Making subsidies work rules vs. discretion

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Introduction

- public subsidies to private firms are a major tool of industrial policy in most countries
  - $61 bil/year in US, €46.5 bil/year in EU in 2018
  - crucial for economic recovery after COVID-19
- Aim: create employment in disadvataged areas
- Their effect(ivenes)s is highly debated and difficult to gauge

What we do

- Study major program of public subsidies to Italian firms (Law 488)
  - RDD → Rationing of funds, applications ranked by a quantitative score
  - Score summarizes objective criteria + discretional priorities by local politicians

- Estimate the effect on marginal firms at the cutoff
- Extrapolate the distribution of TEs across inframarginal firms away from the cutoff (Angrist & Rokkanen, 2015)
  - ➢ compute aggregate policy effects
  - ➢ characterize heterogeneity of treatment effects
  - ➢ estimate the effects of counterfactual policies

Institutional background

- Law 488/92: main instrument of industrial policy in Italy, 1996-2007
  - policy tool: **investment subsidies** to firms
  - **€26 billions** (constant 2010 prices) **over 35 calls** for projects
  - subsidies paid to winning applicant firms in 3 yearly installments

- Allocation mechanism
  - each call addressed to a **specific sector** (Industry, Services, etc.)
    - Mostly industry
  - **Funds** within each call **preliminarily allocated across regions**
    - Mostly southern regions

Institutional background

- **Applications ranked within each** sector-region **cell** according to a **quantitative score** aggregating criteria clearly defined ex-ante
  - 1996-1997
    1. *Skin in the game:* **own funds** relative to amount requested
    2. *Job creation*: number of **jobs created**
    3. *No waste*: **funds requested** relative to the maximum they can apply for (-)
  - 1998-2007
    4. ***Political discretion:*** **points allocated by the regional government**
    5. *Environmental responsibility*: compliance with requirements for an environmental management system (ISO 14001)

$$Application\ Score\colon\ S = \sum_{j=1}^{5}\left(\frac{I_j - \mu_j}{\sigma_j}\right)$$

  - Sub-rankings for specific types of applicants → cell = call-region-type

Data

- information on **75k projects from 49k applicant firms** (Value: €22 bil.)

LEGGE N 488/92 ANNO DI RIFERIMENTO 1996 - GRADUATORIA DELLA REGIONE LAZIO

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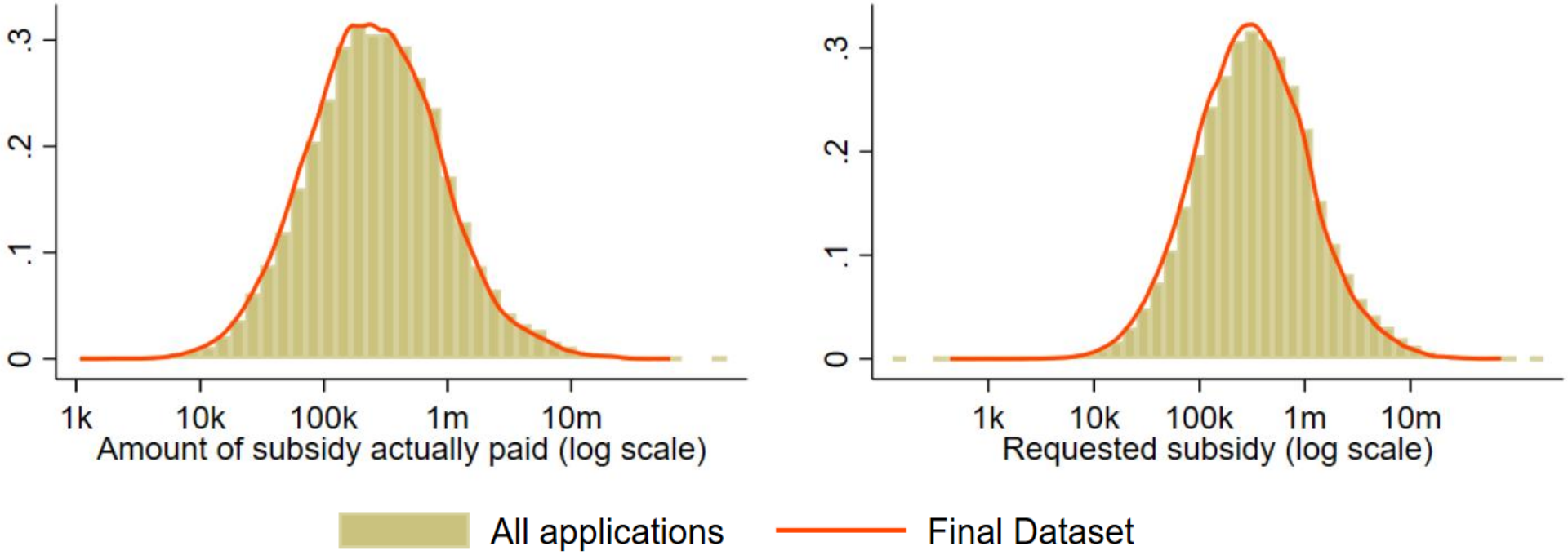
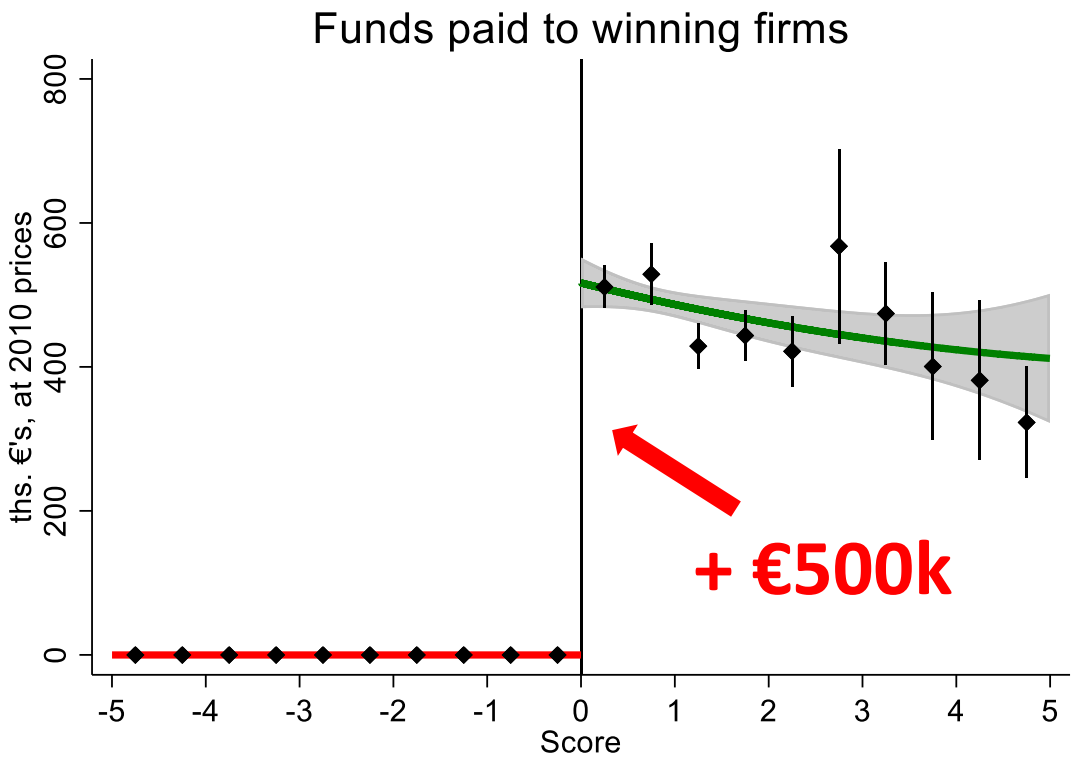


Empirical strategy: at the cutoff

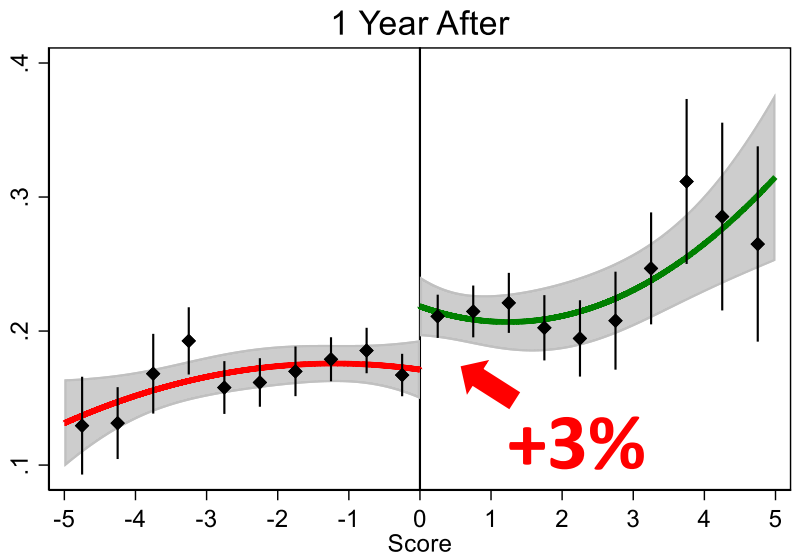
- **Main outcomes** of interest: **investment, employment**, productivity, and firm survival
  - main threat to identification: firms receiving and not receiving the subsidy may be different
- the allocation mechanism generates an **ideal RDD**
  - only **firms scoring above the cutoff** defined by the marginal firm funded in each cell **are eligible** for funding
  - firms scoring **just above and just below** the cutoff are **as good as randomly assigned** into eligibility
    - cutoff in each cell is unknown ex-ante
  - pool together applicants across cells (Fort, Ichino, Rettore & Zanella, 2021)

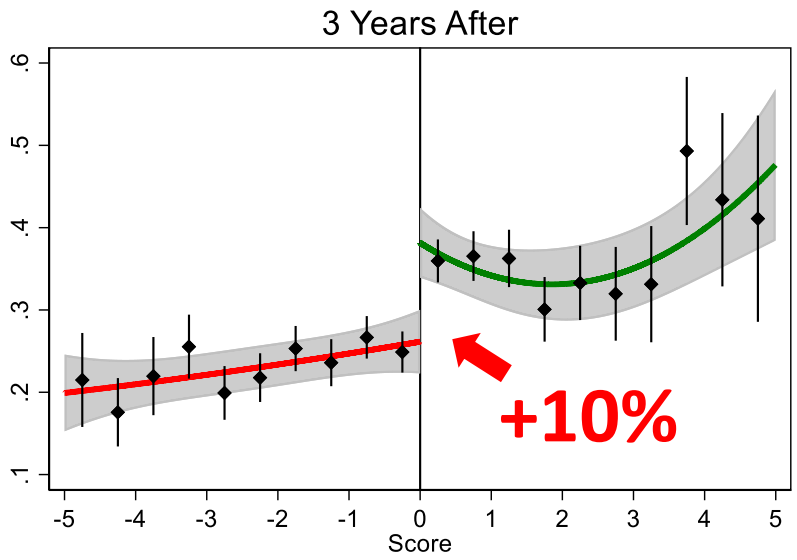
Funds received and effect on investment

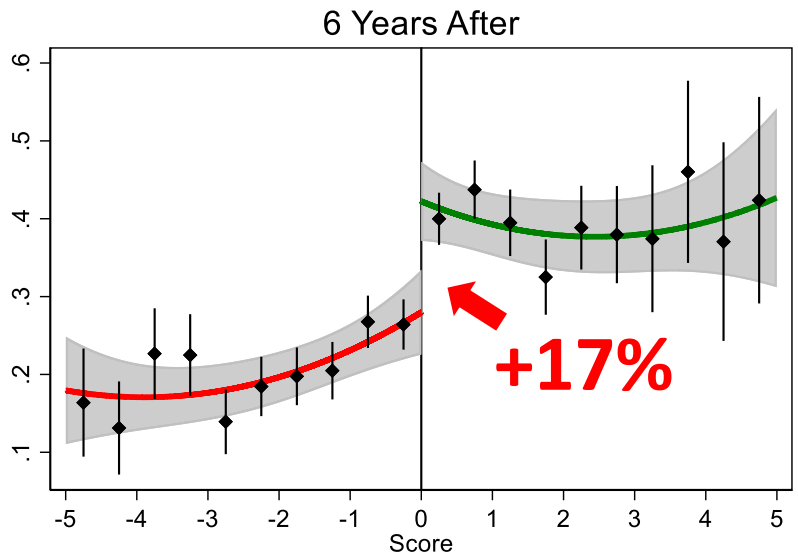


Effect on employment growth

- log change in employment at alternative horizons

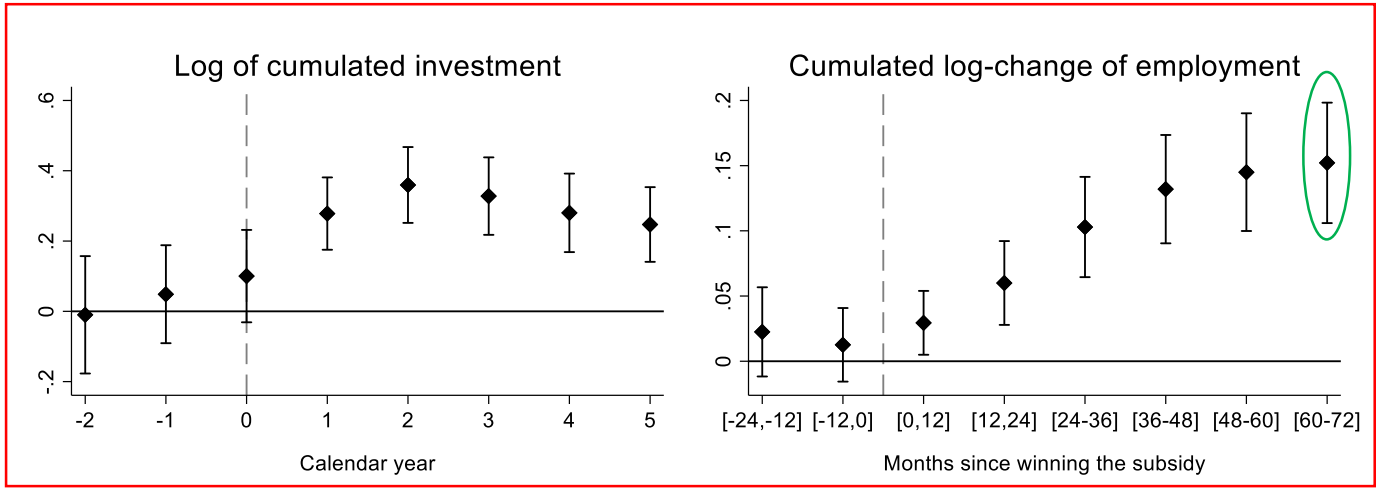


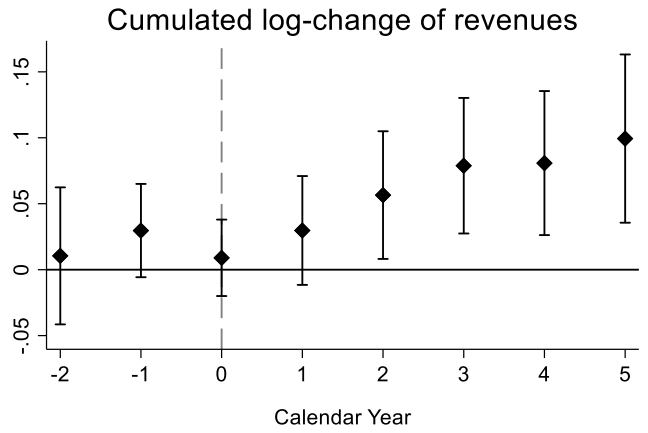


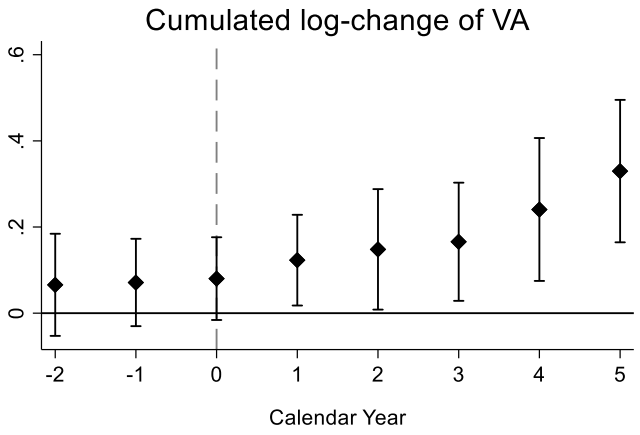


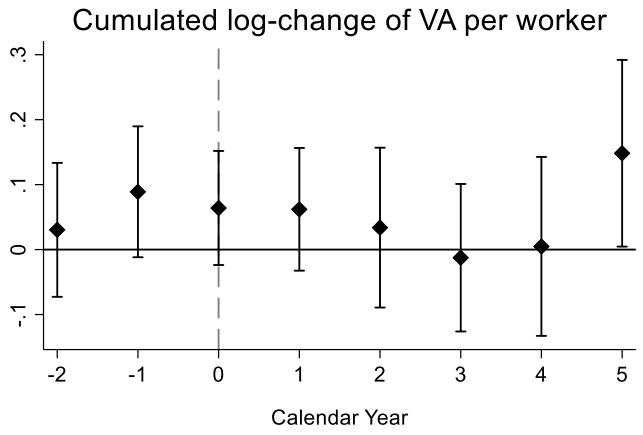
Table

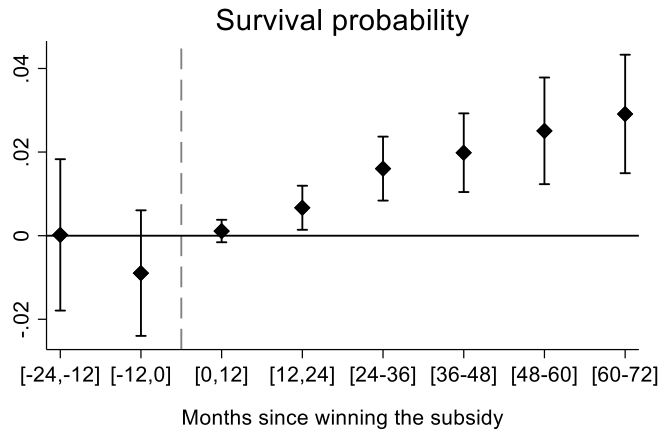
Dynamic effects











Empirical strategy: Away from the cutoff

- Angrist & Rokkanen (JASA 2015) “Wanna get away? Regression discontinuity estimation of exam school effects away from the cutoff”
- **in RDD, selection is captured by the running variable** (s)
  - match eligible and non-eligible on a set of (“*killer*”) covariates x that make the running variable ignorable
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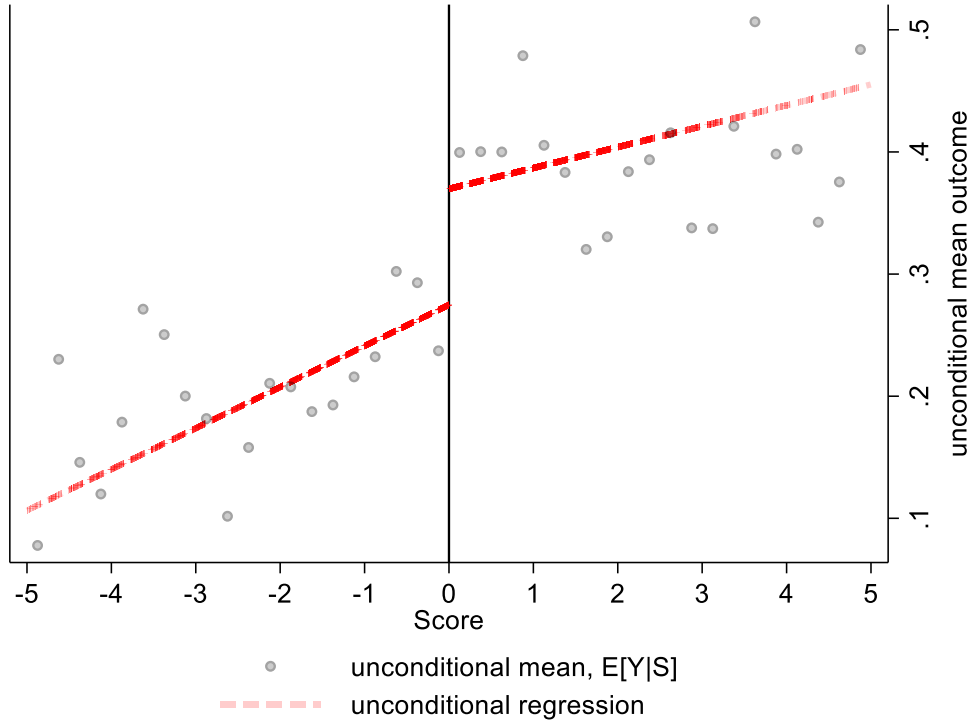
  - put differently: use the RD as a test for matching
- **Crucial**, partially testable conditions:
  1. **conditional independence**: $E[y|s,x] = E[y|x]$ on both sides of the cutoff
  2. **common support**: $0 < E[Z|x] < 1$

Effects away from the cutoff: Testing

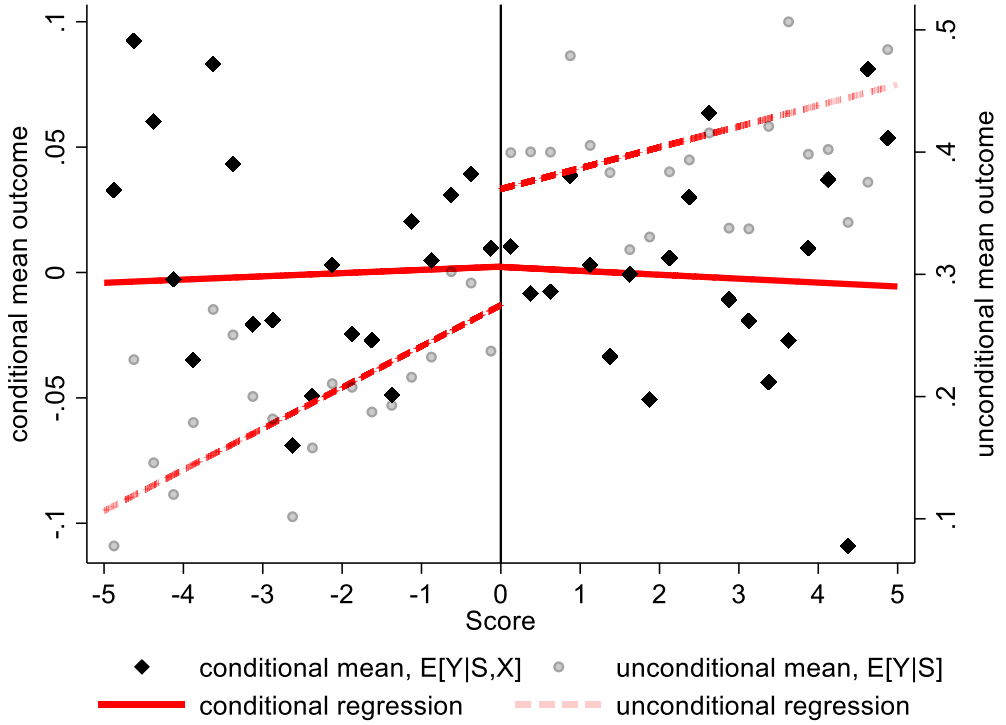
- Unconditionally, firm outcomes (here, $\hat{L}_{t,t+6}$) are correlated with *S*



Effects away from the cutoff: Testing

- Conditioning on x makes the **score ignorable**
  - x includes growth predictors (size, age, …) **selected manually and with ML**

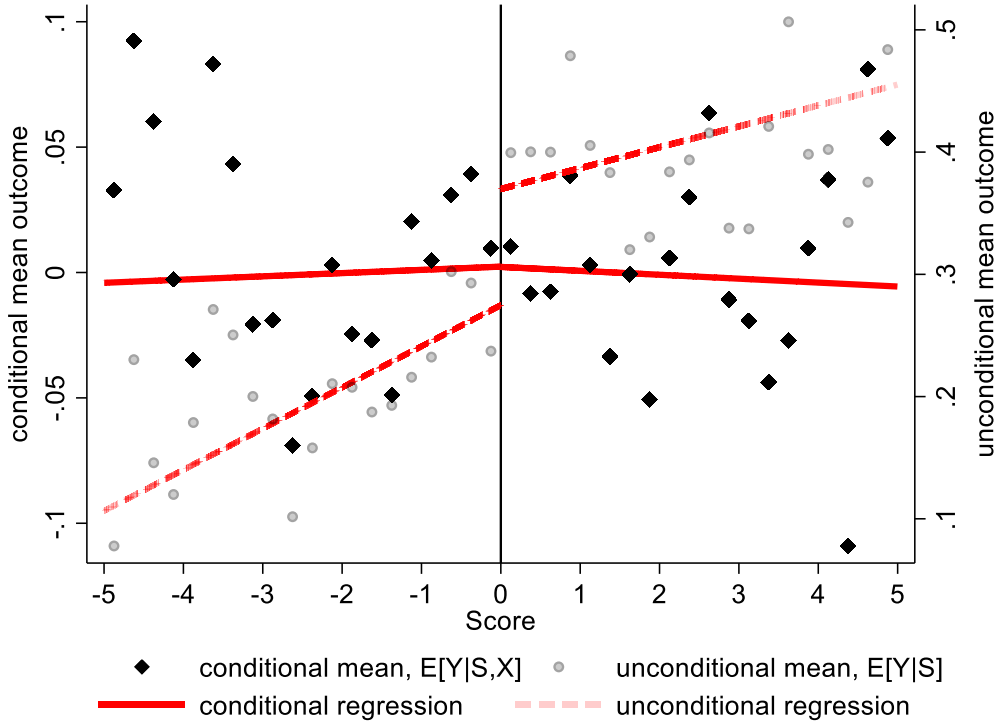
Conditional independence



Effects away from the cutoff: Testing

- Conditioning on x makes the score ignorable, **while granting support**
  - x includes growth predictors (size, age, …) **selected manually and with ML**

Conditional independence



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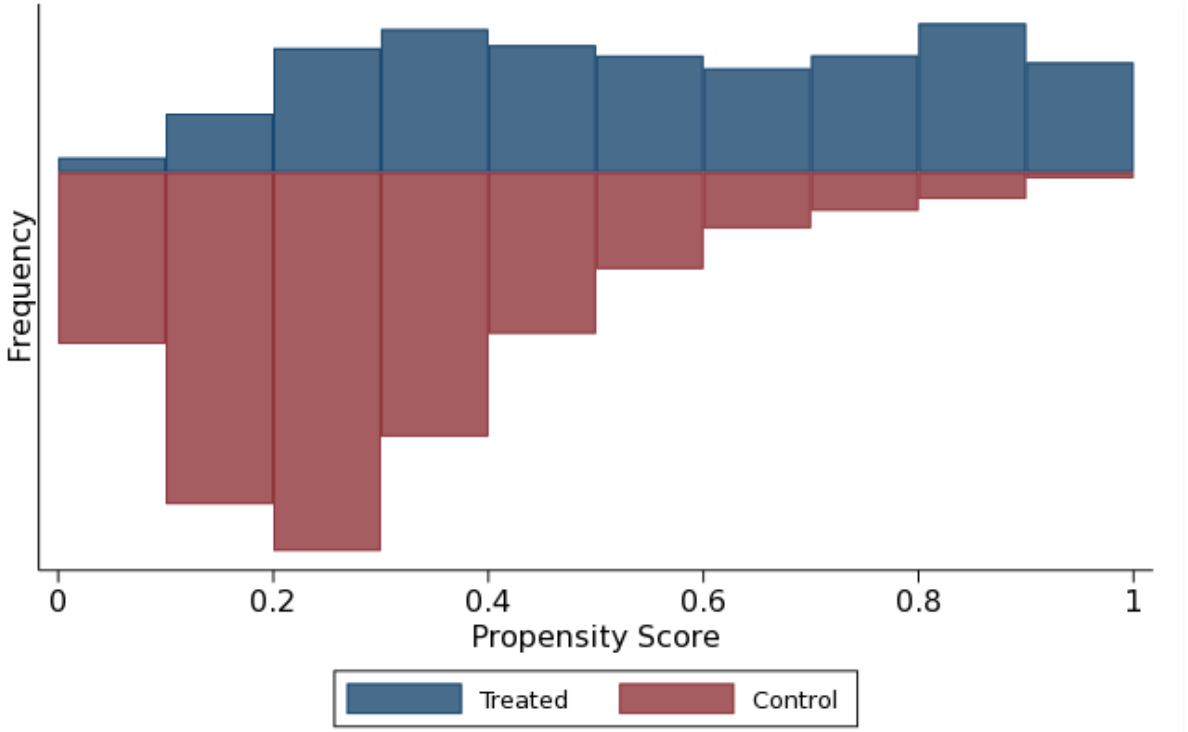


Effects away from the cutoff: Estimation

- Kline (2011): parametric implementation of matching

$$E[y|Z=1] = x'\gamma_1$$
$$E[y|Z=0] = x'\gamma_0$$

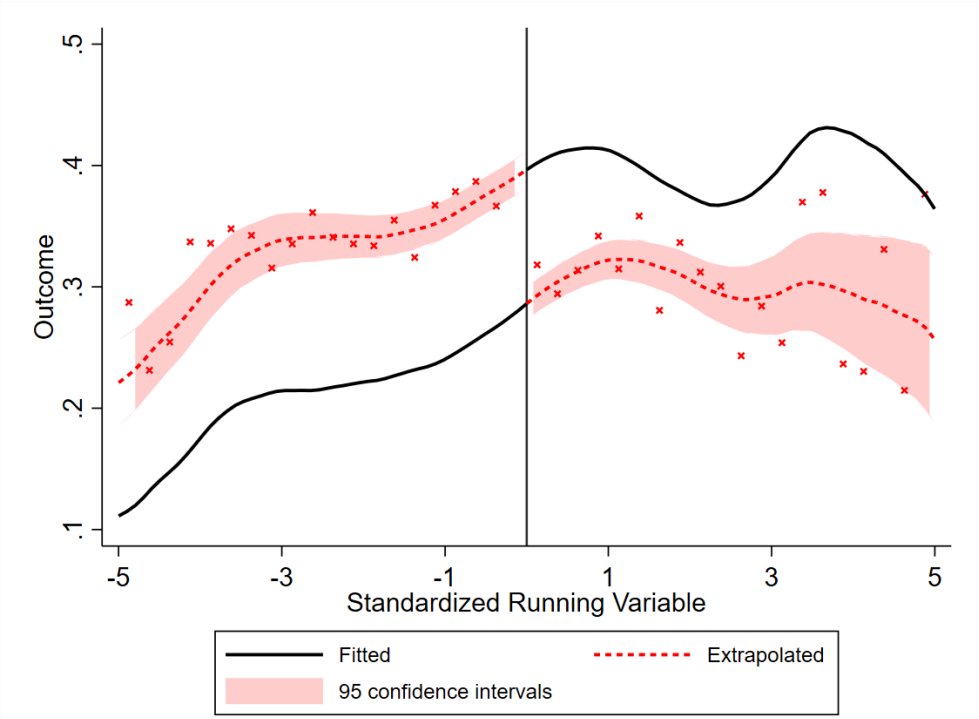
- **treatment effect for any $s \neq \bar{s}$**

$$E[y^1 - y^0|s=\theta] = (\gamma_1 - \gamma_0)'E[x|s=\theta]$$

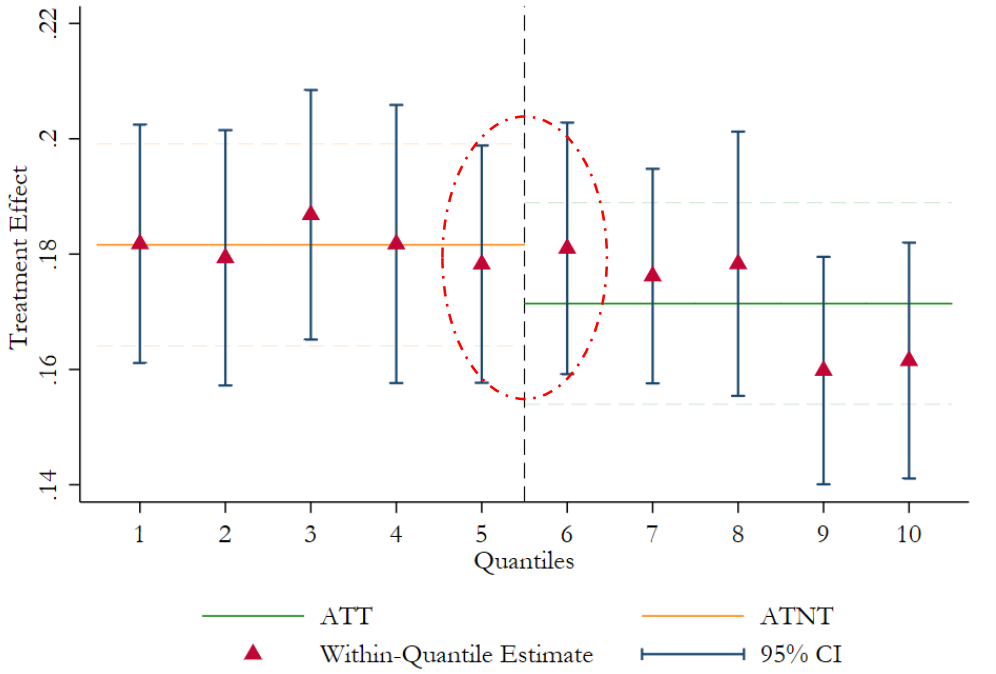
Effects away from the cutoff: Results

- `getaway.ado`: new Stata package implementing A & R + other extrapolation methods (Palomba, 2022)

Potential outcomes



Treatment effects



Total policy effects

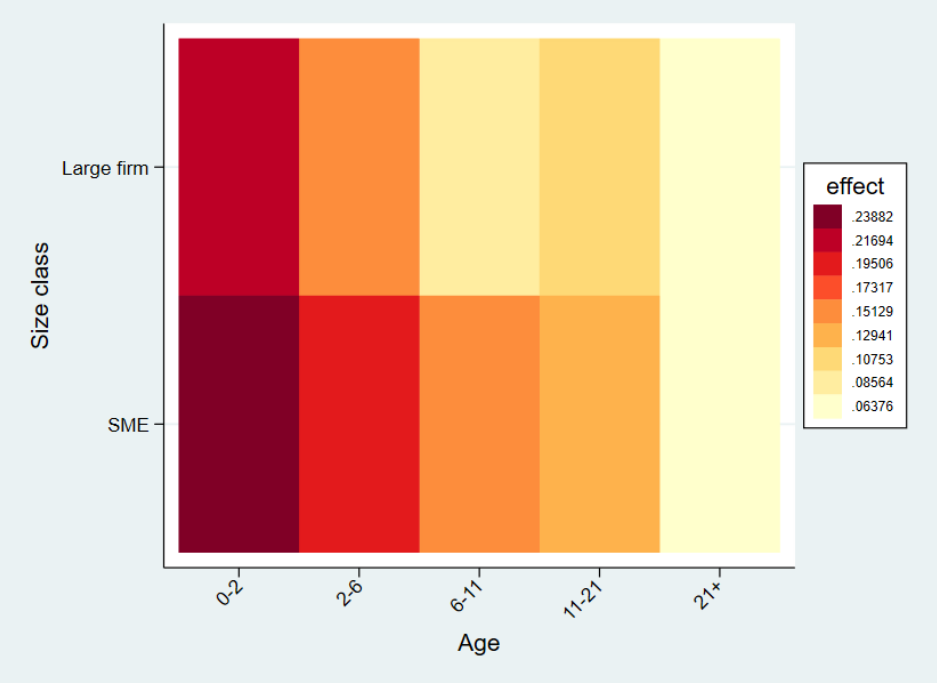
Recover new jobs/investment combining TE & initial size; compute their cost

Cost measure:	cost per new job (thousand €'s)		cost per worker-year (thousand €'s)		cost of new investment (subsidy/investment)	
CIA set of covariates:	manual	data-driven	manual	data-driven	manual	data-driven
all regions	178	172	54	58	0.812	0.745
south	241	215	77	76	1.052	0.979
north-center	68	78	19	25	0.351	0.314

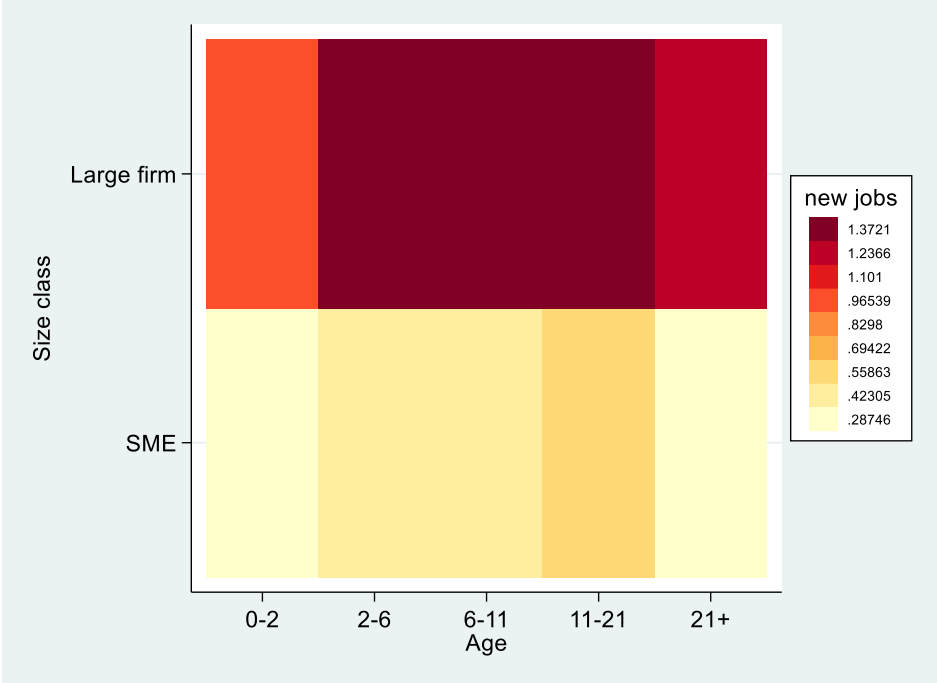
- Clear patterns of geographical heterogeneity, but can explore more..

Heterogeneity by class size and age

% Treatment effects



New jobs per €100k

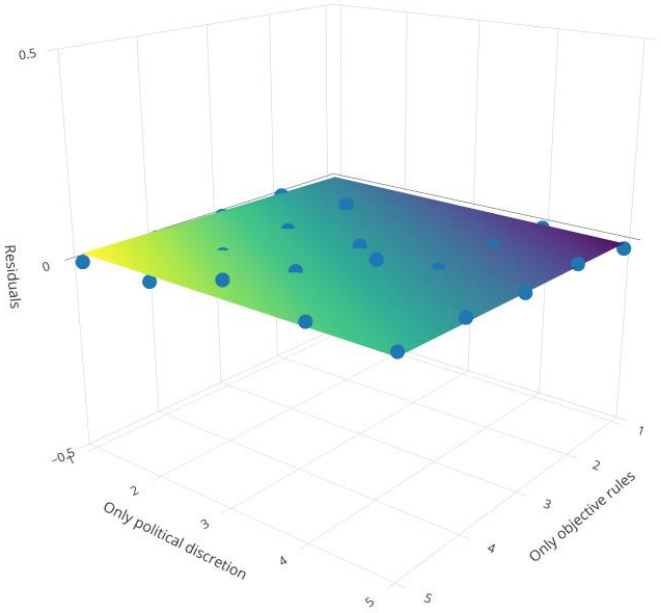


- Smaller firms generate larger % increases in employment, but larger firms produce more jobs-per-€-of subsidy!

Rules vs. discretion

- heterogeneity by score sub-components s^r (*rules*) and s^d (*discretion*)
  - Verify the CIA: $E[y|s^r, s^d, x] = E[y|x]$ on both sides of the cutoff

Left of the cutoff



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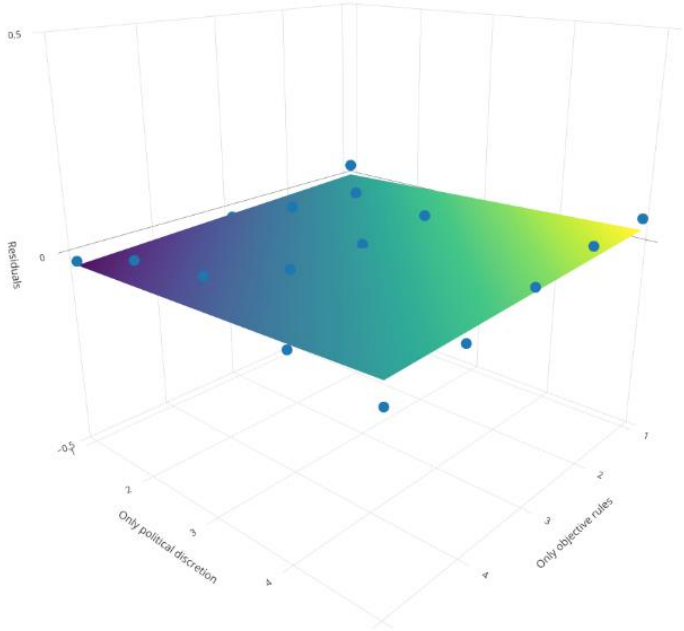

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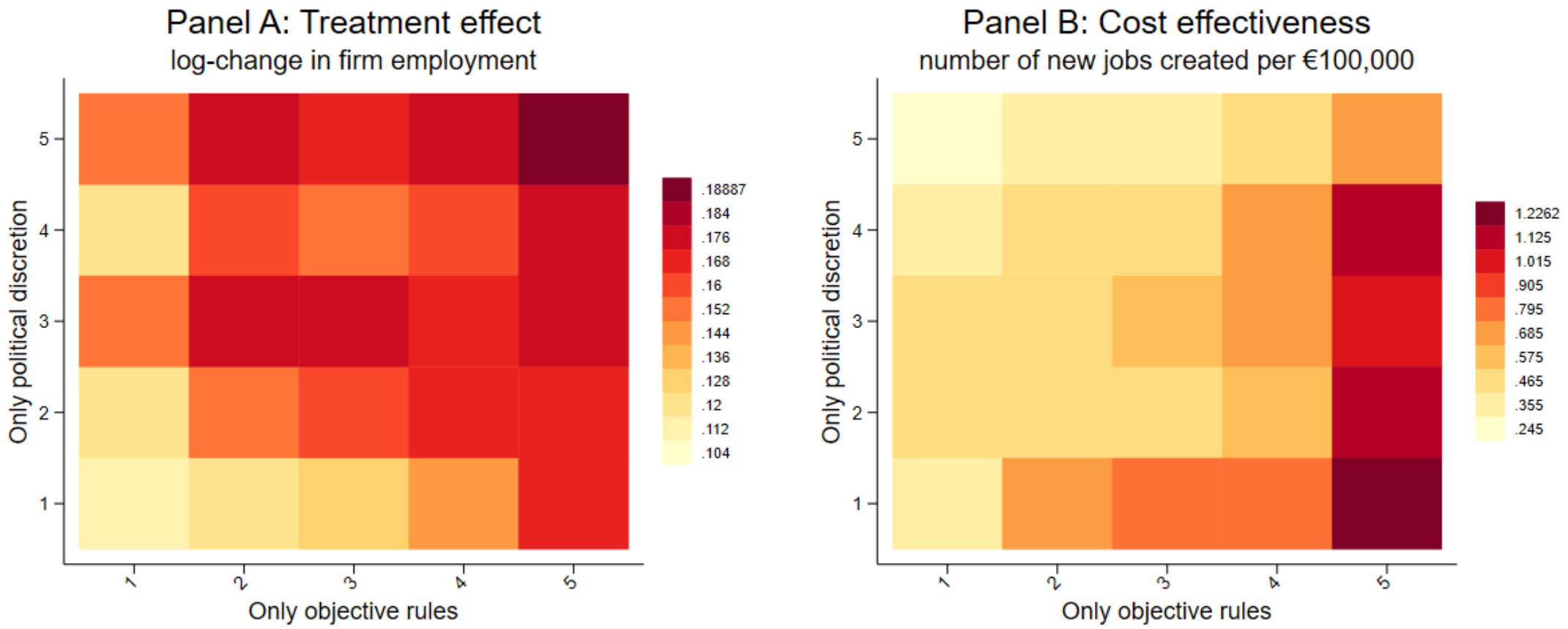
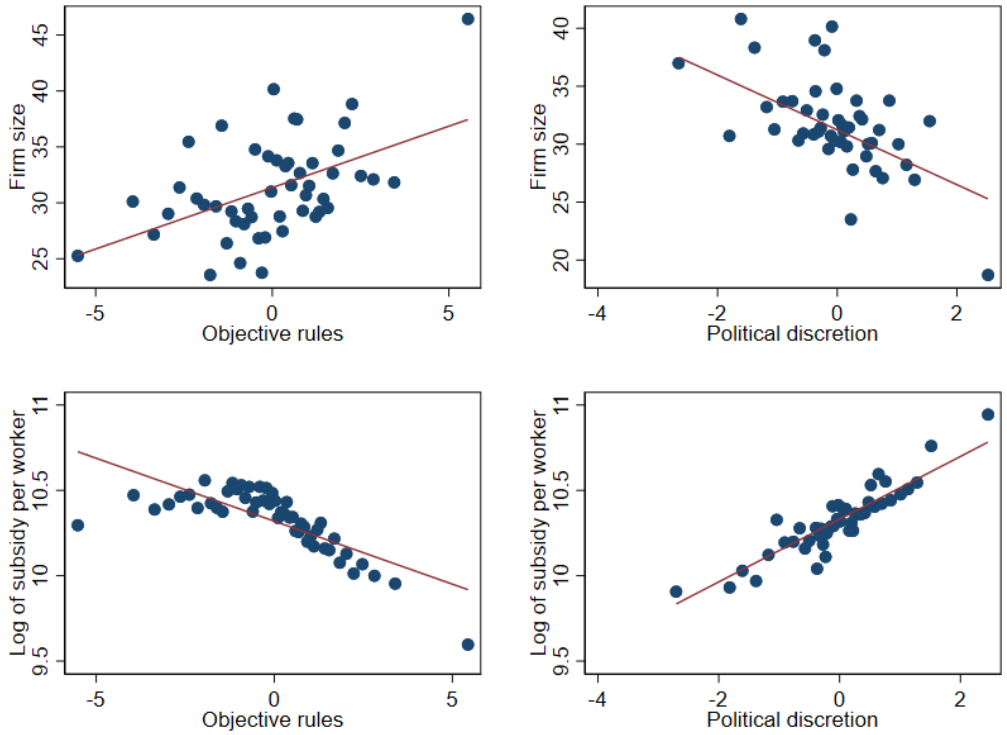


- High-on-discretion firms less cost effective than high-on-rules firms at generating new jobs

Rules vs. discretion

- Explanation: local politicians target applicant firms that are smaller and demand larger subsidies - CORRELATIONS



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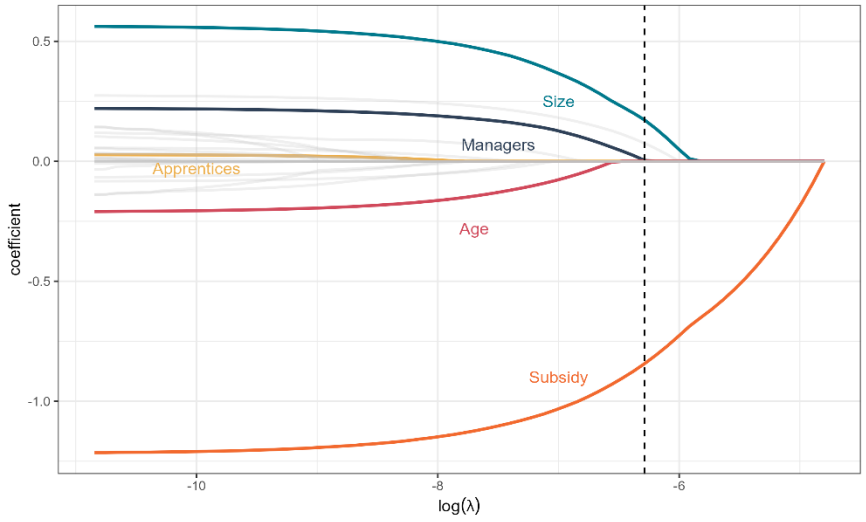
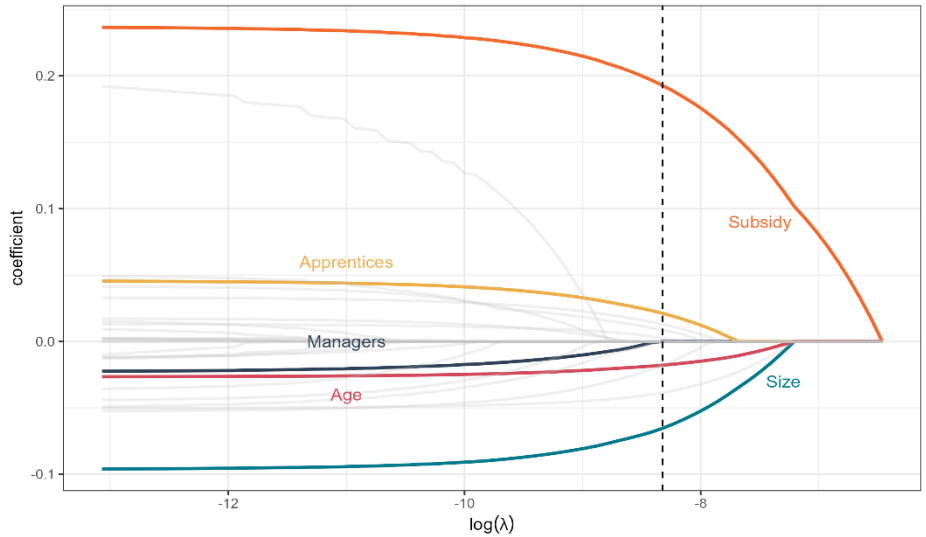
Determinants of Obj score



Determinants of political discretion



Rules vs. discretion: Counterfactual policies

- Re-rank applicants under alternative criteria, compute cost-per-job
  - important assumption: policy invariance (e.g., Heckman, 2010)
  - consistent with balance in observables before/after introduction of discretion

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	Actual policy
	cost
all regions	179
south	225
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	Actual policy	**Counterfactual policies**	
		No discretion	
	cost	cost	%Δ
all regions	179	159	**-11%**
south	225	198	**-12%**
north-center	83	76	**-9%**

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	Actual policy	**Counterfactual policies**			
		No discretion		Only discretion	
	cost	cost	%Δ	cost	%Δ
all regions	179	159	-11%	262	**+47%**
south	225	198	-12%	307	**+41%**
north-center	83	76	-9%	118	**+36%**

Conclusions

- Law 488/92
  - Positive effect on investment (+39%) and employment (+17%) at the cutoff
  - Heterogeneity in the effect of subsidies across different types of firms
    - Large firms more cost-effective than small firms
    - Rules better than discretion

- General lessons
  - Studyin the heterogeneity of treatment effects helps «make policies work» ➔ need to go beyond *local average treatment effect on compliers*

Thank you!

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- difference in observed outcomes between firms with score s_{ic} just above and just below the cutoff $\bar{s}_c$ is the Intention-To-Treat effect on the **marginal firm**

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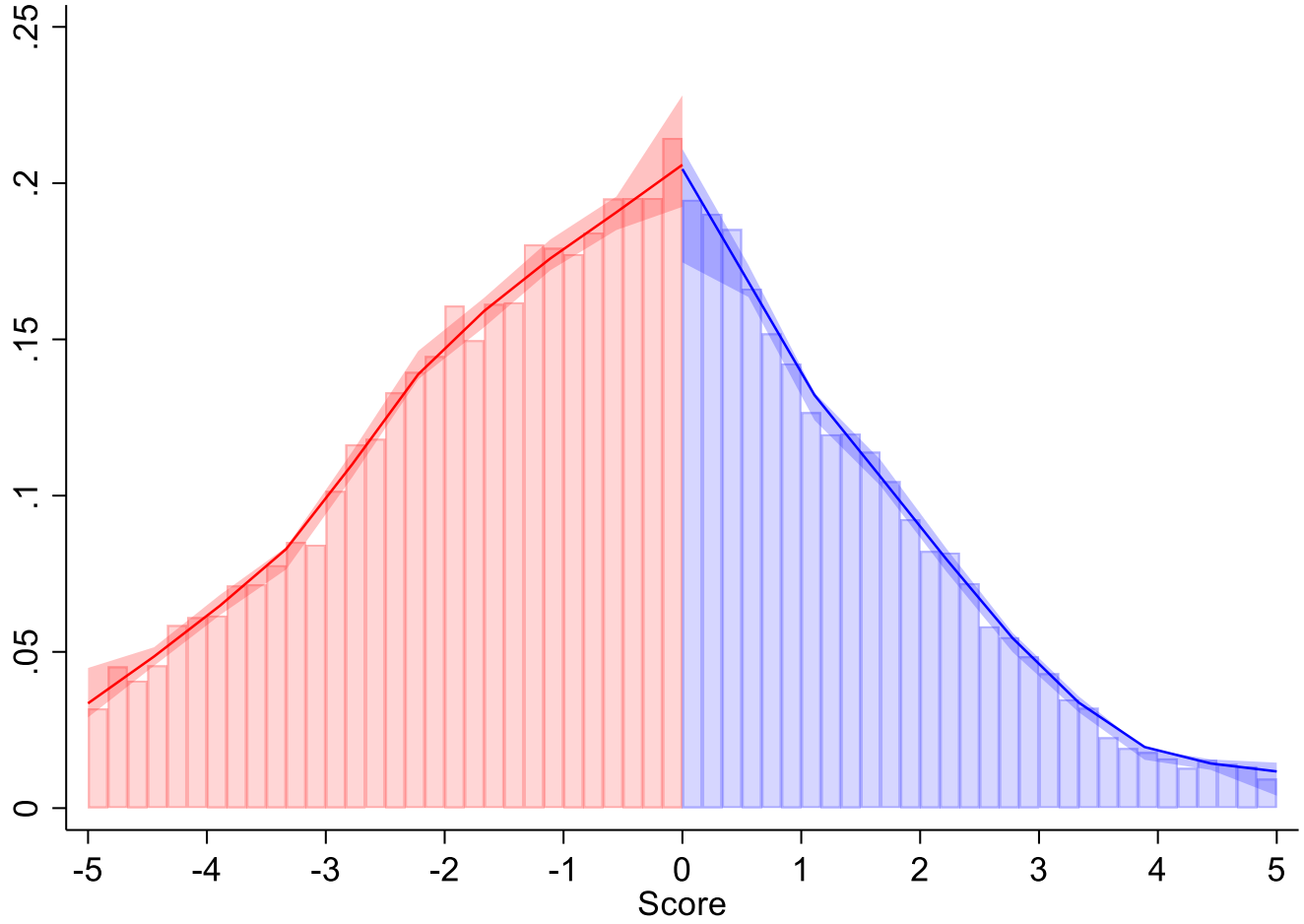
$$\lim_{\theta \to \bar{s}_c^{+}} E[y_{ic}|s_{ic} = \theta] - \lim_{\theta \to \bar{s}_c^{-}} E[y_{ic}|s_{ic} = \theta] = E\left[y_{ic}^{1} - y_{ic}^{0}\middle|s_{ic} = \bar{s}_c\right]$$

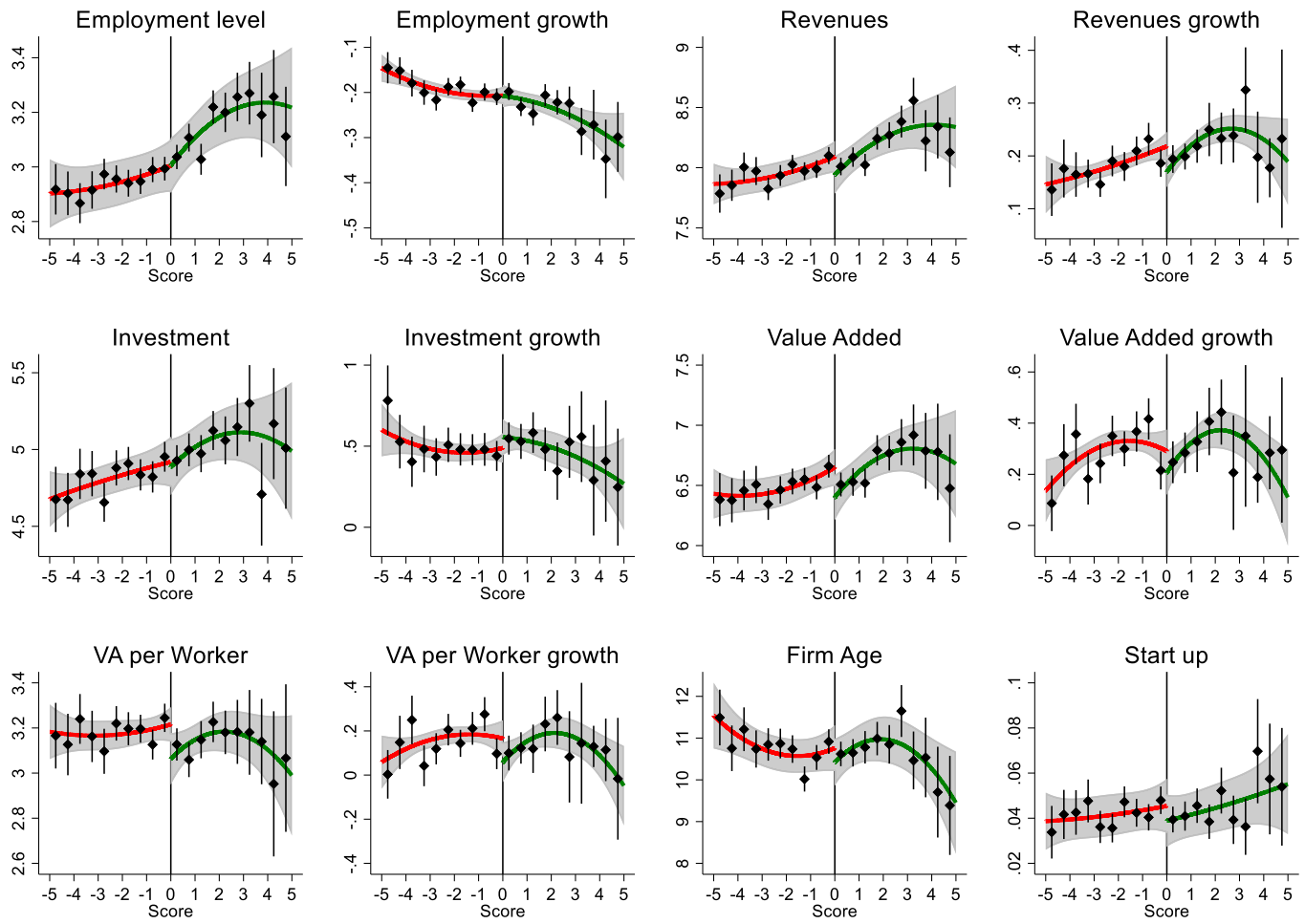
- parametric estimating equation

$$y_{ic} = \beta_0 + \beta_1 Z_{ic} + \beta_2(s_{ic} - \bar{s}_c) + \beta_3(s_{ic} - \bar{s}_c)Z_{ic} + FE_c + \varepsilon_{ic}$$

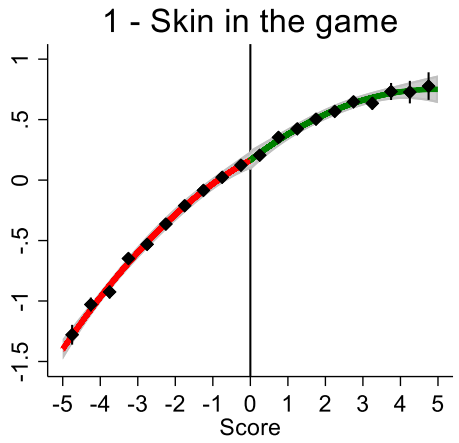
RDD diagnostics: Density tests

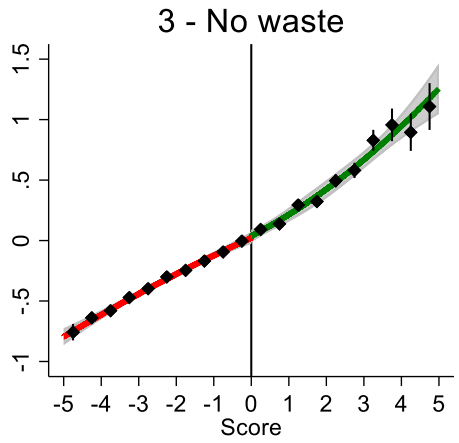


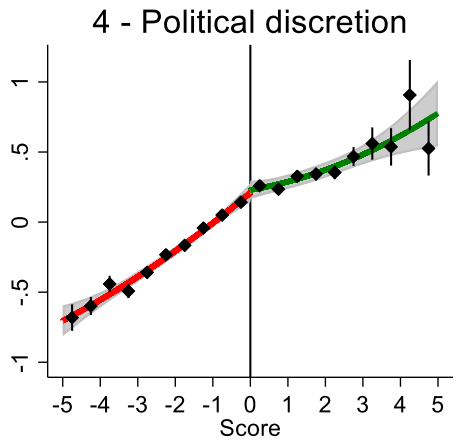
RDD diagnostics: Balance tests (covariates)

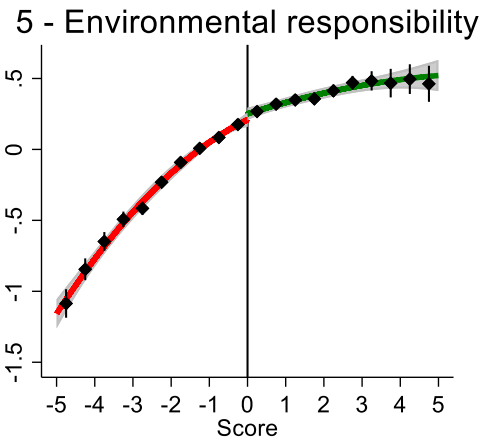


RDD diagnostics: Balance tests (sub-scores)









Parametric estimates

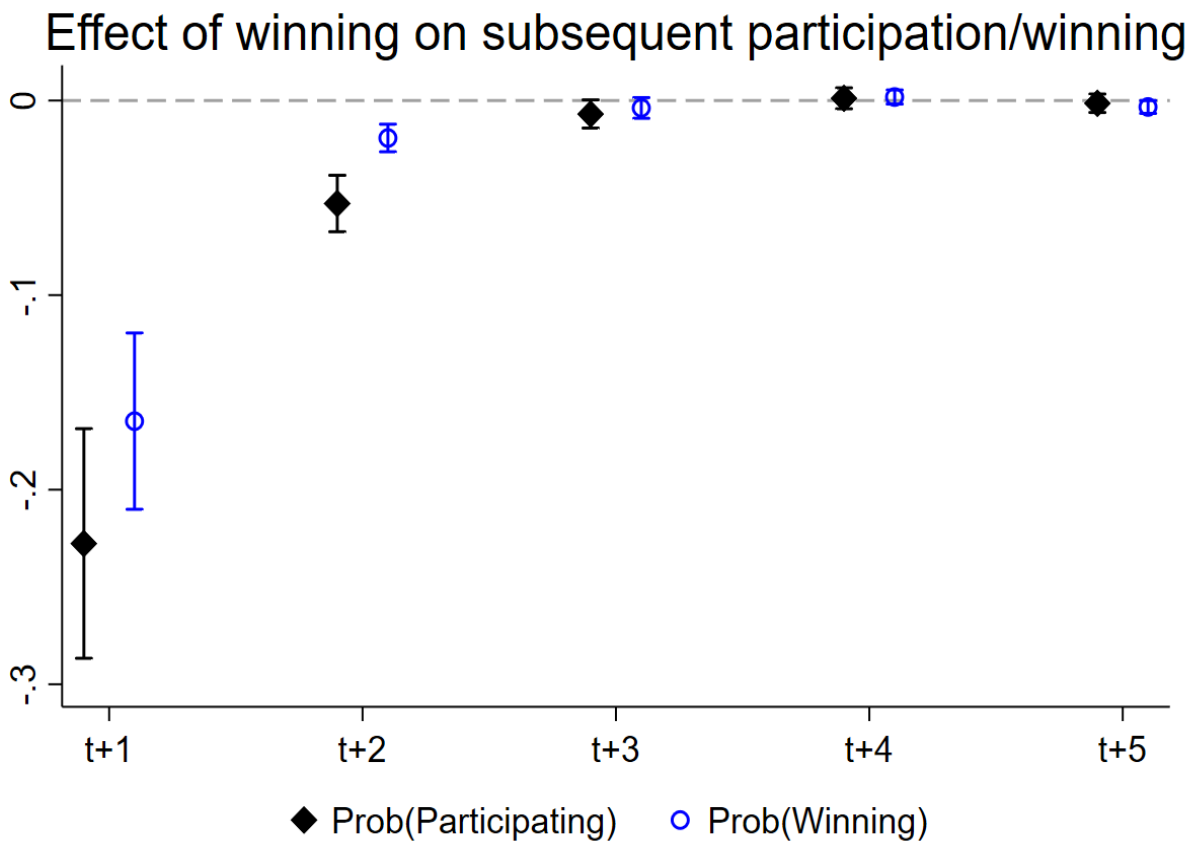
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Specification:	linear				quadratic			
Kernel:	uniform		triangular		uniform		triangular	
Group FE:	no	yes	no	yes	no	yes	no	yes
Log-change in employment over 3 years								
Subsidy	0.088***	**0.104*** **	0.101***	0.104***	0.120***	0.107***	0.114***	0.105***
	(0.019)	**(0.020)**	(0.020)	(0.020)	(0.026)	(0.025)	(0.028)	(0.026)
Observations	31,681	31,681	31,681	31,681	31,681	31,681	31,681	31,681
R-squared	0.004	0.059	0.004	0.063	0.004	0.059	0.004	0.063
Log-change in employment over 6 years								
Subsidy	0.147***	**0.153*** **	0.145***	0.139***	0.142***	0.124***	0.131***	0.119***
	(0.023)	**(0.024)**	(0.023)	(0.023)	(0.030)	(0.029)	(0.032)	(0.030)
Observations	28,759	28,759	28,759	28,759	28,759	28,759	28,759	28,759
R-squared	0.007	0.066	0.007	0.067	0.007	0.066	0.007	0.067

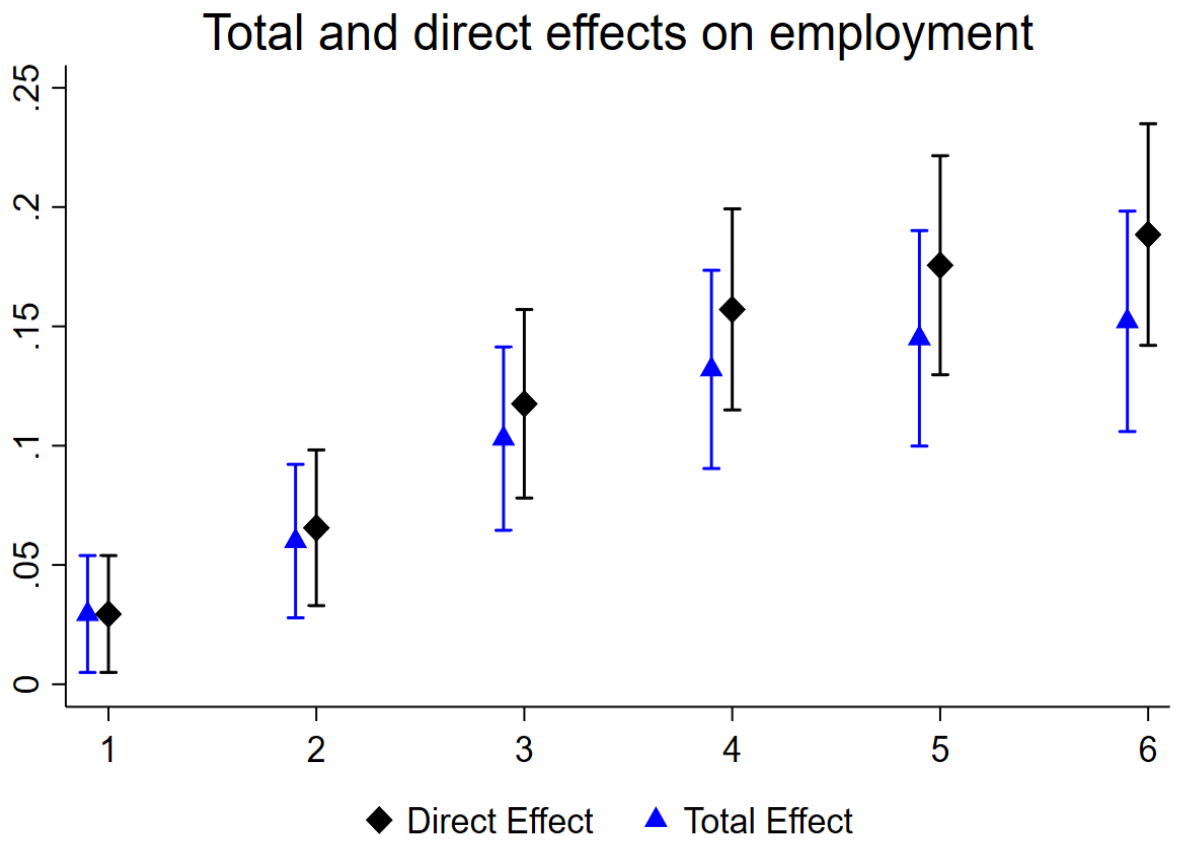
Additional results

- repeated applicants
  - susidized firms firms have a lower probability of re-applying → overall effect: direct effect + indirect effect (negative)
  - baseline estimates are lower bound to direct effect

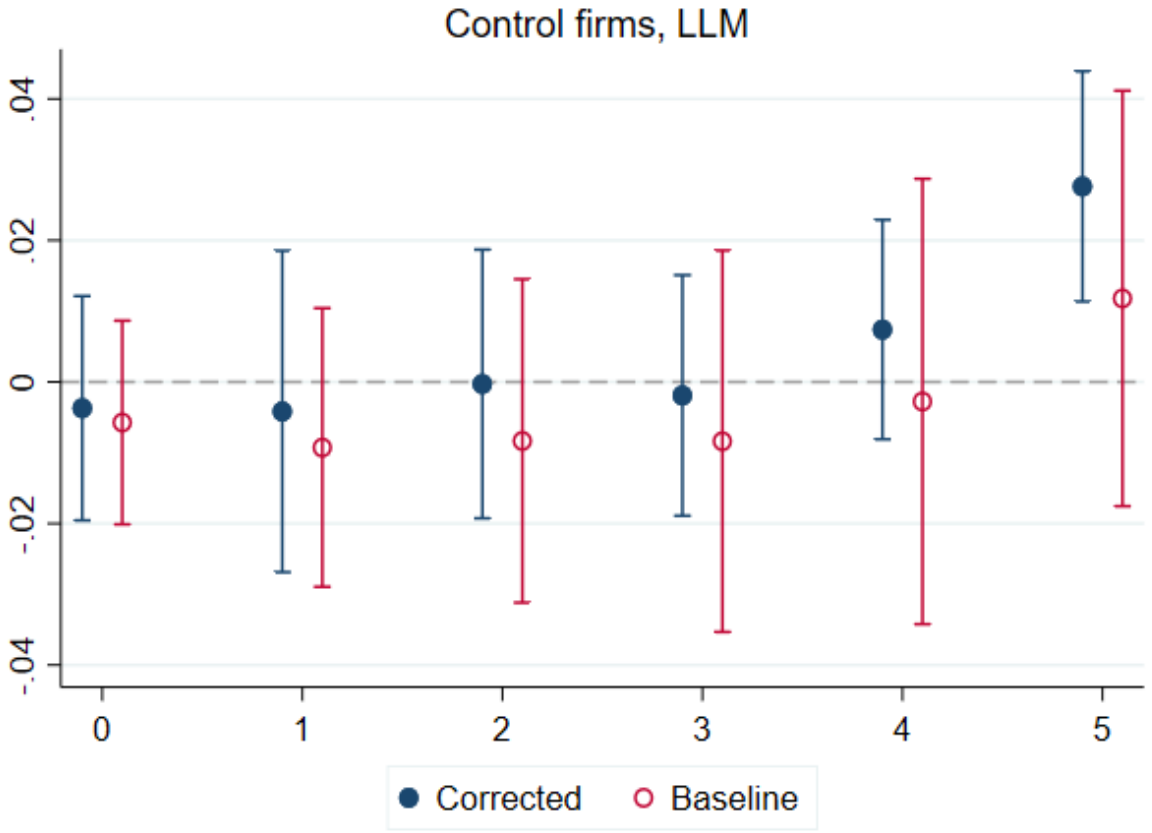
- local effects
  - no significant spillovers on other firms in the same labor market

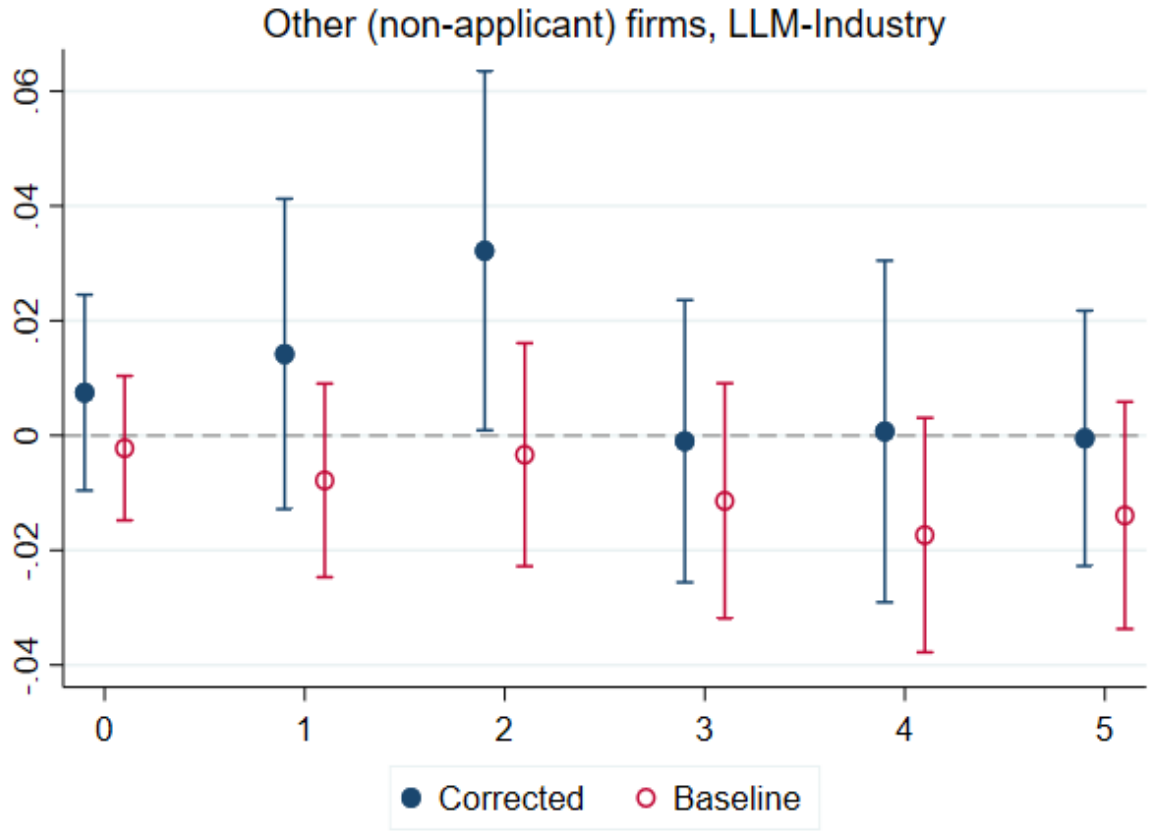
Repeated applicants





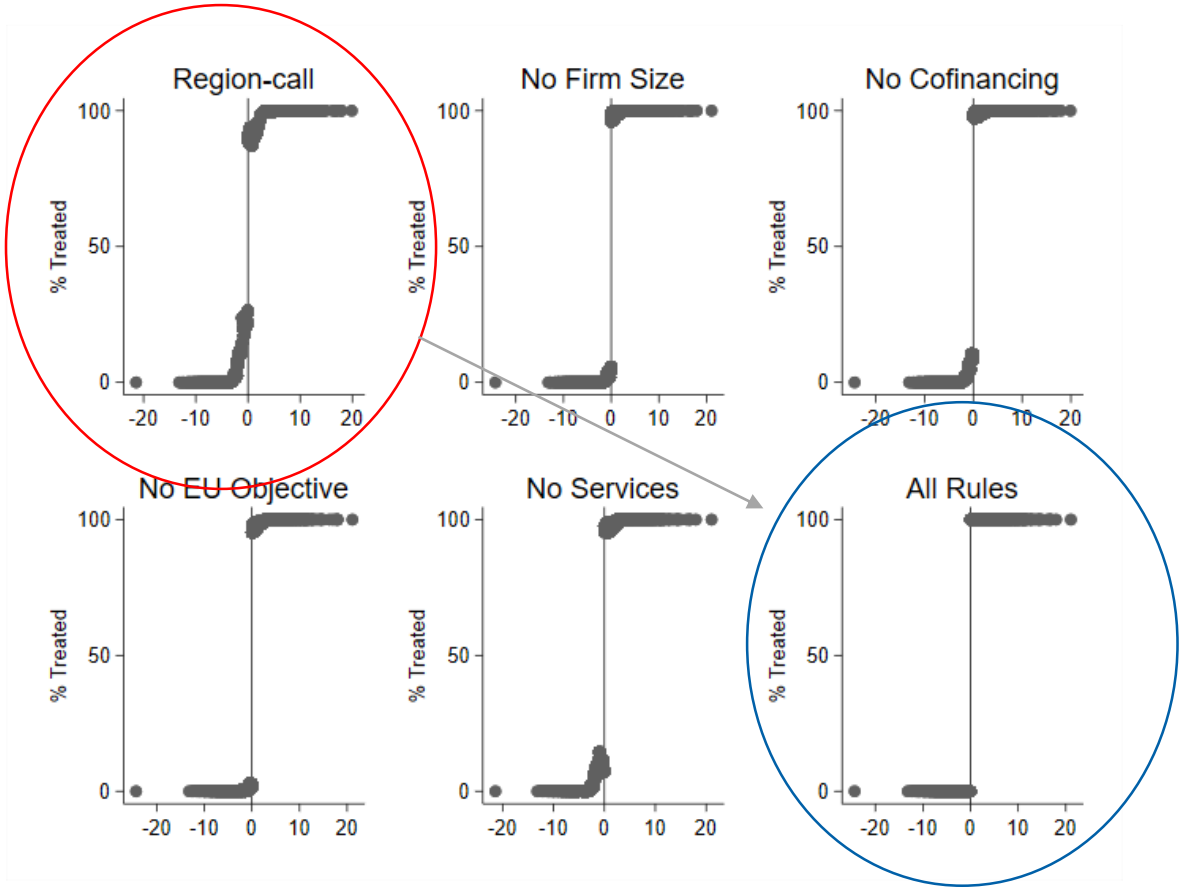
Spillover effects



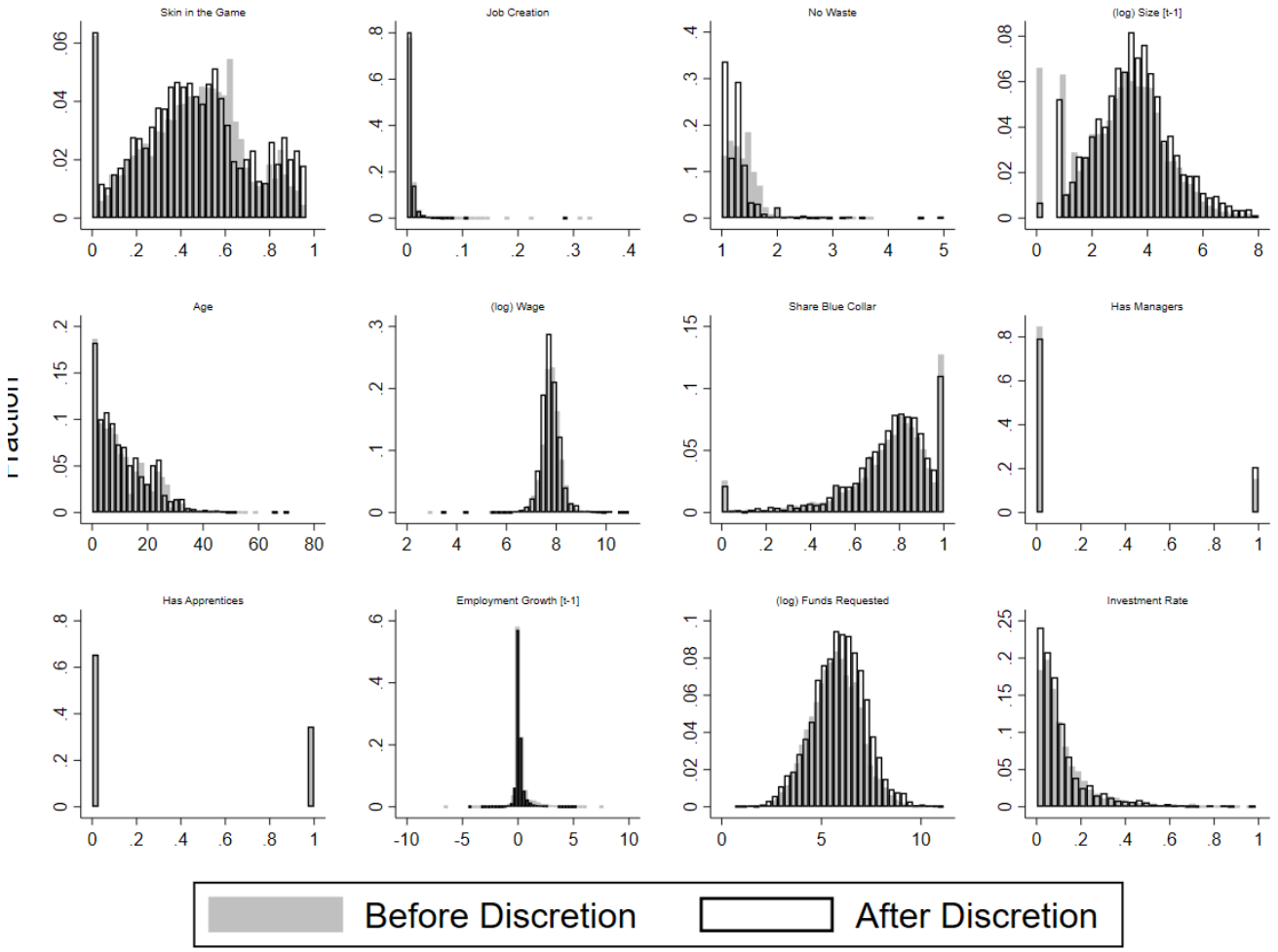


Issues with 488 data

- Region-call specific rankings published in the GU mixed two or more «actual rankings», those used in the allocation of funds.
- We recovered such rankings exploiting additional information on firm size, operating sector, eligibility for co-financing, and geographical area to construct the RD design

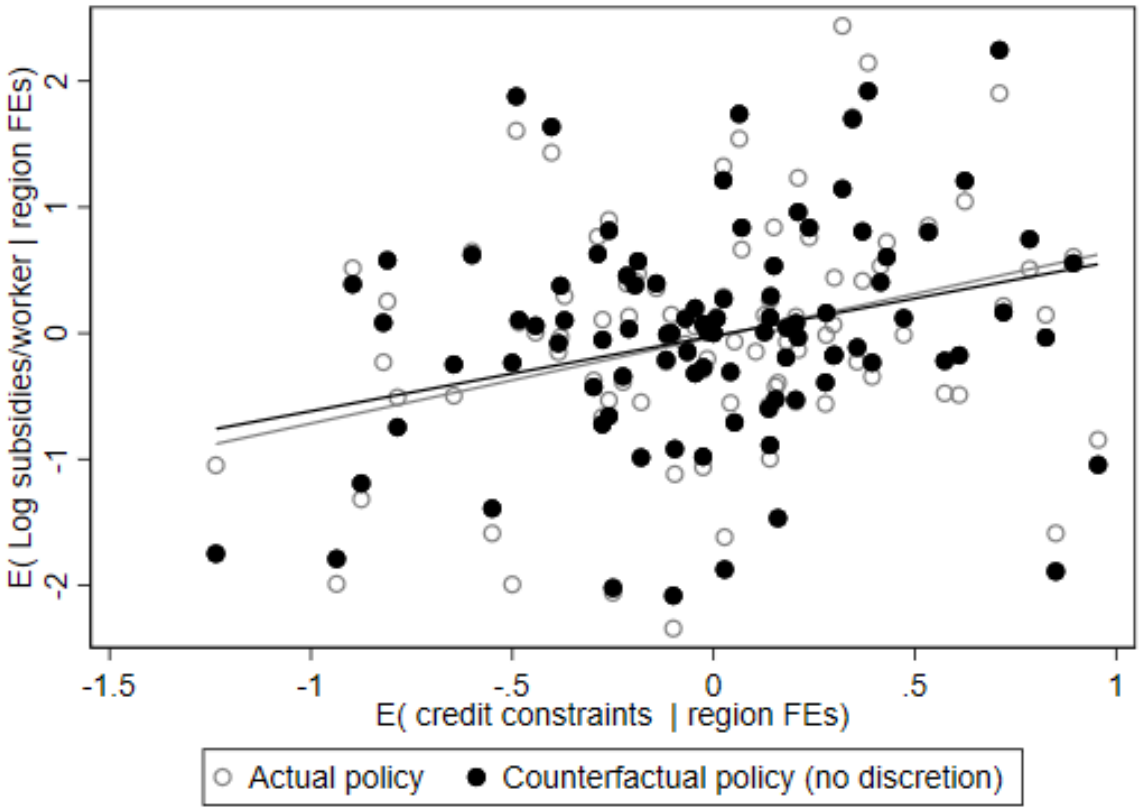


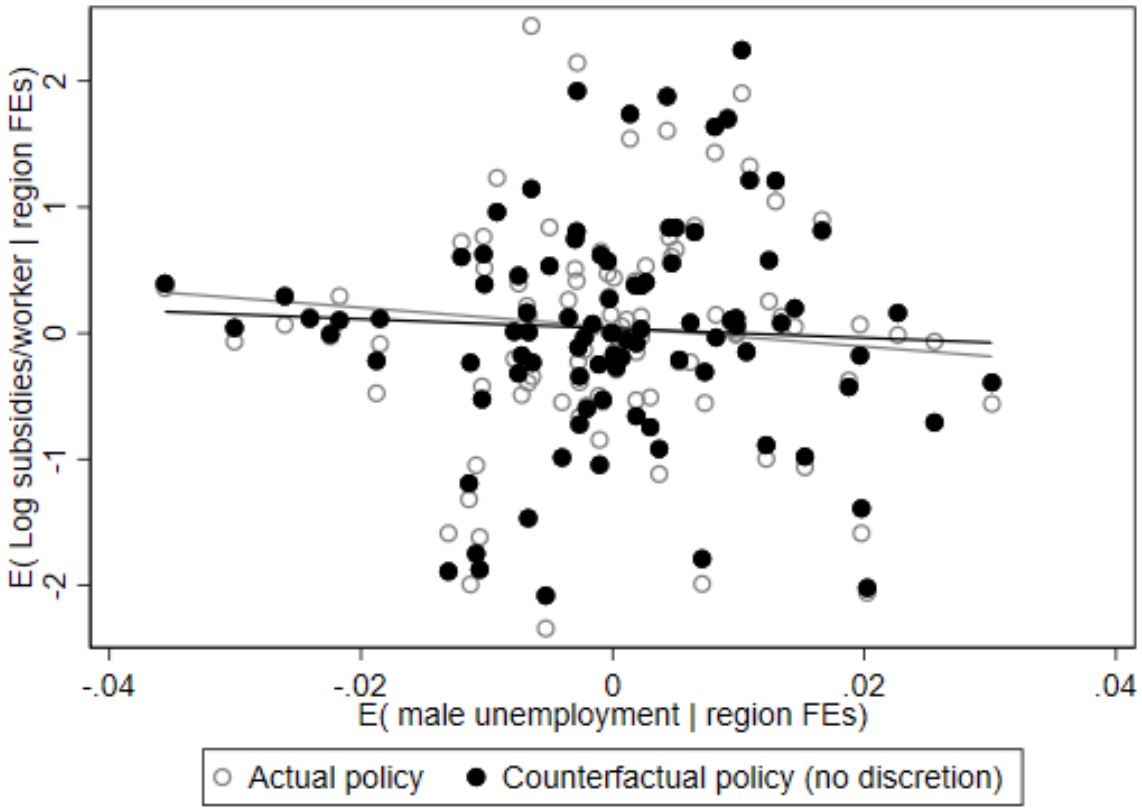
Applicant characteristics, with/out discretion



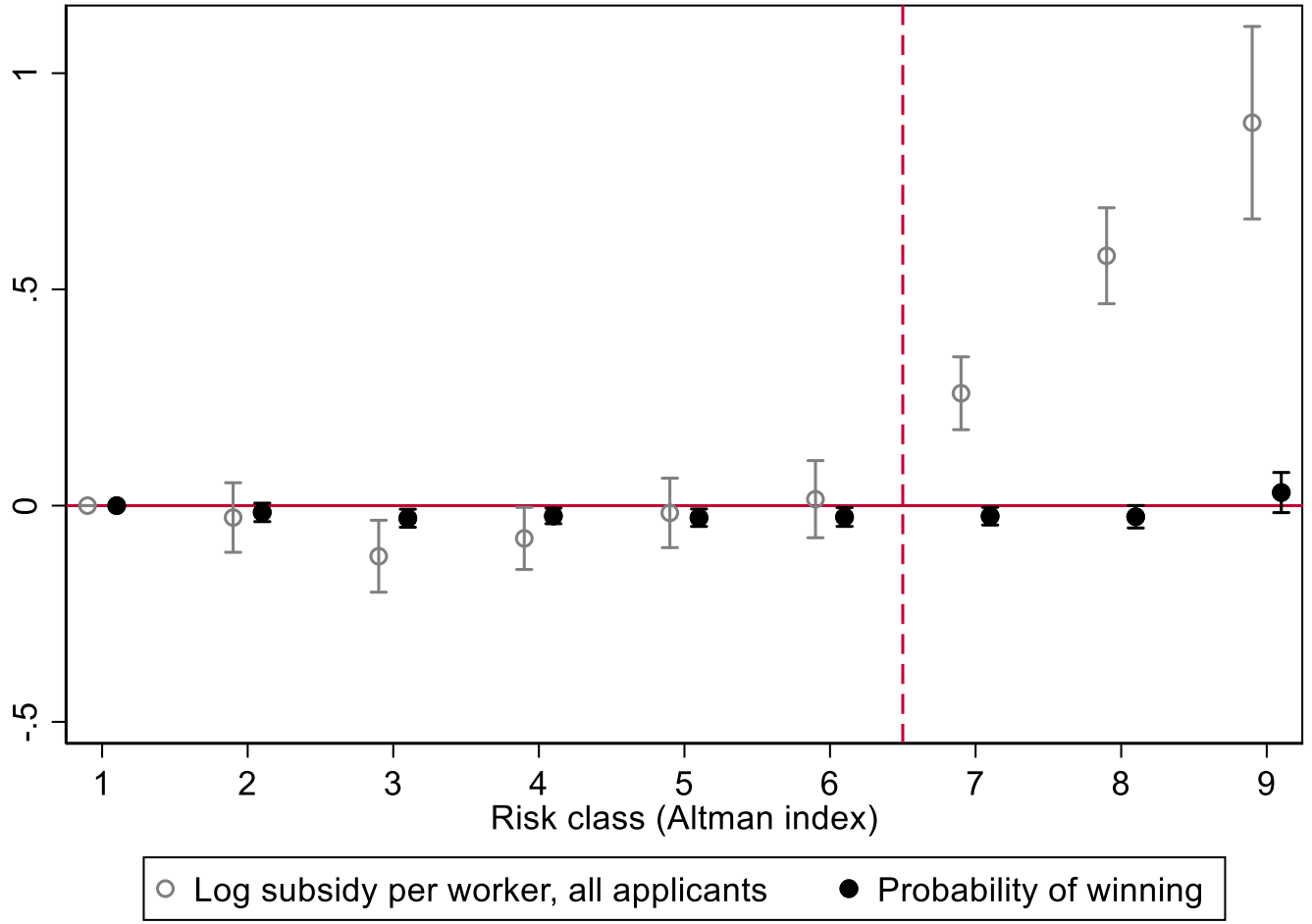
Counterfactual policy effects

- better targeting of constrained/underdeveloped areas?

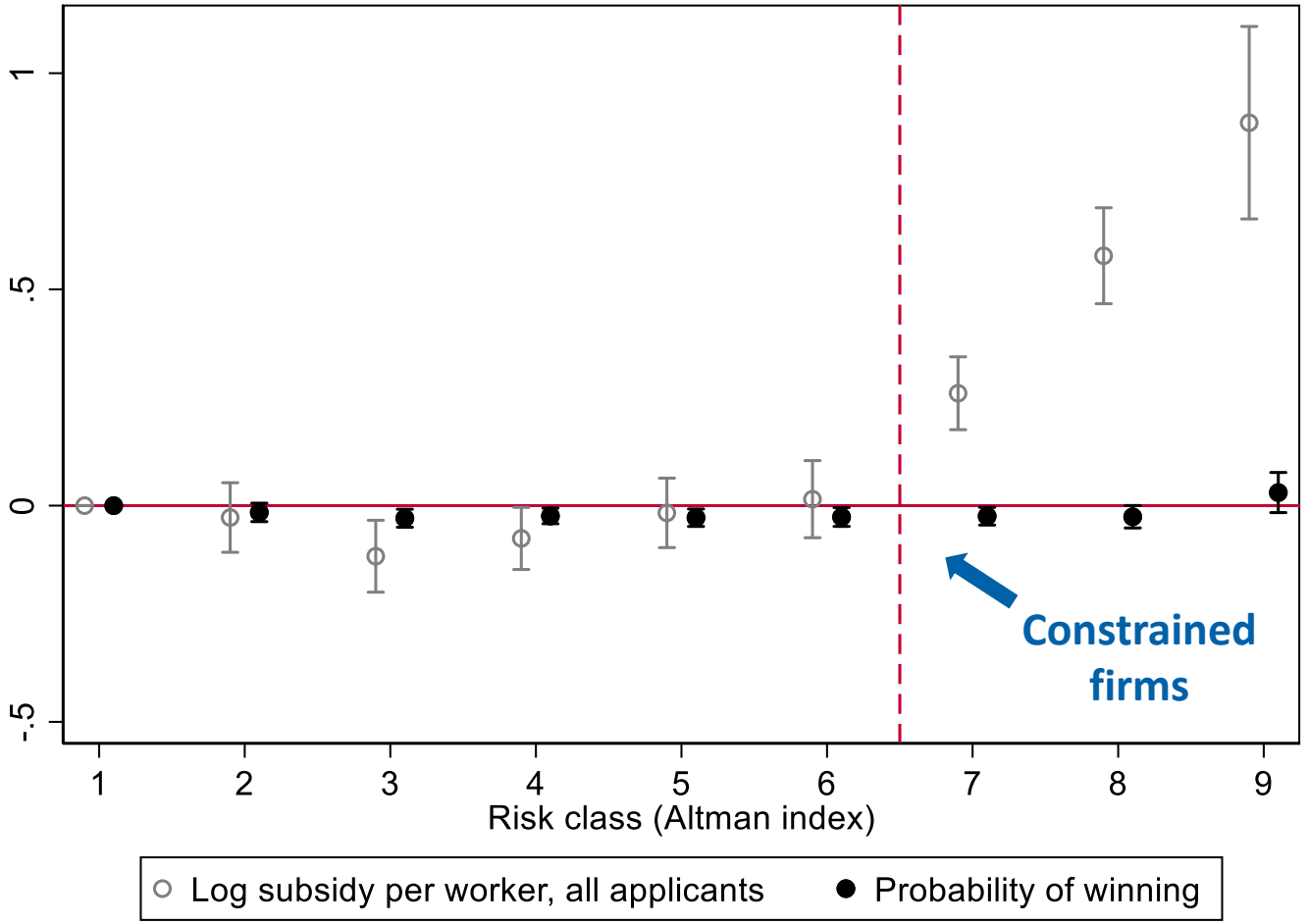




Financially constrained firms (in progress)



Financially constrained firms (in progress)



Financially constrained firms (in progress)