^{***}	−1.32	-6.43^{***}	−6.16	-8.34^{***}	−7.62	-7.60^{***}	−4.72	-8.06^{***}	−4.10	-7.32^{***}	−4.35	-7.46^{***}
# firms $\Delta S \geq 0$	8,593		7,562		3,766		5,663		8,056		4,952		4,405	
# firms $\Delta S<0$	3,002		4,388		6,538		4,812		4,236		5,051		4,578	
# workers (1)	1.3		1.2		0.6		0.9		1.3		0.7		0.7	
# workers (2)	0.4		0.7		1.1		0.9		0.8		0.9		0.7	

Notes: Data refer to all private sector firms with at least 25 employees for which Δ sales is available, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. ΔS = change in sales. ΔWB_2 includes contractual as well as overtime pay, ΔWB_3 includes incidental and extra wage on top of this. $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately and refers to $\Delta S<0$ compared to $\Delta S \geq 0$. The relationship between the items of the decomposition and equation 4.4 is explained in footnote 6. # workers (1) = # workers in firms $\Delta S \geq 0$ (mln); # workers (2) = # workers firms $\Delta S<0$ (mln). Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Als a robustness check the decomposition for 2009-2010 has been repeated for a sample including workers aged 18-22. In that case the results for $\hat{\beta}$ for 2009-2010 (in the same order as in the table) are the following: -8,43; -0.29; 0.64; 0.49; -0.44; 0.49; -7.55; -7.92; -7.94.

Source: Own calculations using registration data from Statistics Netherlands

Table A4.5: Regressions of the growth rate of the hourly wage of job-stayers by sales growth groups 2006–2013

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	<P50	<P25	<P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
State of business						
Growth rate sales (t)	0.0188***	0.0028	0.1455**	0.0021	0.0006	0.0048
	(0.0027)	(0.0031)	(0.0705)	(0.0031)	(0.0042)	(0.0071)
Growth rate sales, squared (t)	−0.0094***	0.0017	0.0699	0.0013	0.0003	0.0023
	(0.0020)	(0.0020)	(0.0461)	(0.0020)	(0.0025)	(0.0036)
Growth rate sales (t−1)	0.0047***	0.0037***	0.1597***	0.0044***	0.0036**	0.0010
	(0.0013)	(0.0014)	(0.0316)	(0.0013)	(0.0016)	(0.0022)
Dummy missing obs.: Growth sales (t−1)	0.0007	−0.0013	−0.0270	−0.0006	−0.0005	−0.0016
	(0.0008)	(0.0010)	(0.0212)	(0.0009)	(0.0013)	(0.0020)
Ref. group: business result (t−1) <0	−	−	−	−	−	−
Business result (t−1)$\geq$ 0	0.0022***	0.0038***	0.0765***	0.0040***	0.0033***	0.0027
	(0.0008)	(0.0008)	(0.0192)	(0.0008)	(0.0010)	(0.0017)
Ref. group: continuing firm (t)	−	−	−	−	−	−
Dummy firm ceases to exits next year (t)	0.0022	0.0031	0.1083***	0.0017	0.0011	−0.0006
	(0.0016)	(0.0020)	(0.0398)	(0.0018)	(0.0024)	(0.0038)
Dummy end of firm out of observed period (t)	0.0045***	0.0067***	0.2484***	0.0059***	0.0049***	0.0045**
	(0.0011)	(0.0011)	(0.0238)	(0.0011)	(0.0015)	(0.0021)
Share of workers subject to part-time UB (t−1)	−0.0136	−0.0199*	−0.0007	−0.0159	0.0031	−0.0011
	(0.0091)	(0.0117)	(0.1663)	(0.0107)	(0.0085)	(0.0141)
Dummy missing obs.: Share part-time UB (t−1)	0.0680***	0.0687***	−0.1851***	0.0689***	0.0692***	0.0695***
	(0.0016)	(0.0020)	(0.0391)	(0.0018)	(0.0024)	(0.0037)

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
Type of job						
Share of open-term contracts (t−1)	−0.0017	−0.0027	−0.0267	−0.0029	−0.0045*	−0.0085**
	(0.0015)	(0.0019)	(0.0383)	(0.0018)	(0.0027)	(0.0039)
Share of regular jobs (t−1)	−0.0114***	0.0027	0.0060	0.0002	0.0020	0.0034
	(0.0034)	(0.0033)	(0.0625)	(0.0032)	(0.0042)	(0.0066)
Share of full-time jobs (t−1)	0.0720***	0.0555***	0.9575***	0.0591***	0.0568***	0.0553***
	(0.0036)	(0.0039)	(0.0623)	(0.0038)	(0.0055)	(0.0067)
Share of jobs hired from TWA's (t−1)	−0.0004**	0.0007***	0.0283	0.0007***	−0.0004	−0.0029
	(0.0002)	(0.0002)	(0.0254)	(0.0002)	(0.0024)	(0.0041)
Share of hired self-employed (t−1)	0.0014***	0.0009	−0.0003	0.0007	0.0013	0.0017
	(0.0003)	(0.0007)	(0.0202)	(0.0006)	(0.0012)	(0.0038)
Dummy missing obs.: Share TWA (t−1)	−0.0024	−0.0025	0.0096	−0.0004	0.0008	0.0098
	(0.0038)	(0.0044)	(0.1084)	(0.0043)	(0.0058)	(0.0072)
Collective labour agreement						
CLA enterprise level (t−1)	0.0058***	0.0060***	0.0728**	0.0069***	0.0060***	0.0061*
	(0.0015)	(0.0019)	(0.0363)	(0.0020)	(0.0020)	(0.0035)
CLA sector level, no extension (t−1)	−0.0024	−0.0005	0.0183	−0.0009	0.0002	0.0040
	(0.0015)	(0.0014)	(0.0345)	(0.0013)	(0.0019)	(0.0031)
CLA enterprise extended to sector level (t−1)	−0.0008	0.0009	−0.0099	0.0007	0.0022*	0.0022
	(0.0007)	(0.0009)	(0.0203)	(0.0008)	(0.0012)	(0.0020)
Ref. group: no collective labour agreement (CLA)	−	−	−	−	−	−
CLA unknown (t−1)	0.0053*	0.0029	0.1857**	0.0043	0.0075*	0.0035
	(0.0030)	(0.0051)	(0.0842)	(0.0044)	(0.0043)	(0.0074)
Composition of the labour force						
Share of male workers (t−1)	−0.0400***	−0.0266***	−0.5414***	−0.0280***	−0.0234***	−0.0216***
	(0.0027)	(0.0032)	(0.0565)	(0.0031)	(0.0045)	(0.0059)

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
Share of workers aged 23-35 (t−1)	0.0059*	0.0039	0.3993***	0.0038	0.0059	0.0008
	(0.0032)	(0.0039)	(0.0778)	(0.0037)	(0.0051)	(0.0081)
Ref. group: Share of workers aged 36-50 (t−1)	–	–	–	–	–	–
Share of workers aged 51-65 (t−1)	0.0053	0.0092**	0.1092	0.0076*	0.0151***	0.0073
	(0.0041)	(0.0043)	(0.0952)	(0.0042)	(0.0058)	(0.0096)
Share of job tenure $\geq$ 10 years (t−1)	−0.0033*	−0.0046**	−0.2021***	−0.0047**	−0.0075***	−0.0093**
	(0.0019)	(0.0020)	(0.0473)	(0.0019)	(0.0025)	(0.0040)
Ref. group: Dutch workers	–	–	–	–	–	–
Share of immigrants after EU-enlargement (t−1)	−0.0282*	−0.0262	−0.0866	−0.0386**	−0.0245	−0.0605
	(0.0145)	(0.0190)	(0.3283)	(0.0188)	(0.0231)	(0.0387)
Share of immigrants other western countries	−0.0020	0.0040	0.0968	0.0003	0.0031	−0.0021
	(0.0050)	(0.0061)	(0.1081)	(0.0058)	(0.0091)	(0.0125)
Share of other non-western immigrants (t−1)	−0.0143**	−0.0265***	−0.3508*	−0.0233**	−0.0323**	−0.0284
	(0.0065)	(0.0103)	(0.1980)	(0.0092)	(0.0156)	(0.0189)
Training, education and contractual wage						
Ratio training expenditures firm / sales (t−1)	0.1248***	0.1584***	3.1330***	0.1402***	0.1159**	0.0411
	(0.0391)	(0.0439)	(1.1421)	(0.0406)	(0.0496)	(0.0434)
Share low educated workers (t−1)	−0.0339***	−0.0420***	−0.7359***	−0.0408***	−0.0441***	−0.0405***
	(0.0024)	(0.0030)	(0.0549)	(0.0029)	(0.0039)	(0.0062)
Share medium educated workers (t−1)	−0.0223***	−0.0275***	−0.5091***	−0.0270***	−0.0300***	−0.0264***
	(0.0020)	(0.0025)	(0.0504)	(0.0024)	(0.0033)	(0.0048)
Ref. group: Share high educated workers (t−1)	–	–	–	–	–	–
Share workers with low wage (t−1)	−0.0145	−0.0298**	0.2707*	−0.0275**	−0.0309**	−0.0117

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
	(0.0092)	(0.0130)	(0.1621)	(0.0123)	(0.0136)	(0.0167)
Share workers with medium wage (t−1)	−0.0238***	−0.0367***	−0.0496	−0.0347***	−0.0370***	−0.0208*
	(0.0067)	(0.0097)	(0.1249)	(0.0092)	(0.0102)	(0.0121)
Ref. group:Share workers with high wage (t−1)	–	–	–	–	–	–
Average hourly wage of the firm (t−1)	−0.0022***	−0.0034***	−0.0089	−0.0033***	−0.0035***	−0.0024***
	(0.0005)	(0.0007)	(0.0074)	(0.0006)	(0.0007)	(0.0008)
Std. dev.of hourly wage in the firm (t−1)	−0.0004*	−0.0001	−0.0050	−0.0001	0.0001	−0.0004
	(0.0002)	(0.0003)	(0.0041)	(0.0002)	(0.0003)	(0.0004)
Dummy missing obs.: training expenditures (t−1)	0.0018	0.0027	0.0445	0.0012	0.0003	−0.0055
	(0.0039)	(0.0044)	(0.1078)	(0.0042)	(0.0057)	(0.0070)
Other firm characteristics						
Ref. group: low Share of incidental wage (t−1)	–	–	–	–	–	–
Intermediate Share of incidental wage (t−1)	0.0013*	0.0009	0.0453**	0.0009	0.0004	0.0014
	(0.0008)	(0.0009)	(0.0206)	(0.0008)	(0.0012)	(0.0019)
High Share of incidental wage (t−1)	0.0009	−0.0012	0.0626**	−0.0007	−0.0010	0.0002
	(0.0009)	(0.0011)	(0.0252)	(0.0011)	(0.0015)	(0.0023)
Ref. group: firm size 25 - 99 workers (t−1)	–	–	–	–	–	–
Firm size 100 - 500 workers (t−1)	0.0028***	0.0014*	0.0113	0.0018**	−0.0001	0.0001
	(0.0007)	(0.0007)	(0.0184)	(0.0007)	(0.0010)	(0.0017)
Firm size $\geq$ 500 workers (t−1)	0.0086***	0.0074***	0.1114***	0.0073***	0.0057***	0.0090***
	(0.0015)	(0.0018)	(0.0409)	(0.0017)	(0.0019)	(0.0032)
Ref. group: # establishments 1 (t−1)	–	–	–	–	–	–

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
# establishments 2 - 50 (t−1)	-0.0026^{***}	-0.0017^{**}	-0.0604^{***}	-0.0017^{***}	−0.0014	−0.0025
	(0.0006)	(0.0007)	(0.0164)	(0.0006)	(0.0009)	(0.0016)
High # establishments ≥ 50 (t−1)	-0.0137^{***}	-0.0100^{***}	-0.3092^{***}	-0.0087^{***}	-0.0054^{*}	-0.0109^{*}
	(0.0036)	(0.0027)	(0.0783)	(0.0027)	(0.0032)	(0.0060)
Ref. group: Dutch ownership (t−1)	−	−	−	−	−	−
UK/US ownership (t−1)	−0.0010	-0.0025^{*}	-0.1447^{***}	−0.0001	0.0002	0.0014
	(0.0012)	(0.0014)	(0.0369)	(0.0013)	(0.0019)	(0.0032)
Foreign ownership, no UK/US (t−1)	−0.0009	0.0012	−0.0216	0.0020	0.0025	0.0036
	(0.0010)	(0.0013)	(0.0286)	(0.0012)	(0.0016)	(0.0026)
Ownership unknown (t−1)	-0.0257^{***}	-0.0169^{***}	-0.5512^{***}	-0.0172^{***}	−0.0082	0.0061
	(0.0044)	(0.0054)	(0.1437)	(0.0047)	(0.0078)	(0.0330)
Ref. group: non-exporting firm (t−1)	−	−	−	−	−	−
Exporting firm (t−1)	0.0014	0.0024	0.0427	0.0024	0.0050^{**}	0.0049
	(0.0013)	(0.0015)	(0.0332)	(0.0015)	(0.0021)	(0.0032)
Export unknown (t−1)	0.0047^{***}	0.0028^{**}	0.0428	0.0028^{**}	0.0037^{**}	0.0074^{**}
	(0.0012)	(0.0014)	(0.0290)	(0.0013)	(0.0018)	(0.0029)
Sectors of economic activity and years						
Mineral extraction sector (t)	0.0075	−0.0018	0.0343	0.0006	0.0107	0.0149
	(0.0069)	(0.0083)	(0.3263)	(0.0076)	(0.0158)	(0.0159)
Manufacturing sector (t)	0.0031	0.0055	−0.1316	0.0076	0.0174	0.0014
	(0.0055)	(0.0062)	(0.2768)	(0.0061)	(0.0134)	(0.0053)
Ref. group: energy and water sector (t)	−	−	−	−	−	−
Construction sector (t)	0.0002	0.0032	−0.0456	0.0059	0.0140	−0.0030
	(0.0056)	(0.0063)	(0.2783)	(0.0062)	(0.0136)	(0.0062)
Goods trade sector (t)	0.0005	0.0006	−0.2823	0.0029	0.0133	0.0004

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
	(0.0055)	(0.0062)	(0.2768)	(0.0061)	(0.0135)	(0.0055)
Horeca sector (t)	0.0007	0.0008	−0.3406	0.0030	0.0112	−0.0017
	(0.0057)	(0.0064)	(0.2813)	(0.0062)	(0.0137)	(0.0070)
Transport and communication sector (t)	−0.0003	0.0051	−0.0365	0.0062	0.0180	0.0066
	(0.0056)	(0.0063)	(0.2781)	(0.0062)	(0.0136)	(0.0059)
Business services sector (t)	0.0046	0.0049	−0.3014	0.0073	0.0164	0.0012
	(0.0055)	(0.0063)	(0.2774)	(0.0061)	(0.0135)	(0.0055)
Ref. variable: year 2008	–	–	–	–	–	–
Dummy year 2009	−0.0075***	−0.0095***	0.0877***	−0.0099***	−0.0096***	−0.0130***
	(0.0012)	(0.0012)	(0.0259)	(0.0012)	(0.0017)	(0.0029)
Dummy year 2010	0.0518***	0.0530***	−0.0070	0.0534***	0.0549***	0.0516***
	(0.0014)	(0.0017)	(0.0368)	(0.0017)	(0.0022)	(0.0033)
Dummy year 2011	0.0481***	0.0478***	−0.1596***	0.0484***	0.0496***	0.0475***
	(0.0012)	(0.0015)	(0.0363)	(0.0015)	(0.0019)	(0.0031)
Dummy year 2012	–	–	–	–	–	–
Dummy year 2013	−0.0344***	−0.0374***	0.1134***	−0.0377***	−0.0379***	−0.0451***
	(0.0016)	(0.0019)	(0.0396)	(0.0018)	(0.0022)	(0.0035)
Relation employment Growth - wage Growth						
Growth employment firm (in %) (t)	0.0068**	0.0085**	0.0999**	0.0080**	0.0068*	0.0073
	(0.0034)	(0.0036)	(0.0458)	(0.0036)	(0.0039)	(0.0052)
Constant	0.0360**	0.0568***	0.0535	0.0511**	0.0428*	0.0335
	(0.0163)	(0.0209)	(0.0535)	(0.0199)	(0.0245)	(0.0260)

Table A4.5 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage > sector mean	Hourly wage	Hourly wage	Hourly wage
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
Observations	34,150	29,463	29,463	31,814	15,908	6,363
R-squared	0.2183	0.2026		0.2008	0.2034	0.1844
Log likelihood			1.31e+05			

Notes: Data refer to all private sector firms with at least 25 employees that exist in two subsequent years and for which sales growth data are available, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. The table presents OLS-regressions for the nominal change in the hourly wages of stayers if sales are increasing (column 1) or decreasing (column 2). Column 3 gives the results of a probit regression of the probability that the nominal change in the hourly wages of stayers exceeds that of the sector the firm is in. Columns 4, 5 and 6 show regressions performed on increasingly smaller samples with increasingly adverse sales growth, the samples respectively containing observations below the median, the 25th percentile and the 10th percentile of the sales growth distribution. Hence, the sixth column contains the least observations, only the ones that experience a severe shock in sales. Dummy 2012 drops out due to multicollinearity with 'dummy end of firm out of observed period (t)'.

Source: Own calculations using registration data from Statistics Netherlands.

Table A4.6: Regressions of employment growth by sales growth groups 2006–2013

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
State of business						
Growth rate sales (t)	0.1158^{***}	0.3275^{***}	1.9444^{***}	0.3145^{***}	0.3290^{***}	0.3442^{***}
	(0.0103)	(0.0128)	(0.0777)	(0.0125)	(0.0198)	(0.0372)
Growth rate sales, squared (t)	-0.0751^{***}	0.1447^{***}	1.0544^{***}	0.1376^{***}	0.1464^{***}	0.1543^{***}
	(0.0083)	(0.0097)	(0.0527)	(0.0095)	(0.0123)	(0.0189)
Growth rate sales (t−1)	0.0292^{***}	0.0653^{***}	0.5278^{***}	0.0621^{***}	0.0733^{***}	0.0793^{***}
	(0.0041)	(0.0055)	(0.0389)	(0.0052)	(0.0073)	(0.0111)
Dummy missing obs.: Growth sales (t−1)	−0.0019	−0.0009	−0.0218	−0.0001	0.0028	0.0062
	(0.0025)	(0.0031)	(0.0229)	(0.0028)	(0.0046)	(0.0084)
Ref. group: business result (t−1) <0	−	−	−	−	−	−
Business result (t−1) ≥ 0	0.0386^{***}	0.0633^{***}	0.4296^{***}	0.0608^{***}	0.0784^{***}	0.1007^{***}
	(0.0023)	(0.0030)	(0.0207)	(0.0028)	(0.0043)	(0.0082)
Ref. group: continuing firm (t)	−	−	−	−	−	−
Dummy firm ceases to exits next year (t)	−0.0053	-0.0322^{***}	−0.0720	-0.0273^{***}	-0.0360^{***}	-0.0456^{**}
	(0.0061)	(0.0082)	(0.0440)	(0.0072)	(0.0105)	(0.0185)
Dummy end of firm out of observed period (t)	0.0208^{***}	0.0227^{***}	0.0936^{***}	0.0218^{***}	0.0254^{***}	0.0461^{***}
	(0.0029)	(0.0034)	(0.0254)	(0.0032)	(0.0052)	(0.0100)
Share of workers subject to part-time UB (t−1)	−0.0028	−0.0349	-0.3791^{*}	-0.0373^{*}	-0.0641^{*}	−0.0073
	(0.0115)	(0.0237)	(0.1955)	(0.0215)	(0.0334)	(0.0537)
Dummy missing obs.: Share part-time UB (t−1)	-0.0375^{***}	-0.0317^{***}	-0.4400^{***}	-0.0346^{***}	-0.0329^{***}	-0.0455^{**}
	(0.0045)	(0.0064)	(0.0443)	(0.0060)	(0.0095)	(0.0190)

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
Type of job						
Share of open-term contracts (t−1)	0.0281***	0.0397***	0.2530***	0.0386***	0.0456***	0.0447***
	(0.0054)	(0.0063)	(0.0430)	(0.0060)	(0.0093)	(0.0170)
Share of regular jobs (t−1)	0.0188	0.0376***	−0.0536	0.0402***	0.0326*	0.0747**
	(0.0133)	(0.0142)	(0.0766)	(0.0136)	(0.0195)	(0.0352)
Share of full-time jobs (t−1)	0.0401***	0.0399***	0.1725***	0.0427***	0.0691***	0.1040***
	(0.0084)	(0.0098)	(0.0662)	(0.0092)	(0.0160)	(0.0313)
Share of jobs hired from TWA's (t−1)	0.0009	0.0021*	0.0147	0.0022**	0.0095	−0.0054
	(0.0008)	(0.0011)	(0.0130)	(0.0011)	(0.0158)	(0.0313)
Share of hired self-employed (t−1)	−0.0024	−0.0008	−0.0493*	−0.0012	−0.0004	−0.0181
	(0.0016)	(0.0031)	(0.0254)	(0.0032)	(0.0053)	(0.0143)
Dummy missing obs.: Share TWA (t−1)	−0.1190***	−0.1145***	−1.0993***	−0.1125***	−0.1189***	−0.1452***
	(0.0166)	(0.0276)	(0.1494)	(0.0266)	(0.0339)	(0.0512)
Collective labour agreement						
CLA enterprise level (t−1)	0.0007	−0.0043	0.0300	−0.0029	0.0014	0.0056
	(0.0035)	(0.0047)	(0.0390)	(0.0045)	(0.0076)	(0.0162)
CLA sector level, no extension (t−1)	−0.0143***	−0.0185***	−0.1628***	−0.0195***	−0.0199***	−0.0190
	(0.0049)	(0.0051)	(0.0379)	(0.0048)	(0.0077)	(0.0159)
CLA enterprise extended to sector level (t−1)	0.0025	0.0007	−0.0467**	0.0026	−0.0008	0.0001
	(0.0019)	(0.0026)	(0.0215)	(0.0025)	(0.0042)	(0.0089)
Ref. group: no collective labour agreement (CLA)	−	−	−	−	−	−
CLA unknown (t−1)	−0.0533***	−0.0356**	−0.3149***	−0.0334**	−0.0352	−0.0163
	(0.0129)	(0.0178)	(0.1037)	(0.0156)	(0.0243)	(0.0440)
Composition of the labour force						
Share of male workers (t−1)	−0.0255***	−0.0319***	−0.0599	−0.0360***	−0.0458***	−0.0734***
	(0.0079)	(0.0090)	(0.0612)	(0.0085)	(0.0142)	(0.0274)

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
Share of workers aged 23-35 (t−1)	-0.0204^{**}	-0.0218^{*}	-0.1269	-0.0155	-0.0235	-0.0318
	(0.0089)	(0.0118)	(0.0838)	(0.0112)	(0.0187)	(0.0352)
Ref. group: Share of workers aged 36-50 (t−1)	−	−	−	−	−	−
Share of workers aged 51-65 (t−1)	-0.0819^{***}	-0.0627^{***}	-0.6260^{***}	-0.0574^{***}	-0.0594^{***}	-0.0658
	(0.0110)	(0.0128)	(0.1021)	(0.0121)	(0.0198)	(0.0401)
Share of job tenure $\geq$ 10 years (t−1)	0.0171^{***}	0.0271^{***}	0.2658^{***}	0.0278^{***}	0.0268^{***}	0.0109
	(0.0054)	(0.0068)	(0.0518)	(0.0065)	(0.0098)	(0.0200)
Ref. group: Dutch workers	−	−	−	−	−	−
Share of immigrants after EU-enlargement (t−1)	0.0245	0.0825	0.0338	0.0933	0.0733	0.1420
	(0.0484)	(0.0675)	(0.3829)	(0.0644)	(0.0790)	(0.1320)
Share of immigrants other western countries	-0.0830^{***}	-0.1133^{***}	-0.7415^{***}	-0.1142^{***}	-0.1302^{***}	-0.2015^{***}
	(0.0169)	(0.0235)	(0.1226)	(0.0220)	(0.0364)	(0.0740)
Share of other non-western immigrants (t−1)	-0.0390^{*}	-0.0230	0.2762	-0.0227	-0.0558	-0.1788
	(0.0214)	(0.0504)	(0.2161)	(0.0443)	(0.0847)	(0.1601)
Training, education and contractual wage						
ratio training expenditures firm / sales (t−1)	-0.0081	0.0200	-1.4667	0.0478	0.0690	0.1102
	(0.0837)	(0.1171)	(0.9741)	(0.1156)	(0.1683)	(0.2360)
Share low educated workers (t−1)	0.0117^{**}	0.0060	0.0808	0.0091	0.0017	0.0001
	(0.0060)	(0.0073)	(0.0584)	(0.0069)	(0.0110)	(0.0210)
Share medium educated workers (t−1)	0.0026	0.0030	0.1168^{**}	0.0043	0.0034	-0.0052
	(0.0051)	(0.0065)	(0.0538)	(0.0062)	(0.0099)	(0.0183)
Ref. group: Share high educated workers (t−1)	−	−	−	−	−	−
Share workers with low wage (t−1)	-0.0741^{***}	-0.0327	-0.3437^{*}	-0.0318	-0.0321	-0.0805

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
	(0.0198)	(0.0257)	(0.1807)	(0.0245)	(0.0393)	(0.0752)
Share workers with medium wage (t−1)	−0.0524***	−0.0089	−0.2013	−0.0129	0.0060	−0.0173
	(0.0147)	(0.0191)	(0.1393)	(0.0183)	(0.0280)	(0.0527)
Ref. group:Share workers with high wage (t−1)	–	–	–	–	–	–
Average hourly wage of the firm (t−1)	−0.0020**	0.0010	0.0051	0.0012	0.0014	−0.0005
	(0.0010)	(0.0013)	(0.0084)	(0.0012)	(0.0020)	(0.0037)
Std. dev.of hourly wage in the firm (t−1)	−0.0002	0.0003	−0.0016	0.0002	0.0013	0.0035*
	(0.0005)	(0.0006)	(0.0044)	(0.0006)	(0.0010)	(0.0019)
Dummy missing obs.: training expenditures (t−1)	−0.0717***	−0.0470*	−0.5263***	−0.0532**	−0.0317	0.0055
	(0.0164)	(0.0271)	(0.1442)	(0.0261)	(0.0332)	(0.0494)
Other firm characteristics						
Ref. group: low Share of incidental wage (t−1)	–	–	–	–	–	–
Intermediate Share of incidental wage (t−1)	−0.0058***	−0.0079***	−0.0877***	−0.0081***	−0.0071*	−0.0018
	(0.0021)	(0.0026)	(0.0221)	(0.0024)	(0.0041)	(0.0084)
High Share of incidental wage (t−1)	−0.0047*	−0.0003	−0.0221	−0.0007	0.0006	0.0132
	(0.0026)	(0.0032)	(0.0270)	(0.0030)	(0.0050)	(0.0102)
Ref. group: firm size 25 - 99 workers (t−1)	–	–	–	–	–	–
Firm size 100 - 500 workers (t−1)	−0.0014	−0.0035	−0.0693***	−0.0031	−0.0045	0.0082
	(0.0019)	(0.0023)	(0.0196)	(0.0022)	(0.0037)	(0.0075)
Firm size $\geq$ 500 workers (t−1)	−0.0017	0.0092**	−0.0672	0.0061	0.0188**	0.0241
	(0.0050)	(0.0045)	(0.0458)	(0.0045)	(0.0075)	(0.0167)
Ref. group: # establishments 1 (t−1)	–	–	–	–	–	–

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
# establishments 2 - 50 (t−1)	−0.0018	−0.0011	−0.0676***	−0.0011	−0.0037	0.0035
	(0.0018)	(0.0021)	(0.0175)	(0.0020)	(0.0033)	(0.0067)
High # establishments ≥ 50 (t−1)	0.0061	0.0052	−0.0750	0.0051	0.0149	0.0340
	(0.0123)	(0.0091)	(0.0850)	(0.0094)	(0.0169)	(0.0455)
Ref. group: Dutch ownership (t−1)	–	–	–	–	–	–
UK/US ownership (t−1)	−0.0109***	−0.0151***	−0.0758**	−0.0142***	−0.0211***	−0.0152
	(0.0036)	(0.0051)	(0.0387)	(0.0046)	(0.0077)	(0.0144)
Foreign ownership, no UK/US (t−1)	−0.0061**	−0.0111***	−0.0664**	−0.0119***	−0.0143**	−0.0264**
	(0.0026)	(0.0038)	(0.0301)	(0.0035)	(0.0061)	(0.0125)
Ownership unknown (t−1)	0.0090	0.0253	−0.2050	0.0316**	0.0546***	0.0976**
	(0.0201)	(0.0167)	(0.1681)	(0.0153)	(0.0199)	(0.0445)
Ref. group: non-exporting firm (t−1)	–	–	–	–	–	–
Exporting firm (t−1)	−0.0181***	−0.0008	0.0105	−0.0029	0.0004	0.0091
	(0.0037)	(0.0045)	(0.0350)	(0.0043)	(0.0072)	(0.0139)
Export unknown (t−1)	−0.0271***	−0.0063	0.1209***	−0.0096**	−0.0142**	−0.0167
	(0.0036)	(0.0044)	(0.0314)	(0.0043)	(0.0071)	(0.0136)
Sectors of economic activity and years						
Mineral extraction sector (t)	0.0046	0.0171	−0.0292	0.0059	−0.0801	−0.0883**
	(0.0633)	(0.0329)	(0.3566)	(0.0337)	(0.0496)	(0.0404)
Manufacturing sector (t)	0.0263	−0.0051	−0.1926	−0.0035	−0.0819*	−0.1566***
	(0.0622)	(0.0301)	(0.3014)	(0.0317)	(0.0446)	(0.0252)
Ref. group: energy and water sector (t)	–	–	–	–	–	–
Construction sector (t)	0.0147	−0.0017	−0.1815	−0.0036	−0.0829*	−0.1545***
	(0.0621)	(0.0303)	(0.3031)	(0.0319)	(0.0450)	(0.0297)
Goods trade sector (t)	0.0173	−0.0044	−0.2727	−0.0034	−0.0850*	−0.1527***

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
	(0.0621)	(0.0301)	(0.3014)	(0.0317)	(0.0447)	(0.0266)
Horeca sector (t)	−0.0015	−0.0123	−0.4655	−0.0132	−0.0907**	−0.1109***
	(0.0623)	(0.0306)	(0.3061)	(0.0322)	(0.0457)	(0.0358)
Transport and communication sector (t)	0.0155	−0.0129	−0.2128	−0.0131	−0.0962**	−0.1767***
	(0.0621)	(0.0302)	(0.3026)	(0.0319)	(0.0450)	(0.0293)
Business services sector (t)	0.0011	−0.0468	−0.2019	−0.0464	−0.1352***	−0.2142***
	(0.0621)	(0.0302)	(0.3020)	(0.0318)	(0.0449)	(0.0257)
Ref. variable: year 2008	–	–	–	–	–	–
Dummy year 2009	0.0012	−0.0046	0.4081***	−0.0068	−0.0240***	−0.0513***
	(0.0037)	(0.0041)	(0.0309)	(0.0043)	(0.0072)	(0.0134)
Dummy year 2010	−0.0291***	−0.0192***	0.2566***	−0.0202***	−0.0192*	−0.0318
	(0.0055)	(0.0064)	(0.0459)	(0.0063)	(0.0098)	(0.0195)
Dummy year 2011	−0.0115***	−0.0056	−0.0687*	−0.0082*	−0.0041	−0.0090
	(0.0037)	(0.0053)	(0.0394)	(0.0049)	(0.0079)	(0.0161)
Dummy year 2012	–	–	–	–	–	–
Dummy year 2013	0.0380***	0.0317***	0.4923***	0.0349***	0.0345***	0.0324*
	(0.0041)	(0.0060)	(0.0444)	(0.0056)	(0.0094)	(0.0188)
Relation employment Growth - wage Growth						
Growth hourly wage stayers (in %) (t)	−0.0244	−0.0274	0.0264	−0.0383	−0.0561	−0.0441
	(0.0328)	(0.0364)	(0.1734)	(0.0365)	(0.0488)	(0.1015)
Indicator downward nominal wage rigidity (t)	−0.3452***	−0.3848***	−4.4572***	−0.4153***	−0.5630***	−0.7624***
	(0.0596)	(0.0661)	(0.4166)	(0.0660)	(0.1043)	(0.1889)
Indicator downward real wage rigidity (t)	−0.3479***	−0.3448***	−4.3806***	−0.3734***	−0.5243***	−0.6987***
	(0.0646)	(0.0725)	(0.4521)	(0.0719)	(0.1138)	(0.2032)
Wage decrease below range indicator (t)	−0.1556**	−0.1933***	−0.1616	−0.2369***	−0.2811***	−0.3483**

Table A4.6 Continued from previous page

Dependent variable:	Employment	Employment	Employment > sector mean	Employment	Employment	Employment
Sample - sales growth:	≥ 0	<0	<0	$<$P50	$<$P25	$<$P10
Estimation technique:	OLS	OLS	Probit	OLS	OLS	OLS
	(0.0676)	(0.0629)	(0.2941)	(0.0668)	(0.0919)	(0.1470)
Wage decrease above range indicator (t)	0.4161^{***}	0.2464^{***}	2.5855^{***}	0.2537^{***}	0.2591^{***}	0.2736^{***}
	(0.0153)	(0.0178)	(0.0973)	(0.0166)	(0.0232)	(0.0390)
Dummy missing obs.: wage rigidity indicator (t)	-0.1276^{***}	-0.1335^{***}	-0.5806^{***}	-0.1307^{***}	-0.1368^{***}	-0.1762^{***}
	(0.0173)	(0.0192)	(0.0988)	(0.0174)	(0.0230)	(0.0419)
Constant	0.3153^{***}	0.2150^{***}	3.8935^{***}	0.2387^{***}	0.4307^{***}	0.6759^{***}
	(0.0946)	(0.0826)	(0.5812)	(0.0823)	(0.1265)	(0.2174)
Observations	33,124	28,559	28,559	30,848	15,471	6,177
R-squared	0.2932	0.2377		0.2454	0.2323	0.2255
Log likelihood			$1.30e+05$			

Notes: Data refer to all private sector firms with at least 25 employees that exist in two subsequent years and for which sales growth data are available, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. The table presents OLS-regressions for the nominal change in the employment of firms if sales are increasing (column 1) or decreasing (column 2). Column 3 gives the results of a probit regression of the probability that the employment growth exceeds that of the sector the firm is in. Columns 4, 5 and 6 show regressions performed on increasingly smaller samples with increasingly adverse sales growth, the samples respectively containing observations below the median, the 25th percentile and the 10th percentile of the sales growth distribution. Hence, the sixth column contains the least observations, only the ones that experience a severe shock in sales. Dummy 2012 drops out due to multicollinearity with 'dummy end of firm out of observed period (t)'.

Source: Own calculations using registration data from Statistics Netherlands.

Table A4.7: OLS-regressions of employment growth and job flows by sales growth groups 2006–2013

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
State of business						
Growth rate sales (t)	0.3145***	0.0384***	−0.2760***	0.3442***	0.0272**	−0.3170***
	(0.0125)	(0.0043)	(0.0113)	(0.0372)	(0.0111)	(0.0336)
Growth rate sales, squared (t)	0.1376***	0.0195***	−0.1181***	0.1543***	0.0141***	−0.1402***
	(0.0095)	(0.0028)	(0.0088)	(0.0189)	(0.0054)	(0.0173)
Growth rate sales (t−1)	0.0621***	0.0096***	−0.0525***	0.0793***	0.0085**	−0.0709***
	(0.0052)	(0.0021)	(0.0044)	(0.0111)	(0.0037)	(0.0094)
Dummy missing obs.: Growth sales (t−1)	−0.0001	0.0042***	0.0043*	0.0062	0.0029	−0.0032
	(0.0028)	(0.0014)	(0.0025)	(0.0084)	(0.0032)	(0.0073)
Ref. group: business result (t−1) <0	−	−	−	−	−	−
Business result (t−1) ≥ 0	0.0608***	0.0054***	−0.0554***	0.1007***	0.0140***	−0.0867***
	(0.0028)	(0.0012)	(0.0025)	(0.0082)	(0.0025)	(0.0074)
Ref. group: continuing firm (t)	−	−	−	−	−	−
Dummy firm ceases to exits next year (t)	−0.0273***	−0.0112***	0.0161**	−0.0456**	−0.0205***	0.0251
	(0.0072)	(0.0030)	(0.0063)	(0.0185)	(0.0064)	(0.0160)
Dummy end of firm out of observed period (t)	0.0218***	−0.0133***	−0.0351***	0.0461***	−0.0133***	−0.0595***
	(0.0032)	(0.0014)	(0.0029)	(0.0100)	(0.0032)	(0.0090)
Share of workers subject to part-time UB (t−1)	−0.0373*	−0.0039	0.0334*	−0.0073	0.0014	0.0086
	(0.0215)	(0.0069)	(0.0199)	(0.0537)	(0.0111)	(0.0516)
Dummy missing obs.: Share part-time UB (t−1)	−0.0346***	0.0195***	0.0541***	−0.0455**	0.0115**	0.0570***
	(0.0060)	(0.0025)	(0.0054)	(0.0190)	(0.0058)	(0.0170)
Type of job						
Share of open-term contracts (t−1)	0.0386***	−0.0431***	−0.0817***	0.0447***	−0.0236***	−0.0684***

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
	(0.0060)	(0.0033)	(0.0052)	(0.0170)	(0.0070)	(0.0145)
Share of regular jobs (t−1)	0.0402***	−0.1961***	−0.2363***	0.0747**	−0.1881***	−0.2628***
	(0.0136)	(0.0093)	(0.0113)	(0.0352)	(0.0182)	(0.0281)
Share of full-time jobs (t−1)	0.0427***	−0.0208***	−0.0635***	0.1040***	−0.0037	−0.1078***
	(0.0092)	(0.0047)	(0.0080)	(0.0313)	(0.0118)	(0.0269)
Share of jobs hired from TWA's (t−1)	0.0022**	0.0040***	0.0019**	−0.0054	−0.0100	−0.0046
	(0.0011)	(0.0012)	(0.0009)	(0.0313)	(0.0154)	(0.0176)
Share of hired self-employed (t−1)	−0.0012	0.0033**	0.0044	−0.0181	−0.0047	0.0134
	(0.0032)	(0.0017)	(0.0028)	(0.0143)	(0.0072)	(0.0147)
Dummy missing obs.: Share TWA (t−1)	−0.1125***	−0.0742***	0.0382*	−0.1452***	−0.0967***	0.0485
	(0.0266)	(0.0096)	(0.0227)	(0.0512)	(0.0162)	(0.0427)
Collective labour agreement						
CLA enterprise level (t−1)	−0.0029	0.0042**	0.0070*	0.0056	0.0112***	0.0056
	(0.0045)	(0.0018)	(0.0042)	(0.0162)	(0.0039)	(0.0156)
CLA sector level, no extension (t−1)	−0.0195***	0.0092***	0.0287***	−0.0190	0.0084	0.0274**
	(0.0048)	(0.0027)	(0.0041)	(0.0159)	(0.0070)	(0.0135)
CLA enterprise extended to sector level (t−1)	0.0026	0.0011	−0.0015	0.0001	−0.0012	−0.0014
	(0.0025)	(0.0011)	(0.0022)	(0.0089)	(0.0029)	(0.0080)
Ref. group: no collective labour agreement (CLA)	−	−	−	−	−	−
CLA unknown (t−1)	−0.0334**	0.0259***	0.0593***	−0.0163	0.0209	0.0373
	(0.0156)	(0.0075)	(0.0131)	(0.0440)	(0.0180)	(0.0346)
Composition of the labour force						
Share of male workers (t−1)	−0.0360***	0.0126***	0.0485***	−0.0734***	−0.0089	0.0645***
	(0.0085)	(0.0045)	(0.0073)	(0.0274)	(0.0107)	(0.0232)
Share of workers aged 23-35 (t−1)	−0.0155	0.0677***	0.0832***	−0.0318	0.0616***	0.0934***
	(0.0112)	(0.0053)	(0.0096)	(0.0352)	(0.0127)	(0.0303)
Ref. group: Share of workers aged 36-50 (t−1)	−	−	−	−	−	−

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
Share of workers aged 51-65 (t−1)	−0.0574***	0.0072	0.0646***	−0.0658	0.0100	0.0758**
	(0.0121)	(0.0060)	(0.0111)	(0.0401)	(0.0125)	(0.0367)
Share of job tenure ≥ 10 years (t−1)	0.0278***	−0.0422***	−0.0699***	0.0109	−0.0452***	−0.0561***
	(0.0065)	(0.0028)	(0.0060)	(0.0200)	(0.0059)	(0.0187)
Ref. group: Dutch workers	–	–	–	–	–	–
Share of immigrants after EU-enlargement (t−1)	0.0933	−0.0130	−0.1063**	0.1420	−0.0048	−0.1468
	(0.0644)	(0.0483)	(0.0520)	(0.1320)	(0.0886)	(0.1056)
Share of immigrants other western countries	−0.1142***	0.0006	0.1148***	−0.2015***	−0.0178	0.1837***
	(0.0220)	(0.0100)	(0.0182)	(0.0740)	(0.0243)	(0.0604)
Share of other non-western immigrants (t−1)	−0.0227	0.0381**	0.0607*	−0.1788	−0.0294	0.1494
	(0.0443)	(0.0161)	(0.0358)	(0.1601)	(0.0371)	(0.1341)
Training, education and contractual wage						
Ratio training expenditures firm / sales (t−1)	0.0478	0.1406**	0.0928	0.1102	0.1736	0.0634
	(0.1156)	(0.0685)	(0.0894)	(0.2360)	(0.1371)	(0.1555)
Share low educated workers (t−1)	0.0091	−0.0091***	−0.0182***	0.0001	−0.0025	−0.0026
	(0.0069)	(0.0033)	(0.0059)	(0.0210)	(0.0072)	(0.0185)
Share medium educated workers (t−1)	0.0043	−0.0028	−0.0072	−0.0052	−0.0029	0.0023
	(0.0062)	(0.0029)	(0.0055)	(0.0183)	(0.0064)	(0.0163)
Ref. group: Share high educated workers (t−1)	–	–	–	–	–	–
Share workers with low wage (t−1)	−0.0318	−0.0580***	−0.0262	−0.0805	−0.0700**	0.0104
	(0.0245)	(0.0122)	(0.0205)	(0.0752)	(0.0281)	(0.0645)
Share workers with medium wage (t−1)	−0.0129	−0.0536***	−0.0406***	−0.0173	−0.0701***	−0.0528
	(0.0183)	(0.0094)	(0.0154)	(0.0527)	(0.0203)	(0.0458)

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
Ref. group:Share workers with high wage (t−1)	–	–	–	–	–	–
Average hourly wage of the firm (t−1)	0.0012	−0.0031***	−0.0043***	−0.0005	−0.0042***	−0.0037
	(0.0012)	(0.0006)	(0.0010)	(0.0037)	(0.0014)	(0.0032)
Std. dev.of hourly wage in the firm (t−1)	0.0002	0.0009***	0.0007	0.0035*	0.0015**	−0.0020
	(0.0006)	(0.0003)	(0.0005)	(0.0019)	(0.0007)	(0.0016)
Dummy missing obs.: training expenditures (t−1)	−0.0532**	−0.0339***	0.0193	0.0055	0.0029	−0.0026
	(0.0261)	(0.0095)	(0.0224)	(0.0494)	(0.0158)	(0.0414)
Other firm characteristics						
Ref. group: low Share of incidental wage (t−1)	–	–	–	–	–	–
Intermediate Share of incidental wage (t−1)	−0.0081***	0.0073***	0.0154***	−0.0018	0.0101***	0.0119
	(0.0024)	(0.0011)	(0.0022)	(0.0084)	(0.0026)	(0.0076)
High Share of incidental wage (t−1)	−0.0007	0.0045***	0.0051*	0.0132	0.0040	−0.0092
	(0.0030)	(0.0015)	(0.0027)	(0.0102)	(0.0037)	(0.0091)
Ref. group: firm size 25 - 99 workers (t−1)	–	–	–	–	–	–
Firm size 100 - 500 workers (t−1)	−0.0031	−0.0003	0.0028	0.0082	−0.0038	−0.0120*
	(0.0022)	(0.0011)	(0.0019)	(0.0075)	(0.0028)	(0.0066)
Firm size ≥ 500 workers (t−1)	0.0061	−0.0162***	−0.0223***	0.0241	−0.0176**	−0.0417***
	(0.0045)	(0.0031)	(0.0043)	(0.0167)	(0.0079)	(0.0159)
Ref. group: # establishments 1 (t−1)	–	–	–	–	–	–
# establishments 2 - 50 (t−1)	−0.0011	0.0012	0.0023	0.0035	0.0012	−0.0022
	(0.0020)	(0.0010)	(0.0018)	(0.0067)	(0.0025)	(0.0059)
High # establishments ≥ 50 (t−1)	0.0051	0.0078*	0.0027	0.0340	0.0066	−0.0275
	(0.0094)	(0.0047)	(0.0077)	(0.0455)	(0.0102)	(0.0425)

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
Ref. group: Dutch ownership (t−1)	–	–	–	–	–	–
UK/US ownership (t−1)	−0.0142***	0.0024	0.0165***	−0.0152	0.0115***	0.0267**
	(0.0046)	(0.0017)	(0.0042)	(0.0144)	(0.0044)	(0.0129)
Foreign ownership, no UK/US (t−1)	−0.0119***	0.0023*	0.0142***	−0.0264**	0.0006	0.0270**
	(0.0035)	(0.0014)	(0.0032)	(0.0125)	(0.0033)	(0.0114)
Ownership unknown (t−1)	0.0316**	−0.2581***	−0.2897***	0.0976**	−0.2339***	−0.3315***
	(0.0153)	(0.0186)	(0.0201)	(0.0445)	(0.0788)	(0.0959)
Ref. group: non-exporting firm (t−1)	–	–	–	–	–	–
Exporting firm (t−1)	−0.0029	−0.0161***	−0.0132***	0.0091	−0.0118**	−0.0208*
	(0.0043)	(0.0023)	(0.0037)	(0.0139)	(0.0057)	(0.0120)
Export unknown (t−1)	−0.0096**	−0.0203***	−0.0107***	−0.0167	−0.0178***	−0.0011
	(0.0043)	(0.0023)	(0.0036)	(0.0136)	(0.0054)	(0.0114)
Sectors of economic activity and years						
Mineral extraction sector (t)	0.0059	−0.0082	−0.0141	−0.0883**	−0.0896***	−0.0012
	(0.0337)	(0.0201)	(0.0208)	(0.0404)	(0.0182)	(0.0433)
Manufacturing sector (t)	−0.0035	0.0200	0.0235	−0.1566***	−0.0355***	0.1211***
	(0.0317)	(0.0193)	(0.0176)	(0.0252)	(0.0095)	(0.0215)
Ref. group: energy and water sector (t)	–	–	–	–	–	–
Construction sector (t)	−0.0036	0.0106	0.0142	−0.1545***	−0.0470***	0.1074***
	(0.0319)	(0.0194)	(0.0179)	(0.0297)	(0.0110)	(0.0253)
Goods trade sector (t)	−0.0034	0.0219	0.0253	−0.1527***	−0.0361***	0.1167***
	(0.0317)	(0.0193)	(0.0176)	(0.0266)	(0.0100)	(0.0225)
Horeca sector (t)	−0.0132	0.0331*	0.0463**	−0.1109***	−0.0179	0.0930***
	(0.0322)	(0.0196)	(0.0182)	(0.0358)	(0.0141)	(0.0306)
Transport and communication sector (t)	−0.0131	0.0139	0.0270	−0.1767***	−0.0481***	0.1286***
	(0.0319)	(0.0194)	(0.0178)	(0.0293)	(0.0110)	(0.0251)

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
Business services sector (t)	−0.0464	0.0224	0.0688***	−0.2142***	−0.0335***	0.1807***
	(0.0318)	(0.0194)	(0.0178)	(0.0257)	(0.0099)	(0.0219)
Ref. variable: year 2008	–	–	–	–	–	–
Dummy year 2009	−0.0068	−0.0128***	−0.0059	−0.0513***	−0.0166***	0.0347***
	(0.0043)	(0.0019)	(0.0037)	(0.0134)	(0.0046)	(0.0117)
Dummy year 2010	−0.0202***	0.0062**	0.0264***	−0.0318	0.0018	0.0336*
	(0.0063)	(0.0027)	(0.0056)	(0.0195)	(0.0059)	(0.0176)
Dummy year 2011	−0.0082*	0.0345***	0.0427***	−0.0090	0.0305***	0.0395***
	(0.0049)	(0.0021)	(0.0044)	(0.0161)	(0.0048)	(0.0144)
Dummy year 2012	–	–	–	–	–	–
Dummy year 2013	0.0349***	−0.0202***	−0.0551***	0.0324*	−0.0141**	−0.0465***
	(0.0056)	(0.0025)	(0.0051)	(0.0188)	(0.0057)	(0.0169)
Relation employment Growth - wage Growth						
Growth hourly wage stayers (in %) (t)	−0.0383	−0.0362**	0.0021	−0.0441	−0.0167	0.0274
	(0.0365)	(0.0162)	(0.0325)	(0.1015)	(0.0294)	(0.0856)
Indicator downward nominal wage rigidity (t)	−0.4153***	0.0511*	0.4665***	−0.7624***	0.0621	0.8245***
	(0.0660)	(0.0295)	(0.0564)	(0.1889)	(0.0637)	(0.1631)
Indicator downward real wage rigidity (t)	−0.3734***	0.0655**	0.4390***	−0.6987***	0.0863	0.7850***
	(0.0719)	(0.0324)	(0.0613)	(0.2032)	(0.0697)	(0.1740)
Wage decrease below range indicator (t)	−0.2369***	0.0123	0.2492***	−0.3483**	0.0253	0.3737***
	(0.0668)	(0.0204)	(0.0610)	(0.1470)	(0.0278)	(0.1366)
Wage decrease above range indicator (t)	0.2537***	0.5395***	0.2858***	0.2736***	0.5391***	0.2655***
	(0.0166)	(0.0118)	(0.0138)	(0.0390)	(0.0232)	(0.0311)
Dummy missing obs.: wage rigidity indicator (t)	−0.1307***	−0.1020***	0.0287**	−0.1762***	−0.1085***	0.0677**
	(0.0174)	(0.0105)	(0.0143)	(0.0419)	(0.0189)	(0.0343)

Table A4.7 Continued from previous page

Dependent variable:	Growth rate Employment	Share entrants	Share exiters	Growth rate Employment	Share entrants	Share exiters
Sample - sales growth:	<P50	<P50	<P50	<P10	<P10	<P10
Constant	0.2387^{***}	0.3063^{***}	0.0676	0.6759^{***}	0.3528^{***}	-0.3231^{*}
	(0.0823)	(0.0404)	(0.0667)	(0.2174)	(0.0770)	(0.1865)
Observations	30,848	30,848	30,848	6,177	6,177	6,177
R-squared	0.2454	0.6958	0.4765	0.2255	0.6903	0.4189

Notes: Data refer to all private sector firms with at least 25 employees that exist in two subsequent years and for which sales growth data are available, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. The table explores the sensitivity of employment growth as well as the share of entrants and exiters in the workforce for sales shocks. The left three columns refer to sales below the median, the right three columns refer to the first decile of the sales growth distribution, representing a severe negative shock in sales. Note that the coefficients for employment are equal to the difference between the coefficients for the share of entrants en the share of exiters. Dummy 2012 drops out due to multicollinearity with 'dummy end of firm out of observed period (t)'.
Source: Own calculations using registration data from Statistics Netherlands.

Table A4.8: Regressions of growth hourly wage job-stayers and employment growth: OLS, FE and RE-specifications, 2006–2013

Dependent variable: Estimation technique:	Hourly wage OLS	Hourly wage FE	Hourly wage RE	Employment OLS	Employment FE	Employment RE
Sales growth						
Growth rate sales (t)	0.0054***	0.0034***	0.0053***	0.1124***	0.0699***	0.1036***
	(0.0008)	(0.0011)	(0.0009)	(0.0041)	(0.0046)	(0.0042)
Growth rate sales, squared (t)	0.0009	0.0000	0.0008	−0.0293***	−0.0250***	−0.0298***
	(0.0007)	(0.0010)	(0.0007)	(0.0039)	(0.0045)	(0.0039)
Contract type						
Share of open-term contracts (t−1)	−0.0023*	0.0161***	−0.0019	0.0333***	0.0606***	0.0367***
	(0.0012)	(0.0032)	(0.0013)	(0.0043)	(0.0124)	(0.0049)
Share of regular jobs (t−1)	−0.0052**	−0.0034	−0.0052**	0.0295***	0.0491	0.0271**
	(0.0024)	(0.0090)	(0.0024)	(0.0099)	(0.0455)	(0.0110)
Collective labour agreement						
CLA enterprise level (t−1)	0.0058***	0.0023	0.0062***	−0.0006	−0.0023	−0.0017
	(0.0012)	(0.0027)	(0.0013)	(0.0029)	(0.0082)	(0.0036)
CLA sector level, no extension (t−1)	−0.0016	0.0028	−0.0015	−0.0180***	−0.0011	−0.0174***
	(0.0011)	(0.0033)	(0.0011)	(0.0036)	(0.0135)	(0.0043)
CLA enterprise extended to sector level (t−1)	0.0000	−0.0020	−0.0004	0.0012	0.0041	0.0018
	(0.0006)	(0.0023)	(0.0006)	(0.0016)	(0.0075)	(0.0020)
Immigrant workers						
Share of immigrants after EU-enlargement (t−1)	−0.0260**	0.1447	−0.0296***	0.0601	0.3249	0.0713*
	(0.0116)	(0.1280)	(0.0113)	(0.0404)	(0.6631)	(0.0408)
Share of immigrants other western countries	0.0004	0.1936	0.0016	−0.1125***	−0.1411	−0.1134***
	(0.0039)	(0.1403)	(0.0042)	(0.0145)	(0.5750)	(0.0188)
Share of other non-western immigrants (t−1)	−0.0184***	−0.0032	−0.0211***	−0.0296	4.8307***	−0.0330
	(0.0056)	(0.2103)	(0.0053)	(0.0237)	(1.5205)	(0.0340)
Wage rigidity						
Indicator downward nominal wage rigidity (t)				−0.3979***	−0.2612***	−0.3709***

Table A4.8 Continued from previous page

Dependent variable:	Hourly wage	Hourly wage	Hourly wage	Employment	Employment	Employment
Estimation technique:	OLS	FE	RE	OLS	FE	RE
				(0.0457)	(0.0655)	(0.0478)
Indicator downward real wage rigidity (t)				-0.3712^{***}	-0.2573^{***}	-0.3463^{***}
				(0.0498)	(0.0742)	(0.0524)
Constant	0.0467^{***}	0.1945^{***}	0.0654^{***}	0.2953^{***}	0.0176	0.2725^{***}
	(0.0130)	(0.0347)	(0.0143)	(0.0659)	(0.1505)	(0.0701)
Observations	63,613	63,613	63,613	61,683	61,683	61,683
R-squared	0.2108			0.2618		
Number of firms		21,007	21,007		20,454	20,454

Notes: Data refer to all private sector firms with at least 25 employees, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. The table compares results using OLS, Fixed Effects (FE) and Random Effects (RE) estimations for a selection of covariates. The results of the OLS and RE-estimations are often similar. A Hausman specification test rejects that the underlying assumptions of the RE-model are satisfied. A test using an auxiliary OLS regression, which in addition includes the time-averages of all time-varying independent variables, shows that the averages of the variables are jointly significantly different from zero, therefore the RE-model is rejected. The FE-model only uses the within-variation of firms. Since my samples are confined to firm-year observations that satisfy certain restrictions regarding sales growth (positive/negative/below the Xth percentile of the sales growth distribution), the panel spells for firm observations are short. Therefore OLS-estimations are used in the main analysis.
Source: Own calculations using registration data from Statistics Netherlands.

Appendix B: Robustness checks

I have performed three robustness checks on the decomposition analysis with regard to the selections applied to the data: first, the selection of firms for which data regarding sales growth is available; second, the exclusion of firms that are subject to firm dynamics (e.g., mergers); and third, within firms, the exclusion of workers aged 18–22.

The first robustness check assesses the representativeness of the sub-sample for which sales growth data are available. The probability of being subject to the sales-survey increases with firm size. Table B4.1 indicates that the decomposition results for this sub-sample agreed with those for the full sample of firms. The first two columns describe the wage-bill decompositions for all firms with respective growing and shrinking *wage bills*. Columns 5 and 6 repeat this for the sub-sample of firms for which the change in *sales* is available. The results for the $\hat{\beta^{'}s}$ are quite similar, confirming that the selected sub-sample is representative for the entirety of private sector firms. Columns 9 and 10 show the decomposition already described in Table 4.2, with the results for the sub-sample sliced by sales growth. These results are much more mitigated, stemming from the mixture of firms with growing and declining wage bills (the categories presented in the first two sets of columns), since not all firms with decreasing sales reduce their wage bills.

The second robustness check concerns the exclusion of firm-year observations subject to firm dynamics, such as mergers. I repeat the decomposition by sales groups but now include these observations, which makes the sample about 4% larger. Table B4.2 shows that the results of decomposition are largely comparable to those in Table 4.2.

As a third robustness check, I repeat the decomposition for one year (2009–2010), now including workers aged 18–22. This age group was excluded from the data because the Dutch mandatory youth minimum wage follows a steep profile from ages 15 to 23. Since this study examines, among other things, to what extent firms adjust wages of representative stayers in response to periods of negative sales growth, the inclusion of youth workers (with their high minimum wage increases) could partly mask this adjustment. The decomposition results for this robustness check are presented in the footnote to Table A4.4). Although job flows are larger, the overall picture remains the same: wage bills are primarily adjusted through job flows, while the wage changes of stayers are only slightly lower, remaining positive when sales growth is negative.

Regarding the regresions, Table A4.8 explores Random Effects and Fixed Effects estimations, as alternatives to the OLS regressions used in the main analysis. The results are described in the note underneath this table.

Table B4.1: Decomposition of wage-bill changes 2007–2013 for different sub-samples of the data

Sample:	All firms				ΔS available				ΔS available			
	$\Delta WB \geq 0$	$\Delta WB<0$	$\hat{\beta}$		$\Delta WB \geq 0$	$\Delta WB<0$	$\hat{\beta}$		$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by:												
-net change in empl.	7.61	-18.12	-25.14	***	6.94	-16.06	-22.67	***	0.51	-7.64	-6.99	***
-hourly wage, stayers	2.69	1.21	-1.43	***	2.71	1.27	-1.39	***	2.27	1.84	-0.35	***
-hourly wage, entrants	-2.71	-1.44	1.15	***	-2.54	-1.32	1.11	***	-2.32	-1.61	0.48	***
-hourly wage, exiters	1.76	2.76	0.78	***	1.59	2.28	0.50	***	1.76	2.06	0.29	***
-hours, stayers	0.95	0.04	-0.77	***	0.91	0.13	-0.61	***	0.71	0.40	-0.17	***
-hours, non-stayers +	0.24	0.97	0.74	***	0.17	0.80	0.63	***	0.36	0.53	0.21	**
Gross wage-bill change (in %):												
-contractual	10.55	-14.57	-24.63	***	9.78	-12.90	-22.20	***	3.30	-4.42	-6.33	***
-contr+ overtime pay	10.38	-14.59	-24.54	***	9.60	-12.91	-22.10	***	3.30	-4.65	-6.61	***
-idem + inc./extra pay	10.39	-14.53	-24.74	***	9.64	-12.84	-22.32	***	3.36	-4.62	-7.11	***
# firm-year obs.	70046	54505			42909	32693			42997	32605		
# worker-year obs. (*mln)	7.5	8.0			5.5	6.7			6.7	5.5		

Notes: Data refer to all private sector firms with at least 25 employees, whereas firm-year combinations with firm dynamics (mergers etc.) are left out of the data. ΔWB = change in wage bill; ΔS = change in sales. ΔWB_2 includes contractual as well as overtime pay, ΔWB_3 includes incidental and extra wage on top of this. $\hat{\beta}$ is the estimation result for applying equation 4.5 to the wage bill and each of its its components separately. The relationship between the items of the decomposition and equation 4.4is explained in footnote 6. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

Table B4.2: Decomposition of wage-bill changes by sales growth groups, including firm dynamics

Sample:	$\Delta S \geq 0$	$\Delta S<0$	$\hat{\beta}$		P75-P100	$\hat{\beta}$		P25-P75	$\hat{\beta}$		P1-P25
Contribution to gross contractual wage-bill change by:											
-net change in empl.	3.34	-6.51	-7.55	***	3.72	-4.67	***	-1.51	-7.90	***	-10.52
-hourly wage, stayers	2.12	1.58	-0.34	***	2.42	-0.24	***	2.06	-0.33	***	1.81
-hourly wage, entrants	-2.74	-1.88	0.51	***	-2.78	0.61	***	-1.94	0.30	***	-1.52
-hourly wage, exiters	1.77	2.10	0.31	***	1.91	-0.15	*	1.59	0.72	***	2.40
-hours worked, stayers	0.81	0.48	-0.16	***	0.68	-0.03	n.s.	0.68	-0.16	***	0.26
-hours worked, non-stayers +	-0.12	0.15	0.25	***	0.17	0.12	n.s.	0.43	0.17	**	0.55
Gross wage-bill change (in %):											
-contractual	5.18	-4.06	-6.79	***	6.11	-4.34	***	1.30	-7.13	***	-7.04
-contractual + overtime pay	5.18	-4.27	-7.06	***	6.17	-4.51	***	1.21	-7.38	***	-7.34
-idem + inc./extra pay	5.22	-4.28	-7.57	***	6.20	-4.71	***	1.21	-7.65	***	-7.20
# firm-year obs.	45,151	33,294			18,753			41,357			18,335
# worker-year obs. (*mln)	7.0	5.7			2.5			7.7			2.5

Notes: Data refer to all private sector firms with at least 25 employees for which Δ sales is available; contrary to other tables, firm-year combinations with firm dynamics (mergers etc.) are included in the sample. ΔS = change in sales, P1-P25, P25-P75 and P75-P100 are subsamples of firms based on the yearly percentile distribution of the change in sales. ΔWB_2 includes contractual as well as overtime pay, ΔWB_3 includes incidental and extra wage on top of this. $\hat{\beta}$ is the estimation result for equation 4.5, applied to the wage bill and each of its its components separately: column 3 refers to $\Delta S<0$ compared to $\Delta S \geq 0$; column 6 to P25-P75 compared to P75-P100; column 9 refers to P1-P25 compared to P25-P75. The relationship between the items of the decomposition and equation 4.4is explained in footnote 6. Standard errors in parentheses. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%.

Source: Own calculations using registration data from Statistics Netherlands

Table B4.3: Descriptive statistics for the variables used in the regressions and in Figure 1

Sample - sales growth rate: Statistic:	Full Mean	Full SD	Full P25	Full P50	Full P75	dS< P50 Mean	dS< P25 Mean	dS< P10 Mean
Dependent variables/variables Figure 1								
growth rate sales	0.021	0.306	−0.081	0.022	0.125	−0.167	−0.297	−0.515
growth rate contractual wage bill	0.001	0.179	−0.054	0.016	0.081	−0.040	−0.071	−0.112
idem. incl. overtime, incidental and extra pay	0.001	0.191	−0.061	0.015	0.086	−0.042	−0.074	−0.115
growth contractual hourly wage	0.030	0.062	0.008	0.031	0.056	0.028	0.027	0.027
employment growth	−0.026	0.182	−0.078	0	0.054	−0.066	−0.098	−0.140
job exit rate	0.180	0.181	0.078	0.129	0.213	0.196	0.225	0.269
job entry rate	0.155	0.157	0.054	0.115	0.203	0.131	0.127	0.129
Explanatory variables regressions								
type of job								
share of open-term contracts (t−1)	0.792	0.246	0.724	0.877	0.965	0.792	0.791	0.780
share of regular jobs (t−1)	0.944	0.178	0.973	1	1	0.942	0.938	0.935
share of full-time jobs (t−1)	0.757	0.200	0.667	0.825	0.900	0.753	0.770	0.776
share of jobs hired from TWA's (t−1)	0.083	1.424	0	0.033	0.083	0.074	0.074	0.076
share of hired self-employed (t−1)	0.033	0.482	0	0	0.015	0.032	0.037	0.036
collective labour agreement								
CLA enterprise level (t−1)	0.369	0.483	0	0	1	0.368	0.367	0.382
CLA sector level. no extension (t−1)	0.063	0.242	0	0	0	0.056	0.052	0.048
CLA enterprise extended to sector level (t−1)	0.080	0.272	0	0	0	0.086	0.090	0.090
ref. group: no collective labour agreement (CLA)	0.477	0.499	0	0	1	0.480	0.481	0.471
CLA unknown (t−1)	0.011	0.104	0	0	0	0.009	0.010	0.010
composition of the labour force								
share of male workers (t−1)	0.727	0.223	0.606	0.802	0.898	0.723	0.744	0.753
share of workers aged 23-35 (t−1)	0.344	0.170	0.221	0.314	0.439	0.331	0.331	0.338
share of workers aged 51-65 (t−1)	0.208	0.122	0.117	0.200	0.285	0.217	0.219	0.216
share of jobs tenure over 10 years (t−1)	0.292	0.216	0.100	0.283	0.455	0.308	0.305	0.287
share of immigrants western countries	0.145	0.117	0.068	0.120	0.190	0.145	0.148	0.155
share of immigrants after EU-enlargement (t−1)	0.010	0.056	0	0	0.001	0.009	0.010	0.011

Table B4.3 Continued from previous page

Sample - sales growth rate: Statistic:	Full Mean	Full SD	Full P25	Full P50	Full P75	dS< P50 Mean	dS< P25 Mean	dS< P10 Mean
share of other non-western immigrants (t−1)	0.032	0.062	0	0.016	0.038	0.031	0.032	0.034
predicted share western countries	0.114	0.120	0.027	0.087	0.162	0.112	0.115	0.116
predicted share EU-enlargement (t−1)	0.006	0.039	0	0	0	0.005	0.006	0.006
predicted share non-western (t−1)	0.025	0.058	0	0	0.029	0.023	0.024	0.024
training. education and contractual wage								
ratio training expenditures firm / sales (t−1)	0.006	0.010	0	0.004	0.008	0.006	0.006	0.006
share low educated workers (t−1)	0.277	0.233	0.070	0.238	0.433	0.274	0.267	0.257
share medium educated workers (t−1)	0.492	0.215	0.339	0.494	0.642	0.496	0.495	0.491
share high educated workers (t−1)	0.230	0.236	0.048	0.146	0.342	0.230	0.237	0.253
share workers with low wage (t−1)	0.256	0.253	0.052	0.163	0.400	0.256	0.234	0.219
share workers with medium wage (t−1)	0.539	0.207	0.400	0.566	0.697	0.540	0.552	0.551
share workers with high wage (t−1)	0.205	0.184	0.071	0.152	0.281	0.204	0.215	0.230
average hourly wage of the firm (t−1)	17.200	4.503	14.126	16.664	19.512	17.437	17.759	18.152
std. dev.of hourly wage in the firm (t−1)	6.738	3.134	4.519	6.261	8.360	6.849	6.962	7.113
state of business								
growth rate sales. squared (t)	0.094	0.368	0.002	0.011	0.045	0.093	0.181	0.409
growth rate sales (t−1)	0.034	0.241	−0.020	0.034	0.085	0.035	0.036	0.047
dummy business result (t−1) ≥ 0	0.811	0.391	1	1	1	0.798	0.767	0.745
ref. group: continuing firm (t)	0.188	0.391	0	0	0	0.172	0.183	0.194
dummy firm ceases to exits next year (t)	0.050	0.218	0	0	0	0.060	0.067	0.082
dummy end of firm out of observed period (t)	0.762	0.426	1	1	1	0.768	0.750	0.724
share of workers subject to part-time UB (t−1)	0.009	0.047	0	0.009	0.009	0.008	0.009	0.009
other firm characteristics								
indicator downward nominal wage rigidity (t)	0.189	0.141	0.103	0.153	0.224	0.208	0.211	0.210
indicator downward real wage rigidity (t)	0.747	0.138	0.700	0.767	0.834	0.720	0.718	0.720
indicator no downward wage rigidity (t)	0.065	0.033	0.040	0.062	0.087	0.072	0.071	0.070
wage decrease below range indicator (t)	0.012	0.032	0	0	0.016	0.013	0.013	0.015
wage decrease above range indicator (t)	0.155	0.141	0.063	0.122	0.206	0.137	0.134	0.138
other firm characteristics								
low share of incidental wage (t−1)	0.181	0.385	0	0	0	0.184	0.184	0.189

Table B4.3 Continued from previous page

Sample - sales growth rate:	Full	Full	Full	Full	Full	dS< P50	dS< P25	dS< P10
Statistic:	Mean	SD	P25	P50	P75	Mean	Mean	Mean
intermediate share of incidental wage (t−1)	0.572	0.495	0	1	1	0.586	0.588	0.591
high share of incidental wage (t−1)	0.247	0.431	0	0	0	0.230	0.229	0.219
ref. group: firm size 25 - 99 workers (t−1)	0.705	0.456	0	1	1	0.699	0.731	0.764
firm size 100 - 500 workers (t−1)	0.249	0.433	0	0	0	0.252	0.233	0.208
firm size $\geq$ 500 workers (t−1)	0.045	0.208	0	0	0	0.049	0.037	0.029
# establishments 1 (t−1)	0.614	0.487	0	1	1	0.591	0.609	0.630
# establishments 2 - 50 (t−1)	0.376	0.484	0	0	1	0.397	0.383	0.364
high # establishments $\geq$ 50 (t−1)	0.011	0.103	0	0	0	0.012	0.008	0.006
Dutch ownership (t−1)	0.472	0.499	0	0	1	0.551	0.553	0.552
UK/US ownership (t−1)	0.043	0.203	0	0	0	0.054	0.055	0.058
foreign ownership. no UK/US (t−1)	0.329	0.470	0	0	1	0.391	0.389	0.388
ownership unknown (t−1)	0.156	0.362	0	0	0	0.004	0.004	0.002
non-exporting firm (t−1)	0.090	0.286	0	0	0	0.091	0.092	0.102
exporting firm (t−1)	0.124	0.329	0	0	0	0.124	0.117	0.114
export unknown (t−1)	0.787	0.410	1	1	1	0.785	0.791	0.785
sectors of economic activity and years								
mineral extraction sector (t)	0.001	0.026	0	0	0	0.001	0	0
manufacturing sector (t)	0.002	0.039	0	0	0	0.002	0.002	0.001
energy and water sector (t)	0.299	0.458	0	0	1	0.293	0.307	0.303
construction sector (t)	0.087	0.281	0	0	0	0.087	0.112	0.132
goods trade sector (t)	0.263	0.440	0	0	1	0.273	0.239	0.208
horeca sector (t)	0.022	0.147	0	0	0	0.024	0.015	0.011
transport and communication sector (t)	0.093	0.291	0	0	0	0.086	0.074	0.070
business services sector (t)	0.233	0.423	0	0	0	0.233	0.252	0.276

Notes: Data refer to all private sector firms with at least 25 employees for which Δsales is available and no firm dynamics (mergers etc.). dS = sales growth rate, dS<$P50$, dS<$P25$ and dS<$P10$ are subsamples of firms based on the yearly percentile distribution of the change in sales. The statistics presented are the mean and standard error (sd) as well as the value of the variable at the 25th, 50th (the median) and the 75th percentile of its distribution.

Source: Own calculations using registration data from Statistics Netherlands

Appendix C: Creation of the dataset and description of variables

Creation of the dataset and applied selections

Yearly linked-employer–employee datasets (LEED) have been created by merging job data from the Social Statistical Datasets (SSD) with data on workers' characteristics from municipal registrations (GBA) and firm data, made available by Statistics Netherlands. The SSD (Bakker et al. (2014)) contain wages, hours worked and other job characteristics for all jobs in the Netherlands. Firm-level data, typically survey data, are often only available for a subset of firms. Firm-level variables from the Production Statistics data files, as sales, are available only for relatively large firms in the industrial, commercial services, retail trade, wholesale trade, construction and transport sector. Data on workers' attained level of education are available for only about two-thirds of workers. I use these data (applying the corresponding weights) to calculate the share of low, medium and highly educated workers at each firm.

The data are confined to jobs existing on October 1, since October is considered by Statistics Netherlands to be a representative month. Hourly contractual wages were derived based on gross contractual wages and contractual working hours. The contractual wage is the base wage as agreed in the labour contract, which in many cases increases according to pay scales stated in the collective labour agreement. Besides the contractual wages and hours, overtime hours and -payments are available in the data, as well as incidental wages (such as bonuses) and extra wages (agreed upon in the labour contract, collectively or individually). Holiday allowances—there is a legal requirement to pay holiday allowances of 8% of gross salary with some CLAs agreeing to a higher percentage—are included in these extra wages.

The job-level datasets have been combined pairwise to two-year datasets (2006–2007; 2007–2008, etc.), while firm-level variables, such as the number of stayers, entrants and exiters and the average contractual wage and hours worked per group (i.e., stayers, entrants, exiters) were generated before creating firm-level datasets. Wage-bill growth was then decomposed for each firm that existed in both years. In cases of firm dynamics (mergers, split-ups, etc.) firms' ID number may change from year to year. However, the data allow a firm's predecessor to be identified, in which case the observations for old and new ID numbers were treated as one firm. For entrant workers in enterprises characterised by firm dynamics, the predecessor firm is unknown, however; in those cases I have assigned entrants to the firm and sector that is the most frequent predecessor among the stayers in that particular firm.

The applied selections are best illustrated by closely examining a particular two-year dataset. The initial LEED set for 2010–2011, for example, contained

13.3 million jobs. After removing 0.4 million observations for which the contractual wage, the contractual hours worked or the hourly wage were very high or low[22] and after removing 0.2 million observations of (generally very small) firms with zero stayers, 12.7 million observations remained: (6.3 million for 2010 and 6.4 million for 2011). Jobs in the (semi-)public sector (about 40%) were excluded, as were jobs in firms that did not exist in both years (fewer than 2%). Converted to the firm-level, a dataset for 2011 was obtained with over 250,000 observations, containing wage-bill growth for 2010–2011 and its decomposed items. Putting the years together, the resulting 2007–2013 dataset comprised 1.94 million firm-year observations, out of which 1.80 million were not subject to firm-dynamics. Small firms comprise a large share of the latter dataset: only about 125,000 firms have 25 workers or more. For 75,602 of these observations, sales data are available for the two subsequent years (42,997 firm-year observations feature zero or increasing sales and 32.605 feature decreasing sales, see Table 4.2). A robustness check explores how similar are the decomposition results of firms for which sales growth data are available to those of all larger firms.

Description of variables

In the dataset used for the regression analyses, the explanatory variables typically refer to (t−1) to address possible problems of reverse causality. Various covariates, such as variables regarding the level of workers' level of education, have some missing observations. I address this by imputing missing covariate data with their means in the particular year and by creating dummy variables that indicate whether a firm has a missing observation for that particular variable in that particular year. In this way, I include as many observations as possible in my regressions. Wherever relevant, the dummy-variables have been included in the regressions.

Some of the explanatory variables used in the regressions might require clarification. Open-term contracts are defined as agreements for an indefinite period of time, in contrast to fixed-term employment contracts which lasts for a specified period. The term 'regular jobs' refers to all jobs except for on-call workers, workers for temporary work agencies, workers under the Sheltered Employment Act ('WSW'), interns and directors/main shareholders. Full-time jobs are defined as those with at least 35 working hours each week. Migrant workers have at least one parent born outside the Netherlands or were born abroad themselves. The level of education is categorised as

[22] I excluded observations for which the contractual monthly wage was (thresholds 2008) below € 24 or above € 25,000, the contractual hours worked per month below 8 or above 250 hours or for which the calculated hourly wage was below € 3 or above € 100

'low' if the highest-attained level is primary school or pre-vocational secondary education ('VMBO'); as 'medium' in cases of senior general secondary education ('HAVO'), pre-university education ('VWO') or vocational secondary education ('MBO'); and as 'high' if a degree from a university of applied sciences ('HBO') or university ('WO') is obtained. Wage levels were classified as 'low' if the gross monthly wage is below the modal wage (€ 2315 in 2006), as 'medium' when between modal and 2*modal; and as 'high' if the gross wage exceeds 2*modal. Firms are classified as continuing if they still exist in the following year and as ceasing to exist if they do not. Firms that still exist in 2013 fall into the category, 'end of firm out of observed period'. The share of workers subject to part-time UB reflects the extent to which a firm used the temporary (April 2009–July 2011) facility for part-time unemployment benefits. Firms meeting the requirements to participate in this facility could reduce the working hours of (some of) their employees by at most 50%, while these workers received UB for their reduced hours. The variable 'share of incidental wage' is based on a ranking of firms according to the share of workers receiving incidental wage. It is classified as 'low' if the firm belongs to the lowest 25%, 'medium' for percentiles 25–75, and as 'high' for firms that are in the top 25% of this distribution.

Immigrants are defined as workers who have at least one parent born outside the Netherlands. I distinguish three groups of immigrants: (1) immigrants from EU-enlargement countries, who originated from a country that entered the EU in 2004 or 2007 and who have been immigrating into the Netherlands in or after the year the country joined the EU; (2) other western immigrants, originating from western countries, except for those countries covered in Group 1, or Morocco, Turkey, the Republic of Suriname and the Netherlands Antilles; and (3) other, non-western immigrants. The group of native workers serves as a reference in the regressions.

To address possible endogeneity (i.e., firms that intend to reduce wages or increase job turnover could hire more migrant workers) I applied an instrumental variables (IV) approach. The instrument comprises the predicted shares of each type of immigrants in a firm. Following the approach proposed by D. Card (Altonji and Card (1991) and Card (2001)), I calculate the predicted share of foreigners in a certain geographical location in a certain year based on the distribution of foreigners across these locations in the previous year and the total net flows of foreigners since. The rationale behind the instrument is that foreigners from a certain origin tend to locate in the same location because of already-existing social networks. For this prediction, I use a version of the 'shift-share' instrument, in the sense that I depart from the actual share of immigrant workers in a firm in the base year, with the predicted stock of

immigrants developing according to changes in the stock of immigrant citizens aged 23 to 65 located in the geographical area (the statistical agency distinguishes 40 so called 'COROP-regions') in which the firm resides. 2006 is used as a base year, unless the firm formed after 2006, in which case the founding year is taken as the base year. So, instead of using the actual changes in the share of migrant workers in the firm, I use as an instrument the changes in the share of migrant citizens in the area in which the firm is located.

Finally, I include indicators for nominal and real downward wage rigidity as explanatory variables in the regression in order to analyse the relationship between downward wage rigidity and employment growth. In the literature, a worker is considered subject to wage rigidity if he or she receives a real or nominal wage freeze during a period where he or she would have received a wage change below a certain threshold if wages would have been fully flexible. For nominal rigidity, this threshold is equal to zero, whereas for real downward wage rigidity, the threshold is the inflation expectation. Several methods for measuring wage rigidity are based on comparing the actual wage-growth distribution with a symmetric, so-called notional (theoretical) wage-growth distribution. In this study, I use the Maximum Likelihood method described by Goette et al. (2007), which controls for measurement error and endogenously estimates the inflation expectation. This method calculates for each job-year combination the probability of being subject to downward nominal wage rigidity, real wage rigidity or no wage rigidity. Wage changes are assumed to be generated according to a linear combination of covariates and a normally distributed error term. I use gender, age, company size and dummy variables for part-time employment, year and sector as covariates. The method was applied to the monthly wages of stayers whose wage growth was between -35% and 60% and who worked at least 12 hours a week as a regular worker (excluding interns, on-call workers, etc.). See Deelen and Verbeek (2015) for a description of these methods and their application to Dutch data. The firm-level indicators used in the regressions are averages of the indicators by jobs per firm, per year. For observations outside the applied selections, the indicators are missing values. Since the three indicators sum to 1, the indicator 'not subject to wage rigidity' serves as a reference group in the regressions. Two respective variables are included in the regressions regarding the shares of workers in the firm for which no wage rigidity indicator was calculated due to growth in monthly wages below -35% or above 60%.

Conclusions

This thesis comprises four applied micro-econometric studies on wages and employment in the Netherlands. The various investigated aspects can be summarised using the metaphor that the labour market resembles a game of 'Snakes and Ladders'. Chapter 1 and 2 studied the steepness of Dutch 'wage-ladders', while chapter 3 analysed the consequences of encountering a 'snake'—in this case, displacement due to firm bankruptcy—for various groups of workers. Chapter 4 considered both the 'ladders' and the 'snakes', studying how firms react to declining demand: do they predominantly reduce employment, or do they also adjust wages?

The ageing of the Dutch labour force and the ensuing policy targets to keep older workers in the work force urge us towards a better understanding of the determinants of older workers' labour-market position. Given the relatively rigid labour market for older workers in the Netherlands, the relation between older workers' steep wage-tenure profiles and their low job-to-job mobility is particularly important in this respect. To explore the factors behind the relatively high wages and low employment rates of older workers after displacement, older and prime-aged displaced workers are examined, mapping out their sensitivity to, for example, moving to a different sector of economic activity.

The first chapter presents evidence that the returns to tenure in the Netherlands are high relative to other countries. This suggests that it is not very attractive for older workers to switch jobs, since their higher wages are partly related to firm- or sector-specific elements which are lost through job mobility. Furthermore, workers' seniority positions apparently increase wages to a certain extent, which may be related to labour-market institutions that protect senior workers relative strongly. Finally, the results suggest that firms in industries with high returns to tenure employ relatively high shares of older workers and workers with high average tenures, indicating that the low job-to-job mobility of older workers and steep wage-tenure profiles are two sides of the same coin.

The second chapter finds evidence that a wage cushion contributes to the steepness of the age-wage profile in the private sector. The results suggest that the collective wage-scales themselves cannot be a major cause of wages continued increase at older ages; only wages exceeding the highest wage-scale ceilings contribute to the steepness of the wage profile over potential experience. This wage cushion allows for wage differentiation between and within age groups, but it remains uncertain to what degree this wage differentiation allows for heterogeneity across sectors and/or firms.

The third chapter identifies that labour-market outcomes after displacement are highly contingent on age, especially in terms of employment probabilities. Prospects for older displaced workers are more adverse in cases of long tenure in the lost job, displacement from a declining local labour market or reemployment in a different sector. For example, older displaced workers who find new employment in a different sector of economic activity than the one from which they were displaced suffer wage losses that are almost 10 percentage points larger than those who find work in the same industry. This also holds for prime-age workers, but to a much lesser extent. The results suggest that job- and sector- specific factors are important to understanding the fact that displacement affects older workers more negatively than prime-age workers.

Theoretically, delayed compensation schemes, strong bargaining positions of well-protected older workers and accumulated firm- and sector-specific human capital are possible reasons for steep profiles of wages over tenure. High labour costs due to these factors of in older workers' jobs prior to displacement may be responsible for their poor outcomes after displacement. Moreover, special provisions for older workers in collective bargaining schemes may reduce their hiring probability. On the other hand, supply side arguments may also partly explain the more severe outcomes of older workers after displacement. Older workers often have more options to retire from the labour market and have longer benefit entitlements, leading to higher reservation wages that come down more slowly.

Empirically, the data do not allow all possible determinants of steep wage-tenure profiles and the adverse position of older workers after displacement to be pinned down. For example, investments in firm-specific human capital and the importance of deferred payment schemes are difficult to identify, since individual productivity is unobservable. Nevertheless, the results give some indications.

Since there is no reason to assume that investments in specific human capital are much higher in the Netherlands than in other western countries, these are unlikely explanations for the high returns to tenure from an interna-

tional perspective. Empirical evidence also suggests that productivity remains stable, at best, at older ages. Still, this study establishes that switching to another sector of economic activity after displacement has a larger negative effect on the wages of older workers (aged 45–54) than on those of prime-age workers (aged 35–44), which points to the importance of firm- and industry-specific capital lost upon displacement. On the other hand, older workers' human capital may be more frequently obsolete because they are concentrated in shrinking occupations; the result that older workers have a larger loss in employment probability after displacement from a declining sector supports this notion.

Deferred compensation schemes may be another part of the explanation. Firms may use such schemes as an incentive for employees to remain at the firm, thereby lengthening the period over which firms can reap the rewards of investments in human capital. Moreover, such schemes can be used as a motivational tool, especially if individual output is difficult to observe. I find that collective wage-scale systems are important guidelines for remuneration in most sectors and that the cushion for wages above the highest wage-scale ceiling in part explains steep wage-tenure profiles. Also, industries employing high shares of older and long-tenured workers tend to have high returns to tenure. Both findings are compatible with the motivation argument.

On the other hand, high returns to tenure may just as well point at the increased bargaining power of older workers, induced by employment protections that increase over tenure. The established positive correlation between the seniority position of workers within a firm and their wage supports this argument.

To summarise these results, job- and sector-specific factors are important to understanding steep wage-tenure profiles and the more vulnerable position of older workers after job losses. Job- and sector-specific factors encompass not only specific human capital, but also tenure-related employment protection and compensation schemes.

A relevant question is the extent to which this is sub-optimal. Wages that continue to increase at older ages may result from optimal firm behaviour, for example if they are caused by firm-specific investments in human capital that are accompanied by deferred compensation schemes. Strong bargaining positions of older workers may, however, lead to a wage-productivity gap at older ages, negatively affecting older workers' job mobility. This can harm labour-market efficiency by preventing the optimal allocation of workers across jobs. Moreover, although theoretically 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 an ageing workforce, the

mechanisms favouring wage-tenure profiles come under increasing pressure. As the period of employment at older age lengthens, workers' knowledge risks becoming obsolete, and the employment share of young workers decreases.

Chapter 4 examined the role played by wages when firms have to adjust to falling sales. The results show that when firms face declining sales, employment reduction is by far the most important channel to contract wage bills. A striking result is that the contractual wage growth of stayers is only somewhat lower at firms hit by adverse sales shocks (even if sales decline over several years) compared to firms with increasing sales, and wage growth remains positive on average. Employment reduction contributes about 20 times more to reduced wage bills than wage reduction of stayers does. Over the years, however, stayers' wage growth has decelerated across the board. Employment losses do not hit a random group of workers; I find after a severe negative shock in sales, employment losses are larger at firms with higher percentages of immigrants, short-tenured workers, temporary contracts, non-regular job types and part-time jobs. Moreover, there is evidence for a significant negative relationship between firms' degree of downward wage rigidity and their employment growth, suggesting that if wages were more downwardly flexible, job losses would be significantly lower after adverse shocks. All in all, these findings illustrate a segmented labour market, where employment adjustment on the one hand predominantly affects workers with relatively weak labour-market positions, while workers who stay are assured of wage increases notwithstanding any sales shocks suffered by the firm.

This limited responsiveness of wages to sales shocks matches the suggestion of the first three chapters that firms perceive wage growth as an important instrument to motivate workers. For the same reason, employers are generally opposed to 'demotion' (reduced rank and salary) for older workers. Paradoxically, although demotion is very uncommon within firms, once displaced, the labour-market clearly forces older workers to adjust to a lower wage level. The fact that the wage growth of stayers has decelerated across the board may point to a high level of coordination: the outcomes of the consultations of the Dutch social partners serve as important guidelines for wage bargaining at enterprise and sector level. One merit of this model of 'controlled decentralisation' is that wage increases of stayers are moderate and predictable and labour-market unrest is avoided, but the model may limit wage flexibility.

To conclude in terms of the metaphor of the 'Snakes and Ladders' game, this thesis has found evidence for rather steep 'wage-ladders' over tenure. The ladders remain standing throughout any storm, as wage growth is relatively irresponsive to declining firm sales and is merely reduced across the board over the course of years. The trade-off for this situation is that encountering

a 'snake' of job loss has large consequences: particularly for older workers, employment probabilities after displacement are relatively low and wage drops are large, especially for those with strong firm and sector ties. Moreover, 'the dice are loaded': there is no level playing field, with the probability of job loss strongly depending on the type of job-contract, tenure and other characteristics of workers and firms.

Firms and workers plausibly optimise their behaviour given the conditions provided by trends and institutions; therefore, it is important to learn more about the impact of labour-market institutions and their interactions on labour market outcomes. Wage-formation institutions, employment-protection legislation, active labour-market policies and, for example, special provisions for older workers all impact the outcomes for firms and workers. Since adjustment currently runs primarily through employment adjustment, more knowledge regarding the effectiveness of various types of active labour-market policy is needed. And, although employment-protection legislation is justifiable to curb the externalities of displacement, its design requires precision: discouraging voluntary job-to-job mobility or to induce rent-seeking behaviour is sub-optimal. Determining the impacts of Dutch wage-formation institutions and employment-protection legislation is therefore an important challenge for future research.

Summary

Chapter 1 of this dissertation, titled 'Wage-tenure profiles and mobility', investigates the role of wage-tenure profiles in explaining patterns of job mobility using the Dutch Social Statistical Database for the years 1999–2005. The Dutch labour market is characterized by low job mobility for older workers and high average duration of unemployment for older jobseekers, features that might be interrelated and make this investigation especially relevant. The study provides a set of estimated wage-tenure profiles, and international comparison shows that wage-tenure profiles in the Netherlands are relatively steep.

The chapter focuses on the impact of tenure (the duration of a match between a worker and the firm for which he works) on wages, as opposed to the impact of the workers' total (potential) labour market experience. Returns to tenure are generally interpreted as the firm-related component of wages. They may, for example, reflect returns on firm-specific human capital or deferred compensation schemes, with senior employees remunerated above their marginal productivity. A drawback of firm-related wage components is that they may act as impediments to job-mobility, because if the worker moves to another firm, he or she will no longer receive these components.

The measurement and interpretation of wage-tenure profiles is not without debate in the economic literature. There are several approaches to estimating the returns to tenure, each aiming to address the problem of endogeneity of tenure in the wage equation in order to prevent biased estimates. The problem of endogeneity arises because tenure is not a fully exogenous explanatory variable of wages, since unobserved individual and match-specific characteristics determine both wage level and tenure. In other words, highly productive individuals tend to experience fewer quits and layoffs, and high-quality matches tend to survive longer. Unbiased estimates of the cumulative effect of tenure can be interpreted as an estimate of what a typical worker would lose in terms of wage if his job were to end exogenously.

Although the approaches of Altonji and Shakotko (1987) and Topel (1991) are likely to produce somewhat biased estimates, I apply them to ensure sound

international comparison. Next, I analyse the effect of workers' seniority position (relative to that of their colleagues in the same firm and conditional on tenure and experience) on wages. The underlying idea is that workers with higher seniority positions may have stronger wage bargaining positions, because they derive more protection from being displaced due to last-in, first-out layoff rules. Finally, I investigate—at the sector level—the correlation between high returns to tenure and older workers' job mobility.

Three main results are obtained. First, Dutch wage-tenure profiles are steep compared to those of other countries, strongly suggesting that wage growth is partly related to firm-specific elements, that are lost in cases of job mobility. Second, estimates show that relative seniority position raises wages: conditional on overall experience in the labour market and tenure, real wages are three-to-four percent higher when comparing the most senior worker with a recently hired worker. However, this effect is modest from an international perspective. Third, I find a significant correlation between high returns to tenure and low mobility: a sector with higher returns to tenure has a higher share of older workers who have longer average tenure. These findings suggest that the low job mobility of older workers and steep wage-tenure profiles are, to some extent, two sides of the same coin.

Chapter 2, titled 'Do wages continue increasing at older ages? Evidence on the wage cushion in the Netherlands' (with Rob Euwals), investigates the anatomy of older workers' wages. The steep wage-tenure profiles established in the first chapter raise the question of how these profiles occur with wages largely determined by collective-bargaining agreements. After all, once workers have reached the top of their maximum wage-scale, one would expect their wage profiles to be rather flat, as wage negotiations and collective labour agreements generally take the wage system as given. Hence, in a system of collectively bargained wage-scales, it is not evident that wages should increase with experience or tenure at older ages, unless a wage cushion plays an important role.

The central research question of this chapter is whether the wage cushion—that is the difference between actual wages and collectively agreed (maximum) contractual wages—contributes to the fact that wages continue to increase at older ages. This wage cushion comprises two parts: (1) extra and incidental wages paid in addition to the contractual wage; and (2) contractual wages exceeding the ceiling of the highest wage-scale as stipulated in the collective labour agreements.

Wages of individual male workers in twenty-two sectors in the Netherlands are followed from 2006 to 2010. Administrative data are merged with wage-

scale data collected from collective labour agreements (CLAs), such as the number of wage-scales, the minimum and maximum wages per scale and the number of spinal points (the wage levels associated with standard increments along a wage-scale). Combining actual wages with wage-scale data enables analysing the effect of the wage-scale system on actual wages.

Indicators are developed for (1) the 'likelihood' of receiving a contractual wage *equal* to the ceiling of one of the wage-scales of the sector's wage-scale system; and (2) the likelihood of receiving a contractual wage *exceeding* the ceiling of the highest wage-scale. These indicators are used to answer a number of empirical questions to unravel the puzzle of wages that continue to increase at older ages:

- Does the likelihood of being at a wage ceiling continue to increase at older ages? Or, alternatively, does the likelihood of receiving a contractual wage above the highest wage ceiling continue to increase at older ages?

- Do workers receiving a contractual wage equal to a wage ceiling receive more in additional wages?

- Do workers receiving a contractual wage above the highest wage ceiling experience more contractual wage growth?

The results are different for the public and private sectors. For the public sector, no evidence is found of a wage cushion. First, the likelihood of a contractual wage equal to a wage-scale ceiling increases with age, whereas wages exceeding the highest wage-scale ceiling are very rare, with the wage-scale system including all types of managerial jobs. Second, workers earning a contractual wage equal to one of the wage-scale ceilings receive less in additional wages than workers who have not yet reached a wage ceiling. Apparently, in the public sector, additional wages are not used to motivate workers who find themselves at the ceiling of their respective wage-scales.

In the private sector, however, evidence is found for a wage cushion, leading to wages that continue to increase at older ages. First, the likelihood of a contractual wage that exceeds the highest wage-scale ceiling increases with age. Since wage-scale systems in the private sector do not seem to include all types of higher and better paid (i.e., managerial) jobs, ceilings are often not restrictive; wages above the highest ceiling are rather common. Second, workers earning a contractual wage above the highest ceiling receive both higher contractual wage growth and a larger amount of additional pay, compared to other workers. The growth in their additional wages is lower, however, possibly because there is less need to use additional wages since contractual wages can be set rather freely.

Re-estimating wage profiles to now include information on individual's positions with respect to the wage-scale system shows that wages exceeding the highest wage-scale ceiling contribute to the steepness of the wage profile over potential experience. So, in the private sector, the wage cushion enhances wage differentiation, and wages above the highest wage-scale ceiling contribute to the steepness of the age-wage profile. Although more research is needed to determine what exactly causes wages to continue increasing at older ages, the empirical evidence at least suggests that the collective wage-scale systems cannot be a major cause. Wage cushions seem to allow for wages to be differentiated between and within age groups, but it remains uncertain to what degree this wage differentiation allows for heterogeneity across sectors and/or firms.

Chapter 3, 'Labour market effects of job displacement for prime-age and older workers' (with Marloes de Graaf-Zijl and Wiljan van den Berge), analyses the effect of job separations related to firm bankruptcies on the employment probabilities and wages of the workers involved.

Displacement may place the burden of economic adjustments on an unfortunate minority of workers. Especially for older workers, finding new employment after displacement appears to be challenging. The labour-market position of older displaced workers has specific policy interest due to the ageing Dutch population and the resulting policy targets to keep older workers in the work force. This chapter investigates to what extent the impact of firm bankruptcy differs between older and prime-age workers, studying how these differences correlate with three factors: (1) long tenures in a job prior to displacement; (2) obtaining reemployment in a different industry and (3) local labour-market conditions in the industry from which workers are displaced.

Displacements due to firm bankruptcy are considered a random sample, because workers so leaving jobs are neither switching jobs voluntarily nor are they selected for dismissal by the firm. The effects will therefore at least partly reflect the impact of the loss of firm- and sector-specific factors. This chapter focusses on comparing the effects in terms of the job opportunities and earnings for older (45–54) and prime-age (35–44) workers.

A difference-in-difference approach is combined with exact matching, using extensive, administrative linked employer–employee data for the Netherlands that includes all workers, combined with data on firm bankruptcies also drawn from an administrative source. The sample comprises nearly 45,000 workers who were displaced due to firm closures between 2000 and 2009; workers can be followed through 2011. A control group of about 158,000 workers not displaced due to bankruptcy was constructed using exact-matching techniques, so that

treated and control groups have comparable observable characteristics.

The results indicate that labour-market outcomes after displacement are highly contingent on age, especially in terms of employment probabilities. Three possible factors behind the different results by age group (long tenures before displacement, the local labour-market situation in the industry from which workers are displaced and the transition to another sector of economic activity) all partly explain the stronger impact of displacement on older workers. Our results suggest that job- and sector-specific factors are important for understanding the more vulnerable position older workers face after job losses.

Older workers not only have longer tenures but are also impacted more severely by displacement after a long-tenured prior job; for prime-age workers, the tenure before displacement is less decisive for their outcomes after displacement. For older workers, longer tenures are accompanied by an extra reduction in employment probability of 2 to 3 percentage points, compared to prime-age workers of the same tenure. Regarding wages, longer tenures are associated with larger wage drops after displacement, both for older and prime-age workers. Older workers displaced from a declining local labour-market experience a stronger loss by 3.5 percentage points in their employment probability in the first year compared to workers displaced from a stable or growing industry. This difference declines to 1.7 percentage point in the third year and disappears over the longer run. The adverse impact is concentrated among older workers, since the impact for prime age workers is small and mostly insignificant. There are no clear differences between age groups regarding wages.

Older displaced workers who find new employment in a different industry than that from which they were displaced suffer wage losses that are 8 to 9 percentage points larger than those who find work in the same industry. This also holds for prime-age workers, but to a much lesser extent. Theoretically, the more severe outcomes of older workers after displacement can be explained by their relatively high labour costs resulting from delayed compensation schemes, stronger bargaining position of well-protected older workers or costly special provisions for older workers in collective- bargaining schemes. Alternatively, the wage-to-productivity ratio may be higher for displaced older workers due to firm-specific, industry-specific or task-specific human capital, that is lost upon displacement, especially after long job tenure and when switching industries. Also, the wage-to-productivity ratio might be higher due to declining productivity with age. On the other hand, supply side factors may play a role: older workers have longer benefit entitlements, causing higher reservation wages, and they often have more options to retire from the labour-market. The results confirm the importance of job tenure and switching industries, which may point to a loss of firm- and industry-specific capital. However, a substantial

part of the difference between age groups remains after controlling for these factors, suggesting that other, yet-unexplored factors also play an important role.

Chapter 4, titled 'Flexible wages or flexible workers? A decomposition of wage bill adjustment by Dutch firms, 2006–2013', investigates to what extent firms adjust wages and employment in periods of adverse economic circumstances, exploring the determinants of these adjustments. If wages' downward flexibility is limited, induced either by institutions or because employers fear harming workers' motivation and productivity, employment reduction in response to adverse shocks is expected to be relatively large. The adjustments of wages and job flows are studied simultaneously at the firm level, using an extensive, administrative linked employer–employee panel dataset for the Netherlands. The analysis includes firms with 25 or more workers for which the year-to-year change in sales is available, comprising more than 75,000 firm-year observations, based on 12.3 million job-year observations.

The study has two parts: (1) decomposition and (2) regression analysis. In the first part, changes in the contractual wage bills of firms are decomposed into items related to price (hourly wages) and volume (hours worked, number of jobs), distinguishing between stayers and workers entering and exiting the firm. I also considered overtime pay and incidental wages. I analyse the impact of adverse sales shocks of various sizes on this decomposition by estimating the asymmetry in the responses by firms to falling or growing sales. The decompositions are examined through various variables, such as sales growth (by group) and the share of open-term contracts. The results of these decompositions are accompanied by additional detailed information regarding job flows, wages and hours worked by groups of workers and types of contract.

The decomposition-analysis discloses how firms choose their mix of wage mitigation and employment reduction in response to adverse sales growth. One limitation arises, however, that comparing decompositions of two groups of firms does not take into account the differences in observed characteristics. The second part of the analysis comprises multivariate regressions which relate wage changes, job flows or employment growth to a number of firm characteristics. Again, the unit of observation is the firm. The analyses generally focus on firm-year observations for which sales decrease, or even decline sharply, since this is when adjustments typically occur.

The main findings of this chapter are the following. In the first part, the decomposition analysis shows that employment reduction is by far the most important channel for wage-bill contraction, indicating downward wage rigidity. Firms use not only increased exits but also reduced entries, probably

to avoid firing costs. A striking result is that the contractual wage growth of stayers is only somewhat lower at firms hit by an adverse shock (even if sales decline for several years in a row), compared to firms with increasing sales, and wage changes remain positive on average. Employment reduction contributes about 20 times more to reductions in wage bills than does any reduction in the wage of stayers. Over the years, however, wage growth has decelerated across the board. I find no indication that job flows are used as a vehicle to reduce the average wage; wages of newly hired workers do not lag further behind those of stayers when sales growth is more adverse. Hence, contractual wages have minor importance for wage-bill adjustment in adverse times, for both stayers and entrants. Contractual working hours provide some downward flexibility, as do overtime pay and incidental wages, but the magnitude of the effect is small.

In the second part, regression analysis confirms that the wage growth of stayers is only somewhat responsive to negative sales shocks. By contrast, employment growth is quite sensitive to firm characteristics, especially with larger negative sales shocks. Employment loss, however, does not hit a random group of workers: given a severe negative shock in sales, employment losses are larger in firms with high percentages of immigrants, short-tenured workers, temporary contracts, non-regular job types and part-time jobs. Moreover, I find a significant negative relationship between firms' degree of downward wage rigidity and their employment growth, suggesting that job losses in response to adverse shocks would be significantly lower if wages were more downwardly flexible. These findings illustrate a segmented labour market, where employment adjustment on the one hand predominantly affects workers in a relatively weak labour-market position, while continuing workers are assured of wage increases regardless of sales shocks suffered by the firm at which they work.

Samenvatting - Summary in Dutch

Dit proefschrift bevat vier toegepaste micro-economische analyses over lonen en banen in Nederland. De verschillende facetten van het proefschrift kunnen worden samengevat aan de hand van een metafoor: het bordspel 'Slangen en Ladders'. Hoofdstuk 1 en 2 onderzoeken hoe steil de 'loon-ladders' in Nederland zijn, terwijl hoofdstuk 3 onderzoekt hoeveel nadeel werknemers ondervinden als zij een 'slang' (in dit geval baanverlies vanwege bedrijfsfaillissement) tegenkomen, en hoe de gevolgen verschillen tussen oudere en jongere werknemers. Hoofdstuk 4 verenigt de slangen en ladders in zich door te onderzoeken hoe bedrijven reageren als hun omzet daalt: verminderen zij vooral het aantal banen of ook de loongroei?

De motivatie voor deze studie ligt in de vergrijzing van de beroepsbevolking en het daarop geïnspireerde beleidsdoel om ouderen langer aan het werk te houden. Hiervoor is meer kennis nodig over de factoren die bepalend zijn voor de arbeidsmarktpositie van ouderen. Omdat de Nederlandse arbeidsmarkt van ouderen relatief rigide is, is meer inzicht nodig in relatie tussen de oploop van lonen over het dienstverband en lage vrijwillige baanmobiliteit. Het volgen van twee leeftijdsgroepen na ontslag geeft vervolgens zicht op verschillende achterliggende factoren van de arbeidsmarktpositie van ouderen. Verder wordt onderzocht hoe bedrijven hun loonsom aanpassen, en in hoeverre neerwaartse loonrigiditeit een factor is die daarbij meespeelt.

Hoofdstuk 1 van dit proefschrift, getiteld 'Wage-tenure profiles and mobility', onderzoekt in hoeverre loonprofielen over baanduur samenhangen met baanmobiliteit. Het onderzoek is uitgevoerd op het Sociaal Statistisch Bestand voor de periode 1999-2005. De relevantie van dit onderzoek ligt in het feit dat de Nederlandse arbeidsmarkt wordt gekenmerkt door een lage baanmobiliteit en lange werkloosheidsduur bij ouderen; kenmerken die mogelijk verband houden met elkaar. De schattingen in dit hoofdstuk tonen aan dat loonprofielen over baanduur voor Nederland een steil verloop kennen, vergeleken met bevindingen uit de literatuur voor andere landen.

De focus van het onderzoek ligt op het effect van baanduur (de lengte van

de periode waarin een werknemer aaneengesloten voor een specifiek bedrijf werkt) op het loon, in tegenstelling tot het effect van het totaal aantal jaren dat men op de arbeidsmarkt werkzaam is. Rendement op baanduur wordt veelal geïnterpreteerd als bedrijfsspecifieke looncomponent: zo kan het rendement op investeringen in bedrijfsspecifiek menselijk kapitaal weerspiegelen of samenhangen met een beloningsstructuur waarbij sprake is van 'uitgestelde beloning' (jonge werknemers worden lager bepaald dan hun marginale productiviteit, ouderen juist daarboven). Een mogelijk nadeel van bedrijfsspecifieke looncomponenten is dat zij een belemmering kunnen vormen voor baan-baan mobiliteit, omdat werknemers deze looncomponenten verliezen bij overstap naar een andere werkgever.

De literatuur kent diverse technieken om loonprofielen te bepalen; deze corrigeren op verschillende manieren voor de endogeniteit van baanduur in de loonvergelijking. Baanduur is namelijk niet volledig exogeen als verklarende variabele van het loon, doordat niet-geobserveerde kenmerken invloed hebben op zowel loon als baanduur. Zo gaat een succesvolle match tussen een werknemer en een bedrijf vaak gepaard met zowel een hoog loon als een langere baanduur. Wanneer hiervoor wordt gecorrigeerd kan het geschatte cumulatieve effect van baanduur worden geïnterpreteerd als het loonverlies dat een representatieve werknemer zou ondergaan als hij zijn baan verliest als gevolg van een exogene schok. Hoewel de methoden van Altonji and Shakotko (1987) en Topel (1991) waarschijnlijk niet volledig corrigeren voor het endogeniteitsprobleem hebben ze als voordeel dat de resulterende loonprofielen internationaal vergelijkbaar zijn.

Naast het schatten van de loonprofielen wordt het effect wordt geanalyseerd wat het effect is van de senioriteit van werknemers (ten opzichte van hun collega's in hetzelfde bedrijf) op hun loon. De idee is dat een hoge senioriteit de loononderhandelingspositie van werknemers kan vergroten, doordat zij relatief sterk beschermd zijn tegen mogelijk ontslag door 'last-in-first-out' (LIFO) ontslagregels. Ten slotte kijk ik (op sectorniveau) naar de correlatie tussen enerzijds een hoog rendement op baanduur en anderzijds de arbeidsmobiliteit van oudere werknemers.

De eerste bevinding van dit hoofdstuk is dat Nederlandse loonprofielen over baanduur in internationaal perspectief relatief steil zijn. Dit suggereert dat de beloning gedeeltelijk samenhangt met bedrijfsspecifieke elementen die de werknemer verliest bij overstap naar een andere werkgever. Ten tweede levert senioriteit een bijdrage aan een hoger loon: conditioneel op ervaring en baanduur is het reële loonverschil tussen de langstzittende en de nieuwst binnengekomen werknemer 3–4 procent. Ten derde is er een negatief verband tussen een hoog rendement op baanduur en lage arbeidsmobiliteit: hoe hoger

het rendement op baanduur in een sector is, hoe hoger het aandeel oudere werknemers in een sector is en hoe hoger de gemiddelde leeftijd en baanduur van de werknemers in die sector. Deze bevindingen suggereren dat de lage baan-mobiliteit van oudere werknemers en de steile loonprofielen twee kanten van dezelfde medaille zijn.

Hoofdstuk 2 is getiteld 'Do wages continue increasing at older ages? Evidence on the wage cushion in the Netherlands'. Dit onderzoek (met Rob Euwals) gaat in op de vraag hoe de steile loonprofielen over baanduur, zoals gevonden in het eerste artikel, verenigbaar zijn met het feit dat lonen voornamelijk worden bepaald via collectieve loononderhandelingen. Collectieve loonovereenkomsten (cao's) bevatten bijna altijd een stelsel van loonschalen, waarbij elke loonschaal een bepaald maximum heeft. Wanneer werknemers de hoogste trede van de maximale loonschaal die behoort bij hun functie hebben bereikt, zou men verwachten dat hun loongroei verder beperkt is, uitgaande van het idee dat loononderhandelingen het loongebouw volgen. Bij een systeem van collectief onderhandelde loonschalen liggen lonen die blijven doorstijgen over baanduur of leeftijd niet voor de hand, tenzij een loonbuffer ('wage cushion') mede bepalend is voor het loon van ouderen.

De hoofdvraag die dit onderzoek beantwoordt is in hoeverre de loonbuffer – het verschil tussen het werkelijke loon en het (maximum) contractloon volgens de loonschalen – bijdraagt aan het feit dat loonprofielen blijven doorstijgen op latere leeftijd. De omvang van deze loonbuffer wordt ten eerste bepaald door additioneel loon naast het contractloon (zoals incidenteel loon en extra beloning) en ten tweede door de mate waarin het contractloon zelf het maximum van het loongebouw van de cao overschrijdt.

Het loon van mannen in loondienst in 22 sectoren wordt gevolgd van 2006 tot 2010. Deze administratieve data zijn gekoppeld met gegevens ontleend aan cao's, zoals het aantal loonschalen, het minimum en maximum contractloon per schaal en het aantal overgangen naar een volgende trede, om het effect van het loonschaal-systeem op de werkelijke lonen te onderzoeken.

Hiertoe zijn indicatoren aangemaakt voor 1) de kans dat het contractloon gelijk is aan het maximum van een van de loonschalen van de betreffende cao en 2) de kans dat het loon het maximum van de hoogste loonschaal van de cao overstijgt. Deze indicatoren worden gebruikt om drie vragen te beantwoorden:

- Neemt de kans om met het contractloon aan het eind van een loonschaal te zitten toe met leeftijd? Of neemt de kans op een contractloon dat het maximum van de hoogste cao-schaal overschrijdt toe met leeftijd?

- Ontvangen werknemers die met hun contractloon op het eind van een loonschaal zitten meer additioneel loon?

- Ontvangen werknemers met een contractloon dat het maximum van de hoogste cao-schaal overschrijdt een hogere contractuele loongroei?

Voor de publieke sector blijkt geen sprake van een loonbuffer die bijdraagt aan lonen die doorstijgen op latere leeftijd. Ten eerste komen lonen boven het maximum van de hoogste loonschaal vrijwel niet voor omdat de loonschalen ook vrijwel alle leidinggevende functies omvatten. Ten tweede ontvangen werknemers met een contractloon gelijk aan het maximum van een loonschaal minder aanvullend loon dan zij die nog geen maximum hebben bereikt. Blijkbaar wordt additioneel loon in de publieke sector niet gebruikt ter motivering van hen die een schaal-maximum hebben bereikt.

Voor de marktsector vinden wordt wel gevonden dat de loonbuffer bijdraagt aan lonen die doorstijgen op latere leeftijd. Ten eerste neemt de kans op een loon boven het maximum van de hoogste loonschaal van de cao toe met leeftijd. In tegenstelling tot de publieke sector lijken de loonschalen in de private sector vaak niet de beter betaalde, leidinggevende functies te omvatten. Het maximum van de hoogste loonschaal is niet restrictief: veel werknemers hebben een loon dat boven dit maximum ligt. Ten tweede is zowel de jaarlijkse loonstijging als het bedrag aan additioneel loon bij deze groep hoger dan bij hen die nog niet het maximum van de hoogste loonschaal heeft bereikt. De groei van het additioneel loon is overigens wel lager, waarschijnlijk omdat de contractuele loonmutatie relatief vrij kan worden bepaald.

Herschatting van loonprofielen, nu inclusief informatie over de positie van individuen in het systeem van loonschalen, laat zien dat in de marktsector lonen boven het maximum van de hoogste schaal van de cao bijdragen aan het steile loonprofiel over leeftijd. De groep die betaald wordt boven dit maximum maakt het loonprofiel over leeftijd steiler. De loonbuffer draagt in de marktsector dus bij aan loondifferentiatie. Hoewel meer onderzoek nodig is om te bepalen welke factoren precies veroorzaken dat lonen blijven doorstijgen op hogere leeftijd, lijkt het dat het systeem van loonschalen in cao's geen hoofdoorzaak is. De loonbuffer lijkt loondifferentiatie mogelijk te maken tussen en binnen leeftijdsgroepen, maar in hoeverre deze differentiatie ook leidt tot heterogeniteit in beloning tussen sectoren en bedrijven is nog onduidelijk.

Hoofdstuk 3, getiteld 'Labour market effects of job displacement for prime-age and older workers' (met Marloes de Graaf-Zijl en Wiljan van den Berge), onderzoekt het effect van baanverlies in verband met bedrijfsfaillissement op de baankans en lonen van de getroffen werknemers. We zijn hierin geïnteresseerd omdat massaontslag en faillissementen de lasten van economische aanpassing neerleggen bij een beperkte groep werknemers. Vooral ouderen komen ver-

volgens vaak moeilijk weer aan de slag. Dit staat op gespannen voet met de maatschappelijke behoefte om, met het oog op de vergrijzing, ouderen langer te laten participeren. Dit hoofdstuk onderzoekt in hoeverre het effect van bedrijfsfaillissementen verschilt tussen oudere en minder oude werknemers en hoe dit samenhangt met drie factoren: lange dienstverbanden voorafgaand aan ontslag, een ongunstige lokale arbeidsmarktsituatie in de sector van waaruit men is ontslagen en het maken van een oversstap naar een andere sector.

Het achterliggende idee is dat het baanverlies in geval van faillissement een willekeurige groep treft, aangezien zij niet uit eigen keus van baan veranderen noch zijn geselecteerd voor ontslag door de werkgever. De effecten zullen daarom naar verwachting, in elk geval deels, samenhangen met bedrijf en sector gerelateerde factoren. De focus ligt in dit hoofdstuk op de vergelijking van de effecten in termen van baankansen en lonen voor oudere (45–54 jaar) werknemers en de leeftijdsgroep 35–44 jaar (in het navolgende aangemerkt als 'jongere werknemers').

We passen een 'difference-in-difference'-benadering toe in combinatie met exacte matching. De data zijn administratieve 'linked employer-employee' data gekoppeld aan administratieve data met betrekking tot bedrijfsfaillissementen. De data bevatten observaties voor een 'behandelgroep' van bijna 45.000 werknemers die hun baan hebben verloren in verband met faillissement tussen 2000 en 2009; zij worden gevolgd tot en met 2011. De controle groep bestaat uit circa 158.000 werknemers die (via exacte matching) vergelijkbare kenmerken hebben als de behandelgroep maar op dat moment geen baanverlies door faillissement meemaakten.

De resultaten geven aan dat de arbeidsmarktuitkomsten na baanverlies sterk afhankelijk zijn van leeftijd, vooral waar het gaat om de baankans. De drie factoren die mogelijk de verschillende over leeftijdsgroepen kunnen verklaren (lange dienstverbanden voorafgaand aan ontslag, een ongunstige lokale arbeidsmarktsituatie in de sector van waaruit men is ontslagen en het maken van een oversstap naar een andere sector) blijken alle drie relevant. De resultaten suggereren dat baan- en sectorspecifieke factoren van belang zijn bij het verklaren van de meer kwetsbare positie van ouderen na ontslag.

Niet alleen komen lange baanduren vaker voor bij oudere werknemers, ouderen met lange baanduren ondervinden sterkere negatieve gevolgen van ontslag: voor jongere werknemers is de baanduur voorafgaand aan het ontslag minder bepalend. Een lange baanduur betekent bij oudere werknemers een extra daling van de baankans van 2 tot 3 procent, in vergelijking met de jongere leeftijdsgroep. De loondaling na ontslag is gemiddeld groter na een lang dienstverband bij de oude werkgever; dit geldt bij beide leeftijdsgroepen in even sterke mate.

Ook zijn ontslagen oudere werknemers gevoeliger voor de situatie op de lokale arbeidsmarkt in de sector van waaruit zij worden ontslagen. In het eerste jaar na baanverlies zijn de baankans van ontslagen oudere werknemers afkomstig uit krimpende sectoren 3,5 procentpunt lager dan die van oudere werknemers ontslagen vanuit goed presterende sectoren. Dit verschil neemt wel af over de tijd en wordt insignificant. Voor jongere werknemers is er geen effect. Het effect op het loon is voor beide leeftijdsgroepen vergelijkbaar.

Eveneens geldt dat de gevolgen voor oudere ontslagen werknemers sterker negatief zijn wanneer zij voor hun nieuwe baan moeten overstappen naar een andere sector. Hun loonverlies is extra groot, waarschijnlijk als gevolg van sectorspecifieke menselijk kapitaal dat niet meer te gelde kan worden gemaakt na de transitie. Oudere ontslagen werknemers die een nieuwe baan vinden in een andere sector lijden loonverliezen van 8 a 9 procentpunt. Dit loonnadeel is voor jongere werknemers duidelijk geringer. Theoretisch kunnen er verschillende oorzaken zijn voor de ongunstiger effecten bij ouderen. De loonkosten van ouderen kunnen hoger zijn dan hun productiviteit als gevolg van beloningsschema's met uitgestelde beloning, of doordat de productiviteit daalt op hogere leeftijd. Ook kunnen hogere lonen hoog zijn doordat hoge ontslagbescherming leidt tot een sterke loononderhandelingspositie en kunnen bijzondere bepalingen voor oudere werknemers in de cao's ouderen duur maken. Na ontslag kan de productiviteit van ouderen laag doordat eerder verworven bedrijfsspecifiek, industrie specifiek of taak specifiek menselijk kapitaal in een nieuwe baan niet meer kan worden aangewend Anderzijds kunnen factoren aan de aanbodkant een rol spelen: wellicht is het reserveringsloon van oudere werknemers hoog door hun lange uitkeringsrechten en kunnen ze kieskeuriger zijn bij het aanvaarden van een nieuwe baan omdat ze meer mogelijkheden hebben om zich terugtrekken uit de arbeidsmarkt. De resultaten bevestigen dat een lange baanduur in de verloren gegane baan en een sector switch bijdragen aan de ongunstiger effecten bij ouderen, wat kan duiden op verlies van specifiek menselijk kapitaal. Maar een groot deel van het verschil tussen de leeftijdsgroepen blijft na correctie voor deze factoren overeind, wat suggereert dat ook andere factoren een rol spelen.

Hoofdstuk 4, getiteld 'Flexible wages or flexible workers? A decomposition of wage bill adjustment by Dutch firms, 2006-2013', onderzoekt in hoeverre bedrijven hun lonen en werkgelegenheid neerwaarts aanpassen in tijden van tegenspoed en welke factoren bepalend zijn voor deze aanpassingen. Als de neerwaartse loonflexibiliteit beperkt is, door instituties of wellicht omdat bedrijven vrezen anders de motivatie en productiviteit van werknemers te schaden, zal er naar verwachting een relatief grote werkgelegenheidsdaling

nodig zijn. Dit hoofdstuk analyseert gelijktijdig de aanpassing van zowel lonen als banenstromen, op bedrijfsniveau, op basis van 'linked employer-employee' data (databestanden waarin gegevens van bedrijven en werknemers gekoppeld zijn). Ik richt me op een steekproef van bedrijven met minstens 25 werknemers waarvoor de omzetgroei beschikbaar is. Deze dataset bestaat uit meer dan 75.000 bedrijf-jaar observaties, gebaseerd op 12,3 miljoen baan-jaar observaties.

De analyse omvat twee delen: decompositie analyse en regressieanalyse. Het eerste deel geeft een decompositie van de groei in de contractuele loonsom van bedrijven; deze wordt uitgesplitst in bijdragen vanuit prijs (uurlonen) en volume (aantal gewerkte uren, aantal banen), waarbij enerzijds baanblijvers en anderzijds nieuw ingehuurde en vertrekkende werknemers worden onderscheiden. Loon uit overwerk en additioneel loon worden ook meegenomen in de analyse. De focus ligt op de asymmetrie in respons op negatieve versus positieve omzetschokken (van verschillende omvang). Hierbij vergelijk ik niet alleen bedrijven met veel of weinig omzet groei, maar ook bijvoorbeeld met veel of weinig vaste contracten. Een sterk punt van de decompositie-analyse is dat het zicht geeft op hoe bedrijven hun mix van loonmatiging en snoeien in banen kiezen. Een beperking is dat decomposities slechts kunnen worden vergeleken tussen groepen, waarbij niet gecorrigeerd wordt voor verschillen in geobserveerde kenmerken.

Het tweede deel van de analyse richt zich daarom op multivariate regressies die loonveranderingen, werkgelegenheidsstromen of werkgelegenheidsgroei op bedrijfsniveau verklaren op basis van een groot aantal bedrijfskarakteristieken. De regressies focussen op bedrijven die door een negatieve omzetschok getroffen worden, omdat daar aanpassing van de loonsom plaatsvindt.

De decompositie-analyse toont aan dat bedrijven in mindere tijden de loonsom voornamelijk verlagen via het baanvolume, zowel via meer uitstroom als minder instroom van werknemers, wat kan duiden op neerwaartse loonrigiditeit. Een opvallende bevinding is dat de contractuele loongroei van blijvers nauwelijks lager is bij bedrijven die hun omzet zien dalen, zelfs als dat meerdere jaren achtereen het geval is. Hun loongroei blijft gemiddeld genomen positief: de werkgelegenheid draagt dan ook circa 20 keer zoveel bij aan de loonsomaanpassing als het loon van blijvers. Wel is in de loop van de jaren na de grote recessie de contractuele loongroei over de hele linie gedaald, wat zou kunnen duiden op relatief sterke coördinatie binnen het loonvormingsstelsel. Ik vind geen aanwijzingen dat werkgelegenheidsstromen worden gebruikt om het gemiddelde loon te verlagen: de lonen van nieuw aangenomen werknemers lijken niet extra te worden verlaagd. Contractlonen blijken dus van ondergeschikt belang voor de loonsomaanpassing in slechte tijden, zowel waar het

gaat om blijvers als met betrekking tot de nieuwe instroom. Verder bieden de contractuele arbeidsduur, overwerk loon en incidentele lonen weliswaar enige neerwaartse flexibiliteit, maar hun bijdragen is beperkt.

De regressieanalyse bevestigt dat op de korte termijn de loongroei van baanblijvers slechts beperkt reageert op een negatieve schok in de omzet. De werkgelegenheidsgroei varieert sterk over bedrijfskenmerken, zeker bij grote omzetdalingen. Het baanverlies raakt geen willekeurige groep werknemers maar is geconcentreerd in bedrijven met een hoog percentage immigranten, werknemers met een korte baanduur, tijdelijke contracten, niet-reguliere baantypes en deeltijdbanen.

Loonrigiditeit is gemeten op basis van de loongroei-verdeling: hoe meer sprake is van een ophoping rond de nul procent of de verwachte inflatie hoe meer neerwaartse nominale of reële loonrigiditeit. Ik vind een significant negatief verband tussen de indicatoren voor neerwaartse loonrigiditeit en de werkgelegenheidsgroei van bedrijven. Dit suggereert dat als lonen neerwaarts flexibeler zouden zijn er minder banen verloren gingen.

De bevindingen wijzen op een gesegmenteerde arbeidsmarkt, waarbij het baanverlies vooral werknemers met een relatief zwakke arbeidsmarktpositie treft, terwijl zittende werknemers zijn verzekerd van loonsverhoging die maar in beperkte mate beïnvloed wordt door negatieve omzetschokken die het bedrijf treffen.

In termen van de metafoor van het spel 'Slangen en Ladders' is een bevinding van dit proefschrift dat de 'loon-ladders' over het dienstverband in Nederland een relatief steil verloop hebben. Deze ladders lijken bovendien stormvast, aangezien de loongroei weinig gevoelig is voor verslechtering van de omzet van een bedrijf. Pas op termijn wordt loongroei beperkt, maar dan over de hele linie en niet zozeer voor bedrijven die het moeilijk hebben. Hier staat tegenover dat het tegenkomen van een 'slang' - in dit geval van ontslag door bedrijfsfaillissement - grote gevolgen heeft: vooral voor oudere werknemers is de kans op werk na ontslag relatief laag en is het loonverlies groot, zeker bij een lang dienstverband en veel bedrijfs- en sectorspecifiek menselijk kapitaal. Ook is de kans op baanverlies sterk afhankelijk van het type arbeidscontract, duur van het dienstverband en kenmerken van werknemers en bedrijven.

Bibliography

Abraham, K. and Farber, H. S. (1987). Job duration, seniority, and earnings. *American Economic Review*, 77(3):278–97.

Altonji, J. G. and Card, D. (1991). The effects of immigration on the labor market outcomes of less-skilled natives. In Abowd, J. and Freeman, R., editors, *Immigration, trade, and the labor market*, pages 201–234. University of Chicago Press.

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

Altonji, J. G. and Williams, N. (2005). Do wages rise with job seniority? A reassessment. *ILR Review*, 58(3):370–397.

Autor, D. H. and Dorn, D. (2009). This job is "getting old": Measuring changes in job opportunities using occupational age structure. *The American Economic Review*, 99(2):pp. 45–51.

Babecký, J., Du Caju, P., Kosma, T., Lawless, M., Messina, J., and Rõõm, T. (2012). How do European firms adjust their labour costs when nominal wages are rigid? *Labour Economics*, 19(5):792–801.

Bakker, B. F. M., van Rooijen, J., and van Toor, L. (2014). The system of social statistical datasets of Statistics Netherlands: An integral approach to the production of register-based social statistics. *Statistical Journal of the IAOS*, 30(4):F411–F424.

Becker, G. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70.

Ben-Porath, Y. (1967). The production of human capital and the life cycle of earnings. *The Journal of Political Economy*, 75(4, Part 1):352–365.

Berge, W. v. d. and Ter Weel, B. (2015). Baanpolarisatie in Nederland. *CPB Policy Brief*.

Bewley, T. F. (1999). *Why Wages Don't Fall During a Recession*. Cambridge, MA: Harvard University Press.

Borghans, L., Cörvers, F., Kriechel, B., and Montizaan, R. (2007). Productiviteit, beloning en arbeidsmarktparticipatie van ouderen. *ROA-R-2007/5*.

Börsch-Supan, A. and Weiss, M. (2011). Productivity and age: Evidence from work teams at the assembly line. MEA discussion paper series 07148, Munich Center for the Economics of Aging (MEA) at the Max Planck Institute for Social Law and Social Policy.

Bosch, N. and ter Weel, B. (2013). Labour-market outcomes of older workers in the Netherlands: Measuring job prospects using the occupational age structure. *De Economist*, 161(2):199–218.

Buchinsky, M., Fougere, D., Kramarz, F., and Tchernis, R. (2010). Interfirm mobility, wages and the returns to seniority and experience in the united states. *Review of Economic Studies*, 77(3):972–1001.

Buhai, I. S., Portela, M., Teulings, C. N., and van Vuuren, A. (2014). Returns to tenure or seniority? *Econometrica*, 82(2):705–730.

Burda, M. C. and Mertens, A. (2001). Estimating wage losses of displaced workers in Germany. *Labour Economics*, 8(1):15 – 41.

Burdett, K. (1978). A theory of employee job search and quit rates. *American Economic Review*, 68(1):212–220.

Burdett, K. and Coles, M. G. (2003). Equilibrium wage-tenure contracts. *Econometrica*, 71(5):1377–1404.

Card, D. (2001). Immigrant inflows, native outflows, and the local market impacts of higher immigration. *Journal of Labor Economics*, 19(1):22–64.

Cardoso, A. R. and Portugal, P. (2005). Contractual wages and the wage cushion under different bargaining settings. *Journal of Labor Economics*, 23(4):875–902.

Carrington, W. J. (1993). Wage losses for displaced workers: Is it really the firm that matters? *The Journal of Human Resources*, 28(3):pp. 435–462.

Clark, A., Knabe, A., and Rätzel, S. (2010). Boon or bane? Others' unemployment, well-being and job insecurity. *Labour Economics*, 17(1):52–61.

Couch, K. A. (1998). Late life job displacement. *The Gerontologist*, 38(1):7–17.

Couch, K. A. (2001). Earnings losses and unemployment of displaced workers in Germany. *Industrial and Labor Relations Review*, 54(3):559–.

Couch, K. A., Jolly, N. A., and Placzek, D. W. (2011). Earnings losses of displaced workers and the business cycle: An analysis with administrative data. *Economics Letters*, 111(1):16 – 19.

Couch, K. A. and Placzek, D. W. (2010). Earnings losses of displaced workers revisited. *The American Economic Review*, 100(1):pp. 572–589.

CPB (2016). *Macro Economische Verkenning*. CPB - The Hague.

Dalen, H. P. and Henkens, K. (2015). Why demotion of older workers is a no-go area for managers. *CentER Discussion Paper-Tilburg University*, (2015-025).

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

Davis, S. J. and Haltiwanger, J. (1992). Gross job creation, gross job destruction and employment reallocation. *Quarterly Journal of Economics*, 107(3):819–863.

De Grip, A. and Van Loo, J. (2002). The economics of skill obsolescence: A review. In De Grip, A., Van Loo, J., and Mayhew, K., editors, *The economics of skill obsolescence*, volume 21 of *Research in Labor Economics*, pages 1–26. Emerald Group Publishing Limited.

De Groot, N. and van der Klaauw, B. (2014). The effects of reducing the entitlement period to unemployment insurance benefits. *IZA Discussion Paper No. 8336*.

De Hek, P. and Van Vuuren, D. J. (2011). Are older workers overpaid? A literature review. *International Tax and Public Finance*, 18(4):436–460.

Deaton, A. and Paxson, C. (1994). Intertemporal choice and inequality. *Journal of Political Economy*, 102(3):437–67.

Deelen, A. P. (2012). Wage-tenure profiles and mobility. *De Economist*, 160(2):141–155.

Deelen, A. P., De Graaf-Zijl, M., and Van den Berge, W. (2014a). Labour market effects of job displacement for prime-age and older workers. *CPB Discussion Paper 285*.

Deelen, A. P. and Euwals, R. W. (2014). Do wages continue increasing at older ages? Evidence on the wage cushion in the Netherlands. *De Economist*, 162(4):433–460.

Deelen, A. P., Euwals, R. W., and Muffels, R. J. A. (2014b). Nederlandse arbeidsmarkt in europees perspectief: Jongeren mobiel, ouderen honkvast (in dutch). *Me Judice*.

Deelen, A. P., Jongen, E., and Visser, S. (2006). Employment protection legislation - Lessons from theoretical and empirical studies for the dutch case. *CPB Document 135*.

Deelen, A. P. and Verbeek, W. P. (2015). Measuring downward nominal and real wage rigidity - Why methods matter. *CPB Discussion Paper*, (315).

Dickens, W. T., Goette, L., Groshen, E. L., and Holden, S. (2007). The interaction of labor markets and inflation: Analysis of micro data from the International Wage Flexibility project. *mimeo, Brookings Institution*, pages 1–51.

Dostie, B. (2011). Wages, productivity and aging. *De Economist*, 159(2):139–158.

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

ECB (2009). Wage dynamics in Europe - Final report of the Wage Dynamics Network (WDN).

Eichler, M. and Lechner, M. (2002). An evaluation of public employment programmes in the East German state of Sachsen-Anhalt. *Labour Economics*, 9(2):143 – 186.

Eliason, M. and Storrie, D. (2006). Lasting or latent scars? Swedish evidence on the long-term effects of job displacement. *Journal of Labor Economics*, 24(4):pp. 831–856.

Elsby, M. (2009). Evaluating the economic significance of downward nominal wage rigidity. *Journal of Monetary Economics*, 56(2):154–169.

Euwals, R., de Mooij, R., and van Vuuren, D. (2009). Rethinking retirement: From participation towards allocation. CPB special publication, CPB Netherlands Bureau for Economic Policy Analysis.

Fallick, B. C. (1996). A review of the recent empirical literature on displaced workers. *Industrial and Labor Relations Review*, 50(1):pp. 5–16.

Farber, H. S. (1993). The incidence and costs of job loss, 1982-91. *Brookings Papers on Economic Activity: Microeconomics*, pages 73–132.

Farber, H. S. (1997). The changing face of job loss in the United States, 1981-1995. *Brookings Papers on Economic Activity: Microeconomics*, pages 55–128.

Fehr, E. and Falk, A. (1999). Wage rigidity in a competitive incomplete contract market. *Journal of Political Economy*, 107(1):106–134.

Fuss, C. (2009). What is the most flexible component of wage bill adjustment? Evidence from Belgium. *Labour Economics*, 16(3):320–329.

Gibbons, R. and Waldman, M. (2004). Task-specific human capital. *The American Economic Review*, 94(2):pp. 203–207.

Goette, L., Sunde, U., and Bauer, T. (2007). Wage rigidity: measurement, causes and consequences. *The Economic Journal*, 117(524):F499–F507.

Grout, P. (1984). Investment and wages in the absence of binding contracts: A nash bargining approach. *Econometrica*, 52(2):449–60.

Hall, R. E. (2005). Employment fluctuations with equilibrium wage stickiness. *American Economic Review*, 95(1):50–65.

Hamermesh, D. S. (1989). What do we know about worker displacement in the US? *Industrial Relations: A Journal of Economy and Society*, 28(1):51–59.

Harteveld, L. (2012). Loonvorming in tijden van crisis. *Tijdschrift voor Arbeidsvraagstukken*, 28(2):138–161.

Heckman, J. J., Ichimura, H., and Todd, P. E. (1997). Matching as an econometric evaluation estimator: Evidence from evaluating a job training programme. *The Review of Economic Studies*, 64(4):605–654.

Heywood, J. S., Jirjahn, U., and Tsertsvardze, G. (2010). Hiring older workers and employing older workers: German evidence. *Journal of Population Economics*, 23(2):595–615.

Hijzen, A., Upward, R., and Wright, P. W. (2010). The income losses of displaced workers. *Journal of Human Resources*, 45(1):243–269.

Hijzen, A. and Venn, D. (2011). The role of short-time work schemes during the 2008-2009 recession. *OECD Social, Employment and Migration Working Papers*, (115).

Hildreth, A. K. G., von Wachter, T. M., and Handwerker, E. W. (2007). Earnings losses of displaced workers in Connecticut. Technical report, Connecticut Department of Labor.

Holden, S. and Wulfsberg, F. (2014). Wage rigidity, inflation, and institutions. *The Scandinavian Journal of Economics*, 116(2):539–569.

Hosios, A. (1990). On the efficiency of matching and related models of search and unemployment. *Review of Economic Studies*, 57(2):279–298.

Huttunen, K., Møen, J., and Salvanes, K. G. (2011). How destructive is creative destruction? Effects of job loss on job mobility, withdrawal and income. *Journal of the European Economic Association*, 9(5):840–870.

Ichino, A., Schwerdt, G., Winter-Ebmer, R., and Zweimüller, J. (2013). Too old to work, too young to retire? *The Austrian Center for Labor Economics and the Analysis of the Welfare State Working Paper No. 1309*.

Jacobsen, L. S., LaLonde, R. J., and Sullivan, D. G. (1993). Earnings losses of displaced workers. *The American Economic Review*, 83(4):pp. 685–709.

Jovanovic, B. (1979). Job matching and the theory of turnover. *Journal of Political Economy*, 87(5):972–990.

Jung, S. and Schnabel, C. (2011). Paying more than necessary? The wage cushion in germany. *Labour*, 25(2):182–197.

Kabátek, J. (2015). Happy birthday, you're fired! The effects of age-dependent minimum wage on youth employment flows in the Netherlands. *IZA Discussion Paper*, (9528).

Knoppik, C. and Beissinger, T. (2009). Downward nominal wage rigidity in Europe: an analysis of European micro data from the ECHP 1994-2001. *Empirical Economics*, 36(2):321–338.

Kotlikoff, L. and Gokhale, J. (1992). Estimating a firm's age-productivity profile using the present value of workers' earnings. *The Quarterly Journal of Economics*, 107(4):1215–1242.

Kuhn, P. and Robert, J. (1989). Seniority and distribution in a two-worker trade union. *The Quarterly Journal of Economics*, 104(3):485–505.

Kuhn, P. J., editor (2002). *Losing Work, Moving On: International Perspectives on Worker Displacement*. W.E. Upjohn Institute for Employment Research.

Lazear, E. (1981). Agency, earnings profiles, productivity, and hours restrictions. *American Economic Review*, 71(4):606–20.

Lefranc, A. (2003). Labor market dynamics and wage losses of displaced workers in France and the United States. Working Paper 614, William Davidson Institute.

Lengermann, P. A. and Vilhuber, L. (2002). Abandoning the sinking ship: The composition of worker flows prior to displacement. Longitudinal employer-household dynamics technical papers, Center for Economic Studies, U.S. Census Bureau.

Lindbeck, A. and Snower, D. (1986). Wage setting, unemployment, and insider-outsider relations. *The American Economic Review*, 76(2):235–239.

Lindbeck, A. and Snower, D. (1991). Interactions between the efficiency wage and insider-outsider theories. *Economics Letters*, 37(2):193–196.

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

Neal, D. (1995). Industry-specific human capital: Evidence from displaced workers. *Journal of Labor Economics*, 13(4):pp. 653–677.

OECD (2004). Wage-setting institutions and outcomes. In *OECD Employment Outlook*, chapter 3.

OECD (2006). *Live Longer, Work Longer*. OECD Publishing, Paris.

OECD (2013). Employment outlook 2013. Technical report, OECD Publishing, Paris.

OECD (2014). *Ageing and Employment Policies: Netherlands 2014*. OECD Publishing, Paris.

Origo, F. (2009). Flexible pay, firm performance and the role of unions. New evidence from Italy. *Labour Economics*, 16(1):64 – 78.

Origo, F. and Pagani, L. (2009). Flexicurity and job satisfaction in europe: The importance of perceived and actual job stability for well-being at work. *Labour Economics*, 16(5):547–555.

Pessoa, J. P. and Van Reenen, J. (2014). The U.K. productivity and jobs puzzle: Does the answer lie in wage flexibility? *The Economic Journal*, 124(576):433–452.

Pissarides, C. A. (2009). The unemployment volatility puzzle: Is wage stickiness the answer? *Econometrica*, 77(5):1339–1369.

Poletaev, M. and Robinson, C. (2008). Human capital specificity: Evidence from the Dictionary of Occupational Titles and displaced worker surveys, 1984-2000. *Journal of Labor Economics*, 26(3):pp. 387–420.

Portegijs, W. and Brakel, M. v. d. (2016). *Emancipatie monitor 2016*. SCP and Statistics Netherlands - The Hague.

Robin, J. (2011). On the dynamics of unemployment and wage distributions. *Econometrica*, 79(5):1327–1355.

Schoeni, R. F. and Dardia, M. (2003). Estimates of earnings losses of displaced workers using California administrative data. Technical report, PSC Population Studies Center.

SER (2013). *Verbreding draagvlak cao-afspraken*, volume 13/03. Social Economic Council - The Hague.

Shapiro, C. and Stiglitz, J. E. (1984). Equilibrium unemployment as a worker discipline device. *The American Economic Review*, 74(3):433–444.

Shimer, R. (2004). The consequences of rigid wages in search models. *Journal of the European Economic Association*, 2(2-3):469–479.

Shimer, R. (2005). The cyclical behavior of equilibrium unemployment and vacancies. *American Economic Review*, 95(2-3):25–49.

Stüber, H. and Beissinger, T. (2012). Does downward nominal wage rigidity dampen wage increases? *European Economic Review*, 56(4):870–887.

Tatsiramos, K. (2010). Job displacement and the transitions to re-employment and early retirement for non-employed older workers. *European Economic Review*, 54(4):517 – 535.

Ter Weel, B., Van der Horst, A., and Gelauff, G. (2010). The Netherlands in 2040. CPB Special Publication 88, CPB, The Hague.

Teulings, C. N. and Bovenberg, A. L. (2009). Rhineland exit? *International Tax and Public Finance*, 16(5):710–726.

Topel, R. (1990). Specific capital and unemployment: Measuring the costs and consequences of job loss. *Carnegie-Rochester Conference Series on Public Policy*, 33(0):181 – 214.

Topel, R. (1991). Specific capital, mobility, and wages: Wages rise with job seniority. *Journal of Political Economy*, 99(1):145–76.

Van den Berge, W. (2016). How do severance pay and job search assistance jointly affect unemployment duration and job quality? *CPB Discussion Paper 334*.

Van Ours, J. C. and Stoeldraijer, L. (2011). Age, wage and productivity in Dutch manufacturing. *De Economist*, 159(2):113–137.

Van Ours, J. C. and Vodopivec, M. (2006). How shortening the potential duration of unemployment benefits affects the duration of unemployment: Evidence from a natural experiment. *Journal of Labor Economics*, 24(2):pp. 351–378.

Williams, N. (2009). Seniority, experience and wages in the UK. *Labour Economics*, 16(3):272–283.

Zwick, T. (2012). Consequences of seniority wages on the employment structure. *ILR Review*, 65(1):108–125.

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