Subdizing Labor Hoarding in Recessions
Employment & Welfare Effects of Short-Time Work

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BoE - Tax & Transfer Workshop

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Motivation

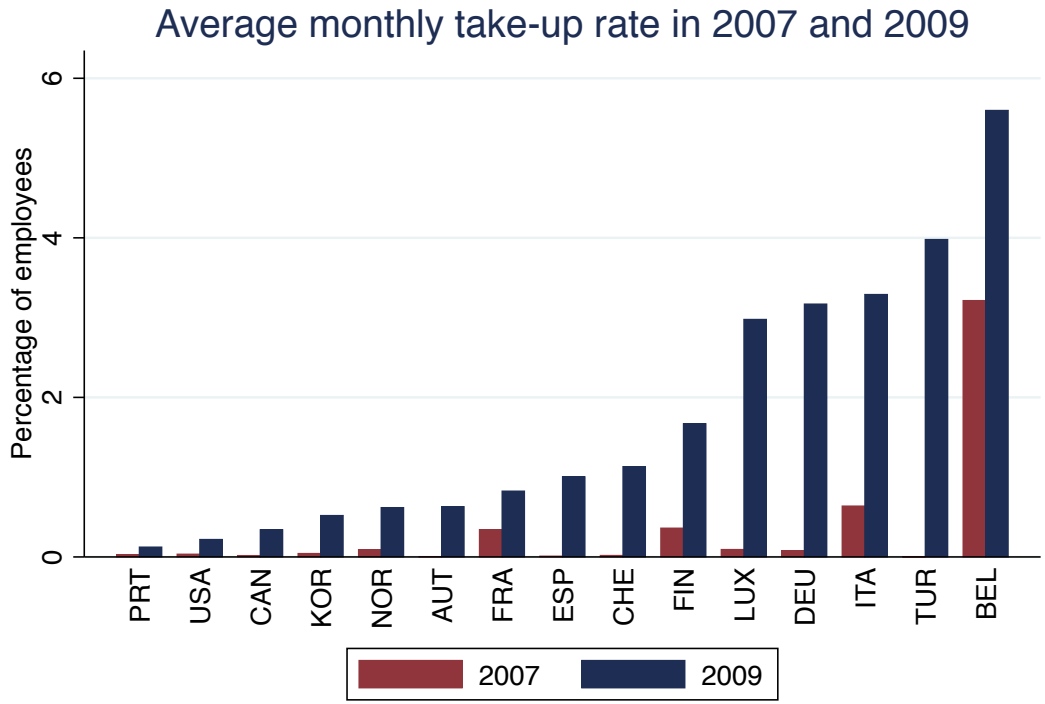
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- Subsidy for hour reductions to firms experiencing temporary shocks
- Policy tool **aggressively used during Great Recession**, especially in Italy

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Source: Hijzen and Venn (2010), OECD data

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Short-time work (STW)

- Subsidy for hour reductions to firms experiencing temporary shocks
- Policy tool **aggressively used during Great Recession**, especially in Italy
- But **WHY?**
- Remarkably **little knowledge about effects of STW** on firms, workers & welfare
  - Lack of good-quality data
  - Lack of credible sources of identification
  - Lack of conceptual framework for welfare analysis

This project:

- Leverage **unique data from INPS** records and **unique policy setting**:
  - ▷ Universe of administrative data on STW at individual and firm level
  - ▷ Quasi-experimental variation from Italian STW policy rules
- Offer compelling evidence on effects of STW:
  1. On firms' **employment, output and balance sheet**
  2. On **short & long-term** insurance of workers
  3. On **reallocation** in the labor market
- Develop conceptual framework:
  1. To rationalize empirical evidence on STW effects
  2. To clarify welfare trade-offs for optimal STW design
  3. To calibrate model & conduct counterfactual policy analysis

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     - Large effects (-) on hours and on employment (+)
  2. On **short & long-term** insurance of workers
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     - No significant effect on output / balance sheet
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     - Almost perfect insurance in short run
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  3. On **reallocation** in the labor market
     - Significant negative effect on employment of untreated firms
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  3. To calibrate model & conduct counterfactual policy analysis
     - Small positive welfare gains from STW, but $dW/d\tau \approx 0$

Outline

1. Institutional Background & Data
2. Effects of STW on Employment & Firm Outcomes
3. Insurance Value to Workers
4. Selection and Reallocation Effects
5. Model & Welfare Implications

Cassa Integrazione Guadagni Straordinaria (CIGS)

- CIGS: Main pillar of STW during Recession
  - Targets **firm experiencing shocks**: demand/revenue shocks, company crisis, restructuring, reorganization, insolvency etc.
- Subsidy for hour reductions, available to workers
  - Replaces about 80% of foregone earnings due to hours not worked
- **Weak conditionality requirements**:
  - ▷ Simply provide justification for economic need & recovery plan
  - ▷ No prohibition of dismissals/layoffs
  - ▷ Workers: No training provision or search requirement
- **Minimal cost to firm** $\approx$ 3-4.5% of subsidy
- Duration: up to 12 months (with possibility of extension)

Data

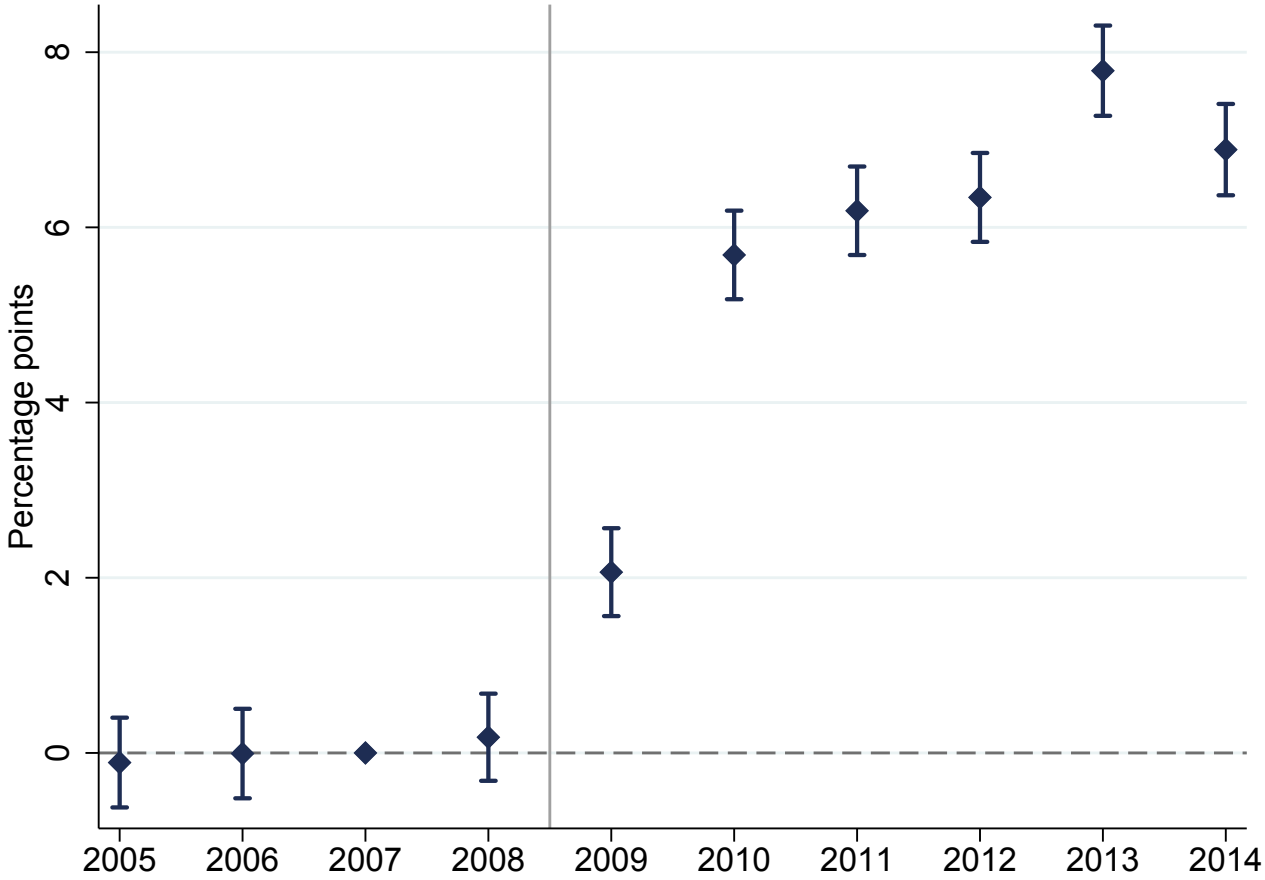
- Administrative data from Italian Social Security Archives
- Universe of **matched employer-employee data** for the private sector
- Monthly data 2005-2015 and annual data 1983-2015
- Information on workers and firms
  - Demographics
  - Working histories
  - Social insurance and social assistance program participation
  - Firm characteristics (size, sector)
- Information on **CIG** eligibility, applications, authorizations, duration and payment for the years 2005-2015
- Matching with firm-level **balance-sheet data** (approx. 50%)

Firms eligibility. Firms take-up. Workers treatment.

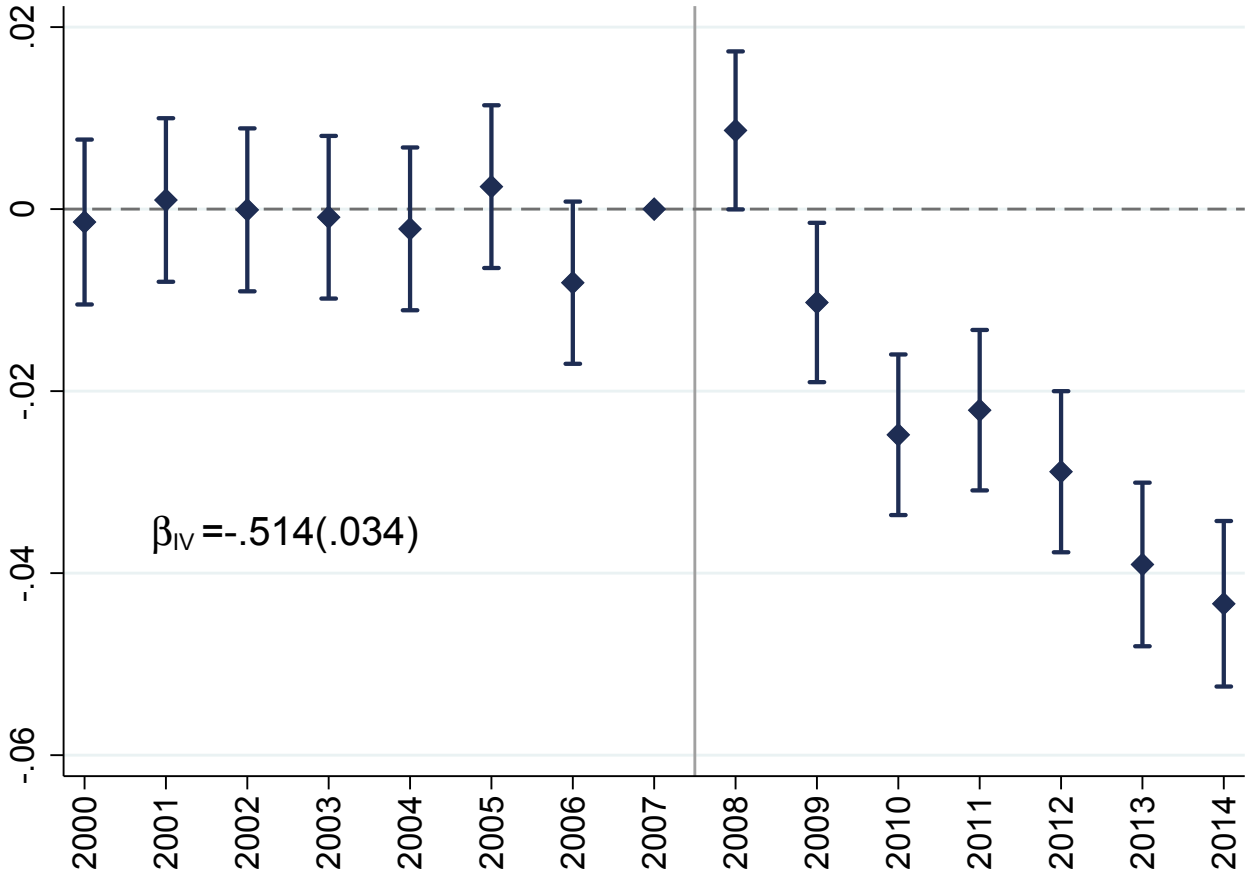
Identification

- Exploit variation in firm's eligibility for CIGS based on:
  - Firms' **industry** $\times$ **contributory codes**: Details
  - **Size**: more than 15 FTE employees in 6 mths prior to application
- **Triple Diff.** within the 5-digit industry codes. Compare outcomes of firms:
  1. In eligible vs non-eligible industry $\times$contributory codes
  2. Just below vs just above 15 FTE-threshold
  3. Before vs after the start of the Great Recession
- **Identifying assumption:**
  No unobservable time shocks that would be, within each 5-digit industry code, specific to firms that are eligible to CIGS *and* whose size is just above the 15 FTE threshold.

Fraction of Firms Receiving CIGS Treatment: 1st Stage



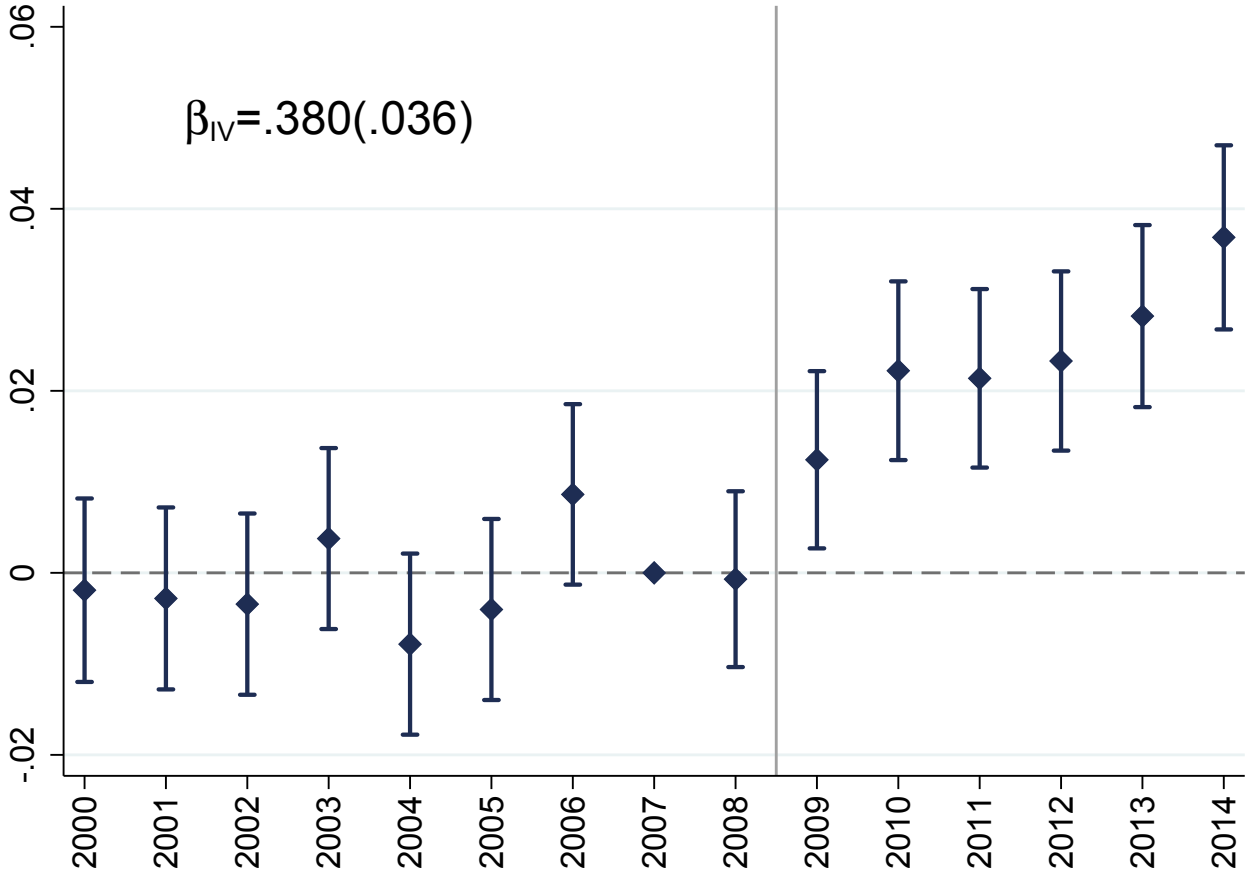
Intensive-Margin Employment: Log # Hours



- **STW decreases # of hours worked per employee by $\approx$ 40%**

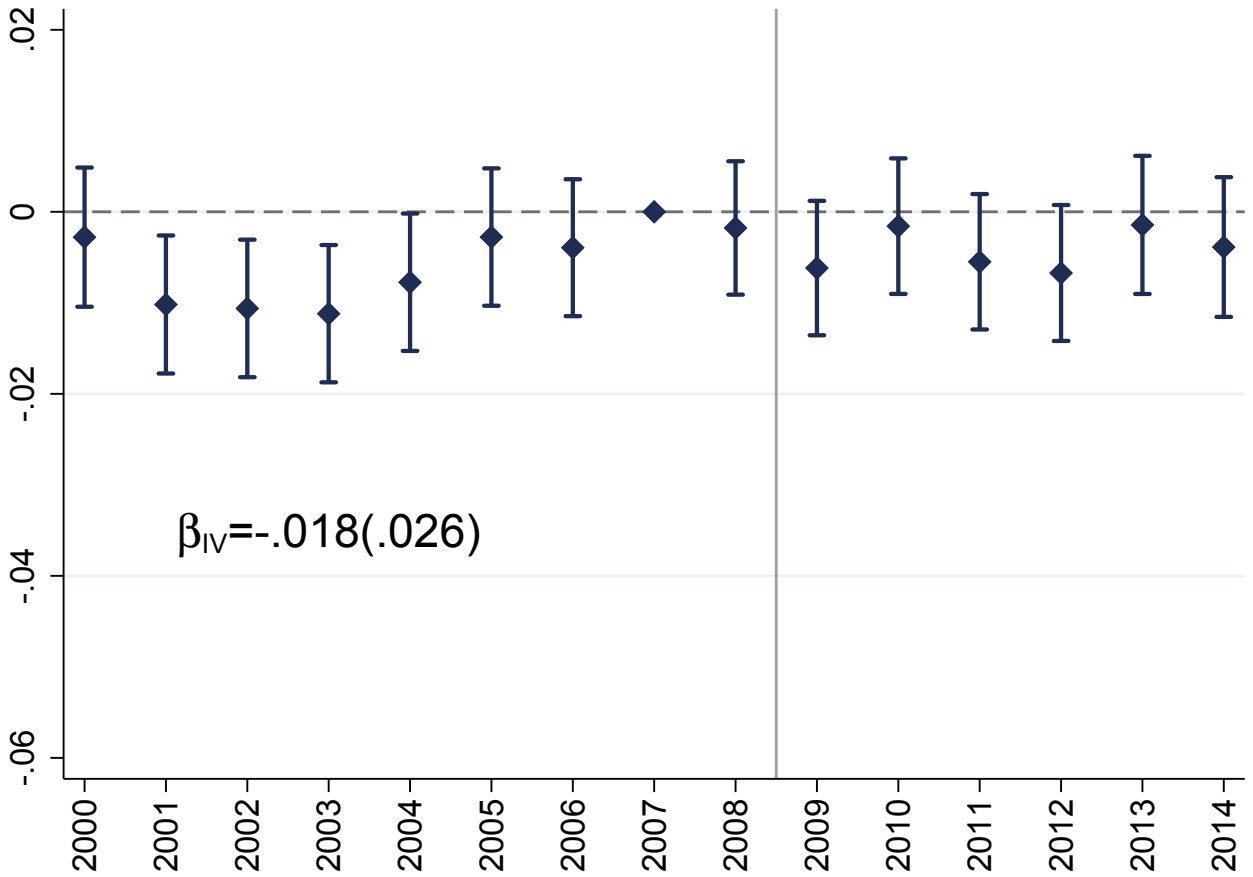
Weeks Worked

Extensive-Margin Employment: Log Firm Size Headcount



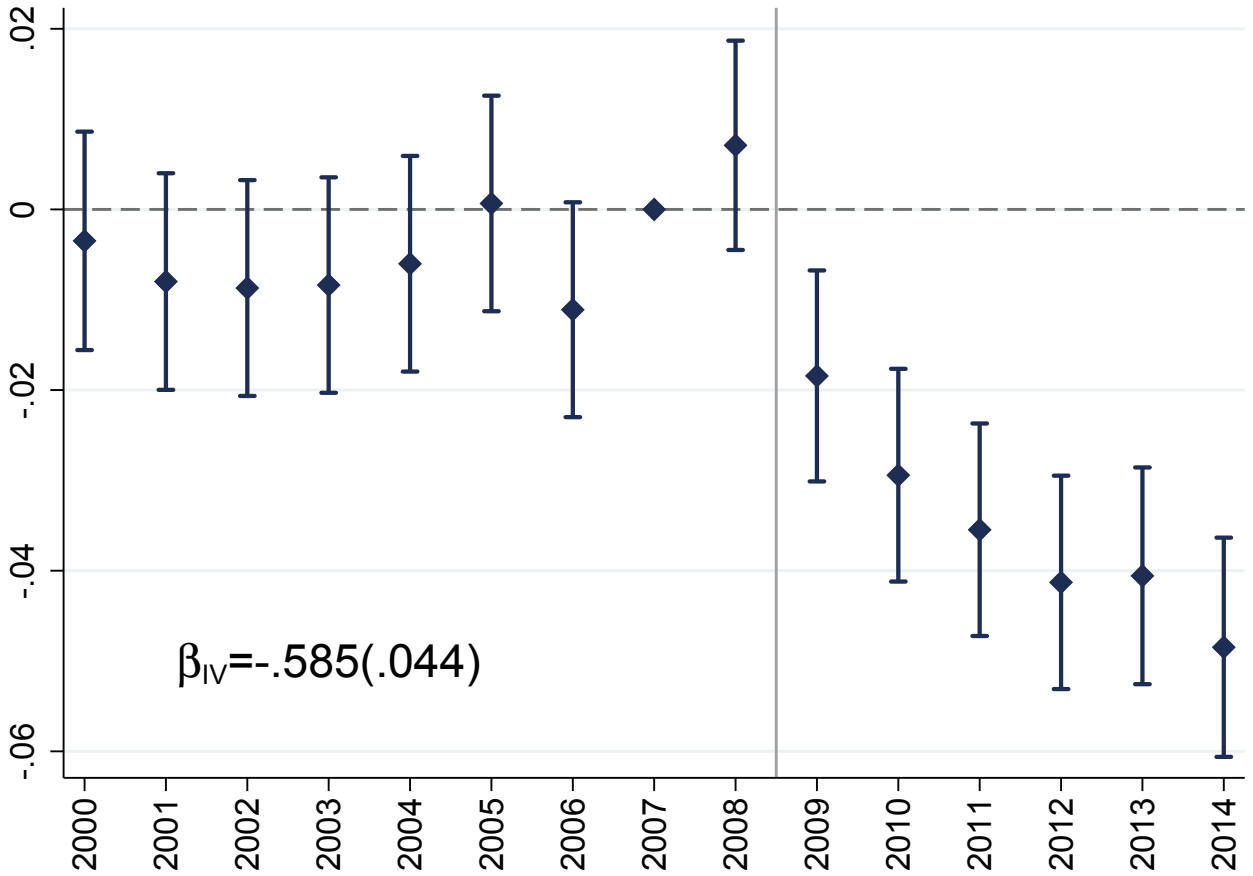
- **STW increases headcount employment by $\approx$ 40%**

Wage Rates: Log Earnings Per Week



- **STW has no significant effect on wage rates**

Log Wage Bill Per Employee



- **STW decreases wage bill per employee by $\approx$ 45%**

Additional Results & Robustness

- Dual labor market effects Open-ended vs fixed term
- Additional effects on firms' outcomes Balance-Sheet
  - Negative effect on output per worker
  - Slight negative effect on labor productivity & TFP
  - No significant effect on balance-sheet apart from liquidity (+)
- Robustness
  - No significant size manipulation Size Manip.
  - No significant eligibility manipulation Eligibility Manip.
  - No significant differential trend btw eligible & non-eligible Trends
  - Placebos & permutation-based s.e. Placebos & Permutation
  - Similar effects for firms without change in dismissal rule at 15FTE No 15FTE dismissal rule

Dynamic effects

- IV estimates capture total effects on firms of exposure to STW
  - Instrument determines both **past + current** treatment Past Treatment
- Develop methodology similar to Cellini & al. [2010] for recursive identification of **dynamic** effects of STW
- Intuition:

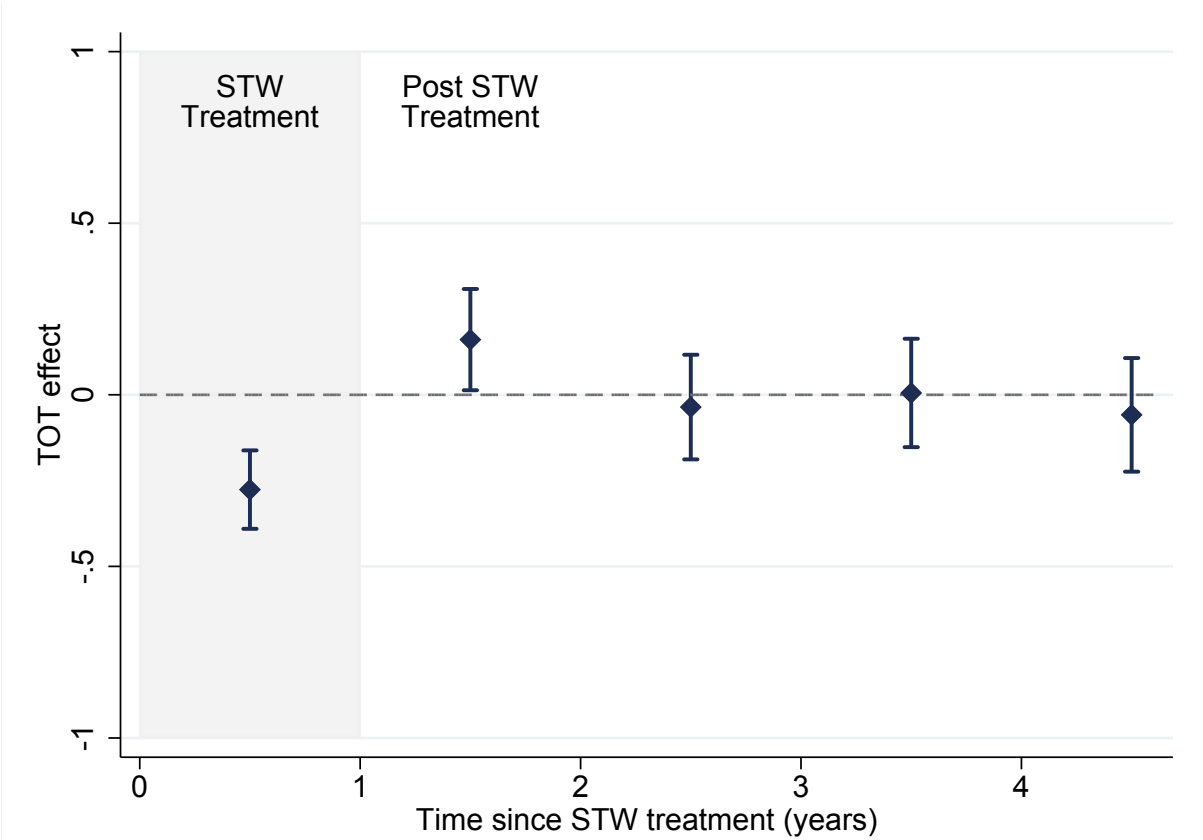
$$\beta^{DDD}_{2009} = \beta^{TOT}_{0} \cdot \frac{\mathrm{d}T_{2009}}{\mathrm{d}Z_{2009}} \tag{1}$$

$$\beta^{DDD}_{2010} = \beta^{TOT}_{0} \cdot \frac{\mathrm{d}T_{2010}}{\mathrm{d}Z_{2009}} + \beta^{TOT}_{1} \cdot \frac{\mathrm{d}T_{2009}}{\mathrm{d}Z_{2009}} \tag{2}$$

etc...

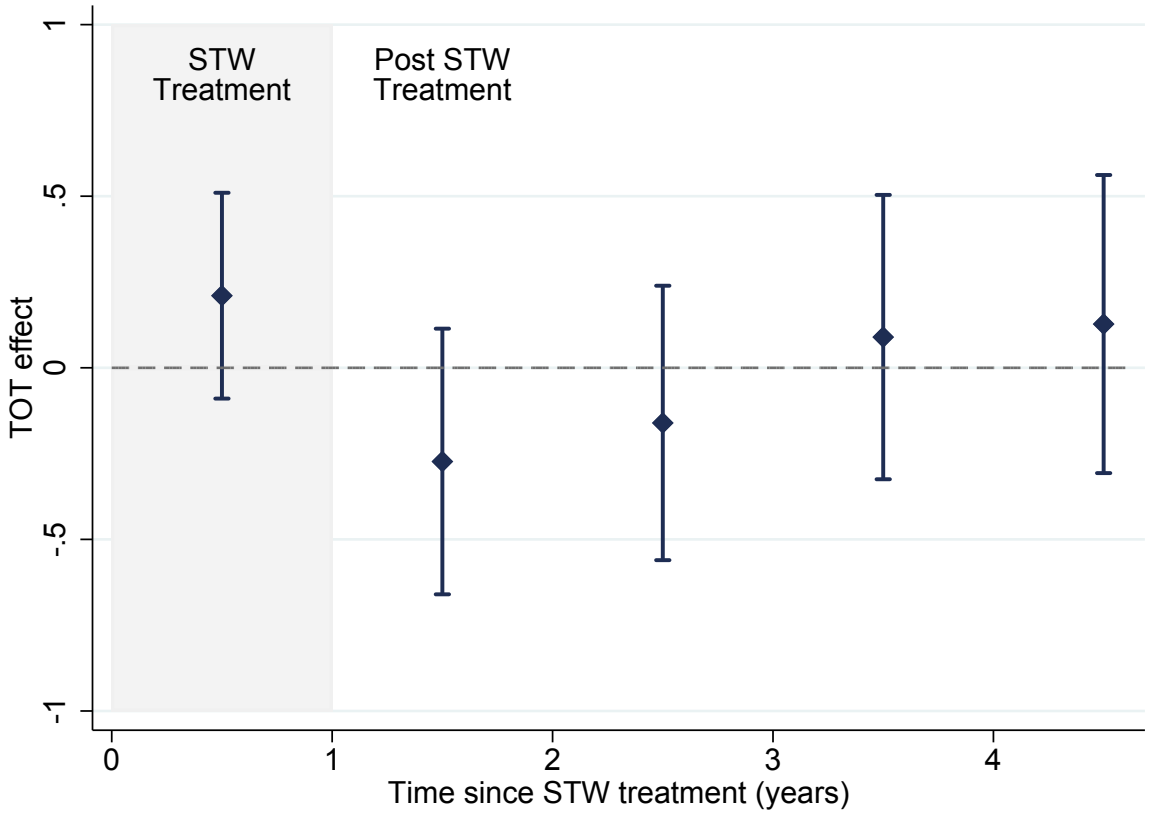
Graphical Results

Intensive Employment Effects Dissipate After Treatment



- **1 year after treatment, intensive margin responses disappear**

Dynamic Extensive Employment Response



- **No significant long term effects on employment** Back

Table: Dynamic TOT Effects of STW on Firm Outcomes

	Time since STW Treatment in Years...				
	0 (β_0^{TOT})	1 (β_1^{TOT})	2 (β_2^{TOT})	3 (β_3^{TOT})	4 (β_4^{TOT})
Log # Hours	-.284	.142	-.084	-.033	-.110
	(.063)	(.081)	(.084)	(.087)	(.091)
Log # Weeks Worked per Employee	-.276	.160	-.035	.005	-.058
	(.058)	(.075)	(.077)	(.080)	(.084)
Log Employment	.210	-.273	-.160	.089	.127
	(.152)	(.197)	(.204)	(.211)	(.221)
Log Wage Bill	-.188	.068	-.079	.062	-.066
	(.107)	(.138)	(.143)	(.148)	(.155)
Log Open-Ended Contracts	.412	-.317	-.069	-.054	.094
	(.125)	(.162)	(.167)	(.173)	(.182)

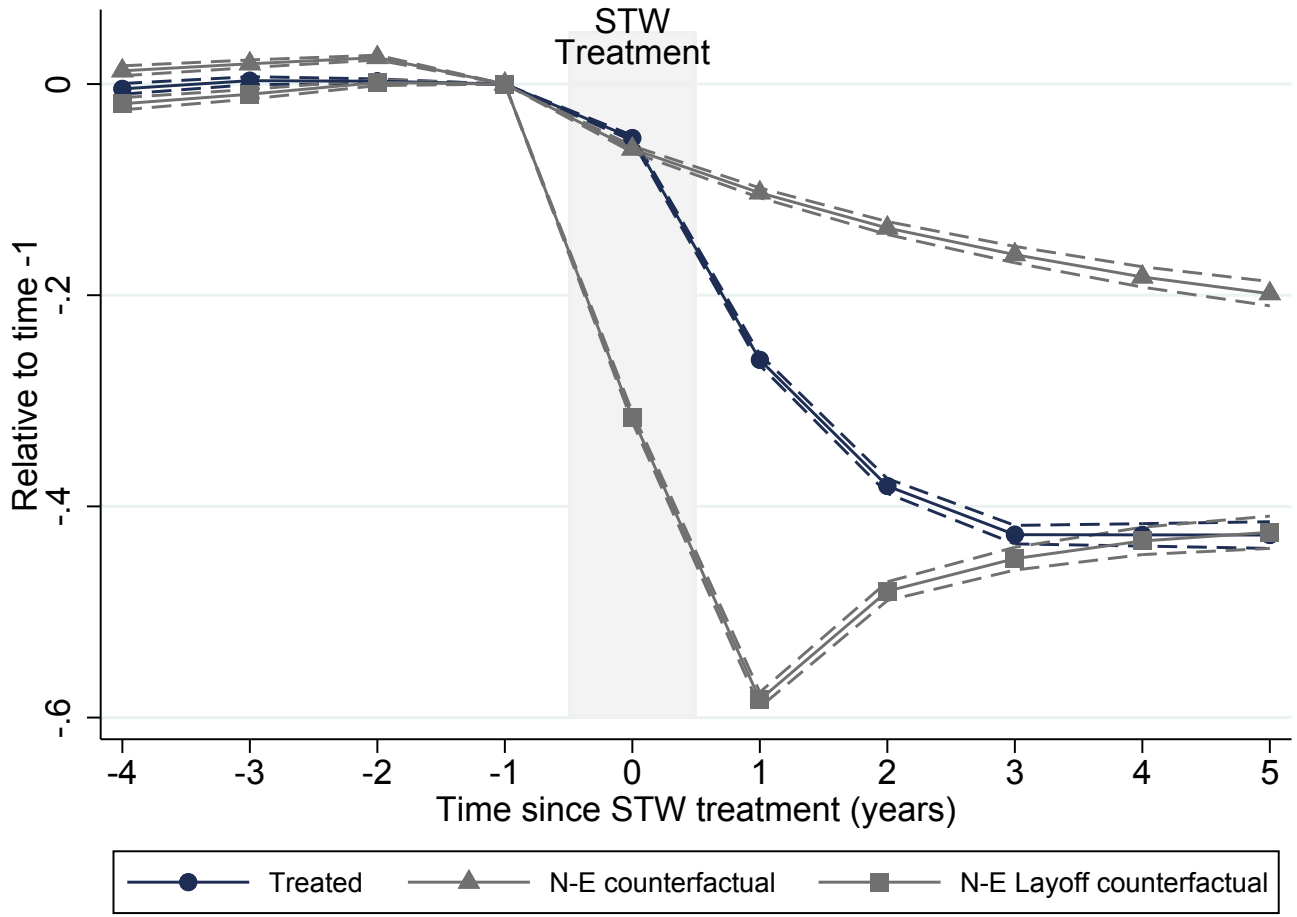
- **Significant short run employment effects upon treatment**

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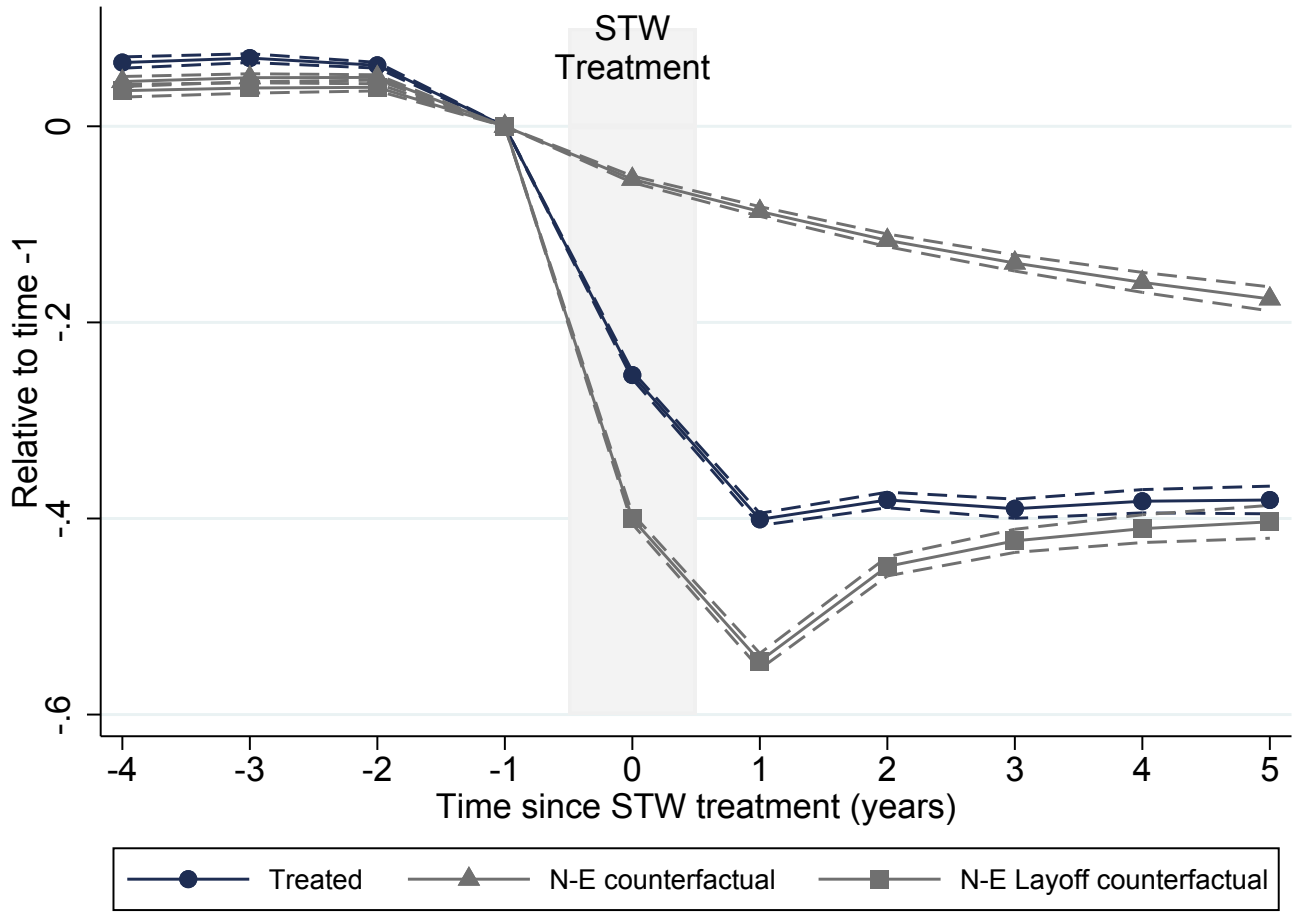
- **No significant long term effects on employment**

STW Event Studies: Workers' Employment Probability



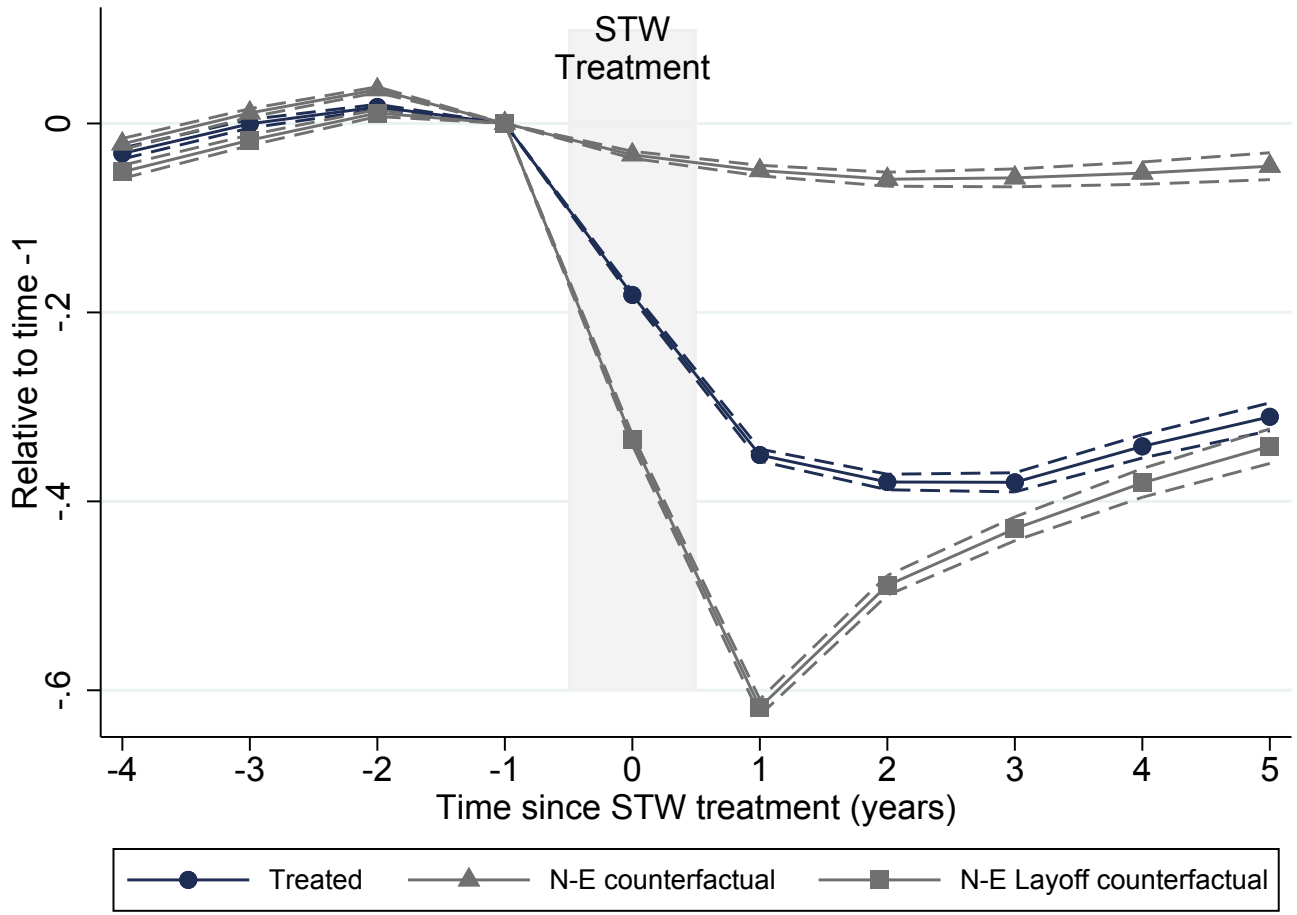
Identification - Details

STW Event Studies: Workers' Total Hours Worked



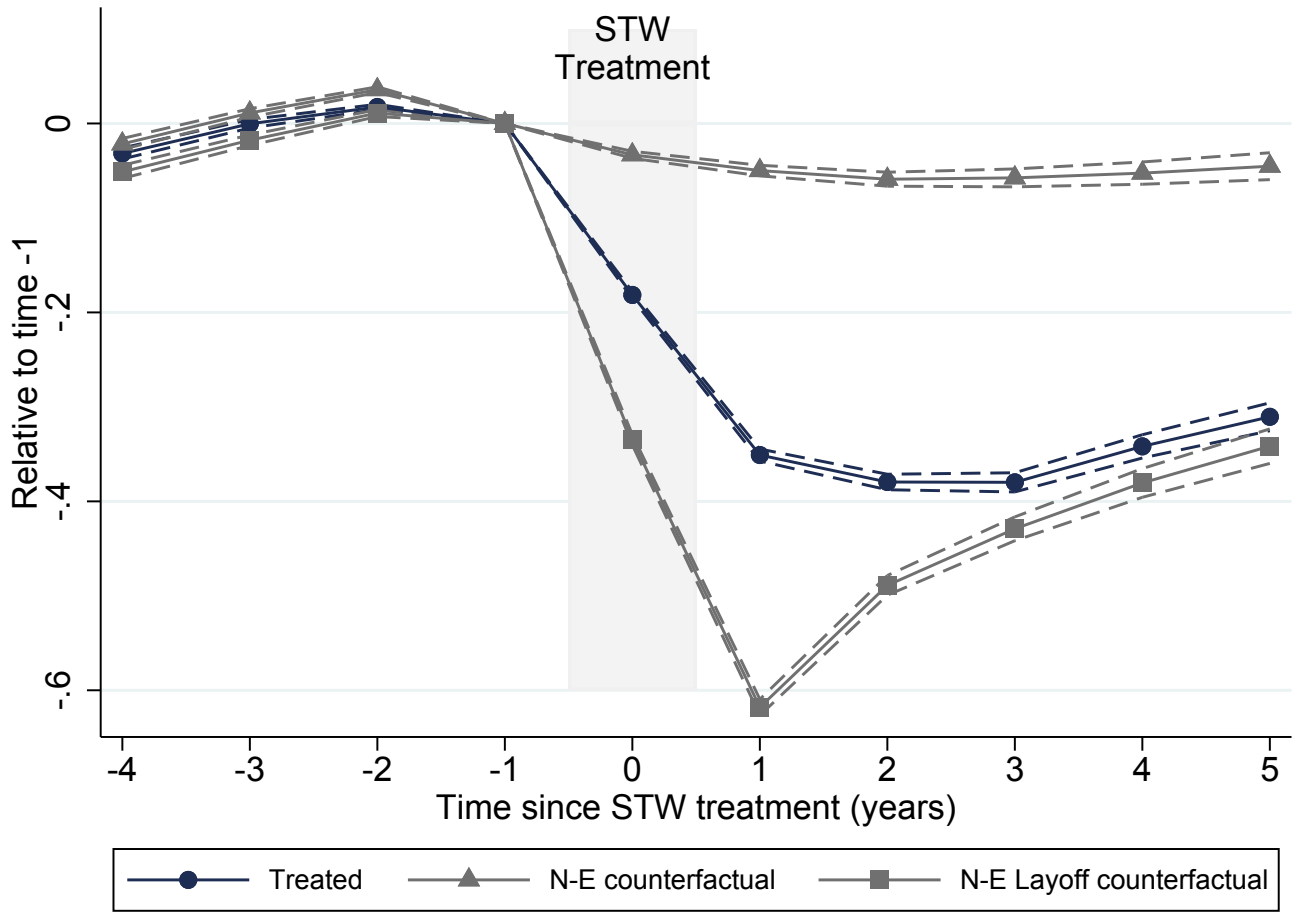
Identification - Details

STW Event Studies: Earnings + Transfers



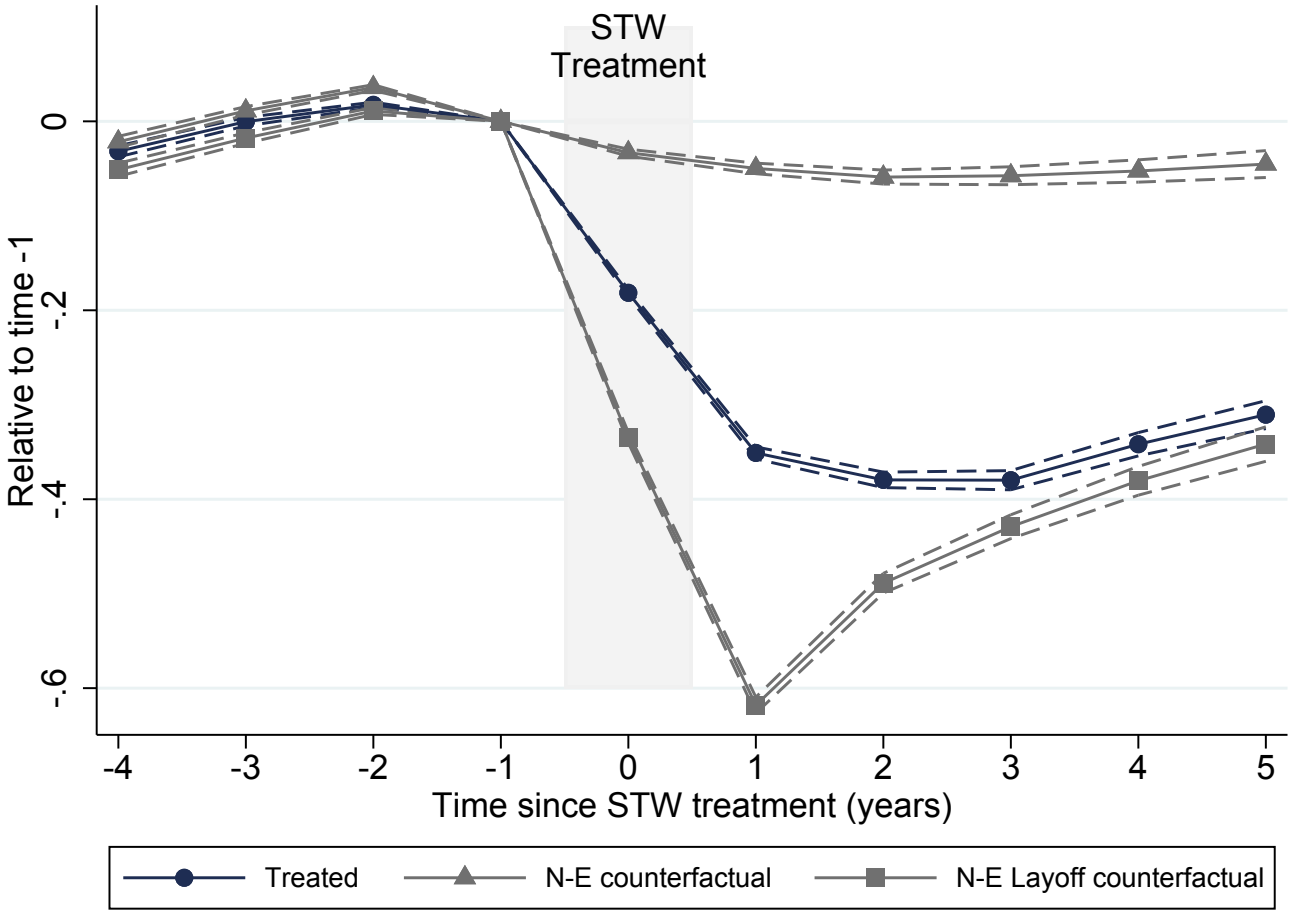
- **STW provides high insurance level in the short run**

STW Event Studies: Earnings + Transfers:



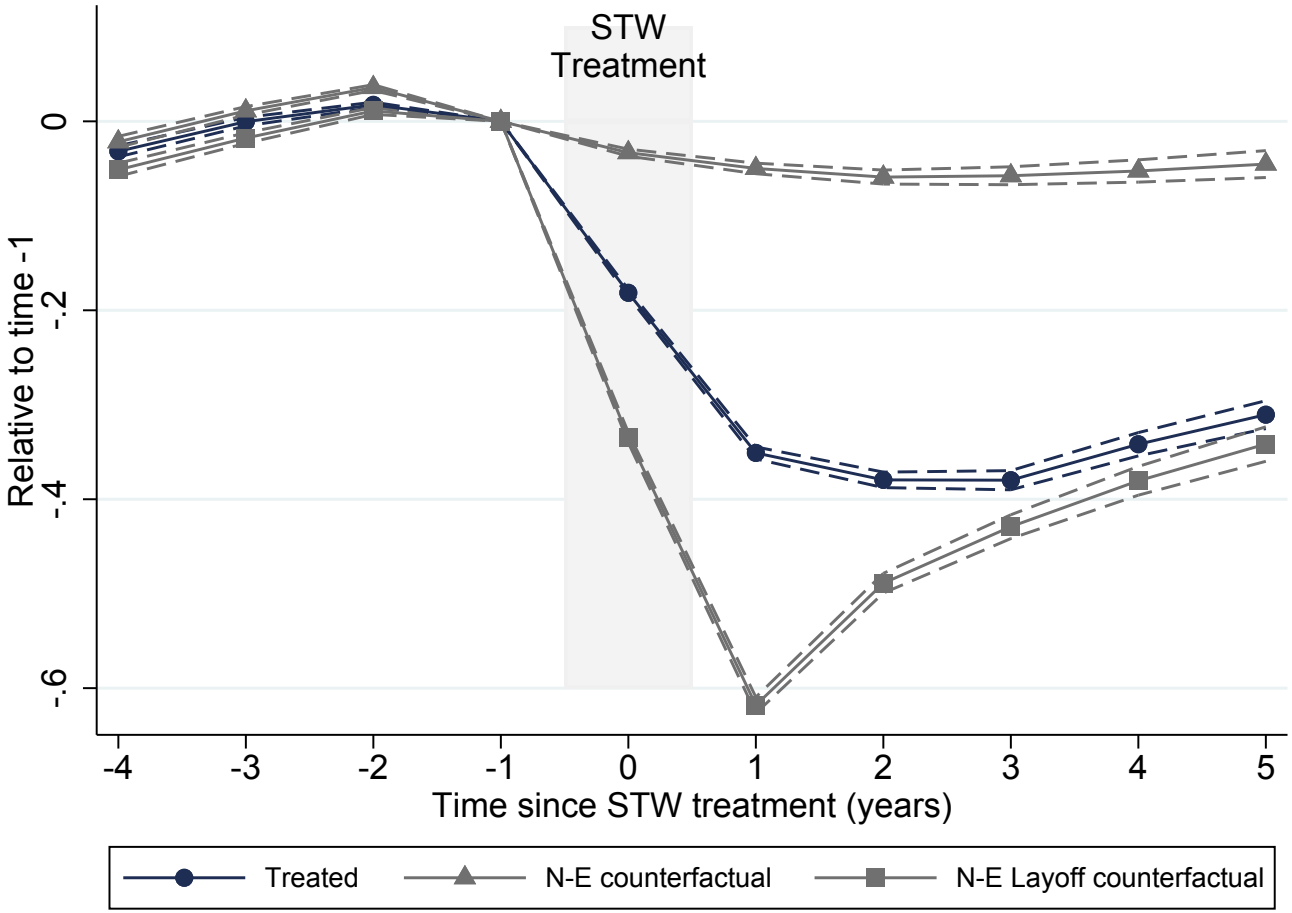
- **But no insurance in the long run**

STW Event Studies: Earnings + Transfers:



- Limited role of STW in preserving experience / specific human K Bounds vs IV

STW Event Studies: Earnings + Transfers:



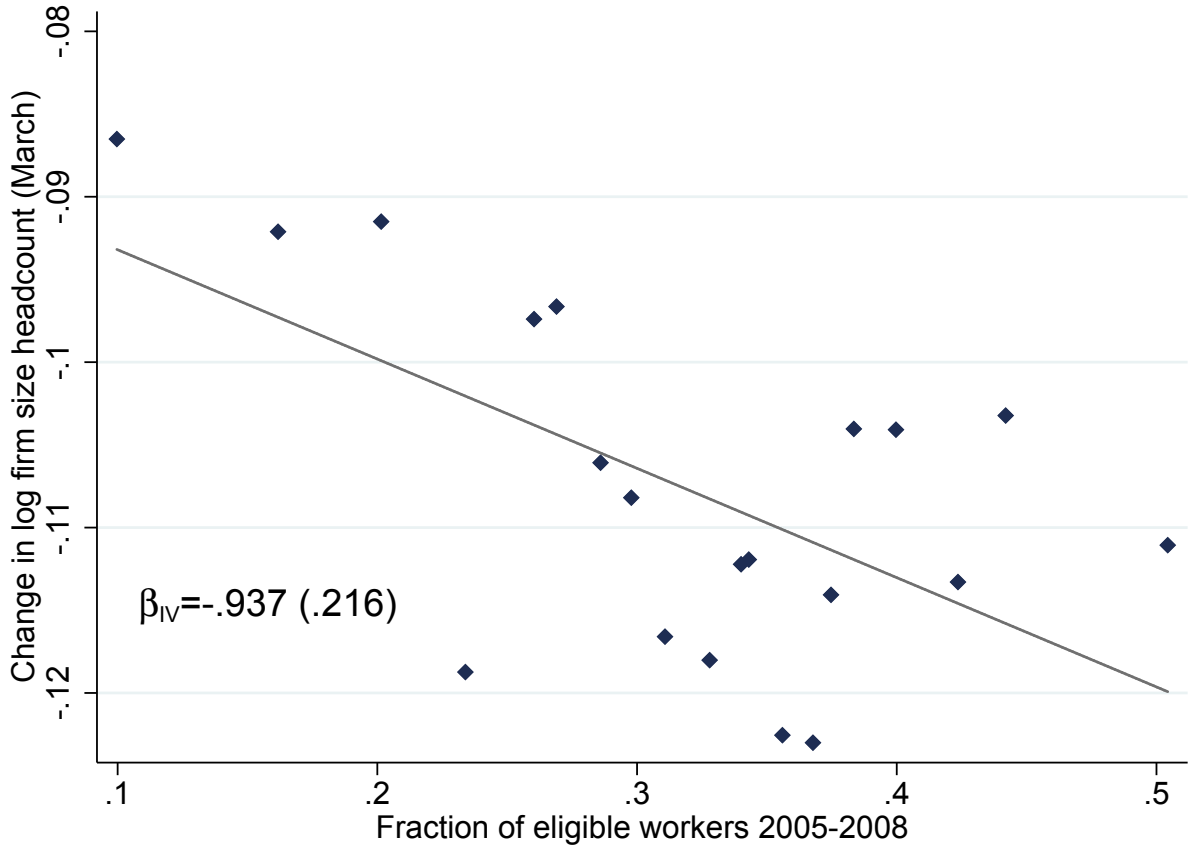
- No dynamic returns to work in low productivity empl. (Card & Hyslop)

Reallocation: Equilibrium Effects

- Low productivity firms select more into STW Graphs
- By increasing employment in low-productivity firms, STW may prevent reallocation of workers to more productive firms
- Identification of equilibrium effects:
  - Estimate effect of increase in fraction of workers treated by STW in LLM on employment outcomes of non-eligible / high productivity firms
  - Instrument fraction of workers treated by STW by fraction of workers eligible in LLM due to size and INPS codes in pre-recession period

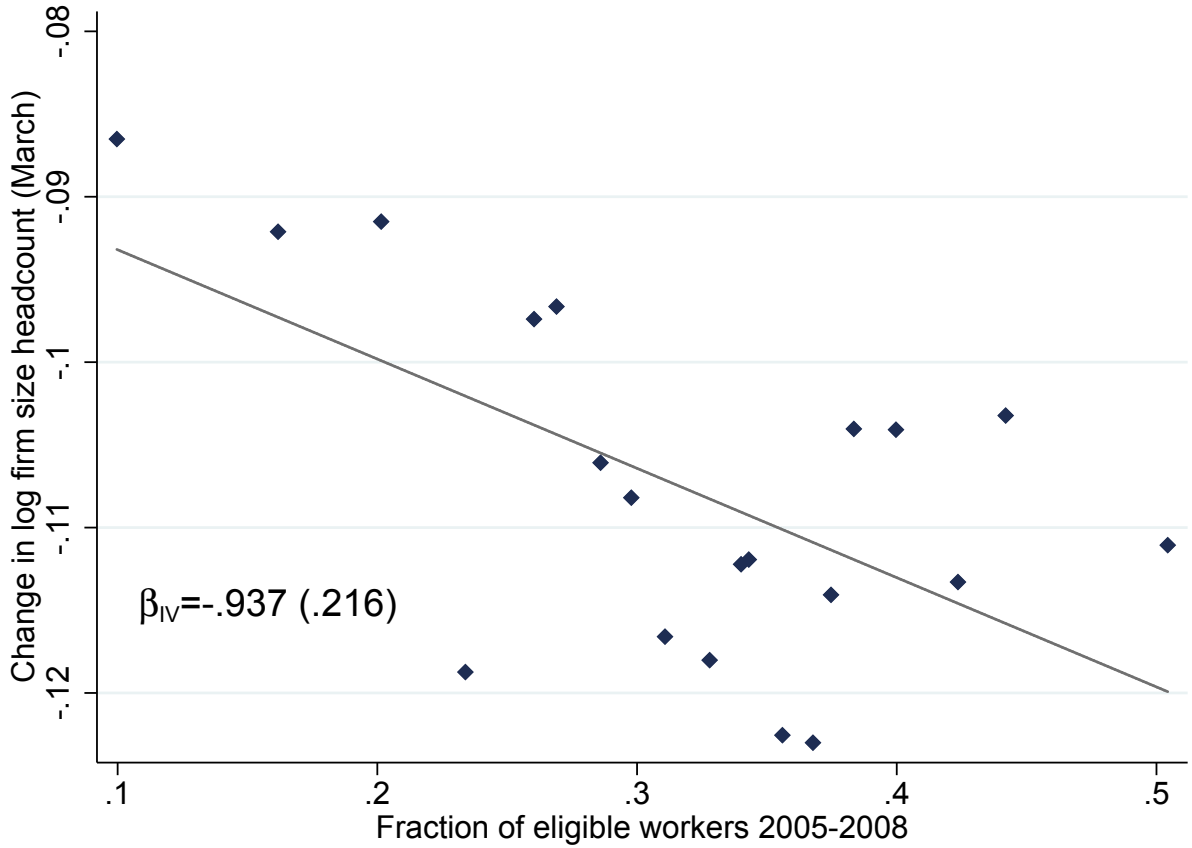
Identification - Details

Equilibrium Effects: Employment Spillovers



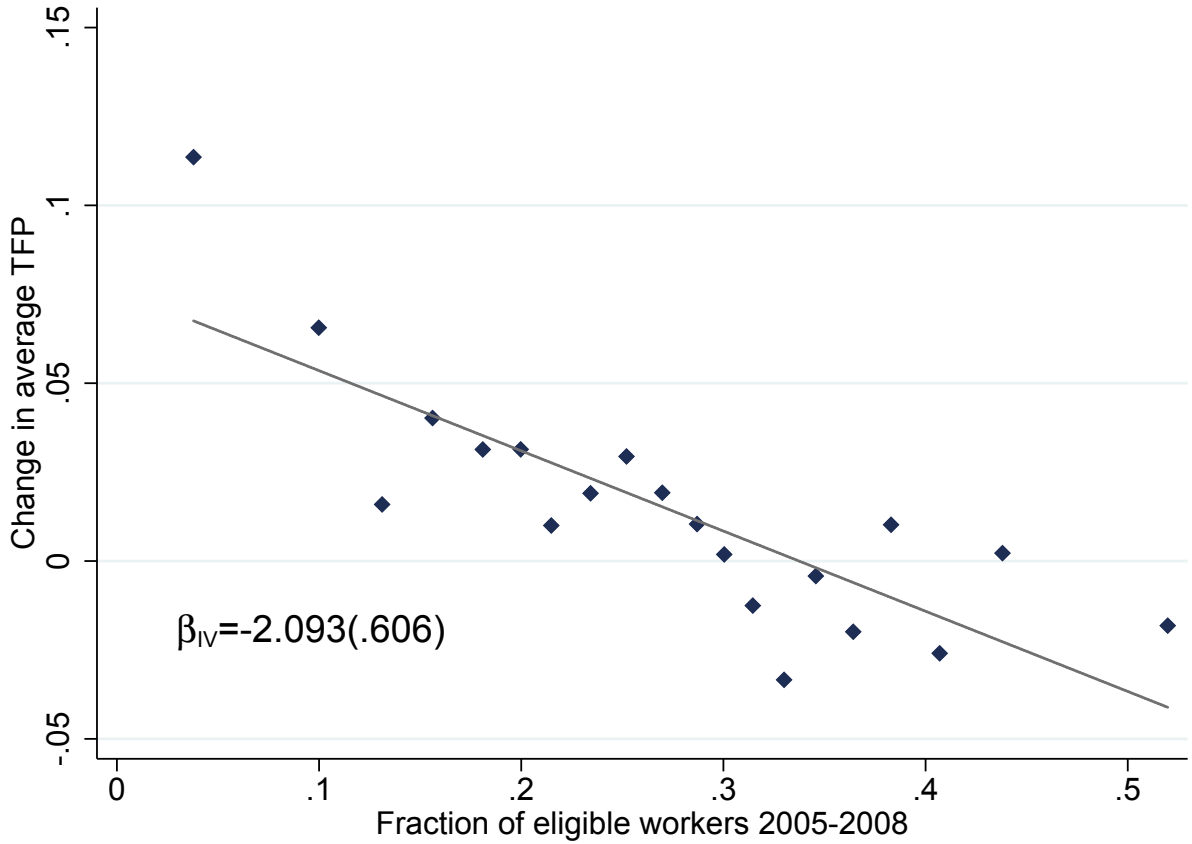
- 1 ppt ↑ in fraction treated by STW ⇒ ≈ 1% ↓ in empl. of non-eligible firms

Equilibrium Effects: Employment Spillovers



- For 1 job "saved" by STW, employment in non treated firms ↓ by .03 job

Equilibrium Effects: Average Firm TFP in LLM



First-Stage Robustness

Model: Set-Up

- Two employment margins: extensive (employment) and intensive (hrs)
- Firms exposed to idiosyncratic productivity shocks ε
  - Can claim STW for workers when $\varepsilon = \varepsilon_{low}$
- Risk-averse workers, identical ex-ante.
- Firms and workers match randomly on labor market with frictions
  - Concave matching function $M(u_t, v_t)$
  - Labor market tightness $\theta_t \equiv \frac{v_t}{u_t}$
- Wage/Hours negotiated to split the match surplus btw workers and firms
  - General hours schedule $h = h(b, \tau, t, \varepsilon, \theta, w)$

Mechanisms

- STW effects on employment magnified by **wage rigidity**
- Hours contraint
  - Workers only accept employment iff $W^u \leq W^e_k$ Workers Value Function
  - Implicitly defines **lower bound on hours** $\bar{h} = \bar{h}(b, \tau)$
  - STW relaxes hrs constraint: $d\bar{h}/d\tau < 0$ Graph

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- Firms' intensive vs extensive margin choices Firms' problem
  - When hit by TFP shock, firms may to "hoard" labor
  - Especially in Recession when hiring is cheap (low θ),
  - $\bar{h}$ constrains ability to substitute h for n
  - STW relaxes $\bar{h}$ & $\uparrow$ demand for n for low-productivity firms Graph

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- Equilibrium & Spillover effects
  - $\uparrow$ demand for n for low-productivity firms $\Rightarrow \uparrow \theta$ in equilibrium
  - $\uparrow \theta \Rightarrow \downarrow n$ in firms non-eligible to STW Graph

Optimal STW: Welfare Trade-Offs

Optimal STW rate τ such that:

$$\text{Value of Transfer} = \text{Fiscal Extern.} + \text{Employment Extern.} + \text{Hrs Extern.}$$

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Optimal STW: Welfare Trade-Offs

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- Value of Transfer:

$$\propto \mathbf{E}_{STW}[u'(c)] - \mathbf{E}[u'(c)]$$

At $\tau \approx .8$, marginal insurance value may be small

Optimal STW: Welfare Trade-Offs

Optimal STW rate τ such that:

Value of Transfer = Fiscal Extern. + Employment Extern. + Hrs Extern.

- Fiscal Externality:

$$1 + \varepsilon_{n,\tau} \frac{\tau - R}{\tau} - \varepsilon_{h,\tau} \frac{h}{1-h}$$

Large elasticities $\varepsilon_{h,\tau}$ and $\varepsilon_{n,\tau} \Rightarrow$ Fiscal extern. $>>1$

Optimal STW: Welfare Trade-Offs

Optimal STW rate τ such that:

$$\text{Insurance Value} = \text{Fiscal Extern.} + \text{Employment Extern.} + \text{Hrs Extern.}$$

- Employment Externalities: Landais & al. [2017], Michaillat & Saez [2015]

$$\underset{\sim}{\propto} \frac{d\theta}{d\tau} \underbrace{\left\{ f'(\theta)\Delta U + q'(\theta)\mathcal{C} \right\}}_{\text{“Hosios” Term}}$$

Positive welfare effect of STW if

- θ suboptimally low in Recession
- And $d\theta/d\tau > 0$

Optimal STW: Welfare Trade-Offs

Optimal STW rate τ such that:

$$\text{Insurance Value} = \text{Fiscal Extern.} + \text{Employment Extern.} + \text{Hrs Extern.}$$

- Hours Externalities: Missing Market for Hours!

$$\underset{\sim}{\propto} \frac{dh}{d\tau} \Big\{ \underbrace{(F'(h) - w) - (MRS_{c,h} - w(1-\tau))}_{\text{Deviation from FB Hrs}} \Big\}$$

  - First-Best: MRT = MRS = wage rate
  - Positive welfare effect of STW if:
    - $F'(h) < MRS$ in Recession

Calibration & Counterfactual Analysis

- Calibration
  - Use reduced-form evidence to identify key parameters of model Calibration

Calibration & Counterfactual Analysis

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- Counterfactual policy I: changes in STW generosity (τ)
  - STW reduces unemployment by $\approx$ 3 ppt
  - STW decreases total TFP by $\approx$ 1.5%
  - STW increases welfare by $\approx$ 2%
  - But $dW/d\tau \approx 0$ Graph
- Counterfactual policy II: changes in UI generosity (b)
  - STW and UI are highly complementary
  - $\uparrow b$ increases hours constraint on low TFP firms
  - STW alleviates effects of $\uparrow b$ Graph

Concluding Remarks & Next Steps

- Provide compelling evidence that STW:
  - Induces sharp $\downarrow$ in hrs and a large $\uparrow$ in empl. in short term
  - Very small net long-run effects
  - Offers large insurance to workers but only in the short term
  - Mostly targets distressed & low productivity firms
  - Negative externalities on higher productivity firms in LLM
- Provide framework to:
  - Rationalize evidence
  - Clarify welfare trade-offs
  - Calibrate counterfactual policies
- STW have overall small positive welfare effects, can be useful when paired with generous UI

Additional slides

Table: Firms by eligibily status

	Eligible firms		Non eligible firms	
	Mean	Sd	Mean	Sd
Employees (headcount)	9.78	5.55	8.22	4.90
Employees (FTE)	9.35	5.38	7.42	4.33
Employees on open-ended contracts	8.96	5.35	7.25	4.60
Employees on fixed-term contracts	0.81	1.78	0.98	2.25
Annual weeks worked	455.41	271.73	432.03	231.68
Annual weeks worked per employee	53.55	25.79	55.19	28.66
Annual wage bill (000)	218.01	157.17	158.61	120.35
Annual wage bill per employee (000)	22.49	13.22	19.80	11.86
Value added per week worked (000)	1.22	14.41	1.01	7.42
Net revenue per week worked (000)	5.94	52.77	6.48	46.31
Profit/loss per week worked (000)	-0.20	17.55	-0.03	3.09
Liquidity (share of total assets)	0.09	0.13	0.12	0.15
Investment in tangible assets (share of total assets)	0.07	0.10	0.07	0.11
Investment in intangible assets (share of total assets)	0.01	0.04	0.02	0.06
Observations	102757		218823	

Notes: Back

Table: Firms by take-up status in eligible sectors

	Takers		Non takers	
	Mean	Sd	Mean	Sd
Employees (headcount)	17.99	5.62	9.57	5.39
Employees (FTE)	17.46	5.44	9.15	5.22
Employees on open-ended contracts	16.98	5.67	8.77	5.18
Employees on fixed-term contracts	1.01	1.80	0.81	1.78
Annual weeks worked	950.72	256.38	494.27	262.71
Annual weeks worked per employee	55.06	30.92	53.51	25.64
Annual wage bill (000)	435.46	170.60	212.64	152.89
Annual wage bill per employee (000)	25.18	15.81	22.42	13.14
Value added per week worked (000)	0.97	1.71	1.23	14.60
Net revenue per week worked (000)	4.47	8.20	5.98	53.48
Profit/loss per week worked (000)	-0.13	2.07	-0.20	17.79
Liquidity (share of total assets)	0.07	0.10	0.10	0.13
Investment in tangible assets (share of total assets)	0.08	0.10	0.07	0.10
Investment in intangible assets (share of total assets)	0.02	0.05	0.01	0.04
Observations	2517		100334	

Notes: Back

Table: Workers by treatment status in eligible sectors

	Treated		Non treated	
	Mean	Sd	Mean	Sd
Proportion female	0.27	0.44	0.22	0.41
Age	40.00	9.26	38.41	10.684
Experience (years)	19.19	10.35	16.29	10.96
Tenure (months)	93.31	87.56	63.66	76.36
Annual labor earnings (000)	20.83	9.22	19.34	12.17
Annual weeks worked	47.62	9.54	42.08	14.77
Proportion on full-time contract	0.94	0.24	0.92	0.27
Proportion on open-ended contract	0.94	0.24	0.86	0.35
Proportion on fixed-term contract	0.06	0.24	0.14	0.35
Proportion on seasonal contract	0.00	0.02	0.00	0.02
Proportion blue collar	0.75	0.43	0.66	0.47
Proportion white collar	0.21	0.41	0.26	0.44
Proportion manager	0.00	0.02	0.01	0.08
Observations	36574		73728	

Back

Triple Difference Specification

$$
\begin{aligned}
Y_{igst} = & \sum_j \gamma_1^j \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[N_{i,t-1} > 15] * \mathbb{1}[j = t] \Big\} \\
& + \sum_j \sum_k \gamma_2^{jk} \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] * \mathbb{1}[j = t] \Big\} \\
& + \sum_j \sum_k \gamma_3^{jk} \cdot \Big\{ \mathbb{1}[k = s] * \mathbb{1}[N_{i,t-1} > 15] * \mathbb{1}[j = t] \Big\} \\
& + \sum_j \sum_k \gamma_4^{jk} \cdot \Big\{ \mathbb{1}[k = s] * \mathbb{1}[j = t] \Big\} \\
& + \sum_k \gamma_5^k \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] * \mathbb{1}[N_{i,t-1} > 15] \Big\} \\
& + \sum_k \gamma_6^k \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] \Big\} + v_{igst}
\end{aligned}
\tag{3}
$$

- i is firm, s 5-digit industry code, t calendar year
- Industry group g. Group of industries eligible to receive CIGS: $g \in \mathcal{E}$
- $N_{i,t-1}$ max 6 month window FTE size in calendar year $t-1$.
- Plot estimated coefficients $\hat{\gamma}_1^t$ for all years t

Back

IV First Stage Specification

$$
\begin{aligned}
T_{igst} = \quad & \kappa_1 \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[N_{i,t-1} > 15] * \mathbb{1}[t > 2008] \Big\} \\
& + \sum_j \sum_k \kappa_2^{jk} \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] * \mathbb{1}[j = t] \Big\} \\
& + \sum_j \sum_k \kappa_3^{jk} \cdot \Big\{ \mathbb{1}[k = s] * \mathbb{1}[N_{i,t-1} > 15] * \mathbb{1}[j = t] \Big\} \\
& + \sum_j \sum_k \kappa_4^{jk} \cdot \Big\{ \mathbb{1}[k = s] * \mathbb{1}[j = t] \Big\} \\
& + \sum_k \kappa_5^{k} \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] * \mathbb{1}[N_{i,t-1} > 15] \Big\} \\
& + \sum_k \kappa_6^{k} \cdot \Big\{ \mathbb{1}[g \in \mathcal{E}] * \mathbb{1}[k = s] \Big\} + \nu_{igst}
\end{aligned}
\tag{4}
$$

- i is firm, s 5-digit industry code, t calendar year
- Industry group g. Group of industries eligible to receive CIGS: $g \in \mathcal{E}$
- $N_{i,t-1}$ max 6 month window FTE size in calendar year $t-1$.

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Firm Eligibility

- Eligibility defined by law supplemented by detailed regulations issued by the Ministry of Labor and made operational by INPS (essentially in the 1970s)
- INPS uses 5-digit INPS industry codes $\times$ additional administrative codes (called codice autorizzazione) to determine eligibility
- $\Rightarrow$ within 5-digit INPS industry codes, some firms are deemed eligible, other ineligible
- We exploit variation in eligibility within these fine-grained 5-digit industry codes (594 industries)
- E.g.:
  1. 5-digit code 11306, 11307 and 11308 = firms in construction specialized installation of electrical machinery. Only those with administrative code 3N are eligible
  2. 5-digit code 10106 produce seeds and beans. Only eligible only if codice autorizzazione 3A, i.e. if they are cooperatives

Back

Table: Effects of STW on Output, Productivity & Balance-Sheet Outcomes

	IV Estimate	Std Error	N
	First Stage		
Proba. of CIGS Take-Up	.05	(.002)	45336
	Balance-Sheet & Productivity Outcomes		
Firm Survival Probability (in $t+1$)	-.018	(.024)	45336
Firm Value-Added	.095	(.159)	10438
Value-Added Per Worker	-.508	(.120)	10438
Labor Productivity	-.142	(.104)	10438
Total Factor Productivity	-.056	(.143)	10438
Liquidity	.939	(.461)	10438

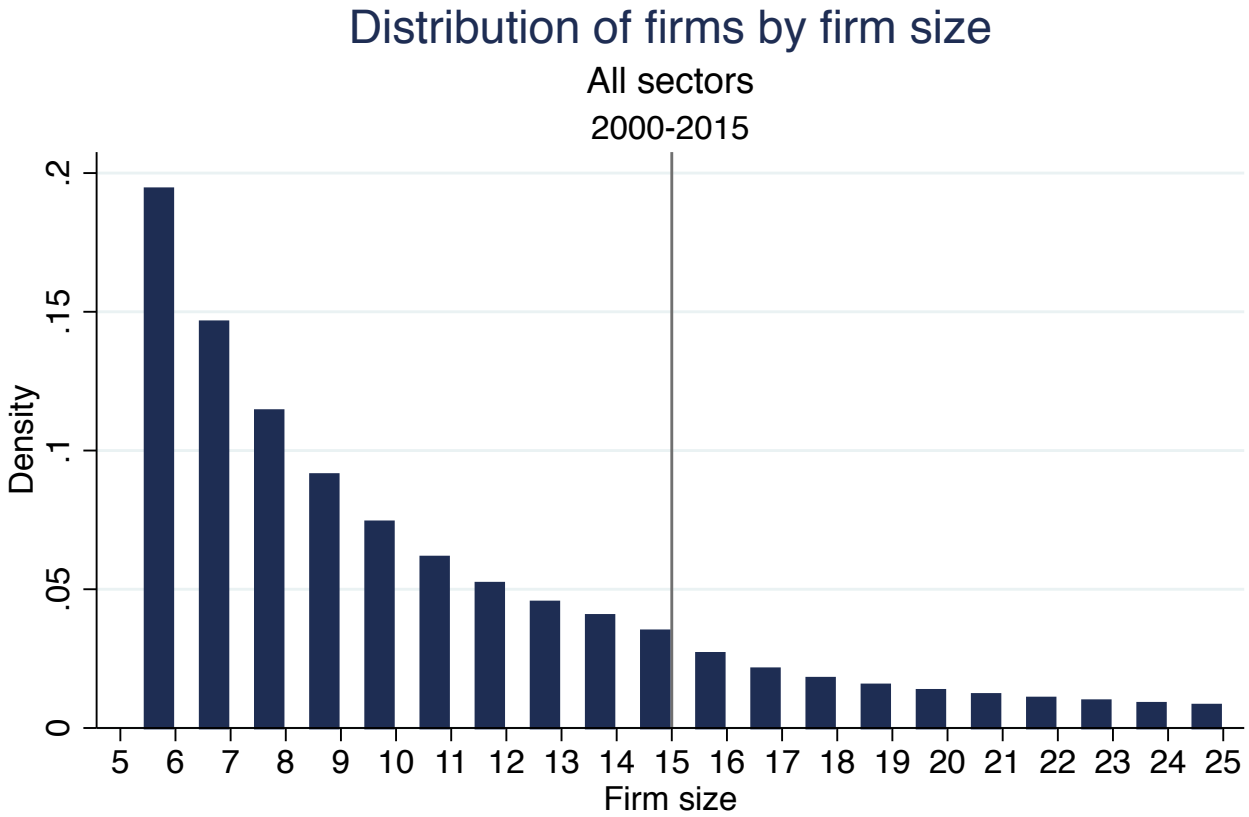
Notes: The Table reports for each outcome the IV estimate scaled by average baseline outcome: $\beta_I V / \bar{Y}$.
Value added = total revenues + unsold stocks - cost of goods and services used in production
Labor productivity = value added / total number of week worked in the firm Back

Table: Robustness of Baseline Effects

	(1) "Doughnut" Regression	(2) Only $\leq$ 15 FTE (Placebo)	(3) Only >15 FTE	(4) Permutation Test (Placebo)	(5) No Dismissal Rule Change >60FTE Across Italy	(6) No Dismissal Rule Change 50FTE threshold
	First Stage					
Proba. of CIGS Take-Up	.053 (.002)	.002 (.000)	.051 (.002)	.000 (.000)	.055 (.005)	.041 (.004)
	Outcomes					
	IV	RF	IV	RF	IV	IV
Log Hrs per wker	-.449 (.037)	-.011 (.020)	-.602 (.081)	.000 (.010)	-.670 (.230)	-.156 (.132)
Log Empl.	.284 (.032)	-.020 (.030)	.306 (.099)	-.001 (.009)	.848 (.297)	.338 (.258)
Log Wage Bill	-.544 (.049)	-.026 (.030)	-.498 (.155)	.000 (.013)	-.568 (.297)	-.390 (.709)
N	2686140	2608383	429490	2978239	152753	44793

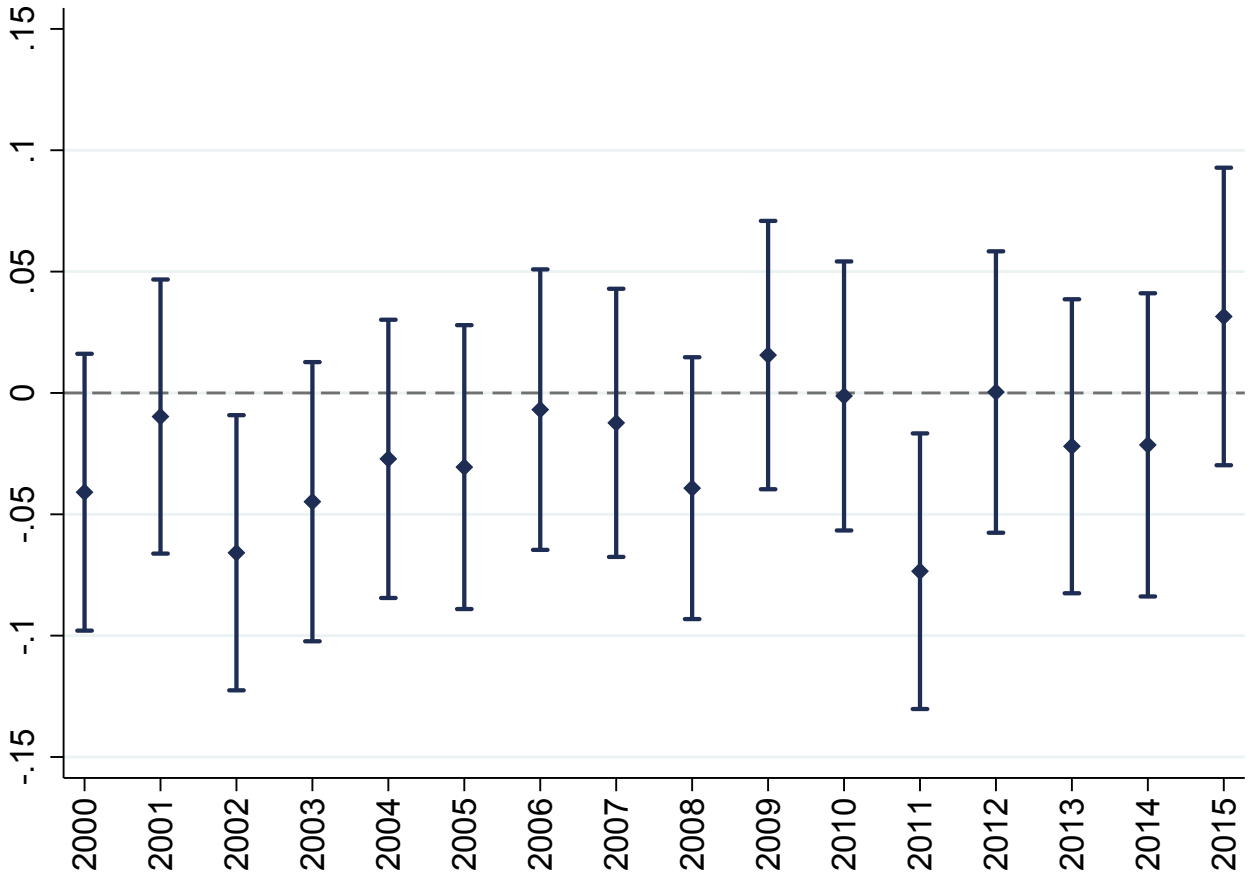
Notes: Permutation P-Values Back

Size Manipulation: FTE size pdf

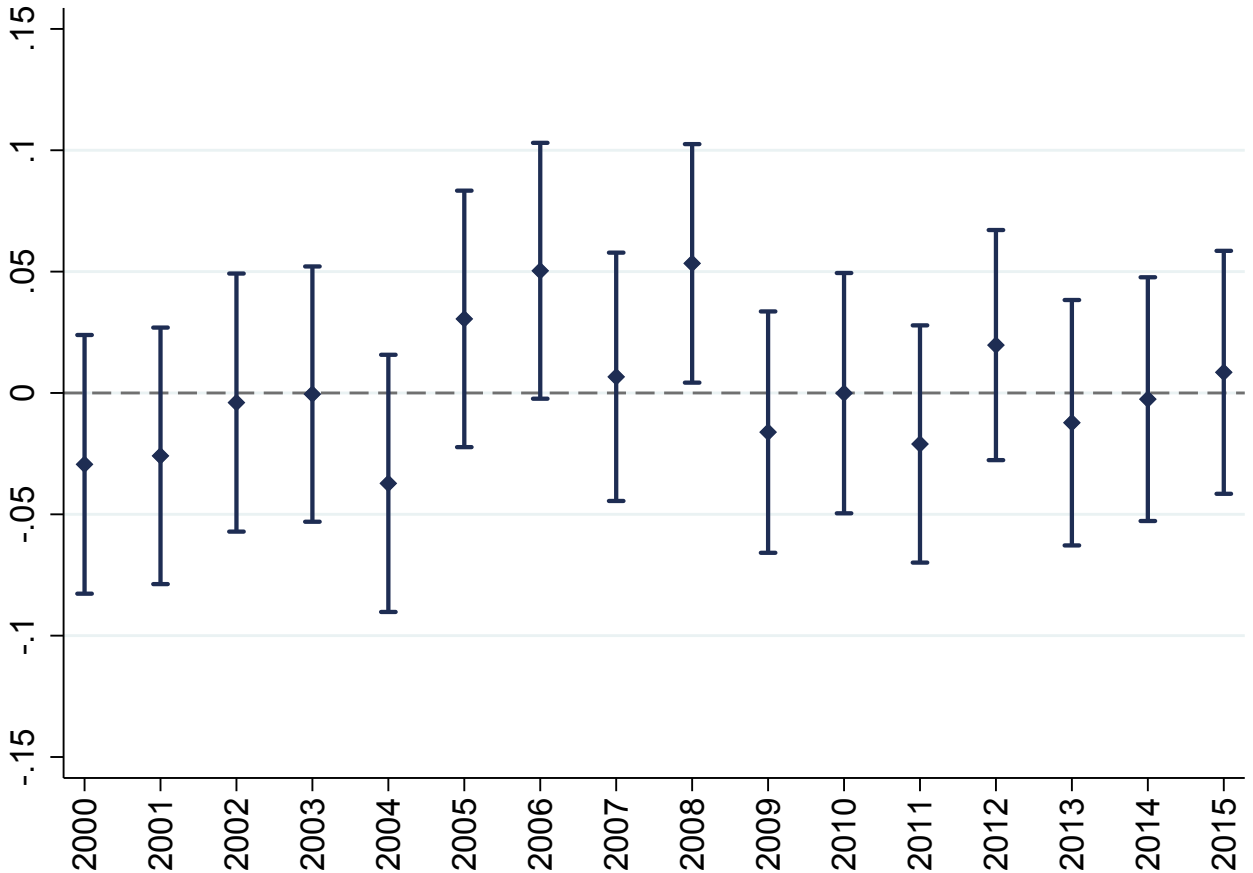


Note: McCrary test -0.008 (s.e. 0.005).
Source: INPS.

McCrary Test Statistic of Discontinuity in Firms' Size Distribution

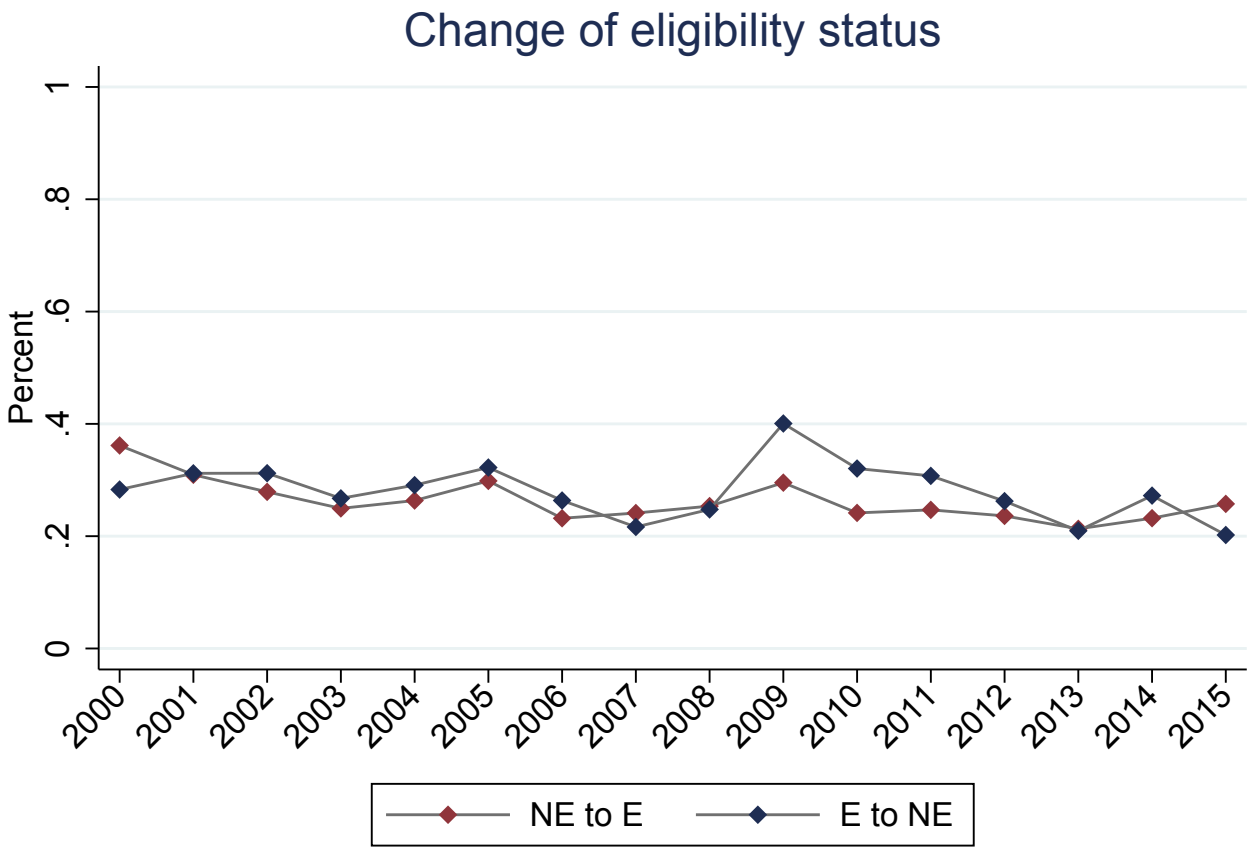


McCrary Test Statistic of Discontinuity in Firms' Size Distribution



Back

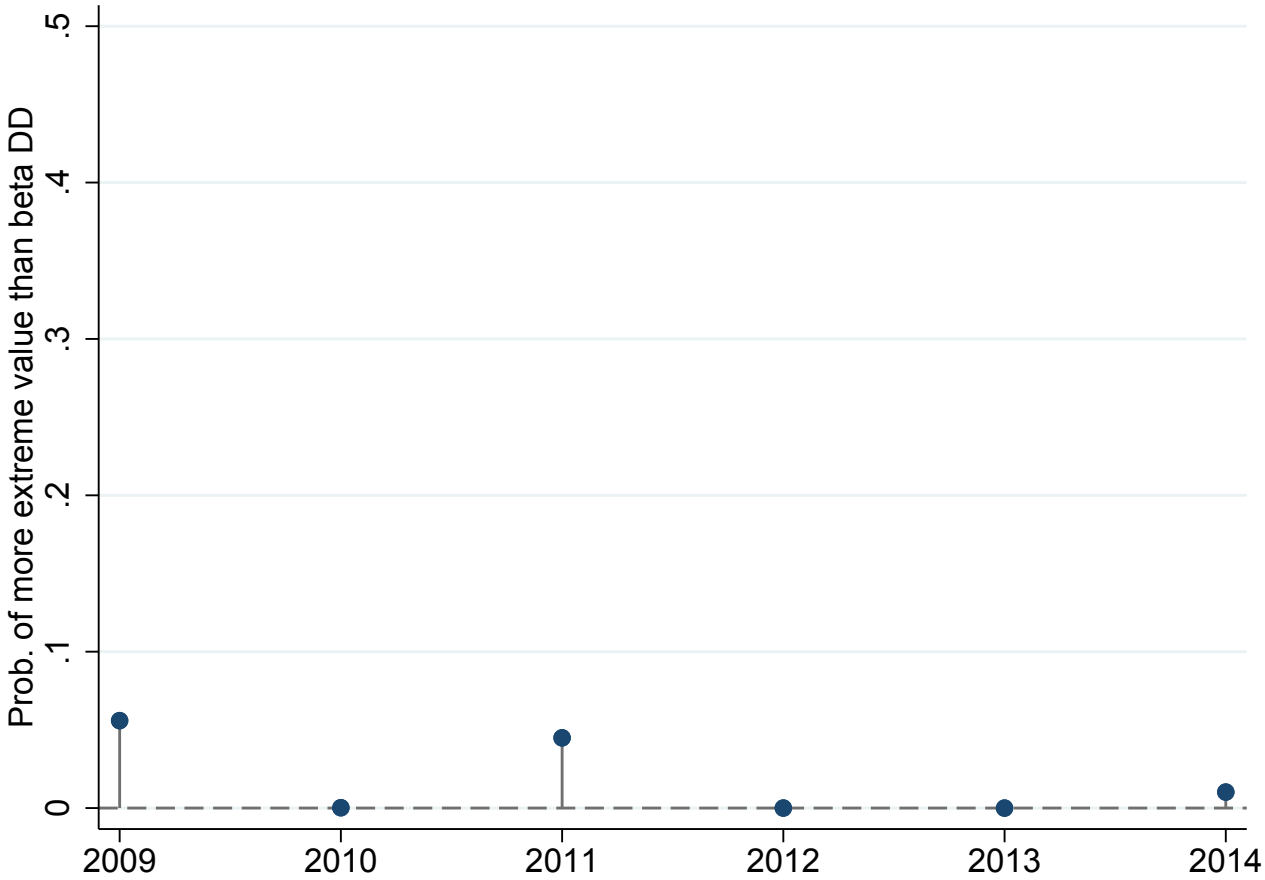
Eligibility Code Manipulation



Source: INPS.

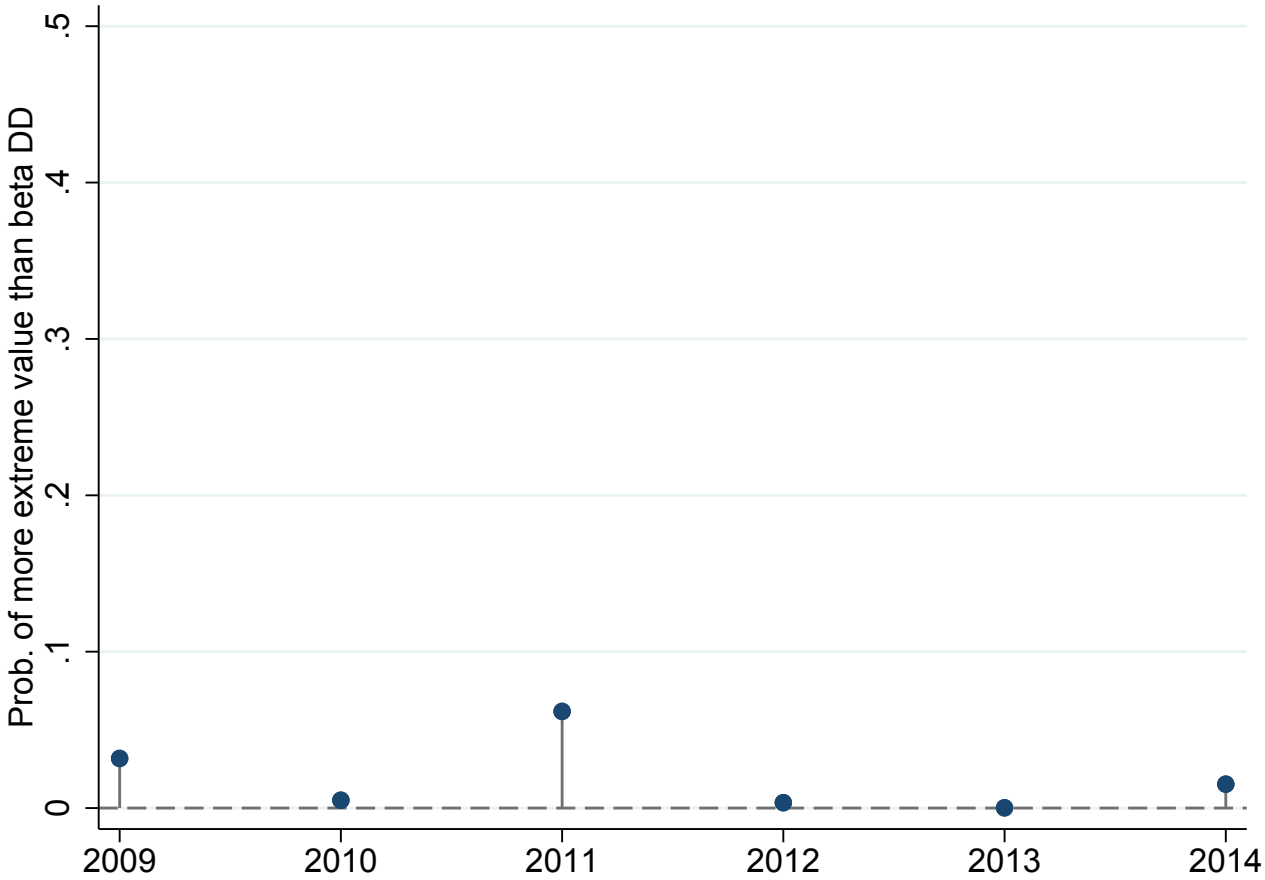
back

P-Values of Permutation Test: Weeks Worked



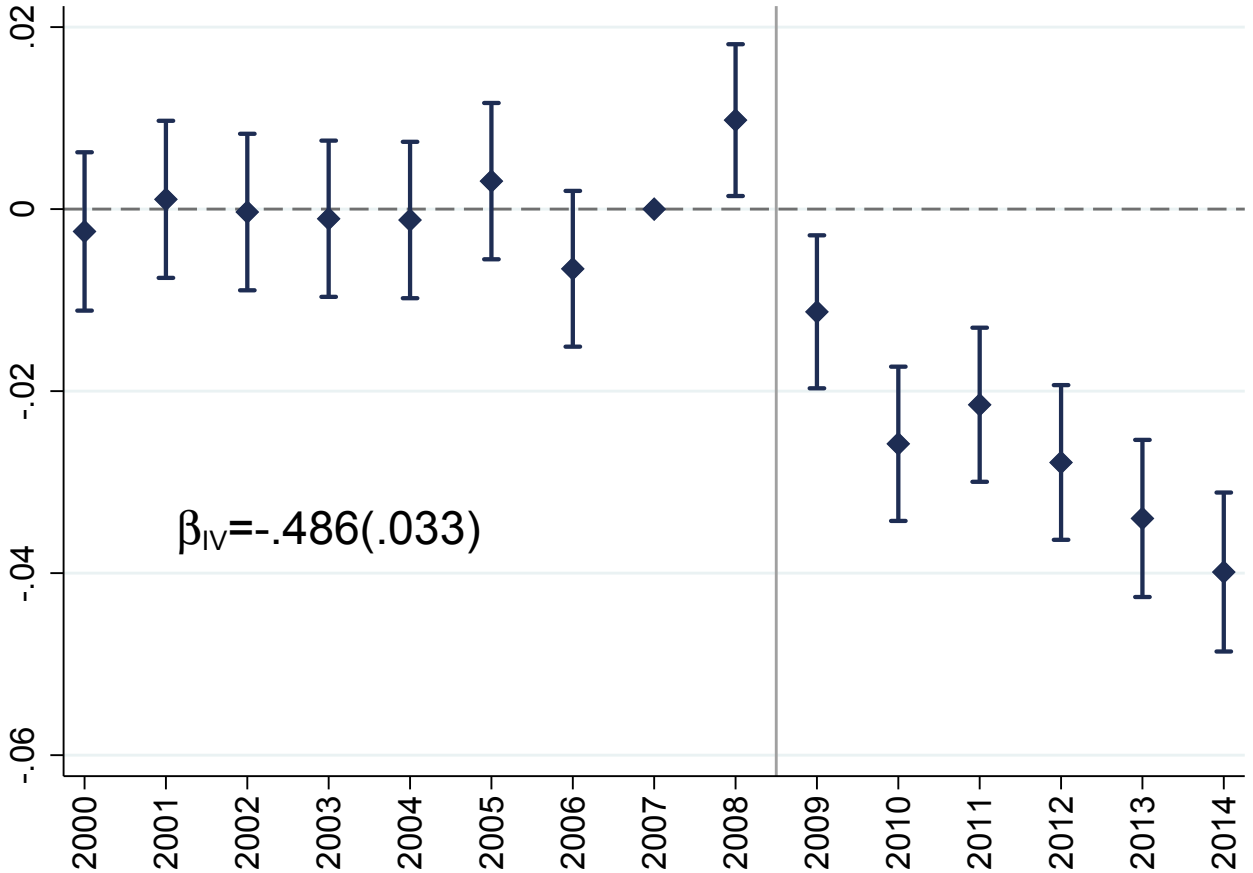
Back

P-Values of Permutation Test: Employment



Back

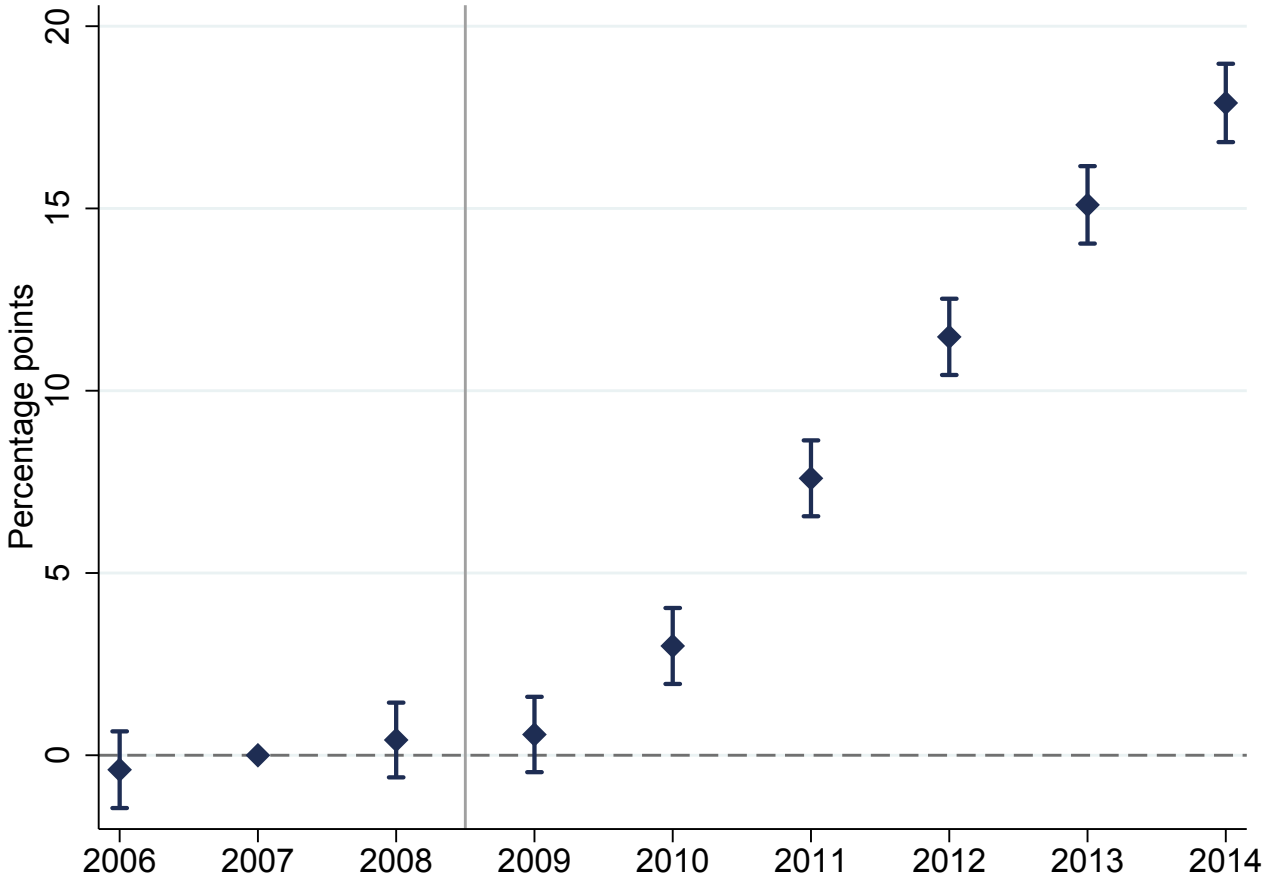
Intensive-Margin Employment: Log # Weeks Worked



- **STW decreases # of weeks worked per employee by $\approx$ 40%**

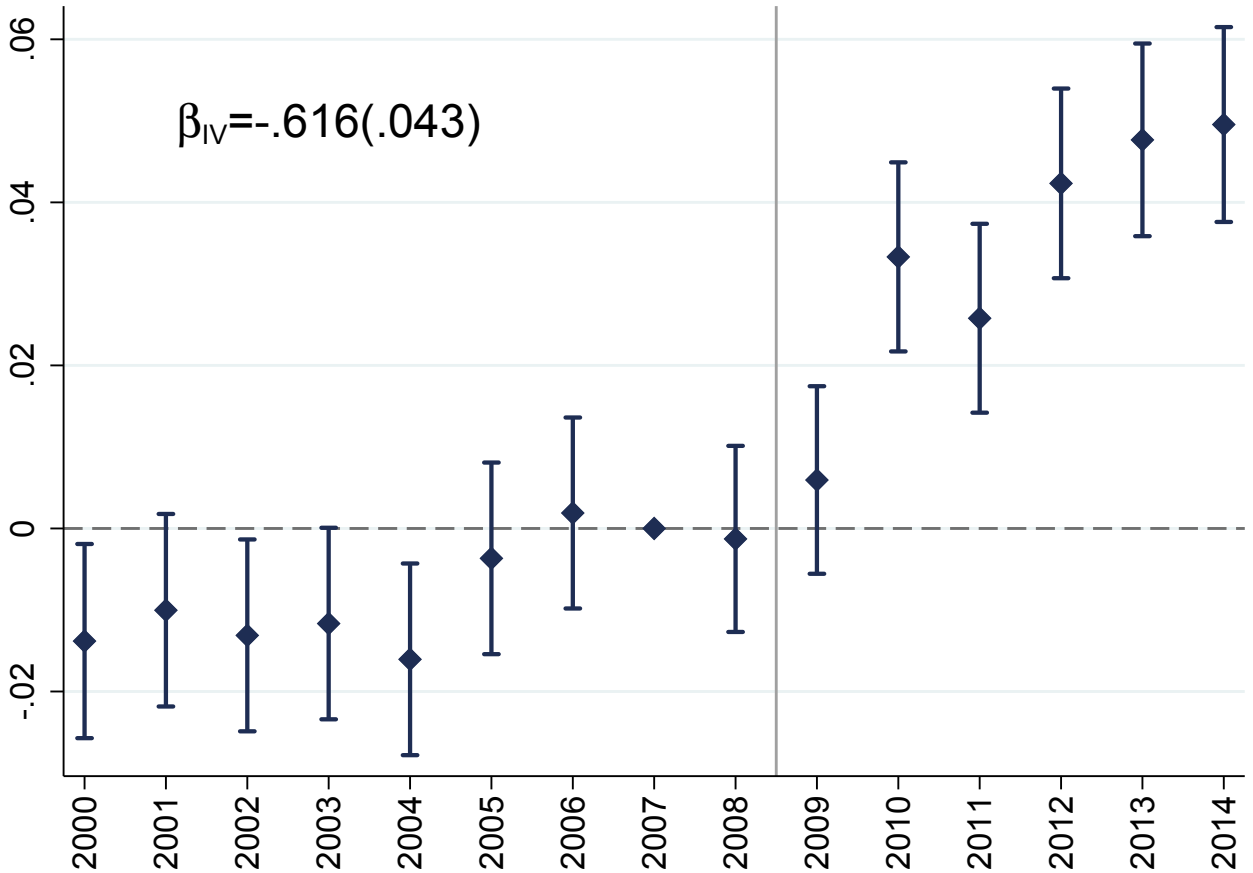
Back

Probability of CIG Treatment in Previous 5 yrs



Back

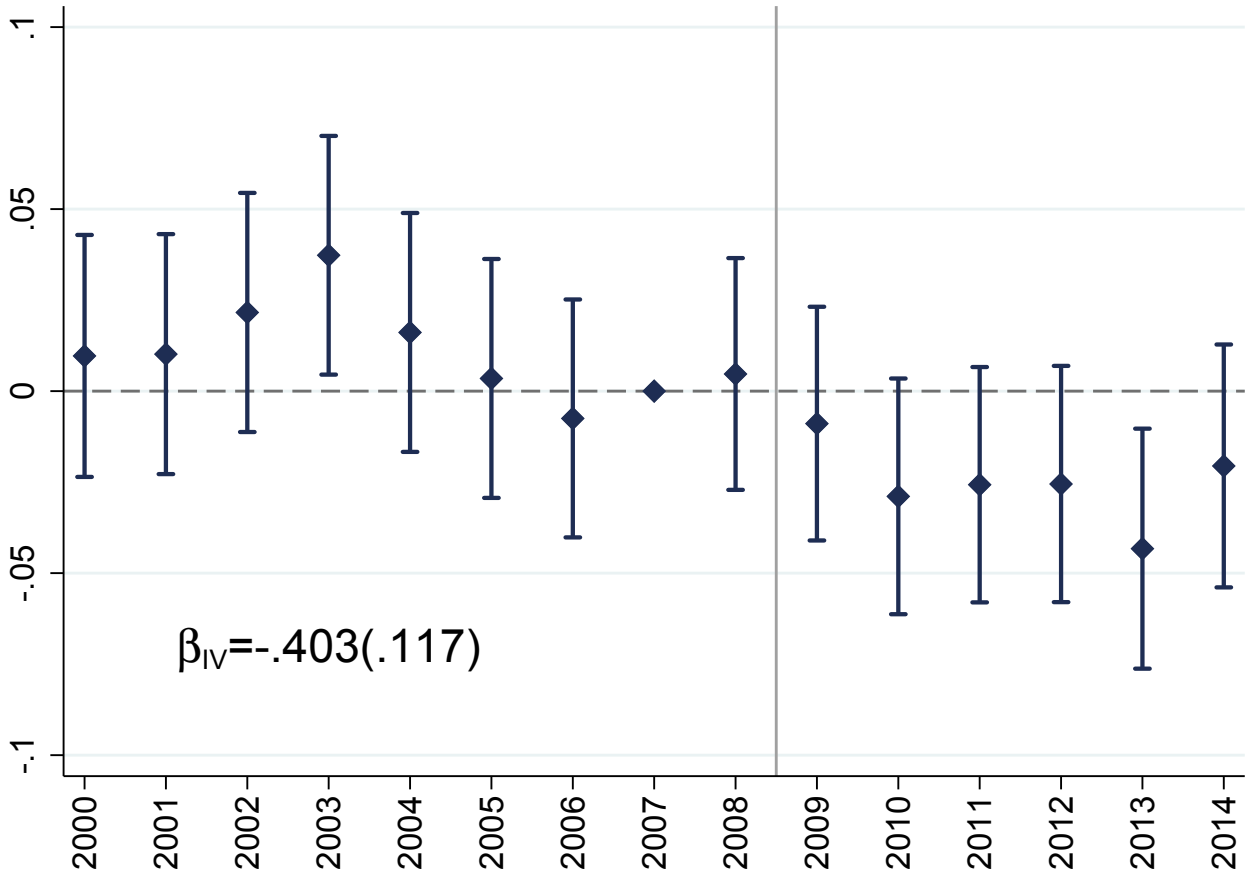
Employment: Dual labor market effects



- **Open-ended employment largely benefits from STW: ↑ by ≈ 85%**

Back

Employment: Dual labor market effects



- **While fixed-term contracts are substituted away: $\downarrow$ by $\approx$ 35%**

Back

Event Studies: Methodology

- Panel of all employees of firms active between 2000 and 2015 and with firm size $\in (5; 25]$ in the year prior to the first worker's STW spell
- Treated individuals: workers with a STW event
- Control individuals: NN matching based on pre-event characteristics
- **Selection**:
  - Focus on control individuals who cannot access STW because of size$\times$eligibility
- **Bounds on selection**:
  - Counterfactual 1 [upper bound]: average worker in similar firms non eligible to CIGS...
  - Counterfactual 2 [lower bound]: laid-off workers in similar firms non eligible to CIGS Back

Event study approach

Individual outcomes

- Panel of all employees of firms active between 2000 and 2015 and with firm size $\in (5; 25]$ in the year prior to the first worker's STW spell
- Individual working histories:
  - Start in the first year the individual appears in the sample
  - End in 2015 unconditional on employment, or before if the individual retires or dies
- An event is defined as the first ever STW spell since 2005
- Treated individuals (i.e. those with a STW event) are matched with control individuals (i.e. those who never experience STW) based on nearest-neighbour matching
- Matching on gender, age, job characteristics at event time *t-1*, employment status, annual weeks worked, earnings and firm size at *t-1*, *t-2*, *t-3* and *t-4*, and main industry at *t-1*

Implementation

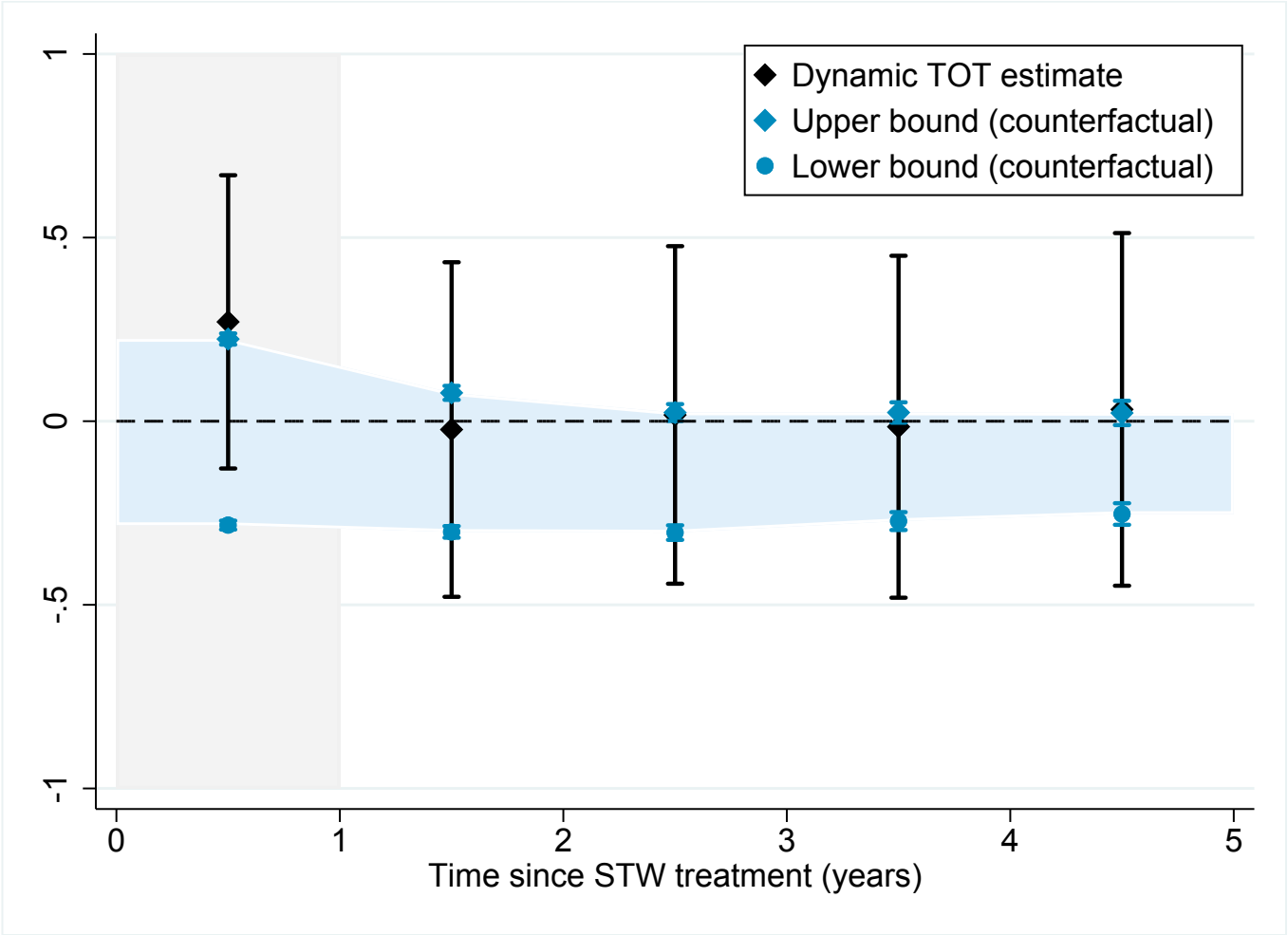
Nearest-neighbour matching

Individual outcomes

- For each calendar year j from 2004 to 2014, select:
  - All treated that are at event time $t = -1$ in calendar year j
  - All controls employed in calendar year j
- Mahalanobis nearest-neighbour matching without replacement
- Matching on gender, age, job characteristics at event time *t-1*, employment status, annual weeks worked, earnings and firm size at *t-1*, *t-2*, *t-3* and *t-4*, and main industry at *t-1*
- Matched controls are assigned a placebo event in calendar year *j+1* (event time *t=0*)
- Panel is balanced over event time for the four years prior to event
- Matched sample: 21,273 treated individuals matched to 18,472 controls

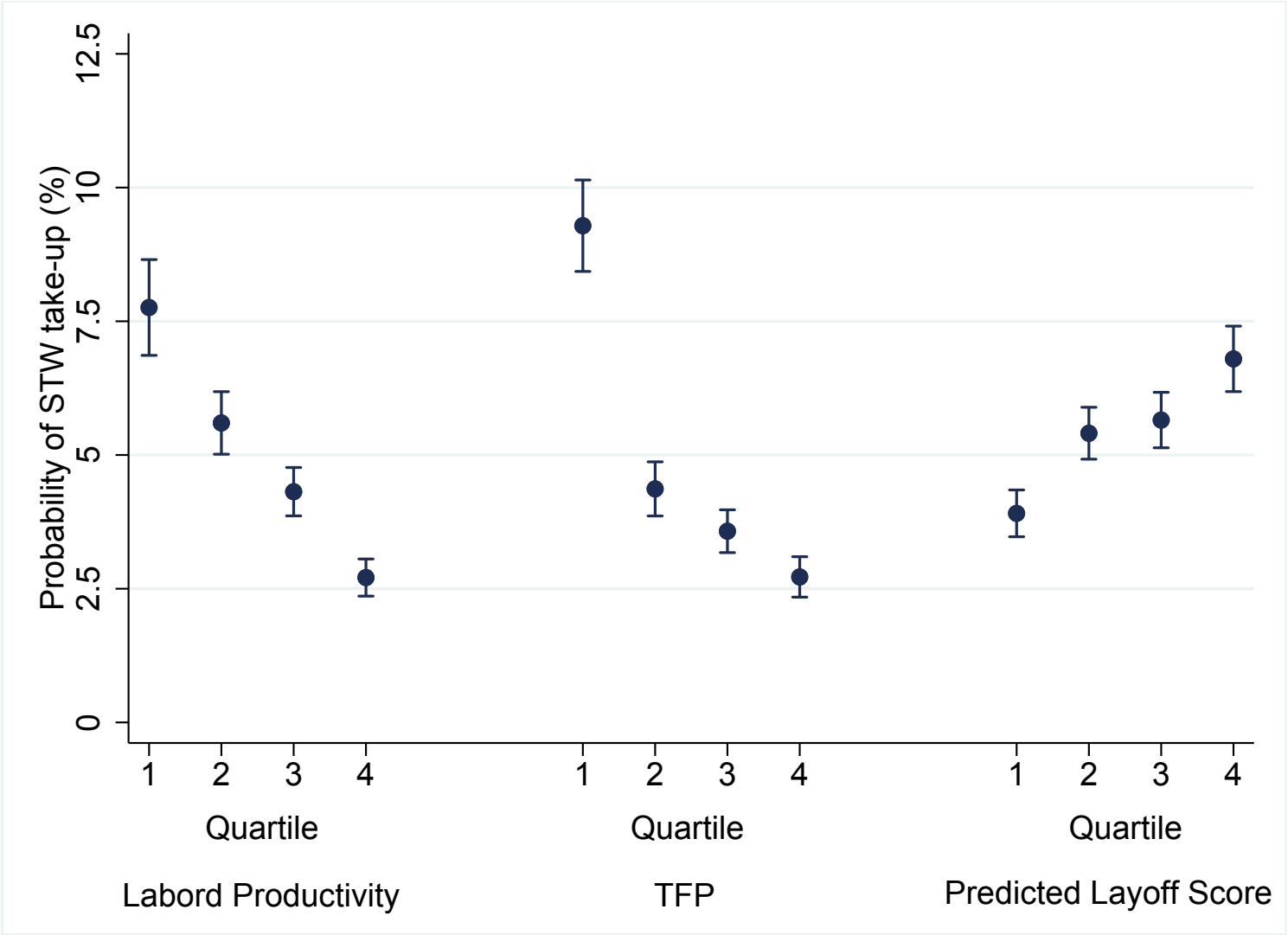
Back

Bounds vs IV-based Recursive Dynamic Estimates



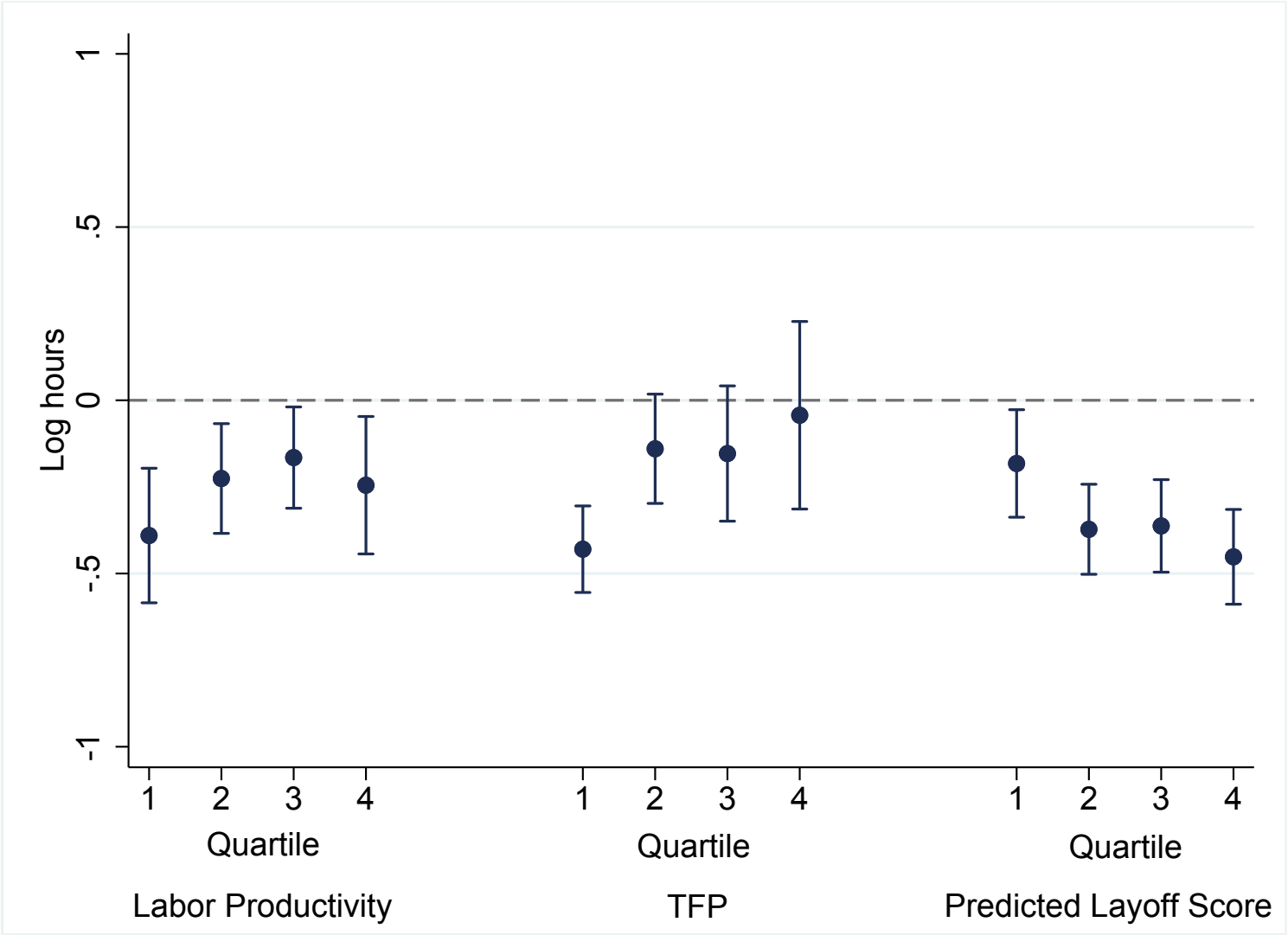
- No dynamic returns to work in low productivity empl. (Card & Hyslop)

Selection into Take-Up



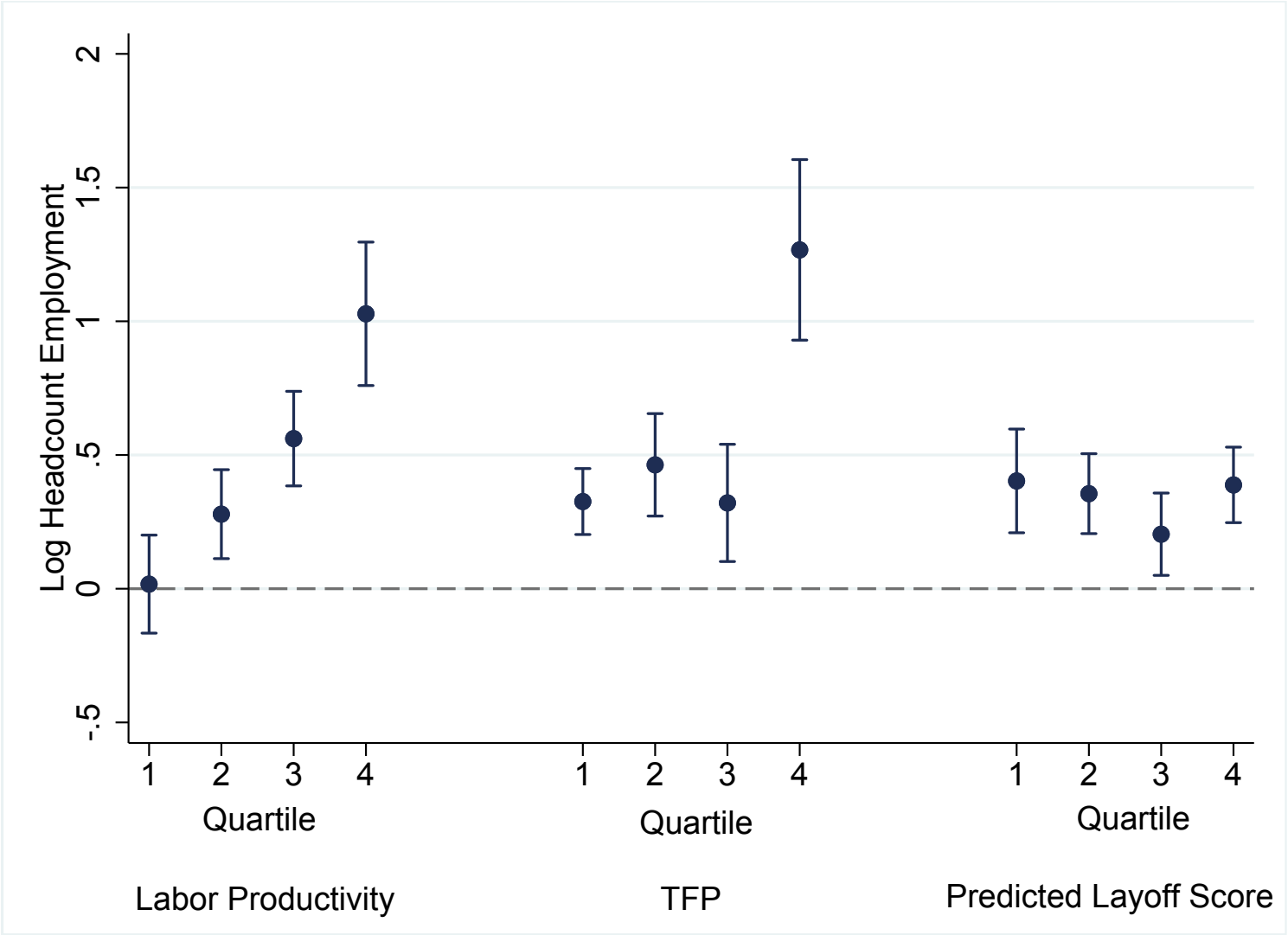
Back

Heteregeneous Treatment Effects: Hours



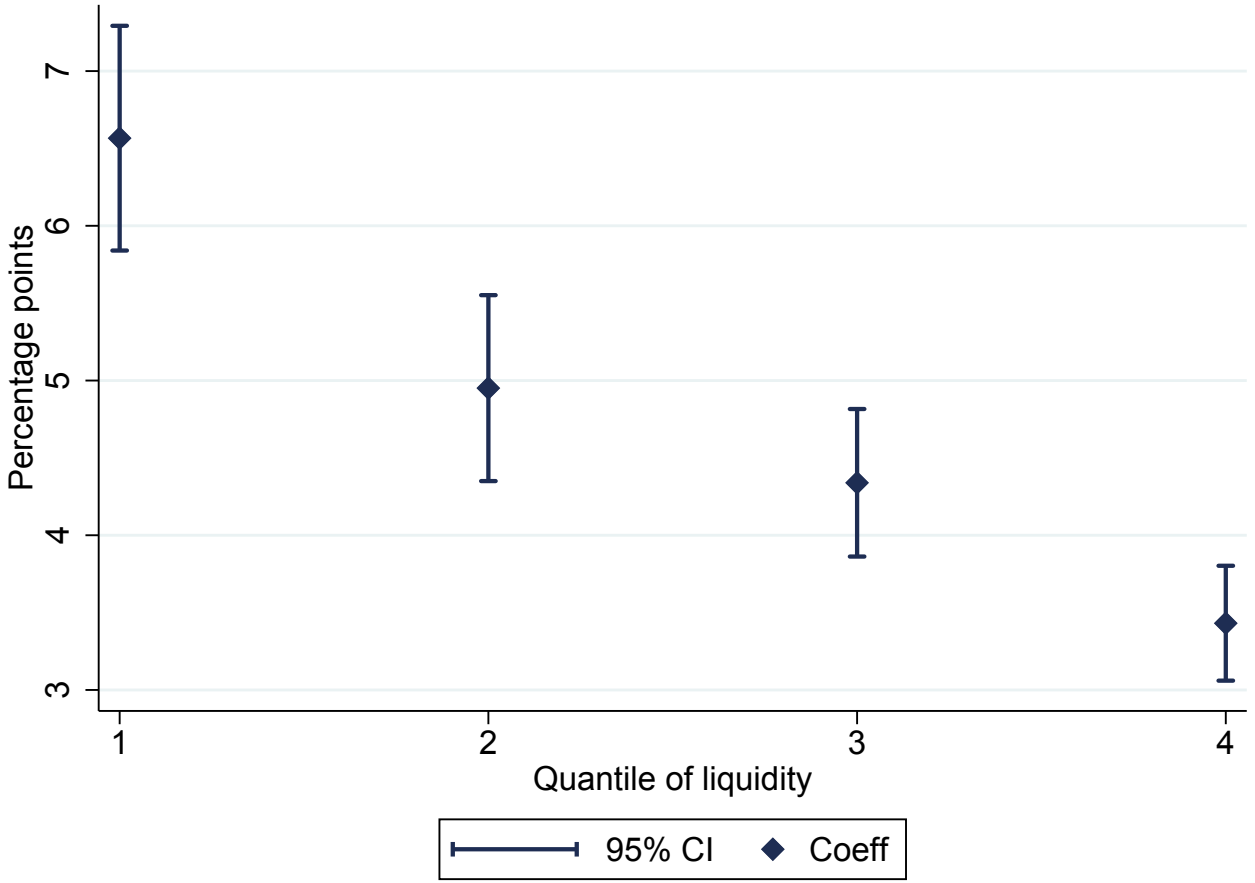
Back

Heteregeneous Treatment Effects: Employment



Back

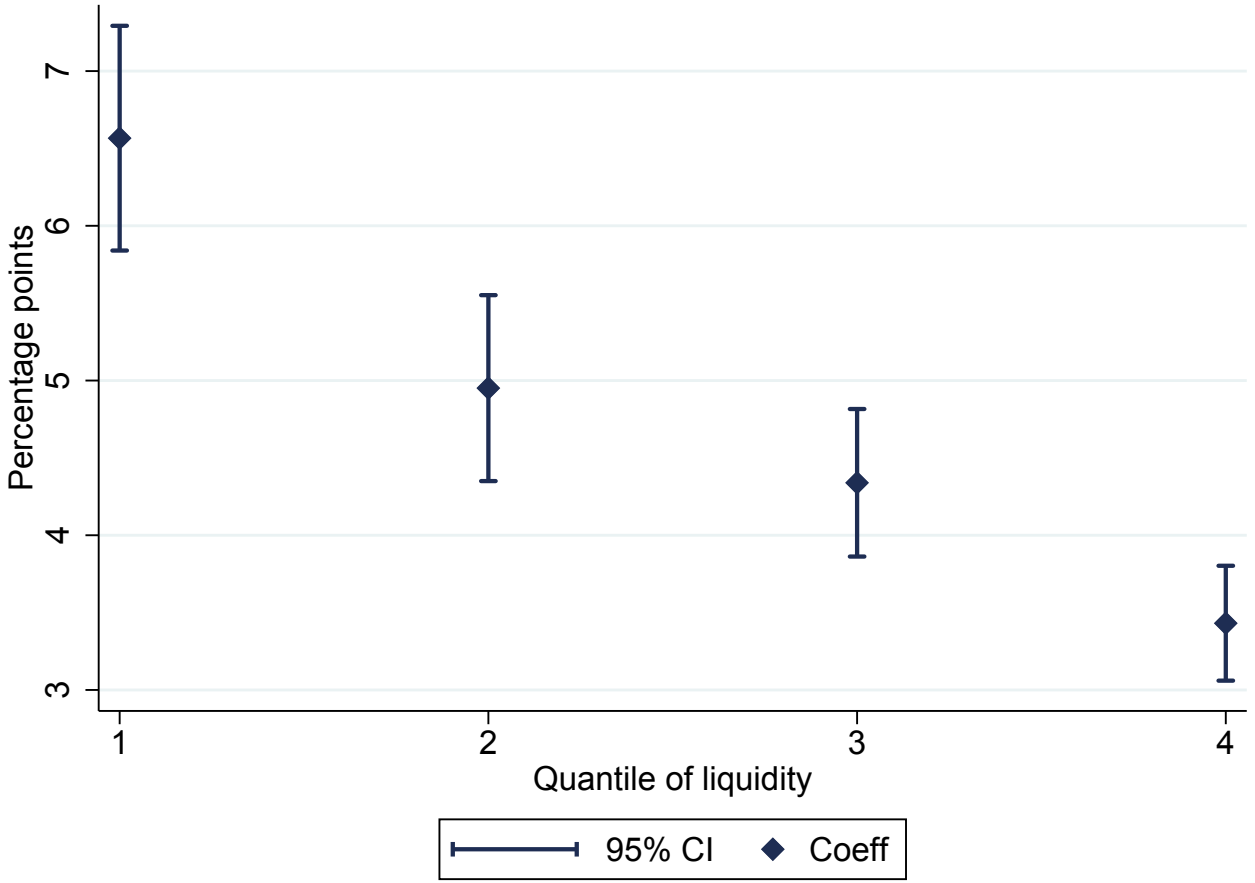
Liquidity constrained firms also take up more strongly



- Rank firms according to pre-recession levels of liquidity

Back

Liquidity constrained firms also take up more strongly



- Liquidity constrained firms much more likely to use STW Back

Reallocation: Equilibrium Effects

- Use spatial variation across more than 500 LLM
- Specification, first difference firm / LLM fixed effects

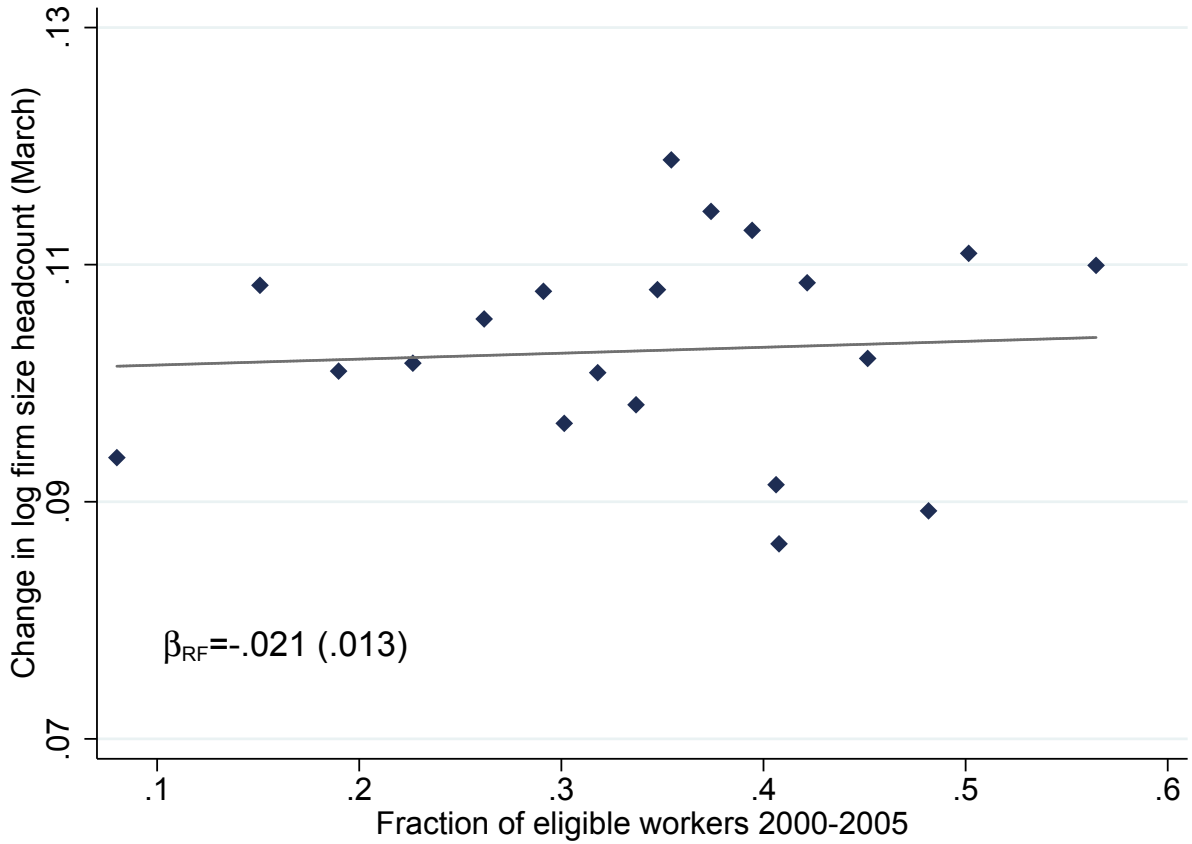
$$\Delta Y_{ij} = \Delta T_j + X_j'\beta + W_i'\gamma + \varepsilon_{ij} \quad (5)$$

$$\Delta T_j = \alpha Z_j^{PRE} + \eta_j \quad (6)$$

  - Firm i, LLM j
  - Instrument: Z_j^{PRE} fraction of eligible workers from size and INPS codes in pre-recession period

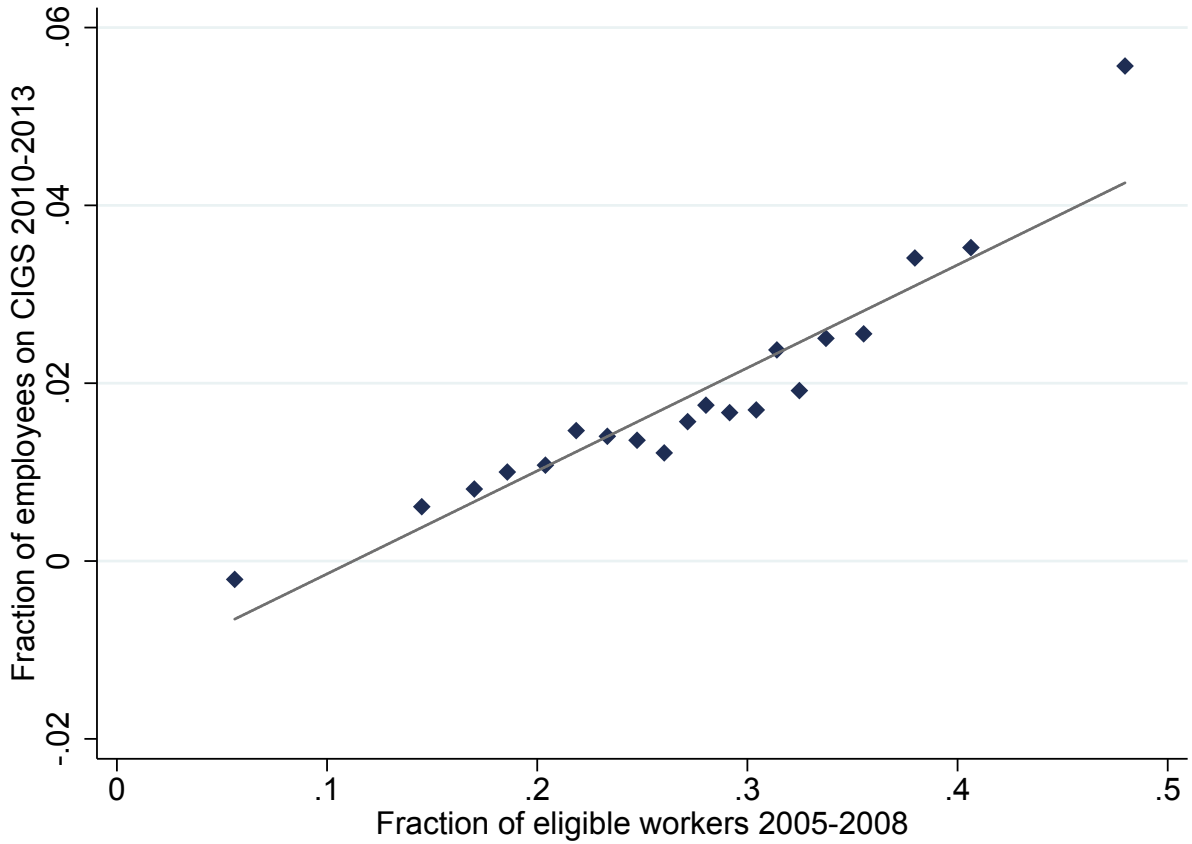
Back

Equilibrium Effects: Placebo



Back

Equilibrium Effects: First-Stage



Back

Table: Equilibrium Effects of STW on Non-Treated Firm Outcomes

	OLS	IV	IV	IV
	(1)	(2)	(3)	(4)
		Non-eligible Firms		
Log Employment	-0.327	-0.492	-0.918	-0.937
	(0.080)	(0.137)	(0.216)	(0.216)
Inflows	0.136	-3.594	-4.406	-3.176
	(1.060)	(1.947)	(2.380)	(1.440)
		Labor Market		
Log TFP	0.005	-1.332	-1.332	-0.368
	(0.159)	(0.386)	(0.286)	(0.242)
Controls				
LLM			×	×
Firm-level				×

Notes: Back

Workers

- Utility when employed in firm of productivity $k \in \{h, l\}$

$$W_k^e = u(c_k, h_k) + \beta(\delta W^u + (1-\delta) W_k^e)$$

  δ: exogenous separation rate

- Utility when unemployed

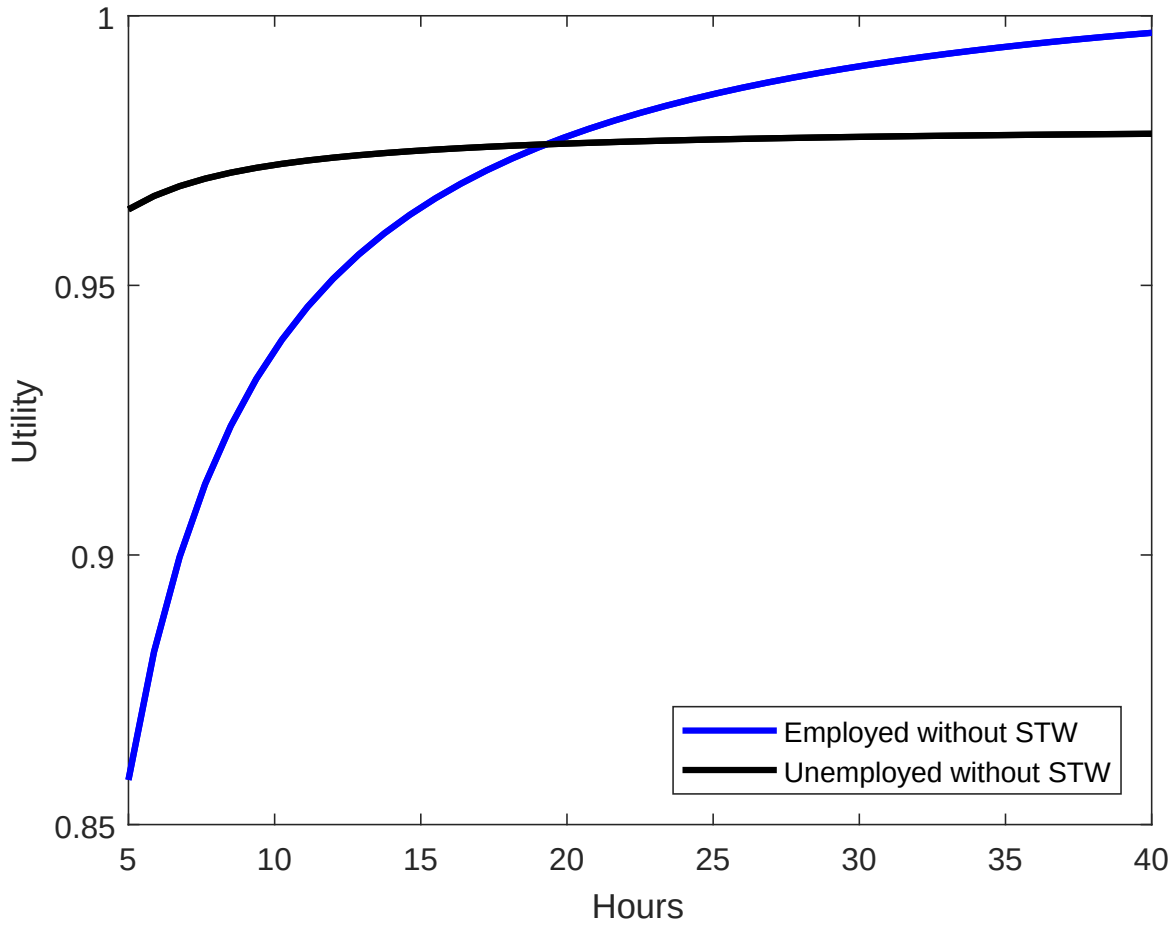
$$W^u = u(b, 0) + \beta(\phi(\theta) W^e + (1 - \phi(\theta)) W^u)$$

  $\phi(\theta)$: job finding probability

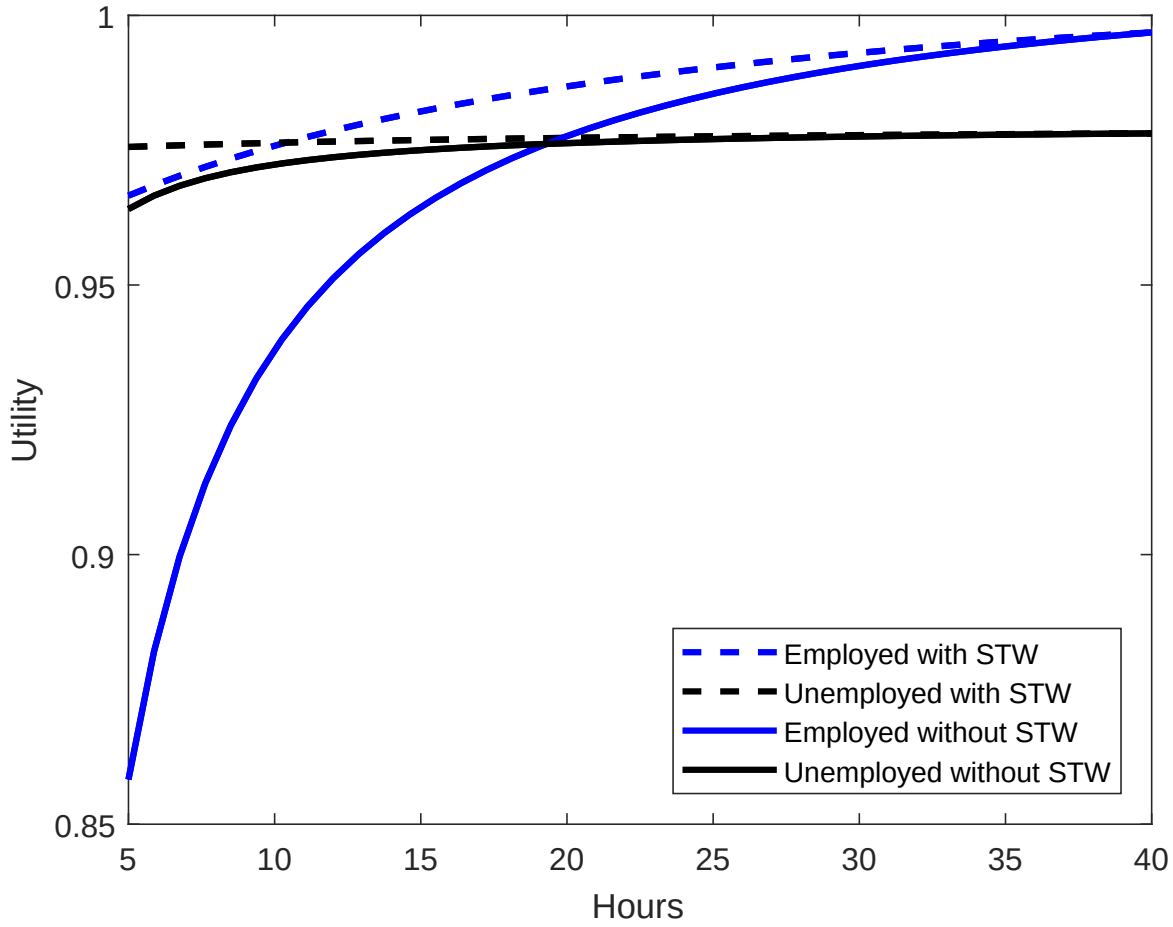
- Workers only accept employment iff $W^u \leq W_k^e$
- Implicitly defines a lower bound **constraint on hours** offered by firms $\bar{h} = \bar{h}(b, \tau)$

back

Workers' Utility & Hours Constraint



Workers' Utility & Hours Constraint: With STW



Back

Firms

- Production function $F(h, n)$:
  - Diminishing returns to labor: $F_h \leq 0$, $F_n \leq 0$
  - Hours and headcount employment not perfect substitute
- Firms maximize profits, s.t. law of motion of employment:

$$\Pi(\epsilon_t, n_{t-1}) = \epsilon_t F(h_t, n_t) - w h_t n_t - c \cdot v + \rho \mathbb{E}_t[\Pi(\epsilon_{t+1}, n_t)] \tag{7}$$

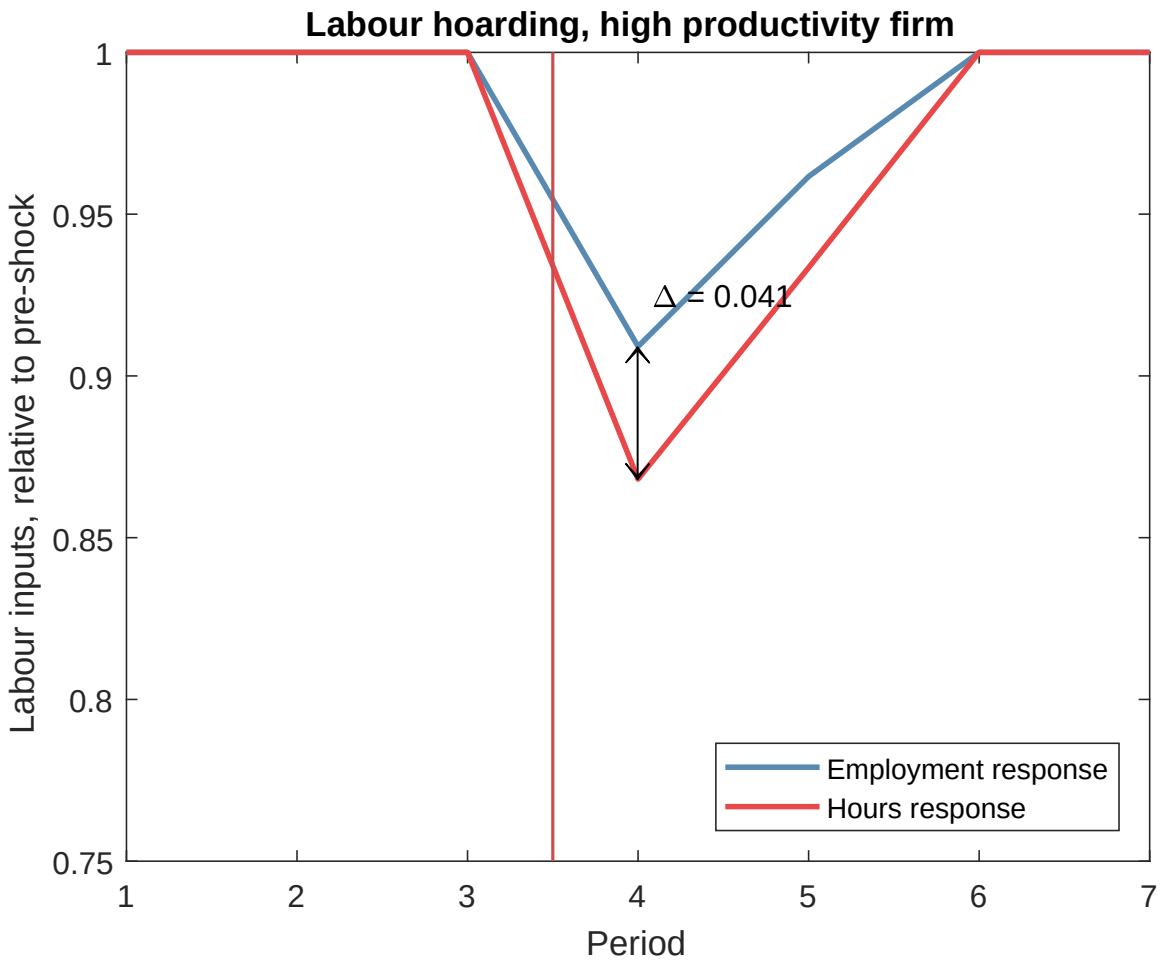
$$s.t. n_t = (1 - \delta) n_{t-1} + v \cdot q(\theta_t)$$

- Firms F.O.C w.r.t n:

$$\{\mathbf{n}\}\ \epsilon_t F_n'(h_t, n_t) = w h_t + \frac{c}{q(\theta_t)} - \rho E_t(\Pi_n(\epsilon_{t+1}, n_t)) \tag{8}$$

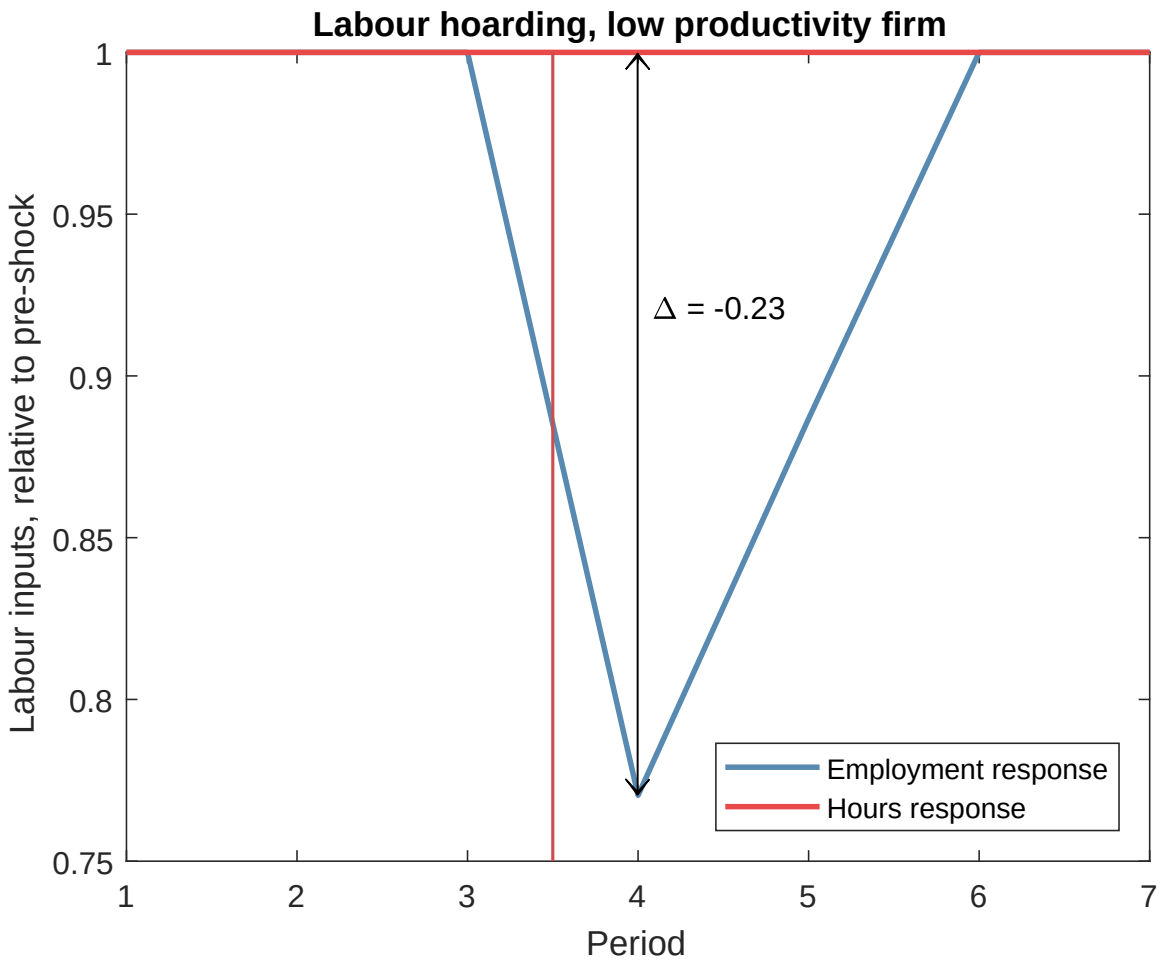
Back

Firms' Labor Hoarding in Recession: High ε



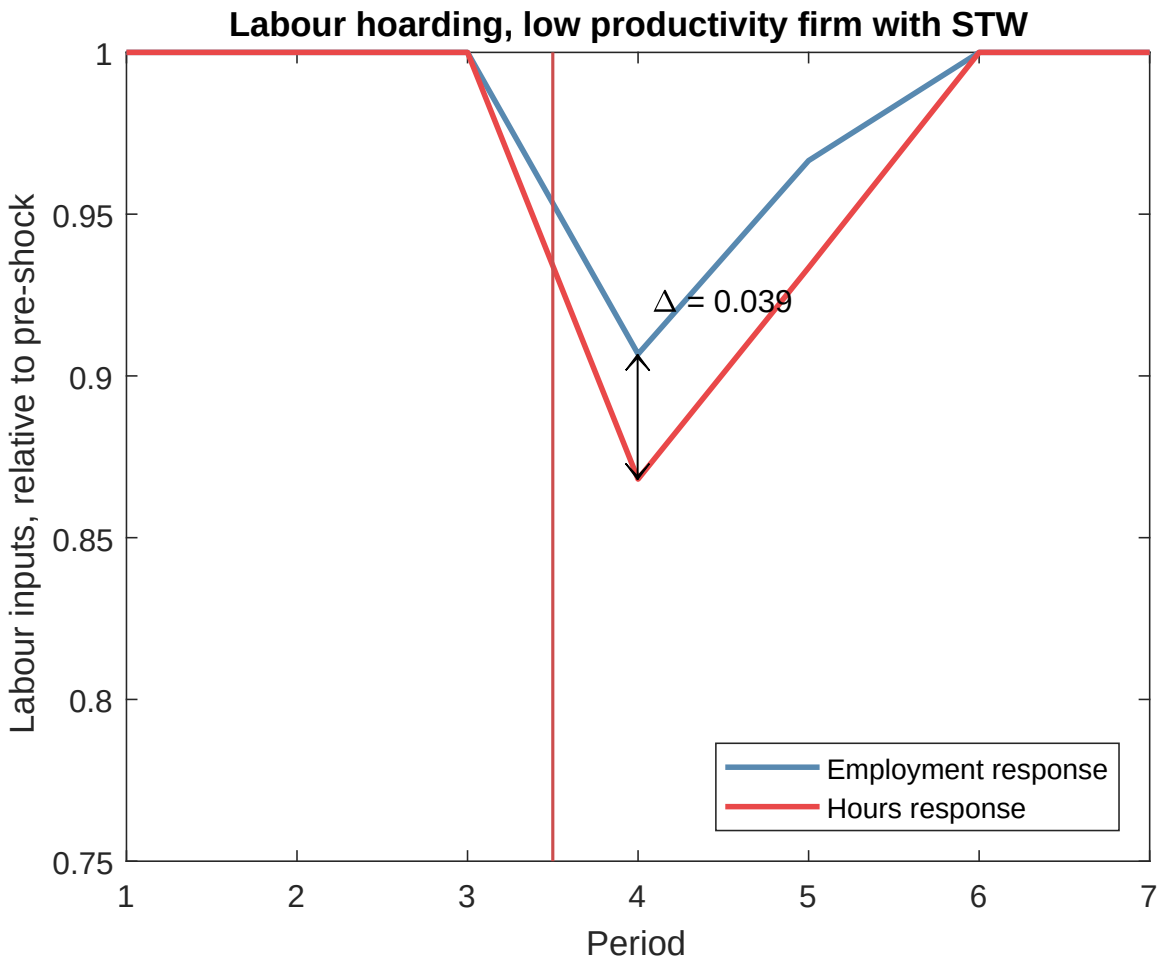
Back

Firms' Labor Hoarding in Recession: Low ε, no STW



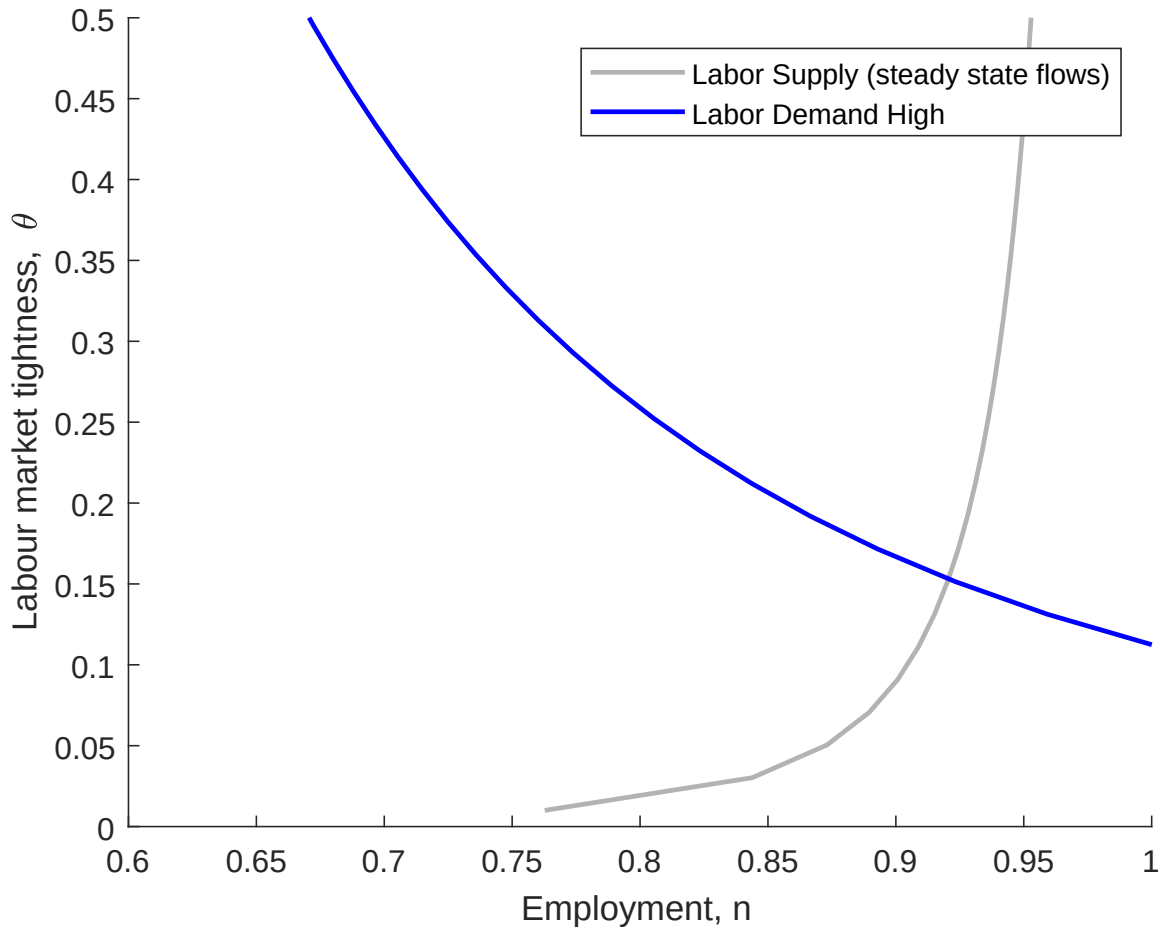
Back

Firms' Labor Hoarding in Recession: Low ε, with STW

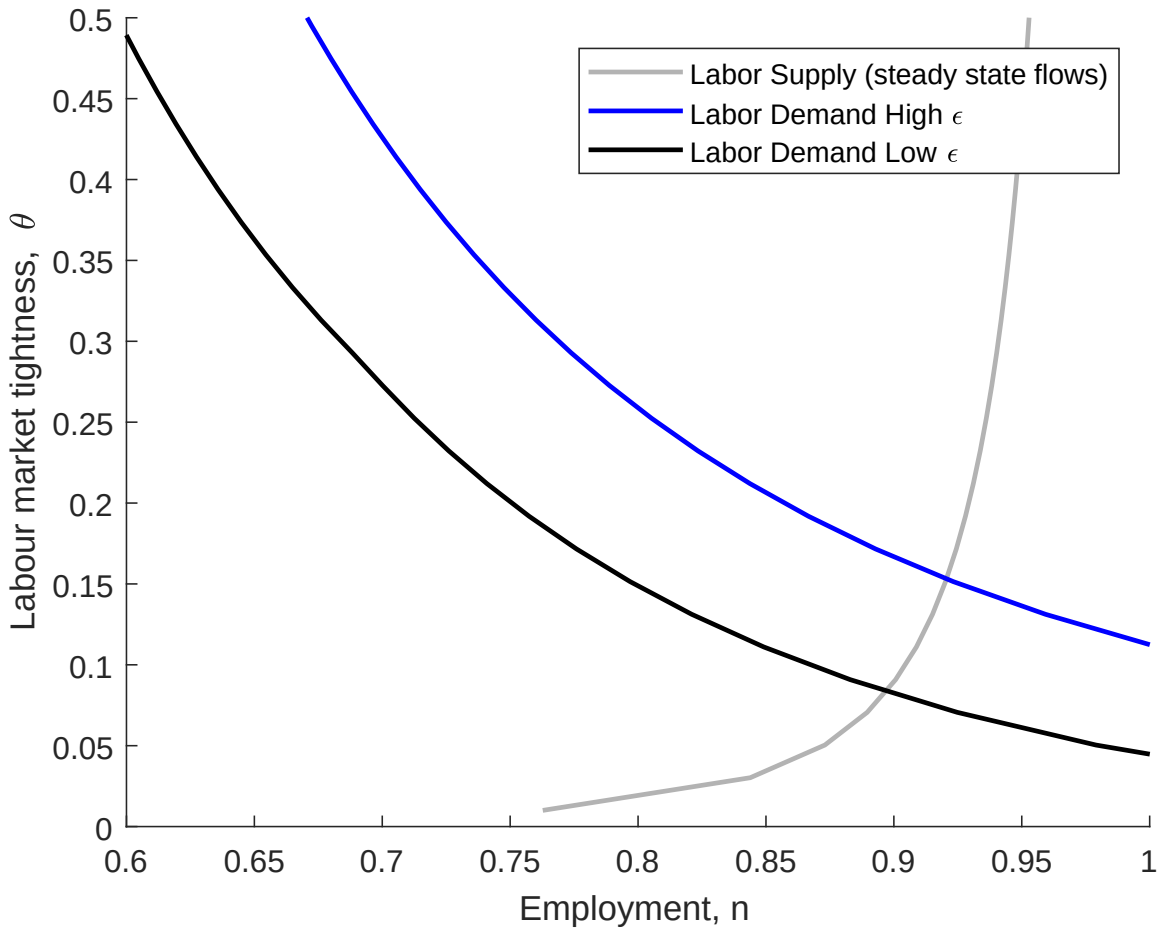


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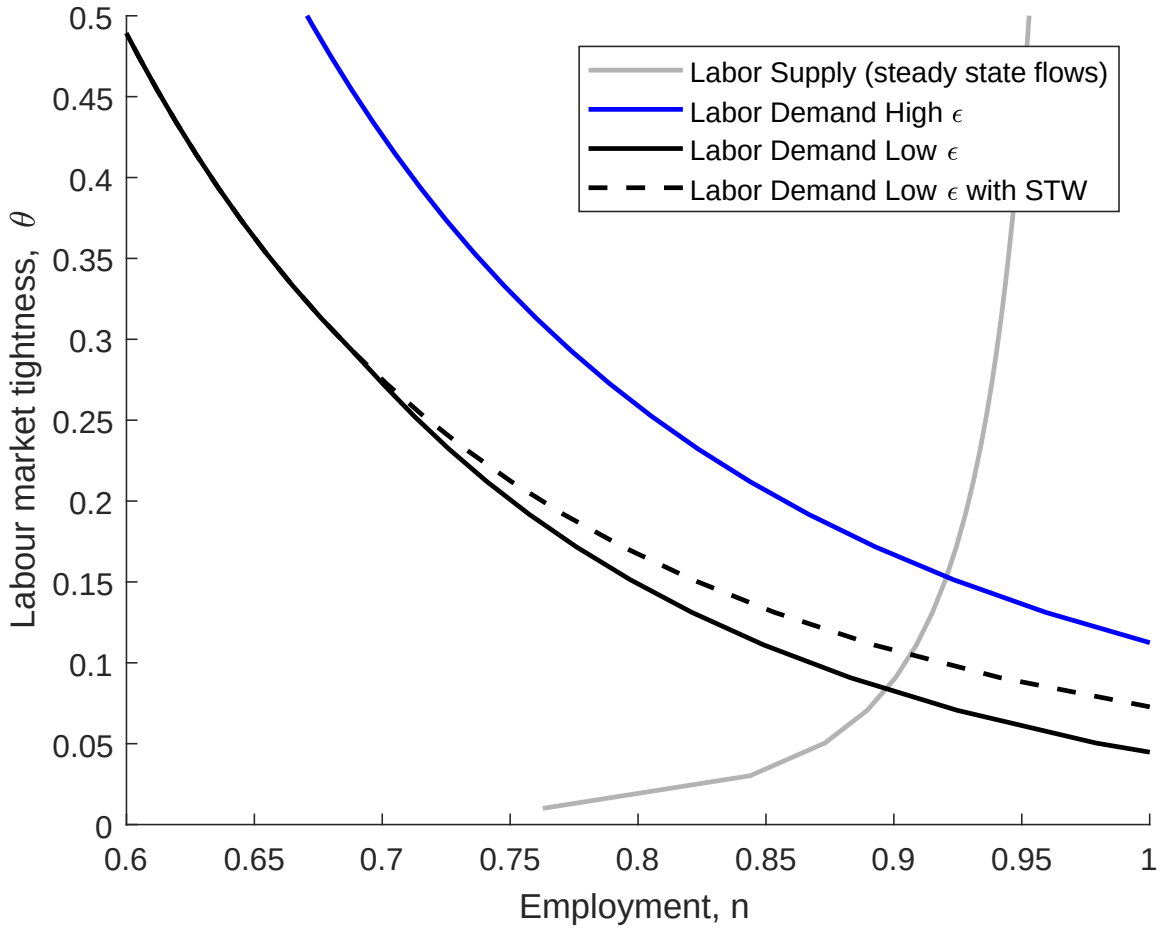
Firms' Labor Demand: High ε



Firms' Labor Demand: Low ε



Firms' Labor Demand: Low ε with STW



Equilibrium

- Aggregate labor demand: $n_d = n_l + n_h$
- Steady-state equality of flows in/out of employment:

$$n^s = \frac{\phi(\theta)}{\delta + \phi(\theta)}$$

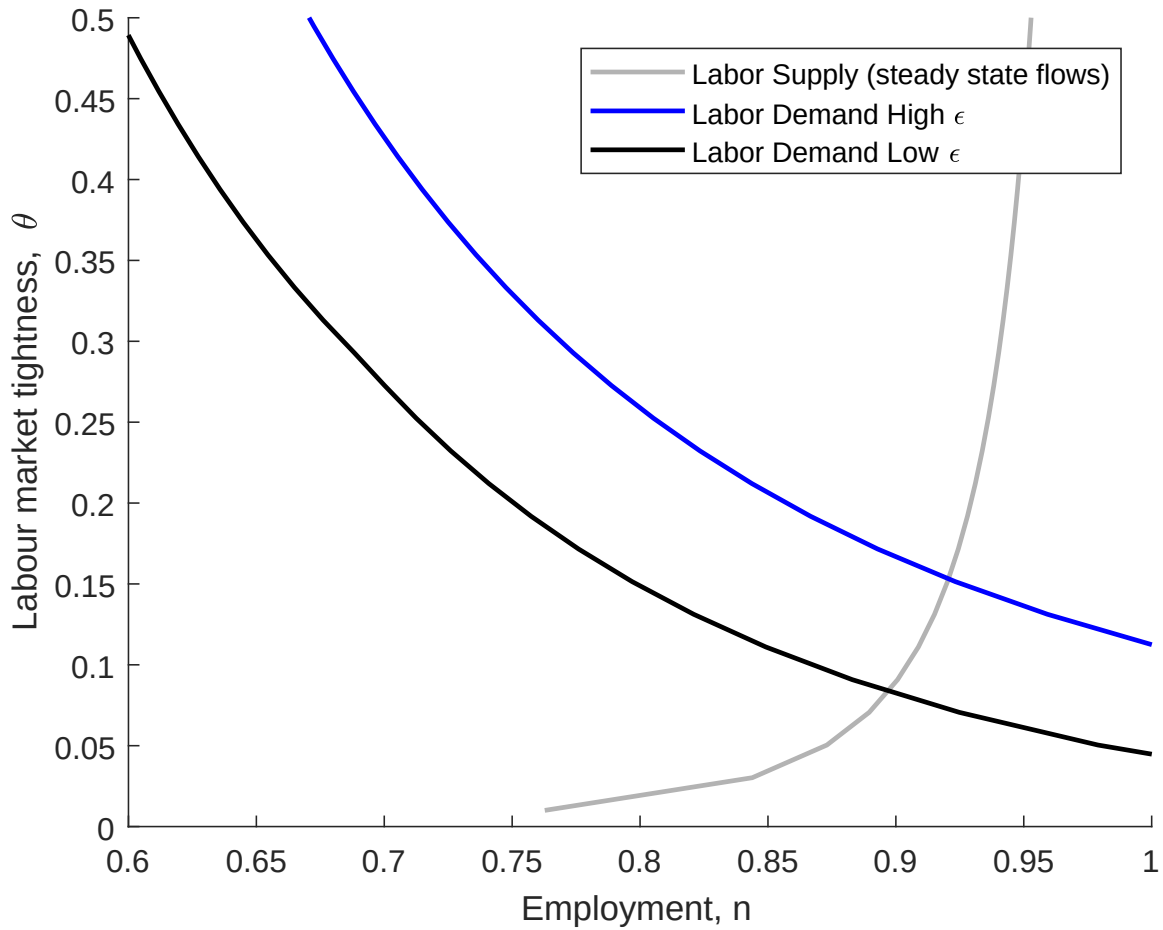
- Gvt budget constraint:

$$u \cdot b + n_l \cdot \tau(\underline{h} - h_l) \leq tN$$

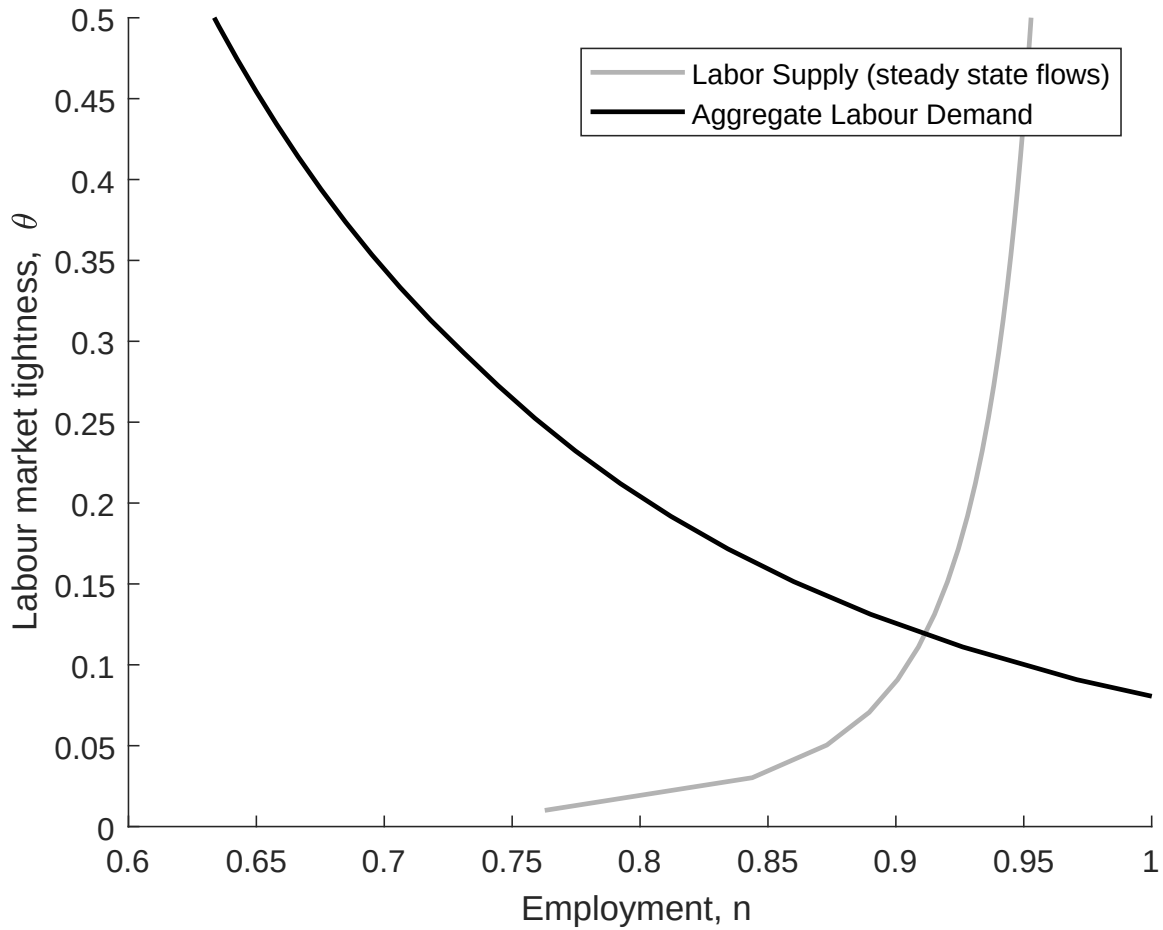
- Equilibrium:

$$n^d(\theta, b, \tau) = n^s(\theta)$$

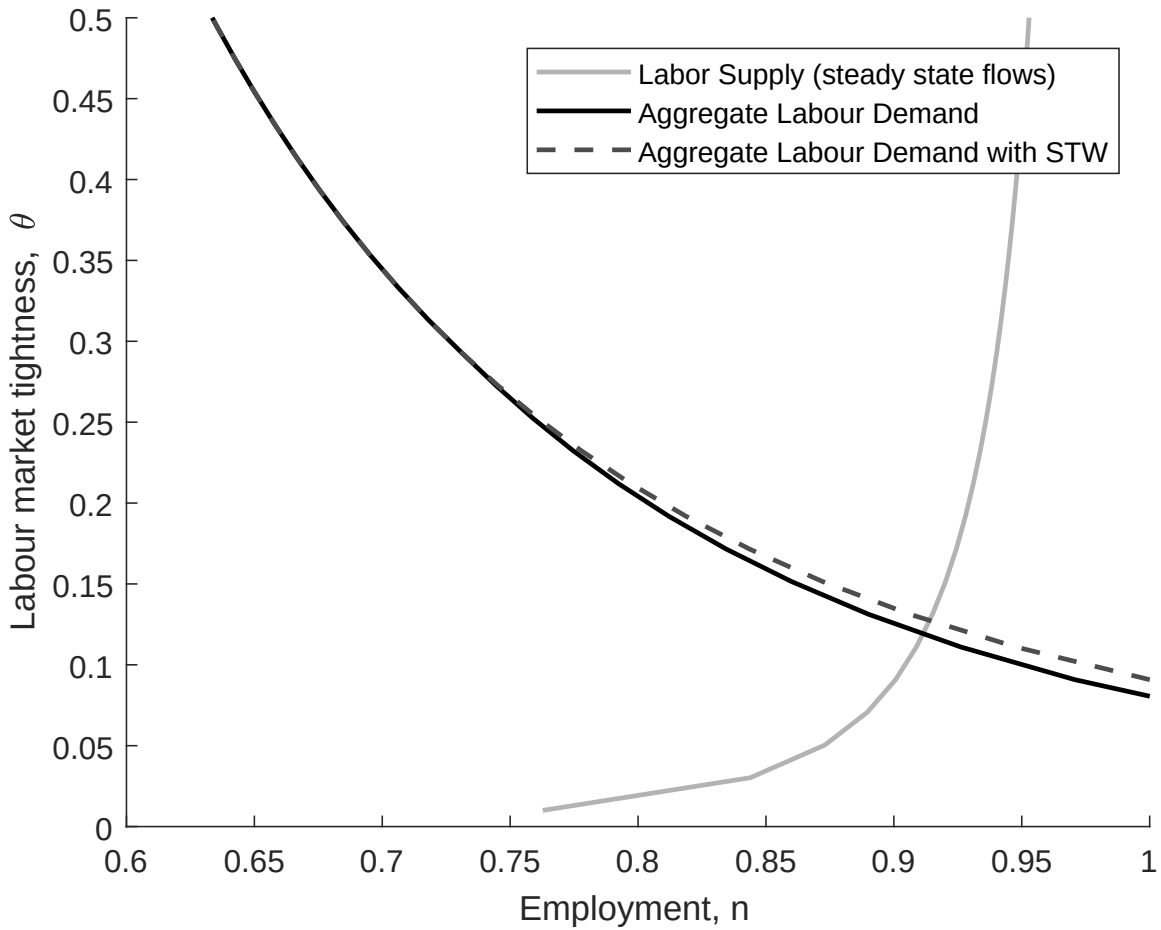
Equilibrium



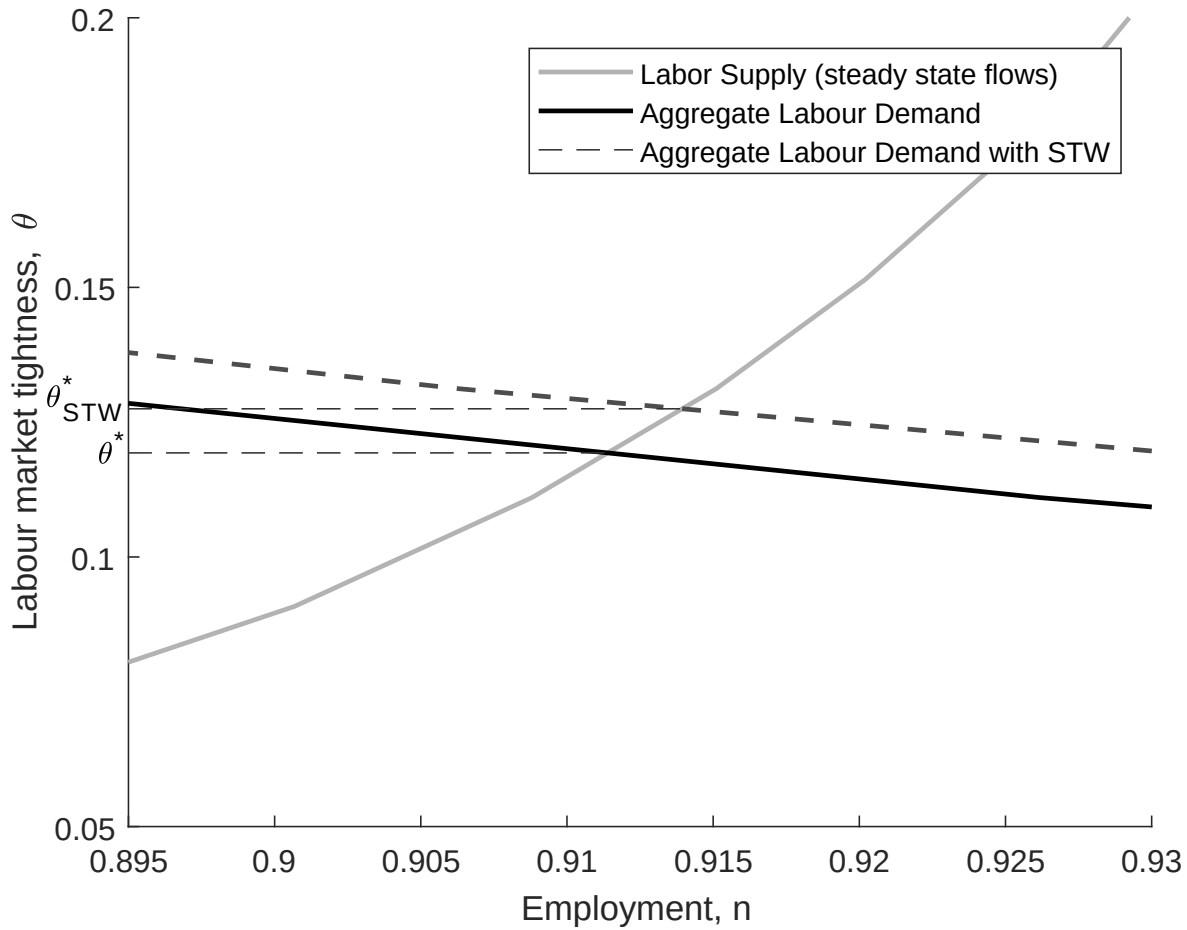
Equilibrium



Incidence of STW Policy



Incidence of STW Policy



Negative Employment Externalities for High ε Firms

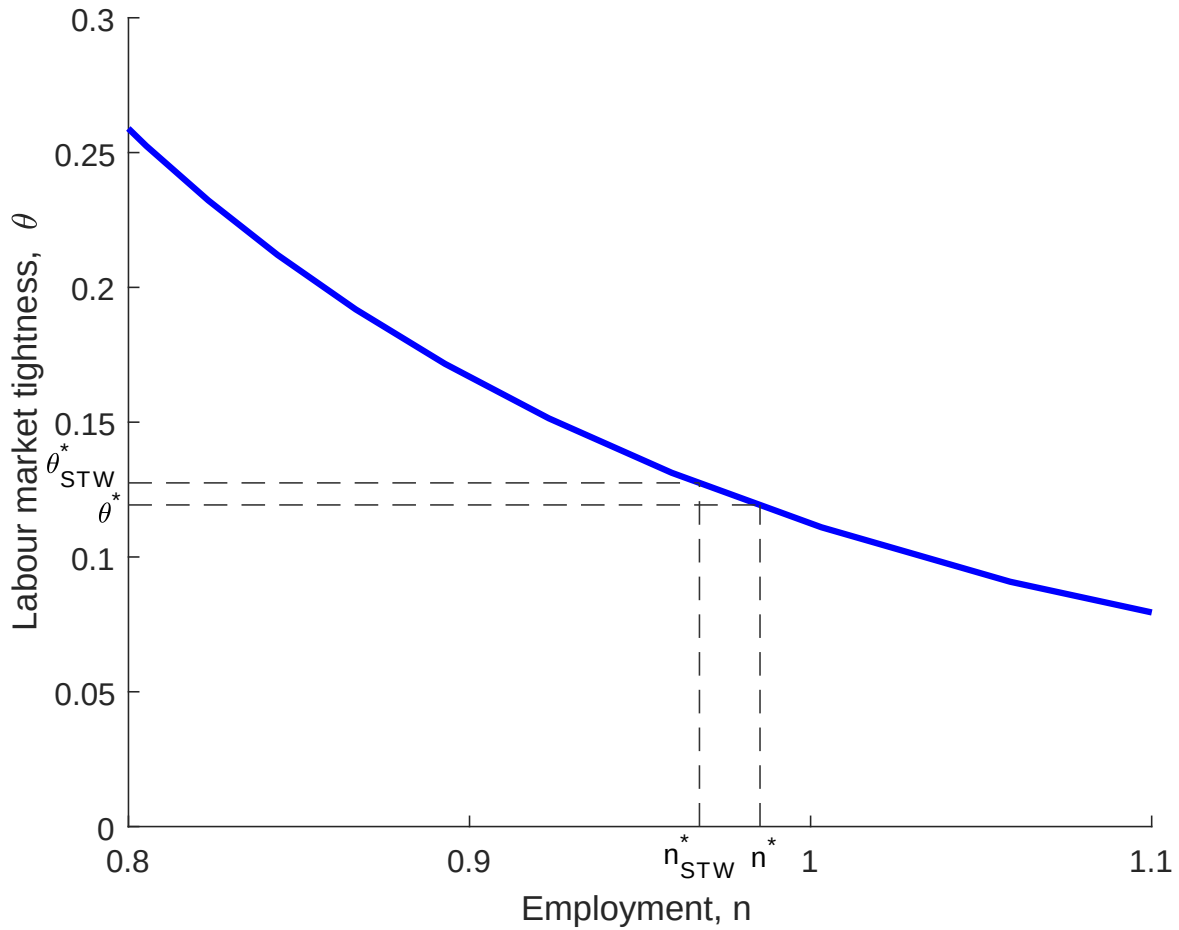
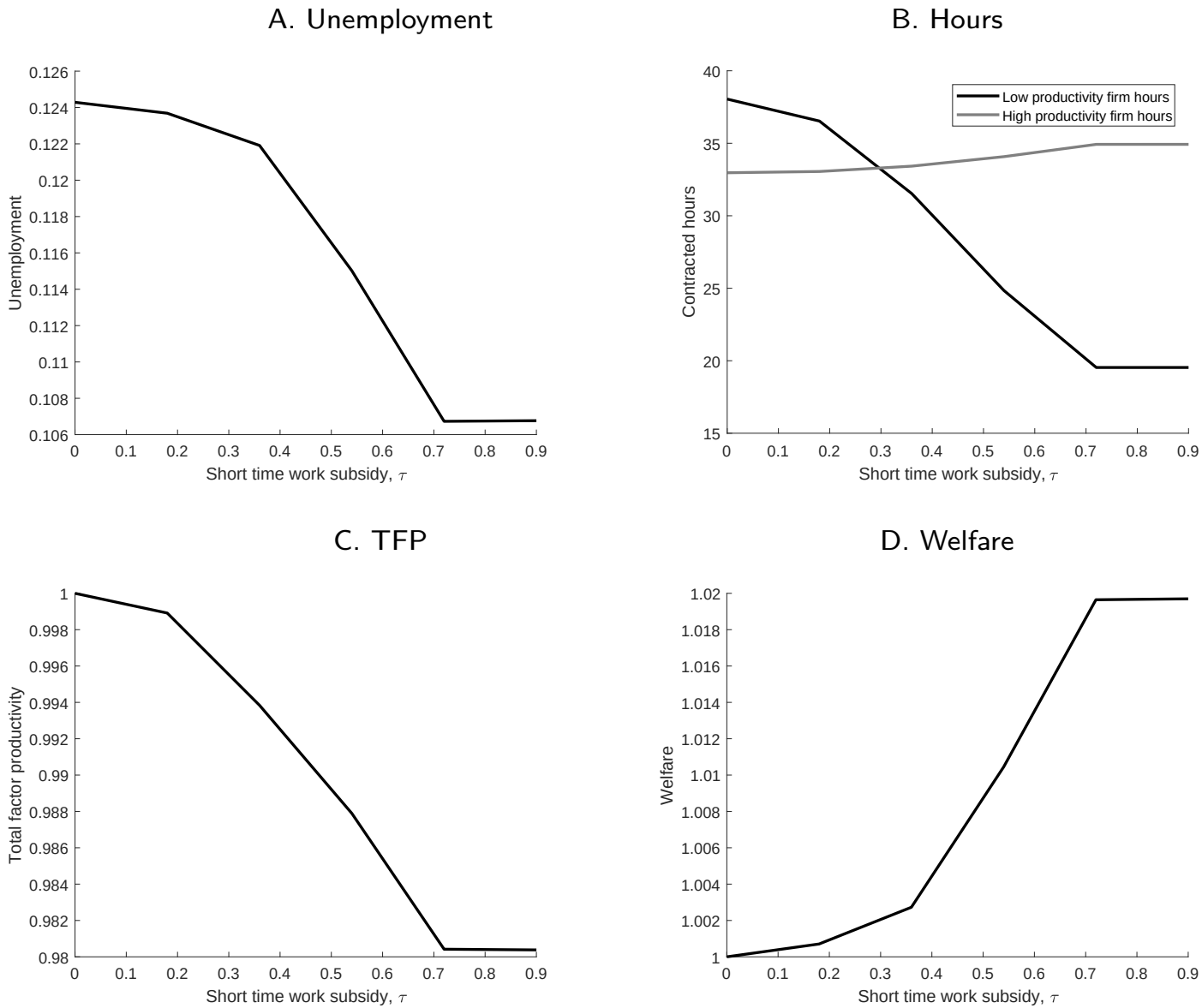
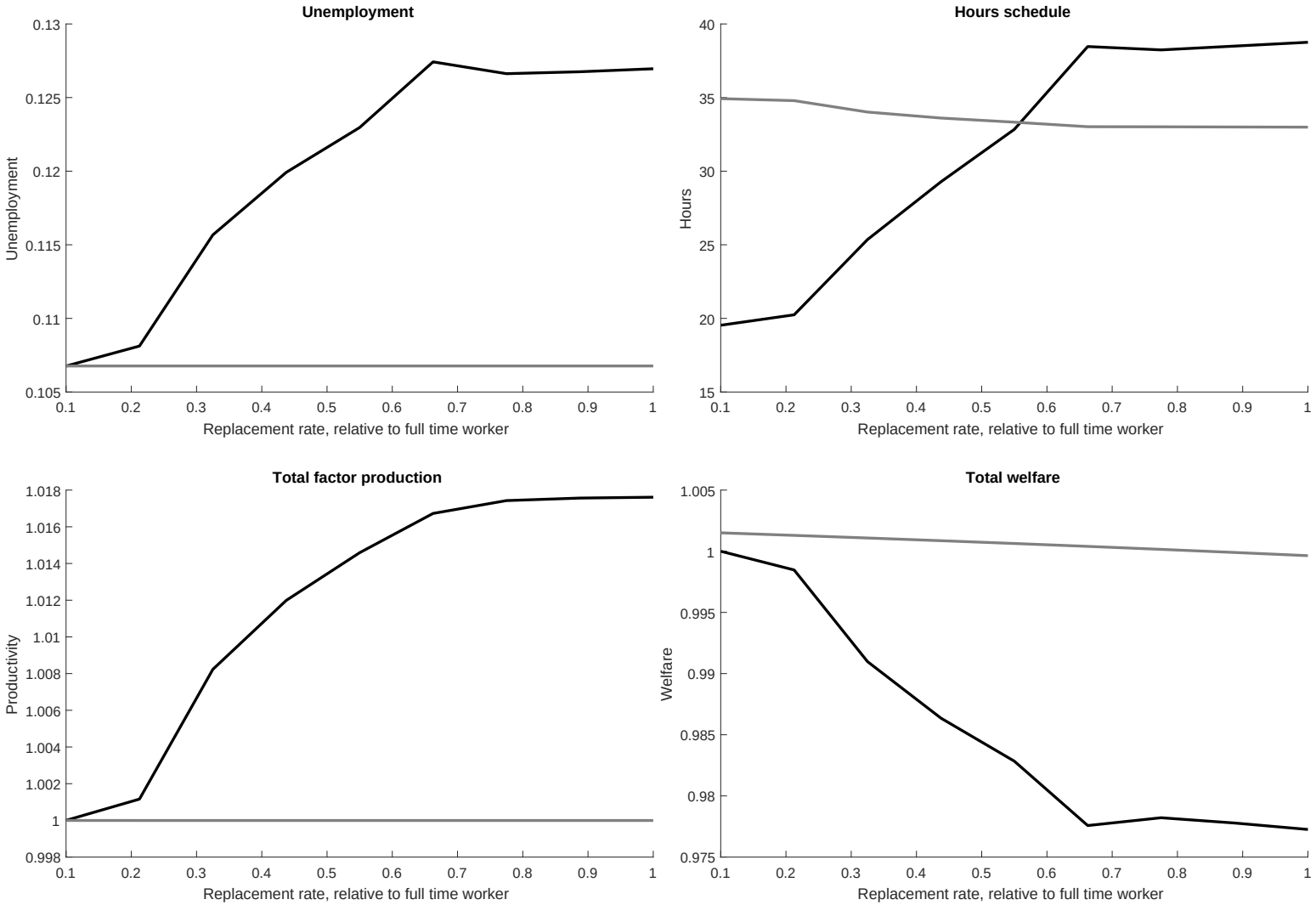


Figure: Counterfactual STW Rate τ

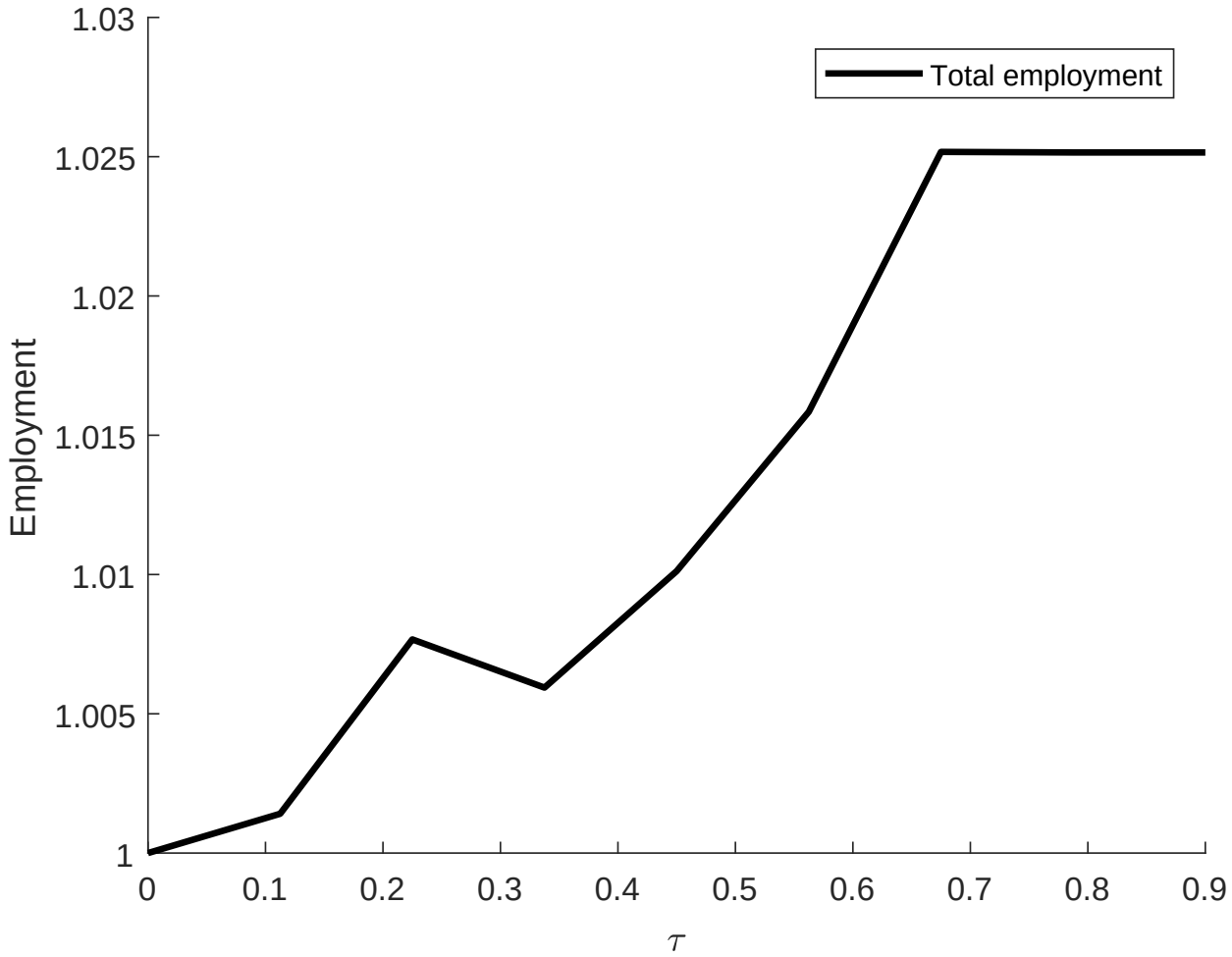


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Counterfactual UI Policy R

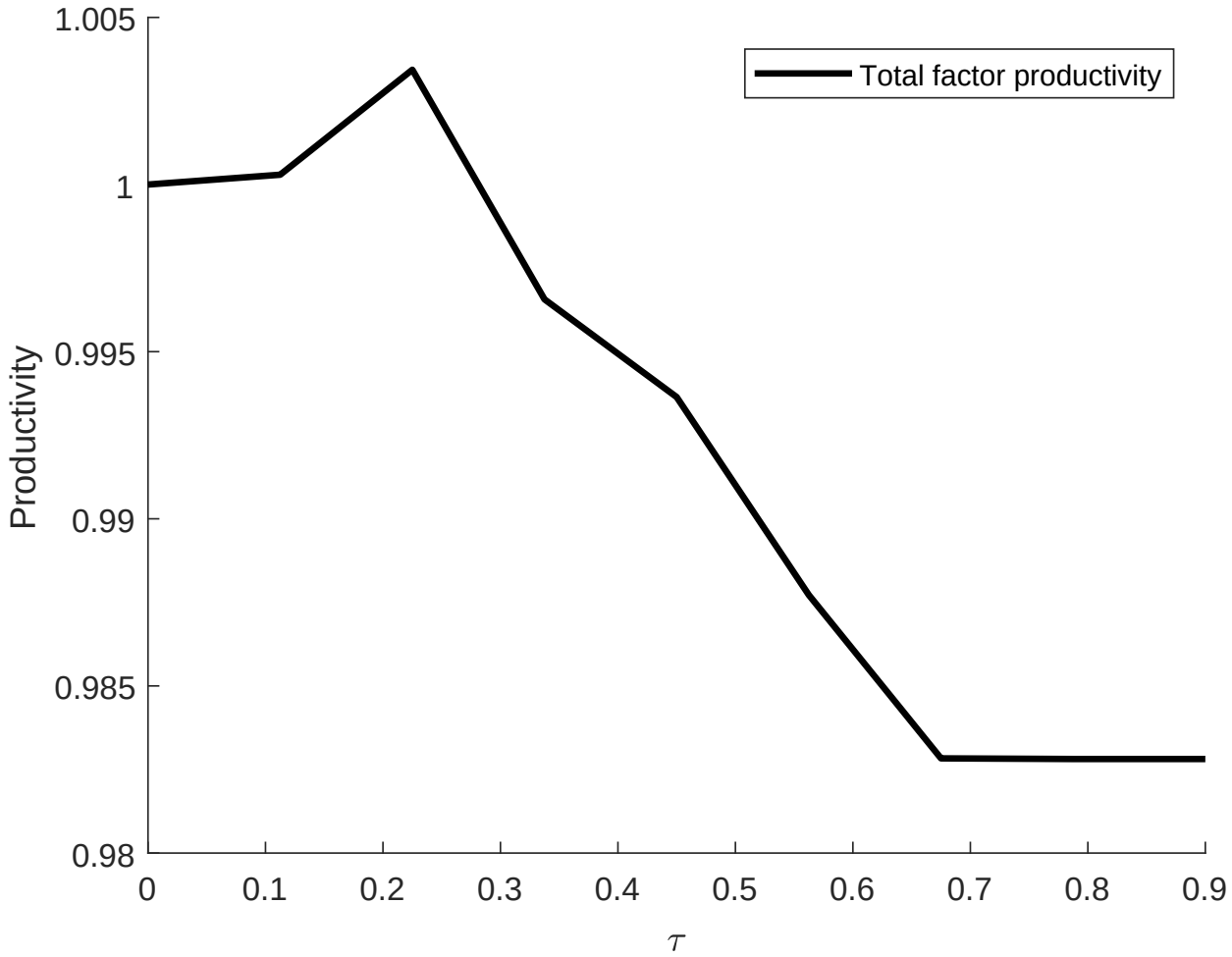


Counterfactual STW Rate τ: Employment



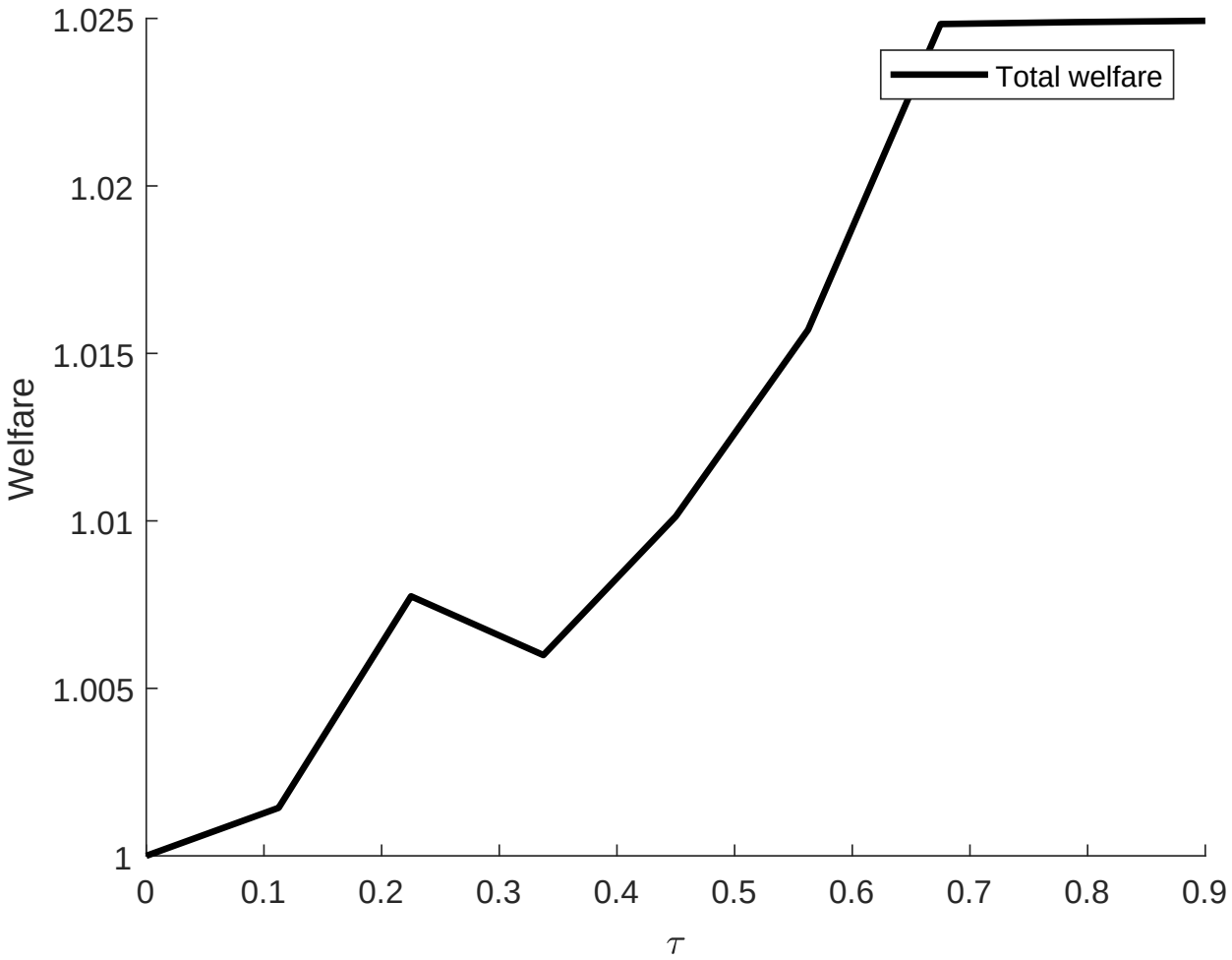
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Counterfactual STW Rate τ: Productivity



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Counterfactual STW Rate τ: Welfare



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Reallocation effects: Selection and Heterogeneity

1. : Firms taking up STW more likely to layoff workers absent STW Graphs

2. : Liquidity constrained firms more likely to take-up STW Graphs

3. : Low productivity firms select more into STW Graphs

Reallocation effects: Selection and Heterogeneity

1. : Firms taking up STW more likely to layoff workers absent STW Graphs

- STW well targeted = firms that take it up most would have laid off workers absent STW

2. : Liquidity constrained firms more likely to take-up STW Graphs

3. : Low productivity firms select more into STW Graphs

Reallocation effects: Selection and Heterogeneity

1. : Firms taking up STW more likely to layoff workers absent STW Graphs
2. : Liquidity constrained firms more likely to take-up STW Graphs
   - If **financially constrained** firms select more, STW injects liquidity and may prevent excessive layoffs (Schoefer [2016])
3. : Low productivity firms select more into STW Graphs

Reallocation effects: Selection and Heterogeneity

1. : Firms taking up STW more likely to layoff workers absent STW Graphs
2. : Liquidity constrained firms more likely to take-up STW Graphs
3. : Low productivity firms select more into STW Graphs
   - If low-**productivity** firms select more, then STW subsidizes low-productivity matches and prevents efficient reallocation of labor

Related Literature

- Following earlier cross-country empirical analyses (Abraham and Houseman, 1993), renewed interest in STW at the onset of the crisis:
  - Cross-country studies: positive effect of STW on employment and a negative on hours (Hijzen and Venn, 2010; Boeri and Bruecker, 2011; Cahuc and Carcillo, 2011; Hijzen and Martin, 2013)
  - Analysis at firm-level remains scarce and inconclusive due to limited data availability and credible exogenous variation (Boeri and Bruecker, 2011; Brenke et al., 2013; Calavrezo et al., 2009)
- Early theoretical literature: STW reduces layoffs, but generates distortions at the intensive margin (Burdett and Wright, 1989)
- Recent theoretical work: STW decreases allocative efficiency (Cooper et al., 2017)