Flexible wages, employment and efficiency

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Motivation

Flexible (variable) wage components have a large share in worker compensation

- Approximately half of the workers receive flexible wage components (Bloom, van Reenen; 2011)
- Flexible components contribute to wage inequality (Lemieux et al. 2009)

How does wage structure affects firms' perfomance?
What does explain the heterogeneity in wage structure?

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Flexible wages are usually considered as a tool of **incentive contracts** (Holmström 1979, 1982), Levin (2003)

Does downward flexibility also protect jobs (Tobin 1972; Weitzman 1983, 1987) ?

Only limited empirical evidence on the employment effects of flexible wages

- databases are rare which contain information on
  1. balance sheet of the firm
  2. individual level wage schemes
  3. job history of workers

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Today's Talk

1. I match individual-level wage structure, tenure of worker, firm-level revenue changes
2. I estimate **the effect of flexible wage structure** on
   1. the performance of the firm
   2. wage adjustment
   3. employment adjustment and separation rates

Main findings

1. Firms with flexible wages are larger, more productive, and have less volatile growth rate
2. Flexible components are more reactive to **firm level revenue changes**
3. Firms with flexible wages have much lower worker turnover
4. **Firms with and without flexible wages have the same employment reactions**
   1. if the revenue drops
   2. during the Great Recession

Interpretation:

1. Flexible wage components are unlikely to protect jobs if revenue drops
2. Results are **consistent with a wage posting model with incentive contracts**

Outline

Related Literature

Incentive effects of flexible wages

- theoretical models: Holmström (1979, 1982), Levin (2003)
- field experiments: Lazear (2000); Shearer (2004), Bandiera et al (2007)
- This paper estimates the effect of flexible wages using observational data

Employment cost of wage rigidity

- Worker with flexible wages have longer tenure in crisis
- Lemieux et al. (2012) Stokes et al. (2014); Pischke (2016)
- This paper shows that flexible wages always induce longer tenure

Related Literature

Flexibility of variable componentes

- variable wage components are more responsive to aggregate shocks than the wage base
- Oyer (2005); Messina et al. (2010); Anger (2011), Lemieux (2012)
- This paper shows that variable components react more on firm level idiosyncratic shocks

Wage posting models with productivity shocks

- papers focus on separation rates and wage dynamics but not on wage structure
- Postel-Vinay, Turon (2010); Robin (2011); Moscarini, Postel-Vinay (2013); Bagger et al. (2014); Jarosch (2014); Pinheiro, Visschers (2015)
- This paper endogenizes wage structure

Outline

Institutional background

Hungarian firms adjust base wage every 13.8 months and **80 per cent of firms adjust wages once a year** (Kézdi, Kónya 2011; Durant et. al., 2012)

- Share of flexible components approximately 10%

Employment protection **institutions are similar to Anglo-Saxon countries** (Riboud et. al. 2002)

- Share of union members is approximately 20 percent
- wage bargaining is on individual level, workers can be dismissed relatively easily (Tonin, 2009)

Stable economic growth before 2008, inflation moderately low (0-5%)
(→link)

Outline

Data

- Linked employer-employee database - **Hungarian Structure of Earnings Survey**
- Panel data at the firm level:
  - **Corporate Tax Data** on the **balance sheet** and income statement
  - Every firm having more than 20 employees is included and a random sample of firms between 5 and 20 employees
  - Firms report the **composition of individual wages** paid in May
- private sector only, years between 2001-2014

Definition of flexible payments

	share of workers receiving the wage element	share of wage parts conditional on receiving		
		mean	p25	p75
overtime payments	0.202	0.105	0.047	0.141
monthly bonuses and premia	0.210	0.216	0.078	0.300
occasional bonuses	0.440	0.085	0.033	0.112
allowances	0.387	0.124	0.054	0.175
reimbursements	0.368	0.054	0.020	0.061
total	0.778	0.221	0.082	0.312

Worker level: somebody received flex. elements at least once (Lemieux et al. 2009)
Firm level: share of workers received flexible wage components

Outline

Comparing firms with and without flex. wages (1)

The two type of firms have similar workforce...

	fix wages	flex. wages	diff	t-stat
Share of females	0.337	0.376	0.039	7.20
	(0.004)	(0.003)		
Average age	39.2	41.2	2.03	20.07
	(0.07)	(0.06)		
Years of education	11.5	11.4	-0.11	-4.34
	(0.01)	(0.01)		
Share of blue collar workers	0.668	0.682	0.014	2.81
	(0.00)	(0.00)		
Tertiary education	0.127	0.129	0.002	0.76
	(0.002)	(0.002)		
Number of observations	15109	38815		

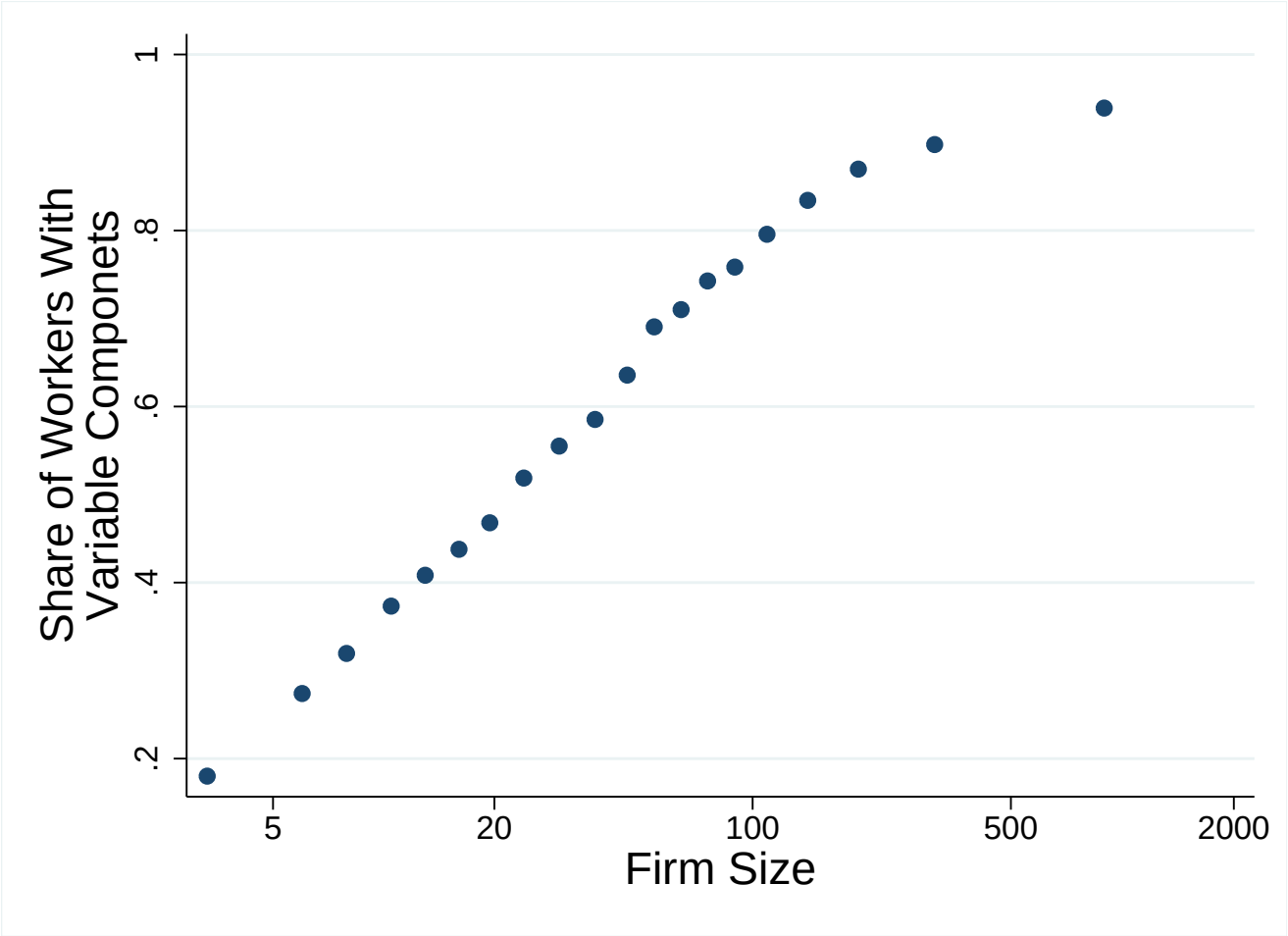
Comparing firms with and without flex. wages (2)

... but they are organized completely different way

- These difference remain highly significant even after using a wide set of control variables

	fix wages	flex. wages	diff	t-stat
Number of employees	34.5	191.	157	23.52
	(0.66)	(6.65)		
Capital per worker (log)	5.57	7.14	1.57	43.84
	(0.028)	(0.022)		
Value added per capita (log)	7.58	8.01	0.43	28.80
	(0.010)	(0.010)		
Share of exporting firms	0.30	0.51	0.21	26.45
	(0.005)	(0.005)		
Share of new entrants	0.170	0.118	-0.052	-22.31
	(0.002)	(0.001)		
Number of observations	15109	38815		

Incidence of flex. wages by firm size



Empirical strategy - variance of sales

Conditional growth of firms

$$\Delta log(sales_{jt}) = \beta_1 flex_{jt-1} + \gamma X_{jt-1} + \mu_t + \varepsilon_{jit}$$

- $\Delta log(sales_{jit})$ is the change of net sales
- $flex_{jt-1}$ is the flexible wage dummy
- X_{jit-1} denote the controls

Predict $\hat{\varepsilon}^2_{jit}$ and run the following regression (similarly to Wald, 1980):

$$\hat{\varepsilon}^2_{jit} = \kappa_0 + \kappa_1 flex_{jt-1} + \lambda X_{jt-1} + \nu_{it}$$

Average change of sales

$$\Delta log(sales_{jt}) = \beta_1 flex_{jt-1} + \gamma X_{jt-1} + \mu_t + \varepsilon_{jit}$$

	average change of sales			
firm payed flex. wages	0.00930***	-0.00544**	-0.00369	-0.00490**
	(0.00201)	(0.00218)	(0.00225)	(0.00231)
constant	0.0300***	0.0405***	0.0393***	0.0388***
	(0.00175)	(0.00183)	(0.00186)	(0.00188)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	53,592	53,475	53,475	50,543
R-squared	0.037	0.050	0.052	0.051

* firms with more than 500 workers are dropped

Volatility of sales

$$\hat{\varepsilon}^2_{jit} = \kappa_0 + \kappa_1 flex_{jt-1} + \lambda X_{jt-1} + \nu_{it}$$

	Variance in sales of firms			
firm payed flex. wages	-0.0123***	-0.00959***	-0.00817***	-0.00656***
	(0.000592)	(0.000624)	(0.000656)	(0.000670)
constant	0.0431***	0.0405***	0.0394***	0.0389***
	(0.000508)	(0.000531)	(0.000545)	(0.000541)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	53,592	53,475	53,475	50,543
R-squared	0.014	0.048	0.050	0.049

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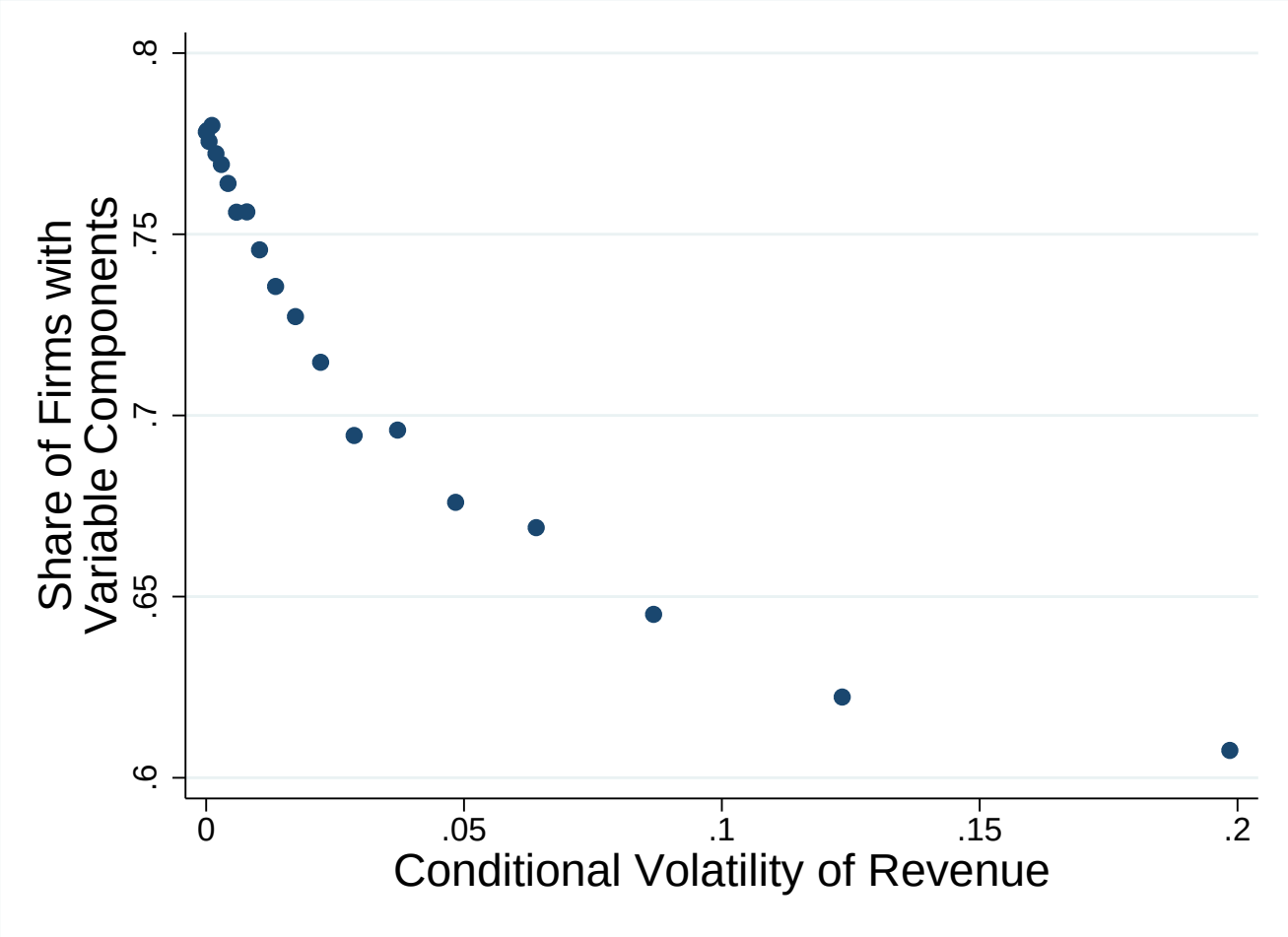
Wage flexibility and the volatility of growth



(→ table)

Outline

Empirical strategy - wage adjustment

Pooled first difference estimations for wage changes

$$\Delta log(wage_{jt}) = \beta_1 \Delta log(sales_{jt}) + \beta_2 flex_{jt-1} + \beta_3 flex_{jt-1} * \Delta log(sales_{jt}) + \gamma X_{j,t-1} + \mu_t + \varepsilon_{it}$$

- Dependent variable is the **change of wages** of of worker i at firm j between year $t-1$ and t
- $\Delta log(sales_{jt})$ is the change of net sales
- $flex_{jt-1}$ is the flexible wage dummy
- $X_{j,t-1}$ denote the controls
- If flex. wage elements react more to revenue changes then $\beta_3 > 0$

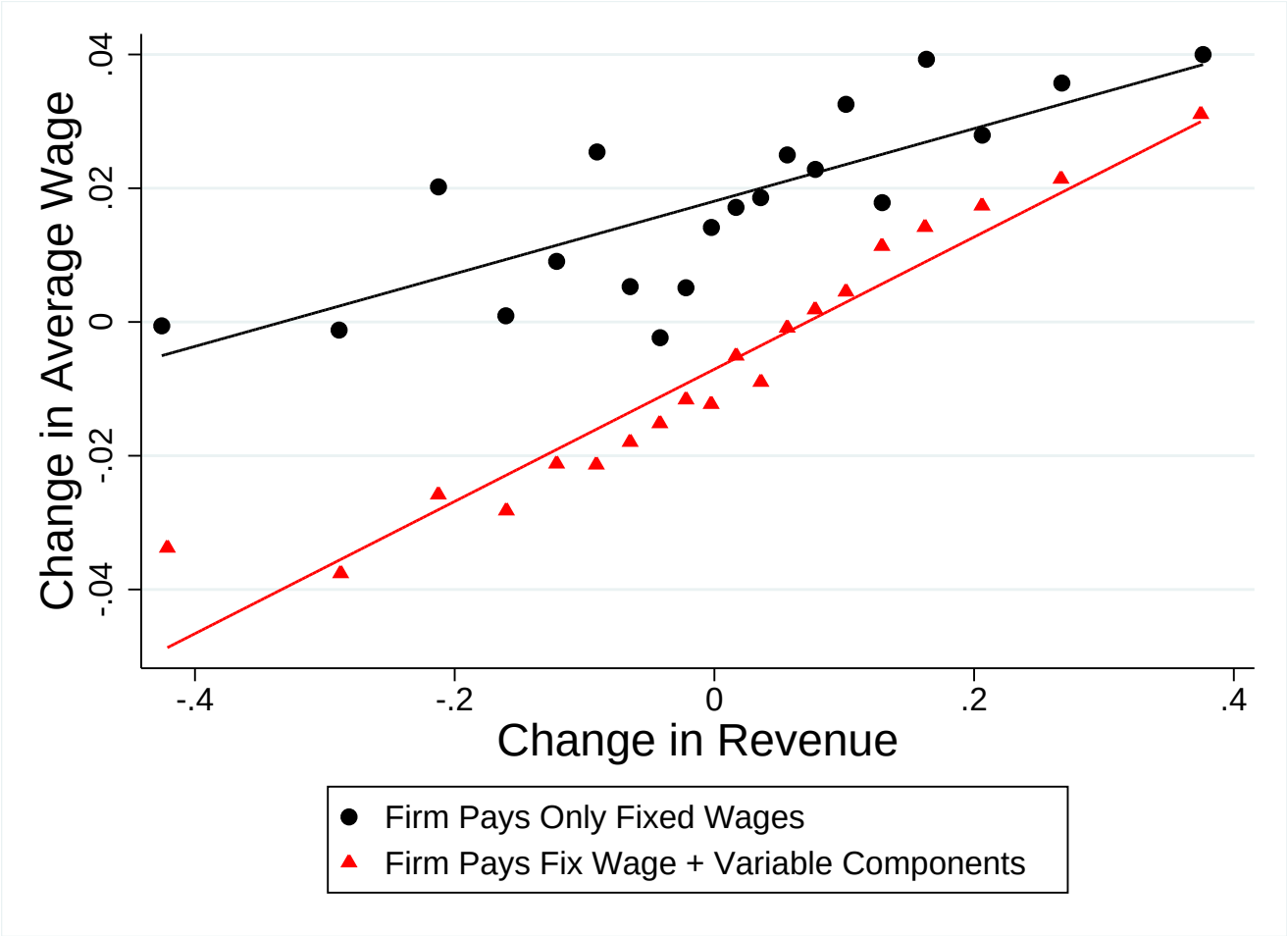
Empirical strategy - employment adjustment

$$\Delta log(emp_{jt}) = \beta_1 \Delta log(sales_{jt}) + \beta_2 flex_{jt-1} + \beta_3 flex_{jt-1} * \Delta log(sales_{jt}) + \gamma X_{jt-1} + \mu_t + \varepsilon_{it}$$

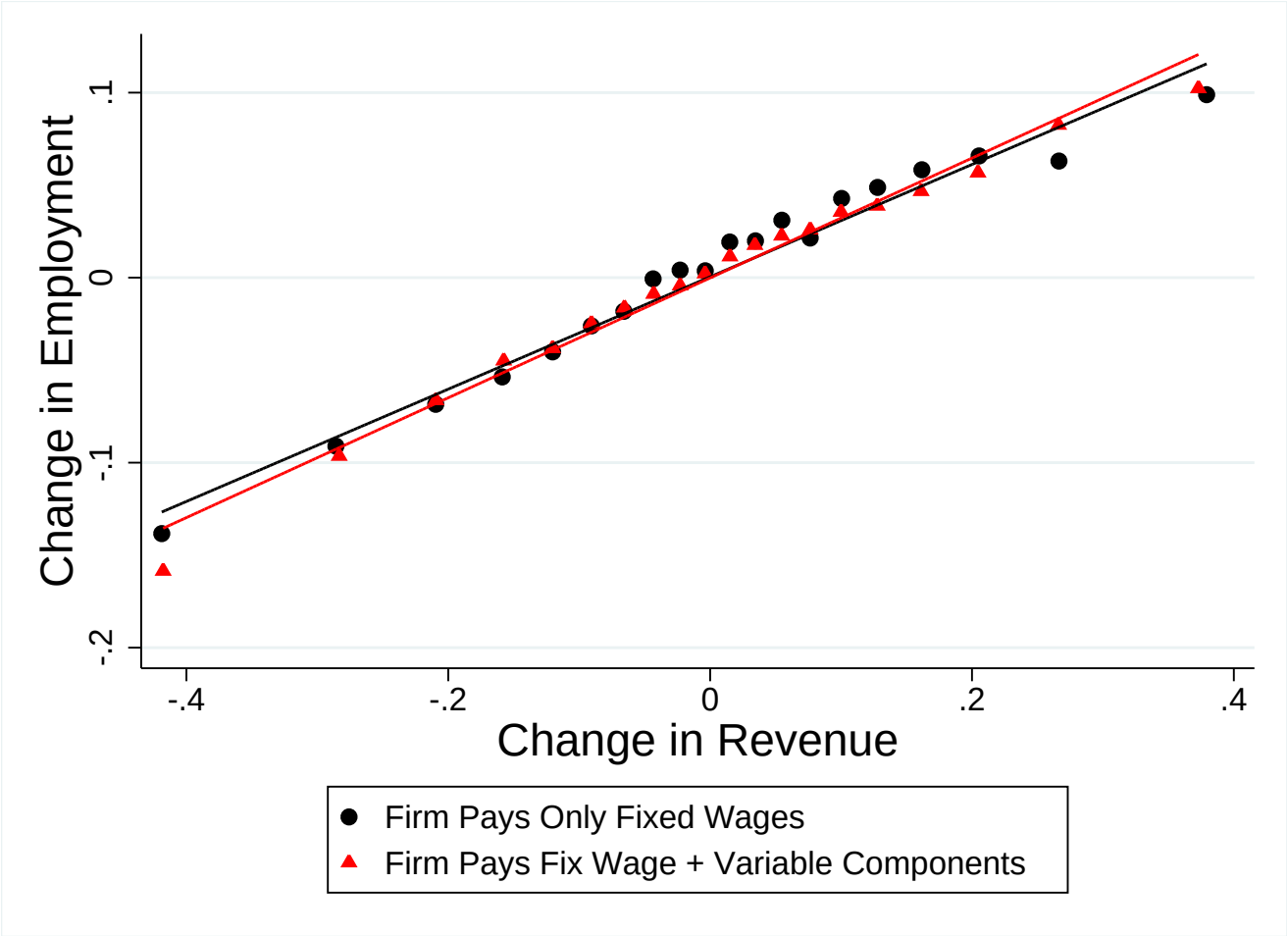
$$separ_{jt} = \beta_1 \Delta log(sales_{jt}) + \beta_2 flex_{jt-1} + \beta_3 flex_{jt-1} * \Delta log(sales_{jt}) + \gamma X_{j,t-1} + \mu_t + \varepsilon_{it}$$

- dependent variable: job of employment change and separation rate at firm j between year $t-1$ and t
- $\Delta log(sales_{jt})$ is the change of net sales
- $flex_{jt-1}$ is the flexible wage dummy
- $X_{j,t-1}$ denote the controls

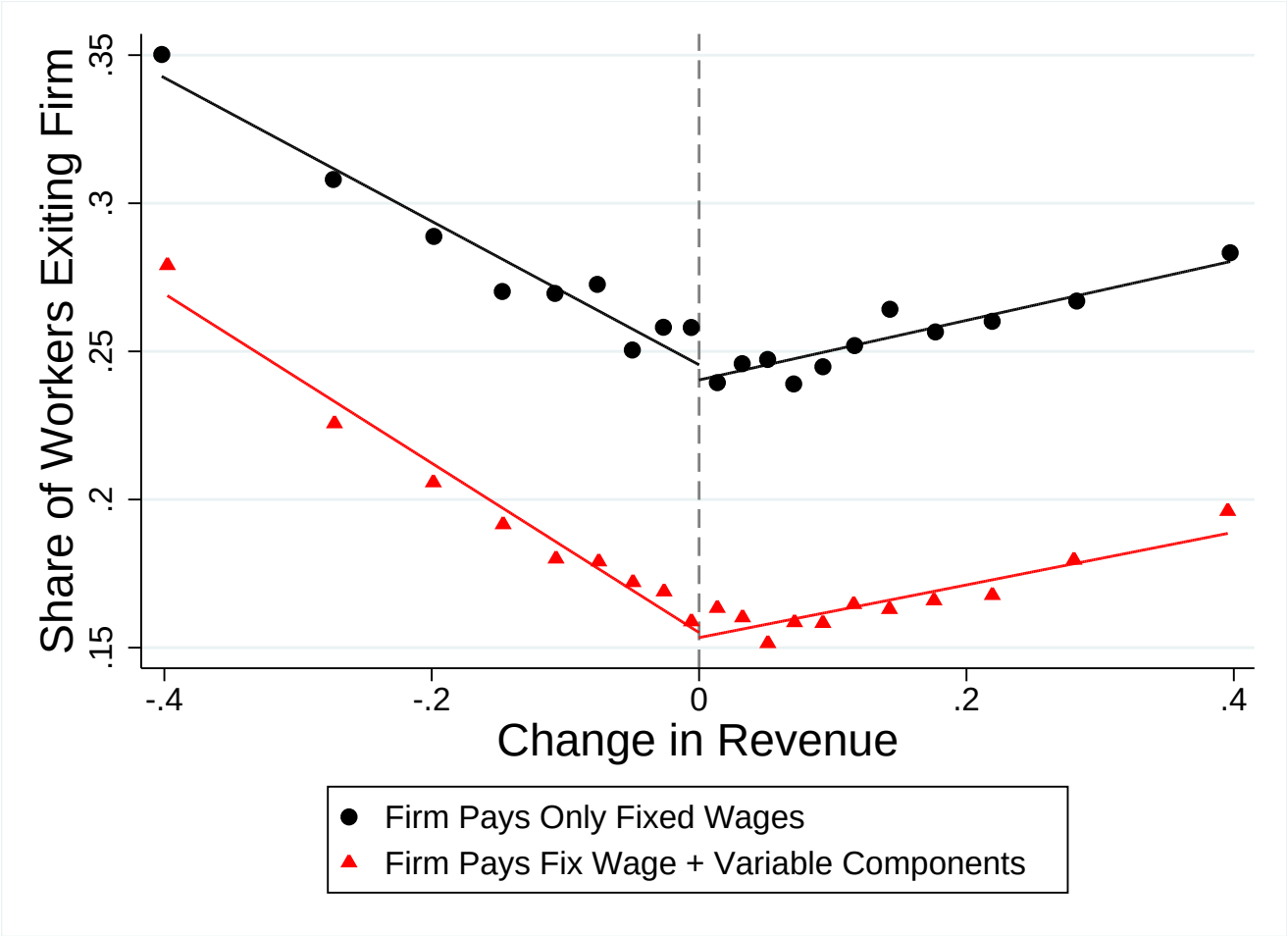
Revenue shocks and wage adjustment



Revenue shocks and employment changes



Revenue shocks and separations



Wage reaction of firms

	average change of wages			
worker got bonus	0.000456	-0.000575	0.00222	0.000499
	(0.00204)	(0.00210)	(0.00213)	(0.00224)
change in sales	0.0393***	0.0365***	0.0315***	0.0310***
	(0.0106)	(0.0104)	(0.0106)	(0.0111)
interaction	0.0766***	0.0752***	0.0763***	0.0796***
	(0.0115)	(0.0115)	(0.0116)	(0.0120)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	379,998	379,998	374,488	254,680
R-squared	0.049	0.051	0.057	0.049

* firms with more than 500 workers are dropped

Employment reactions of firms

	Change of employment			
worker got bonus	0.00296	0.00360	0.00526*	0.00976***
	(0.00225)	(0.00271)	(0.00274)	(0.00279)
change in sales	0.314***	0.311***	0.309***	0.312***
	(0.0111)	(0.0113)	(0.0113)	(0.0112)
interaction	0.0177	0.0160	0.0161	0.00851
	(0.0129)	(0.0131)	(0.0130)	(0.0131)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	711,945	711,945	697,676	480,763
R-squared	0.033	0.043	0.062	0.066

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Outline

Robustness checks

- Changing the definition of bonus payments (→ link)
- Different sample definition (→ link)
- Results are similar in different sub-samples
- Individual level estimations (→ link)

Outline

Theoretical Framework

- The choice of flexible wage structure may have multiple confounders
- The empirical findings are in line with a **wage posting model with incentive contracts**
  - According to the model worker with flexible wages have longer tenure in case of negative revenue shocks even if firms do not have financial constraints

Overview of the model (1)

- develop a discrete **wage posting model** á la Manning (2003, 2004)
  - worker-level revenue shocks,
  - **firms differ in the volatility of revenue shocks** Sutton (2002); Kramarz et al. (2015)
- **workers**
  - are identical and risk averse
  - have hidden effort level
- **flexible payments in the model**:
  - Firms can offer linear contracts to enhance higher effort

(→details)

Overview of the model (2)

1. Firms with low volatility of revenue offer incentive contracts and turn to be more productive
2. In a wage posting setup more productive firms
   - offer higher wages
   - attract some workers from less productive firms
3. Firms with flexible wages have lower turnover
4. The employment and revenue changes is caused by idiosincratic productivity and employment shocks
   - Firms with and without flexible wages have the same employment reaction to revenue changes

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Summary

Firms with flexible wage structure

- are larger, more productive and have less volatile growth rate
- adjust wages more to revenue shocks but do not smooth employment more

The results are consistent with a wage posting model with incentive contracting

Thank you for attention!

Alternative explanations of bonus payments (1)

Screening of workers: firms pay bonuses to select the most productive workers

- BUT: the largest firms does not employ workers without bonuses ($\rightarrow$ link)

Retention effect: firms pay bonuses to cope with outside wage offers

- BUT workers with bonuses are more productive ($\rightarrow$link)

Skills of management: Managers paying bonuses are better in other aspects as well

- BUT results are robust to inclusion of firm fixed effects, the growth rate of firms with bonuses are not faster

Alternative explanations of bonus payments (2)

Tax optimization: firms pay bonuses to decrease the tax liability

- BUT the bonuses and the wage base has the same tax rates

Tax evasion: Firms without bonuses can flexibility adjust adjust undeclared wages

- BUT results are robust to fixed effects; dropping minimum wage earners and firms with less than 100 workers

Nominal vs real wage rigidity: The firms only care with real wage rigidity

- BUT: results are the same in an environment with high and a low inflation as well

Baseline model (1)

Dynamic job search model, simplified **solution for the steady state** presented by Manning (2001, 2003)

- infinite mass of firms and identical workers.
- individuals get a wage offer with probability λ
  - the unemployed always accept the offer but employees accept only if the offer is larger than current utility
- the separation is exogenous with probability δ
- workers outside option is constant U_0

(→back)

Baseline model (2)

- **workers** are **risk averse**:$max\ U_{ij} = E(W_{ij}) - r * var(W_{ij})$
- firm j employing worker i has the profit: $\pi_{ij} = p + \varepsilon_{ij}$
  - **firms differ in** $var(\varepsilon_{ij})$
  - firms choose a fixed wage w_j and the ratio of profit sharing b_j
  - $W_{ij} = b_j * \pi_{ij} + w_j$
- firms maximize expected profit: $\underset{w_j, b_j}{max} E\left[(1 - b_j)\pi_j - w_j\right] N\left(U_j\right)$
- **Equilibrium:** the expected number of entries and exits is constant for every firm
  - firms offering higher wages have **lower profit per worker** but **more employees**
  - more productive firms offer higher wages (Burdett, Mortensen 1998)

Extensions to the baseline model

- Incentive contract explanation
  - Bonuses have incentive effects
  - more productive firms offer higher wages (Burdett, Mortensen 1998)

Incentive contracts

- Workers have **2 discrete effort levels:** low or high effort
  - high effort of the worker cost $c * e$ to the worker.
- The **firm only observes the revenue per worker**:

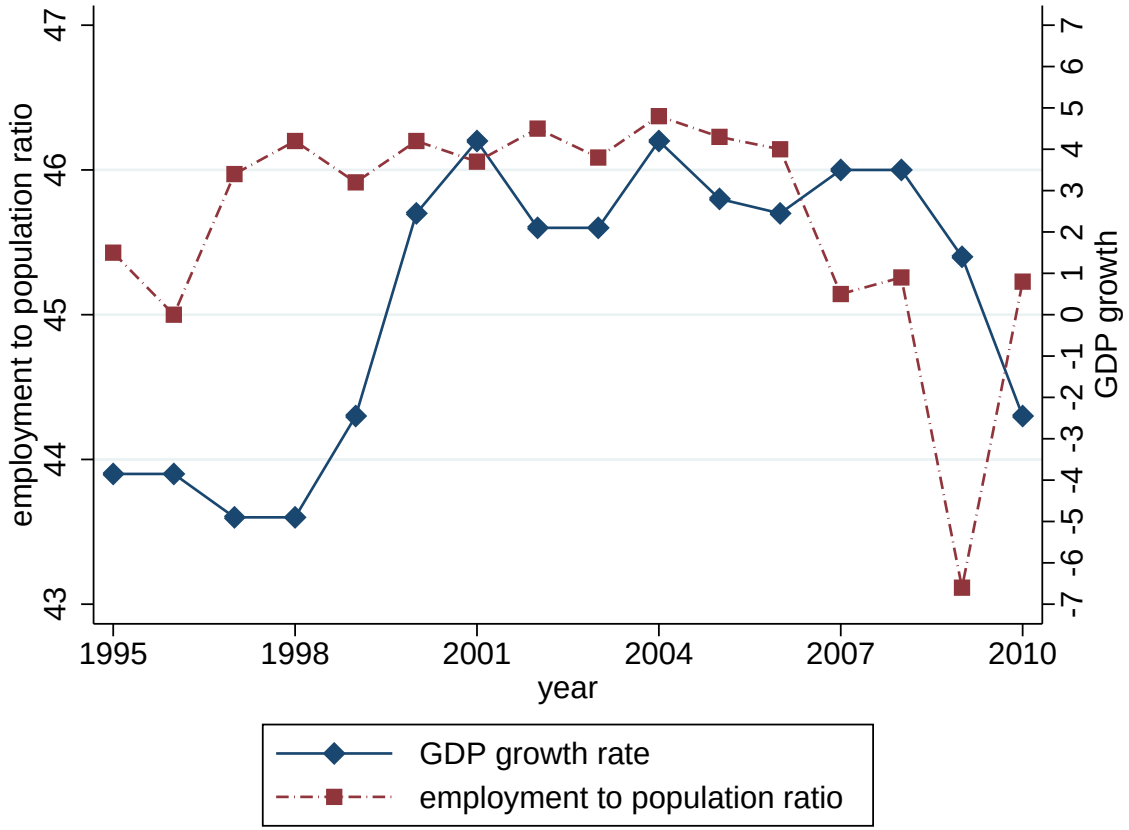
$$\pi_{ij} = \begin{cases} p + e + \varepsilon_{ij} & \textit{if effort is high} \\ p + \varepsilon_{ij} & \textit{if effort is low} \end{cases}$$

- Firms can incentivize workers if the $var(\varepsilon_j)$ is low
- Firms with incentive contracts offer higher utility $\Rightarrow$they are larger

Testable implications

- **Incentive contracts**
  - separation rates are independent from revenue shocks
  - bonus paying firm are more productive and larger
  - less volatile growth rate

Macroeconomic background



(→back)

Alternative measurement of separation rates

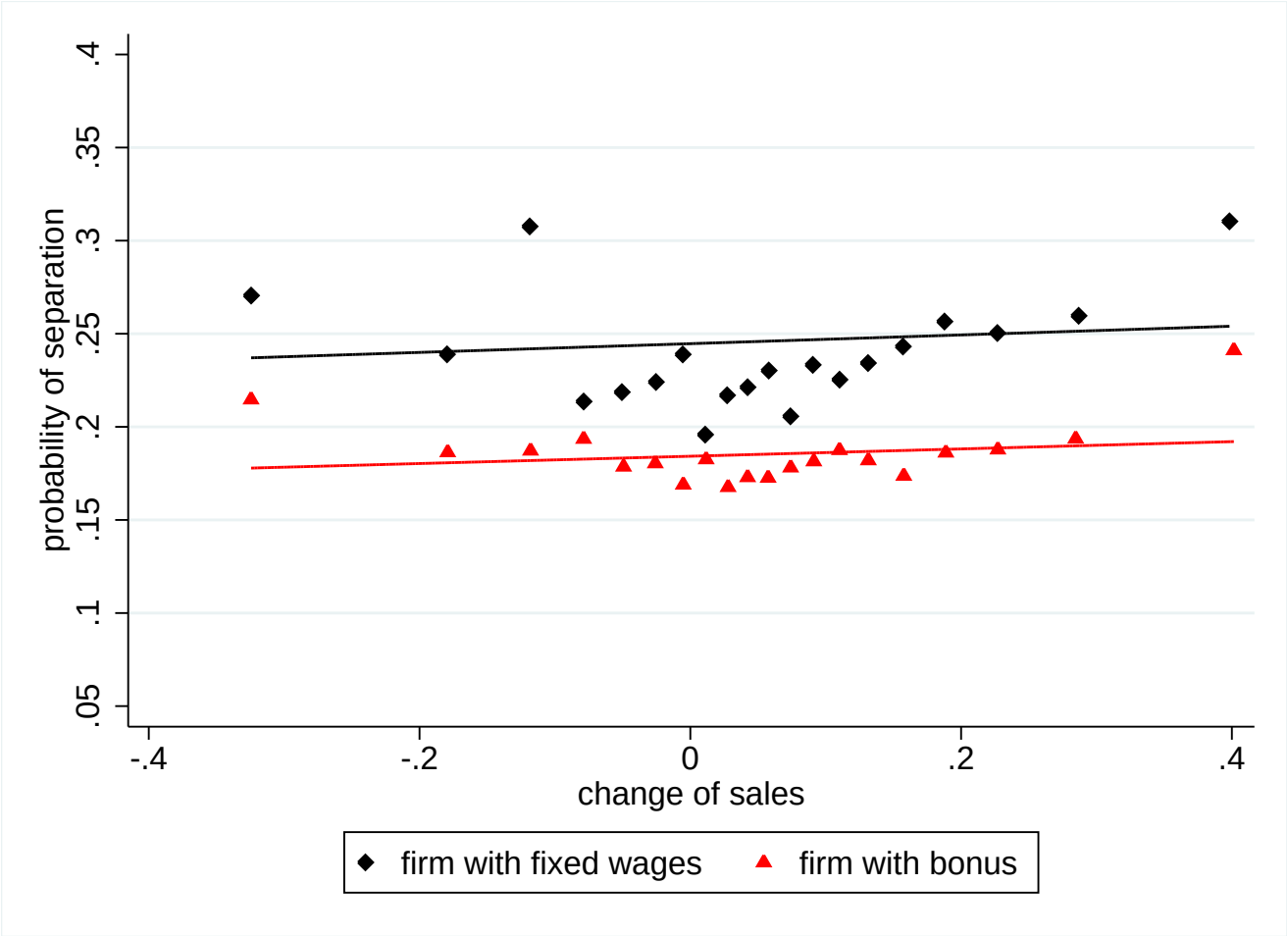
I use social-security contribution data to measure separations

- 50 percent random sample of population
- linked-employer-employee datasaet
  - exact start and end date of employment
  - no data on individual wage structure
- I matched firm level data from the Structure of earnings survey

$$bonus_{jt} = \begin{cases} 1 \textit{ everybody got bonus} \\ 0 \textit{ nobody got bonus} \end{cases}$$

(→ back to data) (→ back to the results)

Alternative measurement of separation rates



Revenue shocks and wage changes

D:/adat/results/dlsales_wage.png

controlled for share of women, average year of education, age, sales and capital per worker and two digit industry-year fixed effects

(→ back)

Alternative sample definitions

Main specification: Firm size: 20-2500, changes of sales trimmed at 50%

- without restrictions on firm size
- trimming at 30%
- total compensation $>$ base wage
- only performance payments

($\rightarrow$ back)

Alternative sample def. - wages

	full sample	average change of wages: change in sales<30%	average change of wages: change in sales<20%	winsorized at 50% dlog(sales)
worker got bonus	-0.00193	-4.99e-05	0.000817	0.000717
	(0.00185)	(0.00212)	(0.00228)	(0.00308)
change in sales	0.0265***	0.0286***	0.0590***	0.0608**
	(0.00856)	(0.0104)	(0.0138)	(0.0245)
interaction	0.0772***	0.0681***	0.0443***	0.0537**
	(0.0101)	(0.0111)	(0.0152)	(0.0247)
year fe.	x	x	x	x
firm-level controls	x	x	x	x
individual-level controls	x	x	x	x
Observations	517,347	364,414	321,603	262,568
R-squared	0.056	0.053	0.050	0.045

Alternative sample def. - separations

		probability of separations		
	full sample	change in sales<30%	change in sales<20%	winsorized at 50% dlog(sales)
worker got bonus	-0.237***	-0.240***	-0.240***	-0.243***
	(0.00423)	(0.00466)	(0.00502)	(0.00559)
change in sales	0.0186	0.0303*	0.0431*	0.00427
	(0.0125)	(0.0164)	(0.0249)	(0.0393)
interaction	-0.0636***	-0.0803***	-0.118***	-0.108**
	(0.0170)	(0.0187)	(0.0284)	(0.0437)
year fe.	x	x	x	x
firm-level controls	x	x	x	x
individual-level controls	x	x	x	x
Observations	964,968	677,663	593,146	481,248
R-squared	0.058	0.065	0.064	0.063

Alternative bonus definitions

Main specification: somebody received bonus at least once during the observed years (Lemieux et al. 2009)
results are robust against different definitions:

- received bonus last year
- bonus>10 percent of total compensation
- total compensation > base wage
- only performance payments

(→ back)

Alternative bonus def. - wages

	average change of wages			
	got bonus last year	bonus>0.1 wage	wage>base wage	perform. pay. only
worker got bonus	-0.0467***	-0.0586***	-0.0478***	0.00487**
	(0.00207)	(0.00163)	(0.00229)	(0.00199)
change in sales	0.0656***	0.0876***	0.0650***	0.0493***
	(0.00935)	(0.00641)	(0.0103)	(0.00972)
interaction	0.0433***	0.0225**	0.0420***	0.0623***
	(0.0106)	(0.00882)	(0.0114)	(0.0109)
year fe.	x	x	x	x
firm-level controls	x	x	x	x
individual-level controls	x	x	x	x
Observations	361,936	361,936	361,936	361,936
R-squared	0.061	0.069	0.061	0.056

Alternative bonus def. - separations

	Probability of separations			
	got bonus last year	bonus>0.1 wage	wage>base wage	perform. pay. only
worker got bonus	-0.0827***	-0.0545***	-0.0812***	-0.269***
	(0.00431)	(0.00350)	(0.00421)	(0.00481)
change in sales	0.0574***	0.0532***	0.0582***	-0.0206
	(0.0146)	(0.0109)	(0.0151)	(0.0142)
interaction	0.0215	0.0246	0.0212	-0.0884***
	(0.0177)	(0.0154)	(0.0178)	(0.0178)
year fe.	x	x	x	x
firm-level controls	x	x	x	x
individual-level controls	x	x	x	x
Observations	673,093	673,093	673,093	673,093
R-squared	0.037	0.035	0.036	0.074

Alternative bonus def. - wages

	average change of wages					
	tradeable ind.	non trad. ind.	white collar	blue collar	low inflation	high inflation
w. got bonus	0.0011	0.0051	0.0169***	-0.0039	0.0054	-0.0063**
	(0.0028)	(0.0033)	(0.0033)	(0.0025)	(0.0042)	(0.0029)
dlog(sales)	0.0230	0.0402***	0.0494***	0.0252**	0.0281*	0.0361**
	(0.0148)	(0.0155)	(0.0183)	(0.0123)	(0.0156)	(0.0161)
interaction	0.0919***	0.0491***	0.0380**	0.0913***	0.0838***	0.0429**
	(0.0159)	(0.0172)	(0.0192)	(0.0136)	(0.0159)	(0.0167)
year fe.	x	x	x	x	x	x
firm cont.	x	x	x	x	x	x
indiv. cont.	x	x	x	x	x	x
Obs.	226,479	135,457	148,296	226,192	167,584	196,830
R-squared	0.064	0.046	0.068	0.053	0.028	0.020

Alternative bonus def. - separations

	Probability of separation					
	tradeable ind.	non trad. ind.	white collar	blue collar	low inflation	high inflation
w. got bonus	-0.27***	-0.23***	-0.26***	-0.25***	-0.26***	-0.22***
	(0.0064)	(0.0068)	(0.0055)	(0.0055)	(0.0054)	(0.0066)
dlog(sales)	-0.0126	0.0489**	0.0272	0.00845	0.0146	0.0175
	(0.0203)	(0.0222)	(0.0201)	(0.0174)	(0.0193)	(0.0249)
interaction	-0.04*	-0.10***	-0.08***	-0.06***	-0.05**	-0.07**
	(0.0229)	(0.0276)	(0.0233)	(0.0201)	(0.0231)	(0.0282)
year fe.	x	x	x	x	x	x
firm cont.	x	x	x	x	x	x
indiv. cont.	x	x	x	x	x	x
Obs.	403,970	269,123	269,348	428,328	298,006	379,657
R-squared	0.056	0.070	0.067	0.062	0.073	0.063

Firm level evidence

Firms can adjust wages by firing worker and employing a new worker at lower wage

- I estimate the model also by using firm level averages

$$\Delta log(w_{jt}) = \alpha_1 \Delta log(sales_{jt}) + \alpha_2 bonus_{jt-1} + \alpha_3 bonus_{jt} * \Delta log(sales_{jt}) + \gamma X_{jt-1} + \mu_t + \varepsilon_{it}$$

$$\Delta log(emp_{jt}) = \beta_1 \Delta log(sales_{jt}) + \beta_2 bonus_{jt-1} + \beta_3 bonus_{jt} * \Delta log(sales_{jt}) + \gamma X_{jt-1} + \mu_t + \varepsilon_{it}$$

Wage flexibility explanation : $\alpha_3 > 0$; $\beta_3 > 0$
Incentive contract explanation : $\alpha_3 > 0$; $\beta_3 = 0$
($\rightarrow$ back)

Wage reaction of firms

	average change of wages			
share of workers with	-0.0296***	-0.0297***	-0.0378***	-0.0336***
bonuses	(0.00375)	(0.00298)	(0.00415)	(0.00324)
change in sales	0.00362	0.0311**	0.000410	0.0300**
	(0.0182)	(0.0143)	(0.0183)	(0.0143)
interaction	0.0708***	0.0399**	0.0661***	0.0363**
	(0.0192)	(0.0170)	(0.0191)	(0.0170)
controls	no	no	yes	yes
weights	no	yes	no	yes
Observations	53,174	52,479	52,479	52,479
R-squared	0.032	0.060	0.039	0.051

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Employment reaction of firms

	average change of employment			
share of workers with	0.00213	0.00475	0.00697	0.00324
bonuses	(0.00423)	(0.00289)	(0.00430)	(0.00297)
change in sales	0.374***	0.348***	0.358***	0.338***
	(0.0188)	(0.0129)	(0.0178)	(0.0126)
interaction	0.00484	0.000430	0.0144	-0.00165
	(0.0225)	(0.0154)	(0.0212)	(0.0152)
controls	no	no	yes	yes
weights	no	yes	no	yes
Observations	53,142	53,142	52,447	52,447
R-squared	0.141	0.120	0.179	0.153

Firm size and bonus payments

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(→ back to data) (→ back)

Value added by bonus payments

$$\Delta log(VAE_{jt}) = \beta_1 bonus_{ji} + \gamma X_{ji,t-1} + \mu_t + \varepsilon_{it}$$

	Variance in sales of firms			
worker got bonus	0.359***	0.125***	0.128***	0.126***
	(0.0227)	(0.0152)	(0.0145)	(0.00934)
year fe.	x	x	x	x
firm-level controls		x	x	x
individual-level controls			x	x
without large firms*				x
Observations	1,049,056	1,023,774	1,023,632	754,674
R-squared	0.190	0.642	0.649	0.614

* firms with more than 500 workers are dropped(→back)

controls are share of women, average year of education, age, sales and capital per