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ORIGINAL PAPER

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

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Abstract
This paper investigates how firms adjust wages and employment in periods of adverse economic circumstances, using extensive, administrative linked employer–employee panel data for the Netherlands. Changes in the contractual wage bills of firms are decomposed into wages and job flows, distinguishing stayers and workers entering and exiting the firm. Employment reduction is found to be the major channel for wage-bill contraction in adverse periods, especially in firms with a low share of open ended contracts. Continuing workers in firms hit by negative sales shocks generally are assured of wage increases, pointing at a segmented labour market.

Keywords Wages · Employment flows · Linked employer–employee data

JEL Classification J30 · J31 · J41 · J62

1 Introduction

This paper studies the ways in whichs firms adjust their wage bills (the sum of all wages paid by a firm) in times of declining demand. The paper takes a relatively wide perspective: as empirical studies typically aim to explain the development of either employment or wages, I study adjustments to wages and job flows simultaneously and from a firm perspective. Hereto I use 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.

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The study decomposes changes in the contractual wage bills of firms 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 consider overtime pay and incidental wages. I analyse the impact of adverse sales shocks of various sizes on this decomposition by estimating the difference 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.

The paper contributes to the literature about downward wage rigidity. Rising unemployment during The Great Recession has led to renewed interest in this subject. Downward wage rigidity can occur for a variety of reasons.[1] Though smoothing wages over time may be optimal from some perspectives, theoretical studies emphasize a trade-off with more employment volatility which may imply less job security for specific groups on the labour market.[2] Recent empirical 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

[1] 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).

[2] 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 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, 2005). On the other hand, wages in new job matches often do show volatility (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).

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 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. 2014). 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. This study aims to shed light on these adjustments.

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. As employment loss is found to be relatively large among firms with a low share of open-term contracts, the findings may point to a segmented labour market; employment adjustments seem to predominantly affect workers in a relatively weak labour market position, whereas ongoing workers can count on wage increases that are not jeopardised by sales shocks suffered by their firms.

The remainder of this paper is organised as follows. Section 2 describes the methodology. Section 3 discusses the data and the institutional features of the Dutch labour market. The results of the decomposition analysis are presented in Sect. 4.1. Estimated

relationships among job flows, wage or employment growth and firm characteristics are presented in Sects. 4.1 and 4.2 discusses the results. Section 5 concludes.

2 Methodology

The first part of the analysis, the decomposition of firms' changing wage bills, is inspired by Fuss (2009), who 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, Eq. (1) simply decomposes the growth rate of the wage bill $W°B_{i,t}$ 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.

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

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 (note that $S_{i,t-1}$ is equal to $S_{i,t}$). 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):

$$\begin{aligned} W°B_{i,t} = &\frac{(\Sigma_{Ji,t \in S_{i,t}} w_{ji,t} + \Sigma_{Ji,t \in N_{i,t}} w_{ji,t})}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \\ &- \frac{(\Sigma_{Ji,t-1 \in S_{i,t-1}} w_{ji,t-1} + \Sigma_{Ji,t-1 \in E_{i,t-1}} w_{ji,t-1})}{0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})} \end{aligned} \tag{2}$$

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 contractual wage bill (Eq. 3). The

first component represents the contribution from the net change in employment, while the second component reflects the contribution from the change in the average contractual monthly wage of stayers. 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]

$$W^{\circ}B_{i,t} = \frac{(N_t - E_{t-1})\bar{w}_t^S + S_t(\bar{w}_t^S - \bar{w}_{t-1}^S) + N_t(\bar{w}_t^N - \bar{w}_t^S) - E_{t-1}(\bar{w}_{t-1}^E - \bar{w}_t^S)}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} \quad (3)$$

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 (Eq. 4). The definition of exiters, entrants and stayers is the same as in Eq. (3); so a change in hours worked does not affect this unless a worker fully leaves or enters the firm. 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 Eq. 4) and one for the change in the average working hours of stayers (the third component in Eq. 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 as well.

$$\begin{aligned} W^{\circ}B_{i,t} = & \frac{(N_t - E_{t-1})\bar{w}_t^S + \Sigma_S(w_t^{hS} - w_{t-1}^{hS})H_t^S + \Sigma_S(H_t^S - H_{t-1}^S)w_{t-1}^{hS}}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} \\ & + \frac{(\bar{w}_t^{hN} - \bar{w}_t^{hS})N_t\bar{H}_t^N - (\bar{w}_{t-1}^{hE} - \bar{w}_t^{hS})E_{t-1}\bar{H}_{t-1}^E}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} \\ & + \frac{(\bar{H}_t^N - \bar{H}_t^S)N_t\bar{w}_t^{hS} - (\bar{H}_{t-1}^E - \bar{H}_t^S)E_{t-1}\bar{w}_t^{hS}}{0.5(\Sigma_{Ji,t}w_{ji,t} + \Sigma_{Ji,t-1}w_{ji,t-1})} \end{aligned} \quad (4)$$

[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.

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 *comparable* 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 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 difference between firm-year observations with falling and growing sales. And in addition, between severe and more moderate negative (positive) sales shocks, for example the difference between subsamples of firms based on the yearly percentile distribution of the change in sales, like P1–P25 compared to P25–P75 or P25–P75 compared to P75–P100 (for subsets of firms with decreasing sales or increasing sales).

To estimate this difference, 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 favourable and the adverse state. 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:

$$\Delta x_{k_{i,t}} = \alpha_k + \beta_k . dum_{k_{i,t}} + \gamma_{k_t} + \epsilon_{k_{i,t}} \tag{5}$$

where $\Delta x_{k_{i,t}}$ refers to the contributions of the various items in the decomposition; where k = 1,…,6, since Eq. (5) is estimated separately for each item of Eq. (4), and where $dum_{k_{i,t}}$ reflects the state (favourable/unfavourable or firm subsamples by percentile classes).[6] The decomposition and the estimated differences shed light on the

[4] Parsimonious regressions in Table 7 in "Appendix A" illustrate that wage-bill contraction is strongly correlated with sales reduction. As a robustness check, in Table 10 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 a large part of the observed period is characterized by reduced demand due to the global financial crisis.

[6] The tables in the results section refer to six items $\Delta x_{k_{i,t}}$ as the contributions to the gross contractual wage-bill growth by the change 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: $(\bar{H}_t^N - H_t^S) N_t \bar{w}_t^{hS} - (\bar{H}_{t-1}^E - \bar{H}_t^S) E_{t-1} \bar{w}_t^{hS} / D$, where D = denominator $0.5(\Sigma_{Ji,t} w_{ji,t} + \Sigma_{Ji,t-1} w_{ji,t-1})$.

response of wage bill items to positive and negative sales shocks. Although the wage bill response to sales increase and sales decrease might be generally symmetric (wage bill decreases if sales decrease, and increases with similar magnitude if sales increase), this does not necessarily hold for the underlying items of the decomposition. Some items may respond asymmetric in terms of sign (for example they rise whether sales increase or decrease), leading to a relatively small value for $\hat{\beta}$. Other items may respond asymmetric in terms of size (items decrease strongly in case of sales drop but increase limitedly when sales grow, for example), resulting in a relatively large $\hat{\beta}$. The results section takes a closer look at this.

3 Data and Institutional Features of the Dutch Labour Market

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 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 with 25 employees or more 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, the analyses focus on

wages paid to workers aged 23 to 65 in ongoing, private-sector firms which are not subject to firm dynamics and employ at least 25 workers.[7]

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). Figure 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, followed by a second dip in 2012 and 2013. The job exit rate (third row, left) is highest in years characterised by high employment growth. The job entry 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 1 presents descriptive statistics for all private-sector firms that exist in two subsequent years and are not subject to firm dynamics (e.g., 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.

[7] This sample comprises about 16% of the entire workforce as in 2010-2011 the sample contains 2.1 million jobs (see Table 6), while the total number of jobs in the entire economy (so including the public and semi-public sector) amount to 13.3 million (see "Appendix C").

Table 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				

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 register data from Statistics Netherlands

3.3 Institutional Features of the Dutch Wage Setting

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 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. 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 Van den 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. 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.

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. 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. 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.

4 Results and Discussion

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. Table 2 shows the decomposition of firms' growth in contractual wage bills in case of fouvourable and adverse sales growth. The upper panel of the table depicts 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

Table 2 Decomposition of wage-bill changes 2007–2013 for firms with negative versus positive sales growth

		$\Delta S \geq 0$	$\Delta S < 0$	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by					
Change in net employment		0.51	− 7.64	− 6.99	***
Hourly wage, stayers		2.27	1.84	− 0.35	***
Hourly wage, entrants		− 2.32	− 1.61	0.48	***
Hourly wage, exiters		1.76	2.06	0.29	***
Hours worked, stayers		0.71	0.40	− 0.17	***
Hours worked, non-stayers	+	0.36	0.53	0.21	**
Gross wage-bill change (in %)					
Contractual		3.30	− 4.42	− 6.33	***
Contractual + overtime pay		3.30	− 4.65	− 6.61	***
Contractual + overtime, inc. & extra pay		3.36	− 4.62	− 7.11	***
# Firm-year observations		42,997	32,605		
# worker-year observations (*mln)		6.7	5.6		

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. $\hat{\beta}$ is the estimation result for Eq. (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 $\Delta S \geq 0$; The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Significance levels: ∗ : 5% ∗∗ : 1% *** : 0.1%. *Source*: Own calculations using register data from Statistics Netherlands

presents for each item separately the $\hat{\beta}$: the estimated difference between 'adverse times' (sales falling) and 'good times' (sales increasing), according to Eq. (5), reflecting the difference in response between favourable and adverse periods.

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 difference between the favourable and adverse state is − 6.33%, or somewhat larger if overtime pay, incidental wages and extra pay are taken into account, according to the $\hat{\beta}$ for the dummy-variable; see the explanation of Eq. (5). In general the estimated $\hat{\beta}$'s are close to the first differences of the firm averages which are presented in the table (for example − 6.33% is close to the difference between 3.30 and − 4.42). So taking into account the distribution of the results for individual firms (by estimating β) gives about the same picture as simply comparing the averages of the subsamples.

Considering the decomposition in more detail, all $\hat{\beta}$'s in column 3 differ significantly from zero, confirming that firms' wage-bill growth items differ 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 'change in employment' contributes 172% (− 7.64/4.42) to the (negative) contractual wage bill growth, while in favourable times it contributes 15% (0.51/3.30) to the (positive) contractual wage bill growth. Hence, although the employment response is symmetric regarding its sign, as it

decreases in advese times and increases in favourable times, in terms of size (relative to the contractual wage bill growth) the response is very asymmetric. The low contribution of 'change in net employment' to the contractual wage growth in favourable times may indicate that firms increase their labour productivity through corporate restructuring and/or adopting technological change instead of expanding their employment.[8]

The response of the contractual wage of stayers is asymmetric as well, but in a different way. In favourable times, stayers' wage growth contributes substantially (2.27 percentage-points or 69% of the contractual wage bill change); in adverse periods its contribution is still positive and substantial, although slightly lower (1.84 percentage-points or − 0.42%). Hence, here the response is asymmetric in terms of sign: regardless of whether sales are increasing or decreasing contractual wages of stayers increase, generally. Similarly, hours worked are hardly reduced, indicating that firms only use the extensive margin to downwardly adjust their wage bills.

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 positive, 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 periods. Note that in general, exits and entries show a different pattern over sales as 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. What happens to the wages of entrants or exiters cannot be seen directly from the decomposition table. The complementary information in Table 8 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 or less favourable and adverse circumstances, Table 3 explores the heterogeneity of wage-bill adjustments over percentile groups

[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'.

[9] Exiters also have lower wages than stayers, although in bad times more highly paid workers tend leave the firm, as Table 8 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.

Table 3 Decomposition of wage-bill changes 2007–2013 by sales growth (percentiles) groups

	$\Delta S < 0$							$\Delta S \geq 0$						
	P75–100	P25–75	$\hat{\beta}$		P1–25	$\hat{\beta}$		P75–100	P25–75	$\hat{\beta}$		P1–25	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by														
Change net employment	− 3.09	− 6.13	− 2.90	***	− 16.75	− 10.14	***	1.99	1.01	− 1.03	***	− 1.75	− 2.57	***
Hourly wage, stayers	1.98	1.75	− 0.30	***	1.89	− 0.08	n.s.	2.51	2.27	− 0.19	**	2.09	− 0.08	n.s.
Hourly wage, entrants	− 1.8	− 1.56	0.17	***	− 1.49	0.07	n.s.	− 2.93	− 2.28	0.55	***	− 1.89	0.32	***
Hourly wage, exiters	1.6	1.60	0.12	n.s.	3.47	1.54	***	2.26	1.62	− 0.43	***	1.61	0.05	n.s.
hrs worked, stayers	0.58	0.46	0.00	n.s.	0.01	− 0.17	**	0.66	0.78	0.03	n.s.	0.63	− 0.13	**
hrs worked, non− stayers +	0.48	0.51	0.05	n.s.	0.72	0.29	**	0.25	0.39	0.01	n.s.	0.45	0.06	n.s.
Gross wage-bill change (in %)														
contractual	− 0.25	− 3.31	− 2.92	***	− 12.15	− 8.43	***	4.73	3.79	− 1.02	***	1.14	− 2.37	***
+ overtime pay	− 0.36	− 3.52	− 3.04	***	− 12.57	− 8.64	***	4.85	3.77	− 1.16	***	1.04	− 2.48	***
+ inc. & extra pay	− 0.43	− 3.48	− 2.99	***	− 12.44	− 8.66	***	4.89	3.85	− 1.13	***	0.11	− 2.57	***
# Firm-year obs.	8808	16657			7140			9.691	21.995			11.311		
# w.-yr obs. (* mln)	2.0	2.6			0.9			1.2	3.2			2.2		

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 sale, seperately in case of sales decrease or in case of sales increase. $\hat{\beta}$ is the estimation result for Eq. (5), applied to the wage bill and each of its its components separately: $\hat{\beta}$ in columns 3 and 10 refer to P25–P75 compared to P75–P100; $\hat{\beta}$ in columns 6 an 13 refer to P1–P25 compared to P25–P75. $\hat{\beta}$ is the estimation result for Eq. (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 $\Delta S \geq 0$; The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Significance levels: ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1%.
Source: Own calculations using register data from Statistics Netherlands

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), in case of decreasing sales (left hand side of the table) and in case of increasing sales (right). Hence, column five ($\Delta S < 0$ and P1–P25) applies to the most extreme sales decreases, while column eight ($\Delta S \geq 0$ and P75-P100) refers to the most extreme sales increases. $\hat{\beta}$ in columns 3 and 10 refer to P25–P75 compared to P75–P100, whereas $\hat{\beta}$ in columns 6 and 13 refer to P1–P25 compared to P25–P75.

Gross wage bill change rages from -12.15% for the most extreme sales decrease category, to 4.73% for the most extreme sales increase category. In case of decreasing sales the variation in wage bill growth is clearly larger than when sales rise. Especially in case of an extreme sales decrease the wage bill growth drops sharply, mainly due to a reduction in employment. The results thus confirm that changes in net employment is the main channel for downward wage-bill adjustment, in particular during a relatively extreme negative sales shock where its contribution amounts to -16.75 percentage-points (138% of wage bill growth). In contrast, in case of extreme positive sales growth (P75-P100) the contribution of net employment is 1,99 percentage-points (being 42% of the wage bill growth of 4.73%). So again, in terms of size (relative to the contractual wage bill growth) the response of net employment is strongly asymmetric.

Growth in the hourly wage of stayers is only slightly sensitive to the variation in sales growth and is positive for all percentile groups (it contribution ranging from 1.75 to 2.51 percentage-points), confirming that its response to changes in sales is asymmetric in terms of sign. Relatively to the wage bill growth its contribution varies more of course, as the wage bill (the denominator) is strongly impacted by chnages in net employment. The fact that growth in the hourly contractual wage of stayers is scarcely lower at the lower end of the sales distribution for stayers, is probably because collective labour agreements put a floor on contractual wage growth. As the lower panel shows, firms use overtime pay and incidental wages as a valve to adjust to the variations in sales.

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 refers to the adifference between the second and first groups of firms, while $\hat{\beta}$ in column 6 refers to the difference between the third and first groups of firms. In case of a protracted sales decrease (Table 4, 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

Table 4 Decomposition of wage-bill changes 2007–2013 by sales growth in current and prior year

		$\Delta S_t \geq 0$	$\Delta S_t < 0$	$\hat{\beta}$		$\Delta S_t < 0$	$\hat{\beta}$	
			$\Delta S_{t-1} \geq 0$			$\Delta S_{t-1} < 0$		
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 observations		32,581	13,534			10,528		
# Worker-year observations (*mln)		4.9	2.2			2.2		

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 2). This sample is split into three groups: first, firms with positive sales growth in the year of observation (t) (where sales growth in (t − 1) and (t−2)) may be positive or negative); 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 Eq. (5), applied to the wage bill and each of its its components separately, each time comparing two subsamples. This is estemated for each year; the tabel gives the average results for the period 2007-2013. $\hat{\beta}$ in column 3 refers to the difference between the second and the first group of firms, while $\hat{\beta}$ in column 6 refers to the the difference between the third and the first group of firms. The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Significance levels: ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1%.
Source: Own calculations using register data from Statistics Netherlands

not by much more then after a one-time drop in sales.[10] 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.[11]

[10] 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.

[11] 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 difference 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

Table 5 Decomposition of wage-bill changes 2007–2013, firms by share of open-term contracts

	Share open-term contracts ≥ *P*50				Share open-term contracts < *P*50			
	$\Delta S \geq 0$	$\Delta S < 0$	$\hat{\beta}$		$\Delta S \geq 0$	$\Delta S < 0$	$\hat{\beta}$	
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, 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		

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 Eq. (5) to the wage bill and each of its its components separately, each time comparing two subsamples. The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Significance levels: ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1%.
Source: Own calculations using register data from Statistics Netherlands

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 Table 5. Comparing results in Table 5 by firm group to those presented in Table 2 for the entire sample suggests that wage bill variations are larger for firms with less open-term contracts. The more flexible firms (regarding contract types) use net employment to a greater extent to adjust their wage bills to a negative sales shock (comparing in Table 5 the relative size of the beta's: − 8.94/− 7.74 exceeds − 5.36/− 5.20).[12] 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

Footnote 11 (continued)

the hourly wage of stayers. The $\hat{\beta}$ describing the difference 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.

[12] Relative to the gross wage bill change the net change in employment in case of decreasing sales is similar (about 170%) for low and high shares of open-term contracts; however in case of increasing sales the contribution of net employment is positive (zero) if the share of open-term contracts is low (high), so the difference between the states measured by the $\hat{\beta}$ is larger in case of more flexible firms

Table 6 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***
+ overtime/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 $\Delta S \geq 0$	8593		7562		3766		5663		8056		4952		4405	
# Firms $\Delta S < 0$	3002		4388		6538		4812		4236		5051		4578	
# 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	

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 Eq. (5), applied to the wage bill and each of its its components separately, each time comparing two subsamples. This refers to $\Delta S < 0$ compared to $\Delta S \geq 0$. The relationship between the items of the decomposition and Eq. (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 register data from Statistics Netherlands

wages and hours worked by stayers are only slightly reduced, remaining positive for such firms in adverse periods.

These differences by contract type are consistent with those over *sectors of economic activity*. The business services and Horeca (hotel/restaurant/caf) 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 9 in "Appendix A"). Several features suggest that these sectors may have a segmented labour market.[13] 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 may 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 6). In 2007–2008, firms facing decreasing sales reduced their wage bills on average by 0.76%, whereas in 2008–2009 the average reduction was 5.66%; also the number of firms facing fewer sales rose by almost 50% in that same period. Although this reduction is large, macro-economic data show that during the early phase of the crisis in the Netherlands the reduction in employment still fell short of the drop in GDP due to labour hoarding, motivated by the relatively strong financial position of firms at the onset of the crisis as well as the fact that the previous tight labour market where it was hard to fulfill vacancies was fresh in the minds of employers (Gelauff et al. 2014). Also, the temporary (April 2009–July 2011) facility for part-time unemployment benefits may have had a limited effect as (Hijzen and Venn 2011) found that the part-time unemployment benefit regulation saved five to six thousand full-time jobs. 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. Our decomposition shows that overtime pay and incidental wages offered some downward flexibility, − 0.50 percentage-points in 2008–2009. Wage-bill contraction found

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

its trough in the next year, 2009–2010. Employment reduction has been the key channel for wage-bill adjustment in the crisis years 2008–2009 and 2009–2010, featuring a net change in employment for firms with a drop in sales of − 10.90 in 2009–2010, against only − 5.68 in 2007–2008.

Wage growth of stayers remained positive in almost every year, even for firms where sales decreased, suggesting nominal wage rigidity.

Notably, hourly wage growth of stayers, although remaining positive in most years, 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 settings. This is clearly reflected by the fact that the beta (which quantifies the asymmetry between the favourable and adverse state, see the explanation of Eq. 5) is relatively low compared to the average growth in the hourly wage for firms with sales drops. For the net change in employment this ratio (of the beta and the coefficient) is much higher, especially in the most severe years of downturn. This again may reflect downward wage rigidity, which presumably is more outspoken during downturns. However, across the board (so both for firms with negative and positive sales growth) the wage growth of stayers has been gradually reduced over the years, possibly due to a relatively high level of coordination, as 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. However, the fact that it took quite some time to reduce wages may partly be related to the fact that at the onset of the crisis many firms were still in a good financial position. Related, labour hoarding was quite common in the onset of the crisis, while more recently the recovery of unemployment took longer than in most other countries.

4.2 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 might 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 2018) 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 in the Netherlands, concentrated among workers who are relatively old, highly educated, and often on open-term contracts and full-time jobs. These are also the groups that are best-represented by labour unions, in line with the idea that the high level of coordination is a factor behind positive wage growth of stayers. The Social Economic Council advised enlarging the support for collective labour agreements by involving groups that are underrepresented among the union membership (SER 2013).

5 Conclusions

This paper 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. However, the fact that it took quite some time to reduce wages may partly be related to the fact that at the onset of the crisis many firms were still in a good financial position. Related, labour hoarding was quite common in the onset of the crisis, while more recently the recovery of unemployment took longer than in most other countries.

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.

Employment adjustments seem to affect workers in a relatively weak labour market position more strongly, as employment loss is found to be larger among firms with a low share of open-term contracts. At the same time, ongoing workers can count on wage increases that are not jeopardised by sales shocks suffered by their firms. These findings may point at labourmarket segmentation, which 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 7 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.

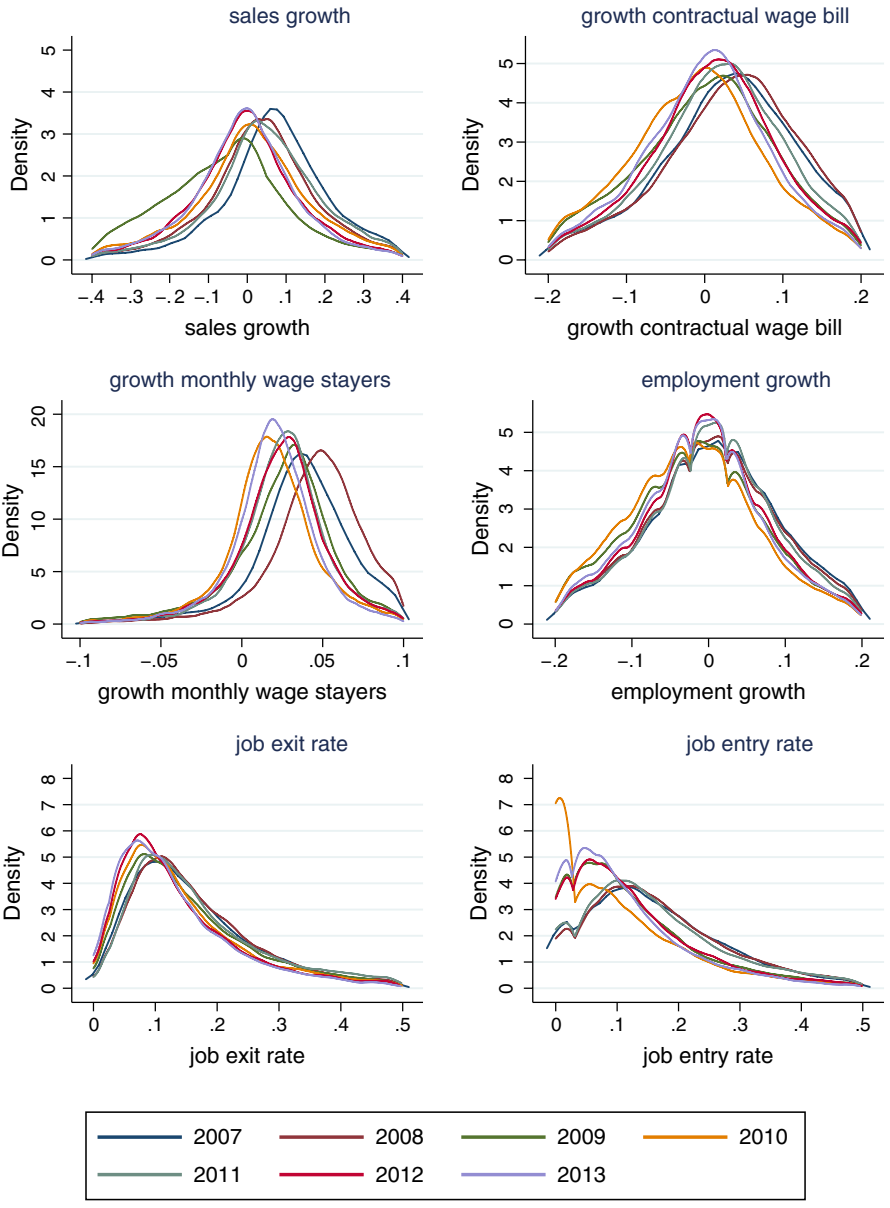

Fig. 1 Kernel density graphs firms ≥ 25 workers, by year. *Source*: Own calculations based on register data from Statistics Netherlands

Table 7 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	≥ 25 workers	≥ 25 workers	≥ 25 workers	≥ 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 ≥ 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	8420	43,787	11,724

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 register data from Statistics Netherlands

Table 8 Complementary info for Table 2, the decomposition for firms with negative versus positive sales growth

	$\Delta S \geq 0$	$\Delta S < 0$	$\hat{\beta}$	
Growth in contractual wage bill (in %)	3.30	− 4.42	− 9.34	***
Growth in # of jobs	0.25	− 7.48	− 10.35	***
Share exiters (t − 1)	16.90	18.46	1.59	***
Share entrants (t)	17.05	13.32	− 4.24	***
Share aged 60–65 among exiters (t − 1)	9.88	10.89	− 0.10	n.s.
Share aged 55–59 among exiters (t − 1)	5.31	5.77	0.27	***
Average age stayers (t − 1)	40.85	41.42	− 0.01	n.s.
Age exiters to age stayers (t − 1)	96.81	97.25	0.18	n.s.
Age entrants to age stayers (t)	85.74	84.44	− 0.70	***
Δ Log wage stayers (hourly), permanent	2.56	2.11	− 0.30	***
Δ Log wage stayers (hourly), temporary	4.19	3.59	− 0.46	**
Δ Log hours worked stayers, permanent	0.35	− 0.02	− 0.15	**
Δ Log hours worked stayers, temporary	− 0.70	− 1.02	− 0.15	n.s.
Log h.wage exiters - Log h.wage stayers	− 10.32	− 9.60	0.63	**
Log h.wage entrants - Log h.wage stayers	− 14.54	− 13.53	0.99	***
Log hours exiters - Log hours stayers	− 8.53	− 7.41	0.85	***
Log hours entrants - Log hours stayers	− 5.59	− 6.93	− 1.03	***
Δ Log overtime hours	0.04	− 0.16	− 0.17	***
Δ Log Share part-time jobs	0.07	− 0.20	0.01	n.s.
Share stayers, permanent (t)	71.05	74.70	3.30	***
Share stayers, temporary (t)	11.89	11.98	0.82	***
Share exiters, permanent (t − 1)	9.76	11.00	1.25	***
Share exiters, temporary (t − 1)	7.14	7.46	0.52	***
Share entrants, permanent (t)	6.81	5.34	− 1.55	***
Share entrants, temporary (t)	10.24	7.98	− 2.68	***

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. $\hat{\beta}$ is the estimation result for Eq. (5); column 3 refers to $\Delta S < 0$ compared to $\Delta S \geq 0$. Significance levels: $*$: 5% $**$: 1% $***$: 0.1%. *Source*: Own calculations using register data from Statistics Netherlands

Table 9 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***
incl. overtime/inc./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		3880		11,082		975		4692		9505	
# Firms $\Delta S < 0$	9741		3269		8772		708		3071		6966	
# 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	

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 Eq. (5), applied to the wage bill and each of its its components separately, each time comparing two subsamples, and refers to $\Delta S < 0$ compared to $\Delta S \geq 0$. The relationship between the items of the decomposition and Eq. (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 register 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 10 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 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 11 shows that the results of decomposition are largely comparable to those in Table 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 6). 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.

Table 10 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	***
incl. overtime/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			42,909	32,693			42,997	32,605		
# Worker-year obs. (*mln)	7.5	8.0			5.5	6.7			6.7	5.5		

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 Eq. (5) to the wage bill and each of its its components separately. The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Significance levels: ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1%.

Source: Own calculations using register data from Statistics Netherlands

Table 11 Decomposition of wage-bill changes by sales growth groups, including firm dynamics

Sample		$\Delta S \geq 0$	$\Delta S < 0$	$\hat{\beta}$	
Contribution to gross contractual wage-bill change by					
Net change in empl.		3.34	− 6.51	− 7.55	***
Hourly wage, stayers		2.12	1.58	− 0.34	***
Hourly wage, entrants		− 2.74	− 1.88	0.51	***
Hourly wage, exiters		1.77	2.10	0.31	***
Hours worked, stayers		0.81	0.48	− 0.16	***
Hours worked, non-stayers	+	− 0.12	0.15	0.25	***
Gross wage-bill change (in %)					
Contractual		5.18	− 4.06	− 6.79	***
incl. overtime/inc./extra pay		5.22	− 4.28	− 7.57	***
# Firm-year obs.		45,151	33,294		
# Worker-year obs. (*mln)		7.0	5.7		

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. $\hat{\beta}$ is the estimation result for Eq. (5), applied to the wage bill and each of its its components separately: column 3 refers to $\Delta S < 0$ compared to $\Delta S \geq 0$. The relationship between the items of the decomposition and Eq. (4) is explained in footnote 6. Standard errors in parentheses. Significance levels: ∗ : 5% ∗∗ : 1% ∗∗∗ : 0.1%.
Source: Own calculations using register 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[14] 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 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.

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[14] 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

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