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Rigid Wages and Contracts: Time- versus State-Dependent Wages in the Netherlands

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Abstract

We study nominal wage rigidity in the Netherlands using administrative data, which has three key features: (1) high-frequency (monthly), (2) high-quality (administrative records), and (3) high coverage (the universe of workers and the universe of firms). We find wage rigidity patterns in the data that are similar to wage behavior documented for other European countries. In particular we find that the hazard function has two spikes, one at 12 months and another one at 24 months and wage changes have time and state dependency components. As a novel and important piece of evidence we also uncover substantial heterogeneity in the frequency of wage changes due to explicit terms of the labor contract. In particular, contracts featuring flexible hours, such as on-call contracts, exhibit a higher probability of a change in the contract wage compared to fixed-hour contracts. Once we split the sample based on contract characteristics, we also find that the response of wage changes to the time and state component is heterogeneous across different type of contracts - with relatively more downward adjustments in flexible-hour contract wages in response to aggregate unemployment.

Keywords: Wage rigidity, microdata, time dependency, state dependency, flexible-hour contracts.

JEL Classification Numbers: E24, J31.

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1 Introduction

Macroeconomists widely accept nominal wage rigidity as an imperfection that may generate substantial fluctuations in unemployment and output in the short term. The existence of nominal wage rigidity also provides a motivation for monetary policy to steer macroeconomic activity. Therefore, traditional Keynesianism and, more recently, the New Keynesian literature, emphasize the importance of identifying the degree of nominal wage rigidity in an economy. In this sense, a better understanding of patterns of wage rigidity is essential for uncovering the sources of business cycles and developing optimal policy instruments to handle economic fluctuations.

In this paper, we use a large, high-frequency micro-panel dataset on monthly salaries for all employees in the Netherlands to explore the dynamics of nominal wage rigidity. Our research objectives are threefold: (i) We estimate nominal wage rigidity at the worker level and (ii) investigate the wage changes of the employees that are related to the explicit contractual terms. The study of the relationship between wage flexibility and contractual-terms is very timely from both empirical and policy perspectives, especially in the context of advanced societies: both flexible-hour and part-time contracting has been rising over the last decade for many countries - a development concerning workers, employers as well as policy-makers. As figures 1 and 2 show, this trend is particularly clear in the Netherlands.¹

¹Several studies have investigated the reasons and possible causes of this trend in the Netherlands (e.g. [Bolhaar, Brouwers and Scheer \(2016\)](#) and [de Beer and Verhulp \(2017\)](#)). As mentioned by [de Beer \(2016\)](#), it is traditionally considered that economic and technological factors explain the increase in the participation of flexible labor contracts in recent years. On the one hand, because more flexible contracts help firms to absorb the economic fluctuations and the greater volatility of demand observed after the financial crisis. On the other hand, the prevalence of flexible contracts would be the consequence of changes in the labor skills demanded as a result of technological progress. Additionally, and from the point of view of the supply, some argue that modern workers prefer flexible contracts because they weigh more the autonomy that this contract provides against the stability and security provided by more permanent contracts.

[de Beer \(2016\)](#) and [Euwals, de Graaf-Zijl and van Vuuren \(2016\)](#) consider, however, that the mentioned causes are of second order of importance and claim instead that one of the main reasons to the rise of flexible contracts, on-call contracts specifically, is the lack of regulation for this type of contracts. This lack of an institutional framework reduces the costs and risks for employers, compared to more permanent contracts, in an environment of volatile markets.

[van der Aa, van Buren and Viertelhaugen \(2015\)](#) surveyed Dutch employers regarding their reasons for using flexible contracts. The authors partially confirmed the findings of Beer (2016) finding that employers prefer flexible contracts, among other reasons, depending on the nature of the work (flexible contracts for monotonous jobs and permanent contracts for specialists), due to their lower costs and because they perceive that flexible contracts are associated with lower risks related to labor laws.

[Figure 1 about here.]

[Figure 2 about here.]

Research that uses microeconomic data to estimate the degree of nominal wage rigidity has concentrated mainly on uncovering the presence of downward wage rigidities, specifically, in the frequency of wage freezes. Some examples of this line of research are [McLaughlin \(1994\)](#), [Kahn \(1997\)](#), [Altonji and Devereux \(2000\)](#), [Gottschalk \(2005\)](#), [Fehr and Goette \(2005\)](#), [Dickens et al. \(2007\)](#) and [Deelen and Verbeek \(2015\)](#). A few studies such as [Bihan, Montornès and Heckel \(2012\)](#), [Barattieri, Basu and Gottschalk \(2014\)](#), [Kurmman and Mcentarfer \(2017\)](#) and [Ehrlich and Montes \(2017\)](#), which use highly disaggregated data, also investigate the interaction between the frequency of nominal wage adjustments and delayed wage adjustments over the business cycle.

In this paper, we expand the existing literature on staggered nominal wage adjustments and fill an important gap by providing a detailed analysis of contract-level channels that are likely to explain empirically observed nominal wage stickiness in micro-data. Specifically, using a micro-detailed approach we aim to understand which particular characteristics of employee-employer contracts induce nominal wages to remain rigid during economic downturns.

A recent study that is closely related to our research is [Sigurdsson and Sigurdardottir \(2016\)](#), whose analysis with administrative data from Iceland reveals the presence of time and state dependency components in the setting of nominal wages. The authors' study shows that in Iceland downward rigidities of nominal wages are present to a large extent, and that wages tend to contract in response to recessionary trends, which indicates the relevance of state-dependent wage setting. The Icelandic administrative data, however, to some extent restrict the conclusions reached by the authors on the deeper determinants of state-dependent salaries, since they can only contrast the behavior of nominal wages across industries, occupations and size of the firms. In this current study, we use administrative data from the Netherlands, which given its structure, allows us to make detailed comparisons between different employment contracts, in addition to occupations, firms and industry characteristics. The ability to make such comparisons also provides us with a framework to investigate the determinants of state dependence versus time dependence on wage determination.

Several theoretical foundations have been highlighted in the literature that could explain why firms may hesitate to cut wages during economic downturns. [Campbell and Kamlani \(1997\)](#) provides a review of the theoretical literature and conducts a firm-level survey to isolate the different theories of wage rigidity qualitatively. However, the absence of observational data in the analysis of [Campbell and Kamlani \(1997\)](#) limits the applicability of their conclusions. Some promising theories for understanding wage rigidity are contract theory, the theory of implicit contracts, theories of efficiency wages, the theory of fair wages and the theory of insider-outside information. The contracts approach to wage rigidities, as proposed by [Fischer \(1977\)](#) and [Taylor \(1980\)](#), suggests that long-term employee-firm agreements require that wages be fixed in advance, which prevents wage negotiations from taking place on a regular basis. Advocates of implicit contract theory, such as [Azariadis \(1975\)](#) and [Stiglitz \(1984\)](#), argue that workers' risk aversion would induce them to prefer stable wages during the business cycle to wages that increase during expansions and decline during recessions. Therefore, risk aversion would give incentives to firms and workers to come to an implicit understanding of keeping wages stable during the business cycle. The implicit theory of contracts would imply that, wherever wages are rigid, firms are expected to pay relatively lower wages by avoiding to compensate for risk premia.

Our empirical analysis uses Dutch data at the employee level that cover from 2006 to 2012 (84 months). Our results show that the frequency of nominal wage adjustments in the Netherlands coincides with the general wage rigidity patterns documented recently for other European countries using high frequency data on wages such as for France ([Bihan, Montornès and Heckel \(2012\)](#)), Luxembourg ([Lünnemann and Winttr \(2009\)](#)) and Iceland ([Sigurdsson and Sigurdardottir \(2016\)](#)).

We divide our empirical analysis into two parts. In the first part we provide a description of the nominal wage stickiness of the Dutch economy. In this preliminary phase we find that nominal wages are downward rigid across a wide range of industrial clusters. We also document a clear seasonal pattern in the degree of rigidity. Likewise, we document significant heterogeneity in nominal wage rigidity across industries and occupations, as well as with respect to firm-size. Importantly, the duration analysis of a change in the contract wage confirms earlier findings in the literature regarding the shape of the

hazard function. Accordingly, we find that the hazard has two spikes, one at 12 months and another one at 24 months.

As a highlighted novel contribution of our research from this first part, we find empirical evidence that the contractual terms of employees are important to understand the degree of nominal wage rigidity. To this end, we uncover that *flexibility* of contractual hours significantly correlates with the likelihood of (downward and upward) nominal wage adjustments, i.e. flexible-hour contracts dominate fixed-hour contracts in terms of wage flexibility. Specifically, on average, the period during which the nominal wage in contracts with fixed-hours remains unchanged is 61% longer than in contracts with flexible-hours. Interestingly, we do not find any significant difference in nominal wage stickiness when we slice the space of contracts in terms of contractual *hours* (part-time vs. full-time) and *tenure* (fixed-term vs. permanent). These findings not only help to understand the determinants of aggregate nominal wage rigidity, but are also increasingly relevant given the change in composition observed in the participation of different types of contract and employment policies during the period of analysis.

In the second part of the paper, using a formal econometric exercise, we study time-dependence and state-dependence in the determination of nominal wages in the Netherlands. We find that time- and state-dependency, represented by changes in macroeconomic variables (such as inflation and unemployment), affect the probability of observing both increases and nominal wage reductions. Time- and state-dependency affect the probability of observing changes in nominal wages for the pooled sample, that is, without disaggregation by type of contract, but also when considering the different types of contracts separately. We also find that the effect of time- and state-dependency is not homogeneous across different contracts. For example, with respect to wage reductions (i.e. downward rigidities), which the past literature primarily concentrated upon, we find that flexible-hour contract wages are more likely to decrease in response to rising unemployment. No other type of employment contracts (including part-time and fixed-term employment status) exhibits this empirical pattern - yielding another unique and important empirical feature associated with flexible-hour contracts.

The rest of this paper is organized as follows. Section 2 presents a summary of the theories of wage rigidity while Section 3 summarizes the institutional setting for wage determination in the Netherlands. Section 4 describes in detail

the data we use. Sections 5 and 6 present our empirical results. Section 7 concludes.

2 Theories of Wage Rigidity: Time-Dependent vs. State-Dependent Wage Setting

There are two broad classes of theories that aim to describe the behavior of wage adjustments: time-dependent and state-dependent models of wage determination. According to time-dependent models of wage adjustments, the state of the economy does not play any role in determining the likelihood and the size of a wage change. Earlier examples of time-dependent wage setting include [Fischer \(1977\)](#) and [Taylor \(1980\)](#), who propose that wages remain constant for an exogenous and deterministic number of periods, such as a particular number of months or a year. Fisher-Taylor type of time-dependent wage setting can be motivated by the behavior of wages observed among unionized workers. Also, in this family of models, a feature pioneered in Calvo's famous 1983 article suggests a random duration in nominal adjustments.² Building upon this feature, many New-Keynesian macro models, such as [Smets and Wouters \(2003\)](#), assume that wages change at random with a probability to re-optimize wages that remains constant over time. Although Calvo type wage stickiness is hard to support with an empirically justifiable microfoundation, the tractability that it induces makes Calvo-stickiness a desirable assumption to apply in New-Keynesian models.

Models with state-dependent wage setting build upon the theoretical argument that fixed costs to renegotiate employment contracts prevent frequent adjustments in wages. Assumptions proposed by [Caplin and Spulber \(1987\)](#) and [Fehr and Goette \(2005\)](#) argue that fixed cost of wage adjustments imply that the likelihood and the size of wage changes vary over time with the conditions of the macroeconomy, the industry and the firm.

In this paper we aim to disentangle the presence of time-vs-state dependent wage setting using a rich data-set for the case of the Netherlands.

²Although [Calvo \(1983\)](#) develops a model of sticky-prices, many papers in the literature implemented Calvo stickiness also for the case of wages.

3 Institutional Setting

The Netherlands is a small, open economy and part of the eurozone for the years of our study. With a population of 16.9 million inhabitants in 2015, it is more populous than the state of Illinois, but smaller than the state of New York.

In 2015 there were about 8.29 million people in the labor force, with 6.9 million workers and 1.38 million self-employed. The three largest industries in terms of workers are health care (16%), trade (15%), and manufacturing (10%).

Important for our analysis is the distinction between workers with a contract of indefinite length (74% as of 2015) and a fixed-term contract (26%). As Table 1 shows, the group of fixed-term contracts is quite heterogeneous: 31% of the workers with a fixed-term contract are on-call; 19% have no hours defined, and 14% work for temporary work agencies (Dutch Labor Force Survey Statistics for 2015). Of the remaining workers with fixed-term contracts, 10% of the workers have a temporary contract for less than a year, and 11% have a temporary contract longer than a year.

[Table 1 about here.]

Legally there are no limits on the length of time of the first fixed-term contract an employer offers, but there are regulations for the maximum number of successive contracts the employer can offer before a fixed-term contract alters into a contract of indefinite length (OECD EPL database, 2013). After three successive fixed-term contracts and/or a period of 36 months covered (including prolongations), the fourth (or next) contract is automatically of indefinite length. Exceptions to this rule are possible in collective bargaining agreements. In practice, the difference between temporary contracts and contracts of indefinite duration is the degree of employment protection. Termination of a labor contract by the employer involves either the courts or the public employment service (OECD EPL database, 2013), with an equal distribution of cases between the two. The courts are more expensive in terms of severance pay but are typically shorter and less administratively burdensome for the employer. Severance pay depends on the tenure of employment, gross wages and some discretionary factor applied by the courts. The average OECD score for job protection of workers with a regular contract is 2.04 in 2013 (on a scale from 0, no protection, to 6, maximum job protection). Workers with regular contracts in the Netherlands are better protected (score of 2.82) compared to the OECD.

The opposite is true for workers with a temporary contract: the OECD average is 1.72, whereas the score for Dutch workers with a temporary contract is 0.94.

With respect to hours worked, the Dutch labor market can be characterized by a high degree of labor flexibility. In 2015 almost half of all workers worked less than the standard number of hours: 26.3% of the men and 75.1% of the women. The share of involuntary part-time work is very low: 8.6% of part-time workers work less than fulltime involuntarily (OECD, 2015). Overtime hours are measured in our data to the extent that hours are paid at a higher wage rate, e.g. weekend and night shifts in certain industries. Overtime premiums and overtime hours regulation are typically covered in collective bargaining agreements.

Trade union density, defined as the number of union members over the number of wage and salary earners, is with 17.8% comparable to the OECD average of 17.0% (OECD, 2013). For comparison with some of the mentioned studies, trade union density is lower in France (7.7%) and the United States (10.7%), and higher in Luxembourg (32.8%) and Iceland (82.4%). Union membership is low, but coverage of wage bargaining is relatively large. Four bargaining regimes can be distinguished (Hartog, Leuven and Teulings (2002)): company level bargaining, industry level bargaining, mandatory extension of an industry agreement, and no collective bargaining.

Figure 17 in the appendix shows the behavior of GDP growth, CPI inflation and unemployment in the Netherlands in the period 2006-2012.

4 Data

One reason empirical research on wage rigidity is limited - especially to the end of identifying the models and theoretical channels that drive the degree of wage rigidity - is the lack of high-frequency microdata, which provide detailed information on contracts between employees and employers. In this respect, there are two fronts of the state of the art datasets that are required to conduct this research project. On the one hand, to capture potential rigidities in wage adjustments over the business cycle frequency, the data should be at a monthly (or at the least of quarterly) frequency. On the other hand, the details of employment contracts should provide enough information about the duration of the agreement and other features of the employee-employer rela-

tionship to allow for a thorough investigation of the sources of wage rigidity that we are interested in.

The analysis in this paper is based on anonymized non-public census-data from Statistics Netherlands (CBS) for the period of 2006-2012. In particular, the dataset allows us to use information on firms from the General Business Register (ABR), personal characteristics of individuals affiliated with municipal administration registers (GBA) and monthly quantitative and qualitative data regarding jobs and wages of employees in Dutch companies (POLISBUS).³ Firms collect the monthly wage data and report it to the unemployment insurance agency. All legal workers are covered by unemployment insurance, and unemployment insurance is based on the number of years of work at all firms (including gaps), and the wages earned in the 12 months prior to unemployment, as well as hours worked. The fact that firms report the data minimizes the measurement error in wages and hours reported. Moreover, we observe in our data the universe of firms, both public and private.

In the first quarter of 2007, the census comprises around 980,000 firms with approximately 8,05 million workers among 480 industries (5-digit NACE), from which, due to computational constraints, we take a 5% random sample stratified by sector and firm size. The data includes monthly contract wages, variable compensation, payroll taxes and hours worked. At the level of the firm 5-digit industry code, collective labor agreement code (if any), and firm balance sheets and income statements can be linked to workers at incorporated firms. The observational unit is defined as the relationship between an employee and the employee's job at a firm (i.e., wage trajectory) which can be followed for up to seven years in our sample. The use of the wage trajectory as our observation unit means that the wage changes discussed in this paper are *within job* wage changes. As standard in the literature, our measurement unit is hourly wages, where wages are given by the contract wage.

Measuring the nominal rigidity in wages is challenging for two reasons: low frequency (annual) data and measurement error in wages, hours or both. The dataset we use in our research helps us with both issues. First, the employee-level dataset is at a monthly frequency giving us the opportunity to observe the exact month of a wage change *within a given wage trajectory*. We also observe the exact month of a new wage trajectory, as well as the month of a job exit

³Under certain conditions, these microdata are accessible for statistical and scientific research. For further information please contact Statistics Netherlands at microdata@cbs.nl.

and entry. Moreover, we can decompose total monthly compensation into the contract wage and variable compensation. These are important improvements on existing research. Most available microeconomic datasets on wages are at an annual frequency making the estimation of short-run wage rigidities quite imprecise. Only few studies provide evidence on wage rigidities at a quarterly frequency, such as [Bihan, Montornès and Heckel \(2012\)](#) for France, and [Barattieri, Basu and Gottschalk \(2014\)](#) for the United States; or at the monthly frequency: [Lünnemann and Wintr \(2009\)](#) for Luxembourg, and [Sigurdsson and Sigurdardottir \(2016\)](#) for Iceland. To the end of contractual details, our data differentiates between variable and base compensation of employees, provides information on hours worked, and the type of contracts (fixed-term versus permanent). The second challenge is measurement error. [Gottschalk \(2005\)](#) finds that measurement error in surveys can be substantial, due to imperfect recall or unwillingness to report hours worked or wages received (or both).

Our research isolates the effects of explicit contractual terms on estimated wage rigidities from that of factors due to firm, industry and macroeconomic characteristics. Moreover, we observe all employees at each firm, which allows us to identify each firm-worker pair in the data uniquely. An additional novel feature of our data is that we observe start and end of unemployment spells and can precisely infer wage changes of job-finders.

Our empirical methodology to estimate wage rigidity follows the recent literature (e.g., [Gottschalk \(2005\)](#); [Bihan, Montornès and Heckel \(2012\)](#); [Barattieri, Basu and Gottschalk \(2014\)](#)) and [Sigurdsson and Sigurdardottir \(2016\)](#).

Data Treatment. Even though we are dealing with high-quality administrative data, some observations should be excluded because it is likely that they contain measurement errors or are the result of misreporting. Specifically, we leave out any observations with nonsense values (e.g. negative nominal wages or number hours worked) and to trim possible outliers, we drop the first and/or the last percentile in most of the variables.

The data cleaning process, however, does not entirely eliminate the presence of measurement error, or misreporting, which may obscure our estimation of the level of wage rigidity. Specifically, we could potentially find spurious changes in wages that are the product of misreporting or due to rounding. In order to differentiate *actual* wage changes from the spurious ones, and reduce the bias generated by the latter, we implement an identification strategy that is standard in the literature. In general terms, the identification strategy assumes

that a step function can describe wage changes. That is, we assume (as intuition dictates) that individual wages stay constant for some unknown number of months and then, when they change, they change in a discrete manner. One way to implement this identification strategy is using a structural break test. However, this econometric approach used by [Gottschalk \(2005\)](#) is computationally expensive and becomes infeasible when the number of wage trajectories is big, as in our case.⁴ Instead, we implement the identification strategy using a heuristic approach which can be summarized as follows:⁵

1. We eliminate the last observation of a wage trajectory if this includes a wage change. This allows us to take into account any possible payment received by the employee at the end of the labor relationship, such as severance payments. Symmetrically, we eliminate the first observation of a wage trajectory if it is followed by an immediate change in wage as well. This way we take into account any possible “extra” payments that wage earner receives in the first month of the employment relationship, e.g. sign-on bonuses.
2. We drop wage trajectories that last for less than 3-months. The idea behind this is to avoid the possible bias generated by very short and potentially volatile wage trajectories.
3. We eliminate wage trajectories where the number of wage changes is greater than 80% of the total possible number of changes (e.g., a wage trajectory of 12 months with ten wage changes is dropped from our analysis). This is in line with our overall identification strategy: wages stay constant for some unknown period.
4. We correct wage trajectories that contain V-shape or inverted V-shape wage changes, i.e. a wage reduction followed immediately by an increase (or vice versa). This kind of sharp wage reversals are potentially due to misreporting or due to rounding error. In our analysis, we take such sharp wage-reversals as a “no-change” in wage.
5. Finally, we correct wage trajectories that contain wage reversals in a time span of three months, i.e. a wage change that is reverted after two or three

⁴See [Barattieri, Basu and Gottschalk \(2014\)](#) for an application.

⁵A similar approach is used in [Sigurdsson and Sigurdardottir \(2016\)](#) and [Lünnemann and Wintr \(2009\)](#).

months leaving the wage exactly as before the change. We consider those wage-reversals as a “no-change” in wage.⁶

Figure 3 depicts the implementation of the above algorithm for a fictional individual over a 24-month wage trajectory.⁷

[Figure 3 about here.]

5 Wage Rigidity: Descriptive Analysis

In this section we conduct a duration analysis and a multinomial logit estimation to document the patterns of employee-level wage adjustments in the Netherlands. We split our results in two. At first, we present a set of findings, some of which have also been highlighted in the previous literature for other European countries and the US. We then show and discuss another set of findings that are novel for the literature - regarding labor contract types and wage rigidities.

The baseline results - that we present in Tables 2-7 and Figures 6-11 - reveal the presence of rigid wages, and in particular downward wage rigidities throughout sectors, firm-size groups and employment types. This means when we compare wage “decreases” against “increases”, contractions in wages are significantly less common than rising wages. These results are in line with those found in the literature as we will delineate below.

Table 2 shows that in the aggregate we capture a frequency of “no-change in wages” of 84.9%. This degree of wage rigidity is comparable to the findings of Sigurdsson and Sigurdardottir (2016), who document 87% probability of “no change in wages” for the case of Iceland, and Lünemann and Wint (2009), who document 85.7%- 93% probability of “no change in wages” for the case of Luxemburg. Both of these studies - like in our approach - use monthly data. Using quarterly data Bihan, Montornès and Heckel (2012) find a wage rigidity of 62% in France and Barattieri, Basu and Gottschalk (2014) uncover a wage rigidity of 78.4%-83.7% in the US. The quarterly equivalent of our wage rigidity

⁶Table 17 in the appendix shows the number of observations lost in each step of the cleaning process.

⁷The wage trajectory in this figure does not correspond to the wage trajectory of any individual in our sample nor in the population. The numbers were fabricated for illustrative purposes.

is 62.1% of no-change, which coincides with the degree of rigidity documented in France by [Bihan, Montornès and Heckel \(2012\)](#).⁸

[Table 2 about here.]

Figure 4 shows the estimated conditional hazard probability of a wage change based on the raw data. This figure indicates that wages are more likely to change every 12 months, and to a lesser extent if the wage remains unchanged for two years. More importantly, the high probability of observing a wage change every period depicted in Figure 4 reveals the presence of some measurement error in the raw data.

[Figure 4 about here.]

Figure 5 presents the hazard function of a wage change based on the data obtained after the cleaning procedure explained in detail in Section 4. The highest probability of a wage change is observed after 12 months: an employee who had an unchanged wage for 11 months has about a 50% chance of observing a change in his wage in the 12th month.

Similarly, if the wage remained unchanged for 23 months, the worker has a probability close to 20% of observing a wage change in month 24. A similar hazard function - with peaks in 12th and 24th months - was also documented by [Gottschalk \(2005\)](#) and [Barattieri, Basu and Gottschalk \(2014\)](#) for the case of the United States.

[Figure 5 about here.]

Moreover, Figure 6 and Table 3 reveal a clear seasonality (synchronization) in wage changes. We find that wages are more likely to rise in January and July. [Sigurdsson and Sigurdardottir \(2016\)](#) found a similar pattern in Iceland but the peaks in their work are documented to be in January and June. Similarly, using the administrative data from Luxemburg [Lünnemann and Wintz \(2009\)](#) uncovered a peak in January. [Bihan, Montornès and Heckel \(2012\)](#) also showed a synchronization in wage changes for the case of France. Finally, for the US [Barattieri, Basu and Gottschalk \(2014\)](#) showed weak evidence of synchronization. Additionally, our data also points out that there is evidence of staggered

⁸Table 14 in the Appendix shows the heterogeneity in the nominal wage rigidity according to some characteristics of the employees such as the type of marriage relationship and gender.

wages at the aggregate level. Figure 6 and Table 3 show that most of the wage changes are distributed over the course of the year.⁹

[Figure 6 about here.]

[Table 3 about here.]

[Table 4 about here.]

Figure 7 and Table 4 (in the Appendix) show that wages in the Netherlands have become more rigid after the financial crisis. [Sigurdsson and Sigurdardottir \(2016\)](#) found a similar pattern regarding the increase of wage rigidity after the crisis for the case of Iceland. However, it is important to note that the “economic recovery” had not been observed yet in the data that they use, because the last period for the analysis is 2010 in [Sigurdsson and Sigurdardottir \(2016\)](#).¹⁰

[Figure 7 about here.]

The results we obtain to the end of variations in marital status and gender of the employee and their implications for wage rigidities are in line with the findings of the previous literature as well. With respect to the marital status the rigidities are comparable between married and non-married, while married workers tend to exhibit rigidities to a larger extent (as also evidenced in [Lünnemann and Wintr \(2009\)](#)). Similarly, results are very close between male and female employees, but male workers appear to have more rigid wage profiles compared to female (also as in [Lünnemann and Wintr \(2009\)](#)).

As a novel piece of evidence Figure 8 and Table 5 uncover a clear positive correlation between age and wage rigidity.¹¹ For instance, the probability of a no-change in wages grows monotonically with the age of the employee until they reach 73 years (for employees over 73 years of age, the probability of a non-change decreases slightly). Therefore, while for employees between 63 and 73 years the likelihood of a no-change in wages is 88.1%, this likelihood is 77.7% for employees under 23 years of age. We observe a monotonic negative

⁹For France, [Bihan, Montornès and Heckel \(2012\)](#) found a stronger evidence of staggering (the probability of a wage increase is greater than 20% in every quarter).

¹⁰However, it is too early to talk about a sustained recovery since the Netherlands registered a negative GDP growth in the last year of our analysis.

¹¹[Lünnemann and Wintr \(2009\)](#) discuss the association between age and wage rigidity as well, but in their case age cannot be separated from marital status.

relationship between the age of the employee and the probability of a wage increase. As Table 5 shows young workers are twice as likely to experience a wage increase compared to their older counterparts. The negative link between the age of the employee and the likelihood of a wage reduction shows less variance than for the cases of no-change and wage increases.

[Figure 8 about here.]

[Table 5 about here.]

The implication of the estimated correlation between wage rigidity and workers' age gains additional relevance once we observe the behavior of the age groups during the observation period. Figure 9 shows this evolution between 2006 and 2012. We can see that, in general, the age groups with less rigidity in wages, ages between 23 and 53 years, have decreased their participation in the working population. In contrast, employees over 53 have shown a steady increase in their share.

[Figure 9 about here.]

Finally, we also document the heterogeneity of wage rigidities with respect to firms' size and industry classifications. First, Figure 10 and Table 6 illustrate that wages become more flexible with the size of the company, which was also highlighted in the past literature.¹² Also, as documented in the past literature, we show that the probability of observing a wage increase is positively related to firm size.¹³ We also find a negative relationship between firm size and the probability of a wage-contraction - as in Bihan, Montornès and Heckel (2012), which differs from the findings of Sigurdsson and Sigurdardottir (2016) and Lünemann and Wintr (2009), who show that the probability of observing a wage decrease is essentially independent of firm size. Second, sectoral comparisons reveal that for workers at municipalities, schools and subsidized sectors wages are more downward rigid compared to the private sector, as illustrated in Table 7 (Figure 11). Further decomposition of the sectors in industries shows that, for instance, wages in the Telecommunication industry are

¹²Sigurdsson and Sigurdardottir (2016) and Lünemann and Wintr (2009) find a similar empirical pattern, while Bihan, Montornès and Heckel (2012) find an inverted U-shaped - with more wage rigidity for the case of mid-size firms.

¹³The same pattern is observed by Sigurdsson and Sigurdardottir (2016), Lünemann and Wintr (2009) and Bihan, Montornès and Heckel (2012)

the least-rigid whereas the wages of the Banking industry are most rigid - with a substantial amount of heterogeneity in the rigidity of wages across the spectrum of industries.¹⁴

[Figure 10 about here.]

[Table 6 about here.]

[Figure 11 about here.]

[Table 7 about here.]

Labor Contracts and Wage Rigidity. Employment contract details in our administrative data provide us with a novel source of variation at the employee level and allows to explore a set of empirical regularities, which the previous literature did not concentrate on. As we highlight in Table 2 we observe that employees with a flexible hours employment relationship have substantially lower degrees of wage rigidity - when it comes to both downward and upward adjustments in wages - compared to employees with fixed hours employment relationships.¹⁵ The frequency of no change is 76.1% for the case of flexible hours contracts, while it is 85.2% for fixed hours contracts. This is an economically significant difference with respect to hourly-wage flexibility of flexible-hour contracts. We would like to note that in the Netherlands, the participation of employees with flexible contracts has increased considerably during the period of analysis (Figure 12).

In Figure 15 and Table 9 we break down flexible-and fixed-hour contract types into sub-components and present a clear positive correlation between “labor flexibility” and “wage flexibility”. Specifically, wages of more flexible types of labor, such as temporary & on-call workers, is a lot less rigid compared to regular workers and directors. While the likelihood of no change in wages is 91.4% for directors, it is 73.9% for temporary workers. This difference is driven by differences in both downward and upward adjustments in wages. This observation is very relevant from a macro point of view because there has been an increase in the number of flexible labor positions in The Netherlands over the recent years. As Figure 16 shows, for instance, the percentage of on-call

¹⁴Table 18 in the appendix shows a sectoral classification at a higher level of aggregation.

¹⁵Flexible employment relationships include temporary workers and on-call. Fixed relationships correspond to directors, interns, SWS-er and rest. Tables 15 and 16 in the appendix shows the distribution of the different type of contracts in our sample.

workers in the Netherlands more than doubled between 2003 and 2015, going from 3.8% to 8%, with respect to the total number of workers.

[Figure 12 about here.]

Our data also allows us to capture a difference in the degree of rigidity of wages when tenured and untenured contracts are compared against each other; however, the difference is far from the level that we observe for the comparison between flexible-hour and fixed-hour contracts. Having said this even small differences in the level of wage rigidity between these contracts can have important implications given how the participation of tenured and untenured contracts has evolved between 2006 and 2012. Figure 13 shows that the percentage of tenured contracts was relatively low in 2006, but it increased significantly in a period as short as six years (an increase of around ten percentage points). We observe the opposite behavior, but with the same magnitude, for untenured contracts.

[Figure 13 about here.]

Finally, we also unpack the contract details of employees and observe further interesting patterns in rigidities of wages across types & terms of contracts. First, in Figure 14 and Table 8 we show that the degree of wage rigidity is higher for employees working for more hours. For instance, while the likelihood of a no-change for the group of 35+ hours is 85.7%, the same likelihood is 82.6% for employees working for less than 12 hours a week. The downward rigidity drives a large portion of this difference in wages. However, again in comparison to the dimension of “hour flexibility” splitting the sample based on the dimension of “hours worked” does not yield economically too significant differences between part-time and full-time employment contracts.

Having established a novel piece of evidence concerning the flexibility of wages associated with flexible-hour labor contracts, next we move on to study time- and state-dependent wage setting behavior across different types of labor contracts using a formal regression analysis.

[Figure 14 about here.]

[Table 8 about here.]

[Figure 15 about here.]

[Table 9 about here.]

[Figure 16 about here.]

6 Wage Rigidity: Time- and State-Dependency

As we have covered in Section 2, the well-known theories of state and time dependency propose different underlying reasons for changes in wages. Theories of state-dependency suggest that the probability of adjustments in wages moves with the state of the economic environment. Theories of time-dependency, in turn, argue that this probability depends on the temporal context, given by a specific period of the year, or the duration of the wage spell - and it is independent of the economic conditions.

The database at our disposal, with the benefits associated with a high periodicity, high disaggregation and ample information at the level of the employee as we described in Section 4, presents a unique opportunity to test which theory best explains the dynamics of nominal wages in the Netherlands. With this objective, we estimate the following fixed-effect model for the probability of observing a change in nominal wages - separately for reductions in wages and wage increases,

$$y_{i,t} = \alpha + \mathbf{q}_{i,t} \boldsymbol{\delta} + \mathbf{x}_{i,t} \boldsymbol{\beta} + \mathbf{z}_{i,t} \boldsymbol{\gamma} + v_i + \epsilon_{i,t}, \quad (1)$$

$$y_{i,t} = \begin{cases} 1 & \text{if } w_{i,t} \neq w_{i,t-1} \\ 0 & \text{if } w_{i,t} = w_{i,t-1} \end{cases}$$

where i is the wage trajectory, t is months and w is the nominal hourly wage.¹⁶

Equation (1) contains variables aimed to capture time- and state-dependent components of wage changes. Specifically, vector \mathbf{q} captures the potential of time-dependency by including monthly and duration dummies. Vector \mathbf{x} proxies the possibility of state-dependency by incorporating factors related to the macroeconomic environment and firm productivity. In particular, \mathbf{x} includes accumulated inflation ($\pi_{t-1} - \pi_{t-\tau-1}$), accumulated unemployment variation ($u_{t-1} - u_{t-\tau-1}$) and a proxy for accumulated firm productivity, which is given by the change in the size of the firm - measured in terms of number

¹⁶A wage trajectory is given by $y_i \equiv y_{ejf}$ with e representing employee, j employee's job and f is business unit. v_i represents wage trajectory fixed effects.

of employees ($ne_{f,t-1} - ne_{f,t-\tau_{-1}}$), with τ_{-1} being the duration of the wage spell.¹⁷ These variables measure the accumulated disequilibrium between the optimal wage set at the beginning of the spell and current wage (Cecchetti (1987)).

The vector \mathbf{z} comprises of characteristics of the wage trajectory and the business unit, which are employment policy, employment relationship, type of contract, type of relationship, contract hours, type of job, size of the business unit, and age of the employee.

6.1 Results: Time- vs. State-dependency

Table 10 shows regression results, using the entire sample, for the case of wage reductions, which tell us about the nature of downward wage rigidities in the data. Column A shows the estimated values for the model that does not include dummy variables of duration, while column B includes dummy variables of duration for up to 12 periods.¹⁸

In Table 10 we find statistical significance of the seasonality variables and the duration dummies, both supporting the presence of time dependence. The Wald test rejects the hypothesis of no joint significance and the hypothesis of equality of the coefficients at 1%. The seasonal pattern does not present peaks as clear as in the case of wage increases; wage reductions are more likely to occur in January, but this probability is not very different from those observed in other months. In addition, it is more likely to see a wage reduction after a short period without wage changes (four months or fewer). These last two results are comparable to those found by Sigurdsson and Sigurdardottir (2016).

[Table 10 about here.]

With respect to downward wage rigidity we also find evidence for state-dependency which survives the incorporation of duration variables.¹⁹ How-

¹⁷Sigurdsson and Sigurdardottir (2016) and Bihan, Montornès and Heckel (2012) include these variables as well, but in the context of a Tobit type II model that allows them, in addition, to model the size of wage changes. We have opted for a linear model due to computational constraints associated with the size of our sample. However, we verified, using a considerably smaller sample, that our results are comparable with those obtained with a Probit model, in line with the specification in Sigurdsson and Sigurdardottir (2016) and Bihan, Montornès and Heckel (2012).

¹⁸The model includes the complete set of dummy duration variables. Due to space restrictions, we only show a subset of them.

¹⁹In contrast, Sigurdsson and Sigurdardottir (2016) found that the probability of a wage reduction does not respond to changes in current accumulated inflation or unemployment.

ever, the effects of macroeconomic variables on the probability of wage reductions are of lesser magnitude. Specifically, Table 10 shows that on average (for models with and without dummy duration variables), an increase in accumulated inflation of 1 pp increases the probability of a wage reduction by 0.65%. Similarly, an increase in accumulated unemployment of 1 pp decreases the probability of a wage reduction by 0.35%.²⁰

[Table 11 about here.]

Table 11 shows the results, using the entire sample, for the case of wage increases. The estimated results confirm the evidence of seasonality in wage changes mentioned in section 5. In this regard, a Wald test rejects the hypothesis that the coefficients associated with the monthly dummy variables are jointly not significant. The same test rejects the hypothesis that all the coefficients associated to the months are statistically equal and, instead, as shown in Table 11 wage increases are more likely to occur in January and July.

This pattern in the temporal behavior of wage increases represents evidence against Calvo's approach to determining wages (equal probability of observing a change in each period). The pattern seen in the estimate instead supports the notion of Taylor-type time dependence, in which wage changes occur at certain fixed time periods, and is in line with our findings in the analysis of the hazard function. The strong statistical significance of the dummy variables of duration, at 1% in almost all cases, reinforces the time-dependency component. It is worth noting that, unlike Sigurdsson and Sigurdardottir (2016), the dummy variables of duration maintain their effect on the probability of a wage increase even when the model takes the months into account as an independent variable.

In our analysis we also find substantial evidence for state dependence associated with wage increases. This empirical observation remains, although with a reduced magnitude in some cases, even after including duration dummies. In particular, as intuition suggests, we find a positive and statistically signifi-

²⁰Regarding the controls, Table 10 shows that, except for tenured workers (with a small positive relationship with the probability of a wage reduction), the variables associated with the characteristics of the contracts are not significant. In addition, wage reductions are less likely for workers who work less than 30 hours and for those who work over 35. We found no evidence of a link between the probability of a wage reduction and the size of the business unit. On the contrary, Bihan, Montornès and Heckel (2012) found that this probability is greater in small establishments. There is a positive but insignificant relationship between age and the possibility of a wage reduction.

cant relationship between the probability of a wage increase and accumulated inflation. In the model without duration dummies, an increase in accumulated inflation of 1 percentage point (pp) increases the probability of an increase in wages by 3.6%. Once we include the duration dummies, the same change in accumulated inflation increases the probability of an increase in wages to 0.7%.²¹

Table 11 shows the expected negative sign for the accumulated unemployment coefficient. Here, and without duration dummies, an increase in accumulated unemployment of 1 pp decreases the probability of an increase in wages by 1.4%. In contrast to the aforementioned effect for accumulated inflation, including duration dummies amplifies the impact of accumulated unemployment. Specifically, when accumulated unemployment increases by 1 pp, the probability of an increase in wages decreases by 3.0%^{22,23}

6.2 Results: Time- vs. State-dependency and contracts

In this section we investigate the time and state component in the probability of observing changes in wages based on the characteristics of employment contracts.

Table 12 shows the estimated results, disaggregated by type of contracts, for the case of wage reductions. With the exception of flexible-hour contracts, which show a decrease in the probability of observing a wage reduction in January (with respect to December), the observed seasonality pattern is similar to that analyzed in subsection 6.1. As Table 12 reveals the negative relationship between the probability of a wage reduction and the variable associated with the months is considerably stronger throughout the year for this type of contract. The link between this probability and the duration variables is also stronger for flexible-hours contracts (on average it is three times higher).

[Table 12 about here.]

²¹In the sample the average accumulated inflation is of 0.81 pp. The 99% percentile is 4.9 pp and the 1% percentile is -1.0 pp.

²²In the sample the average accumulated unemployment is of 0.04 pp. The 99% percentile is 1.4 pp and the 1% percentile is -1.1pp.

²³Regarding the controls, Table 11 shows that all the variables associated with the different characteristics of the contracts are not significant. In addition, there is a negative and significant relationship between the probability of an increase in wages and working hours for those who work over 25 hours a week. As in Bihan, Montornès and Heckel (2012), we detected weak evidence (10% of significance) of a negative link between the probability of a wage increase and the size of the business unit, when it has less than 50 persons employed. In the same line, and confirming our discussion in section 5, the results show that age negatively affects the probability of a wage increase.

The probability of wage reductions also exhibits some interesting state dependence components. In particular, and different from any other types in the contract space, labor contracts with flexible-hours show a statistically significant negative relationship with respect to accumulated unemployment. This indicates that - compared to fixed-hour contracts - flexible-hour contracts are now too downward rigid in the face of deteriorating aggregate economic conditions, captured in our regression analysis by rising accumulated unemployment.

It is again important to note that this important feature is associated with hour-flexibility and not so much with the contractual hours, because as Table 12 indicates, if anything, part-time contract wages tend to reduce less than full-time contract wages when accumulated unemployment goes up.

With respect to wage increases, we find evidence of time dependence for all types of contracts considered. In this sense, and like when the estimate uses the pooled sample, Table 13 shows that in the case of wage increases, the seasonal pattern is also present when we break down the data by contractual characteristics.

The magnitude of the seasonal component for almost all types of contracts is comparable to the aggregate case mentioned in subsection 6.1 but is less pronounced for wage trajectories with flexible hours. The probability of observing a wage increase in January and July for workers with flexible hours is 14% and 6% higher than the probability of observing it in December; for the other contracts, they are 28% and 10% on average, respectively. In other words, the probability of observing a wage increase for contracts with flexible hours is flatter during the year and, therefore, is closer to Calvo's assumption of equal probability of change in each period.

[Table 13 about here.]

We observe something similar regarding the duration variables. For contracts with flexible hours, the probability of having an increase in wage after 11 months with no change is 25%. On average, this probability for other types of contracts is almost double (41%). This observation reinforces again the heterogeneity in wage adjustments between workers with different contractual terms.

In general, most types of contracts show dependence on the state associated with accumulated inflation and unemployment. The estimated coefficients have the expected sign and are similar between the types of contracts

and those obtained with the aggregate data (subsection 6.1). In this sense, it is worth highlighting some findings, nevertheless.

There are two types of contracts for which the state dependency is associated only with one of the two macroeconomic variables considered. In particular, Table 13 shows that for contracts with flexible hours there is no significant relationship between the probability of a wage increase and accumulated unemployment.

Arguably, a stronger dependence on time compensates for this disconnection from the evolution of unemployment since the coefficients associated with the duration dummies are greater for workers with flexible hours compared to those with other types of contracts. Similarly, for fixed-term contracts the probability of a wage increase does not respond to accumulated inflation and, at the same time, its relation to accumulated unemployment is of lesser magnitude. In the case of flexible hours contracts, a stronger response to the duration of the wage trajectory accompanies this weaker dependency of the state.

The link between the likelihood of a wage increase and accumulated inflation for full-time contracts is twice as strong as for part-time contracts. Specifically, while for full-time contracts the positive relationship with accumulated inflation is one to one, an increase of the latter by 1 percentage point only increases the probability of a wage increase for part-time contracts by 0.5%²⁴

7 Concluding Remarks

Nominal wage rigidities not only impede the achievement of an optimal allocation of resources but also exacerbate unwanted fluctuations in unemployment and output, among other macroeconomic variables. These negative repercussions open the door to monetary policy interventions, which, however, can only counteract their effects when the determinants and magnitude of nominal wage rigidities are understood and measured correctly.

Understanding the way in which nominal wages are determined and the possible frictions that prevent them from adjusting to their optimum levels is, therefore, an important task for macroeconomists. However, only recently available databases, with high periodicity and a high level of disaggregation,

²⁴In regard to the controls, Table 13 shows that only for tenured contracts the size of the business unit has a significant (negative) relationship with the probability of a wage increase.

have allowed us to overcome the previous difficulties associated with understanding and measuring the dynamics of nominal wage changes.

This paper helps shed some light on the determinants and magnitude of nominal wage rigidities. We explored the dynamics of nominal wage rigidities in the Netherlands using a high frequency micro database with monthly information on nominal wages and the characteristics of the employment contracts of all employees in the period 2006-2012.

Several results stand out. We documented a clear seasonal pattern in the degree of nominal wage rigidity and a momentary increase in this rigidity immediately after the recent financial crisis. Our results also show a significant variability in the frequency of nominal wage changes in the different sectors, according to the size of the business unit and according to the age of the employee. In addition, we found that the hazard function has two peaks, one at 12 months and another at 24 months.

More importantly, and as a unique contribution, we find that certain characteristics of labor contracts play a role in determining the degree of nominal wage rigidity. In particular, characteristics such as the type of job, the working time, the duration of the contract and the status of the employee are an important source of heterogeneity in the nominal wage rigidity. As far as we know, this is the first time that the relationship between these contractual characteristics and the nominal wage rigidity is empirically uncovered.

In addition, our analysis provides evidence in favor of the theories of time- and state-dependence in the determination of nominal wages. We find that the probability of a change in the nominal wage depends on the duration of the wage trajectory (and the specific month of the year) but also on the evolution of aggregate macroeconomic variables (unemployment and inflation). This result is maintained, in general, when we perform the analysis separately for the different types of contracts, with some exceptions. In this sense, we find, on the one hand, that the probability of a wage increase in flexible hours contracts and in tenured contracts only responds to one of the two macroeconomic variables considered: inflation and unemployment, respectively. On the other hand, our results show that the probability of a nominal wage increase in full-time contracts shows a considerably higher response to changes in inflation and unemployment compared to the way part-time contracts respond.

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Appendix

Additional figures

[Figure 17 about here.]

Additional tables

[Table 14 about here.]

[Table 15 about here.]

[Table 16 about here.]

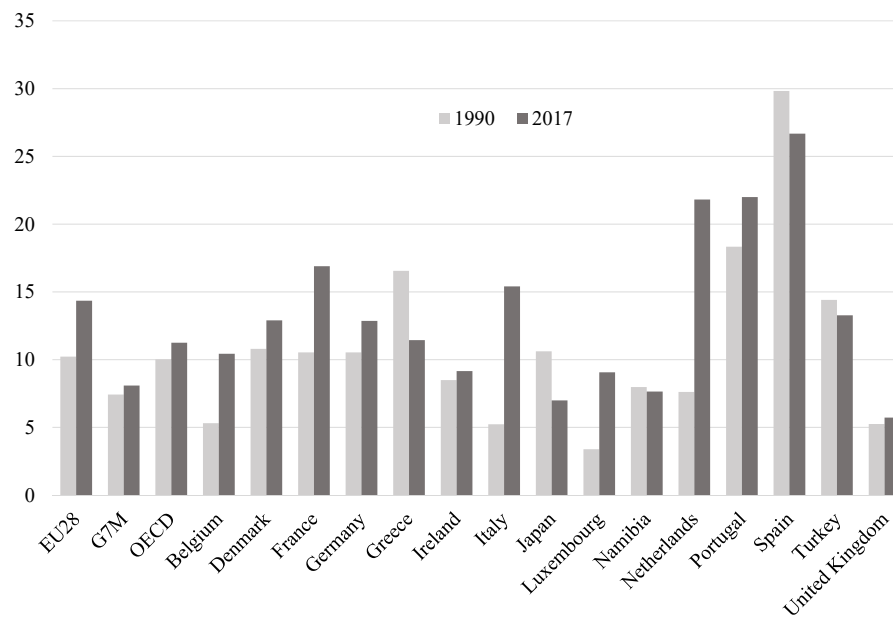
[Table 17 about here.]

[Table 18 about here.]

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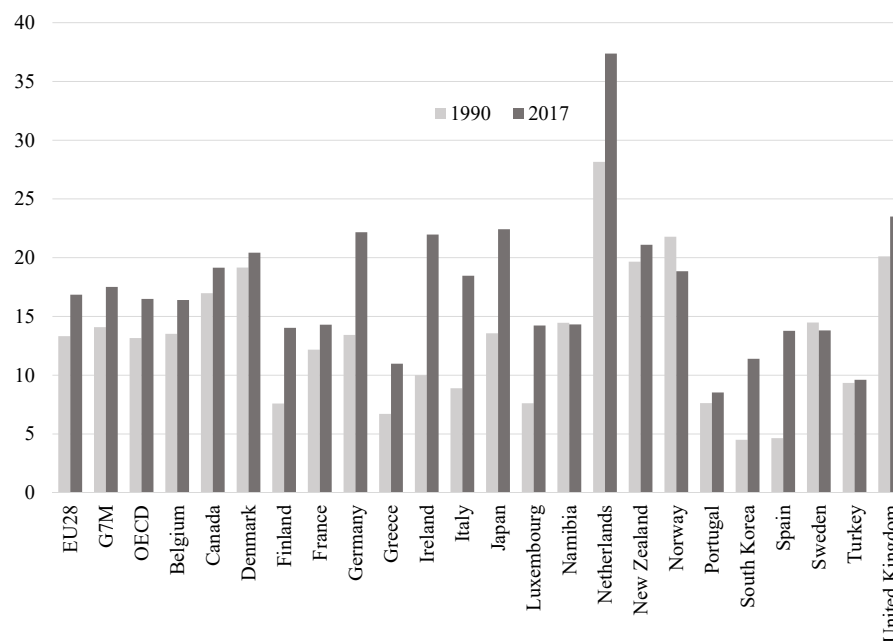
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Figure 1: Temporary employment. Percentage of dependent employment



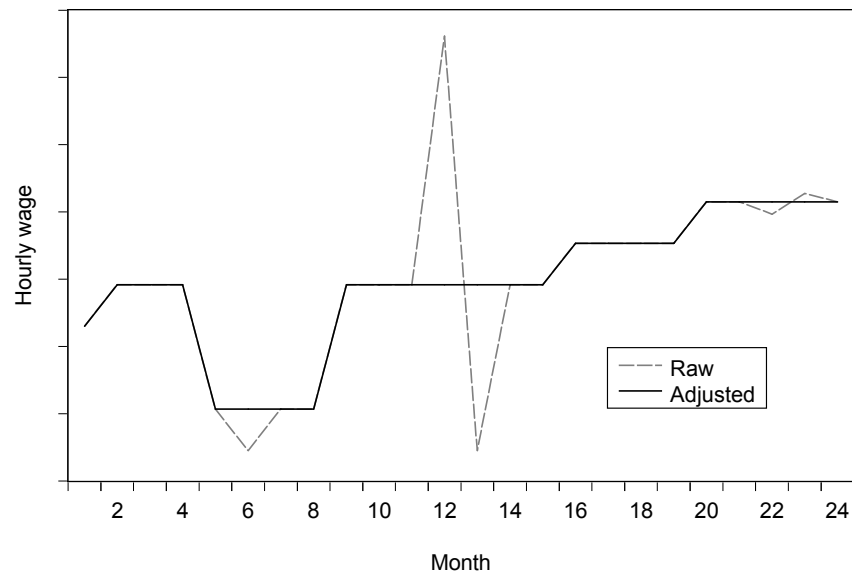
Source: OECD. Temporary employment includes wage and salary workers whose job has a pre-determined termination date. National definitions broadly conform to this generic definition, but may vary depending on national circumstances. This indicator is measured as percentage of dependent employees (i.e. wage and salary workers).

Figure 2: Part-time employment. Percentage of employment



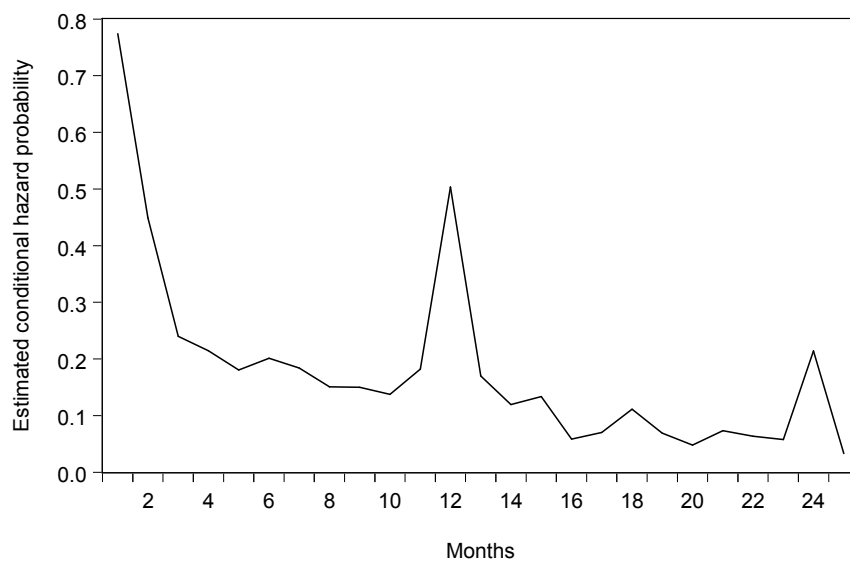
Source: OECD. Part-time employment is defined as people in employment (whether employees or self-employed) who usually work less than 30 hours per week in their main job. Employed people are those aged 15 and over who report that they have worked in gainful employment for at least one hour in the previous week or who had a job but were absent from work during the reference week while having a formal job attachment. This indicator shows the proportion of persons employed part-time among all employed persons and is also called incidence of part-time employment.

Figure 3: Raw and adjusted wage trajectory



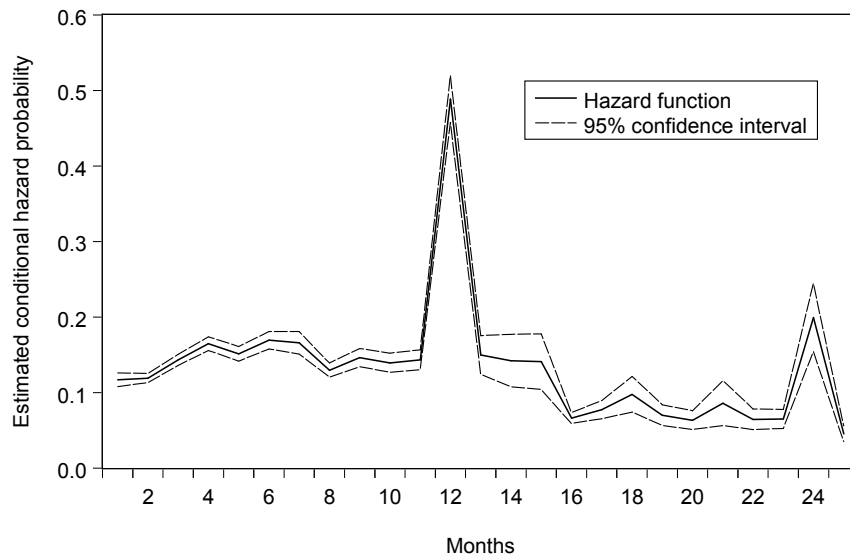
Note: The wage trajectory in this figure does not correspond to the wage trajectory of any individual in our sample nor in the population. The numbers were fabricated for illustrative purposes.

Figure 4: Hazard function of wage changes - Raw data



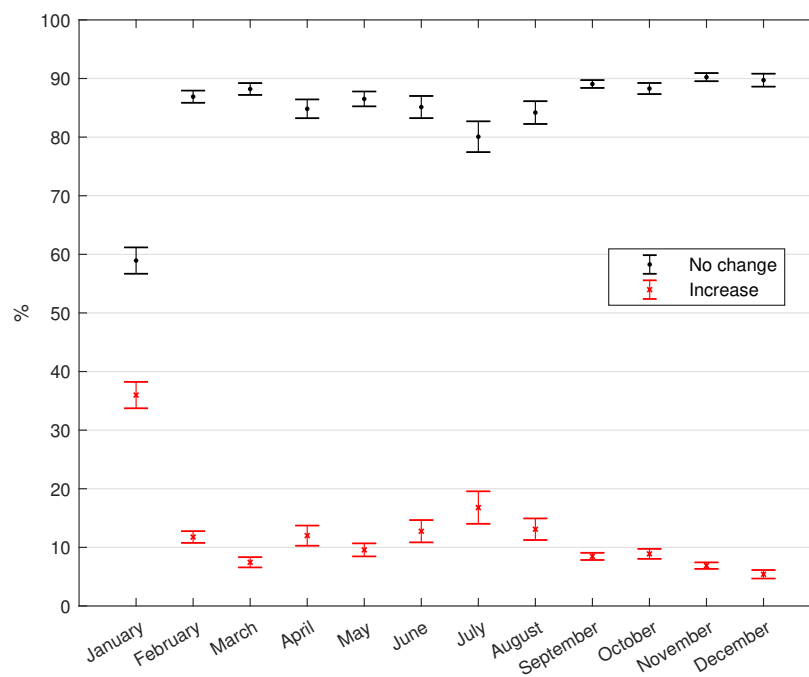
Source: Own calculations.

Figure 5: Hazard function of wage changes - Adjusted data



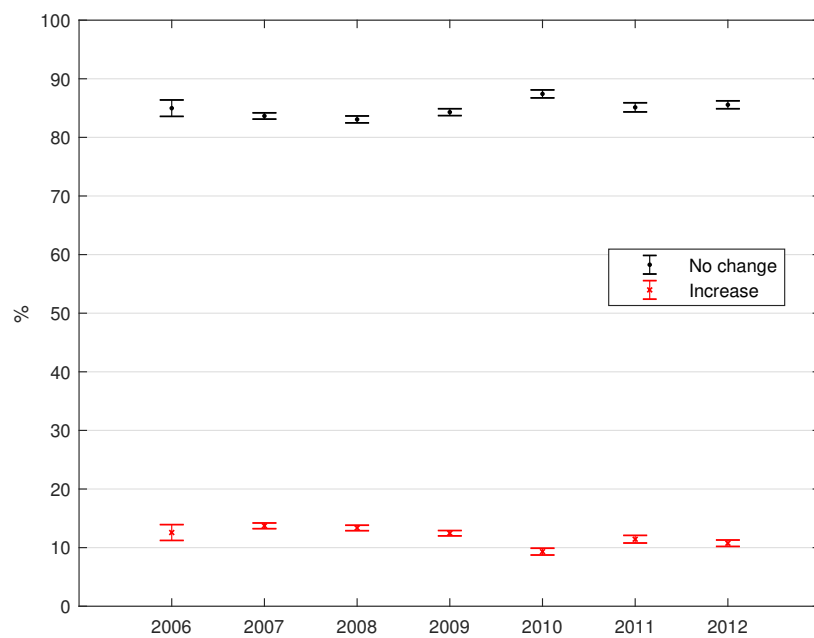
Source: Own calculations.

Figure 6: Months



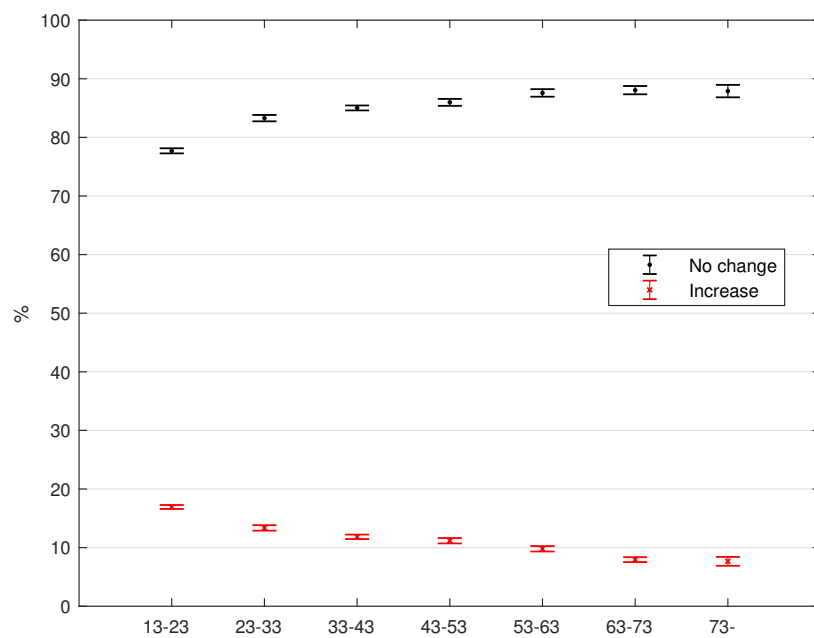
Source: Own calculations.

Figure 7: Years



Source: Own calculations.

Figure 8: Age



Source: Own calculations.

Figure 9: Participation of age groups

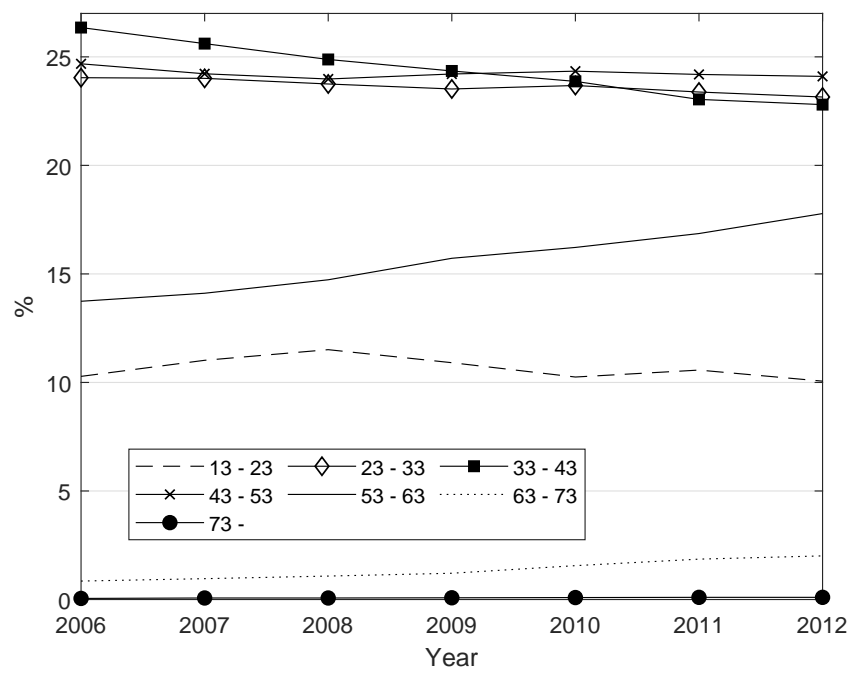
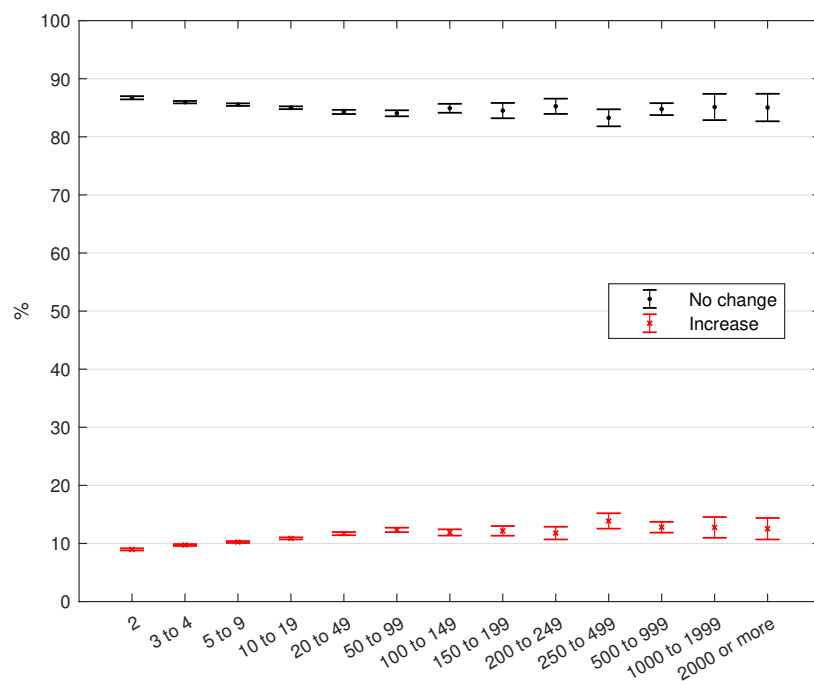
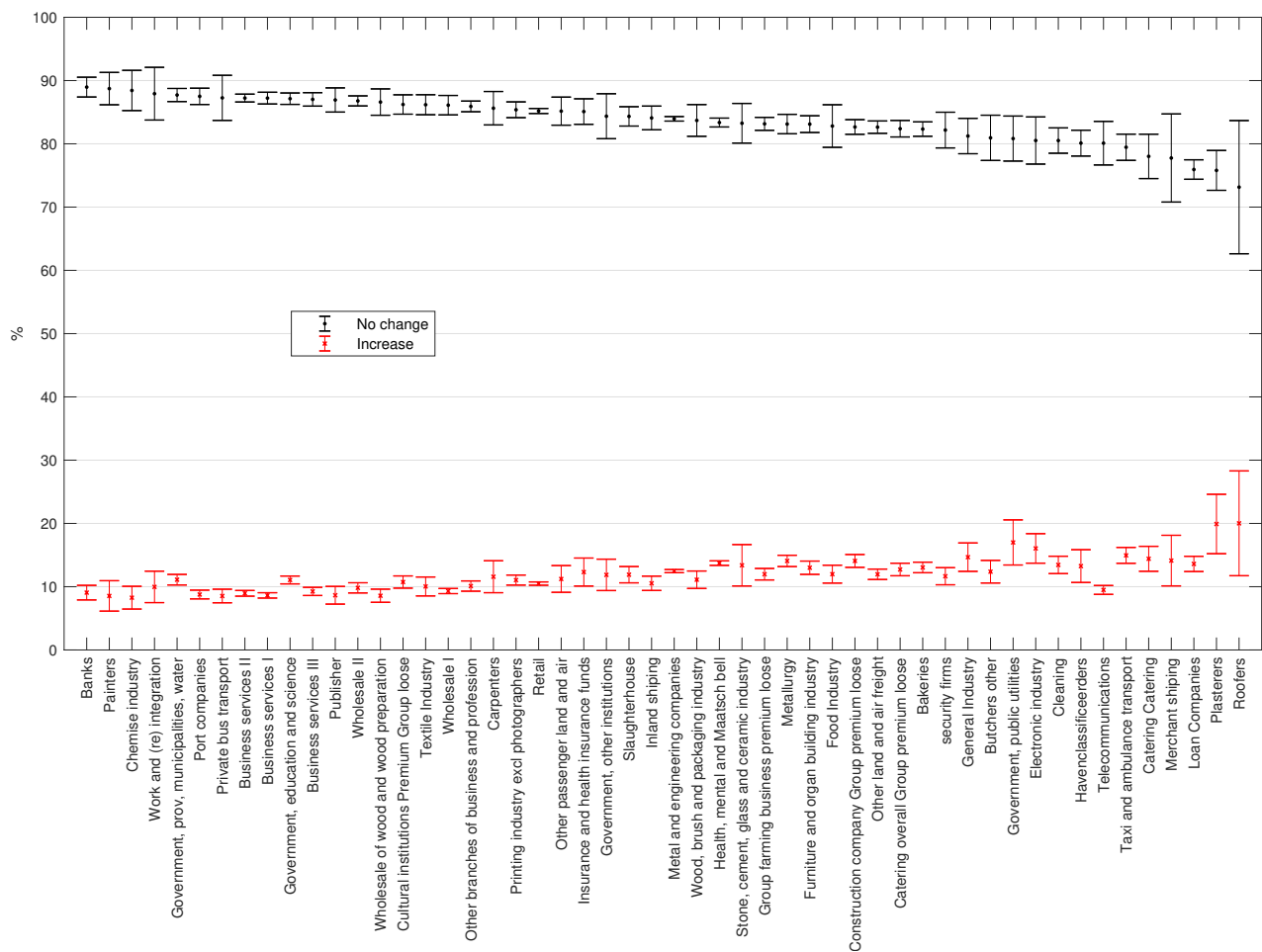


Figure 10: Business size (number of employees)



Source: Own calculations.

Figure 11: Sector



Source: Own calculations.

Figure 12: Participation of flexible and fixed contracts

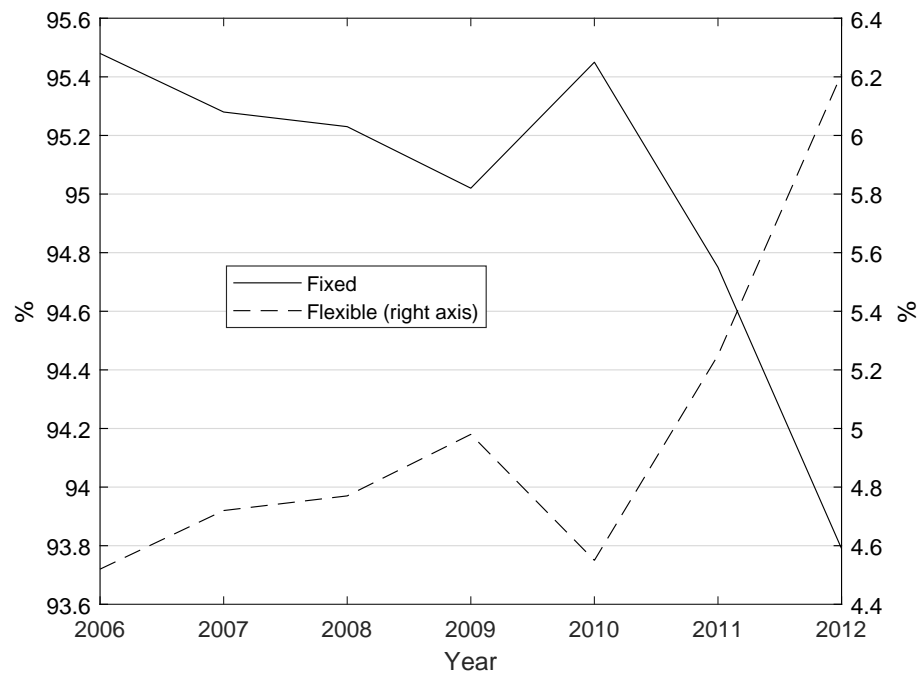


Figure 13: Participation of tenured and untenured contracts

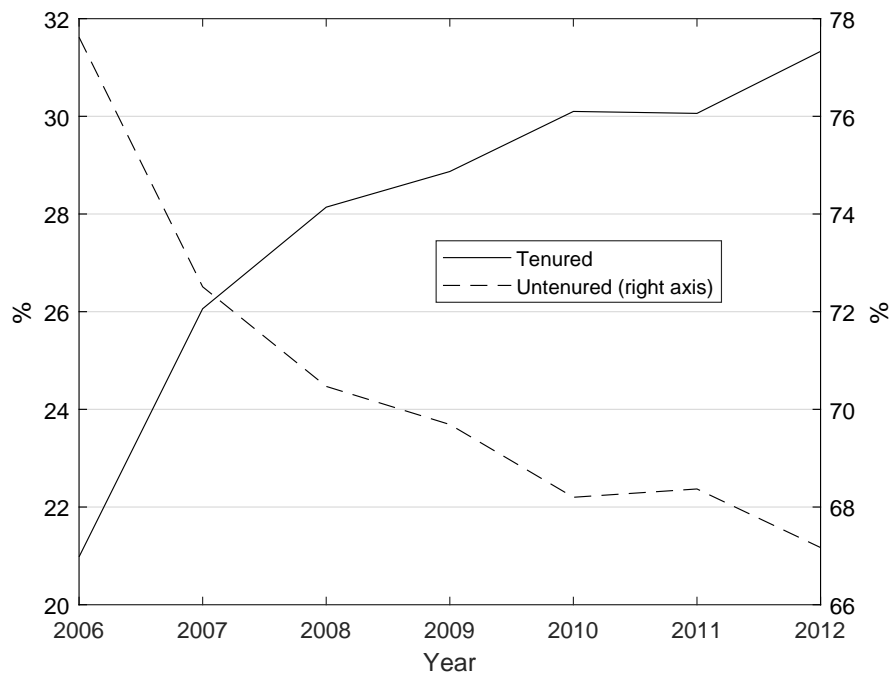
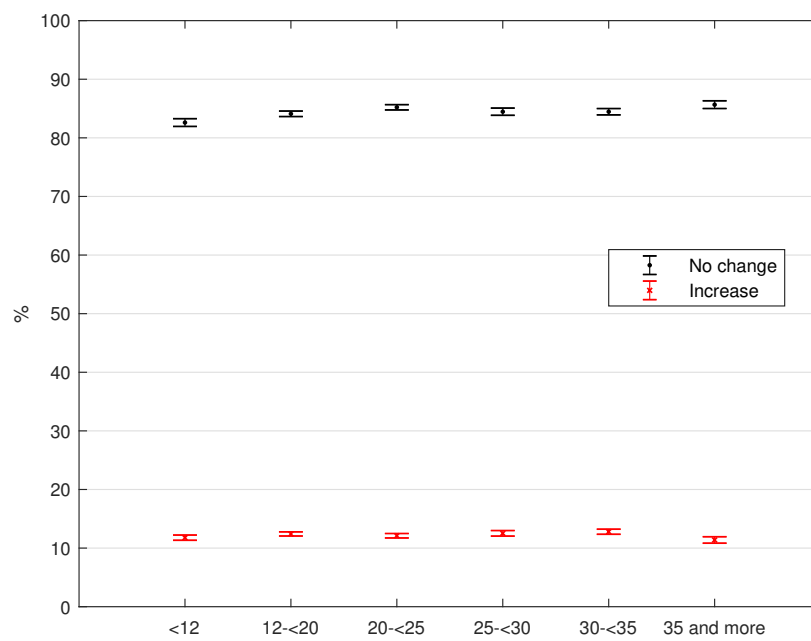
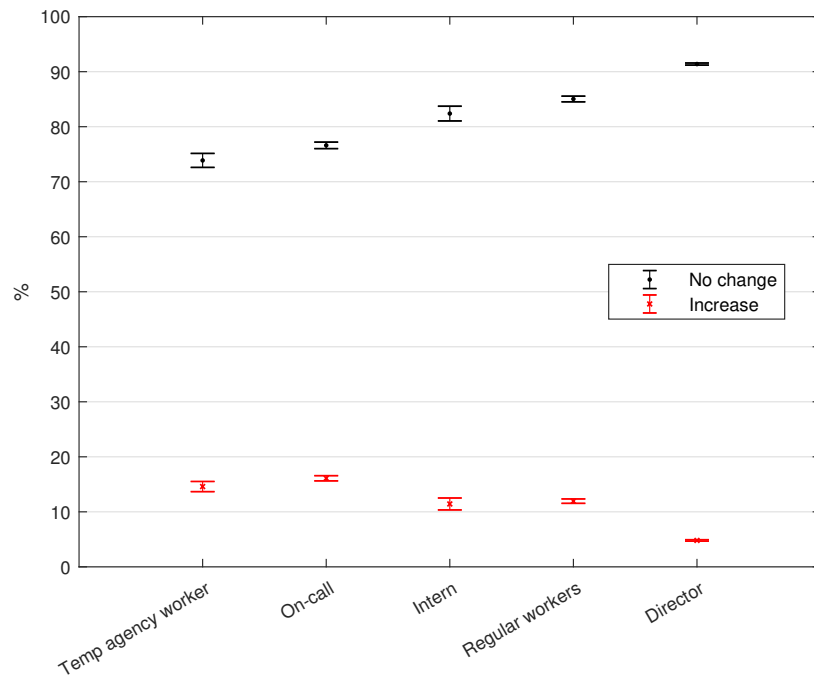


Figure 14: Weekly contract hours



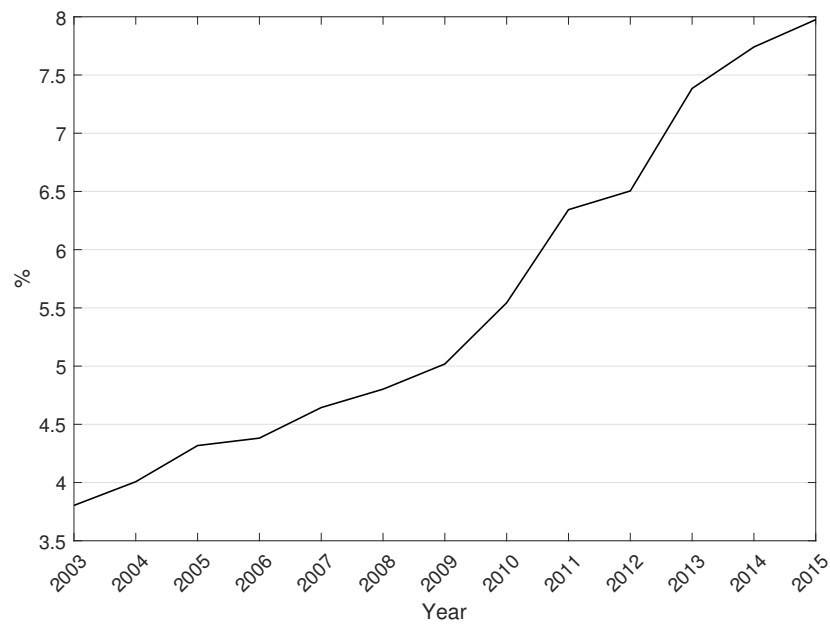
Source: Own calculations.

Figure 15: Type of job



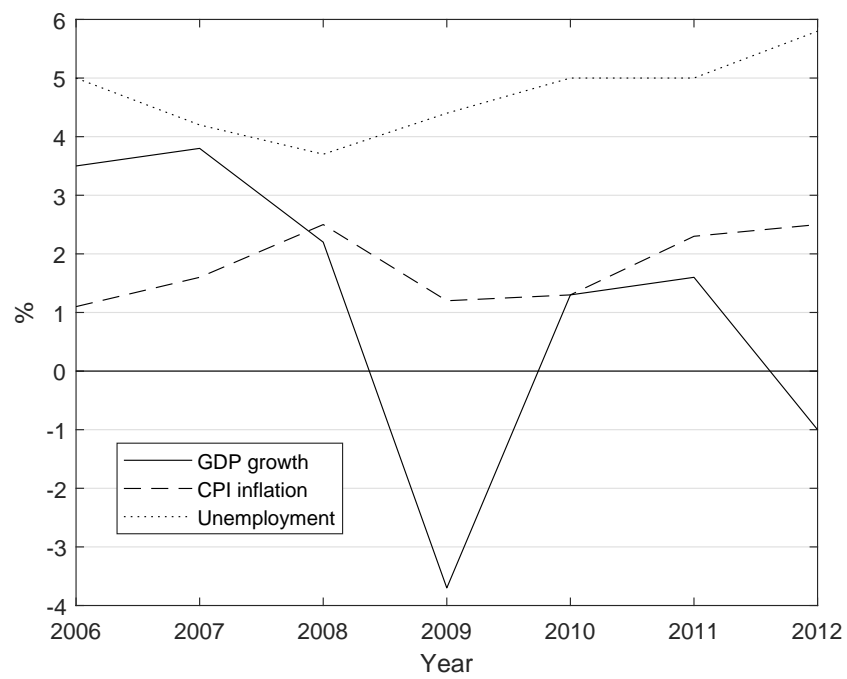
Source: Own calculations.

Figure 16: Share of "on-call" in the total number of workers



Source: CBS - Netherlands.

Figure 17: Macroeconomic series for The Netherlands



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Table 1: Composition of fixed-term contracts

	Percentage
On-call	31%
Temporary, perspective of indefinite	15%
Temp agency	14%
Temporary ≥ 1 year	11%
Temporary < 1 year	10%
Temporary contract, no contract hours	12%
Indefinite contract, no contract hours	7%

Table 2: Wage rigidity

	Decrease	Frequency No change	Increase	Average size Decrease	Increase
Aggregate	3.2 [3.0; 3.3]	84.9 [84.6; 85.2]	11.9 [11.7; 12.1]	-8.9	4.8
Flexibility of Contractual Hours					
Fixed	3.0 [2.8; 3.3]	85.2 [84.7; 85.7]	11.8 [11.4; 12.2]	-9.0	4.8
Flexible	8.1 [7.5; 8.7]	76.1 [75.5; 76.7]	15.8 [15.4; 16.3]	-9.5	5.8
Contracted Hours					
Full-time	2.9 [2.6; 3.2]	85.5 [84.8; 86.1]	11.6 [11.1; 12.1]	-9.5	4.2
Part-time	3.5 [3.2; 3.7]	84.3 [83.9; 84.8]	12.2 [11.8; 12.6]	-8.7	5.4
Tenure					
Tenured	4.2 [3.8; 4.7]	82.7 [81.9; 83.4]	13.1 [12.7; 13.5]	-11.5	7.0
Untenured	2.9 [2.7; 3.2]	85.4 [84.8; 85.9]	11.7 [11.3; 12.2]	-7.9	4.1

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 3: Month

	Decrease	Frequency		Average size	
		No change	Increase	Decrease	Increase
January	5.1 [4.5; 5.7]	58.9 [56.7; 61.2]	36.0 [33.7; 38.2]	-10.0	4.8
February	1.3 [1.2; 1.5]	86.9 [85.9; 87.9]	11.8 [10.8; 12.8]	-10.9	6.7
March	4.3 [3.8; 4.9]	88.2 [87.2; 89.2]	7.4 [6.6; 8.3]	-8.0	6.0
April	3.2 [2.8; 3.6]	84.8 [83.2; 86.4]	12.0 [10.3; 13.7]	-9.1	4.4
May	3.9 [3.5; 4.4]	86.5 [85.2; 87.8]	9.6 [8.5; 10.7]	-7.9	4.2
June	2.1 [1.9; 2.3]	85.1 [83.2; 87.0]	12.7 [10.8; 14.7]	-10.7	4.0
July	3.1 [2.9; 3.4]	80.1 [77.4; 82.7]	16.8 [14.0; 19.6]	-10.8	3.3
August	2.7 [2.5; 3.0]	84.2 [82.2; 86.1]	13.1 [11.2; 14.9]	-8.6	4.3
September	2.5 [2.3; 2.7]	89.1 [88.4; 89.7]	8.5 [7.8; 9.1]	-8.9	6.5
October	2.8 [2.6; 3.0]	88.3 [87.3; 89.2]	8.9 [8.0; 9.7]	-8.2	4.9
November	2.9 [2.6; 3.1]	90.2 [89.5; 90.9]	6.9 [6.3; 7.4]	-8.6	5.9
December	4.9 [4.3; 5.5]	89.7 [88.6; 90.8]	5.4 [4.7; 6.1]	-8.6	5.2

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 4: Year

	Decrease	Frequency		Average size	
		No change	Increase	Decrease	Increase
2006	2.4 [2.2; 2.7]	85.0 [83.6; 86.4]	12.6 [11.2; 13.9]	-10.6	5.0
2007	2.6 [2.4; 2.9]	83.7 [83.1; 84.2]	13.7 [13.2; 14.2]	-11.1	4.8
2008	3.6 [3.2; 3.9]	83.1 [82.5; 83.7]	13.4 [12.9; 13.8]	-9.1	5.5
2009	3.2 [2.9; 3.5]	84.3 [83.7; 84.9]	12.5 [12.0; 12.9]	-8.6	4.9
2010	3.3 [3.0; 3.6]	87.4 [86.7; 88.1]	9.3 [8.7; 9.9]	-9.1	5.2
2011	3.4 [3.1; 3.8]	85.1 [84.3; 85.9]	11.4 [10.8; 12.1]	-7.9	4.3
2012	3.7 [3.3; 4.1]	85.6 [84.9; 86.2]	10.8 [10.2; 11.3]	-8.0	4.2

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 5: Age

	Decrease	Frequency		Average size	
		No change	Increase	Decrease	Increase
13-23	5.4 [5.2; 5.6]	77.7 [77.3; 78.1]	16.9 [16.6; 17.3]	-10.0	9.1
23-33	3.4 [3.1; 3.6]	83.3 [82.7; 83.8]	13.4 [12.9; 13.8]	-10.0	5.2
33-43	3.1 [2.9; 3.4]	85.0 [84.6; 85.4]	11.8 [11.5; 12.2]	-8.8	4.4
43-53	2.8 [2.6; 3.1]	86.0 [85.4; 86.6]	11.2 [10.7; 11.6]	-7.7	3.8
53-63	2.6 [2.3; 2.9]	87.6 [86.9; 88.2]	9.8 [9.3; 10.3]	-8.1	3.8
63-73	4.0 [3.6; 4.4]	88.1 [87.3; 88.8]	7.9 [7.5; 8.4]	-11.3	5.7
73-	4.4 [3.9; 5.0]	87.9 [86.8; 89.0]	7.7 [6.9; 8.4]	-11.8	7.5

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 6: Business size (number of employees)

	Frequency			Average size	
	Decrease	No change	Increase	Decrease	Increase
2	4.3 [4.1; 4.5]	86.7 [86.4; 87.0]	9.0 [8.8; 9.2]	-9.1	7.9
3 to 4	4.3 [4.2; 4.4]	86.0 [85.8; 86.2]	9.7 [9.6; 9.9]	-9.0	7.3
5 to 9	4.2 [4.1; 4.3]	85.5 [85.3; 85.8]	10.2 [10.1; 10.4]	-8.5	6.5
10 to 19	4.1 [4.0; 4.3]	85.0 [84.8; 85.2]	10.9 [10.7; 11.0]	-8.7	6.0
20 to 49	4.0 [3.8; 4.2]	84.3 [83.9; 84.7]	11.7 [11.4; 12.0]	-9.5	5.5
50 to 99	3.6 [3.4; 3.9]	84.0 [83.5; 84.6]	12.3 [11.9; 12.7]	-10.8	5.1
100 to 149	3.2 [2.8; 3.6]	84.9 [84.1; 85.7]	11.9 [11.4; 12.4]	-10.3	5.1
150 to 199	3.3 [2.6; 4.1]	84.5 [83.2; 85.8]	12.2 [11.3; 13.0]	-9.0	4.7
200 to 249	3.0 [2.3; 3.6]	85.3 [84.0; 86.6]	11.8 [10.7; 12.9]	-8.7	4.4
250 to 499	2.9 [2.4; 3.3]	83.3 [81.8; 84.7]	13.9 [12.6; 15.2]	-7.8	3.8
500 to 999	2.4 [2.1; 2.8]	84.8 [83.7; 85.8]	12.8 [11.9; 13.7]	-6.7	3.5
1000 to 1999	2.1 [1.5; 2.7]	85.1 [82.9; 87.4]	12.8 [11.0; 14.5]	-12.3	4.7
2000 or more	2.4 [1.4; 3.5]	85.0 [82.7; 87.4]	12.5 [10.7; 14.4]	-7.4	3.5

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 7: Sector

	Decrease	Frequency		Average size	
		No change	Increase	Decrease	Increase
Banks	2.0 [1.2; 2.8]	89.0 [87.4; 90.5]	9.1 [7.9; 10.2]	-13.2	6.5
Painters	2.7 [2.1; 3.3]	88.7 [86.2; 91.3]	8.5 [6.1; 10.9]	-9.6	7.5
Chemise industry	3.3 [1.5; 5.1]	88.4 [85.3; 91.6]	8.3 [6.5; 10.1]	-6.2	4.6
Work and (re) integration	2.1 [-0.1; 4.3]	87.9 [83.8; 92.1]	10.0 [7.5; 12.5]	-8.9	3.4
Government, prov, municipalities, water	1.2 [0.8; 1.5]	87.7 [86.7; 88.8]	11.1 [10.3; 11.9]	-4.4	2.4
Port companies	3.7 [3.0; 4.5]	87.5 [86.2; 88.8]	8.8 [8.1; 9.5]	-7.7	6.1
Private bus transport	4.2 [0.6; 7.8]	87.3 [83.7; 90.8]	8.5 [7.5; 9.6]	-11.2	6.9
Business services II	3.8 [3.5; 4.1]	87.2 [86.6; 87.9]	9.0 [8.5; 9.4]	-9.1	6.8
Business services I	4.1 [3.3; 5.0]	87.2 [86.3; 88.2]	8.6 [8.2; 9.0]	-9.0	7.0
Government, education and science	1.8 [1.5; 2.1]	87.1 [86.2; 88.0]	11.1 [10.4; 11.7]	-12.8	5.4
Business services III	3.7 [3.2; 4.3]	87.0 [86.0; 88.1]	9.3 [8.6; 9.9]	-9.4	6.5
Publisher	4.4 [3.3; 5.5]	86.9 [85.0; 88.8]	8.6 [7.2; 10.0]	-10.3	8.9
Wholesale II	3.4 [3.1; 3.7]	86.8 [86.0; 87.6]	9.8 [9.0; 10.6]	-8.5	5.3
Wholesale of wood and wood preparation	4.8 [3.4; 6.3]	86.6 [84.5; 88.7]	8.6 [7.5; 9.6]	-8.0	6.6
Cultural institutions Premium Group loose	3.0 [2.3; 3.8]	86.2 [84.7; 87.7]	10.7 [9.8; 11.7]	-7.3	5.2
Textile Industry	3.8 [3.1; 4.5]	86.2 [84.6; 87.8]	10.0 [8.5; 11.5]	-9.7	7.1
Wholesale I	4.6 [3.0; 6.2]	86.1 [84.6; 87.6]	9.3 [8.9; 9.7]	-8.0	6.1
Other branches of business and profession	4.0 [3.4; 4.5]	85.9 [85.1; 86.8]	10.1 [9.3; 10.9]	-8.2	6.2
Carpenters	2.8 [1.9; 3.7]	85.6 [83.0; 88.3]	11.6 [9.1; 14.1]	-8.3	4.8
Printing industry excl photographers	3.6 [2.9; 4.2]	85.4 [84.1; 86.6]	11.0 [10.3; 11.8]	-12.3	5.3
Retail	4.3 [4.1; 4.5]	85.2 [84.8; 85.6]	10.5 [10.2; 10.8]	-9.0	6.8
Other passenger land and air	3.6 [2.3; 4.9]	85.2 [82.9; 87.4]	11.2 [9.1; 13.3]	-11.3	6.4
Insurance and health insurance funds	2.6 [1.3; 3.9]	85.1 [83.1; 87.1]	12.3 [10.1; 14.5]	-11.5	4.8
Government. other institutions	3.8 [2.4; 5.2]	84.4 [80.8; 87.9]	11.9 [9.4; 14.4]	-5.9	3.4
Slaughterhouse	3.8 [3.2; 4.3]	84.3 [82.8; 85.9]	11.9 [10.6; 13.2]	-8.4	6.8
Inland shipping	5.4 [4.4; 6.3]	84.1 [82.2; 86.0]	10.5 [9.4; 11.7]	-8.8	9.9
Metal and engineering companies	3.6 [3.3; 3.8]	84.0 [83.6; 84.3]	12.5 [12.2; 12.7]	-8.9	5.5
Wood, brush and packaging industry	5.2 [3.7; 6.7]	83.7 [81.2; 86.2]	11.1 [9.7; 12.5]	-8.1	6.0
Health, mental and Maatsch bell	2.9 [2.4; 3.4]	83.4 [82.7; 84.1]	13.7 [13.4; 14.1]	-8.8	4.3
Stone, cement, glass and ceramic industry	3.4 [2.5; 4.3]	83.3 [80.1; 86.4]	13.4 [10.1; 16.7]	-7.1	4.0
Group farming business premium loose	4.9 [4.3; 5.4]	83.2 [82.1; 84.2]	12.0 [11.1; 12.9]	-6.8	5.8
Metallurgy	2.8 [2.0; 3.6]	83.1 [81.6; 84.7]	14.1 [13.2; 15.0]	-9.9	3.6
Furniture and organ building industry	3.9 [3.0; 4.8]	83.1 [81.8; 84.4]	13.0 [11.9; 14.0]	-9.6	4.5
Food Industry	5.2 [3.0; 7.4]	82.8 [79.4; 86.2]	12.0 [10.6; 13.4]	-18.2	8.1
Construction company Group premium loose	3.3 [2.6; 3.9]	82.7 [81.5; 83.8]	14.1 [13.1; 15.1]	-13.1	4.0
Other land and air freight	5.4 [4.7; 6.1]	82.6 [81.7; 83.6]	12.0 [11.1; 12.8]	-7.9	5.7
Catering overall Group premium loose	4.9 [4.3; 5.5]	82.4 [81.1; 83.7]	12.7 [11.7; 13.7]	-7.3	6.6
Bakeries	4.6 [4.1; 5.2]	82.3 [81.2; 83.5]	13.0 [12.2; 13.9]	-8.3	6.2
security firms	6.2 [3.5; 8.9]	82.2 [79.4; 85.0]	11.7 [10.3; 13.0]	-9.5	6.1
General Industry	4.1 [3.3; 4.9]	81.2 [78.4; 84.0]	14.7 [12.4; 16.9]	-6.3	3.4
Butchers other	6.7 [4.4; 9.0]	80.9 [77.4; 84.5]	12.4 [10.6; 14.2]	-8.0	5.9
Government, public utilities	2.2 [1.9; 2.5]	80.8 [77.3; 84.4]	17.0 [13.4; 20.6]	-5.5	2.1
Electronic industry	3.4 [1.5; 5.3]	80.5 [76.8; 84.2]	16.1 [13.7; 18.4]	-7.3	4.6
Cleaning	6.0 [5.2; 6.9]	80.5 [78.5; 82.5]	13.4 [12.1; 14.8]	-8.1	4.6
Havenclassificeerders	6.6 [5.6; 7.7]	80.1 [78.1; 82.2]	13.3 [10.7; 15.8]	-4.2	6.8
Telecommunications	10.4 [7.3; 13.5]	80.1 [76.7; 83.5]	9.5 [8.8; 10.2]	-6.5	6.3
Taxi and ambulance transport	5.6 [4.5; 6.7]	79.5 [77.4; 81.5]	15.0 [13.7; 16.2]	-6.3	4.2
Catering Catering	7.6 [6.0; 9.2]	78.0 [74.5; 81.5]	14.4 [12.4; 16.4]	-31.9	16.7
Merchant shipping	8.1 [3.8; 12.4]	77.8 [70.8; 84.7]	14.1 [10.1; 18.1]	-29.5	22.4
Loan Companies	10.5 [9.6; 11.3]	75.9 [74.4; 77.5]	13.6 [12.4; 14.8]	-18.7	6.6
Plasterers	4.3 [1.5; 7.1]	75.8 [72.7; 78.9]	19.9 [15.2; 24.6]	-10.5	4.2
Roofers	6.8 [4.3; 9.4]	73.2 [62.6; 83.7]	20.0 [11.7; 28.3]	-13.2	9.3

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 8: Weekly contract hours

	Frequency			Average size	
	Decrease	No change	Increase	Decrease	Increase
<12	5.6 [5.3; 5.9]	82.6 [81.9; 83.3]	11.8 [11.3; 12.2]	-8.8	9.4
12-<20	3.5 [3.3; 3.7]	84.1 [83.6; 84.6]	12.4 [12.1; 12.8]	-8.8	5.4
20-<25	2.7 [2.5; 2.9]	85.2 [84.8; 85.7]	12.1 [11.7; 12.5]	-8.6	4.3
25-<30	3.0 [2.7; 3.3]	84.5 [83.8; 85.1]	12.5 [12.0; 13.0]	-8.2	4.3
30-<35	2.7 [2.4; 3.0]	84.5 [83.9; 85.0]	12.8 [12.4; 13.2]	-8.3	4.1
35 and more	3.0 [2.6; 3.3]	85.7 [85.0; 86.3]	11.4 [10.8; 11.9]	-9.6	4.2

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 9: Type of job

	Frequency			Average size	
	Decrease	No change	Increase	Decrease	Increase
Temp agency worker	11.5 [10.6; 12.5]	73.9 [72.6; 75.1]	14.6 [13.7; 15.5]	-20.8	5.9
On-call	7.3 [6.8; 7.8]	76.6 [76.0; 77.2]	16.1 [15.6; 16.6]	-5.3	5.8
Intern	6.2 [5.5; 6.9]	82.4 [81.0; 83.7]	11.4 [10.3; 12.5]	-24.9	22.3
Regular workers	3.0 [2.8; 3.3]	85.0 [84.5; 85.6]	11.9 [11.5; 12.3]	-8.8	4.7
Director	3.8 [3.7; 3.9]	91.4 [91.2; 91.6]	4.8 [4.7; 4.9]	-15.4	13.3

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 10: Probability of a wage reduction

		Panel A		Panel B	
		Parameter	Standard error	Parameter	Standard error
"Time dependency"					
Month					
	January	0.029***	0.005	0.028***	0.005
	February	-0.023***	0.003	-0.011***	0.003
	March	-0.019***	0.003	-0.012***	0.003
	April	-0.022***	0.002	-0.015***	0.002
	May	-0.016***	0.003	-0.012***	0.003
	June	-0.036***	0.003	-0.03***	0.003
	July	-0.017***	0.003	-0.011***	0.003
	August	-0.022***	0.003	-0.016***	0.003
	September	-0.025***	0.003	-0.02***	0.003
	October	-0.024***	0.003	-0.02***	0.003
	November	-0.023***	0.003	-0.022***	0.003
Duration					
	1 month			0.024***	0.001
	2 months			0.035***	0.002
	3 months			0.055***	0.003
	4 months			0.043***	0.002
	5 months			0.032***	0.002
	6 months			0.038***	0.002
	7 months			0.032***	0.002
	8 months			0.033***	0.002
	9 months			0.038***	0.002
	10 months			0.029***	0.002
	11 months			0.044***	0.002
	12 months			0.038***	0.002
"State dependency"					
	Accumulated inflation	0.009***	0.001	0.005***	0.001
	Accumulated unemployment	-0.004***	0.001	-0.003**	0.001
	Accumulated productivity	0.000	0.000	0.000	0.000
Employment policy					
	Part-time	0.001	0.002	0.000	0.002
Employment relationship					
	Flexible	0.004	0.004	0.004	0.004
Type of contract					
	Not applicable	0.008	0.007	0.007	0.007
	Untenured	0.005***	0.001	0.004***	0.001
Type of relationship					
	Partnership	0.001	0.003	0.001	0.003
	Single	-0.004***	0.001	-0.003***	0.001
age					
		0.003***	0.000	0.003***	0.000
Weekly contract hours					
	12-<20	-0.014***	0.001	-0.014***	0.001
	20-<25	-0.011***	0.002	-0.011***	0.002
	25-<30	-0.009***	0.003	-0.009***	0.003
	30-<35	0.002	0.004	0.001	0.004
	35 and more	0.011**	0.005	0.01**	0.005
Business size					
	2	-0.011	0.009	-0.010	0.008
	3 to 4	-0.010	0.009	-0.010	0.008
	5 to 9	-0.006	0.010	-0.007	0.009
	10 to 19	-0.002	0.010	-0.003	0.009
	20 to 49	-0.002	0.010	-0.003	0.010
	50 to 99	-0.002	0.011	-0.004	0.010
	100 to 149	0.001	0.012	-0.001	0.011
	150 to 199	0.000	0.013	-0.003	0.012
	200 to 249	0.003	0.013	0.000	0.012
	250 to 499	0.002	0.014	-0.002	0.013
	500 to 999	-0.003	0.015	-0.008	0.014
	1000 to 1999	-0.006	0.015	-0.012	0.013
	2000 or more	0.007	0.018	0.001	0.017
Constant		-0.073***	0.021	-0.109***	0.020
Observations		4,316,234		4,316,234	

The reference wage trajectory is one from a worker with a full-time contract, fixed hours, tenured, married, working in a small business unit. Standard errors (in parenthesis) clustered at business unit level. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 11: Probability of a wage increase

		Panel A		Panel B	
		Parameter	Standard error	Parameter	Standard error
"Time dependency"					
Month					
	January	0.326***	0.015	0.281***	0.013
	February	0.069***	0.005	0.072***	0.006
	March	0.017***	0.005	0.038***	0.005
	April	0.026***	0.010	0.062***	0.009
	May	0.000	0.006	0.034***	0.006
	June	0.029***	0.008	0.055***	0.007
	July	0.1***	0.015	0.105***	0.014
	August	0.069***	0.011	0.067***	0.010
	September	0.017***	0.005	0.025***	0.005
	October	0.019***	0.004	0.036***	0.005
	November	-0.001***	0.003	0.01***	0.004
Duration					
	1 month			0.006*	0.003
	2 months			0.025***	0.004
	3 months			0.051***	0.005
	4 months			0.049***	0.005
	5 months			0.066***	0.006
	6 months			0.086***	0.006
	7 months			0.077***	0.005
	8 months			0.087***	0.006
	9 months			0.101***	0.007
	10 months			0.114***	0.007
	11 months			0.399***	0.015
	12 months			0.139***	0.013
"State dependency"					
	Accumulated inflation	0.036***	0.002	0.007***	0.002
	Accumulated unemployment	-0.014***	0.003	-0.03***	0.003
	Accumulated productivity	0.000	0.000	0.000	0.000
Employment policy					
	Part-time	-0.002	0.003	-0.002	0.003
Employment relationship					
	Flexible	0.009	0.006	0.009	0.006
Type of contract					
	Not applicable	-0.002	0.010	-0.010	0.011
	Untenured	0.002	0.004	-0.005	0.005
Type of relationship					
	Partnership	-0.006	0.005	-0.006	0.005
	Single	-0.004**	0.002	-0.002	0.002
age					
		-0.016***	0.001	-0.014***	0.001
Weekly contract hours					
	12-<20	0.003	0.002	0.002	0.002
	20-<25	-0.002	0.003	-0.003	0.003
	25-<30	-0.007*	0.004	-0.007**	0.004
	30-<35	-0.008	0.005	-0.008*	0.005
	35 and more	-0.034***	0.007	-0.035***	0.006
Business size					
	2	-0.05*	0.026	-0.048*	0.027
	3 to 4	-0.051*	0.027	-0.05*	0.028
	5 to 9	-0.056**	0.028	-0.057**	0.029
	10 to 19	-0.052*	0.029	-0.055*	0.030
	20 to 49	-0.051*	0.031	-0.053*	0.032
	50 to 99	-0.052	0.033	-0.055	0.035
	100 to 149	-0.045	0.036	-0.049	0.037
	150 to 199	-0.040	0.038	-0.043	0.039
	200 to 249	-0.035	0.039	-0.038	0.041
	250 to 499	-0.017	0.042	-0.020	0.044
	500 to 999	-0.003	0.045	-0.009	0.047
	1000 to 1999	0.028	0.043	0.025	0.045
	2000 or more	0.041	0.046	0.043	0.048
Constant		0.727***	0.057	0.618***	0.066
Observations		4,707,989		4,707,989	

The reference wage trajectory is one from a worker with a full-time contract, fixed hours, tenured, married, working in a small business unit. Standard errors (in parenthesis) clustered at business unit level. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 12: Probability of wage reductions by type of contract

	Employment policy				Employment relationship				Type of contract			
	Full-time		Part-time		Fixed		Flexible		Tenured		Untenured	
	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error
"Time-dependency"												
<i>Month</i>												
January	0.034***	0.006	0.022***	0.005	0.029***	0.005	-0.014	0.008	0.015***	0.005	0.031***	0.005
February	-0.014***	0.003	-0.011***	0.003	-0.012***	0.003	-0.042***	0.005	-0.01***	0.003	-0.011***	0.003
March	-0.014***	0.003	-0.01***	0.003	-0.011***	0.003	-0.051***	0.006	-0.015***	0.003	-0.01***	0.003
April	-0.013***	0.003	-0.017***	0.003	-0.014***	0.002	-0.059***	0.005	-0.023***	0.003	-0.013***	0.003
May	-0.009***	0.003	-0.015***	0.003	-0.011***	0.003	-0.062***	0.006	-0.021***	0.004	-0.01***	0.003
June	-0.032***	0.004	-0.029***	0.003	-0.03***	0.003	-0.059***	0.005	-0.04***	0.004	-0.028***	0.003
July	-0.014***	0.004	-0.009***	0.003	-0.01***	0.003	-0.049***	0.006	-0.014***	0.004	-0.01***	0.003
August	-0.021***	0.004	-0.011***	0.003	-0.015***	0.003	-0.054***	0.006	-0.018***	0.004	-0.015***	0.003
Setpember	-0.025***	0.004	-0.015***	0.003	-0.019***	0.003	-0.056***	0.006	-0.023***	0.004	-0.018***	0.003
October	-0.025***	0.004	-0.016***	0.003	-0.019***	0.003	-0.056***	0.005	-0.026***	0.003	-0.018***	0.004
November	-0.028***	0.004	-0.016***	0.003	-0.022***	0.003	-0.028***	0.005	-0.024***	0.003	-0.021***	0.004
<i>Duration</i>												
1 month	0.02***	0.001	0.027***	0.001	0.022***	0.001	0.073***	0.003	0.038***	0.002	0.019***	0.001
2 months	0.028***	0.002	0.041***	0.002	0.032***	0.002	0.122***	0.005	0.057***	0.003	0.03***	0.002
3 months	0.05***	0.003	0.06***	0.003	0.052***	0.003	0.142***	0.006	0.083***	0.005	0.048***	0.003
4 months	0.033***	0.002	0.054***	0.003	0.041***	0.002	0.123***	0.005	0.067***	0.004	0.038***	0.002
5 months	0.027***	0.002	0.039***	0.002	0.03***	0.002	0.128***	0.008	0.059***	0.004	0.027***	0.002
6 months	0.03***	0.003	0.047***	0.002	0.035***	0.002	0.128***	0.010	0.064***	0.004	0.033***	0.003
7 months	0.025***	0.002	0.041***	0.002	0.03***	0.001	0.121***	0.010	0.058***	0.004	0.027***	0.001
8 months	0.026***	0.002	0.042***	0.003	0.031***	0.002	0.127***	0.009	0.058***	0.004	0.028***	0.002
9 months	0.028***	0.002	0.05***	0.003	0.036***	0.002	0.111***	0.011	0.065***	0.005	0.033***	0.002
10 months	0.023***	0.002	0.036***	0.002	0.027***	0.002	0.104***	0.011	0.06***	0.004	0.024***	0.002
11 months	0.041***	0.003	0.047***	0.003	0.041***	0.002	0.117***	0.013	0.068***	0.005	0.037***	0.002
12 months	0.029***	0.003	0.047***	0.002	0.036***	0.002	0.11***	0.012	0.06***	0.005	0.034***	0.002
"State-dependency"												
Accumulated inflation	0.006***	0.001	0.004***	0.001	0.005***	0.001	0.006***	0.002	0.008***	0.001	0.004***	0.001
Accumulated unemployment	-0.001	0.001	-0.004***	0.001	-0.003***	0.001	0.009**	0.005	-0.003	0.002	-0.002**	0.001
Accumulated productivity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Type of relationship												
Partnership	-0.002	0.003	0.005	0.004	0.001	0.003	-0.003	0.079	0.012	0.008	0.000	0.003
Single	-0.004***	0.001	-0.002	0.001	-0.004***	0.001	-0.024**	0.012	0.001	0.003	-0.004***	0.001
age	0.002***	0.000	0.003***	0.000	0.003***	0.000	0.01***	0.002	0.005***	0.001	0.003***	0.000
Weekly contract hours												
12-<20			-0.012***	0.002	-0.01***	0.001	-0.024***	0.004	-0.021***	0.003	-0.009***	0.002
20-<25			-0.008***	0.003	-0.006**	0.002	-0.032***	0.005	-0.025***	0.003	-0.004	0.003
25-<30			-0.005	0.004	-0.003	0.003	-0.044***	0.005	-0.026***	0.004	-0.002	0.003
30-<35	0.018***	0.004	0.01**	0.005	0.008*	0.004	-0.058***	0.007	-0.018***	0.005	0.01**	0.004
35 and more	0.033***	0.005	0.016**	0.007	0.017***	0.006	-0.047***	0.007	-0.006	0.006	0.019***	0.006
Business size												
2	-0.007	0.009	-0.005	0.006	-0.009	0.008	-0.007	0.021	0.004	0.009	-0.016*	0.008
3 to 4	-0.007	0.009	-0.006	0.006	-0.009	0.008	-0.007	0.020	0.008	0.008	-0.016*	0.008
5 to 9	-0.005	0.010	0.000	0.006	-0.006	0.008	-0.004	0.020	0.010	0.008	-0.014	0.009
10 to 19	0.000	0.010	0.002	0.007	-0.003	0.009	0.008	0.021	0.012	0.008	-0.010	0.009
20 to 49	-0.002	0.010	0.003	0.007	-0.004	0.009	0.024	0.022	0.009	0.009	-0.011	0.009
50 to 99	-0.003	0.011	0.004	0.008	-0.005	0.010	0.035	0.027	0.014	0.010	-0.013	0.010
100 to 149	-0.002	0.012	0.010	0.008	-0.002	0.011	0.040	0.028	0.02*	0.011	-0.011	0.010
150 to 199	-0.002	0.012	0.008	0.008	-0.004	0.011	0.050	0.031	0.023**	0.011	-0.015	0.011
200 to 249	0.005	0.013	0.006	0.009	-0.001	0.012	0.075	0.054	0.043***	0.014	-0.013	0.011
250 to 499	-0.005	0.013	0.010	0.009	-0.004	0.012	0.049	0.035	0.016	0.011	-0.013	0.011
500 to 999	-0.016	0.013	0.007	0.009	-0.010	0.013	0.065**	0.026	0.005	0.010	-0.018	0.011
1000 to 1999	-0.024**	0.012	0.007	0.010	-0.014	0.013	0.047*	0.027	0.003	0.010	-0.021*	0.011
2000 or more	-0.013	0.019	0.023	0.015	-0.001	0.017	0.073***	0.027	0.029	0.018	-0.009	0.016
Constant	-0.091***	0.020	-0.134***	0.019	-0.112***	0.020	-0.285***	0.057	-0.18***	0.031	-0.108***	0.020
Observations	2,054,190		2,262,044		4,195,818		120,416		771,440		3,489,291	

Standard errors clustered at business unit level. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 13: Probability of wage increases by type of contract

	Employment policy				Employment relationship				Type of contract			
	Full-time		Part-time		Fixed		Flexible		Tenured		Untenured	
	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error	Par.	St. error
"Time-dependency"												
<i>Month</i>												
January	0.311***	0.014	0.256***	0.013	0.285***	0.014	0.136***	0.011	0.263***	0.015	0.285***	0.015
February	0.08***	0.009	0.067***	0.005	0.071***	0.006	0.1***	0.025	0.085***	0.006	0.07***	0.007
March	0.036***	0.007	0.042***	0.004	0.038***	0.005	0.042***	0.009	0.043***	0.003	0.038***	0.005
April	0.073***	0.012	0.053***	0.006	0.062***	0.009	0.045***	0.010	0.064***	0.014	0.062***	0.009
May	0.027***	0.006	0.041***	0.007	0.034***	0.006	0.041***	0.013	0.055***	0.006	0.03***	0.007
June	0.064***	0.011	0.049***	0.006	0.056***	0.008	0.033***	0.012	0.048***	0.005	0.058***	0.009
July	0.101***	0.011	0.11***	0.017	0.106***	0.014	0.063***	0.013	0.1***	0.011	0.108***	0.015
August	0.055***	0.010	0.08***	0.011	0.068***	0.010	0.015	0.011	0.069***	0.015	0.068***	0.011
September	0.019***	0.007	0.032***	0.004	0.025***	0.005	0.005	0.009	0.035***	0.006	0.023***	0.006
October	0.035***	0.006	0.038***	0.005	0.037***	0.005	0.011	0.009	0.042***	0.005	0.036***	0.005
November	0.004	0.005	0.016***	0.004	0.01***	0.004	0.036	0.025	0.023***	0.005	0.008**	0.004
<i>Duration</i>												
1 month	-0.002	0.005	0.014***	0.003	0.004	0.004	0.04***	0.003	0.02***	0.004	0.003	0.004
2 months	0.016***	0.006	0.036***	0.003	0.023***	0.004	0.075***	0.007	0.046***	0.007	0.022***	0.004
3 months	0.042***	0.007	0.064***	0.004	0.049***	0.005	0.092***	0.005	0.074***	0.007	0.048***	0.005
4 months	0.042***	0.006	0.062***	0.004	0.048***	0.005	0.086***	0.006	0.079***	0.006	0.046***	0.005
5 months	0.074***	0.008	0.064***	0.005	0.064***	0.006	0.106***	0.007	0.107***	0.011	0.061***	0.006
6 months	0.08***	0.007	0.1***	0.006	0.085***	0.006	0.117***	0.009	0.109***	0.006	0.086***	0.007
7 months	0.077***	0.006	0.085***	0.005	0.075***	0.005	0.125***	0.009	0.122***	0.006	0.073***	0.005
8 months	0.083***	0.008	0.098***	0.006	0.085***	0.006	0.176***	0.028	0.142***	0.008	0.082***	0.007
9 months	0.102***	0.009	0.109***	0.006	0.1***	0.007	0.149***	0.012	0.172***	0.012	0.094***	0.007
10 months	0.107***	0.008	0.13***	0.008	0.113***	0.007	0.166***	0.012	0.2***	0.014	0.106***	0.007
11 months	0.417***	0.017	0.388***	0.015	0.398***	0.015	0.254***	0.027	0.454***	0.028	0.398***	0.015
12 months	0.146***	0.014	0.145***	0.014	0.139***	0.013	0.166***	0.014	0.196***	0.015	0.138***	0.014
"State-dependency"												
Accumulated inflation	0.01***	0.002	0.005***	0.002	0.007***	0.002	0.007**	0.003	-0.001	0.002	0.009***	0.002
Accumulated unemployment	-0.028***	0.004	-0.031***	0.003	-0.03***	0.003	-0.008	0.007	-0.023***	0.003	-0.031***	0.003
Accumulated productivity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Type of relationship												
Partnership	-0.01*	0.006	-0.002	0.009	-0.005	0.005	-0.017	0.038	0.001	0.013	-0.008	0.006
Single	-0.003	0.002	0.000	0.003	-0.001	0.002	-0.006	0.013	0.002	0.004	-0.003	0.002
age	-0.015***	0.002	-0.014***	0.001	-0.014***	0.001	-0.022***	0.003	-0.02***	0.002	-0.014***	0.002
Weekly contract hours												
12-<20			0.001	0.002	0.001	0.002	0.008**	0.004	0.003	0.002	0.001	0.003
20-<25			-0.005*	0.003	-0.006*	0.003	0.008	0.005	0.003	0.003	-0.006*	0.003
25-<30			-0.011***	0.004	-0.01**	0.004	0.008	0.006	-0.001	0.004	-0.011**	0.004
30-<35	-0.015**	0.007	-0.013***	0.004	-0.01**	0.005	0.017**	0.008	0.002	0.004	-0.011**	0.006
35 and more	-0.054***	0.009	-0.045***	0.005	-0.036***	0.005	0.010	0.008	-0.024***	0.005	-0.037***	0.006
Business size												
2	-0.020	0.013	-0.079*	0.048	-0.045*	0.025	-0.115*	0.059	-0.119***	0.046	-0.025**	0.012
3 to 4	-0.025*	0.013	-0.081	0.049	-0.048*	0.026	-0.117*	0.062	-0.124***	0.047	-0.025**	0.012
5 to 9	-0.03**	0.013	-0.091*	0.051	-0.054**	0.027	-0.141**	0.064	-0.13***	0.049	-0.033***	0.012
10 to 19	-0.029**	0.013	-0.09*	0.053	-0.053*	0.028	-0.13*	0.068	-0.132***	0.051	-0.03**	0.013
20 to 49	-0.025*	0.014	-0.092	0.058	-0.052*	0.030	-0.124*	0.075	-0.137**	0.054	-0.026**	0.013
50 to 99	-0.022	0.015	-0.099	0.063	-0.053	0.032	-0.128	0.081	-0.156***	0.060	-0.023*	0.014
100 to 149	-0.015	0.016	-0.096	0.068	-0.047	0.034	-0.126	0.083	-0.158**	0.065	-0.015	0.015
150 to 199	-0.013	0.017	-0.085	0.072	-0.040	0.036	-0.089	0.092	-0.168**	0.072	-0.005	0.016
200 to 249	0.003	0.018	-0.085	0.075	-0.035	0.038	-0.194*	0.100	-0.163**	0.075	0.003	0.017
250 to 499	0.015	0.017	-0.066	0.079	-0.017	0.040	-0.125	0.106	-0.161*	0.088	0.023	0.016
500 to 999	0.034***	0.012	-0.061	0.084	-0.005	0.043	-0.176	0.130	-0.196*	0.108	0.038***	0.014
1000 to 1999	0.058***	0.012	-0.021	0.084	0.031	0.041	-0.174	0.133	-0.151	0.105	0.072***	0.016
2000 or more	0.073***	0.014	0.001	0.088	0.049	0.044	-0.193	0.135	-0.153	0.110	0.092***	0.024
Constant	0.656***	0.069	0.649***	0.085	0.61***	0.066	0.944***	0.102	0.847***	0.067	0.61***	0.066
Observations	2,242,959		2,465,030		4,579,206		128,783		835,661		3,816,496	

Standard errors clustered at business unit level. *** Significant at the 1 percent level, ** Significant at the 5 percent level, * Significant at the 10 percent level.

Table 14: Wage rigidity by employee characteristics

Type of relationship					
Marriage	3.0 [2.7; 3.2]	85.8 [85.2; 86.3]	11.3 [10.8; 11.7]	-8.5	4.2
Partnership	3.0 [2.7; 3.3]	85.1 [84.5; 85.6]	11.9 [11.4; 12.4]	-8.5	4.1
Single	3.4 [3.1; 3.7]	84.0 [83.4; 84.5]	12.6 [12.2; 13.0]	-9.4	5.5
Gender					
Male	3.2 [2.9; 3.6]	85.3 [84.6; 85.9]	11.5 [11.0; 12.0]	-8.6	4.7
Female	3.1 [2.9; 3.4]	84.6 [84.1; 85.1]	12.2 [11.9; 12.6]	-9.2	4.9

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

Table 15: Distribution of contracts based on wage trajectory

	Director NA	Intern T U	SWS-er T U	Temp. workers T U	On-call T U	Rest T U	Total
<i>Full-time</i>							
Fixed hours	1.2	0.2 0.1	0.1 0.3			16.0 36.7	54.5
Flexible hours				0.9 0.2	0.6 0.5		2.2
<i>Part-time</i>							
Fixed hours	0.3	0.1 0.0	0.1 0.2			13.9 23.5	38.0
Flexible hours				0.5 0.1	2.6 2.2		5.3
Total	1.5	0.2 0.1 0.4	0.1 0.4 0.6	1.4 0.2 1.6	3.2 2.7 5.9	29.9 60.2 90.1	
% working overtime	0.3	0.8 1.0 0.9	0.1 0.1	12.2 7.6 11.6	1.7 1.8 1.7	3.0 6.2 5.0	4.8

T: Tenured, U: Untenured, NA: Not applicable. The total number of wage trajectories is 567,130. All the numbers are percentages.

Table 16: Distribution of contracts based on observations

	Director NA	Intern T U	SWS-er T U	Temp. workers T U	On-call T U	Rest T U	Total
<i>Full-time</i>							
Fixed hours	1.2	0.0 0.0	0.0 0.7			8.9 36.5	47.4
Flexible hours				0.2 0.1	0.1 0.1		0.5
<i>Part-time</i>							
Fixed hours	0.4	0.0 0.0	0.1 0.4			10.7 37.4	49.0
Flexible hours				0.3 0.0	1.3 1.5		3.1
Total	1.6	0.1 0.0 0.1	0.2 1.1 1.3	0.5 0.1 0.6	1.4 1.6 3.0	19.6 73.9 93.5	
% working overtime	0.4	2.3 2.9 2.6	0.0 0.0 0.0	14.1 12.3 13.8	2.1 2.4 2.2	5.7 7.7 7.3	6.9

T: Tenured, U: Untenured, NA: Not applicable. The total number of observations is 13,174,294. All the numbers are percentages.

Table 17: Number of observations lost in each step of the data cleaning process (5% sample)

Step	# of observations	# observation lost
Raw data	26,384,601	
Elimination of meaningless values	21,515,162	4,869,439
Elimination of percentiles 1% and 99%	21,327,537	187,625
Possible elimination of the first and last observation per wage trajectory	20,623,277	704,260
Elimination of wage trajectories of less than 3 months	20,190,719	432,558
Elimination of excessively volatile wage trajectories	14,905,628	5,285,091
Correction of wage trajectories with a “V” or inverted-“V” shape	14,905,628	0
Correction of spurious wage reversals	14,905,628	0

Table 18: Sector

	Frequency			Average size	
	Decrease	No change	Increase	Decrease	Increase
Private companies	4.1 [3.9; 4.3]	84.4 [84.0; 84.8]	11.5 [11.0; 12.0]	-9.0	5.5
Subsidized sector	2.7 [2.2; 3.2]	83.7 [82.7; 84.7]	13.6 [12.9; 14.3]	-8.7	4.1
Education	1.8 [1.5; 2.1]	87.1 [86.3; 88.0]	11.1 [10.5; 11.6]	-12.5	5.4
Municipalities	1.1 [0.9; 1.4]	87.6 [87.2; 88.0]	11.3 [11.0; 11.6]	-4.7	2.4

Marginal effects from multinomial logit models. All the numbers are percentages, and rows sum up to a 100%. Confidence intervals in brackets. The last two columns represents the percentage change in nominal wage, conditional on a wage decrease or increase. The total number of observations is 13,174,294.

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