The More, the Merrier? Scaling Up and Firm Performance*

ONGOING

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Introduction

- Small firms are the majority worldwide: in OECD countries 80% have $<$ 10 employees (OECD, 2021)
- Small firm growth, targeting financial and regulatory constraints, managerial skills (Manaresi et al., 2022) and skill gaps, is essential for employment, wage and productivity $\uparrow$ (Card *et al.*, 2018; Card, 2022)
- Key Dimensions:
  1. **Age** Young firms hire young workers, pay higher wages, and grow more (Ouimet and Zarutskie, 2014)
  2. Capital/labor substitution or complementarity
  3. Productivity, profitability, and efficiency
  4. Hiring profiles (contract type, security, schedule, qualification, age, edu level)
- Size $\uparrow \rightarrow$ TFP and K/L $\uparrow$ (Bjuggren, 2018, JPE)
  - ✳ Productivity $\uparrow$ only for older firms $\rightarrow$ Mixed evidence on firm age

This Paper

We investigate the impact of small firm scaling on firms' capital-labor choice, productivity, and efficiency

Exploit the Fornero Reform to find an exogenous threshold that incentives firm growth

Combine firm-level and matched employer-employee data and use a *Diff-in-IV* strategy

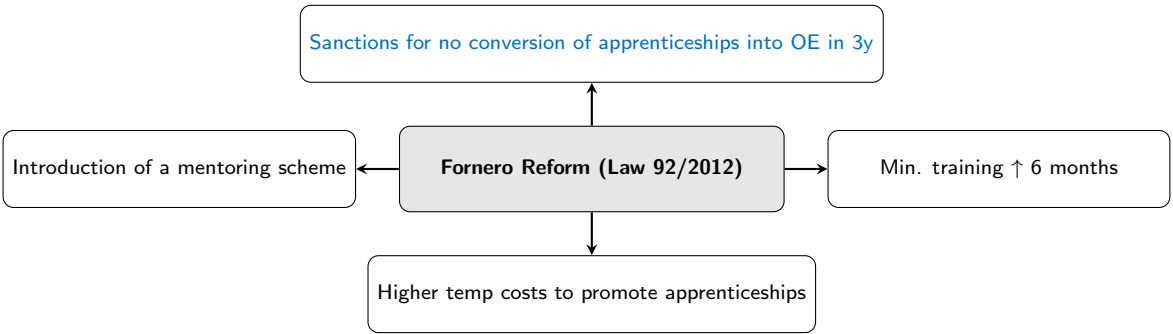
Investigate heterogeneity over time and across sectors

Preview

- Firm size growth leads to ↑ production outcomes but less proportionally
- ROE, ROA, ROI, and ROS are unaffected, suggesting that growth does not ↑ efficiency
- Size ↑ driven by complementary standard workers and apprentices
- *Synchronous Production Theory* firms evolve toward FT schedules
- Dynamics ↑ for standard apprentices, ↓ sales, revenues, and VA, while not on TFP
- Higher effects for younger and manufacturing/construction firms

The *Fornero* Reform

- Apprentice contract (*apprendistato professionalizzante* or AP) was introduced in '03 for 15-29y only
- VET (Vocational Education and Training or *apprendistato* 1^{st} *livello*) contract is a training agreement where students combine classroom education with on-the-job internships
- Firms failing to match the Fornero Requirements are forbidden to hire ANY apprentice in the future



Fornero Reform (Law 92/2012)

- Introduced size-dependent regulation of apprenticeship contracts
- A sharp institutional threshold arises at $L = 10$ employees:
  - Firms with $L < 10$ face no binding apprenticeship quotas and no conversion-rate sanctions
  - Firms with $L \geq 10$ are subject to quantitative limits and penalties for low conversion rates
- The cutoff is exogenously determined: absent the reform, firms below/above would evolve smoothly

The Reform incentivised firms to grow

Firms above the cutoff must have apprentices in quotas over the workforce, pushing to complement apprentices with other workers, while simultaneously apprentices become relatively less costly

- We exploit #firms transiting pre/post reform to identify the causal effect: *Reform* $\Rightarrow$ *Size* $\Rightarrow$ *Firm outcomes*

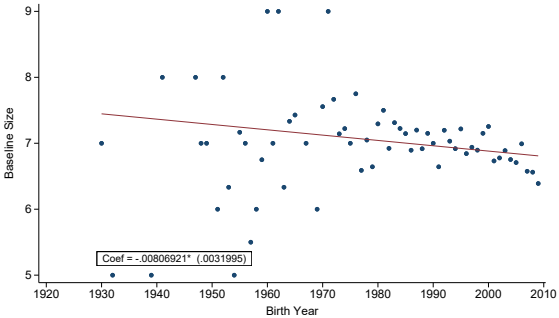
Data and Sample Selection

- **Communicazione Obbligatorie (CO)** Universe of Piedmont and Veneto plant flows in '09-19
  - We focus on qualification, occupation, edu level, age, contract type
- **CERVED** firms' balance records and size (INPS) at the yearly level in 2009-19
  - We focus on size, VA, capital, efficiency and profitability measures, TFP
- We select *growers i.e.,* firms whose baseline size (in '09) is between 5 and 9 employees and monotonically increases in '10-14 (JA in '15) up to 30 employees
  - *e.g.,* firm with 5 employees in '09, increases to 6 in '12 and doesn't decrease up to '14
  - Why *growers* only? because non-growers are bad controls
- Unbalanced panel of $\sim$ 9k plant-year tuples and 2k plants in 2010-14

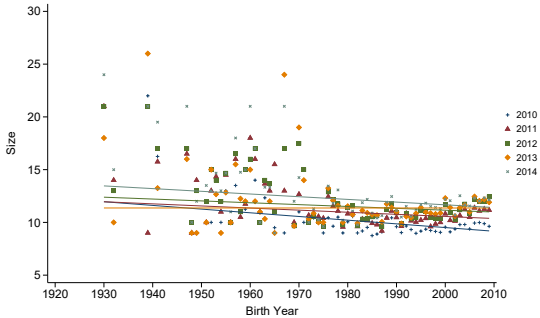
▸ Veneto & Piedmont ▸ Stats ▸ Age histograms ▸ Balancing

Firm Age and Firm Size

- *Growers* firms are younger: younger firms are smaller at the baseline but grow more over time

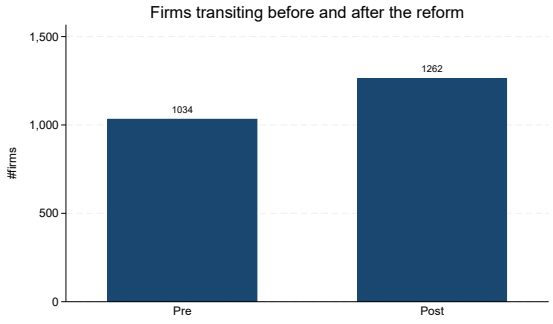


Firm baseline size vs firm birth year.

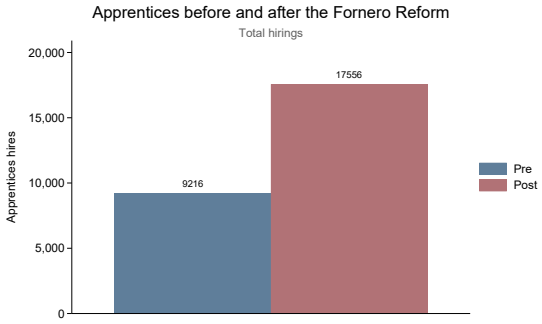


Firm size vs firm birth year over time

#transitions and #apprentices before and after the reform



#transitions pre and post.



#apprentices (AP + VET) pre and post.

Notes: The first panel plots #firms crossing the 10-employee threshold pre (2010–11) and post (2012–14) reform. The second panel plots #apprentices contracts (AP + VET) across the same bins pre and post reform.

▸ diff

Econometric Intuition

- We follow Alsan *et al.* (2025, QJE) *Difference-in-IV* (DIV)
- Consider a firm scaling up before or after the policy and decompose its outcomes as;

$$Y_j = Y_j(0) + \theta^B SB_j + \theta^\Delta SB_j \times Post_j \tag{1}$$

- $Y_j(0)$: untreated potential outcome *i.e.*, the outcome that firm j would experience without scaling
- $Post_j$=1 if firm j scales up after the reform; SA_j: firm size after $= SB_j \times Post_j$
- Two endogenous variables; one before and one after policy
- θ^B: Baseline effect of size on firm j; θ^Δ: Incremental effect of size growth due to the reform
- **Assumptions** 1 Firms didn't anticipate the reform; 2 Zs are positively correlated with the endogeneous variables; 3 Zs affect firm j outcome only through changes in size

Empirical Strategy

- We estimate:

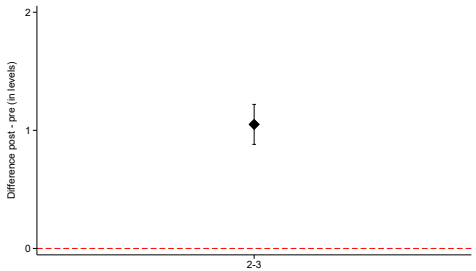
$$lnY_{jt} = \alpha_j + \beta_t + \gamma_{st} + \theta^B \hat{Size}^B_{jt} + \theta^\Delta \hat{Size}^A_{jt} \times Post_t + \epsilon_{jt} \quad (2)$$

  - 1^{st} stage:

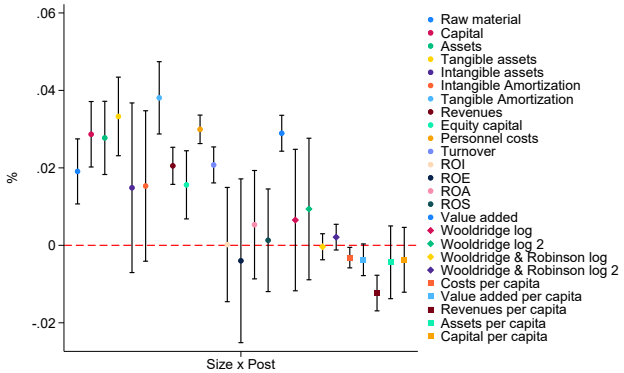
$$Size_{jt} = \alpha_j + \beta_t + \gamma_{st} + \delta_{o,s} Z^B_{o,d} + \Theta_{o,s} Z^A_{o,d} + \epsilon_{jt} \quad (3)$$

- Y_{jt} is an outcome of firm j in year t. α, β, and γ are firm, year, and 2d industry by year FE
- θ^Δ is the difference between two LATEs (θ^A - θ^B) identifying the incremental effect on Y
- Z is a dummy=1 is firm crossing the 10-employee threshold, pre and post policy
- Firm-level clustered standard errors

Baseline Effects



1st **Stage: Size**



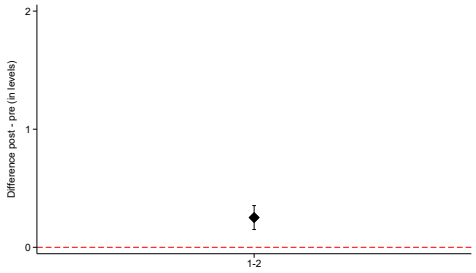
2nd **Stage: Other outcomes**

Notes: Reduced-form difference of $\delta_{o,s}$ and $\Theta_{o,s}$ from Eq. (3). Size in level. 95% CI. Firm-clustered SE. 1st stage statistics

Notes: Estimates of θ^{Δ} from Eq. (2). Outcomes in logs; coefficients are semi-elasticities. 95% CI. Firm-clustered SE.

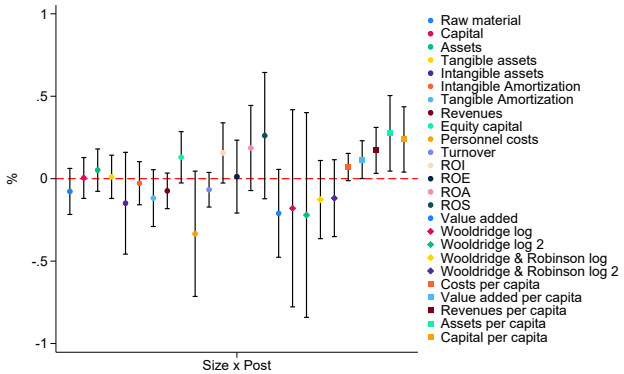
Placebo

- We select firms below the 10-employee threshold exploiting 0-4→5-9 transitions ($Z_{1,2}$)



1^{st} **Stage: Size**

Notes: Reduced-form difference of $\delta_{1,2}$ and $\Theta_{1,2}$. Size in level. 95% CI. Firm-clustered SE.



2^{nd} **Stage: Other outcomes**

Notes: Estimates of placebos θ^{Δ}. Outcomes in logs; coefficients are semi-elasticities. 95% CI. Firm-clustered SE.

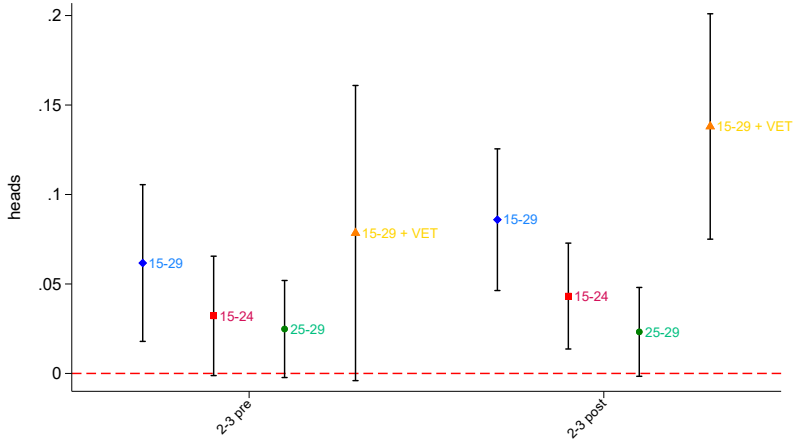
Mechanisms: *Synchronous Production Theory*

- **Labanca & Pozzoli (JOLE, 2022; JHR, 2023)** Supervision, mentoring, on-the-job learning require co-presence → Firms move toward cooperative, team-based technologies → ↓ dispersion of working hours + ↑ full-time + ↓ part-time !Productivity is not additive but arises from interaction!
- We estimate this reduced-form OLS specification:

$$Hirings_{jt} = \alpha_j + \beta_t + \gamma_{st} + \delta_{o,s} Z^B_{o,d} + \Theta_{o,s} Z^A_{o,d} + \epsilon_{jt} \tag{4}$$

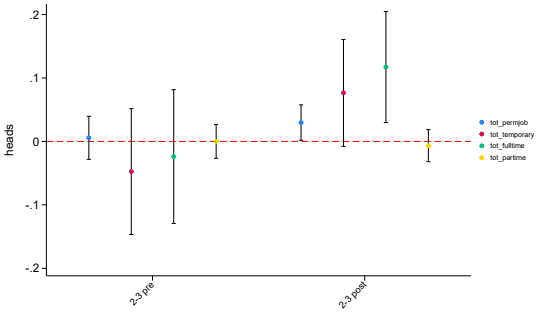
- Hirings separated by contract type, occupation, time schedule, age, and edu level
- $Z^{B,A}_{o,s}$ is a dummy=1 if firm j crosses the 10-employee threshold before and after the reform
- α, β, and γ are firm, year, and industry-year FE
- Firm clustered SE

Apprentices

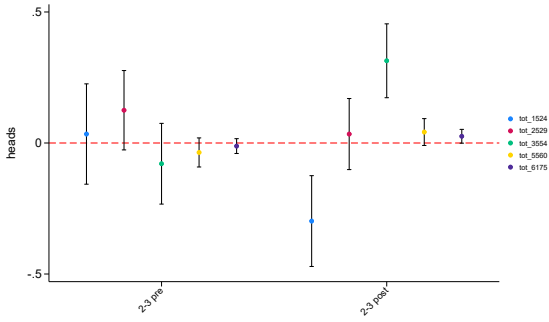


Notes: Graph plots the reduced-form estimates $\delta_{o,s}$ and $\Theta_{o,s}$ of Eq. (4). Outcomes in levels. 95% CI. Firm clustered SE. Only significant outcomes are displayed.

Hirings by Contract Type and Age



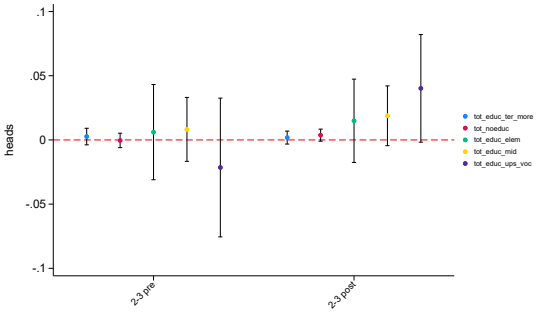
By Contract Type.



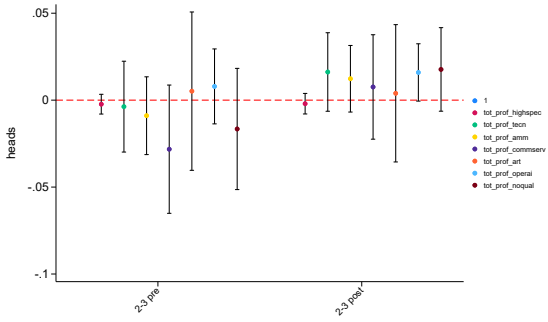
By Age.

Notes: Graph plots the reduced-form estimates $\delta_{o,s}$ and $\Theta_{o,s}$ of Eq. (4). Outcomes in levels. 95% CI. Firm clustered SE.

Hirings by Educational Level and Occupation



By Educational Level.



By Occupation.

Notes: Graph plots the reduced-form estimates $\delta_{o,s}$ and $\Theta_{o,s}$ of Eq. (4). Outcomes in levels. 95% CI. Firm clustered SE.

More

- ▸ By Sectors stronger effects in manifacture/construction (TFP $\uparrow$ and PC Ys $\approx$) particularly 4321/4322
- ▸ Dynamics Estimates all estimates decrease over time: in '19 they become null

Summing Up

- Scaling up ↑ all outcomes → Firms produce at a higher isoquant
- Null effects on ROS, ROI, ROE, ROA and unclear on TFP → Unclear efficiency improvements
- 1 ↑ in apprentices driven by VET; 2 ↑ older low-qualified workers and ↓ youngest workers → Effects driven by complementarity between apprentices and FT older workers
- ↑ standard apprentices + attenuated effects over time
- Stronger effects for younger firms in manufacturing/construction
- Results support synchronous production theory (Labanca & Pozzoli, 2022;2023)

Next

- Extend to all of Italy (VisitINPS?)

Thanks

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Piedmont and Veneto

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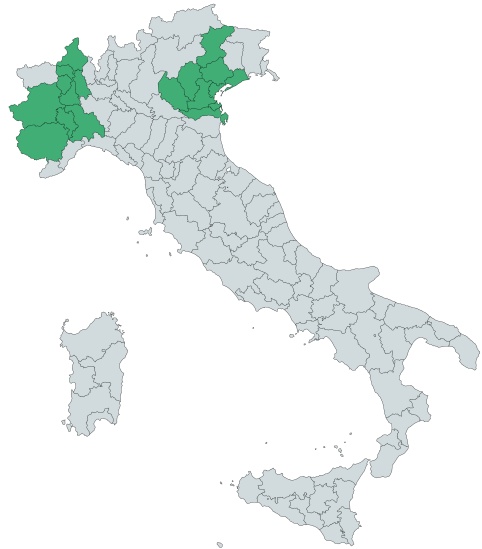
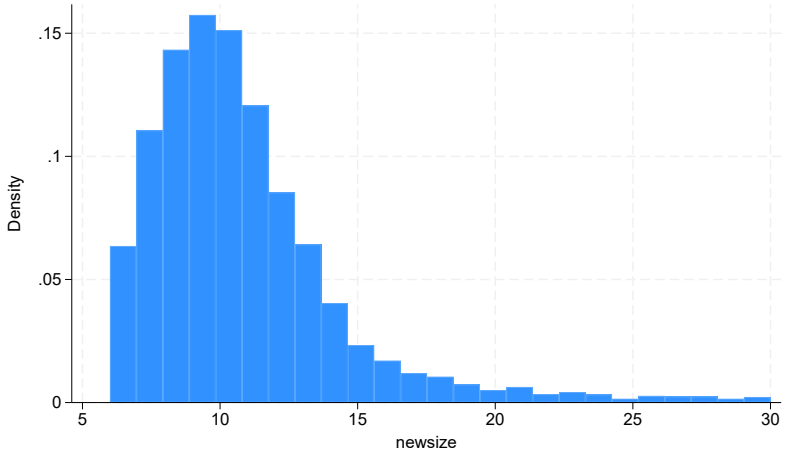
- Veneto's GDP is 180.5b; $\sim$ 9.3% of Italy's GDP. Piedmont's GDP is 146.2b; $\sim$ 7.5% of Italy's GDP
- Veneto has $\sim$ 500,000 businesses, mainly in manufacturing and services; Piedmont 400,000
- Veneto accounts for $\sim$ 10% of Italy's workforce, Piedmont 8%
- In 2012 there were 1206 municipalities in Piedmont and 581 in Veneto
- We cover $\sim$ 18% of Italy's GDP and workforce; 900k firms; 1787 municipalities



Firm Size



Firm size distribution.

Descriptive: Firm Outcomes

back

Descriptive Statistics: Firm Outcomes

Variable	N	Mean	SD	Median	Min	Max
Firm size	8,934	10.53	3.70	10	6	30
Fixed assets	8,934	1,627,169	7,137,202	412,769	0	264,000,000
Working capital	8,934	1,334,224	2,095,617	735,164	1,182	53,100,000
Tangible assets	8,934	556,313	1,356,259	189,844	0	25,400,000
Intangible assets	8,934	55,428	214,529	6,779	0	5,047,060
Material assets	8,934	457,719	1,258,018	127,989	0	25,300,000
Amortization (material)	8,850	9,946	23,176	2,791	0	552,602
Amortization (intangible)	8,850	43,392	59,792	24,726	0	1,309,007
Revenues	8,934	2,664,091	7,471,958	1,269,608	24,289	269,000,000
Equity	8,934	509,772	1,101,651	213,807	-760,631	23,700,000
Labor costs	8,934	308,300	180,504	268,378	314	2,307,272
Turnover	8,934	2,666,977	7,475,033	1,271,672	-1,214,067	269,000,000
ROI (%)	8,934	6.98	15.00	5.70	-440.04	103.38
ROE (%)	8,625	5.17	74.68	8.54	-1000	1000
ROA (%)	8,934	6.72	11.66	4.95	-493.04	103.35
ROS (%)	8,934	5.29	14.59	3.99	-410.26	1000
Cost per worker	8,934	29,061	11,820	27,702	15	167,908
Value added per worker	8,934	48,639	30,098	41,339	4,794	470,763
Revenue per worker	8,934	251,870	699,073	125,841	2,699	29,900,000
Capital per worker	8,850	53,374	119,970	21,191	0	2,535,331
Firm value	8,934	510,979	363,556	412,423	81,473	3,350,684

Descriptive: Firm Hirings

back

Descriptive Statistics: Hirings

Variable	N	Mean	SD	Median	Min	Max
Apprentices (15-29y)	8,934	0.311	0.915	0	0	12
Apprentices (15-24y)	8,934	0.202	0.670	0	0	10
Apprentices (25-29y)	8,934	0.108	0.452	0	0	10
Apprentice share	8,770	0.018	0.074	0	0	1
High-skilled workers	8,934	17.07	32.42	4	0	479
Technicians	8,934	13.80	28.97	4	0	478
Blue-collar workers	8,934	3.26	6.25	0	0	86
Part-time employees	8,934	2.74	9.36	1	0	203
Full-time employees	8,934	14.17	28.63	3	0	448
Executives	8,934	1.51	4.77	0	0	122
Non-contract workers	8,934	0.43	1.27	0	0	18

Balancing: Regression vs Full Sample

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Balancing in firms' characteristics by Sample. pre period.

	No regression sample		Regression sample		
	Mean / N	SD / (%)	Mean / N	SD / (%)	Std. Diff.
Province	9.768	3.8132	9.526	3.8666	0.063
Year of birth	1993	12.458	1996	11.994	-0.259
Industry	51.39	20.236	41.20	20.008	0.506

Balancing: Pre- and Post Reform

back

Covariate Balance by Period

	Post = 0		Post = 1		
Variable	Mean / N	SD / (%)	Mean / N	SD / (%)	Std. Diff.
Province	9.526	3.867	9.544	3.869	-0.004
Year of birth	1996	11.994	1996	12.016	0.009
Industry	41.20	20.008	41.05	19.923	0.008

Firm Age

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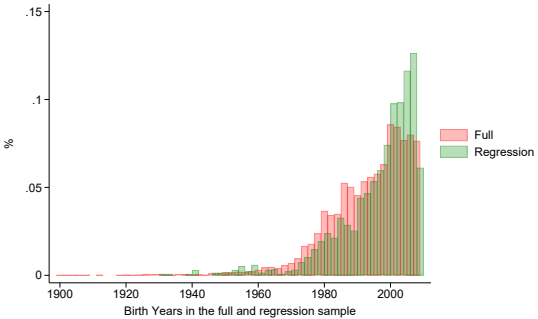
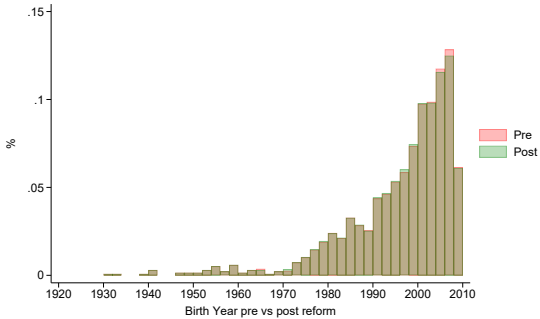


Full vs regression sample.



Regression sample: pre vs post reform.

First Stage Statistics

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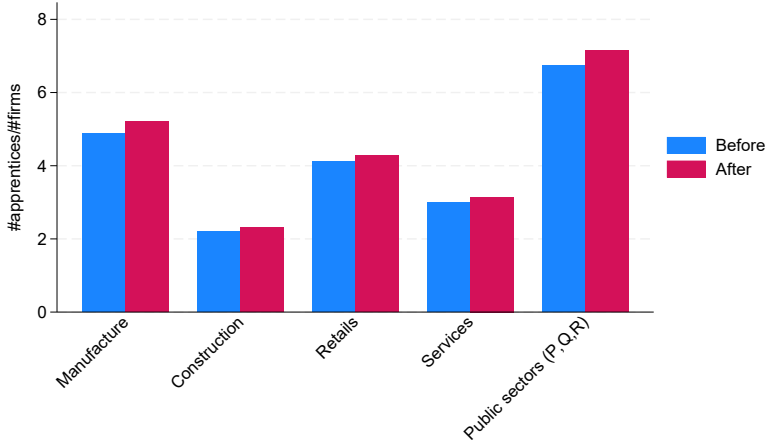
First-stage regression of *Size x Post*

	Dependent variable: *Size x Post*			
	Coefficient	Std. Error	*t*-stat	95% CI
treat23_pre	−1.665	0.108	−15.45	[−1.876, −1.454]
treat23_post	3.647	0.090	40.49	[3.470, 3.823]
Observations		8,873		
Clusters (id_ul)		1,809		
F-test of excluded instruments		$F(2, 1808) = 1178.60$		
Sanderson–Windmeijer F-test		$F(1, 1808) = 1997.16$		

First-stage identification tests

Variable	$F(2, 1808)$	SW $\chi^2(1)$	SW $F(1, 1808)$
Size x Post	1178.60	2074.98	1997.16
Size pre	69.61	212.48	204.51

Apprentices across Macro-sectors



#apprentices per firm in the full sample by macrosectors. *Notes:* Full sample is 1,614,723 firm-by-year tuples and 146,590 firms. The bars plot the cumulative sum of apprentices over the entire period (09-14) divided the number of firms pre and post reform. Pre is 09-11 and post is 12-14. Macro-sectors are an aggregation of 2-digit industry codes.

By Sector: Investments

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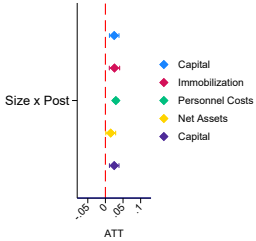

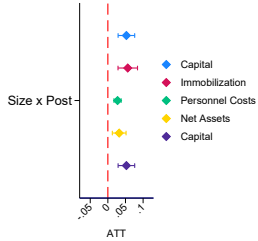

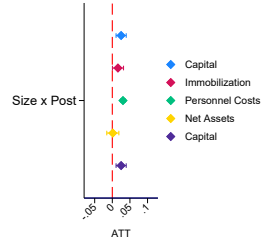

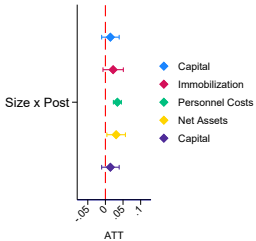

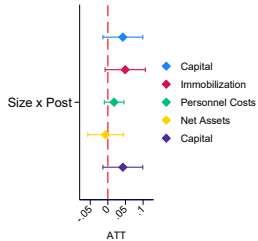

#Transitions pre and post

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Standardised difference of #transitions pre and post reform.

	Post = 0		Post = 1		
Variable	Mean / N	SD / (%)	Mean / N	SD / (%)	Std. Diff.
Transition dummy	0.555	0.497	0.682	0.466	-0.264

By Sector: Productivity and Profitability

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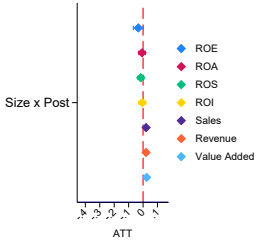
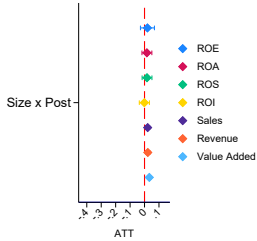
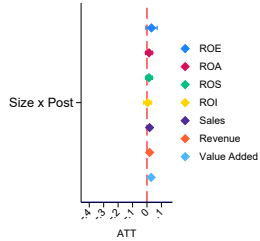
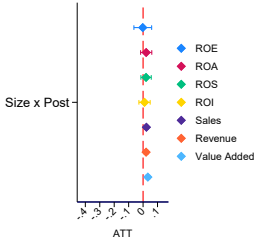
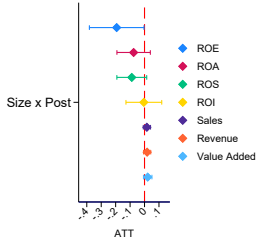


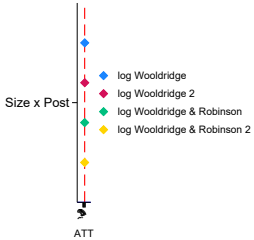


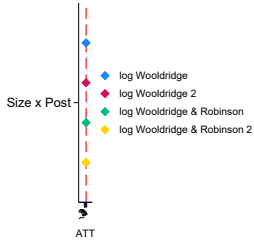


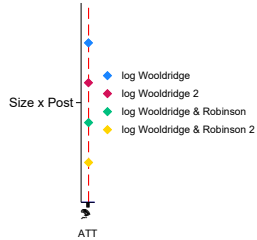


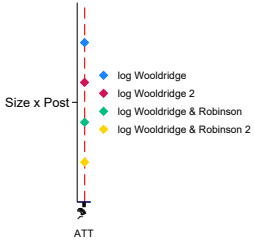


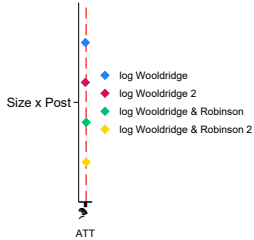
By Sector: TFP





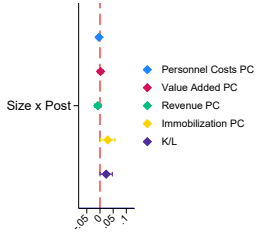


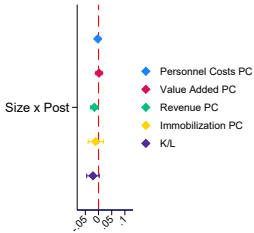


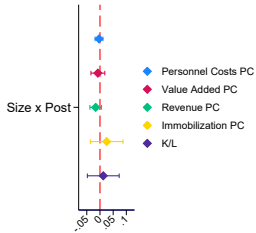


By Sector: Per Capita Outcomes

back



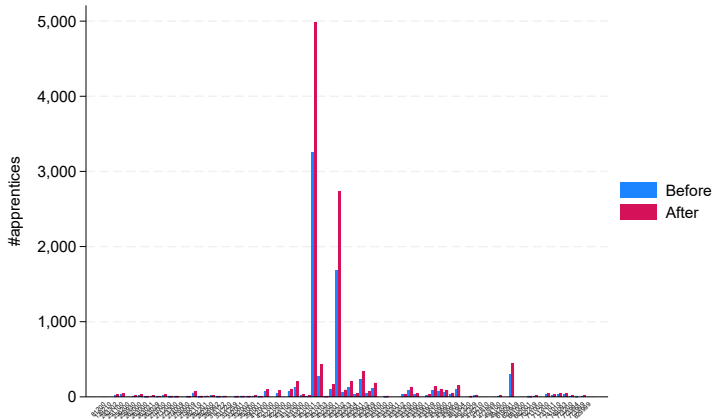




Effects driven within Construction

back

- Specialised Construction Activities (43) → Electrical, Plumbing, and heat installation (4321, 4322)



#apprentice contracts across 6d construction cells, before and after the reform.

Dynamic Specification (provisional) back

- Firms may need time to change strategies and address inefficiencies
- We estimate a dynamic specification adding cumulatively one year at a time up to '19:

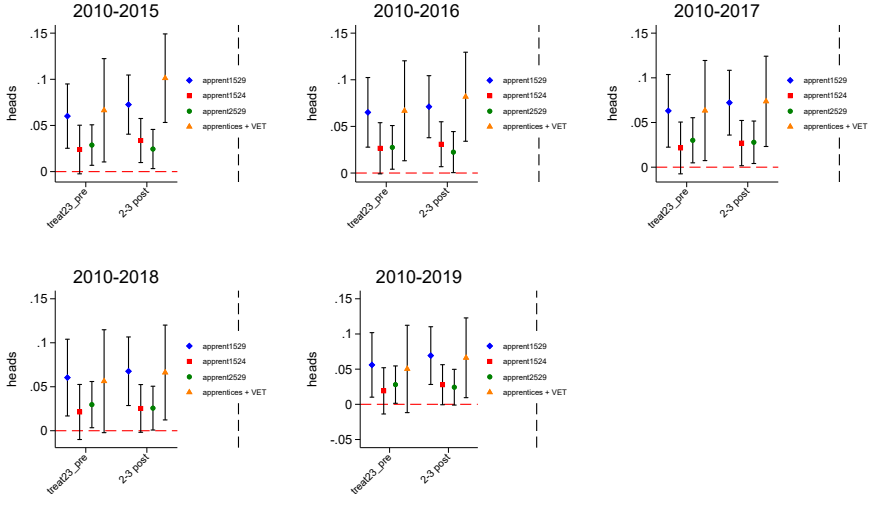
$$lnY_{j,t+i} = \alpha_j + \beta_{t+i} + \gamma_{s,t+i} + \theta^B \hat{Size}^B_{j,t} + \theta^\Delta \hat{Size}^A_{j,t} xPost_{t+i} + \epsilon_{j,t+i} \quad (5)$$

, with $i = [1:5]$, $t = [2010:2014]$, and $t+i$ going from 2015 to 2019

- Zs are exactly those of the baseline: no transition allowed post '14 $\rightarrow$ The sample of firms and their size is the same as the baseline; we only extend the window of analysis

Dynamics Estimates: Apprentices

back



Notes: Graph plots the reduced-form estimates $\delta_{o,s}$ and $\Theta_{o,s}$ of Eq. (4). Outcomes in levels. 95% CI. Firm clustered SE.

Dynamics Estimates: Balance Records I

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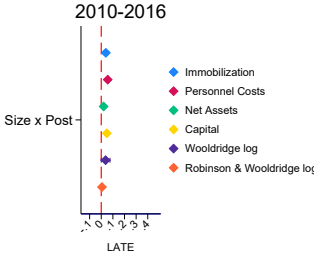
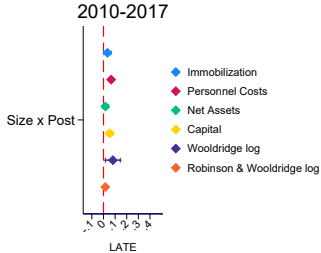
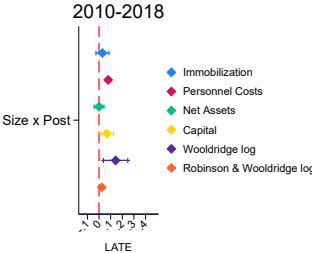
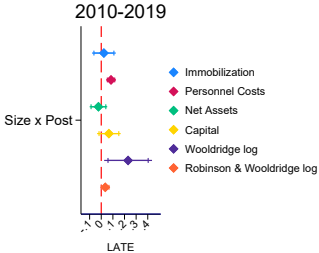
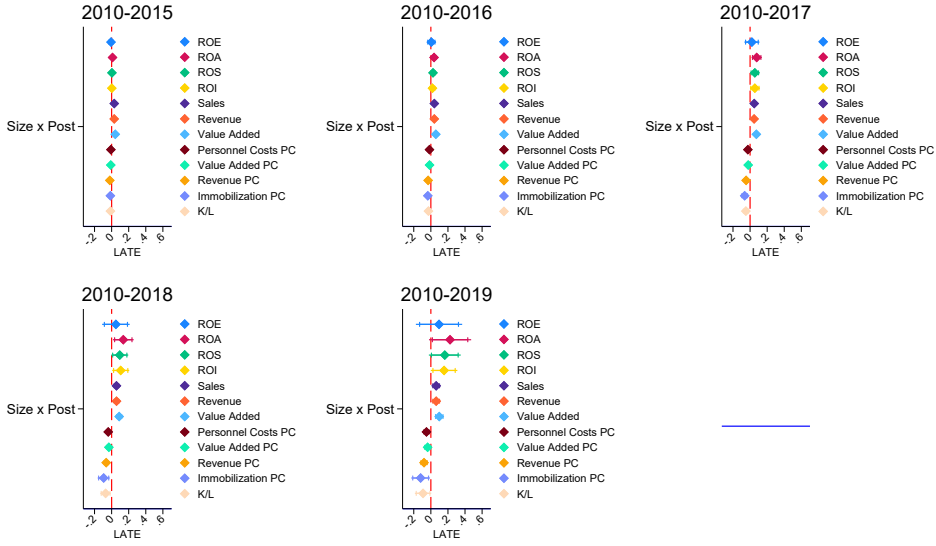








Dynamics Estimates: Balance Records II

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