Who pays for it? The heterogeneous wage effects of employment protection legislation

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- This paper looks at the effects of firing costs (EPL) on **wages**. Exploiting **two** sources of variation of Italian EPL.
  - **Over time**: 1990 reform.
  - **Among firms** of different size: above/below 15 employees.

Previous studies

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  - US cross-state variation: Autor (2003), Kugler and Saint-Paul (2004). US Disabilities Act: Acemoglu and Angrist (2001).
  - Discontinuities in firing costs regimes: Boeri and Jimeno (2005), Borgarello, Garibaldi and Pacelli (2004), Schivardi and Torrini (2008), Kugler and Pica (2008) for Italy and Bauer, Bender and Bonin (2007) for Germany.

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- More recently, also on productivity...
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- ...and wages:
  - Bertola (1990): in high job security countries wages tend to be lower.
  - Firm-level data: Bird and Knopf (2009) and Martins (2009).
  - Individual-level data: Autor, Donohue and Schwab (2006), Cervini Plá, Ramos and Silva (2010) and Van der Wiel (2010).

The evolution of Italian EPL

- Statuto dei Lavoratori, 1970: art.18.
  - Firms $>$ 15 employees:
    individual dismissals are costless either in case of *misconduct* or for *economic reasons*. In case of dismissal, the worker has the right to go to court. The judge decides whether the dismissal is unfair. Unfairly dismissed workers reinstated and paid foregone wages plus damages.

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Although, after 1990, EPL is still stricter in firms above 15 employees, **the reform narrows the gap** between firms above and below 15 employees.

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- In Italy wage determination is to a large extent centralized, but between one sixth and one quarter of the compensation is firm-specific in the form of company-level wage increments (Guiso et al., 2005). In terms of diffusion, half of Italian workers were involved in firm-level negotiations in the period covered by our data.

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- Sample Selection rules:
  - Permanent male workers aged 20-55 with a valid wage between 1989 and 1993 (year of reform 1990 dropped)
  - Firms between 5 and 25 employees
  - Dependent variable: Weekly Wage = Yearly Wage / N. Paid Weeks
  - Drop upper and lower 1% of the weekly wage distribution in each year
  - Final sample of 29,177 workers and 9,914 firms between 1989 and 1993.

Descriptive Statistics

	Pre-reform		Post-reform	
	Small firms	Large firms	Small firms	Large firms
Real weekly wages	297.004	312.041	312.923	331.243
	(72.688)	(83.89)	(78.545)	(90.367)
Real weekly wage growth rate	0.049	0.04	0.024	0.029
	(0.121)	(0.114)	(0.123)	(0.127)
Employment	9.595	19.478	9.541	19.551
	(2.956)	(2.805)	(2.958)	(2.83)
White collar dummy	0.134	0.163	0.133	0.165
	(0.34)	(0.37)	(0.34)	(0.371)
Age	35.06	35.514	37.489	37.918
	(8.598)	(8.525)	(8.675)	(8.623)
Observations	31505	17121	45848	26178

Regression Discontinuity Design + Diff-in-Diff

- Standard RDD . . .
  - Dichotomous treatment that is a deterministic function of a single variable $\Leftrightarrow$ Randomized experiment in a neighbourhood of the threshold.
  - Compare wages paid by firms just below 15 employees to wages paid by firms just above 15 employees. . .

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  - . . . the discontinuity is constant over time.

OLS model

- If firms and workers **exogenously** assigned to treatment:

$$\begin{aligned} \log w_{ijt} &= \beta' X_{ijt} + \tau_t + \delta_1 D_{jt}^S + \delta_2 \left(D_{jt}^S \times Post \right) + u_{ijt} \\ D_{jt}^S &= 1 \left[Firm\ size \leq 15\ in\ year\ t \right] \\ Post &= 1 \left[Year \geq 1991 \right] \end{aligned}$$

  - $\widehat{\delta_2}$: estimated causal effect of EPL on **wages**

- The matrix X_{ijt} always includes a 3rd degree polynomial in firm size. Plus age, occupation, and industry dummies.

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- This model gives unbiased estimates only if workers and firms are exogenously assigned to the treatment status.

Endogeneity of treatment status

Firm sorting

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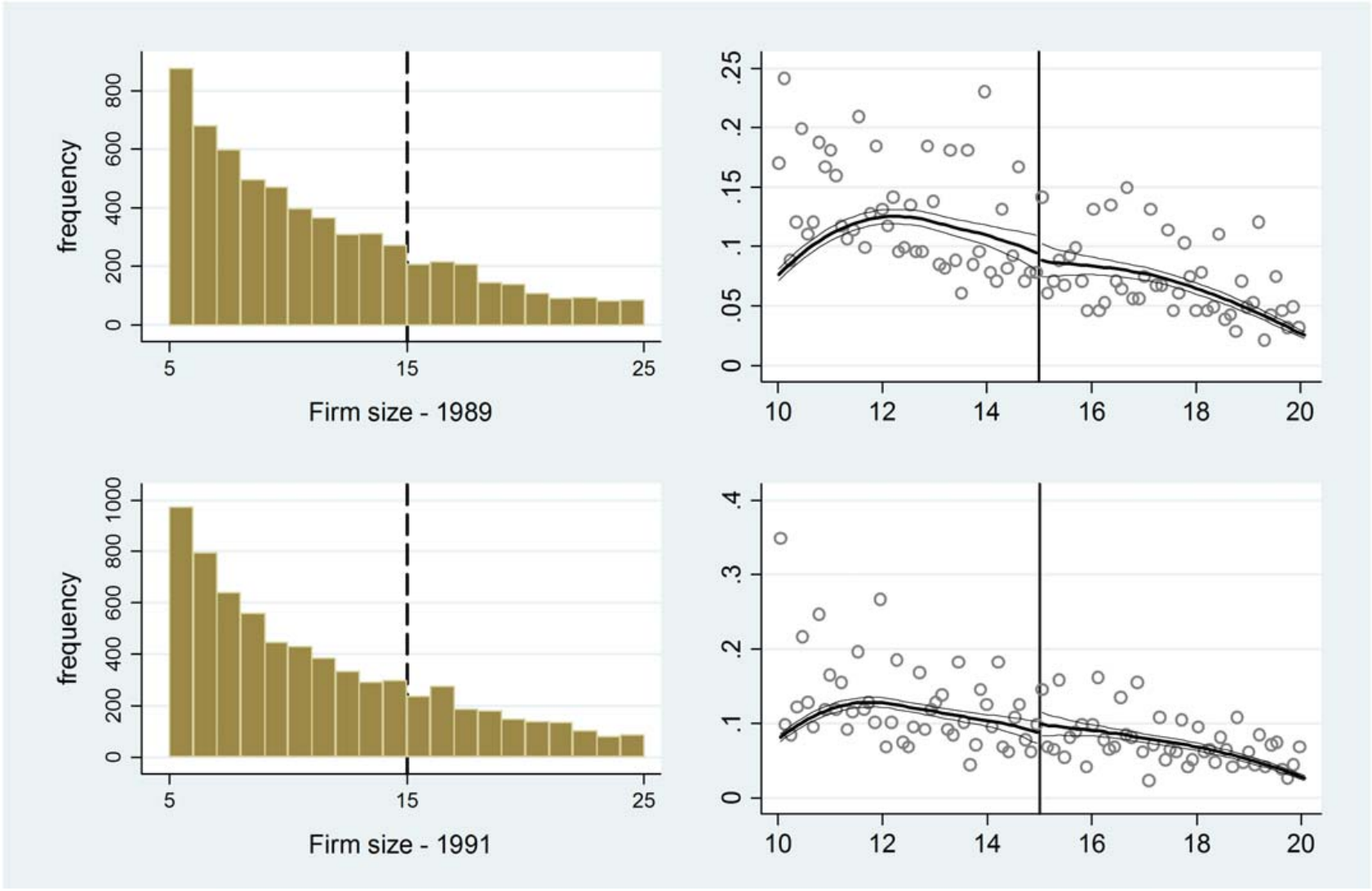
- Test of continuity of density at threshold: kernel local linear regressions of the log of the density separately on either sides of the threshold (McCrary, 2008).

Firm sorting around the 15 employee threshold



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- First estimate a regression of firms' average wages paid in 1986–1989 (before the reform) on firm size, firm age, year dummies and firm fixed effects.
- Then use the time-invariant portion of the residual as one of the determinants of the firm probability of growing:

$$\begin{aligned} d_{jt} = \; & \beta' X_{jt} + \delta_1 dummyS_{jt-1} + \delta_2 FE_j + \alpha_0 \left(dummyS_{jt-1} \times Post\right) \\ & + \alpha_1 \left(FE_j \times Post\right) + \alpha_2 \left(dummyS_{jt-1} \times FE_j\right) + \\ & \alpha_3 \left(dummyS_{jt-1} \times Post \times FE_j\right) + \varepsilon_{jt} \end{aligned}$$

  - $d_{jt} = 1$ if firm j in year t has a larger size than in $t-1$;
  - $dummyS_{jt-1}$: set of lagged firm size dummies;
  - FE_j: estimated firm fixed effect;
  - X_{jt} includes a quadratic in firms' age, year dummies, sector dummies and a polynomial in lagged firm size.

Probability of firm growth

	(1)	(2)	(4)
Dummy 13	-0.012	0.014	0.005
	(0.014)	(0.028)	(0.028)
Dummy 14	-0.026	-0.041	-0.041
	(0.014)*	(0.027)	(0.027)
Dummy 15	-0.029	-0.005	-0.001
	(0.015)*	(0.030)	(0.030)
Post 1990 × Dummy 13		-0.034	-0.030
		(0.030)	(0.031)
Post 1990 × Dummy 14		0.021	0.030
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Post 1990 × Dummy 15		-0.031	-0.035
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Firm Fixed Effect			0.242
			(0.033)***
Firm Fixed Effect × Dummy 13			0.348
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Firm Fixed Effect × Dummy 14			-0.087
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Firm Fixed Effect × Dummy 15			-0.302
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Post 1990 × Firm Fixed Effect			-0.220
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Post 1990 × Firm Fixed Effect × Dummy 13			-0.254
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- **Instruments: size dummies in 1988 and 1989**. Correlated with size in other years but not with the reform:

$$\begin{aligned} \log w_{ijt} &= \beta' X_{ijt} + \delta_0 Post + \delta_1 D^S_{jt} + \delta_2 \left(D^S_{jt} \times Post \right) + v_{ijt} \\ D^S_{jt} &= \gamma_0' X_{ijt} + \gamma_1 Post + \gamma_2' \mathbf{D^S_{jpre}} + \gamma_3' \left(\mathbf{D^S_{jpre}} \times Post \right) + \nu_{ijt} \end{aligned}$$

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- Interaction term also instrumented using the interaction with $\mathbf{D^S_{jpre}}$.

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2. Explicitly look at workers flows across the threshold around the reform.

Balanced test of firms observable characteristics

	Age	White collar	Agriculture	Gas Water Oil	Extraction Minerals Chemical	Metal	Manu-facturing	Construc-tion	Wholesale Retail Hotel	Trans-portation
					2nd degree polynomial					
Post 1990 × Small Firm	-3.760	-0.473	-0.112	-0.001	0.101	-0.699	1.218*	-0.990*	0.823	0.240
	(10.816)	(0.515)	(0.131)	(0.028)	(0.441)	(0.733)	(0.737)	(0.535)	(0.620)	(0.251)
					3rd degree polynomial					
Post 1990 × Small Firm	-41.268	1.355	0.531	0.002	3.533	1.333	-2.234	-1.770	-1.707	-1.541
	(83.991)	(3.996)	(1.014)	(0.216)	(3.420)	(5.691)	(5.721)	(4.155)	(4.816)	(1.952)
Obs.	28043	28043	28043	28043	28043	28043	28043	28043	28043	28043

Flows across the threshold around the reform

Dependent Variable: mover dummy (probit)	$P > 15$		$P \leq 15$	
Small firm dummy	0.009	0.009	-0.000	0.000
	(0.003)***	(0.003)***	(0.004)	(0.004)
Small firm dummy × Dummy 1990	-0.010	-0.010	-0.003	-0.003
	(0.003)***	(0.003)***	(0.004)	(0.004)
Small firm dummy × Dummy 1991	-0.013	-0.013	0.001	0.001
	(0.003)***	(0.003)***	(0.005)	(0.005)
Small firm dummy × Dummy 1992	-0.014	-0.014	0.024	0.023
	(0.003)***	(0.003)***	(0.006)***	(0.006)***
Small firm dummy × Dummy 1993	-0.003	-0.003	0.014	0.014
	(0.003)	(0.003)	(0.005)***	(0.005)***
Worker Fixed Effect		-0.010		-0.061
		(0.012)		(0.014)***
Worker Fixed Effect × Small firm dummy		0.001		0.022
		(0.015)		(0.017)
Worker Fixed Effect × Dummy 1990		-0.008		-0.012
		(0.016)		(0.019)
Worker Fixed Effect × Dummy 1991		-0.020		-0.001
		(0.016)		(0.020)
Worker Fixed Effect × Dummy 1992		-0.019		0.044
		(0.017)		(0.021)**
Worker Fixed Effect × Dummy 1993		-0.008		-0.005
		(0.015)		(0.023)
Worker Fixed Effect × Dummy 1990 × Small Firm Dummy		0.008		0.018
		(0.021)		(0.024)
Worker Fixed Effect × Dummy 1991 × Small Firm Dummy		0.050		0.003
		(0.021)**		(0.024)
Worker Fixed Effect × Dummy 1992 × Small Firm Dummy		0.024		-0.033
		(0.022)		(0.025)
Worker Fixed Effect × Dummy 1993 × Small Firm Dummy		0.016		0.024
		(0.018)		(0.027)
Observations	120652	120652	120583	120583

Flows across the threshold around the reform

Dependent Variable: mover dummy (probit)	$P > 15$		$P \leq 15$	
Small firm dummy	**0.009**	0.009	-0.000	0.000
	(0.003)***	(0.003)***	(0.004)	(0.004)
Small firm dummy × Dummy 1990	-0.010	-0.010	-0.003	-0.003
	(0.003)***	(0.003)***	(0.004)	(0.004)
Small firm dummy × Dummy 1991	-0.013	-0.013	0.001	0.001
	(0.003)***	(0.003)***	(0.005)	(0.005)
Small firm dummy × Dummy 1992	-0.014	-0.014	0.024	0.023
	(0.003)***	(0.003)***	(0.006)***	(0.006)***
Small firm dummy × Dummy 1993	-0.003	-0.003	0.014	0.014
	(0.003)	(0.003)	(0.005)***	(0.005)***
Worker Fixed Effect		-0.010		-0.061
		(0.012)		(0.014)***
Worker Fixed Effect × Small firm dummy		0.001		0.022
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Small firm dummy × Dummy 1990	**-0.010**	-0.010	-0.003	-0.003
	(0.003)***	(0.003)***	(0.004)	(0.004)
Small firm dummy × Dummy 1991	**-0.013**	-0.013	0.001	0.001
	(0.003)***	(0.003)***	(0.005)	(0.005)
Small firm dummy × Dummy 1992	**-0.014**	-0.014	0.024	0.023
	(0.003)***	(0.003)***	(0.006)***	(0.006)***
Small firm dummy × Dummy 1993	-0.003	-0.003	0.014	0.014
	(0.003)	(0.003)	(0.005)***	(0.005)***
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	(0.003)***	(0.003)***	(0.006)***	(0.006)***
Small firm dummy × Dummy 1993	-0.003	-0.003	0.014	0.014
	(0.003)	(0.003)	(0.005)***	(0.005)***
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Worker Fixed Effect × Small firm dummy		0.001		0.022
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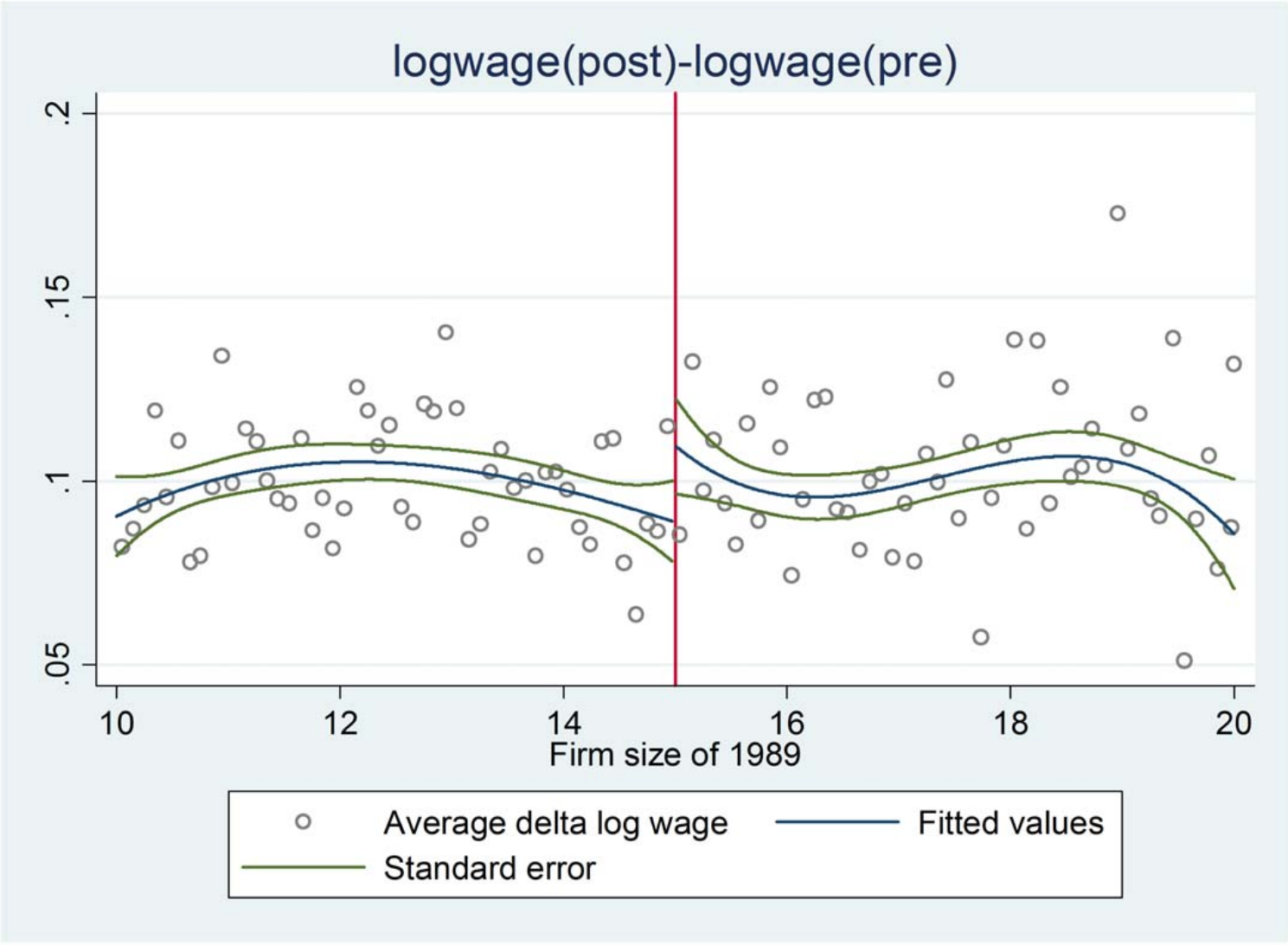
		(0.015)		(0.023)
Worker Fixed Effect × Dummy 1990 × Small Firm Dummy		0.008		0.018
		(0.021)		(0.024)
Worker Fixed Effect × Dummy 1991 × Small Firm Dummy		**0.050**		0.003
		(0.021)**		(0.024)
Worker Fixed Effect × Dummy 1992 × Small Firm Dummy		0.024		-0.033
		(0.022)		(0.025)
Worker Fixed Effect × Dummy 1993 × Small Firm Dummy		0.016		0.024
		(0.018)		(0.027)
Observations	120652	120652	120583	120583

Results

- Effects on average wages:
  - Full sample
  - Movers: change firm at least once between 1989 and 1993.
  - Stayers: never change firm between 1989 and 1993.
  - Blue collars
  - White collars
  - Young (age < 30)
  - Old (age > 45)
- Effects at different points of the distribution of the wage drift
- Robustness

Full sample


logwage(post)-logwage(pre)
.2
.15
.1
.05
10
12
14
16
18
20
Firm size of 1989
Average delta log wage
Fitted values
Standard error

Full sample

	(1)	(2)	(3)	(4)	(5)
	Panel A: log levels				
Post 1990 × Small Firm Dummy	-0.011 [0.003]***	-0.004 [0.002]*	-0.002 [0.002]	-0.013 [0.004]***	-0.008 [0.003]***
Observations	96333	96333	96333	83592	83592
R-squared	0.26	0.16	0.22		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
	Panel B: log changes				
Post 1990 × Small Firm Dummy	-0.013 [0.002]***	-0.011 [0.002]***	-0.010 [0.002]***	-0.016 [0.002]***	-0.009 [0.004]**
Observations	93435	93435	93435	81391	81391
R-squared	0.01	0.03	0.01		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

Movers

	(1)	(2)	(3)	(4)	(5)
			Panel A: log levels		
Post 1990 × Small Firm Dummy	-0.021 [0.006]***	-0.019 [0.005]***	-0.011 [0.005]**	-0.025 [0.008]***	-0.024 [0.008]***
Observations	28451	28451	28451	19074	19074
R-squared	0.20	0.13	0.17		
F-test of excluded instr. (p-value)				0.22; 0.00	0.70; 0.00
			Panel B: log changes		
Post 1990 × Small Firm Dummy	-0.022 [0.005]***	-0.021 [0.006]***	-0.017 [0.007]**	-0.033 [0.007]***	-0.034 [0.013]**
Observations	27322	27322	27322	18251	18251
R-squared	0.02	0.03	0.01		
F-test of excluded instr. (p-value)				0.33; 0.00	0.52; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

Stayers

	(1)	(2)	(3)	(4)	(5)
			Panel A: log levels		
Post 1990 ×	-0.008	0.002	0.001	-0.011	-
Small Firm Dummy	[0.003]***	[0.002]	[0.002]	[0.005]**	-
Observations	67882	67882	67882	64518	-
R-squared	0.28	0.19	0.24		
F-test of excluded instr. (p-value)				0.00; 0.00	-
			Panel B: log changes		
Post 1990 ×	-0.009	-0.006	-0.007	-0.012	-
Small Firm Dummy	[0.002]***	[0.002]***	[0.002]***	[0.002]***	-
Observations	66113	66113	66113	63140	-
R-squared	0.02	0.05	0.01		
F-test of excluded instr. (p-value)				0.00; 0.00	-
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

Blue collars

	(1)	(2)	(3)	(4)	(5)
			Panel A: log levels		
Post 1990 × Small Firm Dummy	-0.014 [0.003]***	-0.004 [0.002]*	-0.001 [0.002]	-0.015 [0.003]***	-0.006 [0.003]**
Observations	82413	82413	82413	71526	71526
R-squared	0.13	0.14	0.09		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
			Panel B: log changes		
Post 1990 × Small Firm Dummy	-0.014 [0.002]***	-0.012 [0.002]***	-0.011 [0.002]***	-0.016 [0.002]***	-0.009 [0.004]**
Observations	79967	79967	79967	69662	69662
R-squared	0.01	0.03	0.01		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

White collars

	(1)	(2)	(3)	(4)	(5)
	Panel A: log levels				
Post 1990 × Small Firm Dummy	0.005 [0.009]	-0.001 [0.006]	-0.004 [0.006]	0.003 [0.019]	-0.006 [0.007]
Observations	13920	13920	13920	12066	12066
R-squared	0.18	0.20	0.20		
F-test of excluded instr. (p-value)				0.37; 0.00	0.13; 0.00
	Panel B: log changes				
Post 1990 × Small Firm Dummy	-0.004 [0.005]	-0.003 [0.006]	-0.003 [0.006]	-0.010 [0.007]	-0.010 [0.008]
Observations	13468	13468	13468	11729	11729
R-squared	0.02	0.04	0.01		
F-test of excluded instr. (p-value)				0.30; 0.00	0.09; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

Young (<30)

	(1)	(2)	(3)	(4)	(5)
			Panel A: log levels		
Post 1990 × Small Firm Dummy	-0.019 [0.005]***	-0.012 [0.005]**	-0.007 [0.004]*	-0.024 [0.007]***	-0.028 [0.010]***
Observations	23579	23579	23579	19934	19934
R-squared	0.17	0.18	0.16		
F-test of excluded instr. (p-value)				0.00; 0.00	0.02; 0.00
			Panel B: log changes		
Post 1990 × Small Firm Dummy	-0.018 [0.004]***	-0.021 [0.006]***	-0.020 [0.005]***	-0.026 [0.005]***	-0.029 [0.010]***
Observations	22028	22028	22028	18717	18717
R-squared	0.01	0.03	0.01		
F-test of excluded instr. (p-value)				0.01; 0.00	0.03; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

Old (>45)

	(1)	(2)	(3)	(4)	(5)
			Panel A: log levels		
Post 1990 × Small Firm Dummy	-0.006 [0.007]	-0.001 [0.005]	-0.001 [0.005]	-0.006 [0.008]	0.001 [0.009]
Observations	19784	19784	19784	17337	17337
R-squared	0.29	0.11	0.22		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
			Panel B: log changes		
Post 1990 × Small Firm Dummy	-0.007 [0.004]	-0.011 [0.005]**	-0.009 [0.005]*	-0.006 [0.005]	-0.021 [0.011]*
Observations	19535	19535	19535	17169	17169
R-squared	0.01	0.07	0.01		
F-test of excluded instr. (p-value)				0.00; 0.00	0.00; 0.00
Workers FE	NO	YES	NO	NO	YES
Firms FE	NO	NO	YES	NO	NO
IV	NO	NO	NO	YES	YES

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where $w_{jt}^{\min}$ is the contractual minimum in sector j.

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- Quantile regression:

$$Q_\theta(\log y_{ijt}|X_{ijt}) = \beta'_\theta X_{ijt} + \delta_{1\theta} D_{jt}^S + \delta_{2\theta}\left(D_{jt}^S \times Post\right) + \sum_{k=1}^{3}(\gamma_{\theta k} fsize_{jt}^k)$$

Quantile regressions

	(1)	(2)	(3)	(4)
	Panel A: full sample 1989-1993			
	Q05	Q10	Q50	Q90
Post 1990 × Small Firm Dummy	-0.062 [0.012]***	-0.035 [0.008]***	-0.021 [0.007]***	-0.014 [0.007]*
Observations	50207	50207	50207	50207
	Panel B: blue collars 1989-1993			
	Q05	Q10	Q50	Q90
Post 1990 × Small Firm Dummy	-0.042 [0.008]***	-0.026 [0.004]***	-0.018 [0.006]***	-0.013 [0.015]
Observations	43539	43539	43539	43539

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- Placebo tests: Post 1990 $\times$ 10 employees threshold dummy, Post 1992 $\times$ Small Firm Dummy, Post 1988 $\times$ Small Firm Dummy.

Conclusions

- RDD + DID: compare the change in mean wages paid by firms just below 15 to the change in mean wages paid by firms just above 15, before and after the 1990 reform.
- Endogenous sorting of workers and firms may bias the results
  - Use workers and firm fixed effects
  - Use size dummy in 1988 and 1989 as instruments for the size dummy.
- Average wages of male workers declined by around 0.7%–1.5% in firms below 15 employees, relative to larger firms, because of the 1990 EPL reform.
- The effect is concentrated on low bargaining power workers (movers, blue collars, young and low-end of wage drift distribution). Stayers suffered a moderate reduction of wage growth after the reform.
- Firms translate on average around **68.8%** of the expected firing cost onto lower wages.

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  - Assuming a probability of 10% of individual firing for economic reasons, the total expected cost ex-ante is $(5,000 + 2,504)/10 = 750.4$ euros.

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  - Wage loss for an average worker in a small firm with average tenure 3.5 years after the reform ($\widehat{\delta_2} = -0.011$): $313 \times 0.011 = 3.4$ euros per week or 179 euros per year.

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  - An annual survival probability: $\rho = 0.71$ (to match 3.5 years of tenure)

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- Average wage loss:
  - Wage loss for an average worker in a small firm with average tenure 3.5 years after the reform ($\widehat{\delta_2} = -0.011$): $313 \times 0.011 = 3.4$ euros per week or 179 euros per year.
  - Annual discount rate of 8%, i.e., a discount factor of $\beta = 0.92$.
  - An annual survival probability: $\rho = 0.71$ (to match 3.5 years of tenure)
  - Let W be the present discounted value of the wage loss due to the reform $W(\widehat{\delta_2}|\beta, \rho) = 179 \times \sum_{t=0}^{\infty}[\beta\rho]^t = 516.1$.

Back of the envelope calculation

- Expected firing cost:
  - Post-reform average weekly wage: 313 euros.
  - Severance pay: 313×16 weeks $= 5{,}008$ euros, excluding legal expenses $(5,000)$ euros.
  - Probability of dismissal unfair: 0.5 (Galdón-Sánchez and Güell, 2000).
  - Expected firing cost: $5,008 \times 0.5 = 2,504$ euros excluding legal expenses.
  - Assuming a probability of 10% of individual firing for economic reasons, the total expected cost ex-ante is $(5,000 + 2,504)/10 = 750.4$ euros.
- Average wage loss:
  - Wage loss for an average worker in a small firm with average tenure 3.5 years after the reform ($\widehat{\delta_2} = -0.011$): $313 \times 0.011 = 3.4$ euros per week or 179 euros per year.
  - Annual discount rate of 8%, i.e., a discount factor of $\beta = 0.92$.
  - An annual survival probability: $\rho = 0.71$ (to match 3.5 years of tenure)
  - Let W be the present discounted value of the wage loss due to the reform $W(\widehat{\delta_2}|\beta, \rho) = 179 \times \sum_{t=0}^{\infty}[\beta\rho]^t = 516.1$.
- Around $516/750 = 0.688$ of the expected firing cost is translated onto lower wages.