Employment Effects and Welfare Consequences of Short-Time Work Programs

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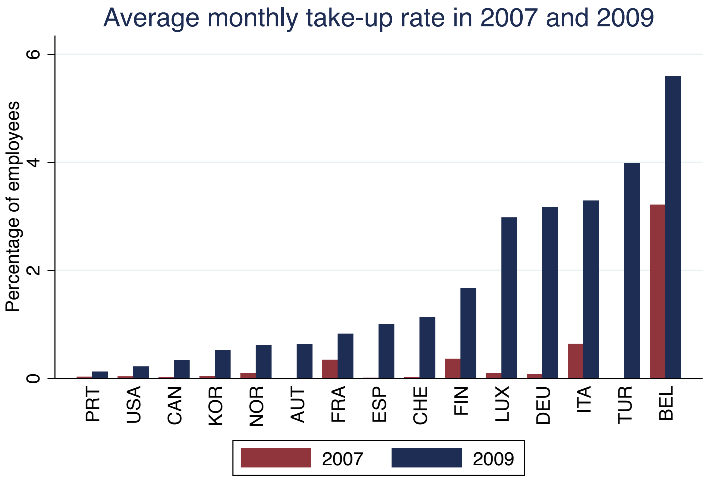
Motivation

Short-time work

- Subsidy for hour reductions to firms experiencing temporary shocks
- Twofold objective:
  - ▷ Insure workers against income fluctuations due to variations in employment at intensive margin
  - ▷ Prevent potentially excessive layoffs in response to shocks and the resulting increase in unemployment
- Policy tool widely used in OECD countries during the crisis
  - ▷ 3-6% of the workforce and 0.1-0.3% of GDP in 2009
  - ▷ Expenditure on UI was 0.7% and 1.1% of GDP in 2007 and 2009
- Little knowledge about the effect of STW on firms and workers
  - ▷ Limited evidence due to lack of good-quality data and credible identifying variation
  - ▷ Lack of conceptual framework to evaluate welfare effects



Source: Hijzen and Venn (2010), OECD data

Research question

STW programs are public schemes intended to preserve jobs at firms experiencing temporary shocks

- Is there an effect of STW programs on employment?
- What are the long-term consequences of STW on individuals and firms?

In a labor market with frictions, shocks to firms may induce inefficient layoffs (Hall and Lazear, 1984) and layoffs may respond to the subsidy

- Are layoffs inefficiently high? Is reducing layoffs welfare enhancing?
- What is the optimal design of STW as a tool to prevent excessive layoffs in a frictional labor market?

Literature

- Following earlier cross-country empirical analyses (Abraham and Houseman, 1993), renewed interest in STW at the onset of the crisis:
  - Cross-country studies find evidence of a positive effect of STW on employment and a negative one on average hours worked (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 shows that STW reduces layoffs compared to UI, but generates distortions at the intensive margin leading to underemployment (Burdett and Wright, 1989)
- Recent theoretical work shows that, by preventing increases in unemployment during a recession, STW decreases allocative efficiency due to a reduction in the vacancy filling rate (Cooper et al., 2017)

This project

- Unique administrative data on STW at the individual and firm level from Italian Social Security records
- Matched with balance-sheet data at firm level
- Credible sources of quasi-experimental variation in Italian policy rules to identify causal effects of STW on:
  - Employment at the intensive and extensive margins
  - Long-term individual and firm outcomes
- Twofold empirical strategy
  - Baseline triple difference to identify short-run effects
  - Triple difference à la Cellini et al. (2010) to identify dynamic effects
- Use empirical evidence to analyze the welfare consequences of STW programs as policy tools to limit potentially excessive layoffs

Outline

Institutional features of the Italian STW program

- Subsidy for hour reductions - either partial or full-time - available to workers in the private sector and administered by the Social Security
- Replaces about 80% of foregone earnings due to hours not worked
- Firms intending to use the program must file an application to the Social Security or the Ministry of Labor
  - Provide justification of economic need
  - Develop a recovery plan
- Weak conditionality requirements
  - No compulsory training
  - No prohibition of dismissal
  - No job-search requirement for employee
- Cost to employer is a fixed percentage of subsidized hours (with exemptions)

Three pillars of Cassa Integrazione Guadagni

	Target	Duration	Avg spell	Industry	Size
CIGO	Transitory, exogenous shocks	13 weeks	2 weeks	Manufact Construct Transport	
CIGS	Crisis Restructuring Insolvency	2 years	3.5 months	Manufact Construct Retail Transport	> 15 > 15 ≥ 50 any
CIGD	Extend coverage or duration of CIGO/CIGS	By decree	3.5 months	Sectors and regions set by decree	

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%)

Identification of STW effects

- We use the Great Recession as our main source of shock
- Identification exploits variations in eligibility for CIG Straordinaria based on:
  - **Size**: having employed more than 15 employees in full-time equivalent in six months prior to application
  - **Industry**: mostly industries in manufacturing and construction
- Compare the difference in outcomes around the 15-threshold in eligible and non-eligible industries, before and after the start of the Great Recession
  - Industry variation in eligibility for STW allows controlling for the confounding effect of employment protection legislation

McCrary Test

Empirical strategy

Reduced-form graphical representation

- Plot the difference in outcomes between firms above and below the 15-threshold, and in eligible and non-eligible industries relative to 2007

Structural-form regression-based estimation

- Instrument the probability of receiving CIGS using the interaction between a 15-threshold dummy, industry and calendar year
- Structural form

$$y_{ist} = \beta_0 + \beta_1 T_{ist} + u_{ist}$$

Empirical strategy (cont.)

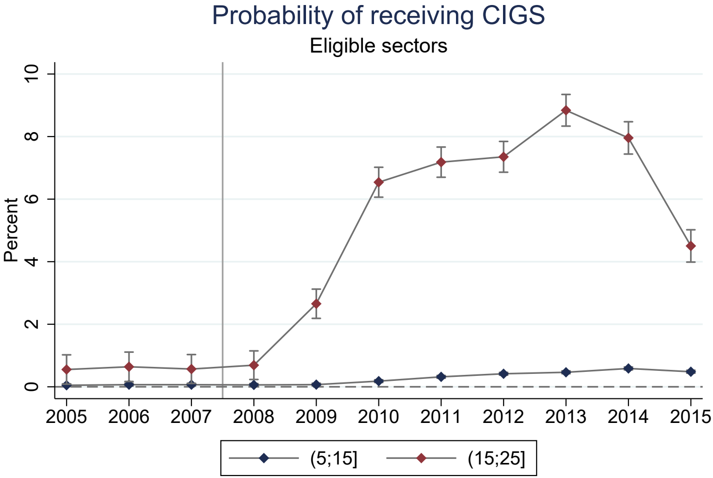
- First stage

$$
\begin{aligned}
T_{ist} = & \gamma_0 + \sum_{j \neq 2007} \gamma_1^j \mathbb{1}[s \in elig] * \mathbb{1}[size > 15] * \mathbb{1}[j = t] \\
& + \sum_{j \neq 2007} \sum_k \gamma_2^{jk} \mathbb{1}[k = s] * \mathbb{1}[j = t] \\
& + \sum_{j \neq 2007} \gamma_3^j \mathbb{1}[size > 15] * \mathbb{1}[j = t] \\
& + \sum_k \gamma_4^k \mathbb{1}[k = s] * \mathbb{1}[size > 15] \\
& + \sum_k \gamma_5^k \mathbb{1}[k = s] + \sum_{j \neq 2007} \gamma_6^j \mathbb{1}[j = t] \\
& + \gamma_7 \mathbb{1}[size > 15] + v_{ist}
\end{aligned}
$$

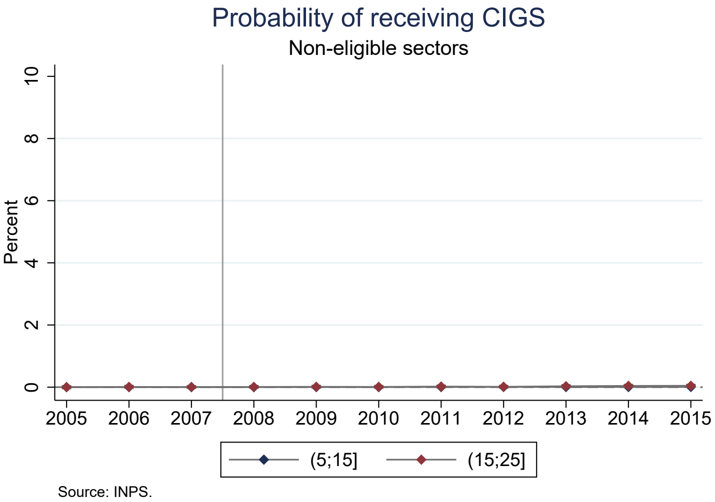
where i is firm, s industry at 5-digit level and t calendar year

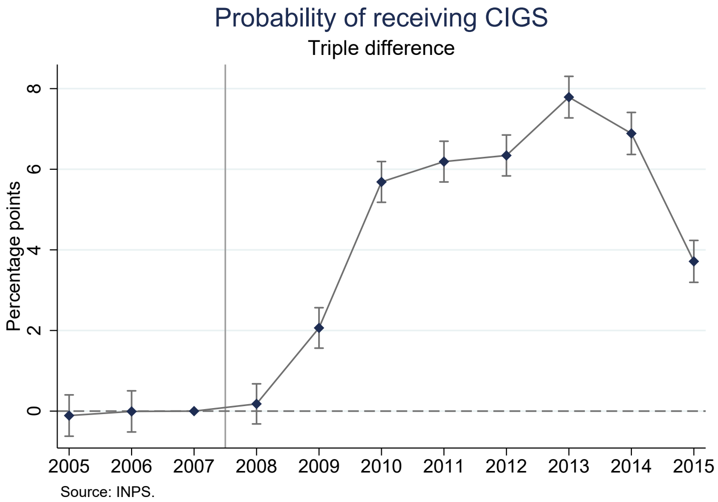
Empirical implementation

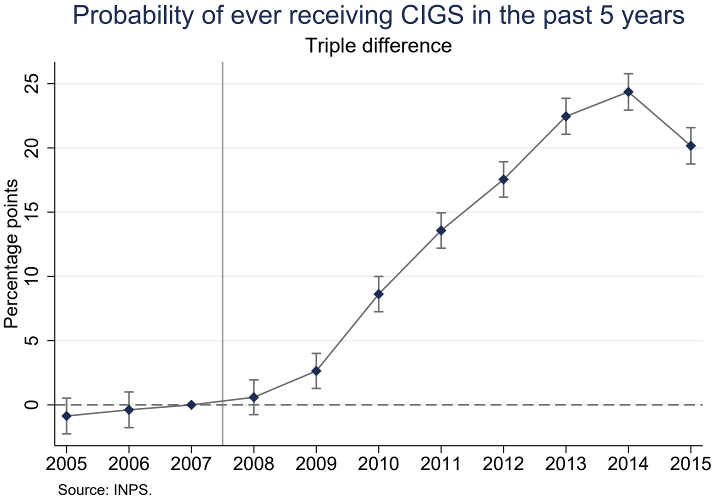
- Annual data from 2000 to 2015
- Panel of all ever-active firms and of their workers (in eligible job positions)
- Eligibility status is defined dynamically based on maximum 6-month average firm size and industry in each year
  - Select firms with 6-month full-time equivalent firm size $\in (5; 25]$
- Definition of a STW event
  - Any month in which a CIG episode is reported, which is also authorized according to the authorization data
  - When aggregating at the annual level, an event is defined as having at least one CIG episode during the year


Probability of receiving CIGS
Eligible sectors
Percent
0
2
4
6
8
10
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
(5;15]
(15;25]

Source: INPS.

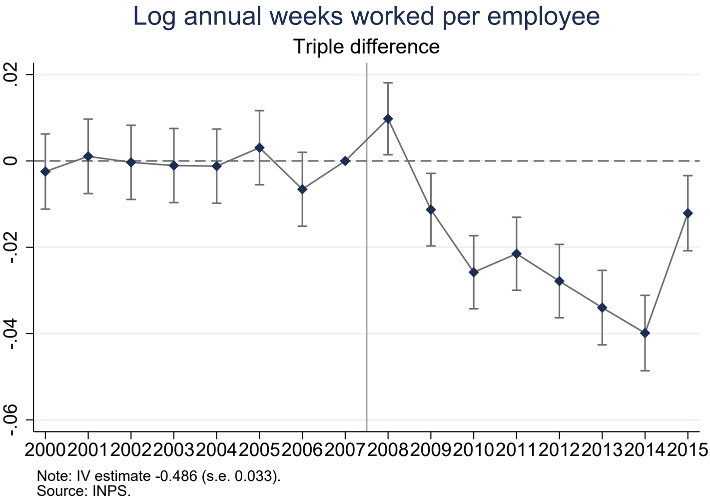

Probability of receiving CIGS
Non-eligible sectors
Percent
0
2
4
6
8
10
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
(5;15]
(15;25]
Source: INPS.

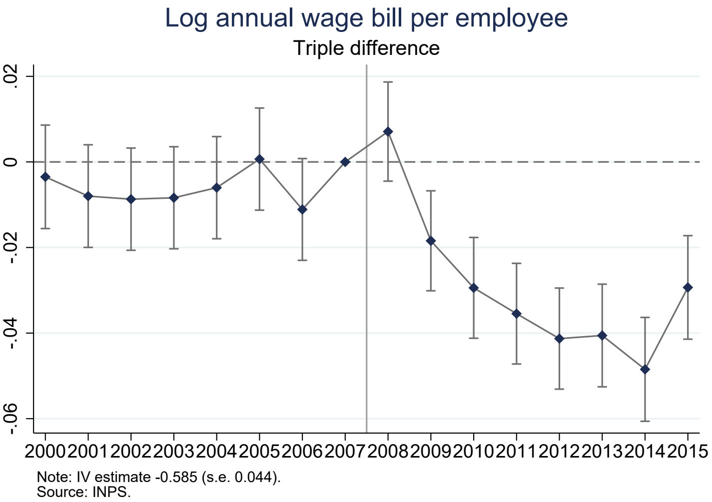

Probability of receiving CIGS
Triple difference
Percentage points
0
2
4
6
8
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Source: INPS.



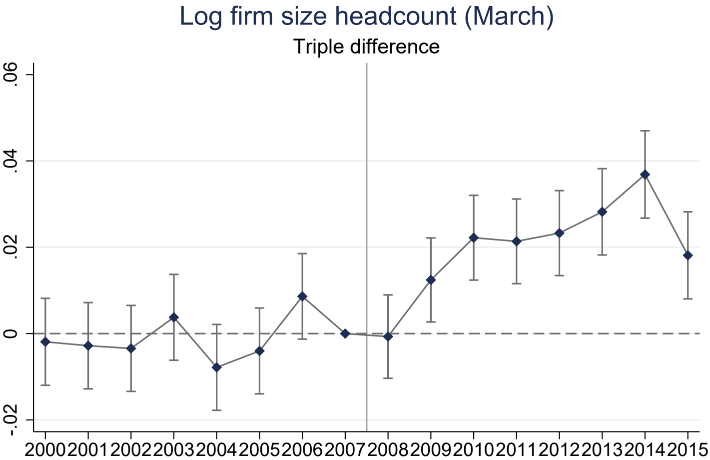
Other programs

Intensive-margin response

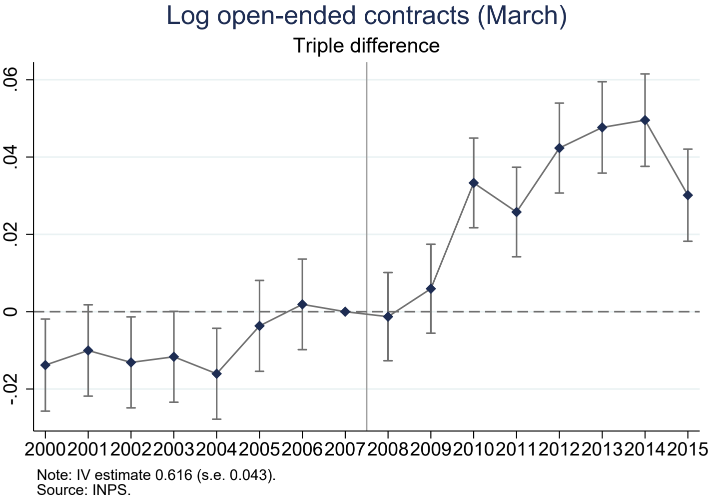


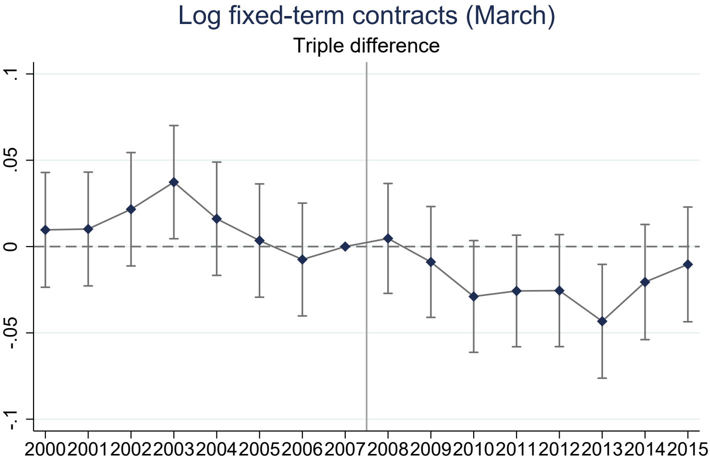

Log annual wage bill per employee
Triple difference
.02
0
-.02
-.04
-.06
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Note: IV estimate -0.585 (s.e. 0.044).
Source: INPS.

Extensive-margin response

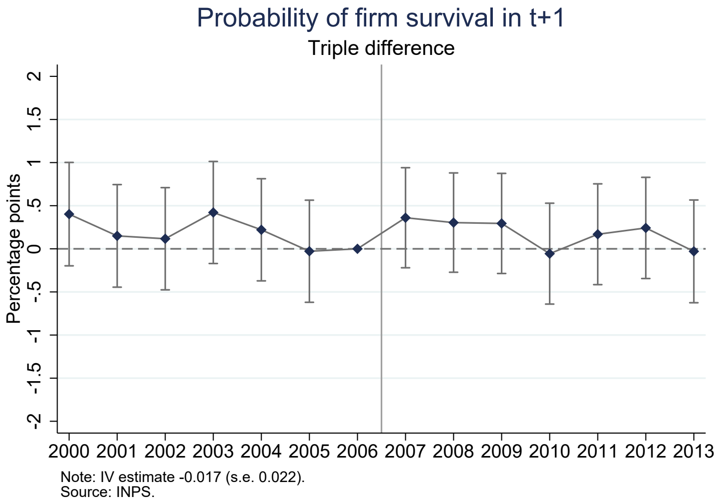


Note: IV estimate 0.380 (s.e. 0.036).
Source: INPS.


Log open-ended contracts (March)
Triple difference
.06
.04
.02
0
-.02
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Note: IV estimate 0.616 (s.e. 0.043).
Source: INPS.



Note: IV estimate -0.403 (s.e. 0.117).
Source: INPS.


Probability of firm survival in t+1
Triple difference
Percentage points
2
1.5
1
.5
0
-.5
-1
-1.5
-2
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
Note: IV estimate -0.017 (s.e. 0.022).
Source: INPS.

Balance-sheet outcomes

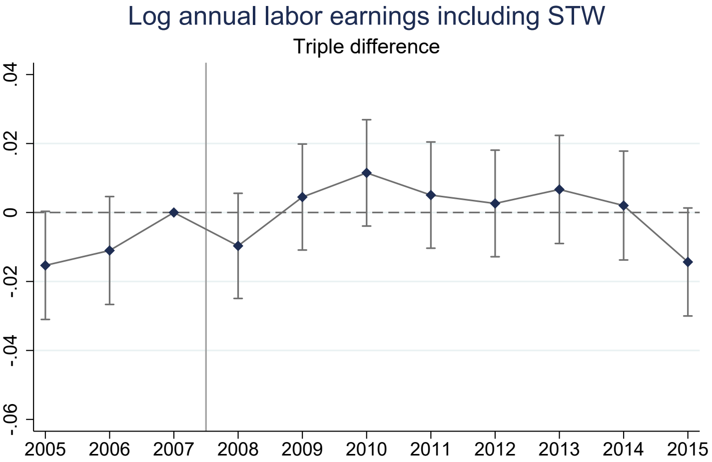
	Net revenue	Profit	Labor product	Liquidity	Invest. intang.	Invest. tang.
CIGS	690.458 (2873.104)	52.638 (602.295)	1.644 (1.710)	701.563** (337.087)	-210.891 (525.144)	-227.865 (481.722)
Obs.	10950	10950	10950	10950	10950	10950

Total labor earnings for hours worked

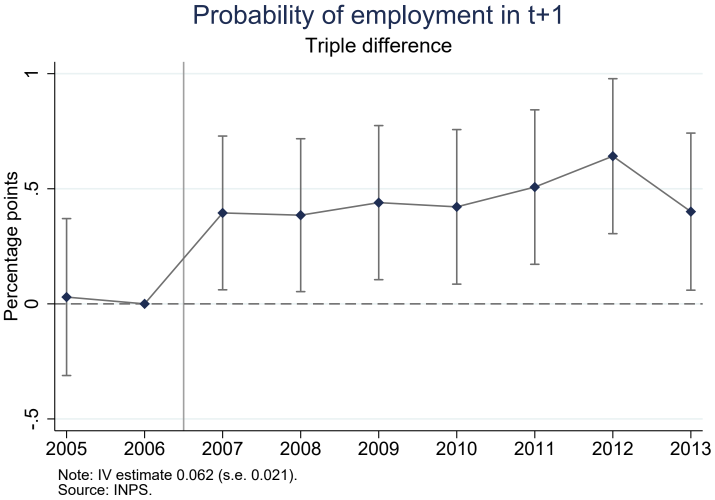
Note: IV estimate -0.324 (s.e. 0.093).
Source: INPS.

First stage

Insurance role of STW compensation



Note: IV estimate 0.337 (s.e. 0.091).
Source: INPS.



Difference in discontinuities

Dynamic effects

- The previous analysis captures the contemporaneous effects of STW on outcomes
- We are also interested in long-term effects:
    - On firms
    - On workers, to capture longer term insurance value of STW
- A challenge in the identification of long-term effects is the possibility of dynamic treatment
- In order to isolate the effect of treatment in $t-k$ on outcomes in t controlling for treatment between $t-k$ and t, we adopt an empirical strategy similar to Cellini et al. (2010)
- Preliminary evidence suggests that effects dissipate quickly over time

Treatment effects with dynamic treatment

We can write $y_{i,t}$ as a function of the full history of treatment:

$$y_{i,t} = \sum_{t=0}^{T} T_{i,t-k}\beta_k$$

Effect of treatment on the treated (TOT): The effect of treatment in $t-k$ on outcome in t, absent any additional treatment between $t-k$ and t

$$\beta_k^{TOT} = \frac{\partial y_{i,t}}{\partial T_{i,t-k}} = \beta_k$$

Intention-to-treat effect (ITT): The effect of treatment in $t-k$ on outcome in t, allowing for the possibility of additional treatment between $t-k$ and t

$$\beta_k^{ITT} = \frac{\mathrm{d}y_{i,t}}{\mathrm{d}T_{i,t-k}} = \frac{\partial y_{i,t}}{\partial T_{i,t-k}} + \sum_{j=1}^{k} \frac{\partial y_{i,t}}{\partial T_{i,t-k+j}} * \frac{\mathrm{d}T_{i,t-k+j}}{\mathrm{d}T_{i,t-k}}$$

$$= \beta_k^{TOT} + \sum_{j=1}^{k} \beta_{k-j}^{TOT} * \pi_j$$

Identification of dynamic treatment effects

1. Estimate $\hat{\pi}_k$ instrumenting $T_{i,t}$ using the interaction between size, industry and calendar year

$$T_{i,t+k} = \pi_0 + \pi_k T_{i,t} + \varepsilon_{i,t+k}$$

2. Estimate $\hat{\beta}_k^{ITT}$ instrumenting $T_{i,t}$ using the interaction between size, industry and calendar year

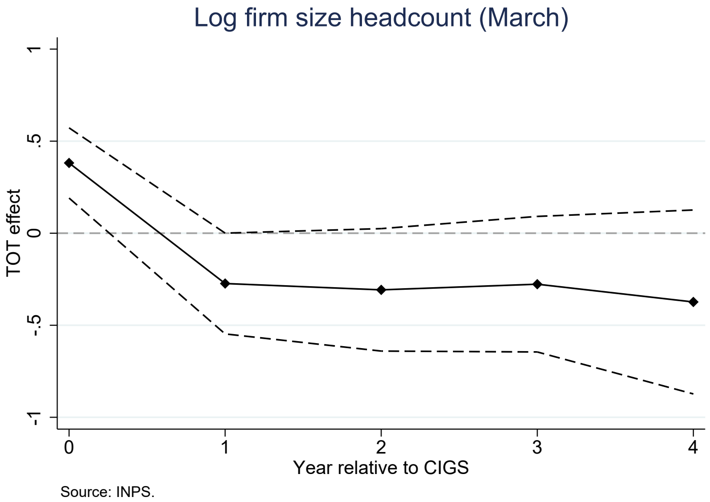
$$y_{i,t+k} = \beta_0 + \beta_k^{ITT} T_{i,t} + \eta_{i,t+k}$$

3. Retrieve β_k^{TOT} recursively and estimate standard errors via bootstrapping

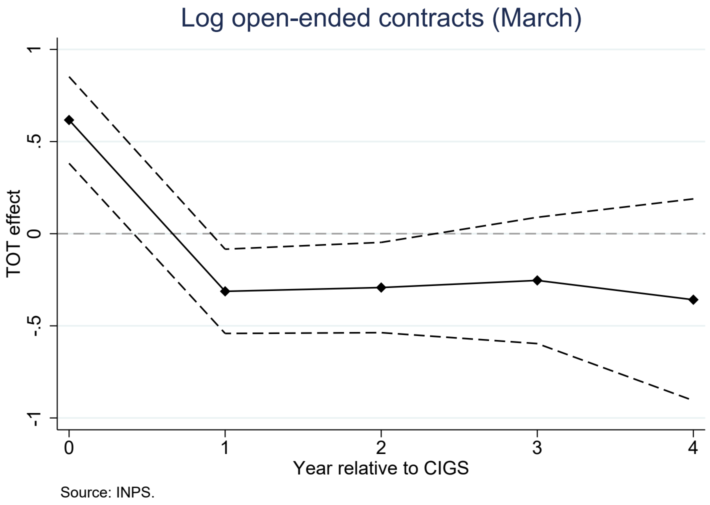
$$\beta_0^{TOT} = \beta_0^{ITT}$$

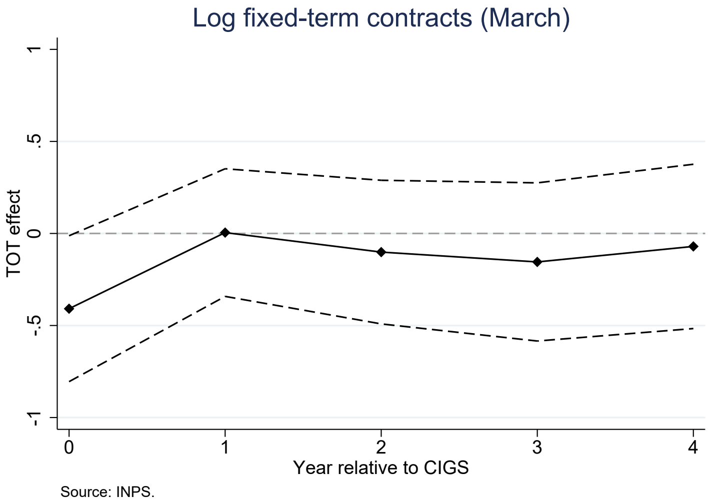
$$\ldots$$

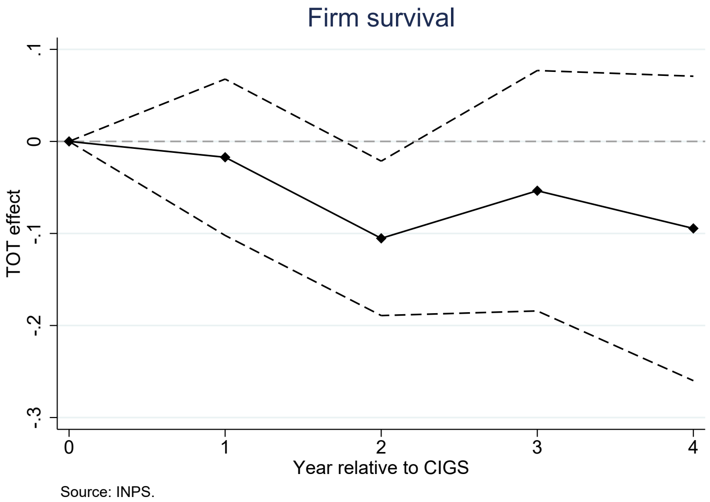
$$\beta_k^{TOT} = \beta_k^{ITT} - \sum_{h=1}^{k-1} \pi_h \beta_{k-h}^{TOT}$$



Treatment dynamics ITT effect


Log open-ended contracts (March)
TOT effect
1
.5
0
-.5
-1
0
1
2
3
4
Year relative to CIGS
Source: INPS.


Log fixed-term contracts (March)
TOT effect
1
.5
0
-.5
-1
0
1
2
3
4
Year relative to CIGS
Source: INPS.

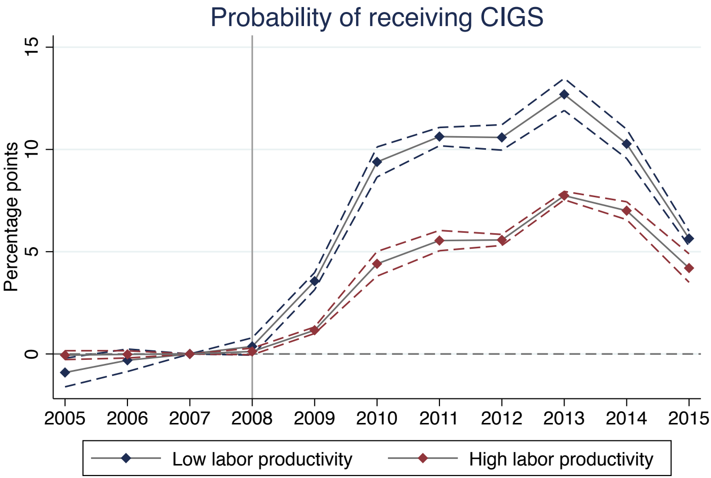

Firm survival
.1
0
-.1
-.2
-.3
TOT effect
0
1
2
3
4
Year relative to CIGS
Source: INPS.

Selection and heterogeneity

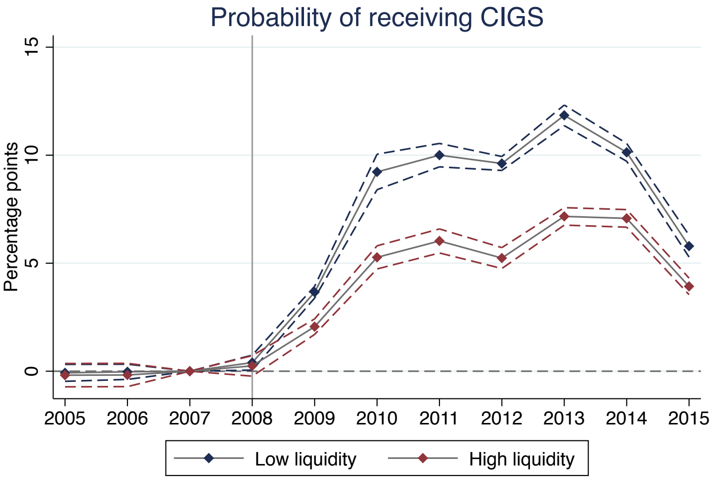
- With heterogenous firms and workers, it is key to understand which firms and workers are taking up STW (*selection*) and how treatment effects vary across different firms (*heterogeneity*)
- **Productivity**: STW subsidizes low-productivity matches and may prevent the efficient reallocation of workers in the labor market, as suggested by the long term effects of STW
- **Liquidity/financial constraints**: STW may provide liquidity to financially constrained firms and prevent excess layoff sensitivity to productivity shocks (Schoefer, 2016)

Selection into STW

- Explore heterogeneity in **take-up** across different firm characteristics
- Use balance sheet data to construct measures of heterogeneity:
    - Liquidity (proportion of liquid assets out of total assets)
    - Labor productivity (value added per employee)
- For each of these dimensions, rank firms by their pre-crisis level of liquidity/credit constraints/labor productivity, conditional on 2-digit industry
- Compare take-up for firms in the top and bottom quartiles of their industry-specific ranking


Probability of receiving CIGS
Percentage points
15
10
5
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Low labor productivity
High labor productivity

Source: INPS.


Probability of receiving CIGS
Percentage points
15
10
5
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Low liquidity
High liquidity

Source: INPS.

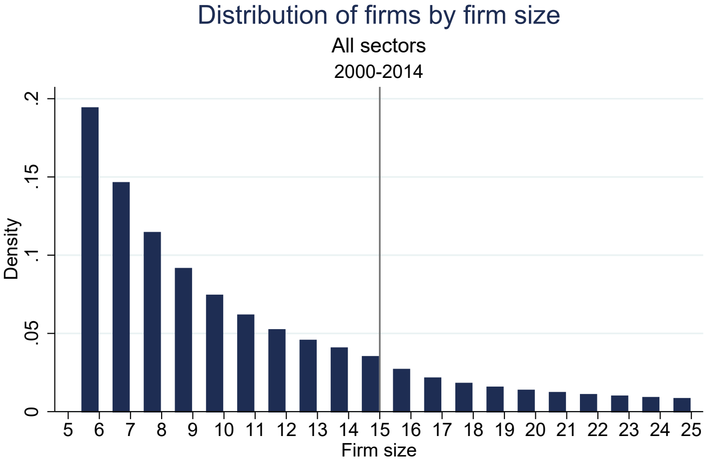
Summary of empirical results

- Exploit richness of administrative data on STW and exogenous variation in Italian STW regulations to assess the impact of STW on firms and workers
- Document large increase in STW take-up by eligible firms during the Great Recession
- Find sharp reduction of employment at the intensive margin and positive effects on the extensive margin, but entirely to the benefit of open-ended contracts
- No significant effect on firm survival
- Matching with firm-level balance-sheet data allows exploring selection and heterogeneous effects by firm-level characteristics and types of shocks
- Some initial evidence of heterogeneity in take-up by degree of liquidity and labor productivity

Theoretical framework for welfare analysis

- Develop a general-equilibrium framework to analyze the welfare effects of STW as a policy tool to prevent layoffs in the presence of frictions and a dual labor market
- Characterize the optimal design of the subsidy
- Use empirical estimates to assess the optimality of the current system and inform policy choices

Additional slides



Note: McCrary test -0.009 (s.e. 0.005).
Source: INPS.

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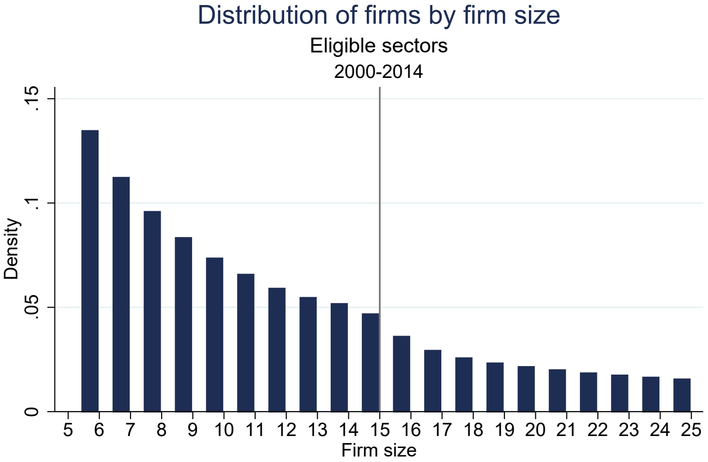

Note: McCrary test -0.024 (s.e. 0.008).
Source: INPS.

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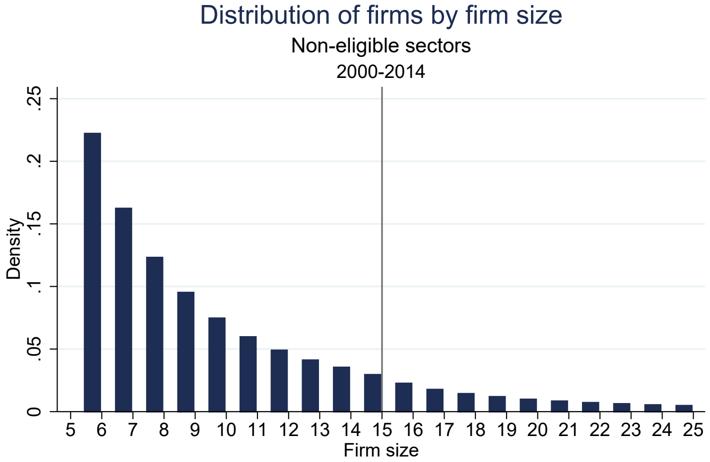

Note: McCrary test 0.003 (s.e. 0.007).
Source: INPS.

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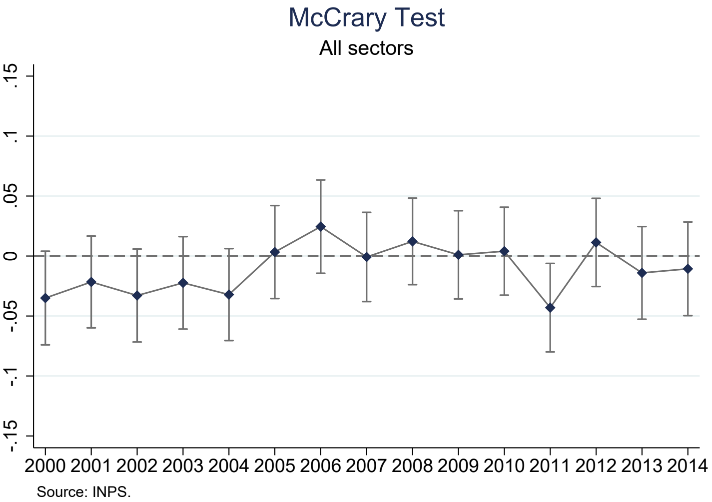
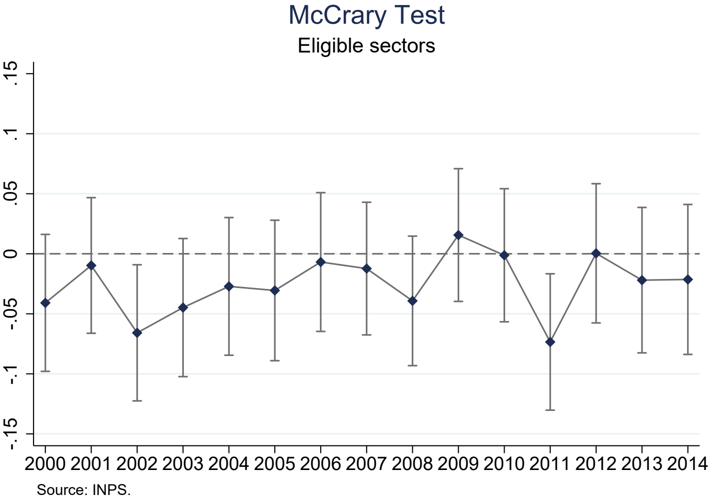

McCrary Test
All sectors
.15
.1
.05
0
-.05
-.1
-.15
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Source: INPS.

Back


McCrary Test
Eligible sectors
.15
.1
.05
0
-.05
-.1
-.15
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Source: INPS.

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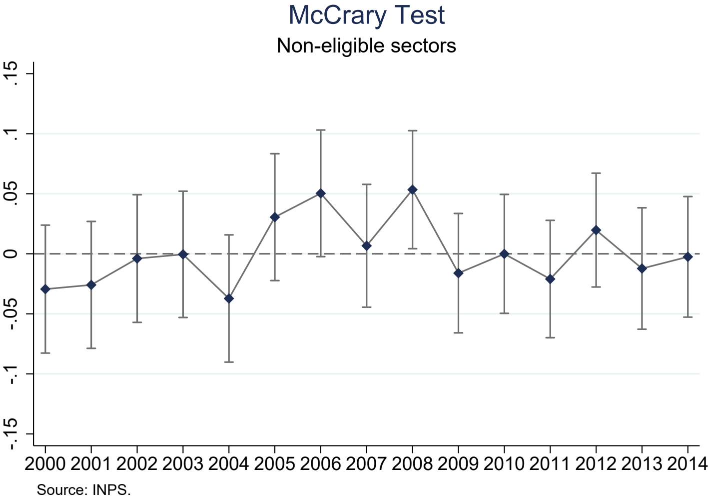
McCrary Test
Non-eligible sectors
.15
.1
.05
0
-.05
-.1
-.15
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Source: INPS.

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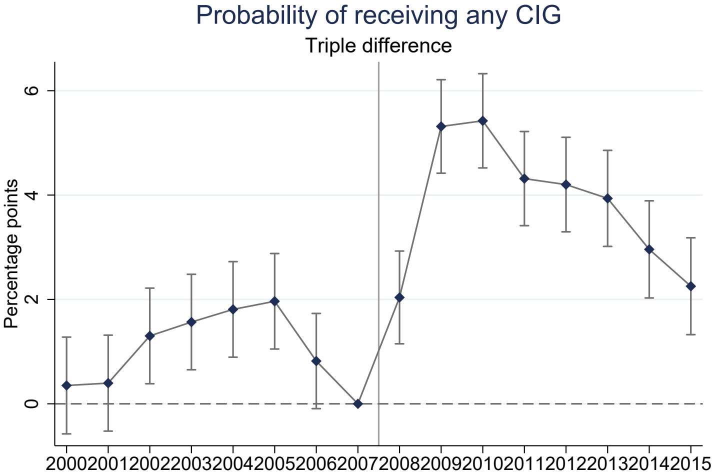

Source: INPS.

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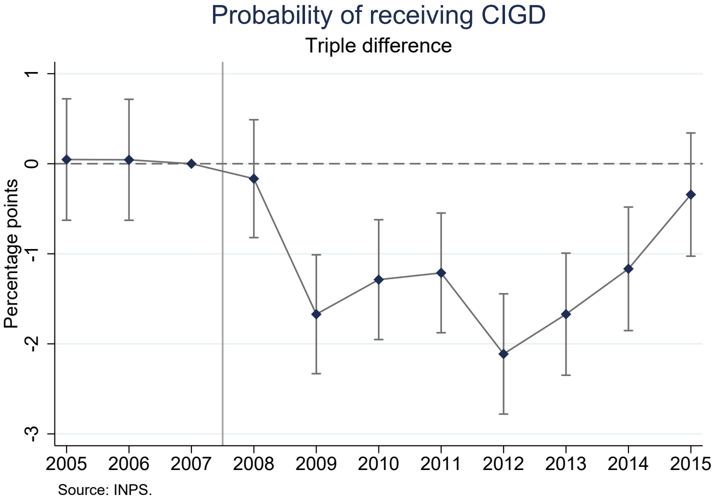
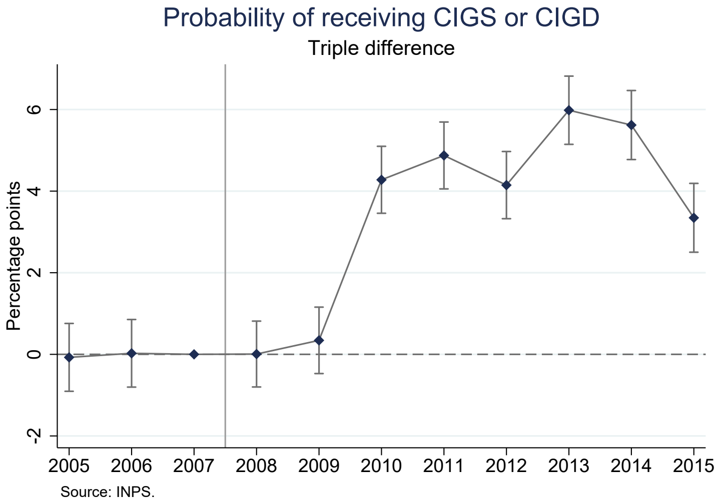
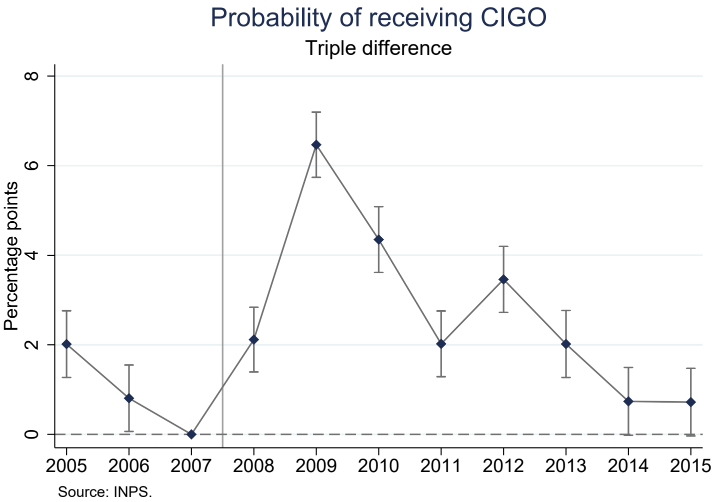

Probability of receiving CIGD
Triple difference
Percentage points
1
0
-1
-2
-3
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Source: INPS.

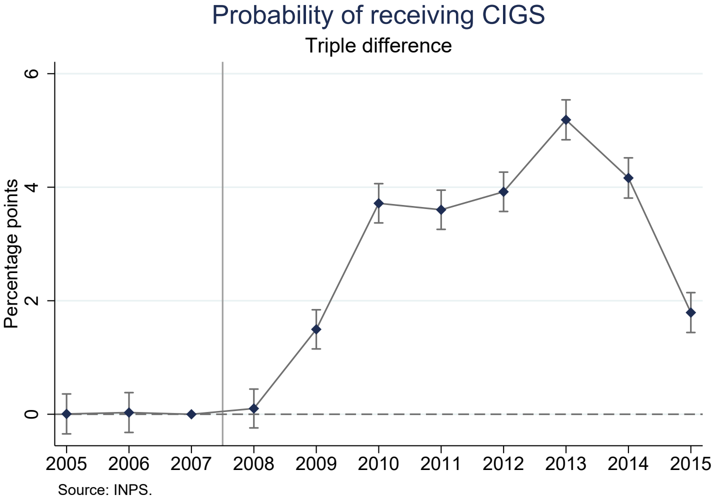
Back


Probability of receiving CIGS or CIGD
Triple difference
Percentage points
-2
0
2
4
6
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Source: INPS.

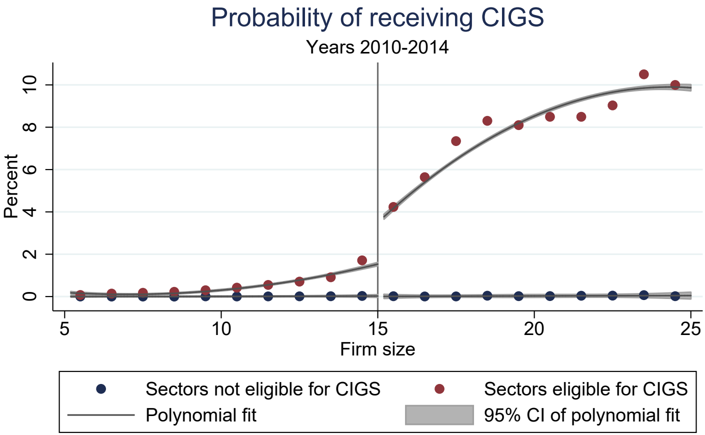
Back


Probability of receiving CIGO
Triple difference
Percentage points
0
2
4
6
8
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Source: INPS.

Back

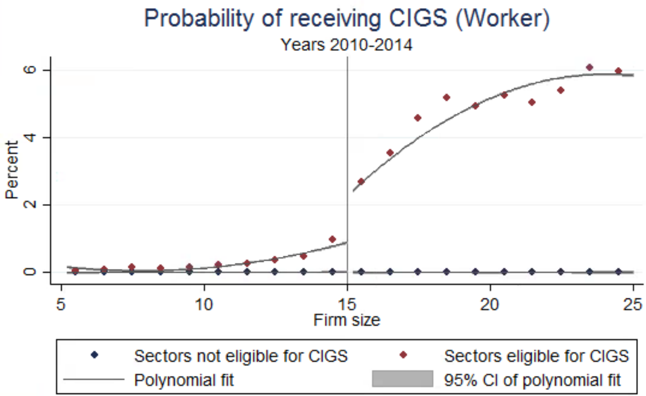

Probability of receiving CIGS
Triple difference
Percentage points
0
2
4
6
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Source: INPS.

Back



Note: Discontinuity in eligible sectors 1.970 (s.e. 0.077).
Discontinuity in non-eligible sectors -0.020 (s.e. 0.063).
Double-discontinuity estimate 1.990 (s.e. 0.100).
Source: INPS.

Back



Note: Discontinuity in eligible sectors 1.383 (s.e. 0.021).
Discontinuity in non-eligible sectors -0.015 (s.e. 0.017).
Double-discontinuity estimate 1.398 (s.e. 0.027).
Source: INPS.

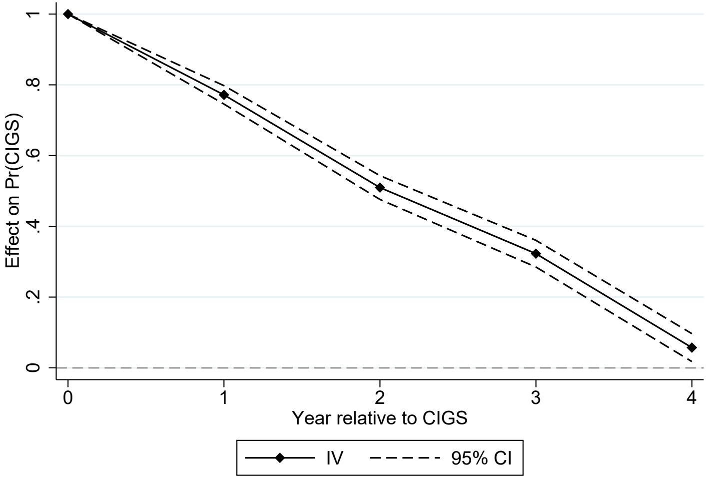
Back

IV Difference-in-Discontinuity Design - Firm-level outcomes			
	Log wage bill per empl	Log total weeks per empl	Log employment
CIGS	-1.403***	-1.291***	-0.330
	(0.437)	(0.302)	(0.273)
Obs.	1424248	1423439	1424786

Back

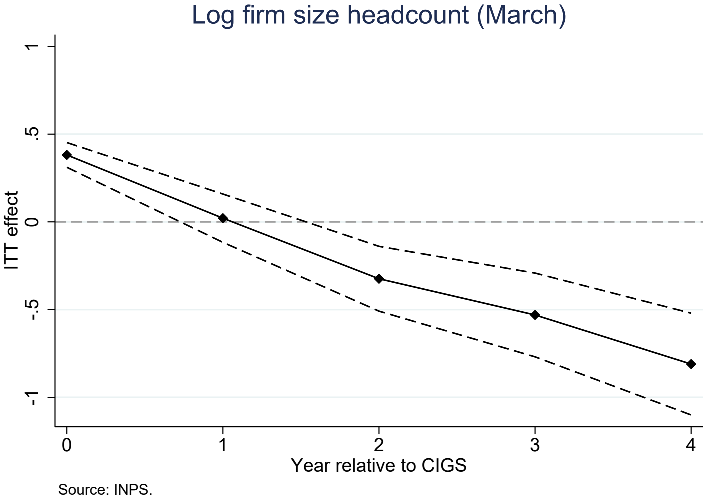
IV Difference-in-Discontinuity Design - Worker-level outcomes			
	Log weeks worked	Log earnings for hours worked	Log earnings including STW
CIGS	-0.672***	-0.464	0.158
	(0.203)	(0.307)	(0.305)
Obs.	14573660	14723369	14723369

Back

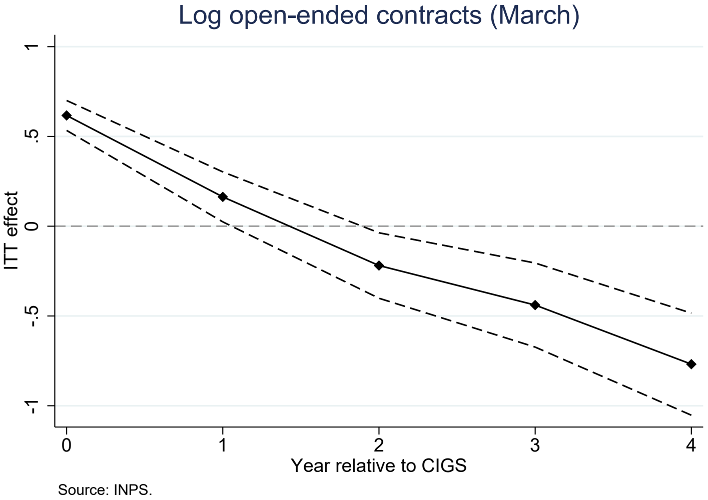


Source: INPS.

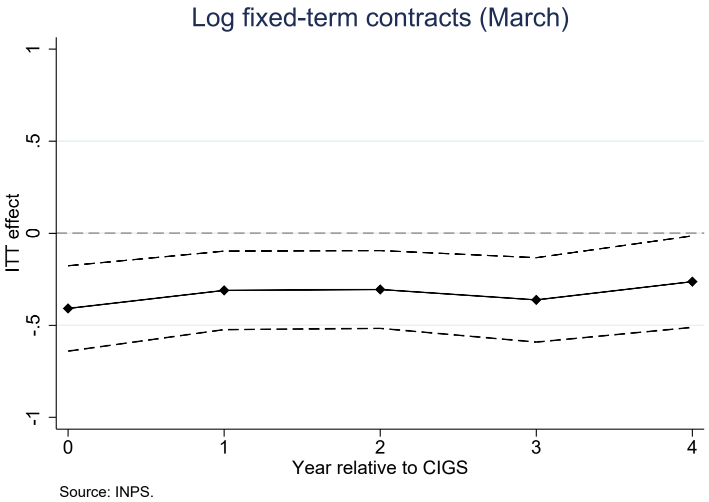
Back


Log firm size headcount (March)
ITT effect
1
.5
0
-.5
-1
0
1
2
3
4
Year relative to CIGS
Source: INPS.

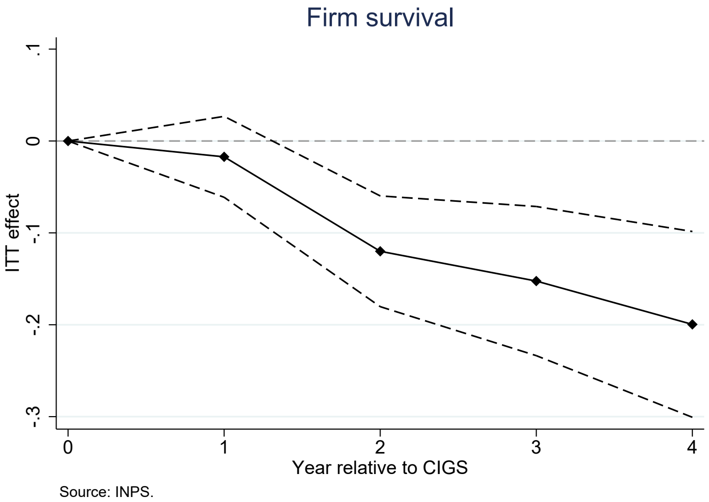
Back


Log open-ended contracts (March)
ITT effect
1
.5
0
-.5
-1
0
1
2
3
4
Year relative to CIGS
Source: INPS.

Back


Log fixed-term contracts (March)
ITT effect
1
.5
0
-.5
-1
0
1
2
3
4
Year relative to CIGS
Source: INPS.

Back


Firm survival
.1
0
-.1
-.2
-.3
ITT effect
0
1
2
3
4
Year relative to CIGS
Source: INPS.

Back