

Online appendix for:

Time-Dependent or State-Dependent Wage-Setting?
Evidence from Periods of Macroeconomic Instability

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This appendix contains four sections. Section [A](#) contains further details about our dataset and data treatment. Section [B](#) documents heterogeneity in wage changes across industries and occupations. In Section [C](#), we estimate a selection model of wage changes, exploring both the factors influencing the probability of wage change and the size of change. Section [D](#) provides supplementary empirical results.

A The dataset and data treatment

The dataset used in the paper is unpublished confidential administrative microdata that was constructed from data collected by Statistics Iceland through the *Icelandic Survey on Wages, Earnings and Labour Costs* (ISWEL). In this section, which complements Section 3 of the paper, we provide further details about the data and data treatment.

Our sample period is from January 1998 to December 2010, the longest period available to us. The sample is a stratified cluster sample, where the sample unit is the local activity unit and the observation unit is the employee. The target population contains all local activity units with at least 10 employees. The population frame is based on monthly pay-as-you-earn data, which reflects firms that reported wages to the tax authorities during a given month. The population is stratified in sections and subsections according to NACE Rev. 1 (statistical classification of economic activities). Activity units with more than A/m employees are selected with a probability of 1 (where A is the number of employees in the stratum and m is the number of activity units to be selected from the stratum). For the rest of the population, a simple random sample is selected from each stratum.

Every month, each firm in the survey submits electronically standardized and detailed information on wages, labor costs, working hours, and necessary background factors on both firm and

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workers. Leading Icelandic software development companies assist firms with modifying their payroll software in order to enable them to submit the required detailed information directly, which minimizes firms' effort and cost related to data collection. When a firm enters the sample, various technical aspects concerning the software for wage calculations are addressed, as well as details on entering records such as classification of occupations according to the ÍSTARF95 standard. The company's wage structure is examined, payroll items are assigned to the wage items of the survey, and working time is classified so as to ensure coordination with other companies. A crucial part of the data collection process is the minimal effort on behalf of the firm once the necessary amendments have been made to the wage software at the time the firm enters the sample. Because limited effort is required, firms agree to provide information on a monthly basis and remain in the sample for a long time. To maintain high quality of data, Statistics Iceland performs an extensive data quality check when receiving the data from the firms. In addition, strong emphasis is placed on giving feedback to both the firms and the software development companies. This constant feedback ensures that data problems are addressed and solved quickly.

The sample frame in ISWEL contains five industry categories: Industrial Production, Construction Industry, Trade and Repair Service, Transport, and Financial Services. However, financial services were not included in ISWEL until January 2004. Within firms, workers are categorized into seven different occupations: managers; specialists; technicians; office personnel; craftsmen and production; blue-collar workers; and service, sales, and support.

From ISWEL, we have detailed information on all wage payments. In addition to basic wages and salaries, the data include payments such as additional allowances, expense payments, bonus payments, shift differential, sickness pay, overtime pay, piecework, irregular bonuses, lump-sum payments, and other irregular payments. We construct five different definitions of wages and use two in the paper: the base wage and the regular wage. Base wages are wages for daytime work divided by the number of daytime hours. Regular wages include, in addition to base wages, all regular monthly payments, including regular bonuses and allowances divided by daytime hours. The base wage is our preferred measure of wages for most of our analysis, but we refer to the regular wage for comparison. The three wider definitions of wages are much more volatile in both frequency and size of changes, as they include payments that are not made on a regular basis. Studying the degree of wage rigidity using only the base wage and the regular wage could cause us to miss a source of wage flexibility. However, including irregular payments may lead to biases in estimated wage rigidity, as frequent changes in irregular payments introduce variation in wage payments without representing substantial changes in the level of earnings. Furthermore, some irregular payments, such as December bonuses, do not represent additional wage flexibility to the base wage, as they are predetermined in wage bargaining at either the firm or the union level. Therefore, in order for estimates to be both relevant for macroeconomic interpretation and compatible to previous studies, we exclude all irregular payments.

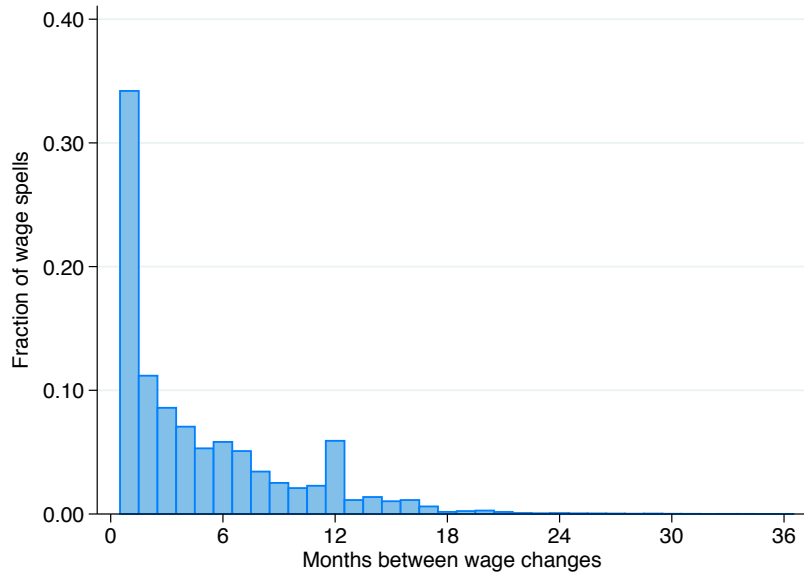
As we have emphasized, the main advantage of our dataset is that data on both wages

and working hours come directly from firms' wage software in a standardized form received and documented by Statistics Iceland. This feature, compared to survey data, removes the risk of errors due to misreporting and, since the data also contain information about working hours, decreases errors in the measurement of hourly wages for workers paid by the hour. As is explained in Section 3 of the paper, we make two amendments to the dataset. First, for both base wage and regular wage, we remove outliers, which we classify as increases or decreases that fall into the bottom 2 or top 2 percent of the size distribution. This reduces the mean size of wage increase by 0.8 percentage points, the mean size of wage decrease by 0.6 percentage points, and the measured monthly frequency of wage change by 1 percentage point. Second, for the base wage, we filter out V-shaped and inverted V-shaped wage trajectories. These variations are generally much smaller than other wage changes, and they probably occur either because of rounding of working hours or monthly wages or because of errors in the calculated wage payment for a given month, which are then corrected in the subsequent month's wage payment. After variables for wage changes and size of changes have been calculated, as is described in Section 4.1. of the paper, we run the following simple algorithm to filter out these trajectories.

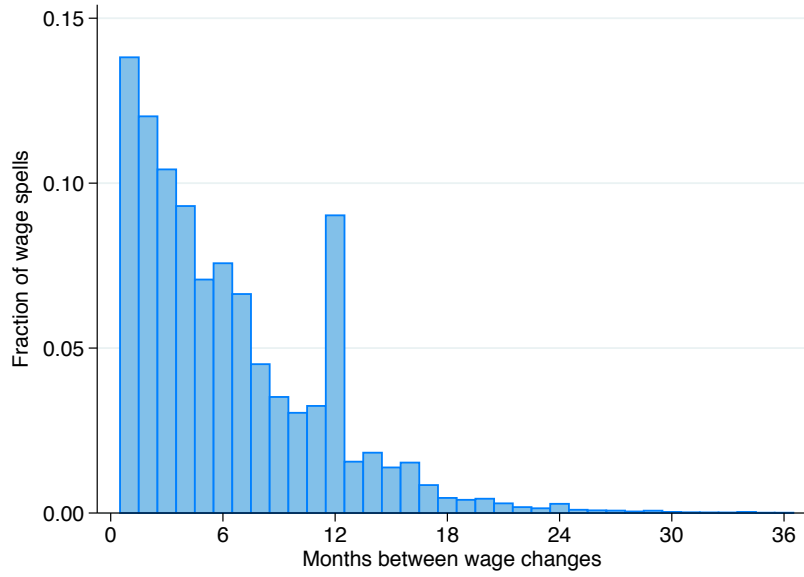
0. Set $\bar{V}_{ij,t} = 0$ and $\underline{V}_{ij,t} = 0$
1. For employer-employee pair ij , if $w_{ij,t} > w_{ij,t-1}$ and $w_{ij,t-1} < w_{ij,t-2}$ then replace $\bar{V}_{ij,t} = 1$
2. For employer-employee pair ij , if $w_{ij,t} < w_{ij,t-1}$ and $w_{ij,t-1} > w_{ij,t-2}$ then replace $\underline{V}_{ij,t} = 1$
3. If $\bar{V}_{ij,t} = 1$ then replace $I_{ij,t}^+ = 0$ and $I_{ij,t-1}^- = 0$
4. If $\underline{V}_{ij,t} = 1$ then replace $I_{ij,t}^- = 0$ and $I_{ij,t-1}^+ = 0$
5. If $\bar{V}_{ij,t} = 1$ or $\underline{V}_{ij,t} = 1$ set $\Delta w_{ij,t}^+$ and $\Delta w_{ij,t}^-$ as missing

This procedure filters out 29 percent of previously measured wage changes and reduces the measured monthly frequency of wage change by 3.3 percentage points. Figure A.1 displays the duration of wage spells in the raw data and in the dataset where outliers have been removed and both V-shaped and inverted V-shaped wage trajectories have been filtered out. As expected, this filtering mainly removes spells lasting only one period, while the relative share of spells lasting two months or longer is largely unaffected.

To further assess how these data amendments affect our results, we have performed our econometric analysis using the raw dataset; i.e., excluding neither outliers in size nor V-shaped and inverted V-shaped trajectories. Figure A.10 plots the hazard function using the raw dataset. Apart from the fact that estimated hazard is now higher in the first month, the hazard functions has the same shape as the presented in Figure 6 in the paper. Next, we estimate the model described in Section 5.2. in the paper using the raw dataset. Table A.1 presents estimates for the probability of wage increase. The results are in all aspects both qualitatively and quantitatively



(a) Raw dataset



(b) Amended dataset

Figure A.1: Distribution of Duration of wage spells

similar to those presented in Table 3 in the paper. Table A.2 presents results for the case of wage decreases, finding broadly similar results to those in Table 4 in the paper, except that effects of cumulated state variables is now substantially stronger and significant than previously estimated.

Table A.1: Probit Estimates of the Probability of Wage Increase – Raw Data

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	1.611*** (0.062)	0.343*** (0.011)	1.621*** (0.058)	0.335*** (0.009)	1.597*** (0.063)	0.331*** (0.009)	1.600*** (0.063)	0.331*** (0.009)
February	0.193*** (0.048)	0.041*** (0.010)	-0.008 (0.052)	-0.002 (0.011)	0.007 (0.053)	0.001 (0.011)	0.027 (0.054)	0.006 (0.011)
March	0.269*** (0.040)	0.057*** (0.008)	0.255*** (0.042)	0.053*** (0.008)	0.278*** (0.052)	0.058*** (0.010)	0.263*** (0.052)	0.055*** (0.010)
April	0.235*** (0.045)	0.050*** (0.009)	0.220*** (0.045)	0.046*** (0.009)	0.227*** (0.049)	0.047*** (0.010)	0.190*** (0.048)	0.039*** (0.010)
May	0.293*** (0.037)	0.062*** (0.008)	0.291*** (0.042)	0.060*** (0.009)	0.284*** (0.040)	0.059*** (0.008)	0.227*** (0.040)	0.047*** (0.008)
June	0.484*** (0.048)	0.103*** (0.010)	0.519*** (0.051)	0.107*** (0.010)	0.524*** (0.046)	0.109*** (0.009)	0.462*** (0.043)	0.096*** (0.009)
July	0.258*** (0.043)	0.055*** (0.009)	0.227*** (0.043)	0.047*** (0.009)	0.224*** (0.043)	0.046*** (0.009)	0.159*** (0.041)	0.033*** (0.009)
August	-0.042 (0.039)	-0.009 (0.008)	-0.097*** (0.037)	-0.020** (0.008)	-0.113** (0.046)	-0.023** (0.010)	-0.142*** (0.046)	-0.029*** (0.010)
September	-0.011 (0.038)	-0.002 (0.008)	0.001 (0.040)	0.000 (0.008)	-0.016 (0.041)	-0.003 (0.009)	-0.052 (0.041)	-0.011 (0.009)
October	-0.000 (0.045)	-0.000 (0.010)	0.028 (0.049)	0.006 (0.010)	0.013 (0.053)	0.003 (0.011)	-0.047 (0.053)	-0.010 (0.011)
November	0.206*** (0.047)	0.044*** (0.010)	0.266*** (0.051)	0.055*** (0.010)	0.274*** (0.058)	0.057*** (0.011)	0.256*** (0.058)	0.053*** (0.011)
Cumulative change in unemployment, current spell	-0.091*** (0.008)	-0.019*** (0.001)	-0.110*** (0.007)	-0.023*** (0.001)	-0.115*** (0.009)	-0.024*** (0.002)	-0.096*** (0.008)	-0.020*** (0.001)
Cumulative inflation, current spell	0.020*** (0.003)	0.004*** (0.001)	0.008*** (0.003)	0.002*** (0.001)	0.009*** (0.003)	0.002*** (0.001)	0.006** (0.003)	0.001** (0.001)
Cumulative growth in firm size	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)
Size of last change	-0.004*** (0.001)	-0.001*** (0.000)	-0.003*** (0.001)	-0.001*** (0.000)	-0.003*** (0.001)	-0.001*** (0.000)	-0.003*** (0.001)	-0.001*** (0.000)
Cumulative change in unemployment, last spell					-0.005 (0.007)	-0.001 (0.001)	-0.004 (0.007)	-0.001 (0.001)
Cumulative inflation, last spell					-0.004 (0.002)	-0.001 (0.001)	-0.004* (0.003)	-0.001* (0.001)
Change in current unemployment							-0.126*** (0.021)	-0.026*** (0.004)
Current inflation							0.024*** (0.006)	0.005*** (0.001)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-738,431		-718,716		-588,737		-588,108	
Observations	1,975,831	1,975,831	1,975,831	1,975,831	1,614,586	1,614,586	1,614,586	1,614,586

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.2: Probit Estimates of the Probability of Wage Decrease – Raw Data

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	-0.056*	-0.003*	0.018	0.001	-0.031	-0.001	-0.026	-0.001
	(0.032)	(0.002)	(0.040)	(0.002)	(0.040)	(0.002)	(0.040)	(0.002)
February	-0.213***	-0.011***	-0.557***	-0.022***	-0.574***	-0.022***	-0.592***	-0.023***
	(0.035)	(0.002)	(0.052)	(0.002)	(0.055)	(0.002)	(0.054)	(0.002)
March	-0.245***	-0.013***	-0.262***	-0.010***	-0.326***	-0.013***	-0.305***	-0.012***
	(0.032)	(0.002)	(0.035)	(0.001)	(0.038)	(0.001)	(0.037)	(0.001)
April	-0.147***	-0.008***	-0.130***	-0.005***	-0.188***	-0.007***	-0.135***	-0.005***
	(0.034)	(0.002)	(0.039)	(0.002)	(0.036)	(0.002)	(0.034)	(0.001)
May	-0.090**	-0.005**	-0.075	-0.003	-0.138***	-0.005***	-0.061	-0.002
	(0.042)	(0.002)	(0.049)	(0.002)	(0.050)	(0.002)	(0.051)	(0.002)
June	-0.075**	-0.004**	-0.103***	-0.004***	-0.132***	-0.005***	-0.063*	-0.002*
	(0.031)	(0.002)	(0.035)	(0.001)	(0.037)	(0.002)	(0.036)	(0.001)
July	-0.072*	-0.004*	-0.184***	-0.007***	-0.224***	-0.009***	-0.151***	-0.006***
	(0.037)	(0.002)	(0.035)	(0.001)	(0.036)	(0.001)	(0.035)	(0.001)
August	-0.054*	-0.003*	-0.067**	-0.003**	-0.081**	-0.003**	-0.056*	-0.002*
	(0.030)	(0.002)	(0.033)	(0.001)	(0.033)	(0.001)	(0.032)	(0.001)
September	-0.025	-0.001	0.076*	0.003*	0.037	0.001	0.073*	0.003*
	(0.037)	(0.002)	(0.041)	(0.002)	(0.044)	(0.002)	(0.043)	(0.002)
October	0.047	0.003	0.105	0.004	0.096	0.004	0.166	0.006
	(0.078)	(0.004)	(0.095)	(0.004)	(0.107)	(0.004)	(0.105)	(0.004)
November	0.067	0.004	0.096**	0.004*	0.081	0.003	0.108**	0.004**
	(0.047)	(0.002)	(0.049)	(0.002)	(0.053)	(0.002)	(0.051)	(0.002)
Cumulative change in unemployment, current spell	0.076***	0.004***	0.051***	0.002***	0.077***	0.003***	0.034**	0.001**
	(0.013)	(0.001)	(0.012)	(0.000)	(0.013)	(0.001)	(0.014)	(0.001)
Cumulative inflation, current spell	-0.086***	-0.005***	-0.015**	-0.001**	-0.015***	-0.001***	0.003	0.000
	(0.009)	(0.001)	(0.006)	(0.000)	(0.006)	(0.000)	(0.006)	(0.000)
Cumulative growth in firm size	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Size of last change	0.008***	0.000***	0.005***	0.000***	0.006***	0.000***	0.006***	0.000***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Cumulative change in unemployment, last spell					0.039***	0.002***	0.036***	0.001***
					(0.008)	(0.000)	(0.008)	(0.000)
Cumulative inflation, last spell					-0.052***	-0.002***	-0.051***	-0.002***
					(0.005)	(0.000)	(0.005)	(0.000)
Change in current unemployment							0.142***	0.005***
							(0.022)	(0.001)
Current inflation							-0.061***	-0.002***
							(0.007)	(0.000)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-242,577		-218,506		-181,667		-181,144	
Observations	1,975,831	1,975,831	1,975,831	1,975,831	1,614,586	1,614,586	1,614,586	1,614,586

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

B Heterogeneity Across Industries and Occupations

This section documents the frequency and size of wage changes across industries and occupations, and how wage changes across those groups evolve over our sample period.

Table A.3 presents the frequency and size of wage changes by industries. Overall we do not find much heterogeneity across industries. Wage adjustment is most frequent in the transport and construction industries, but slightly less frequent in industrial production and trade and repair services, ranging between 12.7 and 13.8 percent in those groups. However, wages seem to be more rigid in financial services where the frequency is 9.7 percent. This is explained both by lower frequency of increases and decreases. This pattern is then reversed when looking at size of changes as both wage increases and decreases are larger on average in *Financial Services*. Similarly, Table A.4 documents frequency and size of wage change by occupational groups. Compared to the differences across industries, there is more heterogeneity across occupational groups. Wages change most frequently for blue-collar workers as well as workers in service, sales and support, but appear more rigid for managers and specialists.

Given the variability in macroeconomic conditions over our sample period it is also of interest to study how wages changes evolve across both industries and occupations. Figure A.2 plots the mean monthly size of changes in base wages by industries over the period 2006 to 2010.¹ The size of wage changes ranges between 5 to 10% on average per month and the size of adjustment is largely similar across industries. However, as emphasized above, wage changes in financial services are on average larger than in other industries, in particular throughout 2007 and early 2008. Figure A.3 plots the monthly size of changes in regular wages, showing stronger wage growth within the financial sector, although it is less prominent. Figures A.4 and A.5 provide a similar set for the occupation groups and depict a relatively homogenous pattern, although wage changes for managers and specialists tend to be larger on average.

Figures A.2, A.3, A.4, and A.5 all display an immediate and strong response of nominal wages to the 2008 financial crisis. A substantial slowdown in wage growth is evident in all sectors, with the construction, transport, and financial sectors experiencing large wage decreases. Similarly, wage growth drops for all occupational groups and is negative in late 2008 for managers, specialists, and technicians.

¹Note that monthly sectoral growth rates are averages over wages that are adjusted in a given sector in a given month and do not account for the selection into adjustment, therefore treating the size of change for unchanged wages not as zero but as missing. See equation (3) in the paper for a definition of a size of wage change.

Table A.3: Frequency of Wage Change, Size of Changes and Duration of Wage Spells by Industry

	Mean Frequency			Mean Size		Wage Spell
	Change (percent)	Increase (percent)	Decrease (percent)	Increase (percent)	Decrease (percent)	Implied Duration (months)
Industrial Production	12.7	11.9	0.8	5.5	5.8	7.4
Construction Industry	13.7	13.0	0.7	5.0	7.8	6.8
Trade and Repair Services	13.3	12.5	0.8	6.3	5.9	7.0
Transport	13.8	12.9	0.9	5.7	6.8	6.7
Financial Services	9.7	9.4	0.3	6.6	7.3	9.8

Notes: All frequencies reported are in percentage per month. The mean size is the mean percentage change per month. The size of decrease is reported in absolute terms. Implied duration is calculated under the assumption that the hazard rate of wage change is the constant λ and the probability of a wage change is $f = 1 - e^{-\lambda}$. The mean implied duration is therefore $d = -1/\ln(1 - f)$, where f is the mean frequency of wage change.

Table A.4: Frequency of Wage Change, Size of Changes and Duration of Wage Spells by Occupation

	Mean Frequency			Mean Size		Wage Spell
	Change (percent)	Increase (percent)	Decrease (percent)	Increase (percent)	Decrease (percent)	Implied Duration (months)
Managers	9.6	9.0	0.6	5.8	7.6	9.9
Specialists	10.0	9.5	0.5	6.5	6.8	9.5
Technicians	11.8	11.3	0.5	5.5	7.1	7.9
Office personnel	12.0	11.4	0.6	6.0	5.7	7.8
Service, sales and support	14.7	13.7	1.0	6.3	5.6	6.3
Craftsmen and production	12.2	11.7	0.5	4.8	6.5	7.7
Blue-collar workers	13.8	12.9	0.9	5.7	6.7	6.7

Notes: All frequencies reported are in percentage per month. The mean size is the mean percentage change per month. The size of decrease is reported in absolute terms. The size of decrease is reported in absolute terms. Implied duration is calculated under the assumption that the hazard rate of wage change is the constant λ and the probability of a wage change is $f = 1 - e^{-\lambda}$. The mean implied duration is therefore $d = -1/\ln(1 - f)$, where f is the mean frequency of wage change.

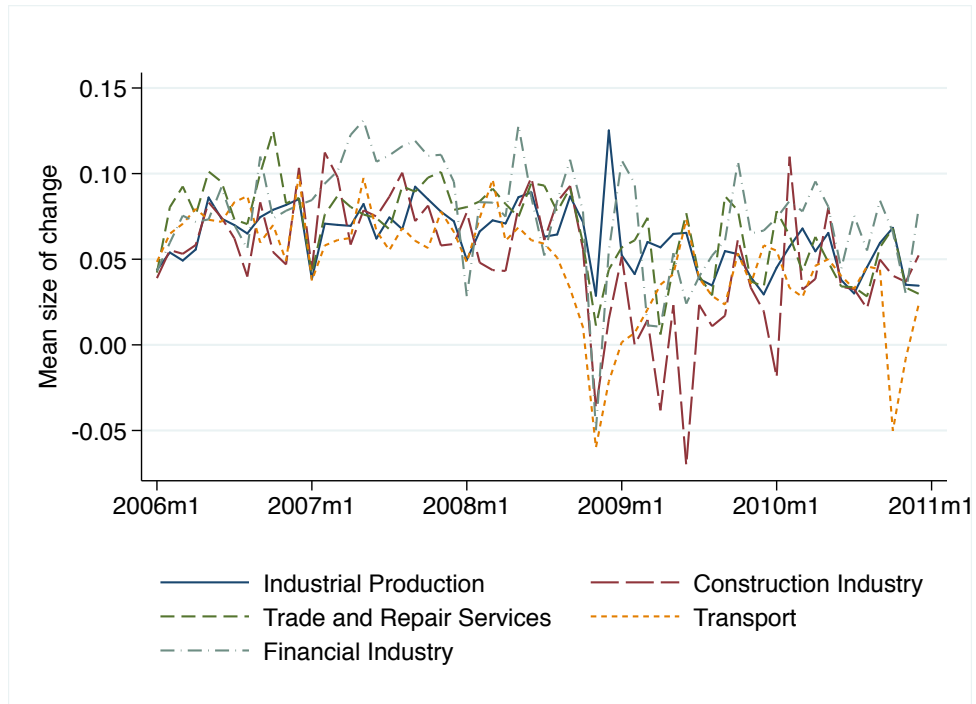


Figure A.2: Growth of Base Wages. *Note:* The monthly growth rates are industry averages of wages that are changed in a given month.

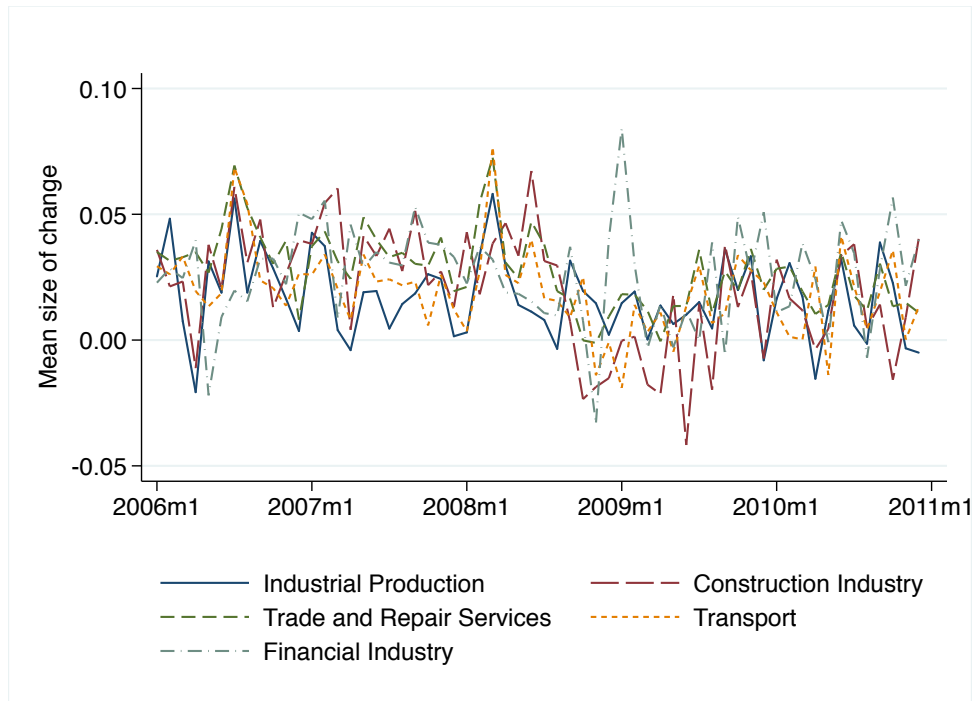


Figure A.3: Growth of Regular Wages. *Note:* The monthly growth rates are industry averages of wages that are changed in a given month.

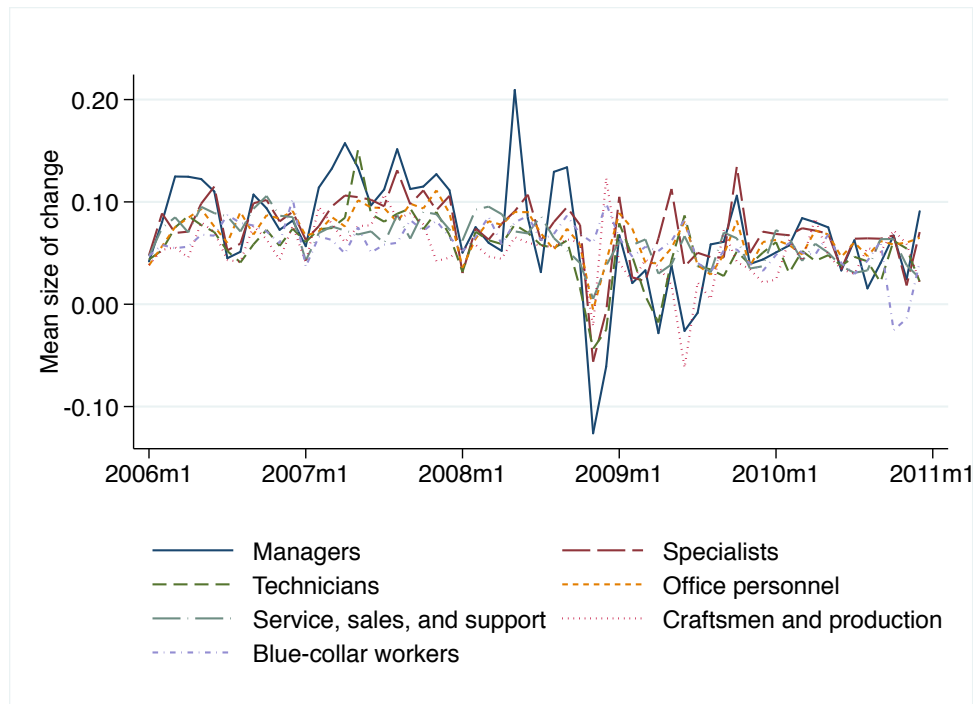


Figure A.4: Growth of Base Wages. *Note:* The monthly growth rates are occupational group averages of wages that are changed in a given month.

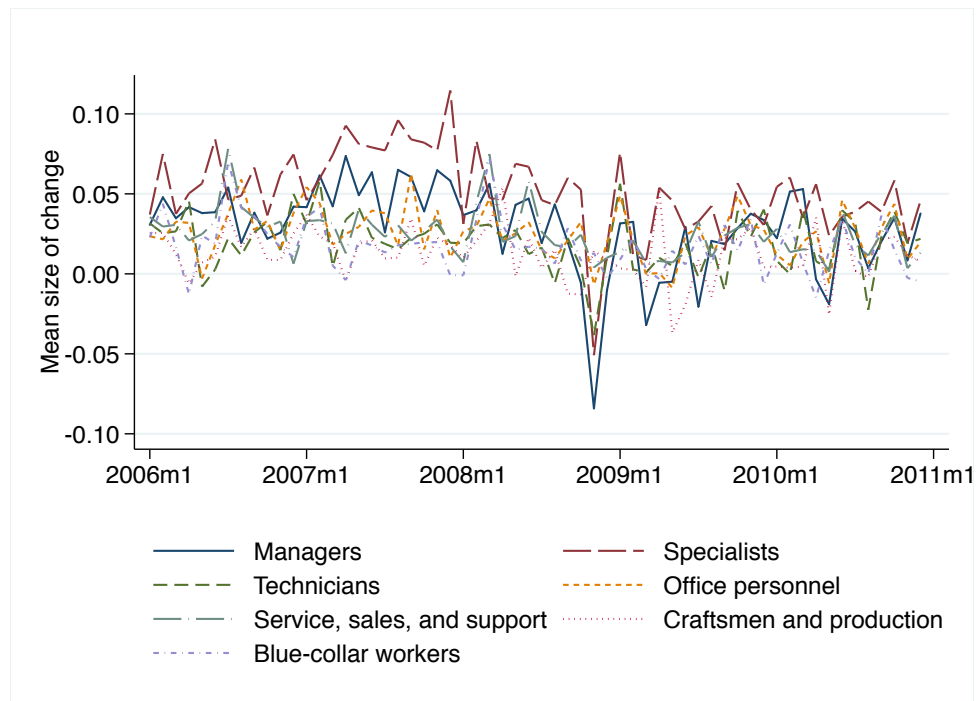


Figure A.5: Growth of Regular Wages. *Note:* The monthly growth rates are occupational group averages of wages that are changed in a given month.

C Selection Model of Wage Changes

This appendix complements Section 5 in the paper by further exploring which factors affect the process of nominal wage changes, both the probability of adjusting wages and the size of adjustment. This analysis enhances the compatibility of our results with previous papers that have estimated determinants of the size of wage changes. [Fehr and Goette \(2005\)](#) study the extent of nominal wage rigidities in a low-inflation environment, estimating a selection model of wage adjustment using Swiss data from the 1990s. In an environment of low inflation, nominal wage cuts are expected to be more frequent in order to channel the adjustment of real wages. They find that a large share of workers, roughly 50 percent, were faced with nominal wage rigidities preventing a downward adjustment in wages. Moreover, they conclude that, in the absence of nominal rigidities, wages would react more strongly to changes in unemployment than they observe in the data. In a study closely related to ours, [Le Bihan et al. \(2012\)](#) estimate a selection model of wage adjustment to explore both the determinants of the probability of wage change and the size of change. When accounting for both time and state factors they do not find evidence of state-dependence in wage-setting. However, when investigating the determinants of size of wage changes they find evidence of a Phillips-curve relation, as unemployment is found to have a negative effect on the size of adjustment whereas inflation has a positive effect.

One approach to exploring the determinants of the size of wage changes, in addition to the determinants of the probability of change as studied in the paper, is simply to estimate a model using ordinary least squares. However, since many observations obviously have a missing value for the size of a wage change, such a regression is likely to produce biased estimates, owing to a sample bias created when restricting the regression to observations where wage changes take place. In order to account for such bias, we estimate a sample selection model where wage changes are modeled as two joint decisions: the decision whether or not to change the wage and, conditional on the former decision, the size of the wage change.² Wage change is modeled as the following selection process:

$$y_{ij,t} = \begin{cases} 1 & \text{if } y_{ij,t}^* > \mu \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

where μ represents a threshold value for wage adjustment. The latent variable $y_{ij,t}^*$, triggering wage change at time t for worker i employed by firm j , is described with the following selection equation:

$$y_{ij,t}^* = z_{ij,t}\gamma + \eta_{ij,t} \quad (2)$$

²The sample selection model is generally referred to as the Heckman model ([Heckman, 1976, 1979](#)) or the Type II Tobit model, see [Amemiya \(1985\)](#).

The set of covariates are collected in a row vector denoted by $\mathbf{z}_{ij,t}$. The relationship between the latent variable describing the selection and the observed wage change is modeled as:

$$\Delta w_{ij,t} = \begin{cases} \mathbf{x}_{ij,t}\boldsymbol{\beta} + \epsilon_{ij,t} & \text{if } y_{ij,t}^* > \mu \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

where row vector of regressors $\mathbf{x}_{ij,t}$ and $\mathbf{z}_{ij,t}$ can have common elements. The parametric form of the model assumes that:

$$\begin{aligned} \eta_{ij,t} &\sim N(0, 1) \\ \epsilon_{ij,t} &\sim N(0, \sigma^2) \\ \text{corr}(\eta_{ij,t}, \epsilon_{ij,t}) &= \rho \end{aligned} \quad (4)$$

We estimate the model separately for wage increases and decreases. The estimation method is a two-step procedure. First, we estimate the probability of wage change by maximum likelihood. The set of covariates $\mathbf{z}_{ij,t}$ includes factors aimed at capturing both time-dependent and state-dependent elements of wage-setting. We include month dummies to account for seasonality and synchronization in wage adjustment. In order to capture time-dependency, we include a set of dummies for the duration of the current wage spell, and to account for state-dependency, we include, as described in detail in Section 5.2 in the paper, transformations of the price level, unemployment and firm size. Additionally, $\mathbf{z}_{ij,t}$ includes worker and firm characteristics. In order for the identification of the selection model not to pivot on distributional assumptions, we need to have a variable in $\mathbf{z}_{ij,t}$ that is not included in $\mathbf{x}_{ij,t}$, i.e., we need a variable that affects the probability of a wage change but not the size of the change. As an exclusion restriction, we choose to follow [Le Bihan et al. \(2012\)](#) and exclude the duration dummies from $\mathbf{x}_{ij,t}$. This restriction is valid if, other things equal, duration of wage spells does affect the frequency but not affect the size of change change, apart from its affect through accumulated macroeconomic variables.

In the second step, we estimate equation (3) with ordinary least squares. In order to gain consistent estimates of the coefficients estimated in the second step, we use the first-step probit estimation to compute the inverse of the Mills ratio, $\hat{\lambda}_{ij} = \frac{\phi(\mathbf{z}_{ij,t}\hat{\boldsymbol{\gamma}})}{\Phi(\mathbf{z}_{ij,t}\hat{\boldsymbol{\gamma}})}$, where $\phi(\cdot)$ is the standard normal density function and $\Phi(\cdot)$ is the corresponding cumulative distribution function. The $\hat{\lambda}_{ij}$ term is then included in the second-step OLS to correct for sample selection bias.

Table A.5 reports the results from the selection equation for wage increases, characterizing the factors affecting the probability of a wage change. Table A.7 reports similar results for wage decreases. The results are as according to the probit estimates reported in the paper. Time factors, both seasonal and duration dummies, have a significant effect on the probability

of wage changes, but also the factors aimed at capturing state-dependency. The results from the estimation of equation (3) for the size of wage change, the second step of our estimation procedure, are presented in Tables A.6 and A.8. The effects of inflation and unemployment on the size of wage increases are as expected: higher cumulative inflation over the wage spell leads to larger wage increases when wages are reset, while a greater increase in unemployment over the spell depresses wage increases. This relationship is independent of the sample period explored; i.e., whether the Great Recession is included or not. Cumulative inflation is found to negatively affect the size of wage decreases, but this effect is not evident if we restrict the sample to exclude the recession.

As is discussed above, ideally the Heckman model is identified through the row vectors $\mathbf{z}_{ij,t}$ and $\mathbf{x}_{ij,t}$ being distinct. This implies that an exclusion restriction is satisfied: $\mathbf{z}_{ij,t}$ includes a variable that only affects the selection process but does not influence the size of wage changes and can therefore be excluded from $\mathbf{x}_{ij,t}$. Technically, however, the Heckman model is identified in the case when $\mathbf{z}_{ij,t}$ and $\mathbf{x}_{ij,t}$ include the same independent variables. Then, identification relies only on the distributional assumptions about the residuals rather than being due to variation in the explanatory variables. But although the model can be identified, it is likely that the parameters of the outcome equation are imprecisely estimated. Furthermore, this will also be true if the selection equation does not perform well in determining selection. For identification, we followed Le Bihan et al. (2012) and exclude from $\mathbf{x}_{ij,t}$ the set of dummy variables indicating the length of the wage spell. The motivation for the exclusion is that models of wage-setting predict that duration of wage spells does affect the probability of wage adjustment, but not the size of change apart from how cumulative state factors are correlated with duration of spells. Still, we believe there may be cases when the exclusion restriction is violated. As an informal test, we ran an OLS regression of the size of wage increase on the variables in $\mathbf{z}_{ij,t}$, including both duration dummies and cumulative state variables, and we find that duration of wage spells has a significant effect on the size of wage increases. A similar regression for size of wage decrease does not show such an effect, however. Therefore, we do not find strong empirical support for the exclusion restriction in the outcome equation predicted by the standard wage-setting models. Obviously, running an OLS regression only serves as an informal test and has some clear shortcomings. First, the OLS estimate will be biased due to sample selection, which was the reason for estimating the selection model. Second, the reason for statistical significance of duration dummies may be that we are unable to fully control for cumulated macroeconomic variation that influence the size of wage adjustment.

Table A.5: Heckman Model – Selection Equation: Probability of Wage Increase

	1998-2010				1998-2007			
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	1.677*** (0.007)	0.284*** (0.001)	1.692*** (0.007)	0.285*** (0.001)	2.281*** (0.008)	0.378*** (0.002)	2.282*** (0.008)	0.375*** (0.002)
February	0.123*** (0.008)	0.021*** (0.001)	0.162*** (0.008)	0.027*** (0.001)	0.149*** (0.009)	0.025*** (0.002)	0.132*** (0.009)	0.022*** (0.002)
March	0.353*** (0.007)	0.060*** (0.001)	0.348*** (0.008)	0.058*** (0.001)	0.160*** (0.010)	0.026*** (0.002)	0.179*** (0.010)	0.029*** (0.002)
April	0.294*** (0.008)	0.050*** (0.001)	0.247*** (0.008)	0.042*** (0.001)	0.348*** (0.009)	0.058*** (0.002)	0.377*** (0.009)	0.062*** (0.002)
May	0.346*** (0.007)	0.059*** (0.001)	0.260*** (0.008)	0.044*** (0.001)	0.497*** (0.009)	0.082*** (0.001)	0.534*** (0.009)	0.088*** (0.002)
June	0.613*** (0.007)	0.104*** (0.001)	0.519*** (0.007)	0.087*** (0.001)	0.291*** (0.009)	0.048*** (0.001)	0.328*** (0.009)	0.054*** (0.002)
July	0.298*** (0.007)	0.051*** (0.001)	0.199*** (0.008)	0.033*** (0.001)	0.272*** (0.009)	0.045*** (0.001)	0.316*** (0.009)	0.052*** (0.002)
August	-0.109*** (0.008)	-0.018*** (0.001)	-0.156*** (0.008)	-0.026*** (0.001)	-0.002 (0.009)	-0.000 (0.002)	0.017* (0.010)	0.003* (0.002)
September	-0.041*** (0.008)	-0.007*** (0.001)	-0.097*** (0.008)	-0.016*** (0.001)	0.054*** (0.009)	0.009*** (0.002)	0.074*** (0.010)	0.012*** (0.002)
October	0.007 (0.008)	0.001 (0.001)	-0.092*** (0.008)	-0.015*** (0.001)	0.129*** (0.009)	0.021*** (0.002)	0.170*** (0.010)	0.028*** (0.002)
November	0.310*** (0.007)	0.053*** (0.001)	0.282*** (0.008)	0.047*** (0.001)	-0.088*** (0.010)	-0.015*** (0.002)	-0.076*** (0.010)	-0.012*** (0.002)
Cumulative change in unemployment, current spell	-0.098*** (0.001)	-0.017*** (0.000)	-0.080*** (0.001)	-0.013*** (0.000)	-0.034*** (0.003)	-0.006*** (0.001)	-0.025*** (0.004)	-0.004*** (0.001)
Cumulative inflation, current spell	0.009*** (0.000)	0.001*** (0.000)	0.007*** (0.001)	0.001*** (0.000)	0.037*** (0.001)	0.006*** (0.000)	0.032*** (0.001)	0.005*** (0.000)
Cumulative growth in firm size	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000*** (0.000)
Size of previous change	-0.004*** (0.000)	-0.001*** (0.000)	-0.005*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.000*** (0.000)
Cumulative change in unemployment, last spell			-0.009*** (0.001)	-0.002*** (0.000)			-0.086*** (0.003)	-0.014*** (0.000)
Cumulative inflation, last spell			0.011*** (0.000)	0.002*** (0.000)			0.010*** (0.001)	0.002*** (0.000)
Change in current unemployment			-0.207*** (0.004)	-0.035*** (0.001)			0.088*** (0.009)	0.014*** (0.002)
Current inflation			0.037*** (0.001)	0.006*** (0.000)			-0.009*** (0.002)	-0.001*** (0.000)
Duration dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
μ	-0.101*** (0.016)		-0.089*** (0.016)		-0.464*** (0.020)		-0.424*** (0.020)	
ρ	0.326		0.298		0.395		0.373	
σ^2	4.720		4.665		4.875		4.823	
Observations	1,857,579	1,857,579	1,823,028	1,823,028	1,316,273	1,316,273	1,290,809	1,290,809

Notes: The selection equation of the Heckman model is estimated by maximum likelihood. Standard errors are in parenthesis. Firm size, industry, and occupation dummies are included in all specifications. Marginal effects on probability of wage increase of one unit are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.6: Heckman Model – Outcome Equation: Size of Wage Increase

	1998-2010		1998-2007	
January	-0.008 (0.091)	-0.143 (0.093)	1.401*** (0.168)	1.245*** (0.163)
February	0.167*** (0.064)	0.190*** (0.065)	0.486*** (0.079)	0.492*** (0.080)
March	1.396*** (0.065)	1.470*** (0.065)	1.093*** (0.082)	1.146*** (0.083)
April	1.399*** (0.064)	1.486*** (0.064)	2.160*** (0.082)	2.208*** (0.084)
May	0.455*** (0.063)	0.551*** (0.063)	1.000*** (0.085)	1.026*** (0.088)
June	0.315*** (0.064)	0.409*** (0.064)	0.824*** (0.079)	0.864*** (0.081)
July	0.290*** (0.060)	0.369*** (0.061)	1.173*** (0.078)	1.137*** (0.080)
August	-0.134** (0.066)	-0.054 (0.067)	0.621*** (0.081)	0.641*** (0.082)
September	0.907*** (0.067)	0.971*** (0.068)	1.369*** (0.081)	1.386*** (0.083)
October	-0.206*** (0.068)	-0.109 (0.070)	0.152* (0.080)	0.161* (0.083)
November	-0.116* (0.064)	-0.111* (0.064)	0.803*** (0.087)	0.835*** (0.088)
Cumulative change in unemployment, current spell	-0.290*** (0.010)	-0.341*** (0.010)	-0.303*** (0.021)	-0.260*** (0.025)
Cumulative inflation, current spell	0.147*** (0.003)	0.149*** (0.003)	0.151*** (0.005)	0.148*** (0.006)
Cumulative growth in firm size	0.000 (0.001)	0.001 (0.001)	0.011*** (0.001)	0.012*** (0.001)
Size of previous change	-0.007*** (0.002)	-0.007*** (0.002)	-0.000 (0.002)	-0.003 (0.002)
Cumulative change in unemployment, last spell		-0.135*** (0.009)		-0.246*** (0.019)
Cumulative inflation, last spell		0.043*** (0.003)		0.049*** (0.005)
Change in current unemployment		0.212*** (0.028)		-0.046 (0.071)
Current inflation		-0.026*** (0.009)		0.022 (0.015)
$\hat{\lambda}$	1.539*** (0.059)	1.388*** (0.061)	1.924*** (0.099)	1.797*** (0.095)
Observations	1,857,579	1,823,028	1,316,273	1,290,809

Notes: The second-step of the Heckman model is estimated with ordinary least squares. The dependent variable, the size of wage increase or wage decrease, is computed as $100 \times \log(w_{ij,t}/w_{ij,t-1})$. The term $\hat{\lambda}$ is included to correct for sample selection. Firm size, industry, and occupation dummies are included in all specifications. Standard errors are in parenthesis. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.7: Heckman Model – Selection Equation: Probability of Wage Decrease

	1998-2010				1998-2007			
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	0.286*** (0.018)	0.004*** (0.000)	0.295*** (0.018)	0.004*** (0.000)	0.481*** (0.024)	0.006*** (0.000)	0.493*** (0.025)	0.006*** (0.000)
February	-0.124*** (0.021)	-0.002*** (0.000)	-0.172*** (0.022)	-0.002*** * (0.000)	-0.075** (0.031)	-0.001** (0.000)	-0.049 (0.032)	-0.001 (0.000)
March	-0.043** (0.019)	-0.001** (0.000)	-0.049** (0.020)	-0.001** (0.000)	0.037 (0.027)	0.000 (0.000)	0.010 (0.028)	0.000 (0.000)
April	-0.007 (0.019)	-0.000 (0.000)	0.059*** (0.020)	0.001*** (0.000)	0.098*** (0.026)	0.001*** (0.000)	0.139*** (0.027)	0.002*** (0.000)
May	0.002 (0.019)	0.000 (0.000)	0.120*** (0.020)	0.002*** (0.000)	0.159*** (0.026)	0.002*** (0.000)	0.217*** (0.028)	0.003*** (0.000)
June	0.038** (0.019)	0.001** (0.000)	0.150*** (0.020)	0.002*** (0.000)	0.250*** (0.025)	0.003*** (0.000)	0.304*** (0.027)	0.004*** (0.000)
July	-0.008 (0.019)	-0.000 (0.000)	0.108*** (0.020)	0.002*** (0.000)	0.201*** (0.025)	0.002*** (0.000)	0.269*** (0.028)	0.003*** (0.000)
August	0.008 (0.019)	0.000 (0.000)	0.054*** (0.020)	0.001*** (0.000)	0.107*** (0.026)	0.001*** (0.000)	0.132*** (0.027)	0.002*** (0.000)
September	0.155*** (0.018)	0.002*** (0.000)	0.220*** (0.019)	0.003*** (0.000)	0.273*** (0.025)	0.003*** (0.000)	0.299*** (0.026)	0.003*** (0.000)
October	0.294*** (0.018)	0.004*** (0.000)	0.418*** (0.019)	0.006*** (0.000)	0.491*** (0.024)	0.006*** (0.000)	0.576*** (0.026)	0.007*** (0.000)
November	0.282*** (0.018)	0.004*** (0.000)	0.348*** (0.018)	0.005*** (0.000)	0.283*** (0.025)	0.003*** (0.000)	0.332*** (0.026)	0.004*** (0.000)
Cumulative change in unemployment, current spell	0.012*** (0.003)	0.000*** (0.000)	-0.012*** (0.003)	-0.000*** (0.000)	-0.121*** (0.009)	-0.001*** (0.000)	-0.089*** (0.011)	-0.001*** (0.000)
Cumulative inflation, current spell	0.010*** (0.001)	0.000*** (0.000)	0.013*** (0.001)	0.000*** (0.000)	-0.018*** (0.003)	-0.000*** (0.000)	-0.009*** (0.003)	-0.000*** (0.000)
Cumulative growth in firm size	-0.002*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.000*** (0.000)	-0.002*** (0.000)	-0.000*** (0.000)
Size of previous change	0.007*** (0.001)	0.000*** (0.000)	0.007*** (0.001)	0.000*** (0.000)	0.008*** (0.001)	0.000*** (0.000)	0.007*** (0.001)	0.000*** (0.000)
Cumulative change in unemployment, last spell			-0.004 (0.003)	-0.000 (0.000)			-0.037*** (0.007)	-0.000*** (0.000)
Cumulative inflation, last spell			-0.009*** (0.001)	-0.000*** (0.000)			-0.025*** (0.002)	-0.000*** (0.000)
Change in current unemployment			0.192*** (0.008)	0.003*** (0.000)			0.046 (0.030)	0.001 (0.000)
Current inflation			-0.072*** (0.005)	-0.001*** (0.000)			-0.075*** (0.009)	-0.001*** (0.000)
Duration dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
μ	-2.462*** (0.042)		-2.527*** (0.043)		-2.427*** (0.055)		-2.523*** (0.057)	
ρ	-0.478		-0.427		-0.294		-0.305	
σ^2	7.486		7.227		7.059		7.002	
Observations	1,858,460	1,858,460	1,823,874	1,823,874	1,317,005	1,317,005	1,291,515	1,291,515

Notes: The selection equation of the Heckman model is estimated by maximum likelihood. Standard errors are in parenthesis. Firm size, industry, and occupation dummies are included in all specifications. Marginal effects on probability of wage increase of one unit are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.8: Heckman Model – Outcome Equation: Size of Wage Decrease

	1998-2010		1998-2007	
January	-1.140*** (0.379)	-0.957** (0.380)	-2.453*** (0.539)	-2.372*** (0.553)
February	0.506 (0.421)	0.349 (0.436)	-1.646*** (0.617)	-1.778*** (0.639)
March	1.108*** (0.372)	1.297*** (0.385)	-0.086 (0.514)	0.136 (0.538)
April	-0.414 (0.361)	-0.342 (0.382)	-1.727*** (0.505)	-1.747*** (0.529)
May	0.436 (0.363)	0.355 (0.395)	-0.235 (0.504)	-0.390 (0.538)
June	-1.021*** (0.356)	-0.917** (0.392)	-2.087*** (0.500)	-2.030*** (0.531)
July	0.099 (0.365)	0.120 (0.401)	-1.439*** (0.504)	-1.471*** (0.546)
August	0.993*** (0.364)	1.072*** (0.392)	-0.810 (0.509)	-0.880* (0.534)
September	-0.826** (0.364)	-0.695* (0.396)	-1.793*** (0.506)	-1.869*** (0.528)
October	-1.640*** (0.393)	-1.652*** (0.444)	-2.526*** (0.548)	-2.744*** (0.593)
November	-1.413*** (0.376)	-1.351*** (0.396)	-1.774*** (0.506)	-1.943*** (0.528)
Cumulative change in unemployment, current spell	-0.007 (0.054)	0.016 (0.060)	-0.208 (0.178)	-0.289 (0.192)
Cumulative inflation, current spell	-0.064*** (0.017)	-0.080*** (0.018)	0.004 (0.042)	-0.020 (0.042)
Cumulative growth in firm size	0.009** (0.004)	0.009** (0.004)	0.005 (0.005)	0.005 (0.005)
Size of previous change	-0.205*** (0.012)	-0.203*** (0.012)	-0.209*** (0.015)	-0.208*** (0.015)
Cumulative change in unemployment, last spell		-0.015 (0.057)		0.262* (0.137)
Cumulative inflation, last spell		0.017 (0.019)		0.040 (0.037)
Change in current unemployment		0.004 (0.207)		-0.021 (0.556)
Current inflation		0.123 (0.098)		0.110 (0.157)
$\hat{\lambda}$	-3.580*** (0.746)	-3.086*** (0.681)	-2.074*** (0.668)	-2.134*** (0.654)
Observations	1,858,460	1,823,874	1,317,005	1,291,515

Notes: The second-step of the Heckman model is estimated with ordinary least squares. The dependent variable, the size of wage increase or wage decrease, is computed as $100 \times \log(w_{ij,t}/w_{ij,t-1})$. The term $\hat{\lambda}$ is included to correct for sample selection. Firm size, industry, and occupation dummies are included in all specifications. Standard errors are in parenthesis. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

D Supplementary Figures and Tables

List of supplementary Figures and Tables:

- Figure A.6: Distributions of size of nominal wage changes, October 2008 – June 2009
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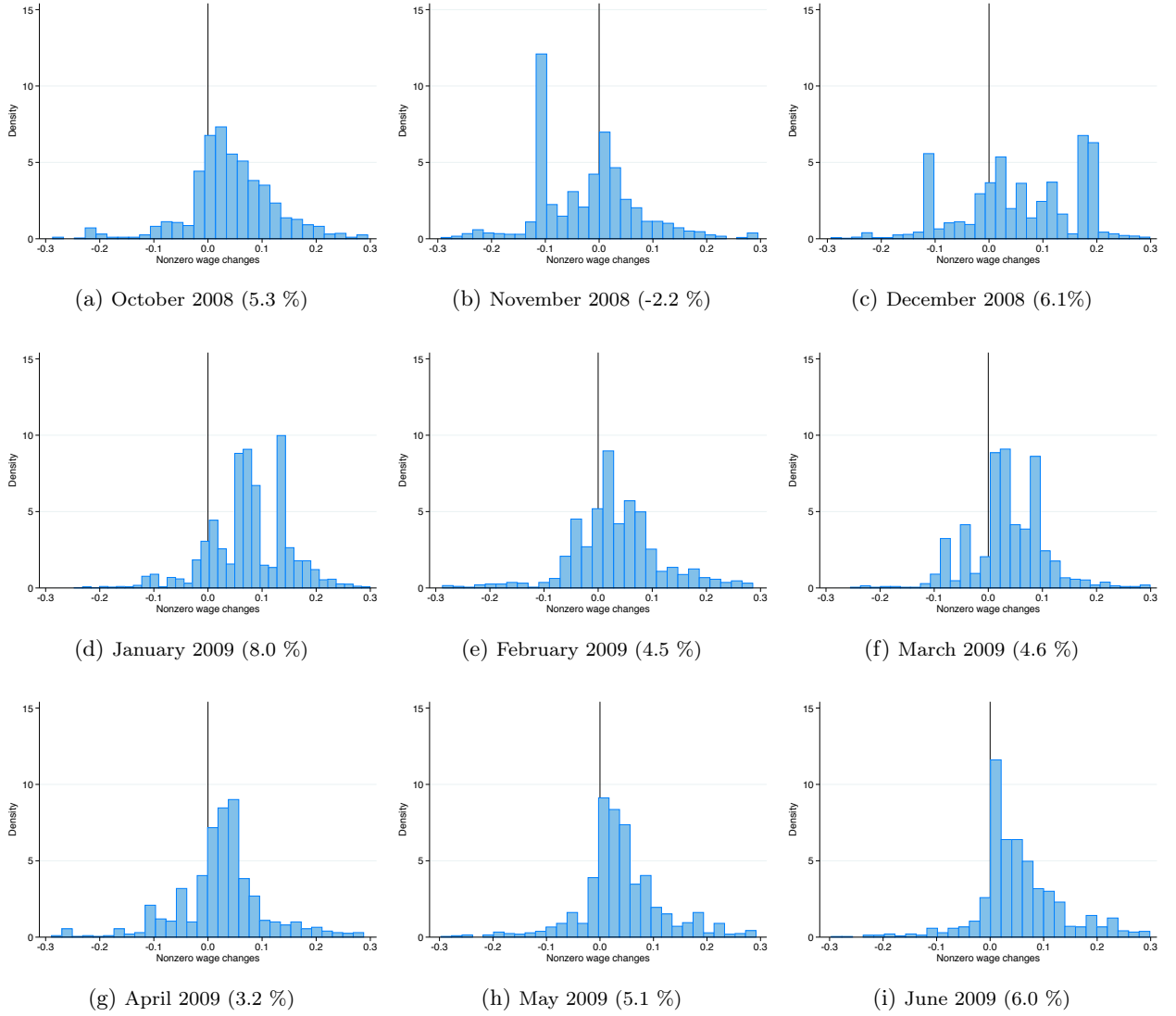


Figure A.6: Distribution of Non-Zero Nominal Wage Changes. *Note:* Average monthly size of change is reported in parenthesis.



Figure A.7: Frequency of Increases and Decreases of Regular Wages by Month



Figure A.8: Frequency of Increases and Decreases of Base Wages, Excluding Union Settlements, by Month

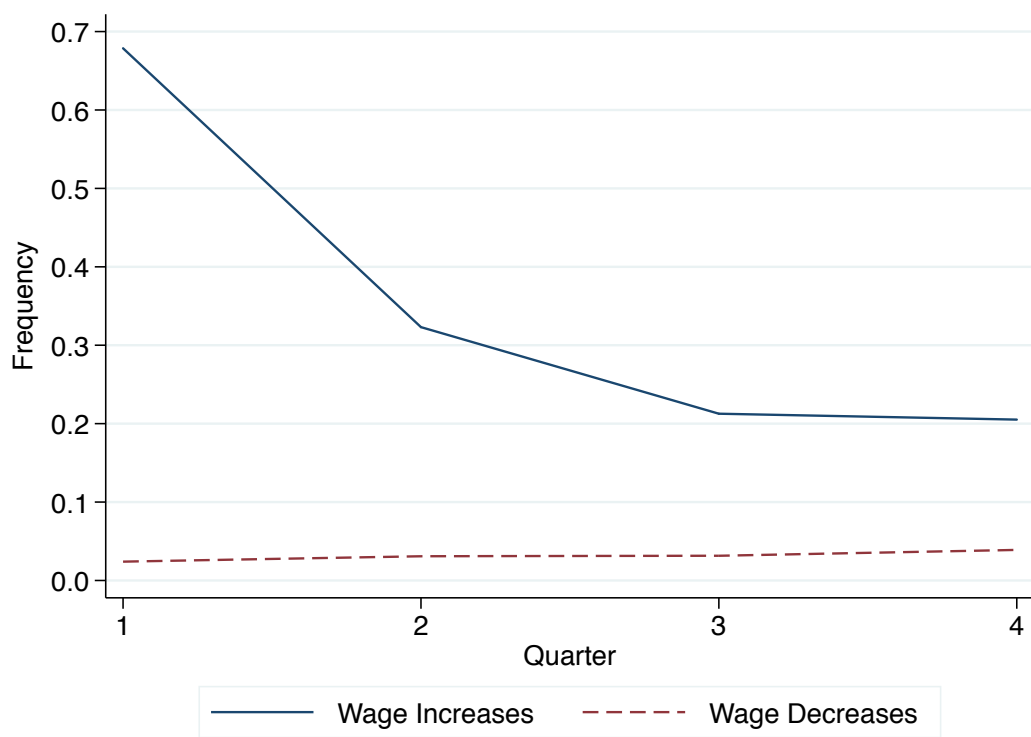


Figure A.9: Frequency of Increases and Decreases of Base Wages, by Quarter (Aggregated Data)

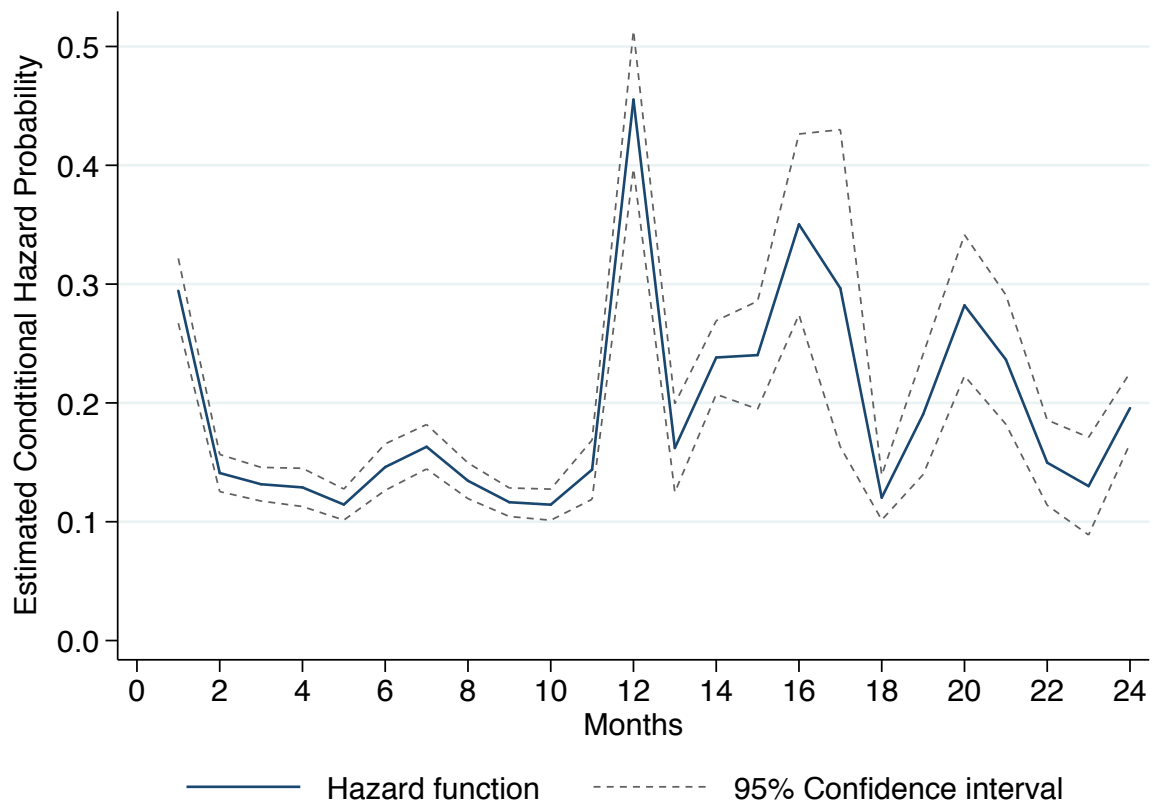


Figure A.10: Hazard Function of Wage Changes – Raw Dataset. *Notes:* Wage spells longer than 24 months are truncated and left-censored spells are dropped. Standard errors are clustered at the firm level.

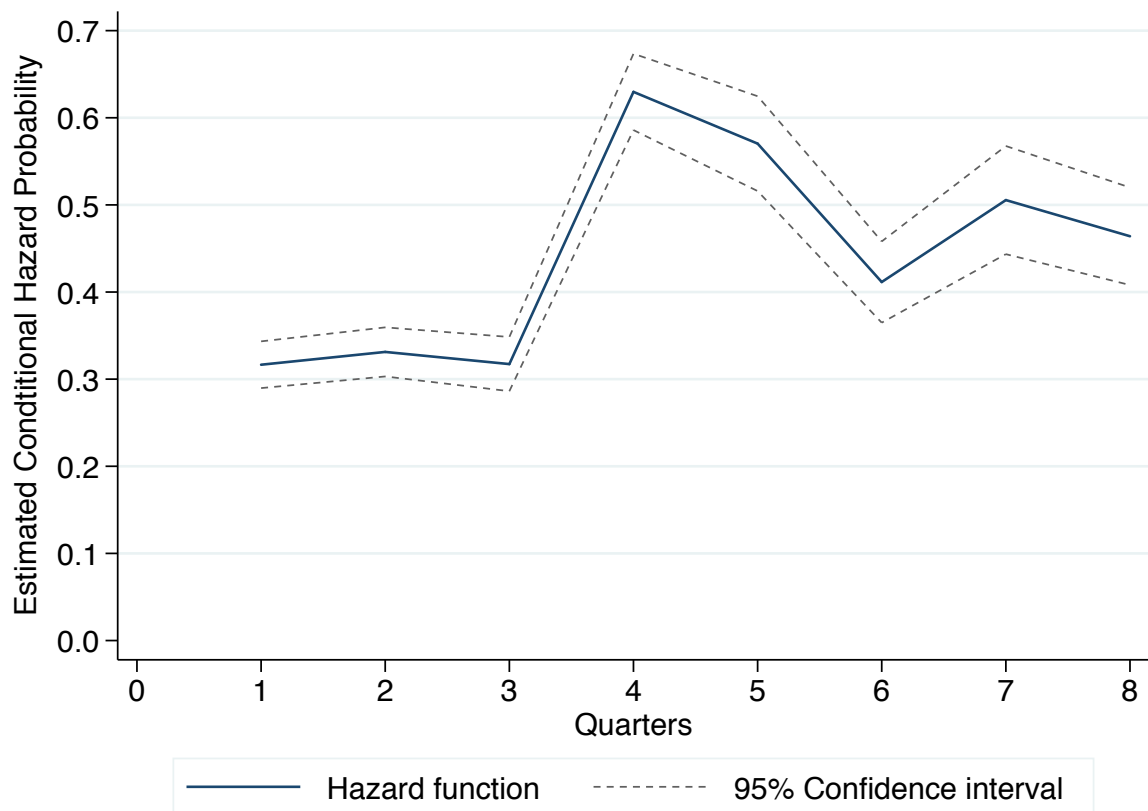


Figure A.11: Hazard Function of Wage Changes – Quarterly Data (Aggregated). *Notes:* Wage spells longer than 8 quarters are truncated and left-censored spells are dropped. Standard errors are clustered at the firm level.

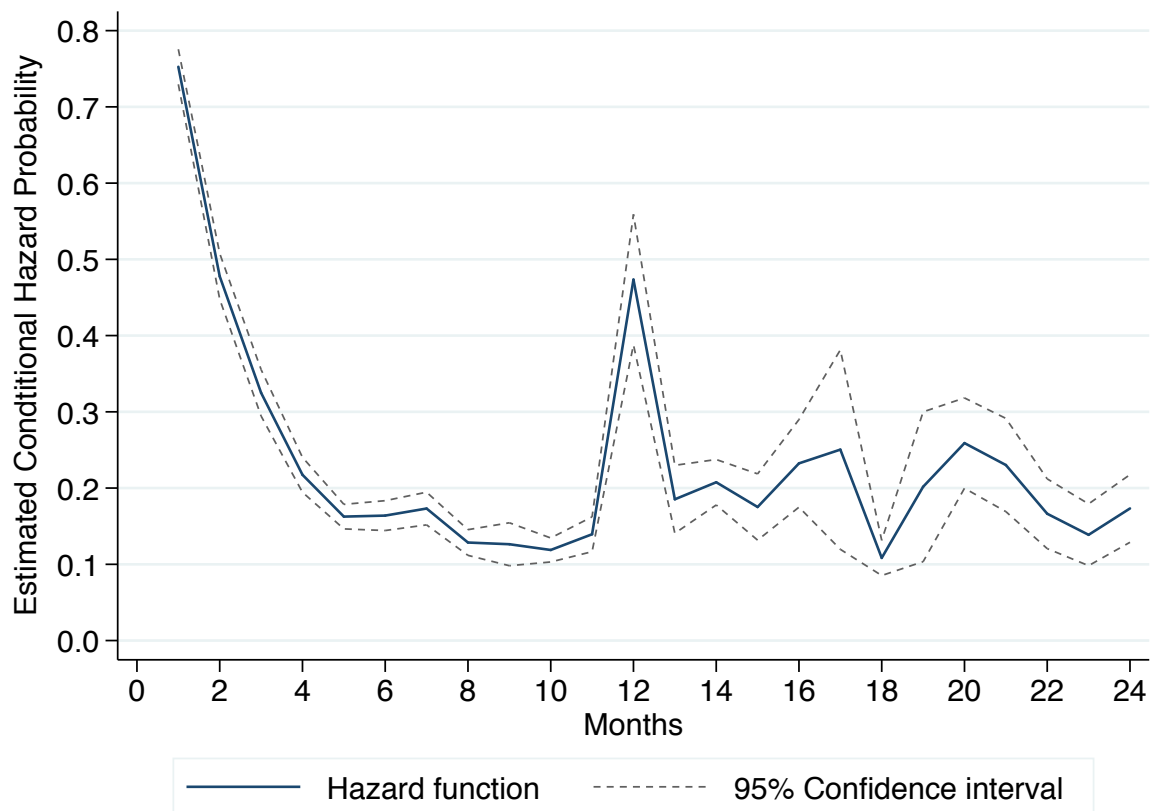
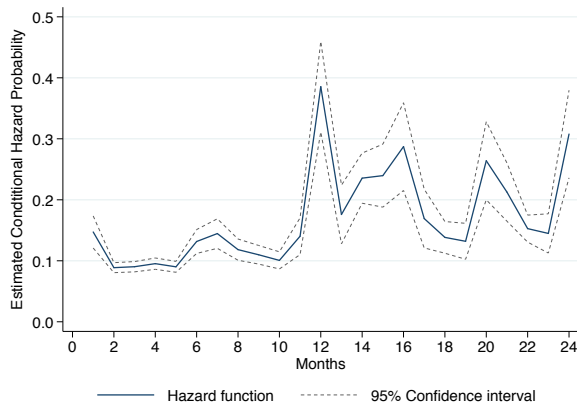
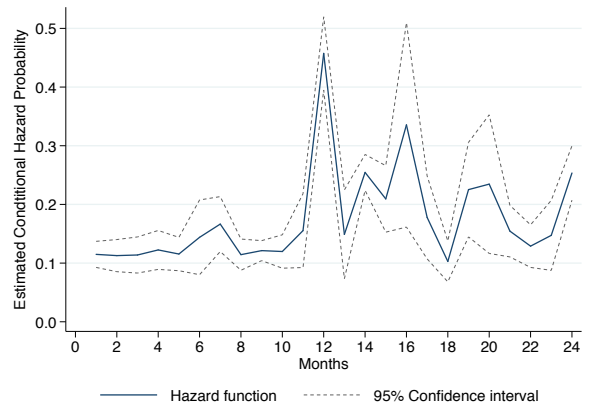


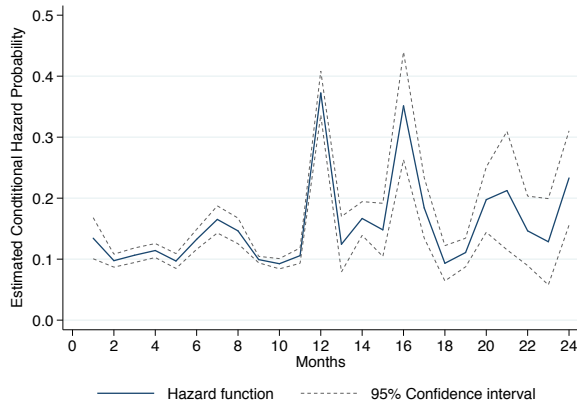
Figure A.12: Hazard Function of Wage Changes – Erroneous Base Wages. *Notes:* Wage spells longer than 24 months are truncated and left-censored spells are dropped. Standard errors are clustered at the firm level.



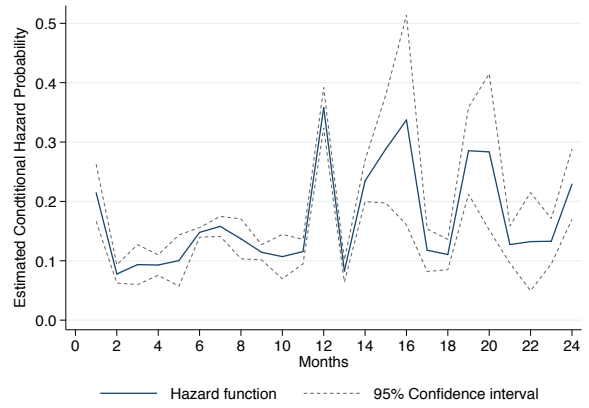
(a) Industrial Production



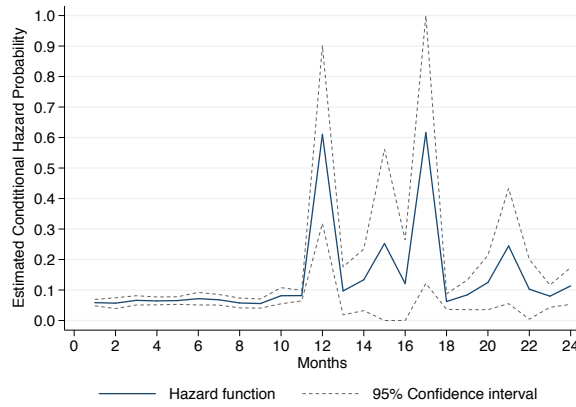
(b) Transport



(c) Trade and Repair Services

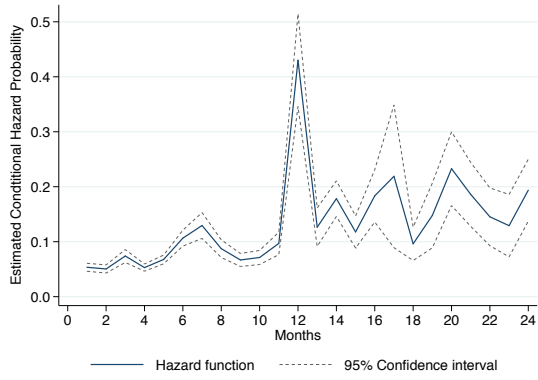


(d) Construction Industry

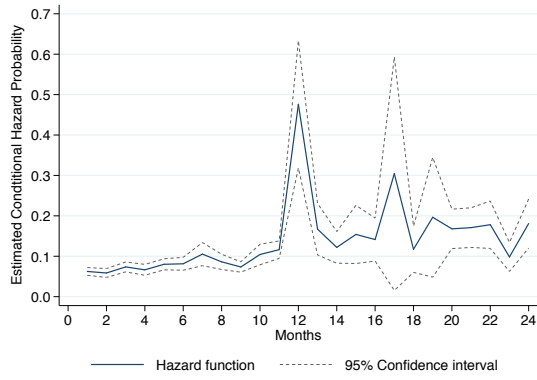


(e) Financial Services

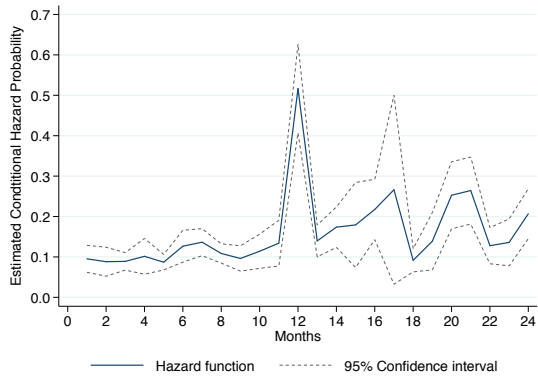
Figure A.13: Hazard Function of Wage Changes – By Sector. *Notes:* Wage spells longer than 24 months are truncated and left-censored spells are dropped. Standard errors are clustered at the firm level.



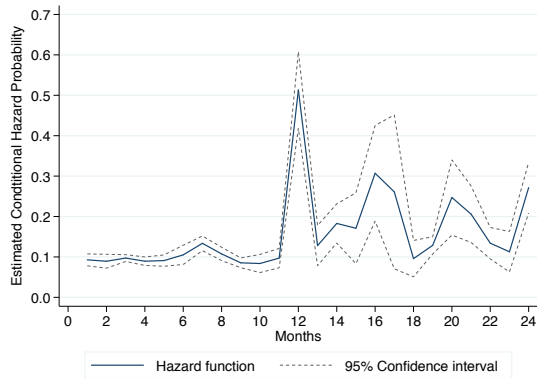
(a) Managers



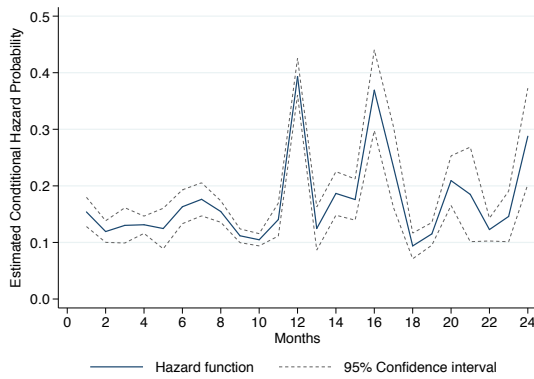
(b) Specialists



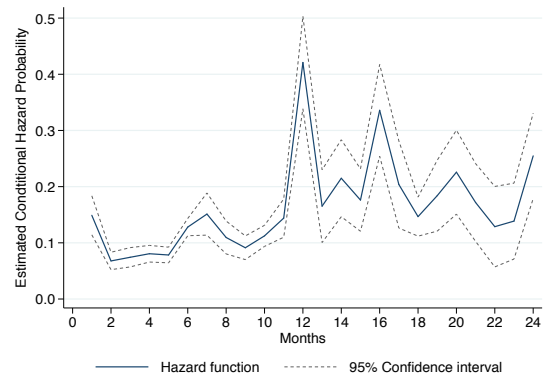
(c) Technicians



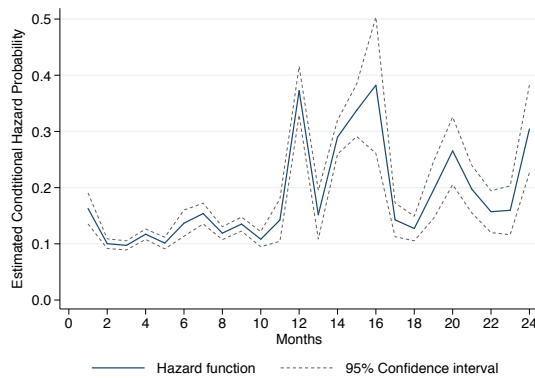
(d) Office Personnel



(e) Services, Sales, and Support



(f) Craftsmen and Production



(g) Blue-collar workers

Figure A.14: Hazard Function of Wage Changes – By Occupation. *Notes:* Wage spells longer than 24 months are truncated and left-censored spells are dropped. Standard errors are clustered at the firm level.

Table A.9: Wage Index and Union Wage Contracts

	Wage Index	Negotiated Wage Increases
1997-2000	6.1	4.2
2000-2004	8.4	3.2
2004-2008	9.1	2.9
2008-2011	3.3	3.4

Notes: Numbers are average percentage changes per year.

Source: Statistics Iceland, Central Bank of Iceland.

Table A.10: Probit Estimates of the Probability of Wage Increase 1998-2007

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	2.274*** (0.078)	0.383*** (0.009)	2.280*** (0.082)	0.377*** (0.009)	2.283*** (0.085)	0.375*** (0.009)	2.280*** (0.085)	0.375*** (0.009)
February	0.357*** (0.075)	0.060*** (0.012)	0.148* (0.080)	0.025* (0.013)	0.140* (0.077)	0.023* (0.013)	0.131* (0.077)	0.022* (0.013)
March	0.241*** (0.072)	0.041*** (0.011)	0.159** (0.071)	0.026** (0.011)	0.166** (0.073)	0.027** (0.011)	0.177** (0.076)	0.029** (0.012)
April	0.374*** (0.059)	0.063*** (0.009)	0.346*** (0.049)	0.057*** (0.007)	0.356*** (0.052)	0.059*** (0.007)	0.375*** (0.055)	0.062*** (0.008)
May	0.496*** (0.061)	0.084*** (0.009)	0.496*** (0.060)	0.082*** (0.009)	0.507*** (0.061)	0.083*** (0.009)	0.533*** (0.066)	0.088*** (0.010)
June	0.327*** (0.051)	0.055*** (0.008)	0.289*** (0.057)	0.048*** (0.009)	0.305*** (0.056)	0.050*** (0.009)	0.326*** (0.058)	0.054*** (0.009)
July	0.346*** (0.054)	0.058*** (0.009)	0.270*** (0.053)	0.045*** (0.009)	0.288*** (0.051)	0.047*** (0.009)	0.314*** (0.049)	0.052*** (0.008)
August	0.040 (0.075)	0.007 (0.012)	-0.004 (0.070)	-0.001 (0.012)	0.001 (0.073)	0.000 (0.012)	0.015 (0.077)	0.002 (0.013)
September	0.082 (0.076)	0.014 (0.013)	0.053 (0.075)	0.009 (0.012)	0.059 (0.078)	0.010 (0.013)	0.073 (0.081)	0.012 (0.013)
October	0.128 (0.079)	0.022* (0.013)	0.128 (0.080)	0.021* (0.013)	0.141* (0.084)	0.023* (0.013)	0.169* (0.092)	0.028* (0.015)
November	-0.074 (0.056)	-0.012 (0.010)	-0.089 (0.057)	-0.015 (0.010)	-0.082 (0.058)	-0.013 (0.010)	-0.076 (0.060)	-0.013 (0.010)
Cumulative change in unemployment, current spell	-0.035*** (0.011)	-0.006*** (0.002)	-0.034*** (0.012)	-0.006*** (0.002)	-0.009 (0.013)	-0.002 (0.002)	-0.025** (0.013)	-0.004** (0.002)
Cumulative inflation, current spell	0.049*** (0.006)	0.008*** (0.001)	0.037*** (0.007)	0.006*** (0.001)	0.031*** (0.007)	0.005*** (0.001)	0.032*** (0.008)	0.005*** (0.001)
Cumulative growth in firm size	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)
Size of previous change	-0.002 (0.002)	-0.000 (0.000)	-0.002 (0.002)	-0.000 (0.000)	-0.002 (0.002)	-0.000 (0.000)	-0.002 (0.002)	-0.000 (0.000)
Cumulative change in unemployment, last spell					-0.087*** (0.021)	-0.014*** (0.003)	-0.086*** (0.021)	-0.014*** (0.003)
Cumulative inflation, last spell					0.009*** (0.003)	0.002*** (0.000)	0.010*** (0.003)	0.002*** (0.000)
Change in current unemployment							0.088** (0.041)	0.014** (0.006)
Current inflation							-0.009 (0.010)	-0.001 (0.002)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-378,588		-374,370		-365,242		-365,190	
Observations	1,316,332	1,316,332	1,316,332	1,316,332	1,290,982	1,290,982	1,290,982	1,290,982

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.11: Probit Estimates of the Probability of Wage Decrease 1998-2007

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	0.469*** (0.098)	0.006*** (0.001)	0.476*** (0.112)	0.006*** (0.001)	0.483*** (0.113)	0.006*** (0.001)	0.488*** (0.110)	0.006*** (0.001)
February	-0.087* (0.052)	-0.001* (0.001)	-0.085 (0.062)	-0.001 (0.001)	-0.063 (0.062)	-0.001 (0.001)	-0.062 (0.061)	-0.001 (0.001)
March	0.184*** (0.055)	0.002*** (0.001)	0.034 (0.055)	0.000 (0.001)	0.005 (0.061)	0.000 (0.001)	0.007 (0.058)	0.000 (0.001)
April	0.233*** (0.042)	0.003*** (0.001)	0.094** (0.048)	0.001* (0.001)	0.092* (0.052)	0.001* (0.001)	0.137*** (0.044)	0.002*** (0.001)
May	0.210*** (0.047)	0.003*** (0.001)	0.145** (0.061)	0.002** (0.001)	0.160** (0.066)	0.002** (0.001)	0.207*** (0.060)	0.002*** (0.001)
June	0.267*** (0.046)	0.003*** (0.001)	0.245*** (0.050)	0.003*** (0.001)	0.262*** (0.052)	0.003*** (0.001)	0.301*** (0.054)	0.003*** (0.001)
July	0.244*** (0.057)	0.003*** (0.001)	0.196*** (0.063)	0.002*** (0.001)	0.217*** (0.063)	0.003*** (0.001)	0.268*** (0.067)	0.003*** (0.001)
August	0.142*** (0.050)	0.002*** (0.001)	0.102* (0.053)	0.001* (0.001)	0.120** (0.051)	0.001** (0.001)	0.128** (0.055)	0.001** (0.001)
September	0.297*** (0.054)	0.004*** (0.001)	0.265*** (0.056)	0.003*** (0.001)	0.291*** (0.059)	0.003*** (0.001)	0.291*** (0.067)	0.003*** (0.001)
October	0.477*** (0.166)	0.006*** (0.002)	0.486*** (0.172)	0.006*** (0.002)	0.521*** (0.178)	0.006*** (0.002)	0.574*** (0.197)	0.007*** (0.002)
November	0.279*** (0.054)	0.004*** (0.001)	0.279*** (0.056)	0.003*** (0.001)	0.301*** (0.058)	0.004*** (0.001)	0.330*** (0.058)	0.004*** (0.001)
Cumulative change in unemployment, current spell	-0.101*** (0.028)	-0.001*** (0.000)	-0.119*** (0.029)	-0.001*** (0.000)	-0.075** (0.032)	-0.001** (0.000)	-0.088*** (0.030)	-0.001*** (0.000)
Cumulative inflation, current spell	-0.035*** (0.011)	-0.000*** (0.000)	-0.017** (0.009)	-0.000** (0.000)	-0.020** (0.010)	-0.000** (0.000)	-0.009 (0.011)	-0.000 (0.000)
Cumulative growth in firm size	-0.002 (0.001)	-0.000* (0.000)	-0.002* (0.001)	-0.000* (0.000)	-0.002* (0.001)	-0.000* (0.000)	-0.002* (0.001)	-0.000* (0.000)
Size of last change	0.010*** (0.002)	0.000*** (0.000)	0.008*** (0.002)	0.000*** (0.000)	0.007*** (0.002)	0.000*** (0.000)	0.007*** (0.002)	0.000*** (0.000)
Cumulative change in unemployment, last spell					-0.037** (0.017)	-0.000** (0.000)	-0.037** (0.017)	-0.000** (0.000)
Cumulative inflation, last spell					-0.025*** (0.009)	-0.000*** (0.000)	-0.025*** (0.009)	-0.000*** (0.000)
Change in current unemployment							0.055 (0.110)	0.001 (0.001)
Current inflation							-0.078*** (0.027)	-0.001*** (0.000)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-43,754		-43,306		-41,438		-41,393	
Observations	1,317,063	1,317,063	1,317,063	1,317,063	1,291,687	1,291,687	1,291,687	1,291,687

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.12: Probit Estimates of the Probability of Wage Increase, Including Monetary Policy Interest Rate (April 2001 – December 2010)

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	1.666*** (0.082)	0.285*** (0.011)	1.638*** (0.081)	0.271*** (0.010)	1.641*** (0.083)	0.271*** (0.010)	1.660*** (0.083)	0.273*** (0.010)
February	0.225*** (0.063)	0.038*** (0.010)	0.102* (0.059)	0.017* (0.010)	0.109* (0.060)	0.018* (0.010)	0.152** (0.061)	0.025*** (0.010)
March	0.391*** (0.066)	0.067*** (0.011)	0.429*** (0.070)	0.071*** (0.010)	0.446*** (0.072)	0.074*** (0.011)	0.439*** (0.072)	0.072*** (0.011)
April	0.264*** (0.068)	0.045*** (0.011)	0.292*** (0.066)	0.048*** (0.010)	0.305*** (0.067)	0.050*** (0.010)	0.262*** (0.065)	0.043*** (0.010)
May	0.263*** (0.048)	0.045*** (0.008)	0.281*** (0.046)	0.047*** (0.007)	0.290*** (0.048)	0.048*** (0.007)	0.231*** (0.047)	0.038*** (0.007)
June	0.535*** (0.061)	0.092*** (0.009)	0.613*** (0.064)	0.102*** (0.009)	0.621*** (0.065)	0.103*** (0.009)	0.581*** (0.060)	0.096*** (0.008)
July	0.299*** (0.055)	0.051*** (0.009)	0.296*** (0.052)	0.049*** (0.008)	0.297*** (0.054)	0.049*** (0.009)	0.245*** (0.050)	0.040*** (0.008)
August	-0.070 (0.070)	-0.012 (0.012)	-0.123* (0.065)	-0.020* (0.011)	-0.123* (0.067)	-0.020* (0.012)	-0.150** (0.063)	-0.025** (0.011)
September	-0.097 (0.060)	-0.017 (0.011)	-0.073 (0.061)	-0.012 (0.010)	-0.075 (0.062)	-0.012 (0.011)	-0.102* (0.059)	-0.017* (0.010)
October	-0.190*** (0.056)	-0.033*** (0.010)	-0.162*** (0.062)	-0.027** (0.011)	-0.162*** (0.062)	-0.027** (0.011)	-0.220*** (0.059)	-0.036*** (0.010)
November	0.223*** (0.063)	0.038*** (0.010)	0.316*** (0.069)	0.052*** (0.010)	0.318*** (0.071)	0.053*** (0.011)	0.318*** (0.069)	0.052*** (0.010)
Cumulative change in unemployment, current spell	-0.130*** (0.013)	-0.022*** (0.002)	-0.132*** (0.012)	-0.022*** (0.002)	-0.143*** (0.015)	-0.024*** (0.002)	-0.113*** (0.014)	-0.019*** (0.002)
Cumulative inflation, current spell	0.048*** (0.005)	0.008*** (0.001)	0.024*** (0.004)	0.004*** (0.001)	0.026*** (0.004)	0.004*** (0.001)	0.020*** (0.004)	0.003*** (0.001)
Cumulative change in mp interest rate, current spell	-0.063*** (0.007)	-0.011*** (0.001)	-0.041*** (0.007)	-0.007*** (0.001)	-0.048*** (0.006)	-0.008*** (0.001)	-0.049*** (0.007)	-0.008*** (0.001)
Cumulative growth in firm size	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)
Size of last change	-0.008*** (0.002)	-0.001*** (0.000)	-0.006*** (0.002)	-0.001*** (0.000)	-0.006*** (0.002)	-0.001*** (0.000)	-0.006*** (0.002)	-0.001*** (0.000)
Cumulative change in unemployment, last spell					-0.035*** (0.008)	-0.006*** (0.001)	-0.029*** (0.008)	-0.005*** (0.001)
Cumulative inflation, last spell					0.014*** (0.002)	0.002*** (0.000)	0.013*** (0.002)	0.002*** (0.000)
Cumulative change in mp interest rate, current spell					-0.007 (0.006)	-0.001 (0.001)	-0.004 (0.007)	-0.001 (0.001)
Change in current Unemployment							-0.154*** (0.030)	-0.025*** (0.005)
Current inflation							0.023*** (0.008)	0.004*** (0.001)
Change in current mp interest rate							0.001*** (0.000)	0.000*** (0.000)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-500,800		-489,250		-479,526		-477,706	
Observations	1,595,400	1,595,400	1,595,400	1,595,400	1,568,449	1,568,449	1,568,449	1,568,449

Notes: The probit model is estimated by maximum likelihood. “mp interest rate” refers to the Central Bank of Iceland’s monetary policy interest rate. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.13: Probit Estimates of the Probability of Wage Increase – Quarterly Data (1998-2010)

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
First quarter	1.288*** (0.069)	0.457*** (0.024)	1.239*** (0.057)	0.438*** (0.020)	1.278*** (0.059)	0.449*** (0.020)	1.424*** (0.051)	0.500*** (0.016)
Second quarter	0.427*** (0.034)	0.152*** (0.013)	0.442*** (0.038)	0.156*** (0.014)	0.493*** (0.042)	0.173*** (0.016)	0.630*** (0.042)	0.221*** (0.016)
Third quarter	0.071*** (0.026)	0.025*** (0.009)	0.069** (0.030)	0.025** (0.011)	0.065* (0.034)	0.023* (0.012)	0.166*** (0.030)	0.058*** (0.011)
Cumulative change in unemployment, current spell	-0.057*** (0.011)	-0.020*** (0.004)	-0.065*** (0.012)	-0.023*** (0.004)	-0.037*** (0.012)	-0.013*** (0.004)	0.033* (0.018)	0.012* (0.006)
Cumulative inflation, current spell	0.029*** (0.004)	0.010*** (0.001)	-0.015*** (0.004)	-0.005*** (0.001)	-0.014*** (0.004)	-0.005*** (0.002)	-0.027*** (0.006)	-0.010*** (0.002)
Cumulative growth in firm size	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.001)
Size of last change	-0.013*** (0.001)	-0.005*** (0.000)	-0.013*** (0.001)	-0.004*** (0.000)	-0.014*** (0.001)	-0.005*** (0.001)	-0.013*** (0.001)	-0.005*** (0.001)
Cumulative change in unemployment, last spell					0.105*** (0.011)	0.037*** (0.004)	0.112*** (0.012)	0.039*** (0.004)
Cumulative inflation, last spell					-0.005** (0.002)	-0.002** (0.001)	-0.008*** (0.002)	-0.003*** (0.001)
Change in current unemployment							-0.118*** (0.027)	-0.041*** (0.009)
Current inflation							0.030*** (0.008)	0.011*** (0.003)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-370,625		-360,572		-275,937		-275,186	
Observations	671,511	671,511	671,511	671,511	521,979	521,979	521,979	521,979

Notes: The probit model is estimated by maximum likelihood. Quarterly data is constructed from the original monthly data by representing average monthly wages in the quarter with wages in the last month in the quarter. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that quarterly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.14: Probit Estimates of the Probability of Wage Decrease – Quarterly Data (1998-2010)

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
First quarter	-0.211*** (0.069)	-0.013*** (0.004)	-0.199*** (0.072)	-0.012*** (0.004)	-0.228*** (0.086)	-0.013*** (0.005)	-0.321*** (0.079)	-0.018*** (0.005)
Second quarter	-0.157* (0.081)	-0.010* (0.005)	-0.316*** (0.076)	-0.019*** (0.005)	-0.337*** (0.079)	-0.019*** (0.005)	-0.420*** (0.075)	-0.024*** (0.005)
Third quarter	-0.087 (0.056)	-0.006 (0.004)	-0.198*** (0.066)	-0.012*** (0.004)	-0.295*** (0.070)	-0.017*** (0.004)	-0.349*** (0.070)	-0.020*** (0.004)
Cumulative change in unemployment, current spell	-0.027** (0.014)	-0.002** (0.001)	-0.011 (0.013)	-0.001 (0.001)	0.007 (0.016)	0.000 (0.001)	-0.066*** (0.022)	-0.004*** (0.001)
Cumulative inflation, current spell	-0.013** (0.006)	-0.001** (0.000)	0.013** (0.006)	0.001** (0.000)	0.013** (0.006)	0.001** (0.000)	0.031*** (0.009)	0.002*** (0.001)
Cumulative growth in firm size	-0.001 (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.000)
Size of last change	0.011*** (0.002)	0.001*** (0.000)	0.009*** (0.002)	0.001*** (0.000)	0.012*** (0.002)	0.001*** (0.000)	0.012*** (0.002)	0.001*** (0.000)
Cumulative change in unemployment, last spell					0.020 (0.014)	0.001 (0.001)	0.014 (0.015)	0.001 (0.001)
Cumulative inflation, last spell					-0.029*** (0.003)	-0.002*** (0.000)	-0.027*** (0.003)	-0.002*** (0.000)
Change in current unemployment							0.104*** (0.020)	0.006*** (0.001)
Current inflation							-0.034*** (0.009)	-0.002*** (0.001)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.013		0.001		0.022		0.026	
Log pseudolikelihood	-91,401		-89,030		-69,092		-68,917	
Observations	671,511	671,511	671,511	671,511	521,979	521,979	521,979	521,979

Notes: The probit model is estimated by maximum likelihood. Quarterly data is constructed from the original monthly data by representing average monthly wages in the quarter with wages in the last month in the quarter. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that quarterly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.15: Probit Estimates of the Probability of Wage Increase – Erroneous Measure of Base Wages

	(1)		(2)		(3)		(4)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January	0.965*** (0.077)	0.343*** (0.025)	0.972*** (0.074)	0.341*** (0.025)	0.956*** (0.075)	0.334*** (0.025)	0.954*** (0.075)	0.333*** (0.025)
February	-0.058 (0.039)	-0.021 (0.014)	-0.169*** (0.042)	-0.059*** (0.014)	-0.186*** (0.041)	-0.065*** (0.014)	-0.186*** (0.041)	-0.065*** (0.014)
March	0.005 (0.032)	0.002 (0.011)	-0.024 (0.032)	-0.009 (0.011)	-0.039 (0.031)	-0.014 (0.011)	-0.041 (0.030)	-0.014 (0.011)
April	0.044 (0.031)	0.016 (0.011)	0.040 (0.030)	0.014 (0.011)	0.023 (0.031)	0.008 (0.011)	0.018 (0.030)	0.006 (0.011)
May	0.086*** (0.028)	0.031*** (0.010)	0.070** (0.030)	0.025** (0.011)	0.059* (0.031)	0.020* (0.011)	0.051* (0.031)	0.018* (0.011)
June	0.244*** (0.031)	0.087*** (0.011)	0.230*** (0.036)	0.081*** (0.012)	0.228*** (0.035)	0.080*** (0.012)	0.223*** (0.034)	0.078*** (0.012)
July	0.158*** (0.037)	0.056*** (0.013)	0.107*** (0.041)	0.037*** (0.014)	0.111*** (0.041)	0.039*** (0.014)	0.106*** (0.040)	0.037*** (0.014)
August	-0.012 (0.027)	-0.004 (0.010)	-0.033 (0.028)	-0.012 (0.010)	-0.032 (0.027)	-0.011 (0.010)	-0.029 (0.027)	-0.010 (0.009)
September	-0.154*** (0.026)	-0.055*** (0.009)	-0.146*** (0.026)	-0.051*** (0.009)	-0.164*** (0.026)	-0.057*** (0.009)	-0.162*** (0.025)	-0.057*** (0.009)
October	-0.052* (0.031)	-0.018* (0.011)	-0.075** (0.032)	-0.026** (0.011)	-0.092*** (0.033)	-0.032*** (0.011)	-0.098*** (0.032)	-0.034*** (0.011)
November	0.039 (0.029)	0.014 (0.010)	0.021 (0.031)	0.007 (0.011)	0.015 (0.032)	0.005 (0.011)	0.010 (0.031)	0.004 (0.011)
Cumulative change in unemployment, current spell	-0.032*** (0.010)	-0.011*** (0.004)	-0.079*** (0.009)	-0.028*** (0.003)	-0.068*** (0.007)	-0.024*** (0.003)	-0.062*** (0.008)	-0.022*** (0.003)
Cumulative inflation, current spell	-0.043*** (0.005)	-0.015*** (0.002)	0.008** (0.004)	0.003** (0.001)	0.006 (0.004)	0.002 (0.001)	-0.004 (0.004)	-0.001 (0.001)
Cumulative change in firm size	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)
Size of last change	-0.032*** (0.001)	-0.012*** (0.001)	-0.030*** (0.001)	-0.010*** (0.000)	-0.030*** (0.001)	-0.011*** (0.000)	-0.030*** (0.001)	-0.011*** (0.000)
Cumulative change in unemployment, last spell					0.005 (0.006)	0.002 (0.002)	0.004 (0.006)	0.001 (0.002)
Cumulative inflation, last spell					-0.028*** (0.004)	-0.010*** (0.001)	-0.028*** (0.004)	-0.010*** (0.001)
Change in current unemployment							-0.006 (0.012)	-0.002 (0.004)
Current inflation							0.023*** (0.004)	0.008*** (0.001)
Duration dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	0.000		0.000		0.000		0.000	
Log pseudolikelihood	-1,237,305		-1,191,020		-1,134,289		-1,134,093	
Observations	2,170,146	2,170,146	2,170,146	2,170,146	2,078,259	2,078,259	2,078,259	2,078,259

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. All specifications include variables controlling for age, age², experience, tenure, education, gender, foreign citizenship, as well as sets of firm size, industry, and occupation dummies. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. Complete estimation results are presented in Table A.8 in Online Appendix D. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.16: Probit Estimates of the Probability of Wage Increase

	(1)		(2)		(3)		(4)		(5)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January			1.686*** (0.069)	0.295*** (0.009)	1.676*** (0.068)	0.284*** (0.008)	1.683*** (0.070)	0.284*** (0.008)	1.691*** (0.071)	0.285*** (0.008)
February			0.238*** (0.054)	0.042*** (0.009)	0.122** (0.058)	0.021** (0.010)	0.124** (0.057)	0.021** (0.009)	0.161*** (0.059)	0.027*** (0.010)
March			0.327*** (0.051)	0.057*** (0.008)	0.353*** (0.054)	0.060*** (0.008)	0.366*** (0.057)	0.062*** (0.009)	0.347*** (0.057)	0.058*** (0.009)
April			0.283*** (0.057)	0.049*** (0.010)	0.292*** (0.057)	0.050*** (0.009)	0.301*** (0.059)	0.051*** (0.009)	0.246*** (0.058)	0.041*** (0.009)
May			0.335*** (0.043)	0.059*** (0.007)	0.345*** (0.044)	0.059*** (0.008)	0.351*** (0.045)	0.059*** (0.008)	0.260*** (0.044)	0.044*** (0.008)
June			0.557*** (0.055)	0.097*** (0.009)	0.611*** (0.056)	0.104*** (0.009)	0.621*** (0.056)	0.105*** (0.009)	0.517*** (0.051)	0.087*** (0.008)
July			0.297*** (0.050)	0.052*** (0.009)	0.297*** (0.049)	0.050*** (0.008)	0.306*** (0.049)	0.052*** (0.008)	0.198*** (0.047)	0.033*** (0.008)
August			-0.061 (0.056)	-0.011 (0.010)	-0.110** (0.049)	-0.019** (0.009)	-0.108** (0.051)	-0.018** (0.009)	-0.158*** (0.050)	-0.027*** (0.009)
September			-0.053 (0.052)	-0.009 (0.009)	-0.042 (0.051)	-0.007 (0.009)	-0.039 (0.053)	-0.007 (0.009)	-0.097* (0.051)	-0.016* (0.009)
October			-0.024 (0.056)	-0.004 (0.010)	0.006 (0.060)	0.001 (0.010)	0.008 (0.062)	0.001 (0.010)	-0.093 (0.061)	-0.016 (0.010)
November			0.236*** (0.059)	0.041*** (0.010)	0.309*** (0.063)	0.052*** (0.010)	0.312*** (0.065)	0.053*** (0.010)	0.281*** (0.064)	0.047*** (0.010)
Cumulative change in unemployment (current)	-0.089*** (0.009)	-0.017*** (0.002)	-0.093*** (0.008)	-0.017*** (0.001)	-0.098*** (0.009)	-0.017*** (0.001)	-0.102*** (0.010)	-0.017*** (0.001)	-0.080*** (0.009)	-0.013*** (0.001)
Cumulative inflation (current)	0.002 (0.003)	0.000 (0.001)	0.032*** (0.003)	0.006*** (0.000)	0.009*** (0.003)	0.001*** (0.000)	0.010*** (0.003)	0.002*** (0.000)	0.007** (0.003)	0.001*** (0.000)
Cumulative growth in firm size	0.000 (0.002)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)
Size of previous change	0.000 (0.001)	0.000 (0.000)	-0.007*** (0.001)	-0.001*** (0.000)	-0.004*** (0.001)	-0.001*** (0.000)	-0.005*** (0.001)	-0.001*** (0.000)	-0.005*** (0.001)	-0.001*** (0.000)
Cumulative change in unemployment (last)							-0.009 (0.008)	-0.002 (0.001)	-0.009 (0.009)	-0.002 (0.001)
Cumulative inflation (last)							0.011*** (0.002)	0.002*** (0.000)	0.011*** (0.002)	0.002*** (0.000)
Change in current unemployment									-0.207*** (0.029)	-0.035*** (0.005)
Current inflation									0.037*** (0.007)	0.006*** (0.001)
Age	-0.031*** (0.005)	-0.006*** (0.001)	-0.032*** (0.005)	-0.006*** (0.001)	-0.036*** (0.005)	-0.006*** (0.001)	-0.037*** (0.006)	-0.006*** (0.001)	-0.038*** (0.006)	-0.006*** (0.001)
Age ²	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Experience	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Tenure	-0.003*** (0.001)	-0.001*** (0.000)	-0.003*** (0.001)	-0.001*** (0.000)	-0.004*** (0.001)	-0.001*** (0.000)	-0.004*** (0.001)	-0.001*** (0.000)	-0.004*** (0.001)	-0.001*** (0.000)
Education	0.042*** (0.007)	0.008*** (0.001)	0.050*** (0.006)	0.009*** (0.001)	0.047*** (0.006)	0.008*** (0.001)	0.050*** (0.006)	0.008*** (0.001)	0.051*** (0.006)	0.009*** (0.001)
Gender	0.035** (0.007)	0.007** (0.001)	0.032** (0.006)	0.006** (0.001)	0.038** (0.006)	0.006** (0.001)	0.039** (0.006)	0.007** (0.001)	0.038** (0.006)	0.006** (0.001)

Probit Estimates of the Probability of Wage Increase (*Continued*)

	(1)		(2)		(3)		(4)		(5)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
Foreign	(0.015) 0.087***	(0.003) 0.017***	(0.014) 0.092***	(0.002) 0.016***	(0.016) 0.104***	(0.003) 0.018***	(0.016) 0.112***	(0.003) 0.019***	(0.016) 0.114***	(0.003) 0.019***
1 month	(0.025) -0.549***	(0.005) -0.105***	(0.024) (0.004)	(0.004) (0.004)	(0.025) -0.492***	(0.004) -0.083***	(0.026) -0.499***	(0.004) -0.084***	(0.026) -0.482***	(0.004) -0.081***
2 months	(0.041) -0.778***	(0.007) -0.149***			(0.047) -0.844***	(0.008) -0.143***	(0.049) -0.868***	(0.008) -0.147***	(0.051) -0.845***	(0.008) -0.142***
3 months	(0.043) -0.729***	(0.007) -0.139***			(0.055) -0.747***	(0.007) -0.127***	(0.060) -0.765***	(0.008) -0.129***	(0.057) -0.735***	(0.007) -0.124***
4 months	(0.033) -0.648***	(0.005) -0.124***			(0.038) -0.688***	(0.005) -0.117***	(0.041) -0.704***	(0.005) -0.119***	(0.038) -0.670***	(0.005) -0.113***
5 months	(0.036) -0.663***	(0.006) -0.127***			(0.037) -0.797***	(0.005) -0.135***	(0.040) -0.817***	(0.005) -0.138***	(0.037) -0.776***	(0.005) -0.131***
6 months	(0.037) -0.471***	(0.006) -0.090***			(0.048) -0.520***	(0.007) -0.088***	(0.052) -0.540***	(0.007) -0.091***	(0.048) -0.504***	(0.007) -0.085***
7 months	(0.050) -0.407***	(0.009) -0.078***			(0.036) -0.326***	(0.005) -0.055***	(0.037) -0.341***	(0.005) -0.058***	(0.036) -0.317***	(0.005) -0.053***
8 months	(0.045) -0.545***	(0.008) -0.104***			(0.044) -0.550***	(0.007) -0.093***	(0.045) -0.563***	(0.007) -0.095***	(0.044) -0.520***	(0.007) -0.088***
9 months	(0.041) -0.601***	(0.007) -0.115***			(0.036) -0.635***	(0.005) -0.108***	(0.038) -0.647***	(0.005) -0.109***	(0.036) -0.601***	(0.005) -0.101***
10 months	(0.036) -0.595***	(0.006) -0.114***			(0.048) -0.810***	(0.007) -0.137***	(0.051) -0.822***	(0.007) -0.139***	(0.048) -0.774***	(0.007) -0.130***
11 months	(0.038) -0.402***	(0.007) -0.077***			(0.062) -0.486***	(0.009) -0.082***	(0.065) -0.496***	(0.009) -0.084***	(0.064) -0.455***	(0.009) -0.077***
12 months	(0.055) 0.614***	(0.010) 0.117***			(0.058) -0.293***	(0.009) -0.050***	(0.060) -0.302***	(0.009) -0.051***	(0.058) -0.278***	(0.009) -0.047***
Duration dummies	(0.074) Yes	(0.014) Yes			(0.066) Yes	(0.011) Yes	(0.068) Yes	(0.011) Yes	(0.068) Yes	(0.011) Yes
Wald test			0.000		0.000		0.000		0.000	
Log pseudolikelihood	-654,954		-590,725		-577,763		-565,586		-563,918	
Observations	1,857,628	1,857,628	1,857,628	1,857,628	1,857,628	1,857,628	1,823,183	1,823,183	1,823,183	1,823,183

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. Firm size, industry, and occupation dummies are included in all specifications. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

Table A.17: Probit Estimates of the Probability of Wage Decrease

	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
January			0.296*** (0.059)	0.005*** (0.001)	0.282*** (0.061)	0.004*** (0.001)	0.283*** (0.061)	0.004*** (0.001)	0.291*** (0.059)	0.004*** (0.001)
February			-0.106** (0.049)	-0.002** (0.001)	-0.129** (0.051)	-0.002** (0.001)	-0.123** (0.050)	-0.002** (0.001)	-0.178*** (0.052)	-0.003*** (0.001)
March			0.050 (0.082)	0.001 (0.001)	-0.046 (0.081)	-0.001 (0.001)	-0.070 (0.084)	-0.001 (0.001)	-0.052 (0.080)	-0.001 (0.001)
April			0.076 (0.077)	0.001 (0.001)	-0.010 (0.081)	-0.000 (0.001)	-0.015 (0.083)	-0.000 (0.001)	0.056 (0.075)	0.001 (0.001)
May			0.043 (0.072)	0.001 (0.001)	-0.006 (0.075)	-0.000 (0.001)	-0.007 (0.077)	-0.000 (0.001)	0.113 (0.071)	0.002 (0.001)
June			0.072 (0.075)	0.001 (0.001)	0.035 (0.078)	0.001 (0.001)	0.034 (0.079)	0.000 (0.001)	0.147** (0.071)	0.002** (0.001)
July			0.026 (0.061)	0.000 (0.001)	-0.014 (0.062)	-0.000 (0.001)	-0.017 (0.065)	-0.000 (0.001)	0.104* (0.056)	0.001* (0.001)
August			0.044 (0.079)	0.001 (0.001)	0.004 (0.080)	0.000 (0.001)	-0.005 (0.081)	-0.000 (0.001)	0.049 (0.072)	0.001 (0.001)
September			0.188** (0.088)	0.003** (0.001)	0.149 (0.093)	0.002* (0.001)	0.149 (0.094)	0.002* (0.001)	0.213** (0.084)	0.003*** (0.001)
October			0.309* (0.172)	0.005* (0.003)	0.290 (0.178)	0.004* (0.003)	0.299* (0.181)	0.004* (0.002)	0.414** (0.171)	0.006** (0.002)
November			0.286*** (0.100)	0.004*** (0.001)	0.279*** (0.100)	0.004*** (0.001)	0.287*** (0.102)	0.004*** (0.001)	0.344*** (0.095)	0.005*** (0.001)
Cumulative change in unemployment (current)	-0.014 (0.014)	-0.000 (0.000)	0.011 (0.011)	0.000 (0.000)	0.013 (0.011)	0.000 (0.000)	0.015 (0.012)	0.000 (0.000)	-0.012 (0.012)	-0.000 (0.000)
Cumulative inflation (current)	0.014*** (0.005)	0.000*** (0.000)	0.000 (0.006)	0.000 (0.000)	0.009* (0.006)	0.000 (0.000)	0.008 (0.006)	0.000 (0.000)	0.013** (0.006)	0.000** (0.000)
Cumulative growth in firm size	-0.002** (0.001)	-0.000** (0.000)	-0.002** (0.001)	-0.000** (0.000)	-0.002** (0.001)	-0.000** (0.000)	-0.002** (0.001)	-0.000** (0.000)	-0.002** (0.001)	-0.000** (0.000)
Size of last change	0.008*** (0.002)	0.000*** (0.000)	0.008*** (0.002)	0.000*** (0.000)	0.007*** (0.002)	0.000*** (0.000)	0.007*** (0.002)	0.000*** (0.000)	0.007*** (0.002)	0.000*** (0.000)
Cumulative change in unemployment (last)							-0.004 (0.008)	-0.000 (0.000)	-0.004 (0.008)	-0.000 (0.000)
Cumulative inflation (last)							-0.010** (0.004)	-0.000** (0.000)	-0.009** (0.004)	-0.000** (0.000)
Change in current unemployment									0.193*** (0.032)	0.003*** (0.001)
Current inflation									-0.074*** (0.016)	-0.001*** (0.000)
Age	-0.001 (0.010)	-0.000 (0.000)	-0.005 (0.010)	-0.000 (0.000)	-0.002 (0.009)	-0.000 (0.000)	0.001 (0.009)	0.000 (0.000)	0.001 (0.009)	0.000 (0.000)
Age ²	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Experience	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Tenure	-0.001 (0.002)	-0.000 (0.000)	-0.001 (0.002)	-0.000 (0.000)	-0.001 (0.002)	-0.000 (0.000)	0.000 (0.002)	0.000 (0.000)	0.000 (0.002)	0.000 (0.000)
Education	-0.041*** (0.013)	-0.001*** (0.000)	-0.049*** (0.013)	-0.001*** (0.000)	-0.044*** (0.012)	-0.001*** (0.000)	-0.050*** (0.012)	-0.001*** (0.000)	-0.052*** (0.012)	-0.001*** (0.000)
Gender	-0.010 (0.030)	-0.000 (0.000)	-0.006 (0.030)	-0.000 (0.000)	-0.010 (0.029)	-0.000 (0.000)	-0.011 (0.029)	-0.000 (0.000)	-0.011 (0.029)	-0.000 (0.000)

Probit Estimates of the Probability of Wage Decrease (*Continued*)

	(1)		(2)		(3)		(4)		(5)	
	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect	Probit coefficient	Marginal effect
Foreign	-0.196*** (0.057)	-0.003*** (0.001)	-0.204*** (0.059)	-0.003*** (0.001)	-0.206*** (0.059)	-0.003*** (0.001)	-0.216*** (0.059)	-0.003*** (0.001)	-0.216*** (0.059)	-0.003*** (0.001)
1 month	0.060 (0.067)	0.001 (0.001)			0.117* (0.061)	0.002* (0.001)	0.093 (0.061)	0.001 (0.001)	0.089 (0.061)	0.001 (0.001)
2 months	0.246*** (0.055)	0.004*** (0.001)			0.279*** (0.055)	0.004*** (0.001)	0.303*** (0.053)	0.004*** (0.001)	0.281*** (0.048)	0.004*** (0.001)
3 months	0.238*** (0.057)	0.004*** (0.001)			0.254*** (0.066)	0.004*** (0.001)	0.277*** (0.069)	0.004*** (0.001)	0.247*** (0.056)	0.003*** (0.001)
4 months	0.111* (0.065)	0.002* (0.001)			0.121* (0.070)	0.002* (0.001)	0.141* (0.072)	0.002** (0.001)	0.103* (0.063)	0.001* (0.001)
5 months	0.061 (0.045)	0.001 (0.001)			0.064 (0.051)	0.001 (0.001)	0.083 (0.052)	0.001 (0.001)	0.043 (0.043)	0.001 (0.001)
6 months	0.042 (0.053)	0.001 (0.001)			0.045 (0.056)	0.001 (0.001)	0.065 (0.057)	0.001 (0.001)	0.026 (0.052)	0.000 (0.001)
7 months	0.009 (0.055)	0.000 (0.001)			0.001 (0.056)	0.000 (0.001)	0.020 (0.055)	0.000 (0.001)	-0.018 (0.047)	-0.000 (0.001)
8 months	0.089 (0.081)	0.001 (0.001)			0.028 (0.088)	0.000 (0.001)	0.046 (0.085)	0.001 (0.001)	-0.005 (0.075)	-0.000 (0.001)
9 months	0.111 (0.071)	0.002 (0.001)			0.004 (0.099)	0.000 (0.001)	0.017 (0.096)	0.000 (0.001)	-0.034 (0.091)	-0.000 (0.001)
10 months	0.067 (0.081)	0.001 (0.001)			-0.032 (0.064)	-0.000 (0.001)	-0.015 (0.062)	-0.000 (0.001)	-0.070 (0.061)	-0.001 (0.001)
11 months	-0.112** (0.053)	-0.002** (0.001)			-0.084 (0.057)	-0.001 (0.001)	-0.067 (0.057)	-0.001 (0.001)	-0.115* (0.061)	-0.002* (0.001)
12 months	0.108** (0.053)	0.002** (0.001)			0.014 (0.064)	0.000 (0.001)	0.020 (0.064)	0.000 (0.001)	-0.018 (0.068)	-0.000 (0.001)
Duration dummies	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Wald test			0.000		0.000		0.000		0.000	
Log pseudolikelihood	-69,550		-69,217		-68,826		-66,169		-65,866	
Observations	1,858,508	1,858,508	1,858,508	1,858,508	1,858,508	1,858,508	1,824,028	1,824,028	1,824,028	1,824,028

Notes: The probit model is estimated by maximum likelihood. Robust standard errors, clustered at the firm level, are in parenthesis. Firm size, industry, and occupation dummies are included in all specifications. Marginal effects on the probability of a wage increase of one unit increase in each variable are evaluated at the sample average. Standard errors of marginal effects are calculated using the delta method. The hypothesis that monthly coefficients are jointly zero is tested with a Wald test. *, ** and *** denotes significance at the 10 percent, 5 percent and 1 percent level, respectively.

References

- Amemiya, T., 1985. *Advanced Econometrics*. Harvard University Press, Cambridge.
- Fehr, E., Goette, L., 2005. Robustness and real consequence of nominal wage rigidity. *Journal of monetary economics* 52, 779–804.
- Heckman, J., 1976. The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. *Annals of Economic and Social Measurement* 5, 475–492.
- Heckman, J., 1979. Sample selection bias as a specification error. *Econometrica* 47 (1), 153–162.
- Le Bihan, H., Montornés, J., Heckel, T., 2012. Sticky wages: Evidence from quarterly microeconomic data. *American Economic Journal: Macroeconomics* 4 (3), 1–32.