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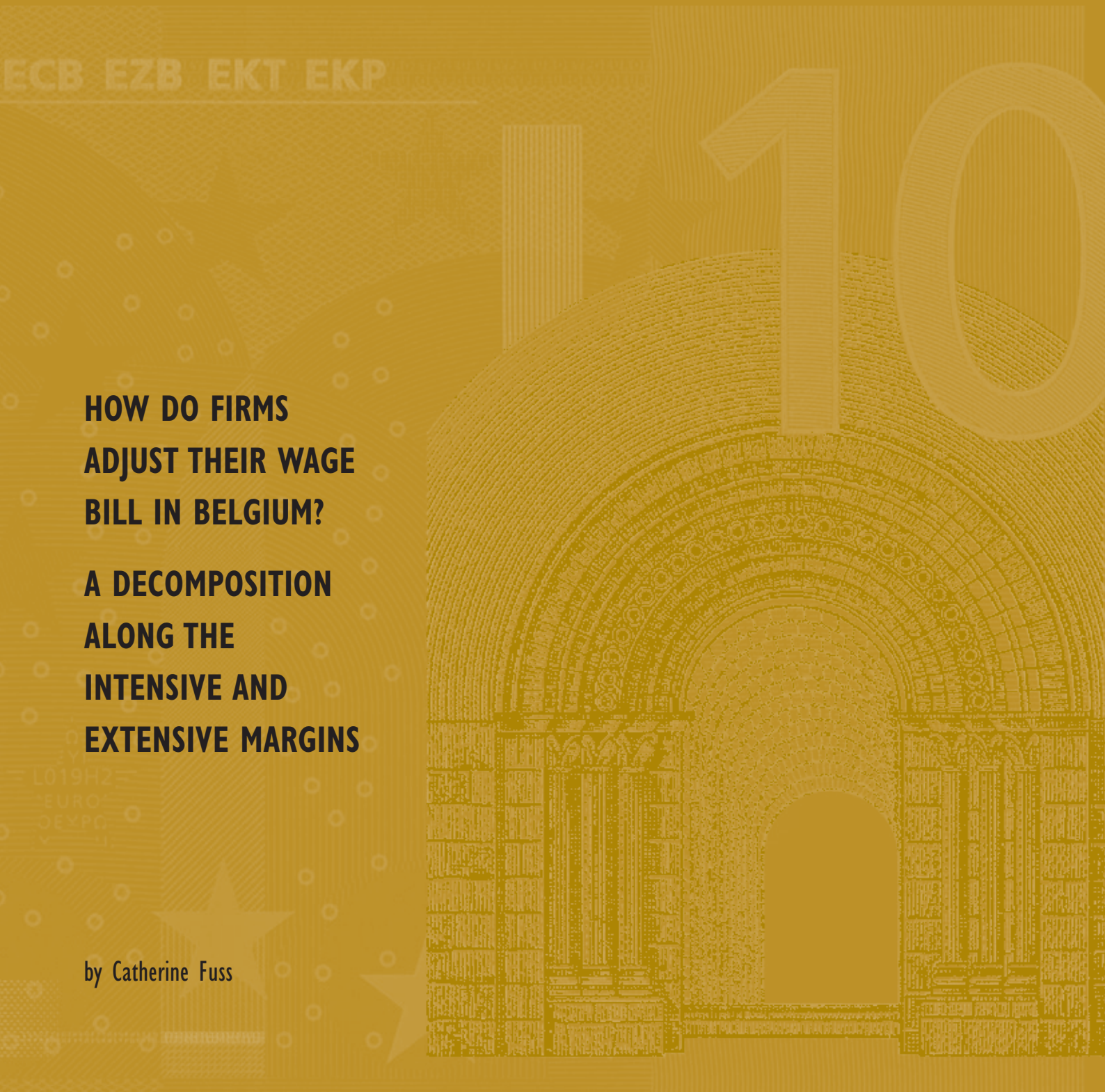


# HOW DO FIRMS ADJUST THEIR WAGE BILL IN BELGIUM?

## A DECOMPOSITION ALONG THE INTENSIVE AND EXTENSIVE MARGINS

by Catherine Fuss

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# A DECOMPOSITION ALONG THE INTENSIVE AND EXTENSIVE MARGINS [1]

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## Wage Dynamics Network

This paper contains research conducted within the Wage Dynamics Network (WDN). The WDN is a research network consisting of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the EU countries. The WDN aims at studying in depth the features and sources of wage and labour cost dynamics and their implications for monetary policy. The specific objectives of the network are: i) identifying the sources and features of wage and labour cost dynamics that are most relevant for monetary policy and ii) clarifying the relationship between wages, labour costs and prices both at the firm and macro-economic level.

The WDN is chaired by Frank Smets (ECB). Giuseppe Bertola (Università di Torino) and Julian Messina (Universitat de Girona) act as external consultants and Ana Lamo (ECB) as Secretary.

The refereeing process of this paper has been co-ordinated by a team composed of Gabriel Fagan (ECB, chairperson), Philip Vermeulen (ECB), Giuseppe Bertola, Julian Messina, Jan Babecký (CNB), Hervé Le Bihan (Banque de France) and Thomas Mathä (Banque centrale du Luxembourg).

The paper is released in order to make the results of WDN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.



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# CONTENTS

**Abstract**

This paper decomposes wage bill changes at the firm level into components due to wage changes, and components due to net flows of employment. The analysis relies on an administrative employer-employee dataset of individual annual earnings matched with firms' annual accounts for Belgium over the period 1997-2001. Results point to asymmetric behaviour depending on economic conditions. On average, wage bill contractions result essentially from employment cuts *in spite of* wage increases. Wage growth of job stayers is moderated but still positive; and wages of entrants compared with those of incumbents are no lower. The labour force cuts are achieved through both reduced entries and increased exits. Higher exits may be due to more layoffs, especially in smaller firms, and wider use of early retirement, especially in manufacturing. In addition, the paper points up the role of overtime hours, temporary unemployment and interim workers in adapting to short-run fluctuations.

**Keywords:** wages, employment flows, matched employer-employee data
**JEL:** J30, J60

**Non-technical summary**

This paper analyses simultaneously wage and employment variations, and their relative contribution to wage bill adjustment. Recent studies point to a high degree of wage rigidity, and particularly so in Belgium. In a situation of wage rigidity, employment is expected to drive most of wage bill variations. However, another strand of the literature on this subject points to non-negligible adjustment costs, such as the cost of hiring and firing, that restrict employment adjustment. In such cases, variations in the number of employees may be limited. Changes in hours worked may then be achieved mainly through variations in the number of hours worked per employee, as well as by interim workers hired from temporary employment agencies. This may provide a flexible adjustment tool in response to short-run variations in production.

This paper investigates the main driving variables of wage bill fluctuations. More precisely, it decomposes variations of the wage bill at the firm level into four components: (1) one associated with changes in the wages of job stayers (employees that work for the firm in year t-1 and in year t), (2) another due to the differences between the wage of entrants (employees that work in the firm in year t but not in t-1) and wages of exiters (employees that work in the firm in year t-1 but not in t), (3) one related to intra-year net flows of employment, (4) and the last due to between-year net flows of employment.

The decomposition is performed separately for periods of wage bill growth and periods of wage bill contraction. It is backed up by information on wages per type of worker (by occupation, age and whether they are job stayers or newly-hired workers), and on entries and exits. Finally, it also considers the evolution of hours worked per employee and hours worked by interim workers.

The analysis relies on an administrative dataset of around one-third of individual annual earnings of the private sector merged with firms' annual accounts and social balance sheets for Belgium, over the period 1997-2001, for the manufacturing, construction and commercial services sectors.

The results show that, on average, wage changes and net employment flows contribute to wage bill fluctuations in the same proportion. However, comparing favourable and adverse economic situations highlights a strongly asymmetric pattern. If wage bills contract, wage growth remains positive on average, so that job cuts make up the bulk of the reduction in the wage bill.

The analysis is performed for firms of different size classes and sectors, as well as for cases of falling sales. The results indicate that smaller firms and the construction and services sectors experience larger fluctuations in wage bill growth and employment than do larger firms and the manufacturing sector. The drop in wage bill growth is larger in cases of wage bill contraction than in cases of falling sales.

In cases of wage bill contraction, wage growth of job stayers is moderated but remains positive. In order words, there is, on average, no cut in the wages of job stayers. This is consistent with previous empirical evidence of high downward wage rigidity for Belgium, and with the institutional features of the Belgian labour market, such as full automatic indexation of basic wages. Furthermore, there is no evidence that firms reduce the pay rate of entrants relative to

incumbents in adverse times. This may result from fairness, efficiency wage considerations, as well as the fact that pay scales are determined at a highly disaggregated level by collective bargaining agreement. Consequently, the average wage level in the firm does not diminish.

Therefore, employment contractions are the main source of wage bill reductions. Because layoffs may be a more costly way of reducing employment levels, I consider alternative ways of reducing the labour force. Firstly, the number of employees may diminish by reducing new hires. As part of the workforce leaves the firm every year on a voluntary basis or due to retirement, reducing entries may lead to employment contraction. Accordingly, not renewing fixed-term workers' contracts has the same effect. The second alternative to costly layoffs may be early retirement. In Belgium, this may apply to distressed firms under specific conditions for workers aged 50 and over. The results show that reductions in the labour force are achieved both through reduced entries and, to a slightly lesser extent, through increased exits. There is evidence that early retirement is more common in unfavourable economic circumstances, possibly thanks to special rules applying to firms in difficulty. This is especially the case in the manufacturing sector. Results also point to a slight fall in fixed-term contract hires, particularly in large firms and in the manufacturing industry.

Lastly, in addition to a reduction in the number of employees, the number of hours worked may diminish, through a lowering of overtime hours, the use of temporary unemployment, as well as interim workers hired from temporary employment agencies. These may prove particularly suitable to adjust to short-term fluctuations in production. These mechanisms also find support in the paper. It reports evidence of a reduction in hours worked and number of days worked (possibly due to temporary unemployment), as well as a cut in hours worked by interim workers, particularly more so in cases of sales contraction.

All together, the paper pleads for a broad view of the wage bill adjustment margins under changing economic conditions.

## 1. Introduction

Wage rigidity and employment adjustment have received a lot of attention, but they have generally been investigated separately. On the one hand, wage rigidity has been shown to have strong implications for unemployment as well as inflation and monetary policy (see, for example, Blanchard and Gali, 2006). Recent microeconomic evidence points to substantial resistance to cut wages (see Dickens et al., 2006, 2007), or sluggish reaction to transitory shocks (Guiso et al., 2005) or to adverse shocks (Biscourp et al., 2005). On the other hand, a large literature on employment adjustment points to strong non-linear adjustment costs (see, for instance, Cooper et al., 2004) and lumpy employment changes (see, among others, Caballero et al., 1997). The present study considers jointly the relative importance of wage and employment variations in the event of changes in total labour costs.

More precisely, this paper assesses the variables that account for most of the wage bill fluctuations, and whether the pattern is asymmetric under favourable or adverse economic conditions. It builds on Duhautois and Kramarz (2006) who apply Davis and Haltiwanger's (1992) decomposition to the wage bill. I decompose changes in the wage bill at the firm level[1] into four main components: (1) one due to changes in the wages of job stayers (employees that work for the firm in year t-1 and in year t), (2) another due to the differences between the wage of entrants (employees that work in the firm in year t but not in t-1) and wages of exiters (employees that work in the firm in year t-1 but not in t), (3) one due to intra-year net flows of employment, (4) and the last due to net flows of employment between years.

Whether labour market rigidities generate more wage rigidity or restricted employment flows is not a priori clear and has to be determined on empirical grounds. If wages are rigid, employment may account for most of the wage bill fluctuations. In the presence of downward wage rigidity in particular, employment cuts may explain most of the wage bill contraction. However, other market features may limit the scope for adjusting employment. For example, firing costs may restrict job cuts. Other adjustment margins, such as hours worked (and overtime hours) may then substitute for changes in the number of employees, in the same way as hours hired from temporary employment agencies.

The above discussion needs a few clarifications. First, downward wage rigidity has been provided for full-time job stayers (individuals that stay within the same firm for at least two consecutive years)[2]. Institutional features of the Belgian labour market, such as full automatic indexation, prevent real wage decreases, and henceforth nominal wage cuts. This explains the high degree of downward real wage rigidity found among full-time permanent job stayers in Belgium (see Du Caju et al., 2007, or Knoppik and Beissinger, 2005). However, firms might cut their average wage bill by reducing the wages of entrants relative to those of stayers. Support for this option can be found in Fehr and Goette (2005) for Switzerland. They find significantly stronger

1 In contrast, Kramarz and Duhautois (2006) perform their decomposition on a aggregate basis.

2 This is the case, for instance, of Altonji and Devereux (1999), Biscourp et al. (2005), Dickens et al. (2006, 2007), Du Caju et al. (2007), Guiso et al. (2005), Kahn (1997), Knoppik and Beissinger (2005), Nickell and Quintini (2003).

wage rigidity for job stayers than for movers. It should be noted that, in Belgium, pay scales, defined by sector, profession and age through collective agreements by social partners, provide a lower wage bound by sector, profession and age. This partly prevents discrimination between entrants and incumbents. In addition, considerations such as fairness, efficiency wage or others, may prevent firms from discriminatory practices. Additionally, changes in the firm's average wage bill may also result from changes in the composition of the labour force. For example, younger workers typically earn less than older workers; blue-collar workers have lower wages than white-collar workers.

Next, exits may take the form of voluntary quits, retirement, early retirement or redundancy. Retirement is related to age and voluntary quits depend, in principle, on workers only. Therefore, one typically expects that layoffs provide the main adjustment tool in adverse times. In this respect, employment flows may differ across worker types. First, there are no firing costs for fixed-length contracts or for interim workers (who are hired from temporary employment agencies). Therefore, one may expect to find that employment reductions concentrate on these workers. Second, firing older workers may be more costly than dismissing younger employees. The reason is twofold. Firm-specific human capital is higher for higher-tenured workers. And firing costs also increase with tenure. Note that in Belgium, early retirement is allowed for older workers (from the age of 50) in cases of deep restructuring, so that a large fraction of exits may concentrate on older workers. Finally, labour may be adjusted through changes in hours worked. This may be achieved through increases in overtime hours in the event of labour shortages or through temporary unemployment in cases of excess labour. Furthermore, interim workers hired from temporary employment agencies provide an additional flexible tool to adjust hours.

The primary goal of the paper is to assess the relative contribution of wage fluctuations and employment changes to wage bill variations under favourable or adverse economic conditions. Complementary information on job flows and wages is used to provide a deeper understanding of the adjustment margins. First of all, I investigate whether wage changes are due to variations in wages of job stayers, or to differentiated compensation of entrants relative to incumbents. Further, I consider wage changes of blue-collar and white-collar workers, as well as the average age of the firm's labour force. Next, the nature of employment adjustment is considered along three lines. First, employment reductions may be due to increased exits or reduced entries. Firing restrictions may limit the use of layoffs so that the net reduction in employment may be achieved primarily through reducing the number of entrants. Second, firing costs may also lead to lower redundancies among workers with open-ended contracts, and bigger cuts in the number of workers with fixed-term contracts, as there are no firing costs to pay at the end of the contract. I also examine the use of early retirement as a way of adjusting workforce size. Third and finally, I consider alternative adjustment margins. In cases where there are high labour adjustment costs such as hiring costs due to advertising, matching and training costs, as well as firing costs, hours worked and manpower workers may be a useful buffer to changing economic conditions, such as a sudden and unforeseen change in demand, at least in the short run.

The analysis relies on an administrative dataset of individual annual earnings in the private sector held by the social security administration merged with firms' annual accounts and social balance sheets for Belgium over the period 1997-2001. The dataset on individual annual earnings is a random sample which includes one-third of the exhaustive administrative dataset. It is used to compute the average wage of stayers, entrants and exiters by firm. Social balance sheets provide the number of entrants, stayers and exiters for each firm, as well as additional information. The public sector as well as small firms are excluded from the analysis. I restrict the dataset to the manufacturing, construction and commercial services sectors.

Broadly, the results indicate that although one-half of the wage bill growth is attributable to wage increases and the other half to employment growth, wage bill contractions are primarily attributable to employment cuts. On average, there is no evidence of wage reductions during adverse economic conditions. At most, wage growth simply slows down. Further, there is no evidence that wages of entrants relative to that of incumbents are any lower in bad times. However, firms may in some cases save on their average wage bill by concentrating exits among older and higher-wage workers. Owing to resistance to wage cuts, wage bill contractions are achieved primarily through employment cuts. Under unfavourable circumstances, the labour force is brought down through several margins. First, employment is lowered through less hiring. Second, there is also an increase in the number of exits. This is achieved not only through retirement, early retirement, and no renewal of temporary contracts, but also through wider layoffs, which are generally speaking more costly. Third, the number of hours and days worked is reduced compared to favourable economic conditions. This suggests that firm reduce overtime hours and make use of temporary unemployment in adverse times. Fourth, the use of manpower workers, which do not formally belong to the firms' workforce but are hired from temporary employment agencies, is also limited in times of contraction.

Against this general view, the results point to differences according to firms' characteristics and sectors. Stronger variations in wage bill growth and employment are seen in smaller firms and in the construction and services sectors than in larger firms and the manufacturing sector. Further, sales declines lead to a bigger reduction in hours, days worked and manpower workers than wage bill contractions.

The paper is organised as follows: Section 2 explains the wage bill decomposition. Section 3 describes the data and relevant institutional features of the Belgian labour market. Section 4 presents the results of the wage bill decomposition together with additional descriptive statistics. First, wage bill adjustment in cases of wage bill expansion is compared with that related to wage bill contraction. Then the analysis is repeated for firms from different size classes, as well as for different sectors of economic activity. Finally, I repeat the exercise defining adverse conditions with respect to sales. Note that adverse times are defined at the firm level. They may capture aggregate business cycle fluctuations, sector-specific as well as firm-specific variations. Robustness to alternative cleaning of the dataset and various definitions of the sample splits are also reported in Appendix. Section 5 concludes.

## 2. Decomposing wage bill changes

The following wage bill decomposition builds on Duhautois and Kramarz (2006). Consider the wage bill of firm i at time t, $WB_{it}$, that employs $J_{it}$ workers (indexed by j), with annual earnings $w_{jit,}$ and define the wage bill growth as follows:

$$\Delta WB_{it} = \frac{\sum_{J_{it}} w_{jit} - \sum_{J_{it-1}} w_{jit-1}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (1)$$

At time t, firm i employs $J_{it}$ employees, from which there are $S_{it}$ stayers (workers that are employed in the firm in t-1 and in t), $N_{it}$ entrants (workers that are employed in the firm in t but not in t-1). Compared to the previous period, $E_{it-1}$ exiters (workers that are employed in the firm in t-1 but not in t) left the firm. Duhautois and Kramarz (2006) break wage bill growth down into one component due to changes in the wage bill of stayers and one component due to the wage bill associated with entrants, and one related to exiters:

$$\Delta WB_{it} = \frac{\sum_{J_{it}\in S_{it}} w_{jit} + \sum_{J_{it}\in N_{it}} w_{jit} - \sum_{J_{it-1}\in S_{it}} w_{jit-1} - \sum_{J_{it-1}\in E_{it-1}} w_{jit-1}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (2)$$

$$\Delta WB_{it} = \frac{\sum_{J_{it}\in S_{it}} \Delta w_{jit}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} + \frac{\sum_{J_{it}\in N_{it}} w_{jit}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} - \frac{\sum_{J_{it-1}\in E_{it-1}} w_{jit-1}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (3)$$

In the above formula, $w_{jit}$ refers to annual earnings. In this paper, I rewrite the expression in terms of daily earnings multiplied by the number of days worked:

$$\Delta WB_{it} = \frac{\sum_{J_{it}\in S_{it}} (w^{d}_{jit} D_{jit} - w^{d}_{jit-1} D_{jit-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} + \frac{\sum_{J_{it}\in N_{it}} w^{d}_{jit} D_{jit} - \sum_{J_{it-1}\in E_{it-1}} w^{d}_{jit-1} D_{jit-1}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (4)$$

As will be explained in the next section, the dataset used in this paper is not exhaustive. For each firm, data is available for around one-third of the employees, rather than all employees as in Duhautois and Kramarz (2006). Therefore, one cannot compute the sum over individual earnings. To get round this, I consider the average wage and number of work days per stayers, entrants and exiters. The equations denote by $\overline{w^{dS}_{it}}$ the average daily wage of job stayers in firm i in year t, $\overline{w^{dN}_{it}}$ the average daily wage of entrants in firm i in year t, and $\overline{w^{dE}_{it-1}}$ the average daily wage of exiters in firm i in year t-1. Accordingly, $\overline{D^{S}_{it}}$ is the average number of work days by job stayers in firm i in year t, $\overline{D^{S}_{it-1}}$ is the average number of work days by job stayers in firm i in year t-1, $\overline{D^{N}_{it}}$ is the average number of work days by entrants in firm i in year t, and $\overline{D^{E}_{it-1}}$ is the average number of work days by exiters in firm i in year t-1. Finally, the denominator $\sum_{J_{it}} w_{jit}$, gives the firm 's total wage bill. The wage bill growth decomposition becomes:

$$\Delta WB_{it} = \frac{(\overline{w^{dS}}_{it}\overline{D^{S}}_{it} - \overline{w^{dS}}_{it-1}\overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} + \frac{\overline{w^{dN}}_{it}\overline{D^{N}}_{it}N_{it} - \overline{w^{dE}}_{it-1}\overline{D^{E}}_{it-1}E_{it-1}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (5)$$

This allows to decompose each term further, distinguishing between variations in the wage bill that are due to changes in job stayers' wages, changes in the number of days worked by job stayers, differences between entrants' and exiters' wages, and differences between the total number of days worked by entrants and the total number of days worked by exiters:

$$\Delta WB_{it} = \frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it} + \overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (6)$$

$$+ \frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it} + \overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$$

$$\Delta WB_{it} = \frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} + \frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$$

$$+ \frac{\overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} + \frac{\overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})} \quad (7)$$

The last two terms may be interpreted in terms of net flows of workers. One advantage of measuring the labour force through both the number of employees and the number of days worked is that it measures not only net flows between year t and t-1 (the last term) but also takes into account exits within the year (the third term). In Duhautois and Kramarz (2006), the third term is not separated from the first one. They measure changes in the wage bill due to stayers but do not distinguish between changes due to wage variation and those due to changes in the number of days worked. On the contrary, the above decomposition separates the two effects. This may be relevant in case of intra-year job flows. Indeed, job stayers are defined as workers that are present in the firm in year t-1 and in year t, and are included in the wage bill of year t and t-1. Of course, some of these people may have started working in March t-1, for instance, or leave the firm in July of year t. Therefore, although job stayers are the same in year t and year t-1, the number of days worked by job stayers does not necessarily have to be identical in year t and year t-1. Therefore, if the third term is negative, there is a decrease in the total number of days worked by stayers, which I interpret as an intra-year negative net flow of workers.

The primary objective of this decomposition is to assess the variables that explain most of the wage bill fluctuations at the firm level. Due to labour market rigidities, it may be much easier to adjust the wage bill upwards than downwards. Duhautois and Kramarz (2006) results show that the adjustment mechanisms are different in cases of wage bill creation and wage bill destruction. Biscourp et al. (2005) provide evidence of an asymmetric response of wage changes to a firm's productivity shocks. Therefore, the analysis of each component of the wage bill is performed

separately for "good times" and "bad times" defined according to wage bill growth. In a later stage, I also use a definition based on sales growth. As these criteria may be endogenous[3], robustness analyses with alternative sample splits (including lagged values of the sample split criteria) are also carried out. However, most of the analysis is undertaken for the year in which the adverse situation is observed. Also, I consider separately medium-sized firms and large firms, and differences across sectors are investigated.

In each of these cases, the wage bill decomposition is supplemented by descriptive statistics on variables taken from firms' social balance sheets. The wage and age of entrants (exiters) relative to stayers gives information about differentiated pay policy for entrants versus incumbents and possible composition effects, as do changes in the wage of blue-collar and white-collar workers. Detailed information about job flows is also provided, such as the percentage of entrants and exiters, the percentage of exiters by motive of exits, the percentage of entrants and exiters by contract duration (open-ended vs fixed-term). Finally, information on other adjustment margins is also reported. Increases in hours worked per employee may reveal wider use of overtime hours. Reductions in the number of days worked may be an indication of temporary unemployment. Lastly, the percentage and evolution of interim workers hired from temporary employment agencies is also given.

## 3. Data description and institutional features of the Belgian labour market

### 3.1 Data description

The analysis rests on an administrative matched employer-employee dataset on individual annual earnings of workers in the private sector merged with firms' annual account information. The dataset includes all people born between the 5th and the 15th of each month. It covers the period 1990-2002 and the entire private sector. If the sample of individual wages per firm was exhaustive, the exact wage bill decomposition in equation (3) could be computed. Because the dataset only includes about one-third of the employees, this paper relies on an alternative approximate decomposition, given by equation (7), where average daily wages and work days are computed as firm averages from the individual earnings dataset; and the total wage bill (in the denominator), number of stayers, entrants and exiters are taken from firms' annual accounts.

Data on individual earnings are held by the social security administration and used to compute retirement benefits. This includes gross annual earnings, so it covers bonuses, premia, overtime hours, social security contributions paid by employees, but not employers' social security contributions, retirement provisions, private insurance paid by employers, and so on. The figures also include the number of work days, and some individual characteristics such as age, gender and occupation.

3 For example, a drop in demand, and therefore in sales, may lead to a drop in production and therefore employment cuts.

People below 18 years or above the legal retirement age (60 for women, 65 for men) are excluded from this dataset. Annual earnings that are below the legal minimum age[4] or above the (yearly defined) 99th percentile are excluded[5]. Further, people with more than one occupation within the same firm are excluded[6]. Finally, the analysis focuses on full-year jobs. These are defined as workers with a minimum of 10 months within the same firm (possibly over two consecutive years)[7]. In order to ensure that entrants in 2001 are full-year workers, the period covered only goes up to 2001[8].

This administrative data on individual earnings is merged with information from firms' annual accounts. In Belgium, (almost) all firms have to file their annual accounts. The dataset includes all sectors of economic activity excluding credit institutions. Annual accounts consist of balance sheet data and, since 1996, a so-called social balance sheet. The latter reports information on the number, costs, flows, and composition of the workforce. Among other things, it reports information on the number of workers, entrants, and exiters. It also provides a firm's total labour costs as well as the costs and hours worked by interim workers hired from temporary employment agencies. A distinction is made according to whether jobs are full-time or part-time. The workforce is given in terms of the number of people employed as well as in full-time equivalents. Finally, entries and exits are given by contract type (open-ended, fixed-term, replacement job, or for a specialised task). And exits are given separately according to retirement, early retirement, layoffs or other reasons.

Because medium-sized and large firms report more detailed information[9], and in order to ensure representativeness of the firm's average daily earnings computed from the individual earnings dataset, I focus on medium-sized and large firms. Additional data trimming concerns the legal situation of the firm and exclusion of outliers from the variables of interest. Foreign and public companies and non-profit associations are excluded from the sample. Also, only annual accounts covering the period from January to December are considered in order to ensure consistency between firms, and between annual accounts and individual earnings data[10].

In addition to the above-mentioned selection criteria, the following consistency checks are performed. The number of employees at the end of the year, and the average number of employees over the year, as reported in the notes to the annual accounts must be the same as the figures

4 The legal minimum wage applies to workers over 21.5 years old and with a tenure of at least six months. Therefore, younger or low-tenure workers may have below minimum wage earnings.

5 This trimming is motivated by the fact that the wage bill decomposition relies on the average wages per firm.

6 It is impossible to compute the wage change in this case.

7 The threshold is set at 10 months in order to allow for sick leave. Sick leave is limited to two months so that there is no overlap with temporary jobs. Results presented below are robust to a trimming that would allow for one to four months' sick leave.

8 In order to verify that a worker entering a firm in 2001 works in that firm for at least 10 months, we need information for the year 2002. For example, a worker who enters a firm in July 2001 has worked 6 months in that firm in 2001. It is considered in the sample if he works at least 4 months in the same firm in 2002, and excluded otherwise. This criterion cannot be used for entrants in 2002 because no data is available for 2003.

9 According to Belgian accounting legislation, a company falls within this category, in 2007, either when the yearly average of its workforce is at least 100 or when at least two of the following thresholds are exceeded: (1) yearly average of workforce is 50, (2) turnover (excluding VAT) amounts to at least EUR 7,300,000, (3) total assets exceed EUR 3,650,000. In general, the latter two thresholds are altered every four years in order to take account of inflation.

10 In some cases, annual accounts refer to only part of the year. In other cases, the period covered spans several years. For instance, in 1997, a firm reports for the period August 1996 to July 1997. If, in future, it wants to report for the period from January to December, then in 1998 it will report from August 1997 to December 1998.

reported in the social balance sheet. Also I keep only those firms for which net job flows reported in the social balance sheet, defined as the difference between entries and exits, do not deviate from five in absolute value from the changes in net employment given in the annual accounts over two consecutive years. Further, the number of entries over the year cannot exceed the number of employees at the end of the year[11].

Contrary to typical job creation-job destruction analysis, I also trim the data for outliers. This contrasts with, for instance, Duhautois and Kramarz (2006) or Davis and Haltiwanger (1992), who examine job creation and destruction from an aggregate perspective. Analysing all firms in the economy is especially useful to derive macroeconomic information on job creation and destruction. This type of analysis captures extreme events such as wage bill destruction due to massive downsizing of a large firm. Therefore, trimming for outliers is ruled out. On the contrary, this paper attempts to understand how individual firms adjust their labour costs and employment. This is a preliminary step to understanding firms' reaction to microeconomic events. Because the present analysis is based on averages across firms and years, removing extreme observations is essential. The concern is more on wage bill management under normal business conditions rather than under exceptional circumstances, i.e. extreme observations are excluded.

Outliers are removed by excluding observations below the 1st percentile or above the 99th percentile (defined year by year) of the following variables: wage bill growth, employment growth (defined with respect to the number of employees and full-time equivalents), sales growth (in nominal and real terms), growth in value added (in nominal and real terms), profits-assets ratio, profitability over assets (net and gross), productivity growth (defined with respect to the number of employees and FTEs). As explained in the robustness analysis in Appendix 4, alternative definitions of adverse conditions are considered. In addition to the definition based on positive and negative growth rates, the variables are also compared with their "normal times" levels. These are defined as the firm-specific median (or first quartile) over the period 1993-2001. To compute these, only firms with at least three observations are considered[12].

Finally, these two datasets are merged. A final trimming is undertaken so as to make individual earnings data as representative as possible of the firms. First, the wage bill growth as computed from information in the annual accounts is not allowed to deviate too far from that computed by summing individual annual earnings within the firm. More precisely, the difference between the log difference wage bill given by the annual accounts and the log difference of the sum of individual earnings should be smaller than 0.15 in absolute value. Robustness tests with respect to a stricter criterion, 0.05, and to a less strict criterion, 0.25, are reported in Appendix 2. Also, I keep firm-year observations which cover at least 10 individual salaries of job stayers and 10% of the number of stayers reported in the social balance sheet, and if there are job flows within the firm in that year, at least 2 entrants (exiters), provided they represent at least 5% of the numbers of entrants (exiters) reported in the social balance sheet.

11 Note that this may be the case when the firm mainly employs workers for short-term periods.

12 In addition, these observations must lie within the 1st and 99th percentile, defined year by year.

Table A1 in Appendix 1 describes the trimming procedure in terms of number of firms. The more severe trimming is actually due to the matching of the individual earnings dataset with firms' annual accounts, as well as to criteria related to the representativeness of individual earnings data at the firm level, i.e. the last criterion described in the preceding paragraph. Descriptive statistics for a control sample of firms, not matched with the individual earnings dataset, are also reported in Table A2 in Appendix 1. These show that in the sample used in this paper there are fewer variations (standard deviations are smaller) in employment growth, wage bill growth and hours worked growth than in the control sample, due to trimming for outliers. However, the average figures are of the same order of magnitude.

Table 1 reports descriptive statistics of the sample, which contains 4,705 observations, 1,974 firms, and covers more than 200,000 employees.

**Table 1. Descriptive statistics**

| | mean | std | Q1 | median | Q3 |
|---|---|---|---|---|---|
| Δwage bill | 0.060 | 0.094 | 0.008 | 0.052 | 0.105 |
| Δnumber of employees | 0.033 | 0.097 | -0.020 | 0.022 | 0.077 |
| $\%entrants_t$ | 0.233 | 0.142 | 0.127 | 0.202 | 0.309 |
| $\%exits_t$ | 0.204 | 0.127 | 0.114 | 0.173 | 0.263 |
| $retirement_t/exits_t$ | 0.021 | 0.060 | 0 | 0 | 0.017 |
| $early\ retirement_t/exits_t$ | 0.039 | 0.091 | 0 | 0 | 0.038 |
| $layoffs_t/exits_t$ | 0.209 | 0.209 | 0.057 | 0.154 | 0.302 |
| Δhours/FTE | -0.006 | 0.055 | -0.026 | -0.006 | 0.013 |
| Δ%part-time workers | 0.005 | 0.021 | -0.003 | 0.000 | 0.011 |
| Δinterim hours | 0.078 | 0.858 | -0.346 | 0.054 | 0.489 |
| $\Delta w^{blue}$ | 0.038 | 0.042 | 0.024 | 0.035 | 0.051 |
| $\Delta w^{white}$ | 0.059 | 0.063 | 0.032 | 0.051 | 0.075 |
| $w_{entrant}-w_{stayer}$ | -0.156 | 0.195 | -0.263 | -0.150 | -0.049 |
| $w_{exit}-w_{stayer(t-1)}$ | 0.010 | 0.253 | -0.128 | -0.023 | 0.109 |
| # firm-year observations | 4705 | | | | |
| # firms | 1974 | | | | |
| # workers | 208059 | | | | |

Δ refers to the first difference of the log of the variable; Δ% part-time workers to the first difference of the percentage of part-time workers; the ratios $\%entrants_t$, $\%exits_{t-1}$ , $\%exits_t$ are computed with respect to the number of employees at the end of the year; $w_{entrant}-w_{stayer}$ is the difference between the low earnings of entrants and the log earnings of incumbents; number of employees is given at the end of the year.

On average over the period, the total nominal wage bill increases by 6% and employment by 3%. Entries represent up to 23% of the number of employees at the end of the year, and exits 20%. Layoffs account for more than 20% of exits, and retirement and early retirement for 6%. Note also that, over the period, there is a decline in the number of hours worked per full-time equivalent and growing use of interim (manpower) hours. Heterogeneity across firms in the increase of manpower hours is the largest of all variables reported in the Table. Averages of individual wages by firm also suggest that nominal wage increases amount to around 4% for blue collars and 6% for white collars. Finally, it is worth noting that entrants' wages are, on average, 15% lower than those of incumbents. One explanation for this is that holiday allowances are not paid by the firm in the

first year of work; these allowances make up 15.34% of the annual earnings of white-collar workers and 15.38% for blue-collar workers.

### 3.2. Institutional features of the Belgian labour market

This section briefly reviews some features of the Belgian labour market that may be relevant for understanding wage bill adjustment. Notable characteristics of wage formation in Belgium are the existence of a minimum wage, indexation, a cap on wage increases, and the importance of sectoral collective bargaining. As far as employment is concerned, adjustment of the labour force may be eased by early retirement, temporary unemployment as well as overtime.

First, a floor for nominal wages is determined by collective agreement and transposed into law. This minimum wage applies to workers over 21 years old and with at least six months' tenure. This prevents wage cuts that would drive wages below this threshold.

Second, a prominent feature of the Belgian labour market is full automatic indexation of nominal gross wages. Indexation is applied with respect to the so-called health index, which is the consumer price index excluding alcoholic beverages, tobacco and motor fuels. This makes nominal and real wage reductions of job stayers very rare.

Third, in addition to indexation, real wage increases in the private sector are also largely established by negotiation between the social partners. Since 1997[13], the so-called wage norm provides a guideline for maximum nominal hourly labour cost increases. It is fixed for two years by an InterProfessional Agreement between employers and workers' representatives. It depends on, among other things, labour cost developments in Belgium's main trading partners - Germany, France and the Netherlands - and includes predicted indexation.

Fourth, collective bargaining at the sector level has the major role in wage formation. Employers and unions bargain with an equal weight to determine various aspects of wages, as well as other aspects of labour (such as training, mobility, among others). These negotiations are often separate for white-collar workers and blue-collar workers. Sector-level collective agreements set pay scales as well as real wage increases. Pay scales define a minimum wage by sector and occupation. These also depend on age or tenure for white-collar workers, and for a few blue-collar workers.[14] This implies that automatic wage increases due to age account for a substantial fraction of the wage evolution of white-collar workers.

After the wage norm is set at national level, sector-level agreements specify real wage increases, which often consist of an absolute rise in the minimum pay scale. To gain an idea of the importance of these mechanisms, note that over the period considered in this paper, indexation amounts to 0.01 to 0.025 and collectively agreed real wage increases between 0.017 and 0.033, so that nominal wage increases derived from these figures range between 0.028 to 0.058.

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13 Pursuant to the law of 26 July 1996 for the promotion of employment and the safeguarding of firms' competitiveness.

14 Over the period considered in this paper, pay scales of white-collar workers were generally defined by age. Following EC anti-discrimination rules, this is less and less the case today.

These features explain why Belgium is characterised as a country with substantial real wage rigidity. However, it should be noted that labour compensation involves extra-wage components such as bonuses, premia and overtime hours, which make them more flexible than the base wage.

Employment developments over the last decade[15] have been characterised by a reduction in the proportion of blue-collar workers in private sector employment (from 54% in 1990 to 46% in 2001), an increasing fraction of part-time workers (they represent 13.5% of employment in 1990 against 17.0% in 2001), fewer hours worked per employee (the annual number of hours worked per employee fell from 1,601 in 1990 to 1,547 in 2001) and a slightly higher number of employees with fixed-term contracts. Although fixed-term contracts represent a large fraction of employment growth (over the decade from 1990 to 2000, they accounted for more than two-thirds of cumulated employment growth), they still represent a small proportion of wage earners (5.3% in 1995, 8.8% in 2001) in comparison with EU average (13% over 1996-2001). In addition, Table 1 above shows that there is an increasing number of interim workers hired from temporary employment agencies; on average, over 1997-2001, hours hired from temporary employment agencies grew at a rate of 7.8% per year.

For the analysis below, it is important to understand two relevant features of employment legislation in Belgium: early retirement and temporary employment. The legal retirement age is 65 for men and 60 for women up to 2002[16]. Also, since 1974, conventional early retirement has been allowed for workers aged 60 and above (or 58 provided a collective labour convention has been agreed). For firms in distress or restructuring, early retirement is possible under specific conditions for workers aged 50 or more. This allows the labour force to be reduced while avoiding or lowering the number of layoffs.

For short-term periods, temporary unemployment allows firms to temporarily interrupt (but not breach) labour contracts. Workers then receive unemployment benefit for a defined period, and are later re-employed by the firm under the initial contract terms. This may be used in cases of pressing reason, collective annual holidays, a strike, a technical incident, economic circumstances, or bad weather. Among the motives for temporary unemployment, those related to a technical incident, economic circumstances, or bad weather apply only to blue-collar workers (and apprentices). Bad weather is typically a problem for construction. Special rules apply to the construction sector in the event of temporary unemployment due to economic circumstances.

Together with changes in the number of hours (due to overtime hours, for example), temporary unemployment allows reductions in the number of hours worked, possibly with no change in the number of employees, and avoiding costly layoffs, as does early retirement.

15 The figures reported in this paragraph come from the Belgian social security Green Book, OECD Employment Outlook and Eurostat.

16 The legal retirement age for women has been gradually raised to 64 in 2006, and it will be 65 in 2009.

## 4. Results

Results of the wage bill decomposition for the entire sample are presented in the first line of Table 2. The table itself reports the average across firms and years of each of the components described in equation (7). On average, wage bill changes amount to 5.4%. Half of this can be attributed to wage changes and the other half to employment changes. Indeed the component related to changes in the wage of job stayers equals 0.037, and the sum of the last two to 0.031. Note that the second component, $W_{new}$-$W_{exit}$, is always negative, because earnings of entrants, unlike stayers and exiters, generally do not include holiday allowances, as mentioned above.

**Table 2 - Wage bill decomposition**

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| entire sample | 4705 | 0.054 | 0.037 | -0.014 | 0.007 | 0.024 |
| $\Delta WB>0$ | 3694 | 0.079 | 0.038 | -0.014 | 0.015 | 0.040 |
| $\Delta WB<0$ | 1011 | -0.038 | 0.031 | -0.015 | -0.021 | -0.032 |
| t-stat equal means | | 25.880 | 4.543 | 0.557 | 23.490 | 19.321 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^S}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^N}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^S}_{it} - \overline{D^S}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^N}_{it}N_{it} - \overline{D^E}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

Although employment and wages seem to play a symmetric role in wage bill changes on average, the pattern varies substantially in times of expansion and contraction. Two-thirds of wage bill increases are due to employment growth while wage bill decreases result from employment cuts *in spite of* positive wage growth. The components associated with wage changes of job stayers are slightly lower in times of wage bill contraction (0.031) than wage bill expansion (0.038), but the difference is significant. More strikingly, wage bill reductions translate into wage moderation rather than into wage cuts. This is not surprising as wage indexation prevents nominal earnings of job stayers from falling. It is also consistent with the evidence of high downward wage rigidity for Belgium found by Du Caju et al. (2007) and Knoppik and Beissinger (2005).

Alternatively, firms may lower the average wage by reducing the wages paid to new entrants relative to those of incumbents in adverse times. However, the discrepancy between entrants' and exiters' wages is not significantly wider in cases of wage bill contraction. This may be due to fairness, efficiency wage considerations, as well as to institutional features such as pay scales. All in all, wage changes make a positive contribution to wage bill growth, even in times of contraction. So, wage bill contraction is accounted for by employment flows.

Contrary to wage changes, job flows differ markedly when the wage bill is growing and when it is declining. By adding up the last two columns of Table 2, it can be seen that job flows within the same year and between years represent 0.055 in the case of wage bill increase, while they represent -0.055 in the case of wage bill decline. So, while wage bill expansion results from both wage increases and rising employment, wage bill contraction is characterised by employment

downsizing, moderate but positive wage changes. Taken together, the results indicate that the variable responsible for most of the wage bill fluctuations is the labour force.

Robustness with respect to alternative trimming of the sample are shown in Table A3 in Appendix 2. Each component of the wage bill decomposition is the same size in all samples. The quantitative and qualitative results are therefore robust to alternative samples.

Results reported in Duhautois and Kramarz (2006) for France confirm that job flows account for a large part of wage bill variation. Although there is a more substantial reduction in the wage changes of job stayers in their study[17], wage bill destruction is essentially characterised by a sharp decline in the labour force. More precisely, their results reveal that entrants account for most of wage bill creation and exiters for most of wage bill destruction.

Table 3 below reports complementary information on job flows and the labour force from firms' social balance sheets, as well as additional information on relative wages, wage changes, age, and number of days worked from the dataset on individual annual earnings. The column *t-stat* shows the value of the t-statistics for the hypothesis that the means are equal in both expansion and contraction.

As far as wage trends are concerned, Table 3 indicates that wages of entrants are always lower than those of job stayers; but the difference is no greater in cases of contraction than in expansion. Wage growth moderation affects blue-collar and white-collar workers, but it is stronger for white-collar workers[18]. One reason is that although the base wages of both blue- and white-collar workers are index-linked and automatic real wage increases are set by collective agreements, a larger fraction of white-collar workers' earnings is not subject to these automatic raises, such as bonuses and premia. Therefore, wage increases may be more easily reduced for this type of workers. Finally, moderation of the average wage growth may be achieved through changes in the composition of the labour force. Indeed, Table 3 shows that exits are concentrated among older and higher-wage workers in cases of wage bill contraction. Exiters earn 4% more than job stayers in times of wage bill contraction (against 0% in good times).

As for employment flows, Table 3 confirms that wage bill contraction induces a strong reduction in the labour force. This is achieved through both reduced entries and increased exits in the current and preceding year. In adverse times, the higher percentage of exits results mainly from higher layoffs and early retirement.

Reduced entries and increased exits concern primarily employees with open-ended contracts. This goes against the view that firing workers with open-ended contracts is more costly. However, one should note that most of the exits are not due to redundancies. The figures reported in Table 3 indicate that layoffs concern one exiter in five. Exits for other motives, including voluntary quits, account for 74% of exits in good times and 71% in adverse times. Further, as noted above, fixed-

17 This is consistent with evidence of lower downward wage rigidity for France than for Belgium (see Dickens et al. 2007) and Knoppik and Beissinger (2005). Note also that the "stayers" component in Duhautois and Kramarz (2006) should be compared with the sum of "$\Delta W_{stay}$" and "$\Delta D_{stay}$" in Table 2.

18 Du Caju et al. (2007) find that downward wage rigidity is higher for white collars. This means that resistance to wage cuts is higher for white-collar workers. Table 3 shows that earnings growth may be reduced to a greater extent for white collars. However, because *earnings growth* remains positive, this does not imply a reduction in *earnings level*.

term contracts are quite rare in Belgium: over the period 1997-2001, they accounted for only 8.4% of wage earners aged between 15 and 64 years. Therefore, because workers with open-ended contracts make up the bulk of the labour force, they also account for the largest proportion of exits.

There is some evidence that firms also take advantage of temporary contracts to enable them to reduce the labour force at no cost simply by not renewing the contract. Indeed, the number of entrants with fixed-term contracts as a percentage of the total number of employees is significantly lower in the event of wage bill contraction. This is consistent with Kleinknecht et al. (2006) who provide evidence for the Netherlands that the use of temporary contracts and self-employed (freelance) workers allow firms to save on their average wage bill. Two elements may explain why the percentage of workers under fixed-term contract does not drop to zero when the wage bill diminishes. The primary reason is that if the wage bill contraction reacts to a permanent shock, firms need to reduce employment on a permanent basis, and may cut the most costly components of the labour force, i.e. older and higher-tenured workers under open-ended contract. Additionally, one may argue that employment policies aimed at promoting hiring of young, low-skilled or unemployed workers, may provide an incentive for firms to hire workers from the target groups on a temporary basis, i.e. by the time they get the economic incentive (fiscal incentives, subsidy, etc.). The incentive may be sufficiently high for firms to keep on hiring the target group even when they cut their wage bill. Note that Cockx et al. (2004, 2005) show that workers hired under subsidised jobs are not necessarily fired at the end of the subsidy[19].

Finally, the bottom part of Table 3 investigates whether hours worked and hours hired from temporary employment agencies follow the same trend as the wage bill. The results indeed suggest that the number of hours worked over a year per full-time equivalent falls as the wage bill contracts. Unfortunately, the data does not make it possible to check whether this corresponds to a reduction in normal working time, a reduction in overtime hours or temporary unemployment. However, the reduction in the number of days worked (by blue-collar as well as white-collar workers) is most likely due to temporary unemployment.

Contracts with temporary employment agencies also enhance flexibility provided they are based on short-term contracts. The figures reported in Table 3 confirm that firms reduce their use of interim workers as they reduce their wage bill. This finding implies that in order to understand firms' reaction to changing economic conditions, one should consider a broad definition of hours worked that would include hours worked by employees (both with open-ended and fixed-term contracts) as well as by interim workers (although they do not formally belong to the set of employees), rather than a narrow definition focusing on the number of employees alone. Using a broader definition, adverse times would be characterised by a stronger decline in hours worked and therefore an increase in productivity relative to the narrow definition.

19 They find that a temporary subsidy for hiring young long-term unemployed people speeds up the transition towards a non-subsidised job for 37% of men and 32% of women.

**Table 3 - Complementary information**

| | entire sample | $\Delta wbill_t$ >0 | $\Delta wbill_t$ <0 | t-stat |
|---|---|---|---|---|
| $\Delta W^{blue}$ | 0.038 | 0.040 | 0.033 | 3.63 |
| $\Delta W^{white}$ | 0.059 | 0.062 | 0.048 | 6.53 |
| $w_{new}$-$w_{stayer}$ | -0.156 | -0.157 | -0.149 | -1.17 |
| $w_{exit}$-$w_{stayer(t-1)}$ | 0.010 | 0.001 | 0.043 | -4.54 |
| age entrants/stayers | 0.83 | 0.83 | 0.82 | 2.82 |
| age exiters/stayers$_{t-1}$ | 1.00 | 1.00 | 1.01 | -2.28 |
| $\Delta$ number of employees$_t$ | 0.033 | 0.052 | -0.034 | 27.98 |
| %entrants$_t$ | 0.23 | 0.25 | 0.19 | 12.80 |
| %exits$_{t-1}$ | 0.21 | 0.20 | 0.24 | -5.41 |
| %exits$_t$ | 0.20 | 0.20 | 0.22 | -5.19 |
| retirement$_{t-1}$/exits$_{t-1}$ | 0.021 | 0.020 | 0.021 | -0.60 |
| early retirement$_{t-1}$/exits$_{t-1}$ | 0.047 | 0.041 | 0.069 | -6.05 |
| layoffs$_{t-1}$/exits$_{t-1}$ | 0.216 | 0.210 | 0.237 | -3.37 |
| retirement$_t$/exits$_t$ | 0.021 | 0.020 | 0.024 | -2.05 |
| early retirement$_t$ /exits$_t$ | 0.039 | 0.034 | 0.056 | -5.45 |
| layoffs$_t$/exits$_t$ | 0.209 | 0.209 | 0.211 | -0.27 |
| %entrants$_{t,\ permanent}$ | 0.167 | 0.178 | 0.125 | 13.22 |
| %entrants$_{t,\ temporary}$ | 0.062 | 0.064 | 0.057 | 2.70 |
| %exits$_{t,\ permanent}$ | 0.150 | 0.145 | 0.170 | -6.24 |
| %exits$_{t,\ temporary}$ | 0.051 | 0.051 | 0.050 | 0.58 |
| %exits$_{t-1,\ permanent}$ | 0.155 | 0.147 | 0.182 | -5.27 |
| %exits$_{t-1,\ temporary}$ | 0.053 | 0.052 | 0.057 | -1.54 |
| $\Delta$hours/FTE | -0.006 | -0.002 | -0.018 | 7.72 |
| $\Delta D^{blue}$ | 0.008 | 0.019 | -0.032 | 9.56 |
| $\Delta D^{white}$ | 0.009 | 0.019 | -0.030 | 9.78 |
| %interim workers | 0.046 | 0.048 | 0.039 | 4.67 |
| $\Delta$interim workers | 0.078 | 0.110 | -0.042 | 4.16 |

$\Delta$ stands for $\Delta$log except for $\Delta$% part-time workers, *hours* for the total number of hours worked, *w* stands for the log of earnings W, *D* for number of work days, *permanent* for workers with open-ended contracts and *temporary* for workers with fixed-term contracts, $W^{blue}$ and $W^{white}$ refer to the wage of blue-collar job stayers and white-collar job stayers respectively.

### 4.1. Differences across sectors and firm size

This section repeats the wage bill adjustment analysis for firms of different sizes and sectors. First, I consider differences across medium-to-small firms (between 50 and 100 employees), medium-sized firms (between 100 and 200 employees) and large firms (with above 200 employees). The wage bill decompositions reported in Table 4 show that the differences in the wage bill growth and employment changes between wage bill expansion and wage bill contraction are larger for smaller firms, consistent with the evidence in Duhautois and Kramarz (2006)[20]. There are few additional

20 Davis and Haltiwanger (1996) show that defining size classes with respect to current year employment may lead to fallacious conclusions about job creation and job destruction. Results are essentially unchanged if size classes are defined according to the average number of employees of the firm over the sample period, as shown in Table A4 Appendix 3.

differences across different sized firms. Although not significant, the gap between the wage of entrants and that of exiters is wider for smaller firms in contraction.

**Table 4 - Wage bill decomposition according to firm size**

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| *49 < number of employees < 100* | | | | | | |
| entire sample | 1673 | 0.060 | 0.032 | -0.010 | 0.009 | 0.029 |
| $\Delta WB>0$ | 1288 | 0.092 | 0.034 | -0.008 | 0.018 | 0.048 |
| $\Delta WB<0$ | 385 | -0.045 | 0.026 | -0.016 | -0.021 | -0.033 |
| t-stat equal means | | 14.93 | 4.86 | 1.48 | 14.68 | 10.44 |
| *99 < number of employees < 200* | | | | | | |
| entire sample | 1512 | 0.056 | 0.038 | -0.015 | 0.007 | 0.027 |
| $\Delta WB>0$ | 1217 | 0.076 | 0.040 | -0.016 | 0.014 | 0.039 |
| $\Delta WB<0$ | 295 | -0.029 | 0.029 | -0.012 | -0.022 | -0.024 |
| t-stat equal means | | 16.77 | 4.58 | -1.39 | 11.39 | 11.34 |
| *199 < number of employees* | | | | | | |
| entire sample | 1520 | 0.044 | 0.040 | -0.017 | 0.005 | 0.016 |
| $\Delta WB>0$ | 1189 | 0.067 | 0.041 | -0.017 | 0.012 | 0.031 |
| $\Delta WB<0$ | 331 | -0.037 | 0.037 | -0.016 | -0.021 | -0.037 |
| t-stat equal means | | 15.68 | 0.88 | -0.42 | 16.73 | 14.95 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

Statistics on wage changes, reported in Table 5 indicate, as before, that wage moderation is stronger for white-collar workers. The main difference in wage evolution across firm size is that a larger part of the wage bill savings of smaller firms is achieved through a significant increase in the wages of exiters relative to those of stayers, because, among other things, exiters tend to be a lot older than in cases of contraction. As far as employment flows are concerned, a prominent difference across different sized firms is that smaller firms have a higher job turnover, resulting from larger entry and exit rates. Gomez-Salvador et al. (2004) also report that job reallocation is stronger among smaller firms. In contrast, Davis and Haltiwanger (1996) find that most of the aggregate job creation and job destruction is due to larger firms. Another difference across firm size is that the difference in employment growth in expansion and contraction is highest for smaller firms[21]. Layoffs are relatively more frequent for smaller firms, while medium-sized and large firms make wider use of early retirement. Finally, smaller firms make stronger cuts in hours and days worked than larger firms, but, unlike larger firms, reliance on fixed-term and interim workers does not fall.

21 Given that wage bill contractions are, on average, larger for smaller firms, this result does not imply that the elasticity of employment is higher for smaller firms.

**Table 5 - Complementary information according to firm size**

| | *49 < employees < 100* | | | *99 < employees < 200* | | | *199 < employees* | | |
|---|---|---|---|---|---|---|---|---|---|
| | ΔWB>0 | ΔWB<0 | t-stat | ΔWB>0 | ΔWB<0 | t-stat | ΔWB>0 | ΔWB<0 | t-stat |
| $\Delta W^{blue}$ | 0.038 | 0.030 | 2.39 | 0.040 | 0.031 | 4.65 | 0.042 | 0.038 | 0.95 |
| $\Delta W^{white}$ | 0.058 | 0.041 | 4.76 | 0.064 | 0.050 | 4.09 | 0.064 | 0.055 | 2.46 |
| $w_{new}$-$w_{stayer}$ | -0.149 | -0.150 | 0.11 | -0.165 | -0.136 | -2.03 | -0.159 | -0.158 | -0.08 |
| $w_{exit}$-$w_{stayer(t-1)}$ | -0.045 | 0.021 | -3.89 | 0.004 | 0.027 | -1.57 | 0.048 | 0.082 | -2.31 |
| age entrants/stayers | 0.85 | 0.83 | 1.39 | 0.83 | 0.82 | 0.90 | 0.81 | 0.79 | 3.18 |
| age exiters/$stayers_{t-1}$ | 0.98 | 1.01 | -2.28 | 1.00 | 1.01 | -0.47 | 1.02 | 1.03 | -1.16 |
| Δ n° of $employees_t$ | 0.060 | -0.034 | 16.54 | 0.053 | -0.028 | 14.78 | 0.042 | -0.041 | 17.81 |
| $\%entrants_t$ | 0.29 | 0.22 | 8.42 | 0.25 | 0.18 | 6.86 | 0.20 | 0.14 | 8.19 |
| $\%exits_{t-1}$ | 0.24 | 0.28 | -2.81 | 0.20 | 0.23 | -2.67 | 0.16 | 0.20 | -5.24 |
| $\%exits_t$ | 0.24 | 0.26 | -2.72 | 0.20 | 0.22 | -2.41 | 0.16 | 0.19 | -4.04 |
| $retirement_{t-1}/exits_{t-1}$ | 0.016 | 0.015 | 0.38 | 0.019 | 0.022 | -1.12 | 0.027 | 0.028 | -0.32 |
| $early\ retire._{t-1}/exits_{t-1}$ | 0.022 | 0.039 | -2.84 | 0.038 | 0.066 | -3.36 | 0.066 | 0.105 | -4.49 |
| $layoffs_{t-1}/exits_{t-1}$ | 0.239 | 0.262 | -1.55 | 0.213 | 0.244 | -2.10 | 0.176 | 0.203 | -2.30 |
| $retirement_t/exits_t$ | 0.016 | 0.021 | -1.29 | 0.018 | 0.022 | -1.24 | 0.026 | 0.029 | -1.05 |
| $early\ retirement_t/exits_t$ | 0.020 | 0.025 | -0.99 | 0.028 | 0.054 | -3.39 | 0.055 | 0.093 | -4.76 |
| $layoffs_t/exits_t$ | 0.231 | 0.237 | -0.41 | 0.213 | 0.201 | 0.84 | 0.180 | 0.189 | -0.75 |
| $\%entrants_{t,\ permanent}$ | 0.225 | 0.162 | 6.51 | 0.178 | 0.117 | 6.04 | 0.128 | 0.089 | 4.68 |
| $\%entrants_{t,\ temporary}$ | 0.063 | 0.056 | 1.01 | 0.063 | 0.064 | -0.01 | 0.065 | 0.051 | 2.54 |
| $\%exits_{t,\ permanent}$ | 0.180 | 0.205 | -3.07 | 0.142 | 0.159 | -2.18 | 0.110 | 0.140 | -4.87 |
| $\%exits_{t,\ temporary}$ | 0.054 | 0.051 | 0.49 | 0.052 | 0.055 | -0.43 | 0.047 | 0.044 | 0.71 |
| $\%exits_{t-1,\ permanent}$ | 0.183 | 0.229 | -5.41 | 0.147 | 0.166 | -1.93 | 0.109 | 0.141 | -5.09 |
| $\%exits_{t-1,\ temporary}$ | 0.055 | 0.052 | 0.48 | 0.054 | 0.062 | -1.23 | 0.048 | 0.058 | -1.88 |
| Δhours/FTE | 0.000 | -0.021 | 5.31 | -0.004 | -0.017 | 3.41 | -0.002 | -0.017 | 4.56 |
| $\Delta D^{blue}$ | 0.025 | -0.037 | 5.29 | 0.016 | -0.025 | 4.18 | 0.016 | -0.033 | 11.84 |
| $\Delta D^{white}$ | 0.024 | -0.037 | 5.89 | 0.018 | -0.027 | 4.79 | 0.016 | -0.023 | 8.62 |
| %interim workers | 0.051 | 0.041 | 2.53 | 0.050 | 0.044 | 1.65 | 0.043 | 0.031 | 4.63 |
| Δinterim workers | 0.091 | 0.020 | 1.02 | 0.109 | -0.023 | 2.04 | 0.129 | -0.115 | 4.33 |

*Δ* stands for Δlog except for Δ% part-time workers, *hours* for the total number of hours worked, *w* stands for the log of earnings W, *D* for number of work days, *permanent* for workers with open-ended contracts and *temporary* for workers with fixed-term contracts. $W^{blue}$ and $W^{white}$ refer to the wages of blue-collar job stayers and white-collar job stayers respectively.

Below I examine differences across sectors of economic activity. In order to keep a sufficiently large number of observations per category, I consider only three broad sectors, manufacturing, construction and commercial services. As shown in Table 6, wage bill changes are smallest in manufacturing and largest in construction, and so are the net job flow components of wage bill growth. Comparing expansions and contractions, it appears that wage moderation is largest in services and largely absent in the construction industry. This is most likely due to the large fraction of the labour force that has lower and more rigid wages[22].

22 Du Caju et al. (2007) find that downward nominal wage rigidity is higher for lower wages.

**Table 6 - Wage bill decomposition across sectors**

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| *manufacturing* | | | | | | |
| WB | 2272 | 0.048 | 0.035 | -0.012 | 0.005 | 0.020 |
| $\Delta WB>0$ | 1762 | 0.073 | 0.037 | -0.012 | 0.014 | 0.034 |
| $\Delta WB<0$ | 510 | -0.035 | 0.030 | -0.011 | -0.023 | -0.031 |
| t-stat equal means | | 22.56 | 5.13 | -0.57 | 18.03 | 15.48 |
| *construction* | | | | | | |
| WB | 549 | 0.056 | 0.033 | -0.008 | 0.009 | 0.023 |
| $\Delta WB>0$ | 428 | 0.085 | 0.033 | -0.007 | 0.019 | 0.040 |
| $\Delta WB<0$ | 121 | -0.047 | 0.031 | -0.012 | -0.028 | -0.037 |
| t-stat equal means | | 10.37 | 0.53 | 1.19 | 14.46 | 7.09 |
| *commercial services* | | | | | | |
| WB | 1768 | 0.061 | 0.039 | -0.018 | 0.008 | 0.031 |
| $\Delta WB>0$ | 1414 | 0.086 | 0.041 | -0.017 | 0.015 | 0.047 |
| $\Delta WB<0$ | 354 | -0.038 | 0.032 | -0.021 | -0.017 | -0.031 |
| t-stat equal means | | 12.74 | 2.35 | 0.66 | 11.18 | 10.28 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

Additional statistics provided in Table 7 confirm that wage moderation is very modest in the construction sector. As before, wage moderation is more severe for white-collar workers. The difference in wage growth between expansion and contraction is not significant for white-collar workers in construction, while it amounts to -1.8% for white-collar workers in the services sector (and 1.2% in manufacturing).

There are other marked differences across sectors with respect to employment flows, and changes in hours worked and interim workers. As noted above, labour force fluctuations appear to be largest in construction and services and lowest in the manufacturing sector. Finding stronger variation in services than in manufacturing is consistent with the evidence reported in Gomez-Salvador et al. (2004). They show that job flows are larger in the services sector in Europe, mainly due to job creation, and lower in manufacturing[23]. The stronger variation in net employment in construction is due to higher exits, in the form of relatively higher layoffs. There seems to be no systematic increase in the use of early retirement in times of contraction in this sector. On the contrary, there is evidence that the construction industry makes much more use of temporary unemployment, which is somewhat tailor-made for this sector. Indeed, the reduction in the number of days worked between expansions and contractions is particularly important for blue-collar workers in this sector. Hours worked by employees and interim workers also fall significantly in adverse times. Manufacturing is characterised by wider use of early retirement. Also, it is the sector

23 In the present sample, employment growth is on average 4.3 percent in services against 3.0 percent in construction and 2.6 percent in manufacturing. Both entries and exits are higher in services (0.29 for entries and 0.25 for exits) and lower in manufacturing (0.19 for entries and 0.18 for exits).

where the reduction in fixed-term workers and interim workers is the most marked. On the contrary, wage bill contractions in the services sector are primarily characterised by higher retirements. There is basically no change in the use of interim workers in this sector.

**Table 7 - Complementary information according to sector**

| | *manufacturing* | | | *construction* | | | *commercial services* | | |
|---|---|---|---|---|---|---|---|---|---|
| | ΔWB>0 | ΔWB<0 | t-stat | ΔWB>0 | ΔWB<0 | t-stat | ΔWB>0 | | |
| $\Delta W^{blue}$ | 0.040 | 0.034 | 3.44 | 0.040 | 0.035 | 2.88 | 0.038 | 0.031 | 1.31 |
| $\Delta W^{white}$ | 0.060 | 0.048 | 4.68 | 0.053 | 0.050 | 0.34 | 0.066 | 0.048 | 5.33 |
| $w_{new}$-$w_{stayer}$ | -0.131 | -0.123 | -0.82 | -0.108 | -0.115 | 0.50 | -0.201 | -0.198 | -0.25 |
| $w_{exit}$-$w_{stayer(t-1)}$ | 0.026 | 0.055 | -2.53 | -0.014 | 0.022 | -1.57 | -0.024 | 0.032 | -3.14 |
| age entrants/stayers | 0.82 | 0.81 | 2.02 | 0.83 | 0.80 | 1.81 | 0.85 | 0.83 | 1.52 |
| age exiters/$stayers_{t-1}$ | 1.01 | 1.02 | -1.18 | 1.01 | 1.01 | 0.45 | 0.99 | 1.01 | -2.52 |
| Δ n° of $employees_t$ | 0.045 | -0.038 | 20.36 | 0.050 | -0.040 | 9.59 | 0.061 | -0.027 | 16.01 |
| $\%entrants_t$ | 0.20 | 0.14 | 10.42 | 0.26 | 0.21 | 3.58 | 0.30 | 0.23 | 7.44 |
| $\%exits_{t-1}$ | 0.17 | 0.21 | -3.84 | 0.21 | 0.27 | -3.97 | 0.24 | 0.28 | -3.08 |
| $\%exits_t$ | 0.16 | 0.18 | -4.17 | 0.21 | 0.25 | -3.55 | 0.24 | 0.27 | -2.72 |
| $retirement_{t-1}/exits_{t-1}$ | 0.021 | 0.018 | 1.250 | 0.017 | 0.013 | 1.24 | 0.019 | 0.028 | -2.61 |
| $early\ retire._{t-1}/exits_{t-1}$ | 0.060 | 0.098 | -5.039 | 0.046 | 0.045 | 0.09 | 0.018 | 0.037 | -3.50 |
| $layoffs_{t-1}/exits_{t-1}$ | 0.196 | 0.226 | -2.564 | 0.262 | 0.281 | -0.70 | 0.216 | 0.241 | -1.88 |
| $retirement_t/exits_t$ | 0.020 | 0.021 | -0.292 | 0.017 | 0.013 | 1.23 | 0.017 | 0.032 | -3.83 |
| $early\ retirement_t/exits_t$ | 0.049 | 0.082 | -4.785 | 0.032 | 0.033 | -0.11 | 0.016 | 0.026 | -2.27 |
| $layoffs_t/exits_t$ | 0.195 | 0.204 | -0.800 | 0.243 | 0.267 | -0.93 | 0.219 | 0.201 | 1.57 |
| $\%entrants_{t,\ permanent}$ | 0.131 | 0.084 | 7.25 | 0.228 | 0.175 | 3.50 | 0.223 | 0.164 | 5.70 |
| $\%entrants_{t,\ temporary}$ | 0.066 | 0.056 | 2.03 | 0.029 | 0.031 | -0.35 | 0.070 | 0.066 | 0.61 |
| $\%exits_{t,\ permanent}$ | 0.109 | 0.134 | -5.17 | 0.184 | 0.224 | -3.27 | 0.179 | 0.203 | -2.84 |
| $\%exits_{t,\ temporary}$ | 0.049 | 0.048 | 0.36 | 0.027 | 0.029 | -0.27 | 0.060 | 0.059 | 0.06 |
| $\%exits_{t-1,\ permanent}$ | 0.114 | 0.147 | -5.86 | 0.183 | 0.232 | -3.88 | 0.179 | 0.214 | -3.71 |
| $\%exits_{t-1,\ temporary}$ | 0.050 | 0.055 | -1.09 | 0.027 | 0.034 | -1.05 | 0.061 | 0.066 | -0.90 |
| Δhours/FTE | -0.002 | -0.021 | 6.29 | 0.005 | -0.015 | 3.45 | -0.005 | -0.015 | 2.82 |
| $\Delta D^{blue}$ | 0.017 | -0.033 | 10.19 | 0.032 | -0.045 | 11.46 | 0.017 | -0.033 | 3.27 |
| $\Delta D^{white}$ | 0.016 | -0.026 | 7.42 | 0.015 | -0.021 | 1.72 | 0.025 | -0.039 | 6.88 |
| %interim workers | 0.061 | 0.041 | 8.00 | 0.017 | 0.010 | 2.68 | 0.042 | 0.043 | -0.26 |
| Δinterim workers | 0.140 | -0.074 | 4.45 | 0.108 | -0.156 | 1.56 | 0.070 | 0.029 | 0.70 |

*Δ* stands for Δlog except for Δ% part-time workers, *hours* for the total number of hours worked, *w* stands for the log of earnings W, *D* for number of work days, *permanent* for workers with open-ended contracts and *temporary* for workers with fixed-term contracts. $W^{blue}$ and $W^{white}$ refer to the wages of blue-collar job stayers and white-collar job stayers respectively.

### 4.2 Differences between wage bill contractions and sales declines

This section repeats the above analysis in cases of falling sales and compares it to wage bill contraction, the later being easily associated with cost-cutting. But the source of the contraction is unclear. It may result from a fall in demand, technological change towards more capital-intensive production technologies, as well as poor performance that calls for restructuring. Sales contraction

is likely to be due more frequently to a drop in demand[24], although it is of course the result of several types of shocks.

The analysis differs from that of Davis and Haltiwanger (1996), who examine the pattern of aggregate job creation and job destruction over the business cycle. In this paper, the sample period, 1997-2001, is too short and the data frequency too high for a proper business cycle analysis. Rather, I consider separately firms that experience favourable economic conditions and firms that face adverse times. This should not be seen as a substitute for a business cycle index. For example, in downturns, some firms will underperform while others may outperform. The sample splits used here may capture aggregate shocks as well as sectoral and idiosyncratic events.

Results of the wage bill decomposition are reported in Table 8. Sales contraction implies a slowdown rather than a contraction of wage bill growth. Although sales declines are substantial - on average, sales growth amounts to 13% in expansion against -9% in contraction - the total wage bill does not come down, but there is a reduction in wage bill growth. Duhautois and Kramarz (2006) also find that there is more wage bill creation among firms with a high value added growth rate with respect to the sector third quartile, and more wage bill destruction among firms with value added growth rate below the sector first quartile. Although, on average, wage bill growth remains positive when sales are declining, it results from both wage moderation and job cuts. Employment contraction is indeed what can be expected from sales reductions that lead to production declines.

**Table 8 - Wage bill decomposition according to alternative sample splits**

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| entire sample | 4705 | 0.054 | 0.037 | -0.014 | 0.007 | 0.024 |
| *sample split wrt $\Delta$wage bill$_t$* | | | | | | |
| $\Delta WB>0$ | 3694 | 0.079 | 0.038 | -0.014 | 0.015 | 0.040 |
| $\Delta WB<0$ | 1011 | -0.038 | 0.031 | -0.015 | -0.021 | -0.032 |
| t-stat equal means | | 25.880 | 4.543 | 0.557 | 23.490 | 19.321 |
| *sample split wrt $\Delta$sales$_t$* | | | | | | |
| $\Delta sales_t>0$ | 3319 | 0.070 | 0.038 | -0.015 | 0.012 | 0.035 |
| $\Delta sales_t<0$ | 1386 | 0.015 | 0.034 | -0.010 | -0.006 | -0.003 |
| t-stat equal means | | 14.114 | 2.995 | -2.528 | 11.355 | 12.719 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^S}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^N}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^S}_{it} - \overline{D^S}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^N}_{it}N_{it} - \overline{D^E}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

Complementary information is reported in Table 9. Because wage bill growth does not decline as much in the case of sales contraction than in the case of wage bill decline, there is less evidence of both fewer wage changes and falling employment. In the event of falling sales, there is no

24 For example, in a very different context, von Kalckreuth (2003) interprets real sales shocks as a proxy for demand shocks.

significant slowdown of wage evolution for blue-collar workers, and there is a smaller wage slowdown for white-collar workers than in case of wage bill contraction.

**Table 9 - Complementary information according to economic situation**

| | $\Delta wbill_t$ | | | $\Delta sales_t$ | | |
|---|---|---|---|---|---|---|
| | >0 | <0 | t-stat | >0 | <0 | t-stat |
| $\Delta W^{blue}$ | 0.040 | 0.033 | 3.63 | 0.039 | 0.037 | 1.02 |
| $\Delta W^{white}$ | 0.062 | 0.048 | 6.53 | 0.061 | 0.053 | 3.91 |
| $W_{new}$-$W_{stayer}$ | -0.157 | -0.149 | -1.17 | -0.160 | -0.144 | -2.71 |
| $W_{exit}$-$W_{stayer(t-1)}$ | 0.001 | 0.043 | -4.54 | 0.011 | 0.008 | 0.35 |
| age entrants/stayers | 0.83 | 0.82 | 2.82 | 0.83 | 0.83 | -0.03 |
| age exiters/$stayers_{t-1}$ | 1.00 | 1.01 | -2.28 | 1.01 | 1.00 | 2.24 |
| $\Delta$ n° of $employees_t$ | 0.052 | -0.034 | 27.98 | 0.050 | -0.007 | 19.73 |
| $\%entrant_t$ | 0.25 | 0.19 | 12.80 | 0.25 | 0.20 | 11.19 |
| $\%exits_{t-1}$ | 0.20 | 0.24 | -5.41 | 0.21 | 0.22 | -1.54 |
| $\%exits_t$ | 0.20 | 0.22 | -5.19 | 0.20 | 0.21 | -1.73 |
| $retirement_{t-1}/exits_{t-1}$ | 0.020 | 0.021 | -0.60 | 0.021 | 0.020 | 0.32 |
| early $retire._{t-1}/exits_{t-1}$ | 0.041 | 0.069 | -6.05 | 0.044 | 0.054 | -2.87 |
| $layoffs_{t-1}/exits_{t-1}$ | 0.210 | 0.237 | -3.37 | 0.221 | 0.202 | 2.81 |
| $retirement_t/exits_t$ | 0.020 | 0.024 | -2.05 | 0.021 | 0.021 | -0.18 |
| early $retirement_t/exits_t$ | 0.034 | 0.056 | -5.45 | 0.035 | 0.048 | -4.13 |
| $layoffs_t/exits_t$ | 0.209 | 0.211 | -0.27 | 0.210 | 0.206 | 0.54 |
| $\%entrants_{t,\ permanent}$ | 0.178 | 0.125 | 13.22 | 0.179 | 0.139 | 10.64 |
| $\%entrants_{t,\ temporary}$ | 0.064 | 0.057 | 2.70 | 0.064 | 0.057 | 2.97 |
| $\%exits_{t,\ permanent}$ | 0.145 | 0.170 | -6.24 | 0.148 | 0.156 | -2.41 |
| $\%exits_{t,\ temporary}$ | 0.051 | 0.050 | 0.58 | 0.051 | 0.050 | 0.46 |
| $\%exits_{t-1,\ permanent}$ | 0.147 | 0.182 | -5.27 | 0.153 | 0.158 | -1.01 |
| $\%exits_{t-1,\ temporary}$ | 0.052 | 0.057 | -1.54 | 0.052 | 0.056 | -1.66 |
| $\Delta$hours/FTE | -0.002 | -0.018 | 7.72 | -0.003 | -0.013 | 5.73 |
| $\Delta D^{blue}$ | 0.019 | -0.032 | 9.56 | 0.018 | -0.016 | 7.51 |
| $\Delta D^{white}$ | 0.019 | -0.030 | 9.78 | 0.015 | -0.006 | 5.43 |
| %interim workers | 0.048 | 0.039 | 4.67 | 0.049 | 0.038 | 6.10 |
| $\Delta$interim workers | 0.110 | -0.042 | 4.16 | 0.173 | -0.152 | 10.78 |

$\Delta$ stands for $\Delta$log except for $\Delta$% part-time workers, *hours* for the total number of hours worked, *w* stands for the log of earnings W, *D* for number of work days, *permanent* for workers with open-ended contracts and *temporary* for workers with fixed-term contracts. $W^{blue}$ and $W^{white}$ refer to the wages of blue-collar job stayers and white-collar job stayers respectively

Concerning employment, in both cases, net employment reduction is achieved primarily through a reduction in the number of entrants, rather than an increase in exits. This is consistent with the findings of Messina and Vallanti (2007) that employment protection legislation smooths the responsiveness of job destruction to the business cycle in Europe.

The number of employees is reduced mainly through more early retirement, and proportionally less through redundancies, unlike the case of wage bill contraction. In both cases, hours diminish and the reduction in the number of days worked points to potential use of temporary unemployment, which can be used under the motive of "economic circumstances" for blue-collar workers. The major difference between sales decline and wage bill contraction is that there is a much stronger reduction in changes in interim workers in the case of sales decline (-0.152) than in

the case of wage bill contraction (-0.042). So sales declines may induce a mix of a reduction in the number of employees together with the use of temporary unemployment, contraction in hours worked and a substantial cut in manpower workers.

The above analysis suggests that falling sales lead to labour reductions in the same year, at limited (firing) costs. Indeed, entries, interim workers and the number of days and hours worked fall more than layoffs increase. These tools allow for a more reversible decision. In a first stage, this may be an optimal response in view of the uncertainty surrounding the size and persistence of the sales fall, and given hiring and firing costs. When sales declines persist, firms may find it necessary or more relevant to reduce their own labour force.

A couple of points are worth checking. First, with respect to the timing of the shock, some timelag may be needed for firms to adjust to sales declines. The wage bill decomposition for the case of sales declining in the previous year, reported in Table A5 in Appendix 4, suggests that most of employment adjustment is contemporaneous to the sales declines. Indeed, following a fall in sales in the previous year, there is no cut in employment and adjustment of the wage bill growth is much smaller. Second, should the sales contraction become larger and more persistent, employment cuts may become more necessary. Indeed, considering firms for which the sum of sales growth in two consecutive years is negative shows that employment cuts are slightly larger. Third, the previous criteria may be criticised on the grounds that a decline in sales (value added) is irrelevant if it follows a (large) increase. I therefore consider an alternative criterion: sales growth is negative and sales are below the firm's median. Again, results of the wage bill decomposition are of the same order of magnitude. Lastly, Appendix 4 also reports wage bill decompositions for nominal sales growth as well as real sales growth, nominal value added growth, real value added growth. The sign and order of magnitude of the terms of the wage bill decompositions are similar across these exercises.

In sum, this section highlights the fact that in cases of sales declines, reversible adjustment tools such as reduction in hours worked, temporary unemployment, and interim workers play a key role in labour force adjustment.

## 5. Conclusion

This paper looks at the variables that explain most of the wage bill adjustment under changing economic conditions. Building on Duhautois and Kramarz (2006), I decompose wage bill growth at the firm level into four components: (1) one due to changes in the wages of job stayers, (2) another due to the differences between wages of entrants and wages of exiters, (3) one due to intra-year net flows of employment, (4) and the last due to between-year net flows of employment. The paper uses an administrative matched employer-employee dataset on individual annual earnings merged with firms' annual accounts and social balance sheets for Belgium over the period 1997-2001.

Wage bill changes are equally attributable to wage changes and net employment flows. However, this general pattern masks a strongly asymmetric behaviour in favourable as opposed to adverse times. Employment contractions are the main source of wage bill reductions. On average,

firms can at best reduce wage growth rates, but wages do not actually fall. Wage moderation may be achieved by concentrating exiters among the older workers and higher earners, or reduce bonuses and premia. However, fairness, efficiency wage considerations as well as institutional features of the Belgian labour market, such as full automatic indexation, may prevent strong nominal wage cuts, as shown in previous analyses of wage rigidity in Belgium. Consequently, job flows are the main driving variable of the wage bill.

Comparing periods of wage bill expansion with those of wage bill contraction is used as a benchmark. The analysis is then repeated for firms of different size classes and sectors, as well as for the cases of sales falls. Smaller firms and the construction and services sectors experience larger fluctuations in wage bill growth and employment than do larger firms and the manufacturing sector. The drop in wage bill growth is larger in cases of wage bill contraction than in cases of sales cuts.

In addition to the wage bill decomposition, more detailed information about job flows and wage growth provide a deeper insight into the relevant adjustment margins in different circumstances. First, employment cuts are made through reduced entries, and to a lesser extent through increased exits, which may involve firing costs. In addition, there is wider use of early retirement, which applies to firms in distress or which are restructuring, especially in the manufacturing sector. This generally involves lower costs than layoffs. Additionally, there is a slight reduction in the percentage of workers under fixed-term contracts, particularly in large firms and in the manufacturing sector. Second, labour force reductions (and labour cost savings) may be achieved through other margins, such as a reduction of hours worked and the use of temporary unemployment. Third, there is evidence that interim workers serve as a buffer under changing economic conditions, more so in cases of sales contraction. This suggests that the firm's labour force should be measured through total hours of both employees and interim workers, rather than by the total number of employees alone. Focusing on the response of the total number of employees could underestimate the decline in total hours worked and change in productivity in adverse times.

Concerning the evolution of wages, increases in job stayers' wages are restricted in times of contraction, and more so for white-collar workers who generally enjoy higher pay rises. Because wages of job stayers do not diminish, firms could save on their average wage bill through a change in the composition of the labour force or through a reduction in the wage of entrants relative to that of stayers. The evidence presented in this paper suggests that the latter explanation does not apply. Generally speaking, there is no difference between earnings of entrants and those of stayers in adverse times than in good times. In some cases, some wage savings are made by hiring younger workers, or by reducing the number of older workers (inter alia, through early retirement).

The main differences across sectors are that there is essentially no wage moderation in the construction sector in cases of wage bill contraction, and therefore employment adjusts more severely. Further, layoffs are proportionally more important. In addition, there are indications of a wider use of temporary unemployment, which is particularly well-suited to this sector. On the other

hand, contractions in the manufacturing sector lead to relatively more early retirement, together with the largest cut in fixed-term-contract and interim workers, compared to other sectors.

A typical feature of sales contraction is the stronger reduction in the use of interim workers, as compared to wage bill declines. Together with reductions in hours worked, and wider recourse to temporary unemployment, these allow for a less costly and more reversible adjustment of the labour force than a reduction in the number of open-ended contract workers.

All in all, the results plead for a broad view of a firm's adjustment margins in order to understand its response to unfavourable economic conditions. Furthermore, it highlights differences in the adjustment variables used according to the size, sector, and adverse event considered.

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## Appendix 1: Trimming procedure

Table A1 below reports the number of firms at each step of the trimming procedure. Starting with the set of firms that report detailed annual accounts, I exclude foreign and public companies and non-profit associations. Then I consider only those firms with a reporting period from January to December. Consistency of social balance sheets implies that the number of employees at the end of the year, and the average number over the year, as reported in the notes to the annual accounts must be the same as those reported in the social balance sheet. Then, to compute the changes in each variable, firms have to be observed over two consecutive years. Further, I keep only those firms for which net job flows, given by the difference between entries and exits as reported in the social balance sheet, do not deviate from five in absolute value from employment changes over two consecutive years, given in annual accounts. Also the number of entries over the year cannot exceed the number of employees at the end of the year. Then, I restrict the set of firms to those above 50 employees[25]. This dataset is matched with the sample of individual earnings data. I remove the 1st and 99th percentiles (defined on a yearly basis) of the following variables: sales growth, value added growth, employment, profits, productivity. A final trimming aims to make individual earnings data as representative as possible of the firms. The wage bill growth as computed from the annual account information is not allowed to deviate by more than 0.15 in absolute value from that computed by summing individual earnings within the firm. Further, I consider only firm-year observations for which there is at least 10 individual earnings of job stayers and 10% of the number of stayers reported in social balance sheets, and in case there are job flows within the firm in that year, at least 2 entrants (2 exiters), provided they represent at least 5% of the numbers of entrants (exiters) reported in social balance sheets.

For comparison, Table A2 reports the same numbers for the final dataset as well as for a larger sample of firms, referred to as the "control sample". This sample is selected along the same criteria as before except that it is not matched with the individual wages dataset, i.e. it meets the first seven criteria listed in Table A1.

25 Firms with at least 50 employees must, by law, have union representation within the firm.

**Table A1 - Number of firms at different steps of the trimming procedure**

| | |
|---|---|
| cleaning in annual accounts | |
| 1. with detailed annual accounts | 22566 |
| 2. which are profit maximisers | 22096 |
| 3. with annual accounts from January to December | 17763 |
| 4. with consistent social balance sheet | 11572 |
| 5. with two consecutive annual accounts | 9901 |
| 6. with consistent flows of workers | 9781 |
| 7. with at least 50 employees | 3497 |
| 8. matched with individual wage dataset | 3166 |
| 9. with cleaned annual accounts variables | 2987 |
| cleaning in individual earnings data | |
| 10. $\|\Delta WB\_AA-\Delta WB\_KSZ\|<0.15$ | 2821 |
| 11. with enough stayers, entrants and exiters | 1974 |

**Table A2 - Representativity of the final dataset**

| | *final dataset* | | *control dataset* | |
|---|---|---|---|---|
| | mean | std | mean | std |
| ΔWbill | 0.060 | 0.094 | 0.070 | 0.167 |
| ΔL | 0.033 | 0.097 | 0.037 | 0.161 |
| $\%entrants_t$ | 0.233 | 0.142 | 0.247 | 0.171 |
| $\%exits_t$ | 0.204 | 0.127 | 0.221 | 0.172 |
| $retirement_t/exits_t$ | 0.021 | 0.060 | 0.020 | 0.064 |
| $early\ retirement_t/exits_t$ | 0.039 | 0.091 | 0.035 | 0.094 |
| $layoffs_t/exits_t$ | 0.209 | 0.209 | 0.215 | 0.228 |
| Δhours/FTE | -0.0057 | 0.055 | -0.0054 | 0.109 |
| Δ%part time workers | 0.0045 | 0.021 | 0.0035 | 0.027 |
| Δinterim workers | 0.078 | 0.858 | 0.067 | 0.912 |
| # obs | 4705 | | 10995 | |
| # firms | 2079 | | 3497 | |

Δ refers to the first difference of the log of the variable; Δ% part-time workers to the first difference of the percentage of part-time workers; the ratios $\%entrant_t$, $\%exits_{t-1}$, $\%exits_t$ are computed with respect to the number of employees at the end of the year; $w_{entrant}$-$w_{stayer}$ is the difference between the low earnings of entrants and the log earnings of incumbents. The final dataset is the one used in the analysis of the paper; the control dataset is the sample of large and medium-sized firms that fulfil the same consistency checks as the final dataset except that it is not matched with the individual wages dataset.

**Appendix 2: Robustness with respect to alternative data trimming**

I examine here the robustness of the wage bill decompositions with respect to the trimming procedure used to clean up the data. In the sample used in the paper, the following three criteria were applied: (1) full-year workers are defined as those with a maximum of two months of sick leave; (2) the firm's wage bill growth computed from the data on individual earnings does not deviate from the wage bill growth as reported in the annual accounts by more than 0.15 in absolute value; and (3) individual earnings above the 99th percentile were excluded. This appendix examines deviations from these criteria. Firstly, the first four lines of Table A3 allow full-year workers to have a maximum of 1, 2 , 3 or 4 months' sick leave. Secondly, I modify the condition that the firm's wage bill growth computed from the data on individual earnings does not deviate from the wage bill growth as reported in the annual accounts. I relax the criterion to be 0.25 in absolute value, then restrict it to 0.05. Thirdly, I consider two alternative trimmings of high wages: no trimming as opposed to a more severe trimming that excludes wages above the 95th percentile.

Table A3 reports the average across firms and years of the components of the wage bill growth (equation (7)). The results show that the estimates of each component is the same order of magnitude as in the base case. Furthermore, the significance of the differences between cases of wage bill expansion and wage bill contraction are identical. So, the qualitative and quantitative conclusions are robust to these alternative trimming procedures.

**Table A3 - Wage bill decomposition** (see equation (7))

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| *W<P99, 1 month sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 4340 | 0.053 | 0.036 | -0.014 | 0.008 | 0.023 |
| $\Delta$WB>0 | 3416 | 0.078 | 0.038 | -0.014 | 0.015 | 0.039 |
| $\Delta$WB<0 | 924 | -0.041 | 0.029 | -0.016 | -0.018 | -0.036 |
| t-stat equal means | | 26.41 | 7.65 | 0.94 | 20.49 | 19.14 |
| *W<P99, 2 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 4705 | 0.054 | 0.037 | -0.014 | 0.007 | 0.024 |
| $\Delta$WB>0 | 3694 | 0.079 | 0.038 | -0.014 | 0.015 | 0.040 |
| $\Delta$WB<0 | 1011 | -0.038 | 0.031 | -0.015 | -0.021 | -0.032 |
| t-stat equal means | | 25.88 | 4.54 | 0.56 | 23.49 | 19.32 |
| *W<P99, 3 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 4981 | 0.054 | 0.037 | -0.015 | 0.006 | 0.026 |
| $\Delta$WB>0 | 3899 | 0.080 | 0.039 | -0.014 | 0.014 | 0.042 |
| $\Delta$WB<0 | 1082 | -0.038 | 0.032 | -0.017 | -0.023 | -0.030 |
| t-stat equal means | | 25.25 | 3.30 | 0.95 | 24.26 | 19.70 |
| *W<P99, 4 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 5208 | 0.056 | 0.038 | -0.015 | 0.006 | 0.028 |
| $\Delta$WB>0 | 4072 | 0.083 | 0.039 | -0.014 | 0.014 | 0.043 |
| $\Delta$WB<0 | 1136 | -0.039 | 0.033 | -0.019 | -0.024 | -0.028 |
| t-stat equal means | | 26.39 | 2.90 | 1.53 | 24.88 | 18.94 |
| *W<P99, 2 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.25* | | | | | | |
| entire sample | 5040 | 0.053 | 0.036 | -0.014 | 0.007 | 0.025 |
| $\Delta$WB>0 | 3922 | 0.079 | 0.038 | -0.014 | 0.014 | 0.041 |
| $\Delta$WB<0 | 1118 | -0.037 | 0.031 | -0.015 | -0.020 | -0.032 |
| t-stat equal means | | 26.53 | 4.24 | 0.65 | 22.95 | 20.32 |
| *W<P99, 2 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.05* | | | | | | |
| entire sample | 2831 | 0.049 | 0.036 | -0.014 | 0.006 | 0.021 |
| $\Delta$WB>0 | 2253 | 0.073 | 0.038 | -0.014 | 0.014 | 0.036 |
| $\Delta$WB<0 | 578 | -0.047 | 0.030 | -0.015 | -0.025 | -0.038 |
| t-stat equal means | | 19.82 | 3.16 | 0.28 | 22.49 | 14.87 |
| *W free, 2 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 4741 | 0.055 | 0.037 | -0.013 | 0.007 | 0.024 |
| $\Delta$WB>0 | 3726 | 0.080 | 0.038 | -0.013 | 0.015 | 0.040 |
| $\Delta$WB<0 | 1015 | -0.037 | 0.030 | -0.014 | -0.021 | -0.032 |
| t-stat equal means | | 25.99 | 4.62 | 0.50 | 23.67 | 19.52 |
| *W<P95, 2 months sick, $\|\Delta WB\_AA-\Delta WB\_KSZ\|$<0.15* | | | | | | |
| entire sample | 4654 | 0.052 | 0.036 | -0.016 | 0.007 | 0.024 |
| $\Delta$WB>0 | 3653 | 0.077 | 0.038 | -0.016 | 0.015 | 0.039 |
| $\Delta$WB<0 | 1001 | -0.039 | 0.031 | -0.017 | -0.021 | -0.032 |
| t-stat equal means | | 25.49 | 4.43 | 0.56 | 23.44 | 19.02 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

## Appendix 3: Robustness with respect to alternative definition of size classes

Table A4 below reports the wage bill decomposition for alternative firm sizes, where size classes are defined according to the average number of employees of the firm over the sample period, rather than the current number of employees, as is done in Table 4. Results are of the same order of magnitude as in Table 4 so that the conclusions remain unchanged.

**Table A4 - Wage bill decomposition according to firm average size (see equation (7))**

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$-$D_{exit}$ |
|---|---|---|---|---|---|---|
| *49 < number of employees < 100* | | | | | | |
| entire sample | 1647 | 0.065 | 0.032 | -0.009 | 0.009 | 0.032 |
| $\Delta WB>0$ | 1277 | 0.094 | 0.034 | -0.008 | 0.017 | 0.050 |
| $\Delta WB<0$ | 370 | -0.035 | 0.025 | -0.012 | -0.019 | -0.029 |
| t-stat equal means | | 17.61 | 5.06 | 1.27 | 13.85 | 12.51 |
| *99 < number of employees < 200* | | | | | | |
| entire sample | 1549 | 0.056 | 0.038 | -0.017 | 0.007 | 0.028 |
| $\Delta WB>0$ | 1243 | 0.078 | 0.040 | -0.016 | 0.014 | 0.041 |
| $\Delta WB<0$ | 306 | -0.035 | 0.029 | -0.018 | -0.025 | -0.022 |
| t-stat equal means | | 15.14 | 4.46 | 0.25 | 12.63 | 11.38 |
| *199 < number of employees* | | | | | | |
| entire sample | 1509 | 0.040 | 0.040 | -0.017 | 0.005 | 0.011 |
| $\Delta WB>0$ | 1174 | 0.063 | 0.041 | -0.017 | 0.012 | 0.027 |
| $\Delta WB<0$ | 335 | -0.042 | 0.037 | -0.015 | -0.020 | -0.044 |
| t-stat equal means | | 12.40 | 0.92 | -0.62 | 15.88 | 10.05 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^{S}}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^{N}}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^{S}}_{it} - \overline{D^{S}}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^{N}}_{it}N_{it} - \overline{D^{E}}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

## Appendix 4: Robustness with respect to alternative criteria

**Table A5 - Wage bill decomposition** (see equation (7))

| | # obs | $\Delta WB_{it}$ | $\Delta W_{stay}$ | $W_{new}$-$W_{exit}$ | $\Delta D_{stay}$ | $D_{new}$ - $D_{exit}$ |
|---|---|---|---|---|---|---|
| entire sample | 4705 | 0.054 | 0.037 | -0.014 | 0.007 | 0.024 |
| *sample split wrt $\Delta sales_t$* | | | | | | |
| $\Delta sales_t>0$ | 3319 | 0.070 | 0.038 | -0.015 | 0.012 | 0.035 |
| $\Delta sales_t<0$ | 1386 | 0.015 | 0.034 | -0.010 | -0.006 | -0.003 |
| t-stat equal means | | 14.114 | 2.995 | -2.528 | 11.355 | 12.719 |
| *sample split wrt $\Delta sales_{t-1}$* | | | | | | |
| $\Delta sales_{t-1}>0$ | 3289 | 0.062 | 0.037 | -0.016 | 0.009 | 0.032 |
| $\Delta sales_{t-1}<0$ | 1393 | 0.035 | 0.036 | -0.010 | 0.002 | 0.007 |
| t-stat equal means | | 5.659 | 0.570 | -3.155 | 4.385 | 6.766 |
| *sample split wrt $\Delta sales_t+\Delta sales_{t-1}<0$* | | | | | | |
| $\Delta sales_t+\Delta sales_{t-1}>0$ | 3540 | 0.070 | 0.037 | -0.014 | 0.011 | 0.036 |
| $\Delta sales_t+\Delta sales_{t-1}<0$ | 1142 | 0.004 | 0.035 | -0.012 | -0.007 | -0.012 |
| t-stat equal means | | 12.785 | 0.812 | -0.958 | 12.190 | 12.377 |
| *sample split wrt $\Delta sales_t$ and $sales_t<median$* | | | | | | |
| $\Delta sales_t>0$ or $sales_t>median$ | 3933 | 0.063 | 0.038 | -0.015 | 0.010 | 0.030 |
| $\Delta sales_t<0$ and $sales_t<median$ | 724 | 0.003 | 0.031 | -0.009 | -0.010 | -0.008 |
| t-stat equal means | | 11.715 | 4.561 | -1.780 | 10.257 | 10.138 |
| *sample split wrt $\Delta real\ sales_t$* | | | | | | |
| $\Delta real\ sales_t>0$ | 3016 | 0.074 | 0.038 | -0.015 | 0.013 | 0.038 |
| $\Delta real\ sales_t<0$ | 1689 | 0.018 | 0.034 | -0.012 | -0.004 | 0.000 |
| t-stat equal means | | 13.941 | 2.573 | -1.867 | 11.680 | 12.088 |
| *sample split wrt $\Delta value\ added_t$* | | | | | | |
| $\Delta value\ added_t>0$ | 3105 | 0.074 | 0.038 | -0.016 | 0.014 | 0.038 |
| $\Delta value\ added_t<0$ | 1600 | 0.014 | 0.034 | -0.010 | -0.008 | -0.002 |
| t-stat equal means | | 15.542 | 2.533 | -2.748 | 14.604 | 12.900 |
| *sample split wrt $\Delta real\ value\ added_t$* | | | | | | |
| $\Delta real\ value\ added_t>0$ | 2866 | 0.077 | 0.038 | -0.016 | 0.015 | 0.040 |
| $\Delta real\ value\ added_t<0$ | 1839 | 0.018 | 0.035 | -0.011 | -0.005 | 0.000 |
| t-stat equal means | | 15.640 | 2.510 | -2.509 | 13.421 | 13.175 |

$\Delta W_{stay}$ stands for $\frac{(\overline{w^{dS}}_{it} - \overline{w^{dS}}_{it-1})\overline{D^S}_{it}S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $W_{new}$-$W_{exit}$ stands for $\frac{(\overline{w^{dN}}_{it} - \overline{w^{dE}}_{it-1})\overline{D^N}_{it}N_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$,

$\Delta D_{stay}$ stands for $\frac{\overline{w^{dS}}_{it-1}(\overline{D^S}_{it} - \overline{D^S}_{it-1})S_{it}}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$, $D_{new}$-$D_{exit}$ stands for $\frac{\overline{w^{dE}}_{it-1}(\overline{D^N}_{it}N_{it} - \overline{D^E}_{it-1}E_{it-1})}{0.5(\sum_{J_{it}} w_{jit} + \sum_{J_{it-1}} w_{jit-1})}$

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